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McMillan Accepts Bid For Keynote Address At Science Conference

Dr. William G. McMillan has accepted an invitation to give the keynote address at the 1968 United States Army Science Conference, June 18-21, at the U.S. Military Academy, West Point, N.Y., on the basic theme of "Combat Needs in Vietnam."

Dr. McMillan's classified address will be based on his observations of combat materiel requirements in Vietnam as scientific adviser to Commanding General William C. Westmoreland.

Approximately 500 top administrators, scientists and engineers representative of U.S. Army research and development activities, other federal agencies and three foreign governments associated with the United States in the Quadripartite Agreement are expected to get his message.

Recognized as one of the nation's top scientists, Dr. McMillan has served since 1960 in an impressive succession of appointments to presidential and Department of Defense committees and advisory groups. He is known for his work in the fields of statistical and quantum mechan-

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KEEN RIVALRY FOR THE HONOR of being selected to present a technical paper at the Army Science Conference was evidenced by the record number of abstracts of proposed papers received this year. The official tabulation was incomplete as this publication went to press, but the number was nearing 500.

Ninety-six papers will be selected for presentation by a panel of judges representative of the major scientific disciplines, and an additional 14 papers will be selected as alternates. From these about 30 will be chosen for cash honorariums and Certificates of Achievement.

Dr. William G. McMillan

Harvard Professor Receives Samuel S. Wilks Award At 13th Annual Conference on Design of Experiments

Prof. William G. Cochran

Presentation of the 1967 Samuel S. Wilks Award, the highest honor of the American Statistical Association, to Prof. William G. Cochran of Harvard University was a highlight of the 13th annual conference on Design of Experiments in Army Research, Development and Testing, Nov. 1-3.

Sponsored by the U.S. Army Mathematics Steering Committee for the Chief of Research and Development, Department of the Army, the conference was conducted under the joint auspices of the U.S. Army Mobility Equipment Research and Development Center and the U.S. Army Engineer Topographic Laboratories at Fort Belvoir, Va.

Prof. Cochran's citation acclaimed him

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Featured in This Issue . . .

General Besson Commends Achievements in Vietnam

Praise and appreciation of the highest order for the men who are fighting the war in Vietnam, and those who are providing the logistical support, came from a 4-star general at the recent 13th Annual Meeting of the Association of the United States Army in Washington, D. C.

General Frank S. Besson Jr., who has headed the U.S. Army Materiel Command since it was activated Aug. 1, 1962, painted vivid word pictures of conditions and problems confronting U.S. Armed Forces in Southeast Asia. But the most glowing terms were reserved for the men on the job — a tone he set at the outset:

"Certainly the war in Southeast Asia is the dominant interest on our national scene today. But in the Army Materiel

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Honored Vietnam Veteran Takes Command of ATAC

Thirty-seven months of major command responsibility for logistics in Korea and South Vietnam ended recently for Maj Gen Shelton E. Lollis when he reported for duty as CG of the U.S. Army Tank-Automotive Command (ATAC) at Warren, Mich.

During the past 16 months, General Lollis has served as deputy and then commanding general of the 1st Logistical Command, whose achievements are acclaimed by General Frank S. Besson Jr., CG of the U.S. Army Materiel Command, in another page 1 article. For 21

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Maj Gen Shelton E. Lollis

Army R&D Newsmagazine

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DDR&E Executive Discusses Transfer of Technology

In a presentation before the Subcommittee on Science and Technology, Select Committee on Small Business, U.S. Senate, made for Dr. Donald M. MacArthur, Deputy Director of Research and Technology, Office of the Director of Defense Research and Engineering, Rodney W. Nichols discussed the critical "Coupling Problem" — the rapid transfer of new research knowledge for industrial applications — as follows:

* * *

The Department of Defense (DoD) is pleased to have this opportunity to discuss technology transfer. The Subcommittee has published an excellent report entitled "Policy Planning for Technology Transfer" which carefully highlights all of the critical issues. Thus, my presentation will assess mainly the experience and perspective of the Department of Defense in transferring defense technology to the private sector.

The Department recognizes the importance of making our technology available to anybody who needs it, within limitations imposed by national security. As the Subcommittee knows, many major defense technologies such as aircraft, electronics, computers and communications have been transferred to the private sector. But we recognize that the Subcommittee is more interested in the broader aspects of technology transfer. So I will try to sketch the general framework of our view of the transfer process.

Technology Transfer Myths. There are certain aspects of technology transfer which sometimes are not clearly understood. There are, in fact, some myths that we would like to try to expose. The first myth is that *most* defense technology *is* marketable in the private sector. Though a great deal of defense technology is "technically" applicable to the private sector, much of it is *not* marketable. Why? — Because defense requirements for high performance often lead to a high-cost technology that is not immediately compatible with the economics of the private sector.

The second myth is that defense technology can be used directly in the private sector. But in practice, seldom can you fully transfer technology without cost. The cost of bringing new ideas to the market is great — estimated at 85 to 90 percent of the cost involved in the overall innovative process. Yet people do frequently make the incorrect assumption that once usable technology is identified by the private sector, it immediately becomes marketable.

A third myth is that technology transfer will increase through additional government efforts alone. This greatly underrates the importance of the user in the technology transfer process. Government programs to make information on technology available is a "push" part of the transfer. However, potential users must be able and willing to take this technology and apply it — this is the "pull" part. No matter how much governmental "push" action, the efficiency of transfer is limited by the amount of "pull" exercised by careful users.

Characteristics of Users. In considering the processes through which technology can be transferred, it is important to recognize the different characteristics of potential recipients. For convenience, these users can be characterized as (1) prime defense contractors which have a research and development capability; (2) nondefense companies which have research and development capabilities; and (3) companies that do not have research and development capability. This last group of companies, including many small businesses, is of particular concern from a technology transfer point of view.

Categories for Transfer. We can also distinguish three general categories of technology which might be transferred: (1) total systems (communication satellites, aircraft engines, radars); (2) components and materials (transistors, aluminum); and (3) techniques, processes and concepts (welding techniques, numerically controlled machine tools, plasma plating, system engineering).

Transfers within the first two categories (systems, components and materials) are comparatively straightforward, and are largely controlled by economic factors. But transfers of techniques, processes and concepts are much more complex, less well understood, and clearly dependent upon special skills of the recipient.

Categories as Related to User. Examples of transferred total systems and devices such as aircraft engines, satellite communications and weather radar are well recognized. The commercial applications of these technologies are generally obvious and the timing of the transfer is a function of the level of market demands.

Exploitation of such systems in the private sector has been carried out by larger companies with strong R&D capabilities. Smaller companies were generally employed only in a subcontracting role.

The transfer of the second category of technology — components and materials — is also fairly straightforward. Information on defense components and materials is readily available to those who desire to exploit them in the private sector. Most manufacturers that develop and produce new components and materials for the Department of Defense also serve the civilian market.

Advances in components and materials normally are well publicized in trade

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Harvard Professor Receives Samuel S. Wilks Award

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"for continued research on the statistical treatment of data, for his highly fertile research on the design and analysis of experiments and surveys, for his excellent books on the theory and practice of statistical methodology, for his efforts in the training of statisticians at all levels, and for his contributions to national and international statistical societies."

