ARMY RESEARCH AND DEVELOPMENT

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Power Group Gains NASA, AEC, ARPA

Establishment of the Interagency Advanced Power Group to stimulate research and development in all areas of unconventional power sources was announced in April.

As successor to the Interservice Group for Flight Vehicle Power (IGFVP), the new organization is broadened by the addition of voting members of the Atomic Energy Commission, National Aeronautics and Space Administration, and the Advanced Research Projects Agency.

Other signatories to the charter and establishing agreement are the representatives of the Departments of the Army, Air Force and Navy who composed the IGFVP.

Formed with the objective of increasing the over-all effectiveness of the Government's advanced power sources program, the new group has the responsibility of insuring an informal exchange of information at the technical level on program goals, requirements and progress.

Power is defined in the charter as encompassing energy sources, conversion techniques, and the devices and transmission systems or components pertinent to the provision of all power for aeronautical, space and military

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Trudeau Stresses Government-Industry Effort As Vital to Growth Need in Basic Research

Science and technology capabilities within the Free World "can give us today just about anything we want, provided we know what it is, and are prepared to pay for it."

Lt Gen Arthur G. Trudeau, Army Chief of Research and Development, made this statement as the keynote speaker at a recent conference of 200 members of the Armed Forces Communications and Electronics Association at Fort Monmouth, N.J., home of the U.S. Army Signal Research and Development Laboratories.

Representatives of many of the Nation's major industries in the electronics and communications field heard General Trudeau emphasize the critical importance of continuing expansion of basic research to meet the Army's long-range military requirements.

"Happily," he said, "both the Wriston Commission and the President's Science Advisory Committee continue to stress the need to expand our national effort in basic research. In the Army we are continuing to get modest increases in the monies we are allotted

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Distribution Change

Effective with the June issue, The Army Research & Development Newsmagazine will be given automatic distribution to Army activities based on requirements stated on DA Form 12-4.

Distribution requirements for the offices of the Secretary of the Army, Under Secretary of the Army, Assistant Secretary of the Army (R&D), Chief of Staff, Chief of Research and Development and Chief of Information will be submitted by the Office of the Chief of Research and Development.

All other Department of the Army agencies should submit their requirements through channels to the Army Publications Distribution Center servicing them. Distribution of the Army Research & Development Newsmagazine to the agencies which fail to report requirements will cease after the May issue.

Other Government agencies presently receiving the Newsmagazine are not affected by the change in distribution procedures. Any changes in the requirements of these agencies should be submitted directly to the Army Research Office, OCRD, Department of the Army, Washington 25, D. C. ATTN: Scientific Information Branch.

Distribution to activities or individuals receiving copies through subscription with the Superintendent of Documents remain unchanged.

Theme of the Month

By Major General A. T. McNamara
Quartermaster General, Department of the Army

That Research and Development is a driving force behind Army Power is a truism of the day.

I do not wish to belabor the obvious by attempting to reinforce this statement. However, I do wish to call attention to a most significant hidden proviso: Research and Development becomes a driving force behind Army Power—provided the coupling is efficient.

My theme for the month, then, is "THE EFFICIENT COUPLING."

First, a few words about the substance of our present program of exploitation of science and engineering.

The Army has made great progress in laying a fertile base for advanced application of science and technology to military use. The value and employment of these instruments of the intellect are now familiar to every commander. Great advances have been made in Army management of research and development on materiel.

The time is opportune for a vigorous attack throughout the Army

(*Continued on page 2*)

Army Announces Phase-Out Of 9 Nike Ajax Batteries

To accomplish "significant economies without the loss of defense effectiveness," four Army Nike Ajax missiles sites in the Washington, D.C.. area will be inactivated by the summer of 1962.

In addition, three Nike sites in the Philadelphia Defense Area and one in the Norfolk Defense Area will be inactivated by this fall, and two in the Pitsburgh Defense Area will be inactivated in the spring of 1962.

This was disclosed by Brig Gen George S. Eckhardt of the Army Air Defense Command's second region. General Eckhardt pointed out that one battery of new Nike Hercules missiles, which can carry an atomic warhead, can provide the same level of defense which previously required several Ajax batteries. He said that Army National Guard Nike Ajax sites will not be affected by the transition.

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Objectives of this publication are: To improve informal communication among all segments of the Army scientific coummunity and other Government R&D agencies; to further understanding of Army R&D progress, problem areas and program planning; to stimulate more closely integrated and coordinated effort among the widely dispersed and diffused Army R&D activities; to maintain a closer link from top management through all levels to scientists, engineers and technicians at the bench level; to express views of leaders, as pertinent to their responsibilities, and to keep personnel informed on matters germane to their welfare and pride of service.

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Theme of the Month

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on maximizing the relevancy of science and technology to Army purpose, and on strengthening the resonating bond between Research and Development and Army Power.

I am not thinking alone of the current Army research and development program. Rather, I am eager to see the use of the tools of science and technology expanded to the grey areas between the current research and development program and other mission programs. We should ensure that the natural bent of creative Army personnel for progressive changes not be inhibited by the restriction of intellectual techniques or scientific disciplines through arbitrary programming artifices. Instead, let the fragrant flowers of research and development bloom in all meadows of need.

I would like to encourage research in warehousing efficiency, maintenance techniques, and supply responsiveness; in procurement procedures, inspection methodologies, and consumer services; and in the solution of production difficulties limiting the availability of type classified items to field units, the daily incremental advances in every activity such as the thousand and one cumulative marginal improvements that have made the 1961 Lincoln a giant leap over the 1904 Ford, and so on.

The Army's recognition of the value of research and development should now be assimilated within functional realities. In my opinion, this can best be done by effecting the required synthesis at all echelons and in all mission elements. The spirit of scientific inquiry must permeate the entire Army structure; it cannot be poured from the top into an artificial programmatic hole in someone's head.

The sooner scientific thinking is incorporated into the operating mission elements, the faster Army Power will grow. The lower the echelon at which the synthesis occurs, the more natural the resonance and the greater the force of the whole. The more extensive the coupling network, the more efficient the transmission train between Research and Development and Army Power.

Actually, this view is almost commonplace with experienced commanders. Army Power is displayed in the execution of missions—the physical action of combat, the psychological presence of strength, the humanitarian assistance in disasters, the comforting services to dependents, and so on. We recognize the essentiality of unified command in these activities. Besides the dictates of sheer practical wisdom, unified command symbolizes the natural integration of functional elements into an operational unity.

It is important to recognize that scientific knowledge per se does not act. It expresses itself through incorporation in action, which is the essence of function. Only by emphasizing the early embodiment of science and engineering in military functions will the Army guard against the dangers of creeping research irrelevancy. In other words, tools must respond to purpose. Technics and resources must be assimilated in the wholeness of mission.

In my opinion, herein lies the secret of THE EFFICIENT COUPLING. We should keep it in clear perspective.

Lt Gen Itschner Retires, Takes Pakistan Job

Lt Gen E. C. Itschner recently retired as Chief of Engineers, U.S. Army, but not from the profession of engineering.

The man who directed such major engineering achievements as construction of the U.S. portion of the St. Lawrence Seaway, reconstruction of the French port of Cherburg after D-Day, and modernization of the Ohio River and Great Lakes navigation systems will leave shortly for Pakistan. There he will be Chief Technical Advisor on the Indus River Project for the Harza Engineering Co., Chicago, Ill.

An Army Engineer for nearly 37 years and a 1924 graduate of the U.S. Military Academy, General Itschner became Chief of Engineers at the age of 53 in 1956—the youngest officer to hold this post in more than a century.

Other engineering projects directed by General Itschner include advancement of the Columbia, Missouri, and Arkansas River Basin developments, and the building of the "city under snow" in Greenland known as Camp Century.

During the early part of World War II General Itschner headed the Air Force construction for the Chief of Engineers. Later he had charge of construction supporting the invasion of Europe. After World War II he served as Chief of Military Construction Operations in Washington, D.C., and was assigned as District Engineer in Seattle, Washington, in 1949.

Advanced Power Group Enlarged by NASA, AEC, ARPA Members

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missions exclusive of propulsive force.

In pursuing its expanded mission, the group will be concerned with uses of unconventional power sources in the air, on land or water, and underwater. Areas of R&D interest will include fuel cells and other chemical and electrochemical devices, thermoelectricity, solar power, nuclear power, thermionics, magnetohydrodynamics, and mechanical power systems.

Under the over-all guidance of a Steering Group, comprised of representatives of each of the member agencies, the IAPG will form ad hoc committees or working groups for each of the major areas of interest. The IGFVP had working groups in the areas of solar, nuclear, chemical, electrical, mechanical and battery power.

The Steering Group will meet in April and October each year and additionally as required to review progress and map future plans. A representative of the Director of Defense Research and Engineering will be invited to participate in meetings.

Provided for in the charter is the establishment of a jointly supported Power Information Center (PIC) "to act as the technical secretariat to the Steering Group and the several working groups, and to act as the technical information center for power research, development and engineering. . . . Wide dissemination of information to government and non-government activities will be effected through the PIC and by means of technical meetings and symposia."

Among the stated services to be performed by the PIC are: Collect, index, abstract (or use existing abstracts) and maintain an abstract file on all power research, development and engineering, making maximum use of such information agencies as ASTIA, TISE, ATIC and the Engineering Index.

The PIC also will maintain lists of existing and proposed U.S. Government contracts, programs, and plans in the power and associated areas, and selectively distribute such lists. It also will assist in arrangements for IAPG meetings and symposia, publish minutes, and publish a monthly "Power Newsletter."

Signatories of the charter and establishing agreement of the IAPG are: Richard S. Morse, Assistant Secretary of the Army (R&D); James H. Wakelin, Jr., Assistant Secretary of the Navy (R&D); Courtland D. Perkins, Assistant Secretary of the Air Force (R&D); Frank K. Pittman, Director, Division of Reactor Development, U.S. Atomic Energy Commission; Robert C. Seamans, Jr., Associate Administrator, National Aeronautics and Space Administration; and Brig Gen Austin W. Betts, Director, Advanced Research Projects Agency.

CRDL Scientist Named Civil Servant of 1960

A research scientist at the U.S. Army Chemical Research and Development Laboratories, Army Chemical Center, Md., has been named Maryland's 1960 Federal Civil Servant of the Year.

The Federal Business Association, an organization of top officials from various Federal offices throughout the State, conferred this distinction on Dr. John A. Clements, 38-year-old pulmonary physiologist, who has a national reputation in his field. In addition, Maryland Congressmen Samuel N. Friedel and Edward A. Garmatz gave him letters of congratulations, and Representative Friedel gave him a 50-star flag which had flown over the Nation's Capitol.

The USACRDL scientist has had a major role in the studies which formed the basis for adoption of the mouth-to-mouth breathing method of resuscitation. He also participated in the discovery of the surface active properties of the fluid lining the air sacs of the lungs, an unnamed protein substance which diminishes the tendency of lungs of infants to collapse.

Dr. Clements' studies in this field, conducted in collaboration with prominent pediatricians, are expected to lead to practical therapeutic measures in the frequent cases of lung collapse among newborn children. (See Issue No. 1 of the *Newsmagazine.*)

CRD Approves Acceleration of Tropical Research

Acceleration of tropical research during Fiscal Year 1962, under the auspices of the Tropical and Desert Branch, Earth Sciences Division, Army Research Office, has been approved by Chief of Research and Development Lt Gen Arthur G. Trudeau.

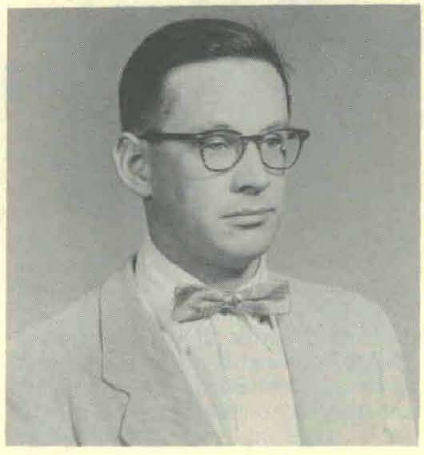
The Branch is scheduled to expend about $2 million in FY '62 through the Technical Services on an Army-wide tropical research program.

Major areas of study will be: Military evaluation of geographic areas, evaluation of existing equipment and materials in humid tropical environments, mobility, target acquisition research, radio signal propagation, packaging and preservatives requirements, meteorology, human factors, and biological research.

The tropical program will complement the polar research program which has been in effect for many years. Aside from Medical and quartermaster Corps activities, little tropical research has been done by the Army since World War II.

The Tropical and Desert Branch, headed by Dr. L. W. Trueblood, was set up Jan. 1, 1961, as the result of Earth Sciences Division studies.

The Branch proposes to outline and budget for an Army-wide program and to allocate funds to the Technical Services on a project basis.



Dr. John A. Clements

Physicist Succeeds Dr. York As Director of Defense (R&E)

Dr. Harold Brown, Director of Lawrence Radiation Laboratories, has been named Director of Defense Research and Engineering, succeeding Dr. Herbert F. York.

A physicist and an authority in nuclear reactor design, Dr. Brown at the time of his appointment as DOD R&E Director was a consultant to Aerojet-General, the Air Force Science Advisory Board, and the President of the United States. He is 33 years old, one of the youngest men to join the Kennedy Administration.

Dr. York, slated to take a post at the University of California, was asked to remain with the new administration a few months.

Trudeau Stresses Government-Industry Research Effort

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for this research, and a fair segment of American industry consciously is expanding its effort in this critical area.

"Together, we must encourage this trend. Government, alone, cannot be responsible for, or do, the whole job in basic research. It cannot assume the entire cost of basic research in this country, now running about $1 billion a year. For the maximum in dynamic and realistic support, America must look to private enterprise, to industry, to our educational institutions, and to our scientific foundations for their contributions.

"Now, let's look closer at basic research and highlight some of the prospects which promise a harvest of advanced weapons and equipment for the future. Our military power today, in terms of firepower, is truly formidable. In communications—the *sine qua non* of command and control—we have leaped ahead. But the Army has one crying need today, and that is for revolutionary strides in the third vital area—mobility.

"We must break the ground-bound barrier! Now, in mobility, imagination and engineering have outstripped existing materials and surpassed the state-of-the-art in power sources. I forecast that, through new advances in the science of materials research, we can cut through conventional barriers and attain the truly revolutionary improvement we require in mobility. Our progress here is dependent on the solution of crucial materials and energy problems.