The Samuel S. Wilks Award was initiated in 1964 to honor the memory of the Princeton University professor who died that year, after having achieved international recognition as the "Statesman of Statistics." It consists of a medal and cash honorarium from a fund established by one of Prof. Wilks' associates, Philip G. Rust, now retired.

The American Statistical Association established the exceptionally high criteria for the award and functions as the administering agency.

The award is given to a statistician ". . . primarily on his contributions, either recent or past, to the advancement of scientific or technical knowledge in Army statistics, ingenious application of such knowledge, or successful activity in the fostering of cooperative scientific matters which coincidentally benefit the Army, the Department of Defense, and the U.S. Government as did Samuel S. Wilks himself."

Other recipients of the award are Dr. Frank E. Grubbs (1964), Army Ballistics Research Laboratory, Aberdeen (Md.) Proving Ground; Princeton Prof. John W. Tukey (1965), and Maj Gen Leslie E. Simon (USA, Ret.), 1966.

Prof. Cochran, born in 1909 in Rutherglen, Scotland, received a master's degree in mathematics from Glasgow University, Scotland (1931) and an MA degree in statistics from Cambridge University, England (1938).

Before he came to the U.S. in 1939, he worked for five years at Rothamsted Experimental Station, England, on agricultural experiments.

He was a professor of mathematical statistics at the University of North Carolina (1946-48) and a professor of biostatistics at the Johns Hopkins University School of Hygiene (1948-1957).

He is author and coauthor of several books, including "Sampling Techniques" (1963); "Experimental Design" (1950) and "Statistical Problems of the Kinsey Report" (1954). He is also coauthor of the sixth edition of "Statistical Methods," a task he assumed at the request of the initial author, George W. Snedecor, 80, retired former head of the Statistical Laboratory,

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Honored Vietnam Veteran Takes Command of ATAC

(Continued from page 1)

months General Lollis commanded the 8th U.S. Army Depot Command in Taegu, Korea.

The retirement of Maj Gen William W. Lapsley, who had served as CG of ATAC since it was established in January 1967 and before that as CG of its predecessor, the Mobility Command, set the stage for General Lollis to succeed him.

In September 1967, General Lollis received the Distinguished Service Medal, the U.S. Army's highest award for service not involving actual combat, and was cited for "mastering the logistical problem of supplying nearly a half-million United States and Free World Forces in Vietnam."

In addition to the DSM, he was awarded the Military Distinguished Service Order, 1st Class, by the Vietnamese General Staff and the Korean Coung Mu Medal, Korea's second highest medal for distinguished service, by the Commander-in-Chief, Korean Forces in Vietnam. He also has been awarded the Legion of Merit with Oak Leaf Cluster, Bronze Star Medal, Army Commendation Medal with OLC and the Air Medal with OLC.

General Lollis was commissioned in the U.S. Army Reserve through the ROTC program at the University of Oklahoma, where he graduated in 1938 with a BS degree in electrical engineering. He is also a graduate of the Army Command and General Staff College, Army War College, the Advanced Management Program at the Harvard Business School, and the management course at Brookings Institution.

His active duty service began in 1940 and he served during World War II in the North African, Mediterranean and European Theaters. Upon his return to the U.S. in 1945, he attended the Command and General Staff College, and then was assigned to Turkey with a Military Assistance Advisory Group for two years.

Following a tour of duty with another MAAG to Nationalist China, he returned to the U.S. in June 1960 and was posted to the Ordnance Board, an advance study group at Aberdeen Proving Ground, Md. The group became the Army Materiel Command Board and General Lollis was its president when assigned to Korea.

Sprint Meets Expectations in WSMR Test

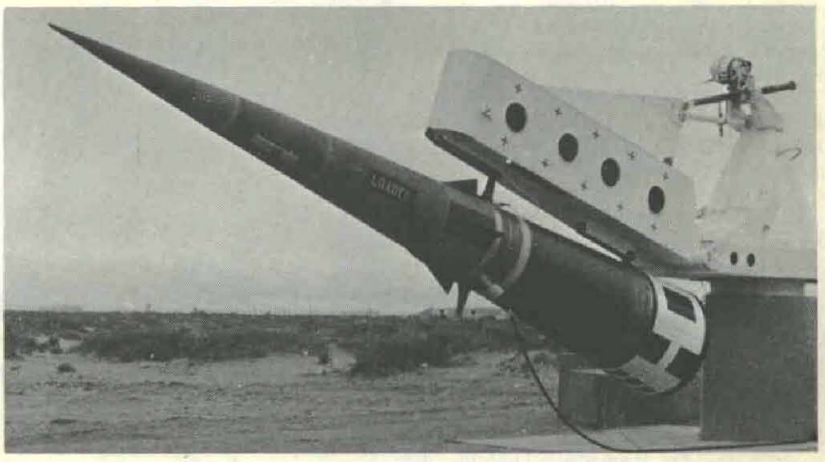
Sprint missile capabilities to maneuver sharply on command, as one of two interceptors in the Chinese Communist-oriented antiballistic missile defense system, were demonstrated successfully in a recent test flight at White Sands (N. Mex.) Missile Range.

In all respects, including ability to withstand the high temperatures involved in executing strenuous maneuvers, the 27-foot-long missile performed according to plan, test monitors reported.

An innovation of the test was the launching from a newly modified underground cell which traps gases from the eject system until the missile is in the air. The redesigned cell is expected to reduce buffeting of the missile in the cell by exhaust gases from the launch charge. The first-stage motor is not ignited until the Sprint is in the air.

The Sprint is a very high-acceleration missile designed as a short-range interceptor to engage attacking intercontinental ballistic missiles and other long-range missiles after they reenter the earth's atmosphere. Guided during flight by ground radars, it is powered by two solid-propellant rocket engines.

The second interceptor missile being developed for the antiballistic missile defense system is the Army's Spartan, which will be capable of engaging attacking missiles outside the earth's atmosphere.



SPRINT antimissile missile under development by Martin-Marietta Corp., as an interceptor missile for Department of Defense Antiballistic Missile (ABM) System.

McMillan Accepts Bid for Keynote Address at ASC

(Continued from page 1)

ics of small molecules; adsorption; equation of state; and spectroscopy.

Graduated in 1941 with a BA degree from the University of California at Los Angeles, he earned a master's degree in 1943 and a PhD in 1945 from Columbia University. He continued advanced studies for the next two years as a Guggenheim Fellow at the Institute of Nuclear Studies, University of Chicago, and was an Alfred P. Sloan Research Fellow from 1957 to 1961.

While attending Columbia he was a teaching assistant in chemistry. From 1947 to 1951, he was an assistant professor of chemistry at UCLA, then became an associate professor for seven years, achieved full professor status in 1958, and from 1959 was chairman of the Department of Chemistry. He went to Vietnam in October 1966 and is still on the UCLA staff and a member of the Physics Division of RAND Corp.

Dr. McMillan has served as a visiting professor and lecturer at Harvard and Columbia Universities, was Coordinator of Atomic Activities for the State of California in 1959, and from 1952 to 1963 was a consultant to Brookhaven National Laboratory.