"For example, the lack of new and unique materials today is perhaps the most important single factor holding up the development of true air vehicles that will fly just above the 'nap of the earth,' permitting the combat soldier of tomorrow to overcome terrain obstacles, such as mud, swamps, ravines, rivers and forests.

"This type of vehicle will have the takeoff and landing characteristics of the helicopter, coupled with the advantages of the fixed wing aircraft in forward flight—and will be able to fly fast, or slow, and quietly; just above the battlefield.

"The most pressing R&D programs are not in the field of development but in research—in finding the new materials which can make possible the creation of advanced military devices. The unprecedented demands for new materials in this area are staggering—materials, for example, that can withstand conditions of extreme heat and pressure in the order of one million pounds per square inch and 5,000 degrees Centigrade.

AN IDEA IS BORN: Kenneth Connelly, 9-year-old 4th grade pupil at St. Matthew's Parochial School, Philadelphia, conceived the notion of a gun to be fired by radar. With the help of his 13-year-old brother, Thomas, an 8th-grader, Kenneth put his idea down on paper and offered it to scientists at the U.S. Army Ordnance Corps' Frankford Arsenal in Philadelphia. The boys visited the Arsenal and talked with Commanding Officer Col A. R. Cyr and members of his staff, who decided the idea showed evidence of precocious original thinking. They encouraged the lads to continue using their imagination and to apply themselves at school, keeping in mind the possibility of someday designing guns for their country's defense as future Army scientists.

"All the Armed Forces share this need, and are working jointly in this area on a variety of approaches—in plastics, in ceramics, in polymers, and in metals—spending several hundred million dollars a year.

"It is important to point out that metallurgy is a field that has seen tremendous advances in the last 10 years, and can be expected to surge beyond the boundaries of our imagination in the next few. For example, it is estimated that within the next decade we shall have beryllium alloys with the strength of steel, but one-fourth the weight.

"Shortly thereafter will come plastics and ceramics with the same strength-weight characteristics. New steels with vastly improved characteristics are in sight now! Hardness is another characteristic we seek in new materials for structural use in high temperature engines, missiles and reactors. . . . New ceramics, a research product of extreme hardness, fashioned into a lathe cutting tool, will cut the hardest metals, at a rate many times faster than the conventional steel cutting tool.

"Research efforts are also underway to bridge the gap between materials and solid state physics. Rich dividends, here, will permit us to chain-link large molecules so that materials—with properties we can hardly now imagine—can be created at our order. Instead of having to work with materials we have, we can fashion the materials we want. We can determine the ideal characteristics we need, then tailor them out of atoms and molecules as needed.

"These and other materials-research-sparked developments will redound to the benefit of our civilian industry and commerce as well as to the military, giving us greater utilization of energy, increased measures of reliability, and more efficient space accommodations.

"How many of us in these days of wondrous advances remain impressed by the fact that electronic parts have

been reduced in size in the last few years by modular concepts, so that now, instead of 7,000 parts per cubic inch, we can put 350,000 parts in the same space?

"Now, even this figure can be increased by a factor of 10 in certain fuze applications. Using solid circuit techniques—or 'molecular electronics' —even this is only a beginning. *Just around the corner of tomorrow, I predict, we shall see a good wrist watch radio of the size of an after-dinner mint. . . .*

". . . To achieve true mobility in the air or on the ground—with almost noiseless operation—we need also to push forward basic research in the search for new energy sources. We must redouble our efforts to achieve new engines at less cost, with more economy, of less size and weight—and most importantly, with higher performance ratings under all kinds of conditions.

"Only at our peril, will we fail to investigate every new avenue that shows promise in the power spectrum —from today's gas turbine to tomorrow's fuel cell—from the magneto-hydrodynamic generator to the solar cell—and, in a future as awesome as it is near, nuclear power sources.

"Of these, the fuel cell now seems the most promising for the 1970s. The fuel cell is an electrochemical device that produces electrical energy by direct chemical action. It has all the features of a battery except that the reactants—oxygen and some companion fuel like hydrogen—are supplied continuously and the products—carbon dioxide and water vapor—are removed continuously.

"There are several commanding reasons for military interest in this cell. Significant is its potentially high efficiency compared with that of a gasoline motor—about 60 to 80 percent compared with 25 to 30 percent. This means more efficient utilization of fuel, with substantial reduction in the logistical load.

"The fuel cell has no internal moving parts—no pistons, crankshaft, transmission and the like—and this means reduced maintenance. Of additional importance is the fact that fuel cells operate with an absence of noise or smoke, and generally without excessive heat. They therefore are harder to detect by the enemy on or above the battlefield. . . .

"Although the fuel cell promises some reduction in our supply requiremetns for fuels, in itself the fuel cell is not the complete solution to our age-old logistics problem. One possible solution I see, in the 1970s, lies in the integration of the fuel cell—or groups of cells—with the nuclear reactor.

"We see a stationary nuclear-powered generation plant, much like a filling station, furnishing hydrogen and oxygen as fuels. Viewed in this light, the problem of providing propulsion fuel is reduced to the task of converting the energy from a nuclear plant to a form which can be conveniently dispensed and utilized in vehicles in numerous types.

"The optimum form, an integrated fuel-power system as an integral part of a vehicle, is speculative. Unfortunately, the extent to which nuclear plants can be miniaturized appears to be limited—and the cost of reactors is still too high. Yet, we can approach the optimum if we utilize a nuclear-powered, cross-country vehicle comparable to the overland train as a mobile supply point. (See *Army R&D Newsmagazine*, January, page 10.)

"The several cars of the train would be equipped to manufacture certain chemicals, perhaps ammonia or hydrazine from water and air, and liquefy it for convenient storage and handling. The heat and power for the process euqipment would be provided by the nuclear plant, which also would propel the train.

"The ammonia or hydrazine, in turn, would be furnished from this mobile service station to combat vehicles equipped with fuel-cell propulsion engines—or to stationary fuel cells providing electrical power for other applications.

"Such nuclear-powered energy depots could manufacture versatile chemical fuel locally within a combat theater and transport it near or to the place of use. We can foresee such a unit that could develop, within itself, the equivalent of 500,000 gallons of gasoline per day. With POL (petroleum, oil, lubrication) constituting 40 percent of an Army's tonnage, the significance of such a development is apparent.

"In basic research, however, we are not exploiting the physical sciences at the expense of the life and social sciences. The requirement is ever increasing to blend knowledge of physical sciences together with that of the life sciences.

"An example of this modern trend is the important research in cybernetics, in which the neurophysiologist, the mathematician and the electrical engineer blend their talents. Utilizing the latest developments in their respective skill areas, they are seeking to improve the state of medical knowledge. . . .

"Recent medical progress is also being integrated with gains in the field of materials research. The result is replacement parts for bodies damaged by accident or in combat. New hope of establishing better compatability with life is thus being offered patients with major body defects. Thus far, only replacement parts for extremities have become common.

"These are the kinds of breakthroughs in basic research—in the life, social and physical sciences—which are necessary to feed the insatiable appetite of applied research and development. For without new knowledge, without new science, applied research and development are limited to product improvement. Product improvement, important as it is, will not put us out in front, where we belong, or keep us there. . . ."

General Trudeau, at this point in his address, launched into a discussion of many of the Army's newer R&D end results such as the GOER vehicle, test aircraft propelled by rotatable ducted fans, ground effect machine (GEM) flying platforms, the SD-5 Surveillance Drone, and various missiles such as the DAVY CROCKET, the PERSHING, the HAWK, the HONEST JOHN, the NIKE HERCULES, and the NIKE ZEUS. Of the latter, he said:

"I feel there is an urgent requirement for such a defensive weapon while we negotiate for peace. I am confident the NIKE ZEUS can do this job in the 1960s." He then continued:

"Now, I have covered the new frontiers of science and technology broadly and described a few of our more promising results. I hope I have given you a flash insight into the future. Remember, it will only be for those with imagination—for those who dare!

"And this brings us back full cycle to my beginning thesis—that in this age of surging progress, all Americans — and freedom-loving peoples throughout the world—must come to the realization that our collective security and progress depend as never before upon the imagination and boldness with which we acquire and utilize new scientific discoveries and industrial techniques for the progress and defense of our civilization, and for the betterment of mankind. Here, we must sense new horizons, continuously, to meet the critical challenges ahead.

"When we wrestle with this problem we should always remember the incisive words of Theodore Roosevelt, great soldier and man of strong convictions, who while speaking of the strenuous life said:

" 'Far better it is dare mighty things, to win glorious triumphs, even though checkered by failure, than to take rank with those poor spirits who neither enjoy much or suffer much, because they live in the grey twilight that knows not victory or defeat. . .' "

NATO Group to Meet in Washington on Second Phase Of Long-Range Scientific Study in Military Field

Plans for the second phase of an international long-range scientific study undertaken from the NATO (North Atlantic Treaty Organization) military viewpoint will be discussed May 10 in Washington, D.C.

Participating in the discussion will be members of the steering committee of the Von Karman Long-Range NATO Scientific Study group. Headed by Dr. Theodore von Karman, Chairman of the NATO Advisory Group on Aeronautical Research and Development, the committee was set up at the direction of the NATO Standing Group, comprising the United Kingdom, France and the United States.

Other members of the committee are Dr. H. P. Robertson, Chairman of the U.S. Defense Science Board; Sir Solly Zuckerman, Scientific Advisor of the United Kingdom Ministry of Defense; Lt Gen Jean M. Guerin, President of the Scientific Action Committee of the French Ministry of National Defense; Dr. Karl Fischer, of the West German Ministry of Defense; and Dr. George S. Field, Chief Scientist, Defense Research Board of Canada.

The first phase of the long-range scientific study culminated in a 3-week conference held during March in Naples, Italy, attended by representatives of Canada, France, Great Britain, Greece, Holland, Italy, Turkey, the United States and West Germany.

Thirty-one U.S. scientists participated, including representatives of the Department of Defense, Departments of the Army, Air Force and Navy, National Aeronautics and Space Administration and one tri-service contractor.

On the basis of monographs prepared in advance of their meeting, the Naples conferees discussed the state-of-the-art in 14 preselected areas of military technology. Conference reports highlighted important trends in scientific and technological developments in these areas and included qualitative forecasts in the areas covering the next 10 or 15 years.

The areas selected for examination were: surveillance and signal processing, navigation techniques, geographical phenomena, communication techniques, data processing technique, weaponry, aircraft, ships and submarines, ground vehicles, chemical and biological warfare, logistics, energy conversion, human factors research and basic research in life sciences.

The monographs pertaining to these areas are available as the basis, in whole or part, for Army technological forecasts and for incorporation in U.S. Army future planning studies. Communication with European scientists during the conference assured U.S. scientists that no major gap exists in the Army-wide research and development program. However, American scientists gleaned some new ideas which they can develop in their own laboratories.

The international summaries evoked complimentary comments by Dr. von Karman, who indicated he was optimistic that expected advancements in science and technology would provide the military with sufficient opportunities to overcome existing problems. Imaginative new ideas, he said, are needed in all 14 of the fields discussed.

Dr. von Karman was given the assignment of preparing a report of the Naples deliberations to be presented to the NATO Standing Group by Apr. 10.

Maj Gen William J. Ely, Director of Army Research, was designated by Lt Gen Arthur G. Trudeau, Chief of Research and Development, as the point of contact for Army participation in the Naples conference. Project Coordinator was Lt Col Frank Schaf, Chief of the Technological Forecasting Branch, Army Research Office.

Army participants included Dr. Frank E. Grubbs and Dr. George Lee, Ordnance Corps; Dr. LeRoy Fothergill, Saul Hormats and Col Adam J. Rapolski, Chemical Corps; Austin Henschell, Quartermaster Corps; Harry Parmer and C. K. Schultes, Signal Corps; Dr. Hugh Cole, Operations Research Office, Johns Hopkins University; and Dr. Leonard S. Wilson, Army Research Office.

Canadian Firm Contracts To Supply U.S. Army With 24 "Caribou" Transports

Delivery of 24 AC-1 Caribou transports, largest of the Army's fixed wing aircraft, is called for in a $13,173,910 contract awarded to DeHavilland Aircraft of Canada, Ltd.

The contract is for airframes, engineering data, special tools and equipment, electronic repair parts, and technical manuals. Purchase of propellers and engines comes under separate contracts.

Powered by two R-2000-13 Pratt and Whitney engines delivering 1,450 takeoff horsepower through Hamilton-Standard constant speed, hydromatic propellers, the Caribou grosses 26,000 pounds and carries a 3-ton payload. It can carry 32 passengers, has a service ceiling of 27,500 feet, a range of 850 nautical miles, and a cruising speed of 156 knots.

The Caribou is designed to increase the combat capability of Army forces by providing airlift to combat, combat support and logistical support elements of the field Army. Short takeoff and landing characteristics enable the aircraft to operate from unimproved fields. Caribou Troop Test Headquarters, at Fort Benning, Ga., is conducting a 60-day program of troop testing these capabilities.

During the tests every possible "combat situation" which can be reproduced will be used, and the Caribou will be literally "wrung out" in the grueling troop test program.

2 Reservists' Report Earn Commendation of OCRD

Two reports on scientific studies conducted by the 2396th U.S. Army Reserve R&D unit at Columbus, Ohio, have earned a commendation from the Office of the Chief of Research and Development.

Recognized as a comprehensive and authoritative study of "Utilization of Ground Effect Machines (GEM) in the Mobility of the Army" was a report on Project TC-51 prepared by Lts James P. Loomis, Signal Corps, and Ralph G. Dale, Corps of Engineers. The report is being considered for reproduction and dissemination within the Army.

Lt Cols John Shuler, Signal Corps, and Harry C. Loudenslager, Ordnance Corps, collaborated with Lts Daniel H. Strohecker, and Hugh D. Hanes, both of the Ordnance Corps, in preparation of an interim report on Project ORD-241, "A Study of Explosive Forming Principles." It was termed "an excellent bibliography" concerning a relatively new area of metal working.

The 2396th R&D Unit is composed of 37 members, most of whom are associated with Battelle Memorial Institute, Ohio State University or North American Aviation, Inc. Active in project work, the unit currently is assigned projects in areas representative of each of the Army Technical Services.

Two members recently served a tour of ACDUTRA with the Army Research Office: Lt Col Harry B. Goodwin, Ordnance Corps, (former Commanding Officer), and Lt Col Melvin Koch, both from Battelle Institute.