Since 1960 he has been a consultant to the President's Scientific Advisory Committee (PSAC), and from 1962 to 1966 was a member of the Defense Science Board. From 1963 to 1965, he served as chairman of the Ad Hoc Group on Radiation Effects, comprised of members from the Air Force, Navy and the Office of the Director of Defense Research and Engineering.

Among his other key assignments are: Member of the Nuclear Panel, Air Force Scientific Advisory Board (AFSAB) from 1961-66; AFSAB "Open Ear" Group, 1961 to date; chairman, AFSAB Ad Hoc Review Committee on Air Force Protective Structures Research Program; Atomic Energy Commission delegate to discussions with the British Atomic Weapons Research Establishment on underground test detection; and

Chairman, Scientific Advisory Group on Effects, Office of the Director of Defense Research and Engineering and the Defense Atomic Support Agency, 1961-66; member, Defense Intelligence Agency Ad Hoc Panel, 1965; vice chairman, Defense Industry Association Advisory Committee, 1965 to date; member, Executive Council, American Chemical Society Division of Physical Chemistry, 1964 to date; member, Weapons and Munitions Panel, AFSAB Tactical Study Group, 1964-65.

Dr. McMillan also is credited with teaming with Dr. Harold Brown in 1963, at which time Dr. Brown was Director of Defense Research and Engineering, in developing the concept of the Defense Science Seminar. This is now an annual assembly of scientific talent carefully selected for potential for training to serve on Department of Defense technical and advisory groups. It is conducted by the University of California at Los Angeles.

DR. MARVIN E. LASSER, Chief Scientist, Department of the Army, will preside as chairman of the 1968 Army Science Conference. Dr. Richard A. Weiss, Deputy and Scientific Director of Army Research, will continue in the role he has filled for each conference as general chairman.

Serving with Dr. Weiss on the arrangements committee are Dr. Craig M. Crenshaw, U.S. Army Materiel Command Chief Scientist; Dr. Gilford G. Quarles, Office of the Chief of Engineers Scientific Adviser and chairman, The Army Research Council (TARC); Col Paul E. Teschan, director, Division of Medicine, Walter Reed Army Institute of Research, Office of The Surgeon General; Dr. John C. Hayes and Lt Col Samuel J. Hubbard, Scientific and Technical Information Division, Army Research Office.

PANEL DISCUSSION. The outstanding success of a 4-hour panel discussion of the topic, "Basic Research and Practical Relevancy," at the 1966 Army Science Conference served to set the stage for a similar panel this year. Members will be selected to represent the Department of Defense, academic institutions and industry. The topic is "Combat Needs in Vietnam."

Project Mallard Awards Study Contracts

The Mallard Project to establish a quadripartite communications system entered the design development phase Oct. 20 with the award of two contracts totaling $7.49 million and calling for an 18-month competitive system study.

The prime U.S. contractors are Radio Corp. of America (RCA), $3.99 million, and Sylvania Electronics System, Inc., $3.5 million. A third, similar study will be conducted by industry in the United Kingdom, which joined Mallard Sept. 12.

The United States, Australia and Canada ratified the Mallard Project agreement in April this year. United Kingdom delay in signing the pact involved agreement on cost sharing and work.

Teamed with RCA are Litton Industries, Inc., Van Nuys, Calif., and Planning Research Corp., Los Angeles. Sylvania will be assisted by IBM Federal Systems Center, Gaithersburg, Md.; Operations Research, Inc., Silver Spring, Md.; and Georgia Institute of Technology, Atlanta. Other contractors of the four nations will provide technical support to the final design of the Mallard system.

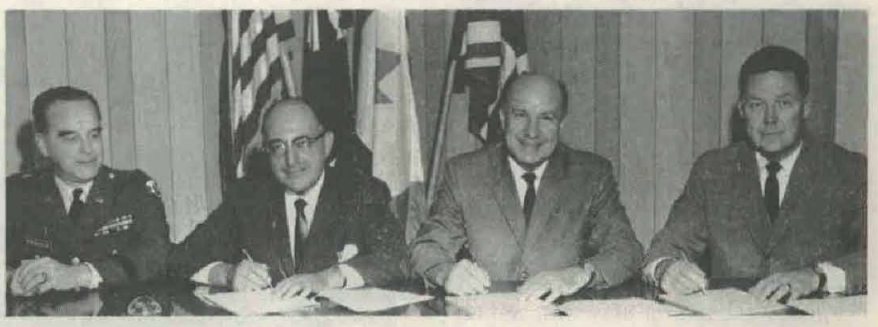
Brig Gen Paul A. Feyereisen, U.S. program and project manager for Mallard, was accompanied by representatives of the U.S. Army Electronics Command (ECOM), the U.S. Army support agency for Mallard, when he attended the contract signing at the Mallard Building, New Shrewsbury, near HQ ECOM at Fort Monmouth, N. J.

Fielding of Mallard to the 4-nation group of users as an operational system is expected in the 1975-77 time frame.

Meetings of representatives of the four countries resulted in a report that such an "unprecedented system was feasible," laid down operational and technical requirements, and proposed an R&D plan.

The system is intended to provide secure, automatically switched tactical communications in the combat zone for the field armies of the four partners and their navies and air forces. It will handle all modes of message and data transmission, from simple written messages to voice-radio links to automatically switched digital computer systems and facsimile. Use of communications satellites also has been considered.

Fort Monmouth was selected as headquarters for managing the development of Mallard because of existing resources and competency in the many phases of tactical communications-electronics.



GOVERNMENT AND INDUSTRY officials at Fort Monmouth, N.J., sign contracts for developing detailed design of Mallard tactical communications systems for field forces of U.S., Australia, Canada and United Kingdom. Shown at contract signing are (from left) Brig Gen Paul A. Feyereisen, U.S. program and project manager for Mallard; S. N. Lev, RCA vice president; Edgar D. Fitzgerald, contracting officer who signed for U.S. Government, and Richard W. Couch, vice president of Sylvania Electronic Systems. Work will be finished in 18 months.

APG Constructing Shock Tube Facility

Construction of a large shock tube facility to study effects of nuclear blasts on operation of internal combustion engines — aimed at development of a Nike-X antiballistic missile system power source — is under way at Aberdeen Proving Ground, Md.

Announcement of the project was made by the Office of the Chief of Engineers, which is serving as an engineering and development agency for the Nike-X Project Office at Redstone Arsenal, Ala.

The $853,449 construction contract with Arnold M. Diamond, Inc., Great Neck, N.Y., calls for completion in June 1968. Testing operations are programed to begin in August 1968 under control of the Office of the Chief of Engineers. The Ballistic Research Laboratories will operate the facility.

Reliability of operation under the most adverse conditions, including effects of nuclear explosions, must be built into the Nike-X power source. The source has to be capable of generating large blocks of electricity while maintaining voltage and frequency within precise limits.

To meet this requirement, use of both diesel engines and gas-turbine engines to drive the electrical generators is being investigated.