ARTS Analysis Shows How Army Emphasizes Basic Research

Basic research, as defined by Government agencies, is being supported by nearly 30 percent of the Army's total research budget, a recent analysis of the Army Research Task Summary (ARTS) for FY 1960 reveals.

In what is often termed a "realistic approach" to the problems and intangibles inherent in long-range programming and technological forecasting, the Army is expending a much higher percentage of its research funds than most major American industries for basic research.

Current reports indicate most industries are spending less than five percent of their research budgets on basic research. Emphasis is on applied research aimed at more immediate profits, whereas the Army is "stockpiling knowledge" intended to insure technological supremacy in producing superior weapons and equipment far into the future.

The ARTS analysis was prepared by the George Washington University Task Group which has prepared the ARTS for the past six years. It shows that Army funding of all research in FY 1960 totaled $188,487,949. Basic research accounted for $54,138,983.

Forty-one percent, or $77,225,258, of the total Army research funds, the analysis shows, were expended through the Ordnance Corps to support in-house activities in laboratories and arsenals and for work done under grants or contracts with universities, colleges, profit and nonprofit research enterprises.

Next in dollar volume of research comes the Signal Corps with $29,524,595 (15.7 percent); Chemical Corps, $24,219,207 (12.8 percent); Army Medical Service, $15,140,322 (8 percent); Transportation Corps, $9,996,309 (5.3 percent); Engineer Corps, $9,236,538 (4.9 percent); Quartermaster Corps, $4,433,000 (2.4 percent); The Adjutant General, $1,050,000 (.6 percent). General research Army-wide totaled $17,662,720 (9.3 percent) as conducted through the Army Research Office, (including the European and Far East branch offices), and U.S. Continental Army Command, Deputy Chief of Staff for Logistics and Deputy Chief of Staff for Operations.

Broken down according to the scientific disciplines or areas, the analysis shows: physics, $70,619,576; engineering, $33,022,663; medical sciences, $20,783,925; chemistry, $19,311,044; operations research, $9,754,142; biological sciences, $9,687,745; geophysical sciences, $9,167,918; materials technologies, $6,713,343; social and behavioral sciences, $5,987,934; mathematics, $3,439,659.

Indicative of the disciplinary range and the integration of research among the Army Technical Services is the breakdown of Ordnance Corps expenditures, which the analysis shows as: physics, $42,810,662; chemistry, $12,763,789; engineering, $12,230,107; operations research, $566,136; geophysical sciences, $522,900; materials technologies, $5,338,178; social and behavioral sciences, $663,500; medical sciences, $615,000; mathematics, $1,659,886; biological sciences, $55,100.

In other breakdowns the ARTS FY 1960 analysis shows expenditures for research by Technical Services and other Government agencies doing work for the Army in each of the scientific disciplines and subfields. It also reveals allocations for internal (in-house) and external (contracts, grants) activities, broken down according to basic and applied research definitions.

Funding analyses compare volume of activities in Army research in the past four years. Total research expenditures grew from $85,335,175 in 1958 to $188,487,949 in FY 1960.

"Cautious Respect" Pays Off for CmlC Veteran

Familiarity hasn't bred contempt, as far as Paul M. Devereaux is concerned. Instead, it has engendered what he calls "cautious respect."

The 67-year-old veteran employee of the U.S. Army Chemical Corps is in excellent health, energetic and full of enthusiasm, notwithstanding the fact that for the last 41 years he has lived with toxic chemicals, incendiary materials and high explosives.

Foreman at the Army Chemical Research and Development Laboratories in Maryland, Mr. Devereaux has a gift for taking a concept and wedding it to a compatible mechanism to "make it work."

Paul M. Devereaux

For example, the idea of using carbon dioxide instead of water in filling munitions with phosphorous has existed for many years. However, it fell to Mr. Devereaux to perfect the technique. Today, at the Laboratories' chemical filling plant, experimental munitions are dry-filled in mass-production fashion by machines that vacuum-load them with CO_2-blanketed phosphorous.

Similarly, a process of coating phosphorous with copper sulfate as a shield against air and weather was conceived in the Laboratories. Mr. Devereaux developed a refined technique, and the chemical filling plant now produces coated phosphorous in small pellets, medium-size wafers and large blocks for a wide range of experimental purposes.

A onetime Maryland farm boy and automobile mechanic, Mr. Devereaux started work at the Edgewood Arsenal, now the Army Chemical Center, in 1919. Today he gives only a fleeting thought to retirement. Commenting on the riskiness of his work, he says:

"Actually, it's not as hazardous as driving to work in the morning."

"I keep getting the feeling that this has been researched before"

Stahr Calls for Progress in Electronics

Secretary of the Army Elvis J. Stahr, Jr., has reemphasized to the electronics industry its responsibility to help the Army fulfill its need for better communications equipment, better instruments for Army planes, and better electronic equipment for combat surveillance.

Speaking recently to the Electronics Industries Association's Defense Planning Forum in Washington, D.C., Secretary Stahr said:

"Our Armed Forces are much more likely to be called upon to put out what some people call 'brush fires' than to fight to a finish in global war. . . . Although all members of our Armed Services would be essential to victory in limited war, it cannot be denied that land units would play the dominant role. . . . It seems obvious to me that we must maintain United States combat-ready forces overseas."

The Secretary urged the electronics industry to step up communications research because "much remains to be done in this field before we have a really secure and dependable global communications capability. . . ."

Problems of the Army pilot are unusual, it was pointed out, in that he must not only fly the ship, usually at low altitude, but "also serve as navigator, flight engineer, communications engineer, and observer, and he needs all the electronic assistance he can get."

Combat surveillance was defined by the Secretary as an "all-weather, day-and-night systematic search of a battle area for information about the enemy, the weather, and the terrain for the use of technical commanders." He said it must be performed by a variety of groups and electronic components, and that "the system must also have the electronic means of processing, analyzing and presenting its collected information—rapidly and effectively. . . .

"It seems clear to me that those contractors who bring to bear the greatest initiative in helping to solve the problems of defense, and who find the shortest path between the conception of an idea and the production of the finished product will have the best chance, not only to serve the Nation well, but also to reap the rewards of free enterprise which are so essential to industrial survival and growth."

Wonder Drugs Promise Instant Creative Writing

Biochemical catalysts to aid authors who seek to garnish the scientific diets of their colleagues are now offered by the Wallerstein Co., manufacturers of enzymes.

In a recent edition of Chemical and Enginering News magazine, it was announced that the following enzymes are now available; others are still in the development stages:

1. Techno-amylase: An enzyme complex that removes bulky, starchy components which add unnecessary volume to reports. (Caution: this enzyme should not be used where reports are judged by weight.)

2. Techno-protease: An enzyme system that removes low quality, protein-aceous quagmire and allows readers to get to the heart of the subject.

3. Techno-pectinase: An enzyme system that clarifies reports by reducing their viscosity; thus they become free-flowing, and cloud-producing elements settle for later rapid removal. (Techno-pectinase is contraindicated in patents and pseudotechnical sales literature.)

4. Techno-flavor: A new enzyme that adds flavor to reports, ensuring sustained reader interest and consumption.

DOD Publishes Handbook On Truck, Tractor Design

Information on Department of Defense requirements in the design of tactical trucks and truck-tractors is now available in one booklet.

These truck design guidelines, previously scattered in dozen of hard-to-get documents, have been assembled in the new Military Standardization Handbook 134, (MIL-HDBK-134), "Design Characteristics of Tactical Trucks and Truck-Tractors."

Resulting from studies made by the Standardization Branch of the Army Ordnance Tank-Automotive Command, (OTAC), Detroit Arsenal, Center Line, Mich., the 60-page-booklet describes the function, materials, manufacturing quality and workmanship, and special military characteristics desired in tactical trucks.

Specific guidelines given the designer include objectives, reliability concepts, human engineering requirements, and environmental conditions.

The contents are compatible with the Army, Navy, and Air Force requirements. In consonance with the Defense Standardization policy, maximum use was made of nongovernment standards, specifications and codes.

The booklet is available from the Superintendent of Documents, U.S. Printing Office, Washington 25, D.C.

Army Orders 1,500 M-113 Armored Personnel Carriers

Production of 1,500 armored personnel carriers (M-113), with repair parts and related items, is called for by a $40,607,751 contract awarded by the Army.

The M-113 is a lightweight personnel carrier for infantry and armor units. It is capable of airdrop and amphibious operations and possesses superior cross-country mobility.

The contract, which will be administered by the San Francisco Ordnance District, Oakland, Calif., was awarded to the Food Machinery and Chemical Corp., San Jose, Calif. Previous contracts with Food Machinery totaling approximately $75,000,000 have been awarded for the procurement of the M-113.

Approximately $21,000,000 in orders will be placed with 530 subcontractors situated in 23 States. Some $11,500,000 of the recent contract will be spent in distressed labor areas.

QM R&E Center Reports On Means of Assessing Physical Capabilities

Publication of "Performance Capacity," a 250-page report concerned with relevant factors, criteria and methods used in assessing physical capability, was announced early in April by the Quartermaster Research and Engineering Center, Natick, Mass.

Although the subject matter for the booklet was developed in 1957 at a conference of nutritionists, medical men and physiologists sponsored jointly by the Army and the National Research Council, it is being considered more urgently now than it was at the time of the meeting.

"Performance Capacity," the QM R&E Center believes, should have wide application to all persons or agencies concerned with problems of physical fitness. It is considered a significant report on the most searching study yet made of the methods used to measure the capacity of human beings to endure work and stress. A continuing QM objective is to increase this capacity through improved rations, clothing and equipment.

Since a certain amount of controversy has existed regarding the most effective means of assessing physical capability, it was the aim of the National Research Council's Committee on Foods, which serves the Advisory Board on QM R&E, to provide an "open court" of scientists to resolve some of them at the 1957 conference.

To weigh the effect of combat situations of the future, knowledge of performance capacity will be essential. "Performance Capacity" brings together not only knowledge on performance testing methodology, but also the results of tests under (a) extreme cold and heat, (b) stress conditions, and (c) limited food and water intake.

The brochure has been issued in only a limited edition since it is directed to research groups concerned with the influence of the various factors that hamper human performance.

Puff of Smoke Gauges Winds For Pressures on Missiles

A puff of smoke—about like the one created after a long drag on a cigar—is helping U.S. Army engineers determine the effect of winds on missiles.

A method of measuring winds aloft in 3-D, that is, vertical wind currents as well as those moving parellel to the ground, has been sought for five years. Conventional means measured only horizontal winds. Vertical winds, however, can also alter the course of a missile unless proper allowance is calculated.

Test engineers at the Army Rocket and Guided Missile Agency now determine the vertical wind effects by a puff of smoke produced in mid-air just prior to the time a missile passes the same point. By studying motion picture film of the test, engineers can compare the performance of the missile against the visible record of the air currents acting on the puff of smoke.

The smoke puff is created by firing aloft a small container filled with a smoke-producing agent timed to burst at a given height along the path that the test missile is following.

The technique provides precise wind measurements at altitudes up to 1,900 feet. It is now being used in Army missile firing tests at Redstone Arsenal, Ala., an element of the U.S. Army Ordnance Missile Command, and at White Sands Missile Range, N. Mex.

Missile engineers of the Army Rocket and Guided Missile Agency's research and development operations test and evaluation laboratory conceived and developed the new technique.

ARGMA is an element of the U.S. Army Ordnance Missile Command at Redstone Arsenal.

Creative Problem Seminar at Fort Belvoir Puts Management Emphasis on Disciplined Decisions

Sternly disciplined decisions and tough-minded follow-up action were stressed as fundamentals of good management during a 3-day Military Creative Problem Seminar sponsored by the U.S. Army Management School at Fort Belvoir, Va.

Conducted for 82 senior officers and civilians of the Army, Navy and Air Force by the Creative Education Foundation of Buffalo University, Buffalo, N.Y., the seminar became a brainstorming session for free exchange of ideas as well as a review of creative principles, techniques and procedures time- and profit-tested by industry.

Attendees raised problems encountered on their jobs and attempted to solve them through discussion and application of the techniques presented. Lists of ideas produced during the creative session were taken back to work, and many will find their way to service boards and possibly even to the desk of the Secretary of Defense in the near future.

Creativity and imagination are indeed key elements of decision making, speakers emphasized, pointing out that an executive can become creative only through rigid self-discipline.

Among those who spoke before the seminar were Dr. Alex F. Osborn, chairman of the board, Creative Education Foundation, and cofounder of the advertising firm, Batten, Barton, Durstine and Osborn, Inc.; Chancellor Clifford C. Furnas of the University of Buffalo; Joseph A. Anderson, vice president of General Motors Corp.; and C. K. Turman, until recently general supervisor of education and training at the Gary Works of U.S. Steel Corp.

Prof. Leo B. Moore, Massachusetts Institute of Technology, stressed the need for ideas strong enough to face the realities of Monday morning's need for action.

Joseph G. Mason, author of the book, *How To Be A More Creative Executive*, challenged each participant to accept his own responsibility for creativity rather than passing the buck to superiors or subordinates.

Mr. Mason coined the memory word, *drive*, to emphasize his point that the military commander or manager, like his business counterpart, can become effectively creative only through his application of self-discipline; his willingness to seek out responsibility; his acceptance of the risks of initiative; his desire for action or velocity; and his evidence of enthusiasm.

Joseph A. Anderson, vice president of the A.C. Spark Plug Division of the General Motors Corp., challenged participants to examine the creative climate of military top management.

Dr. James E. Gates, dean of the University of Georgia's School of Business discussed the obstacles to be overcome and the opportunities to be achieved by management programs designed to increase executive creativity.

Chancellor Furnas discussed unsolved military research and development problems and Dr. Lee H. Bristol, president of the Creative Education Foundation, analyzed methods of problem definition, preparation and processing.

Leadership rather than lectureship was the rule of the session, modeled upon annual institutes conducted at the University of Buffalo, and the emphasis was placed on problem solving by the individual participants.

Tripartite Operations Research Meet Slated

Eighty delegates representing the operations research effort of the U.S., British and Canadian armies will attend a 9-day conference to be held in London beginning May 29.

Discussion of mutual problems related to operations research in the 1965-1975 decade will include such subjects as limited and general warfare, war games as a tool of operations research, and the value of field experimentation as an aid to modern research.

Objectives of the seventh ABC conference, as laid out at the first tripartite conference in 1949, are:

To foster and improve the technique of Army Operational Research, as a scientific subject, by a free discussion among scientists particularly engaged in it.

To approach, where desirable, a common technique and terminology in this field.

To assist the general project of standardization by harmonizing the ideas on the requirements for future weapons and their performance and on military techniques in general, of those scientists likely to be consulted on these matters by the General Staffs they serve.

To improve arrangements for the interchange of papers and workers in this field and, so far as possible, to plan the work of the three countries to avoid undue overlap and to achieve a national balance of effort.

Dr. Richard A. Weiss, Deputy and Scientific Director of Army Research, Office of the Chief of Research and Development, Department of the Army, together with Dr. George S. Pettee, Assistant Director of the Johns Hopkins University Operations Research Office (ORO), and Col Edward M. Parker, also of ORO, visited London in March to arrange with British and Canadian representatives for the forthcoming conference.

Conferees Weigh Gains In Man-Machine Factors

Results of the Army's continuing program to make sure its weapons and machines are properly engineered, from a man-machine compatibility requirement, for the troops who have to use them were evaluated at a University of Michigan meeting of the Army Human Factors Engineering Committee, Apr. 25-26.

Plans also were formulated for the 8th Annual Army Human Factors Engineering Conference to be held at the University, Oct. 3-6. Dr Lynn E. Baker, Scientific Advisor, Human Factors Research Division, Army Research Office, said the conference will attract about 250 scientists and design engineers from Army, academic and industry R&D centers.

The Conference report, always a "best seller" among design engineers and human factors scientists, carries complete summaries of all Army research and development in this field, as we'l as the proceedings.

Prof. Arthur W. Nelton, University of Michigan Department of Physics, acted as the host at the April meeting and will also direct the University's participation in the October conference.

The Committee, established in 1958, has representatives of the Army's Technical Services and has the specific requirement to "recommend policy and procedures . . . to improve compatibility of Army weapons and equipment with the skills and abilities of the troops serving and maintaining them."

6 Army Experts to Attend International Symposium On Materials Science R&D

Six Army experts will participate in an international symposium on materials science in Paris, May 15-19. Sponsored by the Science Advisor to NATO (North Atlantic Treaty Organization) and the Materials Panel of the Advisory Group on Aeronautical Research and Development to NATO, the symposium is expected to attract representatives of all members of NATO.

Besides the Army, the Navy, Air Force and Department of Defense have been invited to send representatives. Invitations have also been extended to the National Aeronautics and Space Administration, Atomic Energy Commission, the President's Science Advisory Committee, the Department of the Interior's Bureau of Mines, National Academy of Science, and to representatives of universities, research institutes and industry.

Participants will review progress in basic materials science, discuss the organization of materials research and development in the NATO countries, and consider the translation of materials science into technological progress.

Named to represent the Army at the symposium are:

Lt Col Robert R. Wessels, U.S. Army Research and Development Liaison Group, Office of the Chief of Research and Development (OCRD).

Dr. S. Benedict Levin, Deputy Director, Institute of Exploratory Research, Hq. Signal Research and Development Laboratory, Fort Monmouth, N.J.

Dr. Z. V. Harvalik, Engineer Research and Development Laboratories, Fort Belvoir, Va.

Dr. John J. Antal (Alternate: Dr. Allen Goland), Ordnance Materials Laboratory, Ordnance Materials Research Office, Watertown Arsenal, Mass.

Dr. Sidney J. Magram, Army Reserve Office, OCRD, Arlington, Va.

Dr. Peter R. Kosting, Director, Metallurgy and Ceramics Division, Army Research Office—Durham, N.C.

50 R&D Reservists to Hold 2-Week Seminar at Belvoir

The fourth annual Research and Development Seminar for Reserve Officers will be conducted by the U.S. Army Engineer Research and Development Laboratories, Fort Belvoir, Va., July 29-Aug. 12.

Designed to acquaint the Reservists with the latest development in Corps of Engineers' equipment, along with some of the problems in R&D, the past Seminars have drawn Reserve officers from all sections of the country.

Attendance at this year's Seminar is being limited to 50, with priority being given to CE Reservists in R&D work. Personnel who attended the 1959-1960 Seminars are not eligible to attend. Attendance by reservists will be considered as fulfilling active duty training tour requirements.

Mobilization Designation Detachment No. 39, the Reserve unit at the Laboratories, for the fourth consecutive year, will sponsor and provide the necessary administrative support for the Seminar.

Lt Col Adolph H. Humphreys, civilian chief of the Camouflage Branch at the Laboratories, will serve as Seminar Director. Other members of the control group, including committee chairmen, are Maj Robert G. Alexander, Assistant Director; Maj Ben St. Jermaine, transportation and quarters; Capt Joseph Hannigan, arrangements; Maj Howard McComas, administrative; Maj George Johnston, publicity; Capt Lowell Barnett, field trips, and Lt Col Gilbert Lorenz, publications.

PAD Seminar Changed From May to June 14-16

Dates shown in the article, "Frankford Arsenal Calls PAD Symposium May 17-19" in the March issue of the Army Research and Development Newsmagazine have been changed to June 14-16, to allow more time for participants to prepare papers.

Widespread interest among PAD (propellant actuated devices) users and developers has been evidenced. In addition to the various Ordnance Corps activities, all Army Technical Services are sending representatives. Other agencies participating include the Navy, Air Force, NASA, Federal Aviation Administration and Atomic Energy Commission.

As of March 31, technical papers totaling nearly eight hours of presentation time had been accepted.

"Developer papers" will discuss the latest work in such areas as propellants and gas generants, interior ballistics, effect of space environment on PAD, thrust modulation and programming, ignition problems, control of acceleration in rocket catapults, and concepts of PAD for application to future equipment systems.

"User" presentations already scheduled include current PAD applications and problems, requirements of future escape systems for advanced flight vehicles, recovery systems, separation systems, and other concepts of future equipment systems in which PAD may be required.

CmlC Cites Dr. Fothergill For R&D Accomplishments

Dr. LeRoy D. Fothergill, Scientific Advisor to the U.S. Army Biological Laboratories, Fort Detrick, Md., was awarded the Army's Outstanding Performance Award by Col Carl S. Casto, Commanding Officer, for his accomplishments in the program of the Chemical Corps at Fort Detrick.

Dr. Fothergill was cited for his high standards of performance in vital research and development activities as advisor to the commanding officer and scientific personnel at Fort Detrick and also for his services to

Dr. Fothergill, Col Casto

the Chief Chemical Officer in the information and educational areas. Dr. Fothergill, who holds the rank of captain, U.S. Navy Reserve, retired, has been at Detrick since 1943, the year the post was activated.

A graduate of Harvard Medical School, cum laude, class of '29, he is known throughout the Nation as an outstanding authority in the biological research field, and has lectured to many medical and scientific groups. He is president of the Rotary Club of Frederick, Md.

Industry Experts Discuss Light Metals at ERDL

Representatives of leading U.S. metals firms discussed aluminum, magesium and titanium and their alloys at a 3-day light metals symposium held recently at the U.S. Army Engineer Research and Development Laboratories, Fort Belvoir, Va.

Conducted by the Laboratories with the cooperation of industry, the symposium was held to disseminate the latest technical information to design and materials engineers, metallurgists and welding engineers of the Corps of Engineers and other Government agencies.

Speakers on aluminum and its alloys included J. W. Hood, chief metallurgist, E. V. Blackman, assistant chief metallurgist, fabricating division, C. J. Walton, division chief, research laboratories, and J. G. Sutton, staff metallurgist, fabricating division, all of the Aluminum Company of America; Howard Adkins, welding specialist, Daniel Erhard, chief forge engineer, and Robert Ridout, manager of field technical services group, all of Kaiser Aluminum and Chemical Corp.; Paul Brandt, director of engineering service, and G. R. Darrow, chief finishes engineer, Reynolds Metals Co.

Magnesium and its alloys were discussed by Phillip Craighead, chief engineer, and James S. Kirkpatrick, vice president in charge of research and development, Brooks & Perkins, Inc.; Dr. T. E. Leontis, assistant director, metallurgical laboratory, and Dr. J. A. Stevens, technical service and development department, Dow Chemical Co.; K. E. Nelson, head of technical services development, Wellman Bronze and Aluminum Co.; Paul Wisniewski, production manager, nuclear and electrical products, Wyman-Gordon Co.

Those discussing titanium and its alloys included: H. R. Ogden, chief of the nonferrous division, Battelle Memorial Institute; James S. Kirkpatrick, vice president in charge of research and development, Brooks & Perkins, Inc.; Russell Hardy, chief metallurgist, Oregon Metallurgical Corp.; Donald B. Tik, manager, chemical applications, J. Neuman, assistant manager, process controls, and Ward W. Minkler, manager of technical service, Titanium Metals Corp.; Robert Colton, metallurgist, Watertown Arsenal Laboratories; and James Coyne, manager, metallurgical development, Wyman-Gordon Co.

Faster Service Anticipated From Automated Map System

An automated mapping system, designed to lighten the time-consuming chore of putting the names of cities and other landmarks on maps, was announced at the 1961 convention of the American Society of Photogrammetry and the American Congress on Surveying and Mapping held recently in Washington, D.C.

The new system was announced by Concord Control, Inc. Automation of map processing was declared to be a necessity because of the great volume of data currently gathered through aerial photography and soon to be gathered by satellites.

Employees of the Geodesy, Intelligence and Mapping Research and Development Agency (GIMRADA) and the U.S. Army Engineer Research and Development Laboratories (USAERDL), Fort Belvoir, Va., took an active part in the joint convention. Seven employees of GIMRADA and one employee of USAERDL presented technical papers.

Dr. Denison Retires After 41 Years of Service

More than 40 years of Federal Government service ended for Dr. Irving A. Denison, a senior member of the scientific staff of the Diamond Ordnance Fuze Laboratories, Washington, D.C., when he retired on Mar. 17.

An internationally recognized expert in the field of corrosion of metals, Dr. Denison in recent years had made contributions in the field of fuel cell research.

Dr. Denison received his A.B. degree in 1920 and his M.S. degree in 1921, both from the University of Illinois, following two years of military service in World War I. In 1922 Dr. Denison entered Government service as a chemist with the Department of Agriculture.

After receiving his Ph. D. degree from George Washington University, Dr. Denison transferred in 1929 to the National Bureau of Standards. As a result of his research on underground corrosion of metals, Dr. Denison gained national and international stature. His published papers in this field are referred to in many text books. In 1953 Dr. Denison transferred to the Army's Diamond Ordnance Fuze Laboratories.

Dr. Denison is a member of the American Chemical Society, the American Electro-Chemical Society, the National Association of Corrosion Engineers, the Philosophical Society of Washington, D.C., and the Washington Academy of Sciences.

Dr. Irving A. Denison

TRECOM Pushes Crash Safety Research

The United States purchased the first airplane ever sold in this country in 1908. In that purchase contract, there was specific mention of provisions for pilot safety in the event of a crash. Since man took to the skies, survival in the event of disaster has been of paramount importance.

Francis P. McCourt
TRECOM, Author

Only a generation ago, flying was considered so hazardous an undertaking that pilots were popularly regarded as daredevils and heroes. The idea that men might crash and survive was a violation of common sense; those who flew did so with the conviction that they were taking their lives in their hands. Planes were built to fly, not to crash.

Early pilots resisted even the use of parachutes, on the grounds that to wear them was a sign of cowardice. To men brave enough or foolhardly enough to fly, the air was not a fit place for the kind of person who worried about precautions in case of an accident. Early pilots were fatalists who, of necessity, lived by the maxim that a man dies when his number is up. They were men to whom taking chances was a way of life.

Like so many matters involving change of public attitude, the concept of flight safety was introduced against considerable odds.

Each year, more and more people travel by air. More commercial aircraft are being used, and private flying has increased tremendously. Current and future military concepts of warfare have placed a great reliance on the air vehicle to achieve the battlefield supremacy required for survival in any future conflict.

New aircraft types are being continuously developed, with emphasis on speed, range, and all-weather capability. Better environmental facilities are being provided, new flying aids are being introduced, and operational limits are strictly defined in requirements for airworthiness certification.

With all of the steps being taken to prevent the occurrence of accidents, the present accident rate will undoubtedly be decreased. Really striking reductions cannot be achieved, however, without seemingly disproportionate or prohibitive increases in the cost of aircraft and aircraft operations. Further, there is the unpredictable human error which is the causation factor in many accidents.

Many will agree that so long as man is in any way associated with the design, construction, maintenance, and operations of air vehicles . . . "there shall be accidents." *It does not necessarily hold true, however, that so long as we have aircraft . . . "there shall be injuries and/or deaths."*

Experience has shown that, under certain conditions, human structure can withstand exposure to impact forces which will normally disintegrate aircraft structure. Considering, then, the capability of the human body to withstand certain magnitudes and direction of force application, it becomes possible to proceed to isolate and classify predominant injury-producing factors which may be revealed through the crash-injury study of aircraft accidents. *Such investigations and analyses clearly indicate that force, in itself, has not been the outstanding cause of injury or death in aircraft accidents.*

Accepting the inevitability of an occasional accident, it becomes the joint responsibility of certain medical, engineering, and research groups to strive to minimize the consequent injury to occupants of aircraft by drawing attention to measures which may reduce unnecessary death and injuries. *The aim must be to provide the safest possible design, within the limits imposed by operational and economical considerations.*

The major objective of aviation crash injury research is to provide data for engineering design which will, in turn, assure survival with little or no injury in aircraft accidents which involve *survivable conditions* of crash force.

To elaborate further, there is a reason for every injury. If all the facts are known, each injury can be related to forces, with or without direct contact between the site of the injury and some part of the aircraft. A knowledge of the relations between injury and force, and aircraft structure will serve as a source for ideas concerning prevention, diagnosis, and treatment of certain injuries, all of which will improve the survival rate.

The foregoing suggests that "crashworthiness" or "crash safety" is a subject as worthy of comprehensive study as is "airworthiness."

To meet its mobility requirements under present and future concepts of warfare, the Department of the Army has drastically increased the number of aircraft in its inventory during the past decade. Expansion of aviation in the Army has been paralleled by an increase in emphasis on the safety of personnel and cargo being transported by air. This emphasis has been directed toward the prevention of aircraft accidents, and the prevention or reduction of damage or injury.