One of the complicating factors is that air-breathing engines require large amounts of intake air. Present design concepts require intake and exhaust ducts to be open to the atmosphere and therefore subject to the environmental effects of nuclear blasts

The Aberdeen facility will be composed of two shock tubes and supporting buildings and equipment. One shock tube, 5.5 feet in diameter and 610 feet long, will be connected to the inlet of the engine under test. Another shock tube, 8 feet in diameter and 500 feet long, will be connected to the engine exhaust.

Shock waves will be generated by the quick release of compressed air stored in the driver sections of the shock tubes. The release will be accomplished by rupturing thin metal diaphragms with primacord. Sections of the shock tubes containing the diaphragms will be removable for changing in a building that also will house the air compressors.

Design of the shock tubes will provide the simulation conditions necessary to test prime-movers up to 25,000 horsepower. Prior to generation of the shock waves, the engines will operate by taking inlet air through the open end of the 5.5 foot shock tube and exhausting through the 8-foot tube.

Laser Beams Simulate Practice Round Fire

Laser beams that can simulate the fire of heavy cannons and various antipersonnel weapons hold the promise of savings of millions of dollars in costs of training tank gunners and artillerymen.

Recent success in tank weapon simulation has turned consideration of Army researchers to other areas of training, such as automatic weapons, using large amounts of ammunition.

One Army estimate is that the technique may reduce overall training costs as much as 20 percent and meanwhile improve accuracy of gunners.

Another significant advantage is that lasers permit highly efficient target practice even inside Reserve and National Guard armories. The low-power units light up the spot hit but cause no damage to the target. Training of these units usually is limited by scarcity of suitable ranges.

The Army now lists the laser device as standard equipment for tank training units. Laser simulators replace less accurate 30-caliber and 7.62 machinegun trainers commonly used to simulate cannon fire on M-48 and M-60 tanks. They also present a more realistic training situation.

When firing a machinegun trainer, the gunner lines up his target in an optical sight, squeezes off a round and checks his accuracy by glancing at the distance between the bullet hole and the intersection of his gunsight crosshairs. He should then make a mental note of how far off he was, make the proper sight correction, reaim, and fire again.

Many trainees, however, make a short-cut sight correction by zeroing the crosshairs of the sight on the previous bullet hole — a habit impossible to practice under battlefield conditions where a miss leaves no mark and targets keep moving.

The laser simulator insures against this habit by emitting a burst of light that endures only for microseconds. To the gunner's eye, it appears briefly as a half-inch spot of light on his target, then disappears as a tracer bullet would in combat.

The gunner is forced to make his mental note of needed correction with battlefield speed and techniques, thus increasing his accuracy.

Kollsman Instrument Corp., a subsidiary of Standard Kollsman Industries, has developed and manufactured initial quantities of the lasers under a series of Army contracts totaling $500,000.

LWL Develops Light Bridge Made of Flexible Sections

Combat Infantrymen in Southeast Asia can carry a newly developed bridge on their backs, in 11-foot sections weighing 26 pounds, the U.S. Army Limited War Laboratory at Aberdeen Proving Ground, Md., has announced.

The 7-foot-wide sections are made of ¼-inch thick closed-cell polyethylene flexible foam core bonded between two sheets of nylon reinforced polyethylene film. Sections are rigidized laterally with plastic poles spaced 32 inches apart.

Any number of 11-foot units can be fastened end-to-end and used to cross a canal of any given width. The bridge is deployed across streams up to 50 feet wide by throwing an anchor attached to a rope to the other side of the stream. For streams wider than 50 feet, a man must swim across with the anchor rope.

The bridge is deployed across the stream by pulling the rope through the eye in the anchor. Each end of the bridge has five 24-inch aluminum stakes for anchoring to the bank of the canal.

Preliminary tests have shown the bridge is completely safe for foot troops, the Limited War Laboratory developmental team said. A quantity of bridge sections is being produced for operational tests in Vietnam early next year.

CRD Discusses MBT, AAFSS, SAM-D Systems

Chief of Research and Development Lt Gen Austin W. Betts outlined the capabilities designed into three of the Army's newest weapon systems in development — the Main Battle Tank 1970s (MBT-70), the Cheyenne armed helicopter (Advanced Aerial Fire Support System), and the SAM-D air defense missile — in addressing the 13th Annual Meeting of the Association of the United States Army, as follows:

* * *

For the past ten years the United States Army has been spending $1.5 billion a year to develop new weapons and equipment — a truly colossal sum, but still not as much as we would like to have. Nevertheless, it has been money well spent. No soldier of any nation in the world has materiel of the quality that is issued to the American soldier of today. We propose to keep it that way.

During the past 10 years, we have seen a variety of new and dramatic advances in equipment and weapons systems. Perhaps the most memorable example is the transition of the ballistic missile from a liquid-propelled towering monster of uncertain reliability to a compact solid-propellant, transportable missile like the Pershing. Even more dramatic is our ability to turn that technology to antitank weapons like the Dragon, a highly reliable weapon, man-portable, with accuracies comparable to modern tank guns.

During these past years, we have seen the helicopter progress from the OH-13, a finicky craft of limited lift and range that demands inordinate maintenance, to a reliable mainstay of today's battlefield, the Huey, that makes such a difference in Vietnam.

With new materiels and new technological skills on every front, we can now build a new tank, one that will be as far ahead of the World War II tank as a Mercedes is ahead of a Model A Ford — the MBT-70. But, you may ask, what is so new about a helicopter and a tank? Some improvements, perhaps, but are they *really* new? That is just what I want to talk about. What *is* new about the MBT-70? Or the Cheyenne? Or SAM-D? Let's take just those three items as illustrative of the kind of progress we are making in Army research and development.

As most of you are aware, the MBT-70 is the new United States-Federal Republic of Germany Main Battle Tank; the AH-56A Cheyenne is a new armed helicopter; and SAM-D is a new air-defense missile system. All of them are currently in development. I intend to make it clear why each is not just a slightly new edition of an existing capability, but a *major* advancement — one of integrated subsystems that provide really new operational capabilities, with vastly greater reliability, and much less need for upkeep.

Perhaps the best way to do this is to compare the performance of each of these new systems with that of something we all understand, something with which we all are familiar. Obviously, today's capabilities should be our baseline. In sequence, then, I'd like to compare the Cheyenne with the Huey B; the MBT-70 with the M-60 Tank and the Nike Hercules and Hawk combination with the SAM-D.

First, the Hueys. These gunships have surely paid their way in Southeast Asia, but as aircraft they are years behind today's technology. They were designed originally to carry people, not to function as gunships. As good as they are, they fall far short of what today's technology can provide.

For example, let's assume a not untypical action, such as might happen in Vietnam. To put in some reasonable numbers, let's assume a commander has selected a helicopter landing zone on the Vietcong's probable course of retreat. If the commander can throw part of his force into this landing zone, he can probably intercept and hold the VC until his land mobile forces can close in. The landing zone is some 20 kilometers away. That distance would have posed a major problem before the days of air mobility, but with today's airmobile forces, such distances and difficult terrain obstacles no longer pose a problem.

As a matter of practice, a commander will not normally make an airmobile move to a distance greater than the range of his supporting artillery. Artillery must therefore be prepositioned. In this case, no problem! Chinook aircraft are available from general support to move an artillery battery to its forward fire base.