To support a program of action directed toward these objectives, the U.S. Army Transportation Research Command (TRECOM) entered into a research contract with the Flight Safety Foundation (FSF). It provides for investigation and analysis

Dropped 28 feet feet by a crane traveling 30 m.p.h., H-25 Piasecki Helicopter remained relatively intact, sustaining but little deformation of the fuselage.

of individual accidents, the collection and analysis of quantitative accident data, and the training of crash injury investigators. This effort is supported by the U.S. Army Medical Corps, the Armed Forces Institute of Pathology, the Deputy Chief of Staff for Operations, the United States Navy and Federal Aviation Agency (FAA).

Continuous gathering of post-accident facts, and the reduction of these data under standard investigative and analytical procedures, are basic to the FSF contract. Through accumulation of knowledge, it is believed much can be accomplished in improvement of the structural environment and components of aircraft as they affect crash safety or the probability of survival in aircraft accidents.

Numerous improvements in safety have resulted from these procedures including safety belts, shoulder harnesses, crash helmets, and, in many cases, increased structural integrity of fuselages and cockpits.

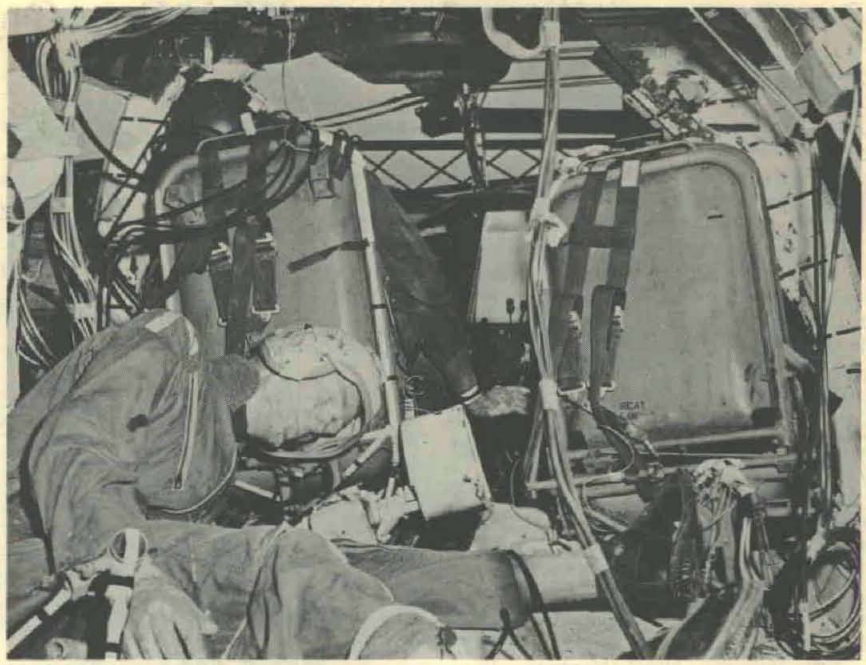
Post-crash investigation and analysis are not enough since they can never be *quite* as *precise* as is necessary to answer the many questions confronting aircraft designers and operators. Something more is needed. It is believed that this answer can only be provided by *full-scale crash tests*, backed up with a well-integrated, broadly-supported program of *dynamic testing* of components.

The initial step toward a long-range program of dynamic testing was accomplished with a drop of an H-25 Piasecki Helicopter from a height of 28 feet at a forward speed of nearly 30 miles per hour, in a manner to simulate a known accident configuration where the estimated initial impact forces would approximate 40 g's.

Objectives of the first experiment in a potentially long-range experimental research program were to measure crash forces through proper instrumentation of the test article, to determine the feasibility of using airborne *electronic* recording equipment during a crash with high *g forces*, and to analyze experimental dynamic testing problems for applications to more complex future tests.

The extent of the experimental instrumentation was an airborne instrument package which was suspended from the cabin ceiling. In addition, five camera locations were selected to give optimum coverage to both cockpit and passenger dummies and 16 accelerometers and strain gauges were installed in two dummies, on the auxiliary gas tank, and on the seats, structure and restraint systems.

Because there were questions as to the possible reliability and accuracy in the airborne recording system at accelerations exceeding 15 g's, shock-mounting this equipment was considered necessary. Preliminary tests of these recording components at the Chance-Vought Aeronautics Structure Laboratory in Dallas, Tex., verified the ability of a foamed-plastic installation to serve as the needed energy-absorption material to protect this equipment.



Collapse of seat structure in helicopter crash threw dummy occupant against cockpit seat with lateral force against head exceeding 100 g's in test crash.

To serve as an aid to high-speed movie coverage, the interior and exterior surfaces of the aircraft were painted white. Identification markings were placed on important structures such as landing gear, fuselage frames, and seat supports, using red reflective tape. Markings were placed on the exterior fuselage to aid in judging structural deformation.

After a final instrumentation checkout, the H-25 Helicopter was hoisted into position on a mobile crane. The run commenced 4,000 feet prior to the impact point in order for the crane to reach the desired speed. The release hook was triggered automatically about 54 feet ahead of the impact point.

At ground contact, the soft fuselage structure was pushed in by the stiffer landing gear. The helicopter then moved forward for some 16 feet.

An immediate inspection of the crashed aircraft revealed: (1) that the aircraft remained relatively intact with little deformation to the fuselage; (2) that fuel had spilled from a rupture in the auxiliary fuel tank; (3) that the head of the pilot dummy had been jammed so hard into the fuselage ring that the visor of the crash helmet split.

Perhaps the most remarkable outcome of the test was the functioning of all 34 channels of data recording during and after the crash. The equipment had sustained the shattering crash forces without attrition of a single item. One hundred percent reliability such as this had been unknown under such stringent conditions. A preliminary examination of the recorded data indicated favorable tests results for all objectives.

The significance of this truly dynamic testing program lies in the ultimate application of the findings to the specific problems of both military and civilian aviation. The findings from this initial step, and those experiments to follow, are directly applicable to helicopters and VTOL and STOL aircraft.

However, the knowledge gained on structural behavior under impact loads will be useful in the design of all flight vehicles, including those operating in space. As the program proceeds, three major areas will be explored. These areas have been divided into structural integrity of aircraft and component designs, post-crash fire, and biomechanics of crash injuries. These results will certainly lead to increased "crashworthiness" in the aviation field, and offer safeguards to the military's most priceless commodity—PERSONNEL.

Demonstrator Shows Students What Goes On Inside Nuclear Reactor

Want to know what goes on inside a nuclear reactor? Just ask one of the students in the Nuclear Power Plant Operators Course (NPPOC) of the Nuclear Power Field Office (NPFO), a part of the Corps of Engineers Research and Development Laboratories, Fort Belvoir, Va.

NPPOC students have seen what takes place within a reactor in a laboratory "Neutron Phenomena" demonstration devised by Capt Stanley R. Meeken, CE, and modified by T/Sgt Robert Ondek, U.S. Air Force, as part of their 48-week course.

By using various geometrics and shieldings, the students can actually observe what takes place by noting changes in the counts per unit time on a scalar. In this manner, such phenomena as thermalization, diffusion, scattering, leakage, reflection, absorption, and fission can be shown.

The NPPOC is divided into three 16-week sections devoted to Academic Training, Specialty Training, and Plant Operations.

Conducted by the Training Branch of the NPFO, the operators course qualifies students as crew members for the land-based reactors of the Army, Navy and Air Force. Headed by Maj Robert P. Graves, the branch has trained some 200 men since 1956.

To perform the "Neutron Phenomena" demonstration the laboratory instructor needs only four basic ingredients: a source of fast neutrons, a neutron detector, a container, and water. The source used in this particular demonstration is a plutonium-beryllium mixture. (Sketch 1).

The plutonium emits an alpha particle, which reacts with the beryllium to produce neutrons with different energies.

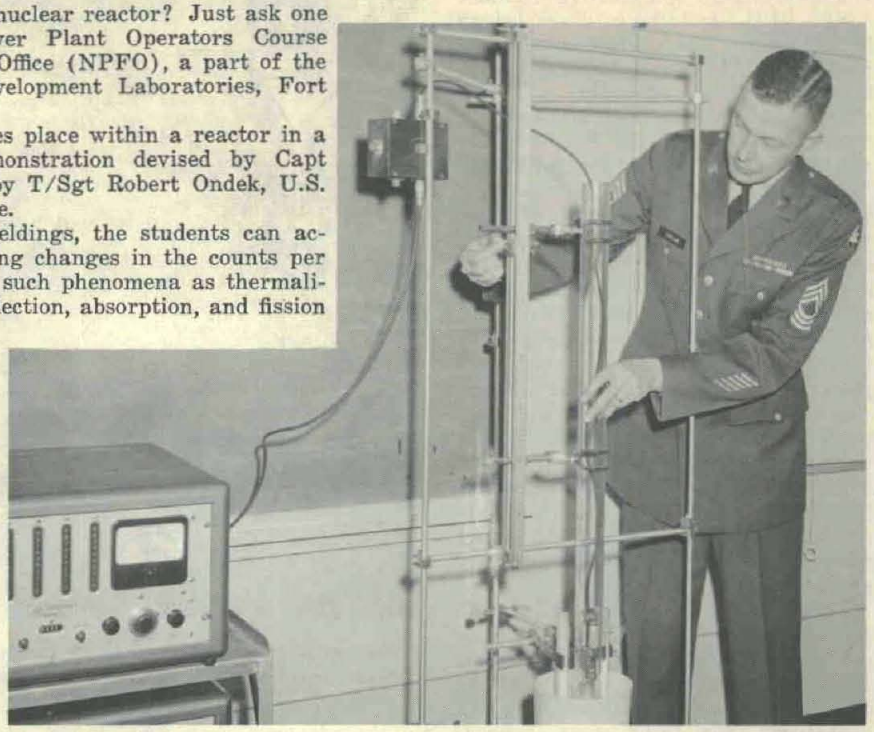
Since only fast neutrons are desired, a cadmium shield is placed around the source, stopping thermal neutrons (neutrons having the same average kinetic energy as the nuclei of the surrounding material), while letting fast neutrons pass through.

A boron trifluoride gas-filled tube is used as the thermal neutron detector. This detector is connected to either a scalar or count rate meter so that the thermal neutron count may be taken.

Since the other phenomena involve thermal neutrons, the first effect to be shown is thermalization. Thermalization is the slowing down of fast neutrons by a moderator, in this case, water. The water slows down the fast neutrons until they become thermal neutrons.

To show this effect a count is taken with the source in the container, but with no water. Theoretically this count should be zero, but, due to background radiations and fast neutrons thermalized by collisions with the container walls, a small count is observed.

When water is added, a large count reveals that thermal neutrons have been created by the slowing down effect of the water. The thermalization process takes place by scattering: When fast neutrons collide with the water molecules they give up some of their energy and change direction.



M/Sgt Lee D. Taylor, instructor, prepares to show neutron-absorption effect of boric acid in Fort Belvoir "Neutron Phenomena" laboratory demonstration.

To show the scattering effect, a count is taken with the detector at some specified distance from the source. If scattering did not take place, all the neutrons would enter the detector through the end facing the source, and if a cadmium shield were placed on this end, no count should be observed.

Only a slightly lower count is observed, however, when the cadmium end shield is in place. (Sketch 2). This means that thermal neutrons enter through the sides of the detector. Since the detector sides are perpendicular to the source, and since the source emits neutrons radially, the neutrons could not enter the sides of the detector unless their direction was changed.

After thermal neutrons are created they continue to move through the moderator. This motion takes place through a series of scattering collisions with the moderator molecules. The neutrons tend to move from regions of high neutron density to regions of low neutron density. This movement is called diffusion, and means there should be thermal neutrons counted regardless of distance between the source and detector.

The number of diffusion neutrons at different distances from the source is a function of the moderator and number of neutrons moving in that direction from the source. It is not a function of the distance squared. To show diffusion, counts are taken at several distances from the source. A decrease in counts is observed as the distance is increased.

Not all the neutrons stay inside the container. Some thermal neutrons diffuse through the walls of the container and escape; some fast neutrons are not thermalized and escape.

This loss of neutrons is called escape, or leakage, and can be shown by placing a detector outside the walls of the container and noting that counts are registered.

For thermal neutrons a detector like the gas-filled tube already described is used. For fast neutrons a photo-multiplier tube with a suitable scintillation crystal is used.

The performance of a reactor can be improved by surrounding the fuel with a reflector. The reflector scatters the neutrons back into the system in a process called reflection. Since most good moderators are also good reflectors, water is used as the reflector in the demonstration.

A cadmium shield is placed around the sides of the detector to prevent scattered neutrons from entering.

Then a count is taken at a chosen distance from the source with the water level even with the end face of the detector, indicating moderation effect of water in the container.

When water is added to cover several inches of the detector, it forms the reflective laver. The increase in counts shows reflection has taken place.

Some materials absorb neutrons. In this process a neutron is captured, or absorbed, by a nucleus of the absorbing material. Absorption can be shown by first taking counts without an absorber in the container. Then, two lucite tubes containing boric acid, boron being a good absorber, are placed close to the detector and source. The decrease in counts indicates boric acid has absorbed some neutrons.

The reaction of prime interest to the students is fission. They soon learn that fission is the splitting of a heavy nucleus by bombarding it with neutrons. In a suitable material such as plutonium this process creates more neutrons.

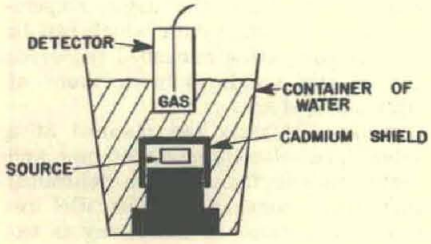
The creation of more neutrons is called multiplication. Since multiplication accompanies fission, fission can be demonstrated by showing the multiplication effect.

To show multiplication, a different arrangement is used. A paraffin block is placed in the container. The plutonium-beryllium source is placed in a hole in this block. A photomultiplier tube with a suitable crystal for interacting with fast neutrons alone is the detector, which is placed outside the container.

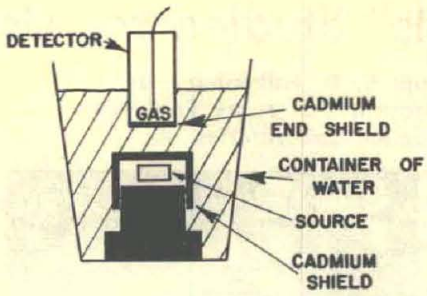
A count is taken with a cadmium shield, which allows passage of fast neutrons, between the source and the paraffin. The shield prevents those neutrons thermalized and reflected back from reentering the source.

Since thermal neutrons more readily cause fission, fission is effectively prevented. When the cadmium shield is removed from the source, thermal neutrons will fission the plutonium, producing additional fast neutrons. An increase in counts is observed indicating that fissioning is taking place.

As a result of this experiment,



I. BASIC APPARATUS



2. SCATTERING

students are acquainted with some of the theory behind reactor behavior. They have increased their understanding of thermalization, diffusion, scattering, leakage, reflection, absorption and fission.

In the NPPOC the students not only learn which switch to pull, but the reasons WHY.

ARADCOM Celebrates 10 Years of Progress

The United States Army Air Defense Command, responsible for the employment of all surface-to-air missiles in defense of the Nation, celebrated its 10th Anniversary Apr. 18. Lt Gen Robert J. Wood, ARADCOM CG, was Deputy Chief of Army Research and Development, until last July.

Since ARADCOM's formation World War II anti-aircraft guns have been replaced by a family of surface-to-air anti-aircraft missiles, including the NIKE AJAX, NIKE HERCULES, and HAWK. Any deployment of NIKE ZEUS, the third generation anti-missile-missile presently under advanced development, will be made by ARADCOM.

Placing of Army air defense units assigned to continental defense under a single command made it possible to bring about greater uniformity of standards and to assure maximum effectiveness and readiness of forces.

With the establishment of the Command the Army began to expedite rocket and missile development and the program to emplace combat-ready air defense units at permanent sites.

Exclusive responsibility for employment of surface-to-air missiles for continental defense was delegated to the Army and the Command in 1956 by a Secretary of Defense directive clarifying the missions and roles of the various services.

The most recent innovation in air defense recorded by the Command is the activation of above-ground NIKE HERCULES missiles shielded in pressurized plastic tents which unzip in an instant upon command to fire.

CmlC Gives 3 Civilians Blue Sky Certificates For Imaginative Ideas

Chemical Corps Blue Sky Certificates of Achievement were recently presented to three civilian employees of the Corps by Maj Gen Marshall Stubbs, Chief Chemical Officer, U.S. Army.

Cited for suggestions which are expected to have a far-reaching effect on the Chemical Corps mission were W. Bowman Cutter, Office of the Chief Chemical Officer; William Z. Penland, Chemical Corps Engineering Command; and Everett E. Champlin, a former member of the Corps, now privately employed.

Mr. Cutter's suggestion anticipated a need for a study of the methods of control of chemical and biological weapons in a world disarmament situation. The proposed study would provide in advance the technical data necessary to implement any disarmament program.

Mr. Penland and Mr. Champlin received recognition of the imaginative thinking expressed in their proposal: "Concept of a BW Rapid Warning System." Early detection and analysis of airborne biological agents are paramount in a successful warning system. Instruments envisioned by the men would quickly detect the presence and composition of airborne particles. The system then would predict areas of contamination and warn of the danger.

During the slightly more than two years the Chemical Corps Blue Sky suggestion program has been in effect 430 suggestions have met its established criteria for acceptance. To be considered under the program, suggestions must present novel approaches to the solution of major problems or must prescribe new subjects for investigation.

The program seeks suggestions from private industry, research organizations, educational institutions, members of all the Armed Services and other Government agencies, as well as from Chemical Corps personnel. Suggestions have been received from persons with no other interest than a desire to make an individual contribution to the defense effort.

Missiles Supplant AAA Guns

All National Guard antiaircraft batteries have now been converted from guns to missiles.

Eighty-two batteries are now on 24-hour alert at sites near major population areas—76 Nike Ajax batteries in the continental United States and six Nike Hercules batteries in Hawaii.

"Buildings in Barrels" Studied for Use in Remote Areas

By L. W. Shanahan and Capt S. D. Falkenbury, Jr.
Climatic Research and Test Branch, U.S. Army Engineer Research and Development Laboratories

"Buildings in Barrels," a radical new concept for rapid erection of structures in remote locations without transporting bulky materials to the site, is receiving intensive study by the Special Equipment Branch, Civil Department, U.S. Army Engineer Research and Development Laboratories (USAERDL).

The concept involves airdropping barrels filled with plastic foam, which when placed in or sprayed on a mold, forms a rigid building material.

Experiments at Fort Belvoir, Va., have demonstrated feasibility of the concept. Field tests of shaping and construction methods will be conducted in Greenland this summer.

Possibility of great logistical advantages was recognized within the Climatic Research and Test Branch, Technical Service Department, USAERDL, as a result of the branch's work with the design and construction of Camp Century, 138 miles from Camp Tuto on the Greenland Icecap. Supplies are transported to Thule via water and air, and then transhipped overland or by air.

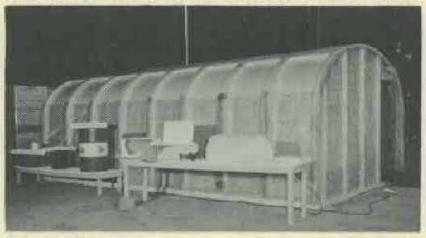
Difficult logistical problems encountered in providing facilities at this remote location are common in any remote area of the world. Cost of shipping the prefabricated Arctic-type building used in Century's construction, added impetus to development of the buildings in barrels concept.

Chemical reaction produces a rigid material which is approximately 30 times the volume of the original resins. Volumetric change is controlled by modifying the formulation of the two components, and is dependent upon the desired density of the polyurethane building material.

Present costs for raw polyurethane materials are comparable to those of conventional building materials, and these costs are being rapidly reduced. Actual costs of present arctic buildings, compared with those of the prototype plastic building designed for use in snow trenches, indicate substantial savings may be realized through future use of the plastic construction method.

Transition from this concept to an actual building shape was made after a thorough study of all the physical properties of polyurethanes. It was found that the coefficient of thermal conductivity (K factor) of two-pound density foam is approximately one-third that of rock wool insulation.

Plastic foam wall section is light enough to be carried easily by girl.



Completed plastic structure, 24 feet long by 16 wide, stands behind its compactly packaged building components (on table at left) and model of its shape and reinforcement structure.

Since the modified arch buttress shape would enable the building to be self-supporting without the addition of reinforcing material, it was decided to use this shape on the prototype. This shape also minimized the amount of plastic material required for each building. A building width of 16 feet was chosen since this is the width of present Century structures and snow trench widths would be a controlling factor for structures planned there.

Four molds were used in shaping the prototype building. Fabricated by S. B. Swenson, Chief of the USAERDL Model Shop, the molds were of wooden construction lined with sheet aluminum. A metered amount of polyurethane resin and hardener was placed in these molds.

The castings produced for the wall sections were the largest known polyurethane castings ever attempted. Their weight, however, was only approximately 22 pounds.

Protection of the low compressive strength (approximately 20 p. s. i.) foam plastic casting was essential; it was accomplished by spraying each casting with a mixture of fiber glass and polyester plastic resin. The resultant fiber glass skin, approximately 1/16-inch in thickness, also enhanced the flexural strength.

The completed members, however, were of sandwich construction due to the lack of a complete bond between the foam plastic casting and fiber glass-skin. Wax used to facilitate removal of the casting from the mold had remained on the casting. Present techniques employ fiber glass sprayed molds; foaming thus produces a homogeneous casting. Bond between all materials is exceptionally high.

Assembly of the various castings into the final building shape can be accomplished by coating the tongue and groove joints with resin similar to that used in the skin, placing tabs of fiber glass across the joints around the periphery of the building, or using metallic fasteners. All of these methods of assembly will be studied as research in this area progresses.

The prototype building, displayed for the first time to the Engineer Commanders Conference at Fort Belvoir Nov. 16, 1960, was assembled by the fiber glass tab method. This 16' x 24' building, complete with a floor, was constructed with approximately 55 gallons of polyurethane plastic resin, five 30-pound rolls of fiber glass, and 15 gallons of polyester resin.

Future research in the plastic building area, to be conducted by the Special Equipment Branch, will include:

a. Development of the most economical shape for varied usage.

b. Studies of various methods and materials for reinforcement.

c. Development of different and simplified techniques which may be used in fabricating structures.

d. Development of a single metering and application machine for use in the field Army.

The field test of the present shape and method of construction in Greenland this summer will consist of erecting two structures. One will be a living quarters in the ice tunnel at Camp Tuto, the other a laboratory building for the U.S. Army Cold Regions Research and Engineering Laboratory at Camp Century. Experiments will provide data which can be used in comparing expended resources for plastic buildings with those of previous systems.

Additional tests are planned at a later date. Development of new and better plastic foams by the chemical industries, coupled with parallel research programs in the Army is expected to result in radical departures from present building and shelter concepts, suitable for use in any theater of military operations.

Engineering Imagination Held Key to Combat Mobility

Civil engineering, the oldest activity of the Corps of Engineers, is taking on new significance in providing Army combat forces with the type of mobility they need in the missile age.

Solution of the combat mobility problem "calls for wholesale imagination on the part of our engineers," according to Dr. G. H. Hickox, Director of Research at the U.S. Army Engineer Research and Development Laboratories, Fort Belvoir, Va. His viewpoint is expressed in an article in *Civil Engineering* (February), the official magazine of the American Society of Civil Engineers.

This imagination presently is coming up with such concepts as ground effect machine "flying carpets" able to carry bridge spans up to 90 feet long, implaceable by a remote operator up to 50 miles away. Also, bridges made out of air mattresses which can be inflated at site and implaced with the help of ram jets. In the making is a whole new family of tractors and cranes, airliftable and amphibious.

Hickox warns, however, that "although much has been said and written about the use of planes, helicopters and ground effect machines for the transportation of personnel, it is probable that the Army will be dependent on bridges and ferries for river crossings for a long time."

An interim solution to the problem of assault bridges, Hickox states, is the aluminum alloy "scissors" (See *Army R&D Newsmagazine*, Vol. 2, No. 2, page 11) which is carried and hydraulically launched by a modified, turretless tank. Eighteen tank launchers, and 18 60-foot and 9 40-foot scissors bridges to go with them, are being procured for U.S. armored units in the States and in Europe.

Tests have been held to determine the possibilities of delivering bridge and supporting equipment to the site by air. The Hickox article states: "Using the H-21 helicopter, which has a load-carrying capacity of about 3,000 pounds, the following have been successfully air-lifted: a complete bay of the 12-ton-capacity complete light tactical bridge, floats of the widened steel treadway bridge, superstructure for these floats, the 19-foot bridge erection boat, and eight nested assault boats. With the heavier H-37 helicopter, "it is possible to airlift the pneumatic float of the M4T6 bridge and place the aluminum deck on it."

Hickox believes adaptations of the commercial air mattress made of nylon-impregnated rubber can be used to aid combat mobility. He explains: "We expect to carry deflated mattresses on trucks or trailers to a point near the launching site where they will be inflated and readied for launching with the help of ram jets. The jets will propel the bridge as well as support its forward end. Small samples of load-carrying pneumatic structures have been fabricated by interested rubber companies. This type definitely warrants further consideration. . . ."

A third method being investigated is a unit which will have all the equipment necessary for field fabrication of precast prestressed concrete bridge structures for use in line-of-communications operations. The article states:

"Through the use of indigenous materials and with complete facilities for processing the raw materials and for batching, placing, forming, curing and testing, the Engineer Construction Battalion becomes a self-sufficient unit in any locality."

Construction power in the field is another problem. Hickox writes that "an accelerated airborne construction equipment program has produced a family of machines capable of building an assault airstrip 1,500 feet long and 100 feet wide within 12 hours after the airdrop."

But this isn't good enough. According to Hickox, troops must have the capability of building assault airstrips within five hours.

To meet this need the Corps is developing a revolutionary ballastable airborne, air-droppable tractor weighing less than 16,000 pounds but ballastable at the work site to do the work of a 35,000-pound tractor. A crawler version is also designed to be air-droppable and ballastable up to 35,000 pounds. This tractor can perform the work of a dozer, a scraper, grader, dump truck, and prime mover.

The Corps is also developing an airborne 8-ton crane that can pick up 9 tons. The unit tows readily at convoy speeds, has a self-propelled speed of 8 miles per hour, and can be converted to perform the operations of a ⅜-cubic yard clamshell, dragline and front-loading shovel. A rough terrain crane with the capacity of 20 tons at a 30-foot-radius is reported in the engineering test stage.

Besides these improvements in the standard tools of civil engineering, the article also detailed new Corps of Engineers developments in the fields of rapid survey equipment, mapping, water purification, and nuclear power plants for military purposes.

Sergeant Setting Pace as CmlC Research Volunteer

The letter "V" on the armband worn by Sgt Karel Grunwald of Fort Devens, Mass., stands for "Volunteer." It could just as well represent the Roman symbol for "five." Here's why:

(1) Sgt Grunwald recently completed his fifth tour of volunteer duty as a test subject in the medical research program at the U.S. Army Chemical Research and Development Laboratories at Army Chemical Center, Md.

(2) Since his first 30-day tour in 1958, Sgt Grunwald has completed a total of five months' service as a subject for tests of chemical compounds and items of protective equipment, as well as various physiological studies that assist in the accomplishment of the Laboratories' mission.

(3) The sergeant holds five Letters of Commendation awarded him by the Army Chemical Research and Development Laboratories. In addition, he has received a Letter of Commendation from Maj Gen William J. Verbeck, Commanding General at Fort Devens, Sgt Grunwald's home post.

Pace-setter among 1,875 Army and Air Force men who have served as members of the soldier-scientist teams in research and development work for the Chemical Corps, Sgt Grunwald has a simple explanation for his volunter activities:

"It seemed to be a good program," he says, "and I wanted to help." The 43-year-old noncommissioned officer has an ingrained reason for wanting to contribute to the strength of his adopted country; he has seen what can happen to a nation faced with powerful aggressive forces.

A native of Czechoslovakia, he was impressed into a forced-labor battalion and sent to Germany during World War II. When Communism engulfed Czechoslovakia after the war, he decided not to go home. He enlisted in the U.S. Army in 1951 at Sonthofen, Germany. In 1957 he became a citizen of the United States.

M/Sgt Ignace Ditchkus puts "volunteer" armband on Sgt Karel Grumwald, 5-time research test subject.

Army Tests Vehicles in Panamanian Jungles Intended to Improve Tropic Ground Mobility

Intensive studies to determine capabilities of Army vehicles in dense jungles and swamps are being conducted by the U.S. Transportation Corps.