For our hypothetical situation, four Huey companies and three Chinooks are allocated. This permits the commander to set up the artillery base rapidly, and also to make nearly simultaneous landing of a whole infantry battalion. In less than two hours after decision, his artillery can be positioned and the airmobile elements briefed, airborne and headed for the objective.

With low ceilings more or less normal in Vietnam, the aircraft will be flying at altitudes that will render them vulnerable to enemy ground fire. As the troop-carrying Hueys head toward the landing zone, the point and flanks of the column are therefore covered by Huey gunships.

The cruise speed of the troop carrier formation is about 90 knots; should the column be fired upon, the gunships, with no more speed than the troop carriers, must swing away from the column to attack any source of fire below. Then, before the objective is reached, they must rejoin the formation to provide close suppressive fire on the landing zone during the troop landing. Frequently, the troop carriers must loiter to let them catch up.

As you can see, the limited performance of the present gunships is a significant handicap to obtaining concerted action on the landing zone. For adequate escort and suppressive fire support, we would like to have a combination of 40mm grenades, 2.75-inch rockets and 7.62mm machine-gun fire. Today's gunships are lift-limited and cannot carry all three systems.

Now let's take a look at how the Cheyenne would fit into this hypothetical picture. Our situation is the same. The difference rests in vastly increased operational capabilities.

Our assumed force structure may be basically the same, except that instead of Hueys, the airmobile companies should be equipped with an advanced, VSTOL-type troop carrier. The aerial fire support will

New LWL Delta Platform Aids Helicopter Troop Landings

Landing troops from helicopters in the rice paddies, swamps and shallow water which characterizes Vietnam's Mekong Delta will be facilitated with a new "Delta Platform."

Being developed by the U.S. Army Limited War Laboratory, Aberdeen Proving Ground, Md., the device consists of a 22-foot hexagonal platform of aluminum tubing with a walking surface of aluminum chain link fencing.

Extending from the platform are six 20-foot legs. They are attached to a steel wire net to form the base of the structure, which weighs 900 pounds and is carried to a designated position by helicopter. When set down in place, it is ready for immediate use.

With various modifications, the developmental team reports, it could be used as a weapons platform, command post, troop shelter, first aid station, or helicopter landing port.

Delta Platform

be provided by the new Cheyennes — the advanced aerial fire support system now in development. It will be a truly versatile and amazing gunship.

Experience in Vietnam has proved the invaluable worth of the armed helicopter. It is now every bit as much a part of the ground commander's arsenal as his mortars, his automatic weapons, and his artillery support. But this same experience also pointed out areas of weakness in existing models.

Our current, armed UH-1 Hueys were designed as litter carriers, not as weapons mounts. Consequently, there is some degradation in performance of both weapons and aircraft. They must close to short range to see and fire at the enemy. Furthermore, since the Huey represents the helicopter technology of the late 1950s and early 60s, it is obvious that tremendous advances have been made in the subsequent years.

The Cheyenne provides the ground commander, for the first time, with a truly effective over-the-hill, instant-reaction target-acquisition and kill system. This aircraft can even hover at full gross weight at altitudes up to 6,000 feet. Using its very effective high-magnification, stable, sighting system, it scans the whole battle area well out of the range of enemy small-arms fire.

The next hill or bend in the road will, in themselves, no longer provide the cover and concealment they once did for waiting enemy forces.

Instead of having to draw fire, by foot and surface-vehicle probes to develop the enemy's strength and position, and then bring our own destructive fire to bear — a deliberate process requiring a varying period of time — we have in the Cheyenne totally new capabilities. Once having detected the enemy, the crew has the choice of either firing from outside enemy range or closing at high speed to deliver fire from close range.

The Cheyenne is thus not just a faster means of moving after the enemy, or a platform with better visibility from which to observe the enemy, or just another machinegun or rocket platform on a faster, more maneuverable aerial mount.

For the first time, tomorrow's ground commander will have a flexible and totally integrated gunfire support system designed from the very beginning to acquire and attack targets instantly, targets beyond the range or reaction time capability of his ground-based weapons.

By means of Cheyenne units at the various levels of command, commanders will have at their disposal a new offensive capability, an extremely rapid maneuver element with which to influence the course of battle. A task force commander who needs quick reinforcement will know that his next higher headquarters can provide this added firepower in minutes — not hours or days — through Cheyenne gunships.

A number of major areas of technological progress, when put together in a designed package, provide for more than just a little bit better aircraft than the armed Huey. These areas are in the rotor and airframe technology, in totally new day and night navigation, target detection, and fire-control systems, higher reliability, and, last but far from least, greatly reduced maintenance requirements — less than four manhours for each hour of flight time. Futhermore, weather should have significantly less impact on operational plans.

The armament systems carried by the Cheyenne have been designed and tailored for the aircraft. The flexible nose or chin turret will have either a 40mm grenade-launcher, or a 6-barrel, 7.62mm minigun capable of tearing up a target with some 6,000 shots per minute.

A swiveling belly turret with 360-degree coverage carries a 30mm automatic gun that fires a very effective new round capable of destroying lightly armored or protected targets. Six wing pylons can carry some 2,000 pounds of greatly improved 2.75-inch rockets and TOW wire-guided antitank missiles.

The Cheyenne has another role — reconnaissance by fire. Swinging in low near the area where the troop-carrying aircraft are to land later, the Cheyenne can risk going in for a closer look.

Even if the enemy reacts with machine-gun and rifle fire, the Cheyenne can complete its mission. Its speed is more than double that of currently available Huey Bs, and its protective armor should greatly reduce its vulnerability.

Riding in the front seat is the gunner. By means of the full swivel seat and very wide field of view, he visually scans

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Army Tests Heavy Equipment Transporter-70

One of the largest and most powerful military vehicles ever built, the first prototype of the 36-ton Heavy Equipment Transporter (HET-70), has been delivered to the Army for testing.

Designed primarily to carry the U.S./FRG Main Battle Tank (MBT-70), the transporter will also carry general cargo and other heavy equipment used by the U.S. and West German armies in the 1970s.

A combination tractor-semitrailer, HET-70 is capable of hauling loads up to 105,000 pounds. It is 60 feet long, 11.5 feet wide, and slightly more than 9 feet high at the cab level. The tractor unit is powered by a 660-horsepower multifuel compression ignition engine, driving a 5-speed, power-shaft transmission with torque converter. All four axles drive.

Top speed for the vehicle with full payload is 38 m.p.h. Speed ranges from 25 m.p.h on a 2.5 percent slope to 4 m.p.h. on a 15 percent slope. Without payload, the vehicle can climb a 30 percent grade.

Although the flatbed height of the semitrailer is only 44 inches, the vehicle has a fording depth of four feet. A special steel frame and deck design, utilizing T-1 steel construction, gives the trailer strength and light weight.

The trailer suspension system arrangement is based on four nonpowered axles, each with dual 15x19.5 14-ply tires. The third and fourth axle suspensions are air-actuated and can be raised and lowered pneumatically to reduce turning radius, to allow the trailer to run on two axles when unloaded, and to permit tire changes without jacking.