The first example, Project "Tropical Wet," held in late November 1960 during the rainy season, demonstrated that two Weasels could conquer more than 60 miles of the densest jungle in eight days. Also, that by dead reckoning navigation alone, they could traverse the trackless growth to their announced destination.

The exercise also proved that U.S. Army troops, properly trained, can master any environment. Participants had manned Project "Lead Dog" in Greenland four months before.

The second exercise, Project "Swamp," to be held July through September 1961, will test the T-116 Cargo Carrier, the Terrain Dynamometer Vehicle (Terrapin), the M-113 Amphibious Carrier, and the Nodwell Track Transporter over the same type of terrain.

Conducted by the Transportation Environmental Operations Group with Engineer, Ordnance, Quartermaster and Signal Corps participation, the purpose of Project "Tropical Wet" was to evaluate: (1) the role of the amphibian in tropical inland waterways; (2) how far tactical vehicles could penetrate tropical terrain without engineer support, surface and aerial navigation techniques; (3) the feasibility of using the Rolling Liquid Transporter (RLT) in the tropical environment.

The jumping-off place for the jungle phase of Project "Tropical Wet" was Chepo, Panama, 20 miles west of Fort Kobe in the Canal Zone. Within five miles, all the wheeled vehicles with the exception of two jeeps were hopelessly bogged down in the bottomless mud. After five more miles the RLTs, the jeeps and a 2½-ton truck with Jungle-Trac bogged down and were sent back to the rest of the vehicles to form the base camp.

The Weasels subsequently plunged into the jungle so dense that all visual contact with H-13 helicopter was lost. Three days later radio contact with the party was made by H-34 helicopter though it was impossible to locate the men visually.

The group finally came out of the jungle on the bank of the Rio Chepo, only three miles from its intended destination! It had traveled through 60 miles of trackless terrain, the last 30 through extremely dense jungle where it was necessary to cut through foot by foot.

The trek out was negotiated by water, with the Weasels tied to an assault boat for safety. With the Weasels furnishing the power, the trip 30 miles down river was accomplished at speeds of 8 to 10 knots.

Though slight damage to metal seams suffered by the Weasels in the heavy jungle going had to be caulked with rags and Permatex as a field expedient, the vehicles performed adequately throughout the trip.

Project "Tropical Wet" personnel suffered no accidents and no illness though plagued by torrential rain, insects, snakes, animals and other dangers of the jungle.

Principal finding was that small track vehicles can operate successfully in the jungle in wet season without engineer support. It was demonstrated that the RLT can negotiate deep jungle mud (though not the bottomless variety) but encounters difficulty in dense undergrowth and heavy forestation. Still it was concluded that the RLT is the best available means of transporting fuel in jungle environment.

The Project also established that reasonable directional and distance control can be achieved in the jungle by careful dead reckoning navigation, and that combat units can be resupplied in the jungle at streams and rivers by helicopters. Also, that because of the difficulty of visual contact, radio homing devices and visual signals (flares) are necessary.

Besides testing the previously mentioned vehicles, the upcoming Project "Swamp" will evaluate the HU-1A "Iroquois" helicopter as a personnel and cargo carrier, and liaison craft for jungle work. The Iroquois Doppler Navigational System and Army Aviation resupply and evacuation techniques in support of a ground force in the tropics also will be evaluated. An attempt will be made to devise a system to allow aircraft to locate surface elements under the jungle canopy.

Extensive research into the problems connected with deploying and maintaining troops in a tropical environment will begin in Fiscal Year 1962 under the guidance of the Tropical and Desert Branch, Earth Sciences Division, Army Research Office. (See story page 3.)

Can one train to become a director of research through the administrative ladder? Dr. Charles H. Best of the University of Toronto has expressed the following view:

"While increasing amounts of nonspecific administrative duties may be discharged by other than research personnel, I do not believe that we will ever evolve a successful strain of directors of research who have been developed along any other route than that of extensive personal experience with the technical and scientific problems involved. The director must have experienced the thrills and disappointments himself if he is to act as the mentor and guide for successive waves of enterprising, efficient and highly motivated young people.

"A director should be one who really knows when a junior worker is properly motivated and otherwise equipped for a career in investigation. He should be able to recognize those who are using research merely as a stepping stone and those, usually more senior and rather troubling people, who may be sheltering behind a forest of scientific names and complicated procedures in an obscure and little-used byway of research—or, on the other hand, may be the geniuses of the future.

"A director should realize, of course, that new techniques can unlock a stubborn door and reveal long clear upward trails—and that in exceptional circumstances they can produce plausible findings which may be published in long series of papers over many years before it is realized that these results are essentially meaningless and are devoid of physiological significance."

$175,000 Contract Awarded For Pershing Missile Device

A $175,000 contract has been awarded for the manufacture of a mock Pershing missile training device to be used in training Army personnel in "countdown" procedures used in firing missiles. The mockup device will also enable trainees to spot and repair malfunctioning parts.

To be manufactured by the Hayes Aircraft Corp., the trainer will be used at the Ordnance Guided Missile School at the Army Ballistic Missile Agency in Huntsville, Ala.

Army-Funded Research Project Advancing Moho Probe of Earth Crust Under Ocean

Research supported by the land-lubbing U.S. Army is teaching old salts how to keep a ship stationary so that deep sea drilling operations can be conducted.

This ability is especially important to the success of the National Science Foundation's Project Moho, which is attempting to drill through the ocean floor to the Mohorovicic layer of discontinuity (Moho, the boundary zone between the earth's crust and mantle).

Any appreciable movement by the ship while actual drilling is in progress will snap the drilling pipe, which extends down through two miles of sea water before it begins drilling through the bottom deposits to hard rock.

Interested in acquiring new techniques of maintaining position of work boats at particular spots in harbors, the Corps of Engineers agreed to underwrite research to find a system that would keep the Moho ship stationary.

The result of this research, conducted by Robert Taggart Incorporated, is an integrated control console which allows its operator to coordinate the effort of four diesel engines driving screws so as to maintain the ship's position over the drill hole.

Many forces exert pressure affecting movement of a ship, including wind, current, and rotation of the drill pipe. The combination of these forces could exert a pressure of 12,900 pounds acting at an angle of 70 degrees off the bow of the current Moho ship, *Cuss I*.

The console's operator utilizes a joy stick and a wheel mounted on a gimbal. Moving the joy stick from the vertical in any direction will result in ship motion in that direction; rotation of the wheel will result in rotation of the ship. Both controls can be operated simultaneously.

This console is presently being used aboard *Cuss I*, owned by the Global Marine Exploration Co., which has been outfitted to do the preliminary Project Moho work. The 2.900-ton vessel is being used for drilling into ocean floor sediments near Guadalupe Island in preliminary tests before going down four miles through what is believed to be basalt to the Moho.

[On April 1, the drillers brought up two cores of hard, fine-grained basalt from 560 feet below the ocean bottom. The previous day a core of gray-green clay some 25,000,000 years old was brought up from a depth of 234 feet below the ocean floor, and more than two miles below the surface of the Pacific Ocean.]

The actual attempt to drill to the Moho zone will be conducted aboard a vessel to be constructed in the future. Experimentation with *Cuss I's* console will lead to an improved version for the new ship.

Photo by Robert Taggart Inc.

Operating Moho ship control console.

Power directed by *Cuss I's* console is furnished by four Murray & Tregurtha 200-hp. Harbormaster diesel engines, two mounted forward and two aft, which run continuously during positioning. When the ship is directly over the hole and no movement is necessary, the engines, at idling speed, are so oriented that they thrust against each other so that the thrust and movement on the ship is zero.

To achieve changes in ship position or heading, or to resist wind or tidal forces, the engines are unbalanced by varying both their orientation and r.p.m. to an arrangement providing the proper reacting thrust.

From their idling speed when no movement is needed, the engines accelerate as either the joy stick or the wheel, or both, is moved to extreme positions. The more control that is exercised, the greater the engine speed required. For special maneuvers some of the engines can be operated automatically while others are operated manually.

In recent tests off of Guadalupe Island this console was able to keep the ship from varying more than 500 feet from the drill hole. The maximum distance that the ship can wander from the hole without stressing the drill pipe inordinately is about 1,000 feet.

Planning for Project Moho was accomplished by an AMSOC Committee (American Miscellaneous Society, National Academy of Sciences) of which Dr. Leonard S. Wilson, Chief of the Earth Sciences Division, Army Research Office, is a member. Approximately $40,000 of the planning expense was funded by the Office of the Chief of Research and Development, Department of the Army.

Provocative Ponderables

". . . It would be impossible to overstress the importance of reducing to a minimum the time which elapses between the development of an idea and its translation into a useful piece of military hardware. In view of the scientific and technological 'explosion' of our age, this time lag is the most critical factor in the maintenance of military capability adequate to dissuade any enemy from making war. . . ."—Secretary of the Army Elvis J. Stahr, Jr.

* * *

"We have not yet reached the point where we can step forward boldly and justify basic research in terms of its important objective, namely the pursuit of knowledge for its own sake—as typified by the work of Galileo, Newton, Maxwell, Faraday, Henry, Darwin, Gibbs and Einstein."—Dr. Alan T. Waterman, Director, National Science Foundation, in NSF's 10th annual report to the President.

* * *

In considering the advisability of setting up a committee to accomplish a result which perhaps might be done more expeditiously and effectively by knowledgeable decision at the leadership level, it might be helpful to apply the jest of one who defined a committee as "the unable who have been asked by the unwilling to do the unnecessary."

* * *

"Unless American science is vigorous and creative, our industrial technology cannot flourish. And without superior technology the Nation's economic health as well as its security will suffer. It is, therefore, fair to say that the safety and welfare of the Nation largely depend upon our maintaining a benign environment for scientific activity."—Dr. J. R. Killian, Jr., former Special Assistant to the President for Science and Technology.

New Transistor Developed By U.S. Army Signal Lab

An all diffused silicon MESA PNP transistor, believed to be the first such device developed within a Government laboratory, has been successfully tested at the U.S. Army Signal Research & Development Laboratory.

Scientists of the Solid State Devices Division of this Laboratory developed transistors having betas (common emitter current gain) of approximately 40 with FT (frequency at which the high frequency beta becomes one) values of 80-85 mcs.

QMC's Dr. Anstey Honored for Use of Reserves

In this era of rising research costs, the United States Army is receiving a half-million dollars worth on the world's climate for almost nothing because of an idea put into action by Dr. Robert L. Anstey of the QMC Research and Engineering Center, Natick, Mass.

Dr. Anstey has been given a Special Service Award and $300 for using qualified Army Reservists on an unpaid basis to perform the research. A QMC major in the reserve, he is civilian chief of the Desert and Tropics Section of the Center's Environmental Protection Research Division.

Each reservist spends two weeks of active duty training at the Center and then works approximately 100 hours a year doing research at home. They pick up one retirement point for each two hours of "homework." Seventy-nine reservists, including a number of noncommissioned officers, were trained in 1960.

The research involves collating environmental data, primarily on climate, for 17 major regions of the world, which the QMC then machine tabulates and stores as part of the Army R&D program. If performed under contract to universities or industries, estimates indicate this work would have cost more than $500,000.

After the idea was approved in 1958, 10 officers reported for duty during the summer of 1959. Trained and started on their individual studies during two weeks of active duty at Natick, they were sent home with source materials, base maps, and overlay sheets. The officers, living throughout the United States, report their results and receive additional assignments.

Dr. Robert L. Anstey, left, works on problem with Dr. Earl E. Lackey at QM R&E Center, at Natick, Mass.

The QMC climate project was launched in 1956 with the purpose of punching 550 items of data on electrical accounting machine punchcards for each land geographic degree quadrangle—an area lying between two degrees of latitude and two degrees of longitude.

An estimated 20 percent of the work had been completed at the beginning of this year. Approximately four more years will be required to finish the project.

Canada Joins U.S. in Study Of Ballistic Missile Defense

The United States and Canada have joined in a study of the problems of ballistic missile defense.

Test facilities provided by the Canadians include indoor ranges which enable study of model nose cones in flight. The ranges also simulate atmospheric conditions encountered by a missile at it leaves and reenters the earth's atmosphere.

Through this system scientists are studying the requirements for detecting and tracking incoming long-range missiles. The United States has established a liaison team at the Canadian facilities and provides some of the technicians and equipment.

Conducting the study are the U.S. Army Rocket and Guided Missile Agency, an element of the Army Ordnance Missile Comand, Redstone Arsenal, Ala., and the Canadian Armament Research and Development Establishment, an element of the Canadian Defense Research Board at Valcartier, Canada.

Itschner Award Announced

The commander of the outstanding company-size active Corps of Engineers Unit each year will receive an award on behalf of Lt Gen E. C. Itschner, the Corps' retiring Chief.

The purpose of the award is to "promote leadership in junior officers and the esprit of small units."

Donated by General Itschner, the plaque will be presented by the Society of American Military Engineers.

Antarctic Mountain Named After Army Scientist for IGY Meteorology

A measure of immortality has been awarded to an Army scientist for his contributions to Antarctica research.

On future maps a barren 2-mile-high mountain on the South Pole continent will be listed as Mount Dalrymple after Paul C. Dalrymple, meteorologist and geographer for the Quartermaster Research and Engineering Command, Natick, Mass.

Dalrymple's name was proposed by Dr. Charles R. Bentley and Mr. George R. Toney, members of the International Geophysical Year team, for initiating the American micrometeorological research program in Antarctica in 1957-58. His findings, used in research on heat transfer between surface and air—a condition which influences large-scale weather patterns—had already won him the Meritorious Civil Service Award.

After approval of the honorary name by the Board on Geographic Names of the Department of Interior, Mr. Dalrymple was notified by Dr. Joseph Kaplan, member of the National Academy of Sciences—National Research Council and Chairman of the U.S. National Committee for IGY.

Mount Dalrymple, approximately 12,000 feet in elevation, is located at latitude 77 56′ S., longitude 86 02′ W., and is a prominent peak in the Sentinel Range of the Ellsworth Mountains located in that part of Antarctica near South America.

A graduate of Clark University, Worcester, Mass., Mr. Dalrymple received his M.A. degree from Syracuse University. During World War II he saw combat with the 94th Infantry Division in Northern Frances, the Ardennes, and the Rhine.

He has done weather research at the Harvard University Blue Hill Meteorological Observatory at Milton, Mass.; the Mount Washington, N.H., Observatory; and at the Woods Hole, Mass., Oceanographic Institution.