Designers claim at least two significant "firsts" for the vehicle — use of air — and walking-beam suspension systems on a tractor or trailer of any kind, and use of super-single-type tires on a military vehicle in a 4-axle dual arrangement.

Personnel at Fort Belvoir, Va., have begun to perform loading and bridge-crossing tests on the vehicle.

HET-70 was designed and developed by Chrysler Corp. Defense Engineering and two West German firms to conform to the military and road characteristics of the two countries. It uses nationally available major components that offer maximum interchangeability without loss of function or performance.

HET-70 Heavy Equipment Transporter

CRD Discusses MBT, AAFSS, SAM-D Systems

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ahead and to both sides of the aircraft. On the first pass he spots a distant target, a vehicle. The gunner flips switches as he selects the weapon he is going to employ. In this case, he picks the 40mm grenade-launcher.

The gunner then activates his laser rangefinder that instantly computes range and sends it to the central fire control computer. Simultaneously, the computer integrates input from the other components — ballistic data on the weapons selected as well as velocity, direction, and movement of the aircraft as sensed by the Doppler radar.

The Cheyenne's rigid rotor and short wings provide a remarkably stable weapon platform. Equally important is the ability of the gunner to place his entire fire control system — his seat, sight and weapon — in a stabilized mode, permitting him to remain on target automatically, even though the pilot is twisting and turning the aircraft.

Facilitating the gunner's aim is the 12-power telescope that is part of the stabilized sight. No vibration and greatly magnified target presentation are the result. . . . Turning on his telescope about 2,000 meters away from a suspected target, he zooms it to 4½ power. The target emerges clearly. Then, as the Cheyenne gets closer, he switches to 12-power magnification for a still sharper picture.

While the gunner is tackling this target to the front, the pilot (seated above and behind the gunner) spots enemy vehicles moving along a narrow dirt road to the right. By means of a slaved helmet sight that can be linked to any of the aircraft weapons, the pilot takes command of the belly-mounted 30mm gun that is then swiveled around to match the picture on the pilot's sight. Again, the computer instantly calculates the needed data, and as the pilot pushes his firing button the 30mm gun goes into action at the second target.

Your Cheyenne crews enjoy still another big advantage over earlier armed helicopter systems. That is the self-contained navigation system. No further ground facilities are required once the system is first oriented. All the crew member has to do is to select the map coordinate he wants to go to, give it a check-point designation, and put it in the computer.

When the range and bearing button are pushed, one obtains a readout of the range and bearing to those coordinates. A needle on the pilot's instrument panel will point to that check point and the distance to that point will also be constantly displayed in a special window.

Placing the laser rangefinder on a point on the terrain, and pushing another button on the computer control panel, crewmen can determine and display immediately the map coordinates of that point.

In addition, range, bearing and difference in elevation between two points on the ground can be measured and displayed, thereby providing instant and accurate fire-direction data.

Other Cheyennes accompanying troop-carrying aircraft can monitor the radio net and pick up the coordinates of the enemy from the reconnaissance flight. These coordinates are quickly punched into the computers of the accompanying Cheyennes — eliminating the need for detailed map and terrain reference en route.

Under normal conditions, an accompanying platoon of four Cheyennes will have sufficient ammunition to keep direct, observed suppressive fire on an enemy position for at least 30 minutes. And, if necessary, they can dash back to their laager area at 210 knots, and be completely refueled and rearmed in a scant 10 minutes ground time.

In a word, it should be clear by now that the Cheyenne is not just another helicopter; it represents a major improvement in operational capability. Now let's turn to the MBT-70.

Surely you are aware of the massive Soviet armored threat that we and our NATO allies face in the European Theater. You are also aware of the tank improvement program we have been pursuing for some years now, starting with the M-48. This was basically a good tank and it is still being used effectively, in Vietnam, for example. But, again, it represents old technology.

Progressively, we have improved the M-48, so much so that we changed its designation to the M-60, a third-generation of which is now in production. The great advance in this tank is that its armament includes both the conventional 152mm gun and the Shillelagh guided missile. Since the new MBT-70 will also carry the 152mm gun and the Shillelagh, one can very well ask what it is about the MBT-70 that makes it worthwhile to spend the millions of dollars it takes to develop this new tank.

The answer is not easy, but perhaps I can say, simply, that it is my conviction that the MBT-70 will enjoy the confidence of the men who man it, since it will out-shoot, out-maneuver, and generally out-perform any known tank or any we expect an enemy to be able to throw at us during the time period of its availability. It is the product of the research and development efforts of two nations — the U.S. and the Federal Republic of Germany.

One of the most important areas of technical advancement of the MBT-70 over the M-60 series tanks is the addition of a high-performance conventional round to the main armament and its associated, remarkably more accurate fire-control system.

The lower silhouette is another very important gain since it pays off in reduced vulnerability. The MBT-70 can have a 2-foot lower silhouette — which is considerable in terms of achieving a minimum target for the enemy to see and shoot at.

If you have ever ridden in an M-60 tank

Firebee Target Missile Chalks Up 1,000th Flight

In support of development testing of Army air defense missiles, the U.S. Army's Firebee target missile recently chalked up its 1,000th test flight over an 8-year span.

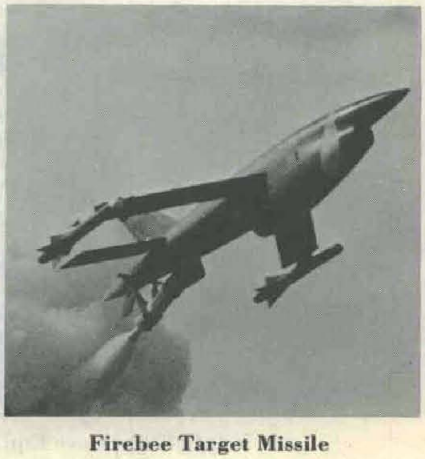
Most of the flights of the swept-wing, subsonic, bright reddish-orange target were made at White Sands (N. Mex.) Missile Range in tests of the capabilities of various types of missiles or to try out modifications in target development.

Firebee missiles have been in existence since the late 1940s and continuing improvements have been made to fit it to the needs of the missiles that try to knock it down.

Sometimes the Firebee carries infrared sources for testing such missiles at Chaparral and Redeye; at others it carries two targets aboard, with miss-distance indicating equipment and numerous other accessories.

Firebees that survive flight without being blown to bits by attacking missiles are recovered by parachute for re-use. One Firebee was flown 32 times before its usefulness ended.

Ground launched in the Army role with the aid of a rocket motor, the Firebee is powered in flight by a turbo-jet engine with 1,700 pounds of thrust. Development of the Firebee by the Army Missile Command is the responsibility of the Target Missile Branch, Development Division, R&D Directorate, Redstone Arsenal, Ala. Ray E. Stanley is project engineer.



Firebee Target Missile

and tried to keep the gunner's sight on a target as the tank travelled across a field at about 18 miles per hour, you realize that while there is a stabilization device to hold the gun level, the sight continues to bounce all over the sky. This really doesn't do much to help accurate firepower on the move. Although possible, firing on the move becomes a very difficult maneuver.