For two years he participated in the Atlantic Weather Project of the U.S. Weather Bureau.

Paul C. Dalrymple

Dr. Zacharias of MIT Addresses Junior Science Symposium at Duke U.

Dr. Jerrold R. Zacharias, Professor of Physics at the Massachusetts Institute of Technology, discussed "Atoms and All That" as the principal speaker at a recent 3-day North Carolina Junior Science and Humanities Symposium.

Sponsored by the Army Research Office—Durham (AROD) and the North Carolina Academy of Science, the symposium was held on the campuses of Duke University, the University of North Carolina, and North Carolina State College. Attended by 180 selected students and 45 teachers from 75 high schools throughout the State, it was the third symposium since the idea was originated by AROD's predecessor, the Office of Ordnance Research, in 1958.

Dr. Zacharias is head of the National Science Foundation Physical Science Study Committee, a group that is examining methods of improving the teaching of physics at the high school level. He was introduced by Governor Terry Sanford, who is pushing a comprehensive education program for North Carolina.

The MIT physicist spent two days at the Symposium, during which gifted young scientists presented papers reflecting a high degree of scientific knowledge.

Col George W. Taylor, Commanding Officer of AROD, briefed participants on various aspects of the Army's basic research program.

Key figures at North Carolina Junior Science Symposium of 1961: Col George W. Taylor, Commanding Officer, Army Research Office—Durham; Dr. Jerrold R. Zacharias, principal speaker; Governer Terry Sanford.

William R. Fairchild, right, of Bishop McGuiness High School, Winston-Salem, N.C., developed the decimal-to-binary converter being examined by Sister Irma Mildred at the North Carolina 1961 Junior Science Symposium.

Gens Powell, Trudeau Watch Operation White Plan II

General Herbert B. Powell, Commanding General of the U.S. Continental Army Command, and Lt Gen Arthur G. Trudeau, Chief of Army Research and Development, recently witnessed demonstrations of Signal and Artillery technological advances at the U.S. Army Electronic Proving Ground, Fort Huachuca, Ariz.

One of the principal purposes of the visit to Fort Huachuca was to observe operation of White Plan II, a system of firing artillery weapons from data compiled and evaluated by electronic computers. Included in the demonstrations was the first launching at Fort Huachuca of the SD-2 Surveillance Drone, designed to provide field commanders with photographs of enemy territory.

Besides Generals Powell and Trudeau, senior observers at the demonstrations included 16 other Army Generals, among them Brig Gen George W. Power, Director of Developments, Office of the Chief of Research and Development.

CmlC Places $700,200 Order for C&B Detection Devices

The U.S. Army Chemical Corps has awarded a $700,200 contract to Melpar, Inc., a Northern Virginia firm, to develop expendable detection devices for chemical and biological agents. A new range of warning and detection equipment for use by the Army in the field is sought.

The contract calls for a comprehensive survey of published literature on the subject, extensive feasibility studies and fabrication of prototypes. The study is also expected to provide approaches to enable detection of agents which may be developed in the future.

QM R&E Command Cosponsors Science Seminar

Six teenagers, four girls and two boys, presented scientific papers as a highlight of the science seminar conducted jointly by the Natick High School and the U.S. Army Quartermaster Research and Engineering Command at Natick, Mass.

Initiated last year, the science seminar program offers science students guidance beyond that normally included in the high school program. Each student participating in the program is assigned an advisor from the QM R&E Command and has access to the Command Technical Library and laboratory facilities during his investigations. (See December issue, *Newsmagazine.*)

Papers presented were: "A Transistorized Digital Computer," by James Mannos; "Carbon-14 Determination in Fossils," by Robert Anstey; "Heat-Resistance of Bacterial Spores —Significance of Dipicolinic Acid and Calcium," by Florence Moore; "Analysis of Laminarin by the Microcolumn Chromatography Method," by Diane Hawkes; "Natural Inhibitors of Collulase," by Pamela Brady; and "Method of Determination of Calcium, Phosphorous, and Manganese Content in Spores," by Patricia Mansell.

The joint program is supervised by Mr. Wendell F. Bennett, head of the Natick High School Science Department, and Dr. Otto A. Bessey, biochemist and associate chief of the Environmental Protection Research Division of the QM R&E Command.

Brig Gen Merrill L. Tribe, Commanding General of the QB R&E Command, and Dr. Dale L. Sieling, its Scientific Director, have expressed the belief that the Quartermaster-Natick High School cooperative program has stimulated interest in career opportunities in Army R&D.

Research Agencies Present Cash, Certificates, Patents For Usable Inventions, Ideas

Certificates and cash awards totaling $4,330 for performance ratings, inventions ad beneficial suggestions have been presented to 25 men and women Army employees at three separate installations.

Awards went to 15 employees and 2 former employees of the U.S. Army Engineer Research and Development Laboratories (USAERDL) and to 5 employees of the Geodesy, Intelligence and Mapping Research and Development Agency (GIMRADA), at Fort Belvoir, Va. Col John K. Kerkering, Director of USAERDL, presented certificates and cash to:

For "Outstanding" and "Sustained Superior Performance," Bela J. Bodnar and Howard O. McComas, $250 each; Mrs. Mildred O. Sportsman, Mrs. Dorothy M. Whiting and Leon Keener, $150 each; Miss Jeannette Twiford, $100.

For "Sustained Superior Performance," Walter H. Spinks, $300; William H. Carr and Charles R. Manor, $250; Austin B. Foster, Ernest A. Lenzer and Weller C. Collier, $200; Melvin J. Albright, $150; Mrs. Peggy J. Purnell and Alice G. Caton, $100.

Patent awards for inventions and cash went to Michael G. Grant, $100; Lewis D. Eckard, $50 (a coinventor with Irving S. Cassell, former USAERDL employee); and Robert F. Summers, formerly with the Laboratories, $50.

Col John A. Martin, Deputy Commander of the U.S. Army Chemical Corps Research and Development Command, Washington, D.C., presented certificates for "Sustained Superior Performance" and cash to Mrs. Marie C. Lilly, $100; Mrs. Maxine G. Walker, $150; John Haje, $250; J. Rex Pimlott, Sr., and Harley H. Hood, $300 each.

At the Dugway Proving Grounds, Utah, Arthur J. Jones, Chief, Examination Finance and Accounting, received a "Sustained Superior Performance" award and $200.

Army Spends $200 Million for M-60 Tanks, Hawk Parts

Contracts totaling $200 million recently awarded by the Army included two for more than $56 million each for production of 660 M-60 tanks and for missiles, radar sets and other gear for use on the Hawk air defense system.

Developed to replace the M-48 medium tank, the M-60 packs a heavyweight punch: over 5,000 rounds of ammunition for its 7.62mm machinegun, about 1,000 rounds for the .50-caliber machinegun, and 57 rounds for the 105mm gun. It has a cruising range of 250 miles and a road speed of 30 miles per hour.

Designed by the Detroit Arsenal, the tank has undergone extensive testing by the Army Ordnance Corps at the Yuma Test Station, Ariz., Fort Churchill, Manitoba, Canada, and Aberdeen Proving Ground, Md. Prime contractor is the Chrysler Corp.

The contract for missiles, radar and other gear for the Hawk system was awarded to Raytheon Co. The Hawk missile is operational with the Army and U.S. Marine Corps. It will also be produced by companies in the NATO (North Atlantic Treaty Organization) Nations for use as an air defense weapon.

Students who presented papers at cooperative Natick High School-Quartermaster R&E Science Seminar, with their supervisors: seated left to right, Patricia Mansell, Diane Hawkes, Florence Moore; standing, Wendell F. Bennett, head of Natick High School Science Department, Robert Anstey, Pamela Brady, James Mannos, and Dr. Otto A. Bessey, associate chief of the Environmental Protection Research Division, Quartermaster R&E Command.

Youth Wants to Know . . . What's with Missiles?

A 16-year-old boy in New York City has asked the U.S. Army to help him send the family cat on a rocket ride.

His letter, one of many received daily at Redstone Arsenal, the headquarters of the U.S. Army Ordnance Missile Command at Huntsville, Ala., asked that *one complete Army missile with empty nose cone be forwarded as soon as possible.*

Teenagers, both in the United States and abroad, manifest a continuing interest in missiles and rockets. Most ask for information about Army missiles. The Army is glad to comply.

Some of the mail addressed to Maj Gen August Schomburg, AOMC Commanding General, however, asks for items that the Army cannot supply.

A youth in New Jersey forwarded a diagram of a proposed missile, adding that he was having trouble finding some economical, safe, heavy-duty propellant. He wondered if the general could loan him "about a gallon of rocket fuel." Another lad asked where he could get nitroglycerine.

A young man in Indiana addressed a letter to the "Army Missile People" at Redstone Arsenal, with this request: *"I would like some information on rockets and missiles if you know anything."*

From Florida came a request to the chief of the Army's missile program asking: "Please send me some information on the Navy and Marines and their airplanes."

A 10-year-old wrote asking for missile information, adding apologetically, "I asked the mayor and the chief of police, but they don't seem to know much about them."

Then there was the youth who sent along a jelly-like substance and asked to have it analyzed as a possible rocket fuel. An Army demolition expert handled that one. His report:

"That stuff could have blown the headquarters building sky high."

A cost-conscious young man in Michigan asked: "Would you please send me some FREE information on missiles?" He got it.

Many youngsters write regularly. A boy in California, who had received a packet of unclassified information and photographs of Army missiles, expressed thanks and a problem in his second letter. He said almost everyone in his science club had requested and received similar information. He wanted "a few secret things" to spruce up his report.

A correspondent in Texas also had a report problem. He said: "I have to hand in a report on missiles. Please send a composition on white paper typed double space."

Lightning Beats Radar in Storm Warning System

Use of lightning flashes to predict a storm hours before it is detected by weather radar is the subject of a research project being carried on by the U.S. Army Signal Corps, the Air Force and private industry.

The system pinpoints all lightning flashes (sferics) within a 2,000-mile radius of a central plotting station. Remote antennas pick up radio signals generated by the sferics. Processing equipment converts the signals into directional data and transmits the information to the Air Force's Severe Weather Warning Center in Kansas City, Mo. After triangulation at the Center, the signals are traced on a display which gives the storm's location and path.

The sferics research carried on by the two military services and Lockheed Electronics, of Plainfield, N.J., points to the use of sferics as an aid in forecasting tornados and for plotting severe storms in midocean, where present forecasting devices cannot be used.

Army Publication Planning Issues on Navy, Air Force

The June issue of *The Army Information Digest*, official Army magazine will be devoted entirely to presenting the story of the Navy and the September issue to that of the Air Force, in accordance with an offer made to these two services by General George E. Decker, Army Chief of Staff.

In making his proffer, General Decker said that he had long maintained "that the land, sea and air components of our national military power are interlocking elements—each indispensable and complementary to the others, forming an integrated team. The Army's official magazine hopes to give tangible expression to this concept in the realm of information and ideas. . . ."

2 ERDL Developers Granted Fuel Safety Control Patent

Lewis D. Eckard, an employee of the U.S. Army Engineer Research and Development Laboratories, Fort Belvoir, Va., and Irving S. Cassell, a former ERDL employee, have been granted a patent on an electrical control device designed to assure complete safety during ignition, operation and shut-off of all types of fluid fuel burners, including gas and liquid fuels.

Col John H. Kerkering, Director of the Laboratories, presented letters of patent to the two men. Under terms of the patent, the Government is permitted to use the invention without payment of a royalty. Mr. Cassell is now with private industry.

Engineer Corps Develops Heater for Missile Systems

Designed for extensive use in missile systems is a new 150,000 BTU/hour heater developed by the U.S. Army Engineer Research and Development Laboratories, Fort Belvoir, Va.

Compact, lightweight and self-supporting, the unit can withstand rough handling and usage in the field. Components are packed in a metal housing 24 inches high, 24 inches wide and 36 inches long. Total weight is 300 pounds.

Smaller and lighter than present commercial heaters, because of the use of special alloy metals in all components, the unit is powered by a gasoline engine which develops 3 to 5.3 horsepower at a constant speed of 3,600 r.p.m.

The unit has an instant lighting, gasoline burning blowtorch, ignitable at low operating temperatures even in winds of 35 m.p.h., which is used to preheat the engine prior to starting at temperatures of —25° F. or below. Even at —65°, only five to seven minutes of preheating is required to start the engine.

TC Employee Receives Award

Outstanding performance of his duties during a 3-year period won for Alexander Tedesco, Assistant Chief of the Surface Research and Development Division, a Sustained Superior Performance Award from the Army Chief of Transportation.

During the period covered by the award, from August 1956 to September 1959, Mr. Tedesco supervised the development, testing, and standardization of various items of Army surface transportation equipment, including off-road vehicles, amphibian and marine craft, and rail items.

Rodriguez Elected to Academy

In recognition of his contribution to the engineering sciences in the development of a subsurface water well for glacier areas, Raul Rodriguez an employee of the U.S. Army Engineer Research and Development Laboratories, Fort Belvoir, Va., has been elected to membership in the Washington Academy of Sciences.

The water supply well at Camp Century, Greenland, was named the "Rodriguez Well," in recognition of his having devised its scheme of operation. He is an employee of the Sanitary Branch of the Laboratories.

SATURN TOWER PROGRESS

"MAN INTO SPACE"

DESIGN & CONSTRUCTION SUPERVISED
BY
U.S. ARMY ENGINEER DISTRICT, JACKSONVILLE
CORPS OF ENGINEERS, JACKSONVILLE, FLORIDA

The 28-story tower for NASA's 1½-million-pound-thrust Saturn booster is nearing completion at Cape Canaveral, Fla., under the direction of the Corps of Engineers, U.S. Army.

Being built by the Kaiser Steel Co., the $4 million 2,800-ton service tower will assemble, erect and fuel the rocket on the launch pedestal, and propel itself on steel rails some 600 feet to a parking place.

The tower contains its own power supply, water, air conditioning units, elevator systems, cranes, retractable service platforms. It can attain speeds of 40 feet a minute on its flat car carriages.

Five 60-ton service platforms, built in halves, will completely enclose the rocket without damaging it. Inflatable rubber bumpers on the face of the platforms permit technicians to get within eight inches of the rocket.

Aluminum houses attached to the service platform levels by the tower's built-in crane contain shops, offices, fueling and electronic checkout equipment.