But in the MBT-70, this has been tremendously improved. In the M-60, we stabilize the gun and then slave the sight to the gun. The MBT-70 will have the sight stabilized and the gun slaved to the sight. The result will be a considerably improved hit probability when firing on the move.

Contributing to the inherent fire control accuracy of the MBT-70 is its new suspension system. Like a big cat crouching to spring at its prey, the MBT-70 can deliberately reduce its silhouette, or, if the terraine requires it, it can raise itself to attain additional ground clearance. It is also capable of tilting itself front-to-back and side-to-side in order to remain level under all terrain conditions.

. . . There can be little doubt of the tremendous advancement in the riding qualities of the MBT-70. The vehicle seems to float over the obstacles. The view from within the test rig is equally impressive. Not only is the ride improved; with almost twice the horsepower, the MBT-70 can run rings around the M-60.

A driver can almost drag-race his tank from a dead stop to 30 m.p.h., either forward or backward. During development, the fast-moving MBT-70 demonstrated that it could outdistance automobiles on the narrow, twisting, hard-surface test track at the Cleveland Army Tank Automotive Plant.

Another totally new component in the MBT-70 will be the environmental control system that protects the 3-man crew, by means of shielding, special filters and warning devices, against radiation, chemical and biological airborne contaminants. Air purification, air conditioning, and heating provide a compatible and adaptable environment in the crew compartment. The great strikes made through materials research have provided a big improvement in the ballistic armor.

Major advances have also been made in the main armament itself. The 152mm gun-launcher handles interchangeably the Shillelagh guided missile — with its very high-hit probability at long ranges, and a variety of conventional rounds.

With the Shillelagh, the saying "if we can see it, we can kill it" is not an idle boast. Add to this an automatic loading of ammunition for both the main and secondary armaments, which eliminates the fourth member of the crew, and a complete night-vision capability. All in all, it is quite a fighting machine.

. . . The Army is directing considerable R&D effort to another highly important program to improve our air defense, and, in the process, do something about defending the field army against ballistic missiles.

In our last two military actions, Korea and Vietnam, there has been little need for defense against air and missile attack. Our own people have had nearly complete control of the air over both hostile and friendly territory. The enemy, at least until now, has chosen not to use tactical ballistic missiles.

Our situation in NATO poses a very different threat. The enemy has a capability for use of both aircraft and short-range tactical ballistic missiles should he choose to attack. I want to discuss with you our efforts in this direction.

You are all familiar with our Hawk and Nike Hercules air-defense missile systems. Both have been in the field since the late 1950s. Without a doubt, they provided a vast improvement over the gun systems of World War II but, as was the case with earlier guns, they are now beginning to show limitations against the air and missile threat we expect to meet in the 1970s.

These limitations are due to several changes in the threat, some of which are seen in our own forces' air action in Vietnam. A capsule of these threat developments would consist of higher aircraft speeds at lower altitudes, increased missile accuracies allowing effective use of nonnuclear warheads, and technology advances permitting much greater electronic countermeasure capability in smaller packages.

The SAM-D is our candidate to meet these new threats. It will replace both the Hawk and Nike Hercules. SAM-D is a system using completely new concepts on which we began work only a few years ago. Exhaustive feasibility studies, component development, and contract definition gave us the answers we needed to enter advanced development in May of this year.

The new concepts we are now putting into hardware are basically three:

- First, a phased array radar that can simultaneously acquire, identify, and track targets and intercepter missiles.
- Second, a high-speed digital computer to provide a combined man-machine operation with short reaction time, greatly increased knowledge of the situation, and the ability to coordinate air defense with other actions in the air.
- Finally, a high degree of mobility achieved by a combination of compact packaging and of replacing cables with radio data links.

The system has five main groups. The sensor unit is the main part of the Fire Control Group. It is one of the most important technological advances in air defense in the past 10 years. On this vehicle is a computer-controlled, phased-array radar capable of handling a multiplicity of functions simultaneously. You may recall earlier air-defense systems that required a veritable antenna farm of separate radars to handle the various functions of acquisition, identification, target tracking, and missile guidance. Not so with SAM-D. One unit does it all.

Part of this group is the weapon control

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COMMANDERS of the U.S. Army Combat Developments Command (USACDC) met recently with Lt Gen Harry W. O. Kinnard, commanding general, at the largest of the subcommands, the USACDC Experimentation Command, Fort Ord, Calif. Headquartered at Fort Belvior, Va., the USACDC determines how the Army should fight and how it should be equipped in terms of doctrine, materiel and organization. It operates through five study institutes, two subcommands, three management groups, and nine field agencies. Seated at the conference table are (from left) Maj Gen George L. Mabry Jr., CG of the Experimentation Command; Maj Gen J. J. Ewell, CDCEC deputy CG; General Kinnard; Lt Gen M. S. Davidson, CG, Institute of Combined Arms and Support, Fort Leavenworth, Kans.; Brig Gen R. M. Lilly, former CG, Automatic Data Field Systems Command, Fort Belvoir. Brig Gen Wilson R. Reed succeeded General Lilly Nov. 1 when his tour ended.

CRD Discusses MBT, AAFSS, SAM-D

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unit wherein we house the operators, the controls and displays. The operators are kept aware of the current situation by various displays. They can select any mode of operation from fully automatic to manual, whichever best counters the threat of the moment.

The operators' actions are monitored in real time at the Battery Control Center (BBC), where an override capability can be exercised if neccessary. Human command and control of the weapon system is assisted by use of very high-speed data processors housed in the radar and the command vehicles. Information flows between these units via a secure RF, digital data, communications link.

The data processors in the radar vehicle control the phased-array radar in its search, acquisition, track and engage function. It also assesses the threat, determines the best engagement procedure, and via radar, guides the missile to target. At the same time, radio links the data processor with the Battery Control Unit as well as with other radars.

The BCC data processor keeps track of the current situation by means of radio data links with all radars and assists human controllers in passing on necessary fire control and engagement information.

The SAM-D launcher is remotely controlled, capable of firing six ready missiles, either singly or in close-sequence salvo. The missile itself can carry either a high-explosive or a nuclear warhead, as previously selected. It can be handled in its canister essentially like a round of ammunition, dispensing with much of the preflight testing required of older missiles.

Actually, the SAM-D is fired from the same canister that serves as a protective shipping and storage container as well as an integral launch tube. The missile is cradled within the canister and supported by teflon-coated, rigid-foam, launch rails that bear on the missile skin and support it during launch.

The guidance of the SAM-D missile also uses a new technique. Earlier experience with command guidance and semi-active homing systems proved that, while each has its good points, each has significant deficiencies. Command guidance suffers from increases in miss distances at longer ranges as radar tracking errors increase. Semi-active homing suffers from the need for high radiated power and an extremely sensitive seeker in the nose of the missile.

The guidance system for SAM-D will use the best features of each of these approaches. I can assure you that with the SAM-D air-defense system, we will have the best tactical air defense that today's technology can provide.

There you have it — three important, new capabilities for a better Army of the future. The Cheyenne will *not* be just another gunship; it will be a new airborne weapon system that will provide an control and engagement information.

The MBT-70 will *not* be just another tank; it will set a new standard in ground mobile, striking power.

The SAM-D will *not* be just another surface-to-air missile system; it is being designed to provide a major improvement in our ability to protect the field army from a variety of advanced threats.

I said earlier that these three systems are illustrative of the progress we are making in Army research and development. I regret that there is not time to tell you about the many other programs that are equally advanced in exploiting modern technology. I urge you to spend time at the many exhibits and see for yourselves the results of the Army-industry teamwork that promises to keep our Army modern as far into the future as we can see.

Reservist Wins Beneficial Suggestion Award

Army Reserve Maj Earl F. Fox of Columbus, Ohio, has turned an idea into annual Army savings of some $46,000, won for himself an $885 Beneficial Suggestion Award and improved the physical examinations of Reservists, National Guardsmen and ROTC students in the state.

Civilian staff administrative assistant to Brig Gen William W. Davis, commander of the 2291st Army Hospital (Reserve), Maj Fox received an Army certificate and cash award for his idea that turned an olive-drab Army semitrailer into a white mobile X-ray hospital unit.

General Davis and Col Hubert E. Strange, commander, 20th Army Corps (Fort Hayes, Ohio), presented the award at the Whitehall Memorial U.S. Army Reserve Center, Columbus. More than 250 members of the 2291st Hospital participated.

The mobile hospital unit staffed by 15 doctors and 25 enlisted men can provide complete physicals, including blood tests and eye examinations, to more than 13,000 military Reservists, National Guardsmen and ROTC students throughout Ohio.

Much of the saving is credited to the X-ray section of the unit which eliminates contracts with local laboratories for tests which often cost the Army more than $10 per person. Success of the unit has given Maj Fox the green light to build a similar second composite medical examination center on wheels.

Cerar Succeeds Stone at Edgewood Arsenal

Col Paul R. Cerar became the 25th commanding officer of Edgewood (Md.) Arsenal, established in 1918, when he recently accepted the sabre symbolizing command from Brig Gen William W. Stone Jr.

General Stone, who served as executive to the first Director of Army Research in 1958, is now Assistant Deputy for Research and Laboratories, directly under Dr. Jay Tol Thomas, at U.S. Army Materiel Command Headquarters, Washington, D.C.

Col Cerar was first assigned to Edgewood Arsenal as an instructor and executive officer of the Radiological Branch of the Chemical Warfare School from 1949-51. He returned in 1954 for a 2-year tour as ground munitions branch chief and (later) munitions division chief of the then Chemical Research and Development Laboratory.

Col Paul R. Cerar

After majoring in chemistry at Southern Illinois Normal University for two years, he entered the U.S. Military Academy, West Point, N.Y., graduating with a BS degree in 1942. He returned to the Academy in 1944 to serve three years as a physics instructor and received a master's degree in physics from Columbia University in 1949.

Upon graduating from the Chemical School's 6th advanced class in 1952, he reported to Naples, Italy, for a 2-year tour as a training officer at HQ, Allied Forces Southern Europe.

Following graduation in 1957 from the Air Command and Staff College at Maxwell Air Force Base, Ala., he was assigned as nuclear effects adviser to the Army Chief Chemical Officer, and then attended the Industrial College of the Armed Forces in Washington, D.C.

Col Cerar reported to Dugway (Utah) Proving Ground as director of the CBR weapons orientation course in 1961 and was DPG commander from 1962 until transferred in 1964 to Seoul, Korea, to command the Yongsan District Command and the Yongsan Compound.

Returning to the United States in 1965, he served for 15 months as director, Planning and Evaluation at Deseret Test Center, Fort Douglas, Utah.

Cheyenne Project Manager Takes First Test Flight

Based on first-hand knowledge gained as the first U.S. Army project manager to go on a dynamically new aircraft's initial test flight, Lt Col Emil E. (Jack) Kluever thinks the Advanced Aerial Fire Support System AH-56A Cheyenne is a real winner.

No small amount of persuasion was required to gain permission to ride with Lockheed test pilot Don Segner, but Lt Col Kluever's long record as a test pilot overcame objections. Perched on an improvised copilot-gunner's seat, he "got the feel" of the Cheyenne rigid-rotor compound helicopter during a 26-minute test.

"Nothing substitutes for first-hand knowledge of the aircraft you manage," he reported, "and by making the first test flight at Van Nuys, Calif., I gained a powerful new management tool for further testing and shaking-down of the Cheyenne."

The elation he experienced after the initial flight prompted him to go on the second-day 35-minute test run. He plans to fly the Cheyenne periodically to keep close contact with future performance.

All systems worked satisfactorily in the "flight envelope," a term for a pilot-engineer prepared pattern to be followed during each test. The first flight instructions called for 10 knots sideward, 10 knots rearward, 20 knots forward speed, and various hovering turns.

Speeds were increased slightly in each maneuver the second day, and the thrusting propeller was used to accelerate the aircraft. In a subsequent test, a speed of 120 knots was reported.

"I was impressed by the low vibration, low noise level and ease of control during the vertical takeoff and hovering maneuvers," Col Kluever told an *Army R&D Newsmagazine* staff member.

Col Kluever reportedly has another "first" established with Lockheed Aircraft Corp. — that of being the only Army test pilot to solo the Lockheed F104 at Mach 2, twice the speed of sound.

The Cheyenne, first aircraft of the Advanced Aerial Fire Support System (AAFSS), is a high-performance combat helicopter designed to replace most of the current armed rotor craft in South Vietnam. It is scheduled for certification by the Federal Aviation Agency in 1968 and will be up for Army service evaluation in 1969.

Before assignment to the AH-56A program, Col Kluever was a research pilot on the Lunar Landing Research Vehicle for the National Aeronautics and Space Administration (NASA) at the NASA Ames Research Center, Calif.

Winner of the 1960 Honts trophy for overall excellence at the Air Force Test Pilot School, Edwards Air Force Base, Calif., he became chief test pilot of the Army Test Office there and later ran a test-flying gamut of experimental fixed- and rotary-wing aircraft.

In Korea, he served as CO, 13th Transportation Helicopter Company (H-21), later redesignated Airmobile Company of the 7th Infantry Division, and engaged in extensive airmobile troop operations.

After test pilot school, he flew various helicopter test projects and participated in the XV-3 and X-14 programs at NASA Ames Research Center.

Col Kluever entered the U.S. Army Aviation Cadet Program in 1943 and won his wings at the San Antonio (Tex.) Aviation Cadet Center in 1945. Separated from active Army duty until the Korean conflict, he returned to fly 213 combat missions in L-19s, logging 630 combat hours, with the 2d Infantry Division.

In 1956, he attended the Armored Officer Advanced Course, Fort Knox, Ky., and became CO of an armored reconnaissance company under the Atomic Field Army Concept. He also completed the Parachute and Jumpmaster School at Fort Benning, Ga.

He has a BS degree in aeronautical engineering from Auburn University (1959) and is a graduate of the Command and General Staff College.

Lt Col Emil E. Kluever

Army Orders 100-kw. X-Ray Generator

A dual-purpose 100-kw. X-ray generator is being designed by Dr. A. Taylor of Westinghouse Research Laboratories under a contractual arrangement with the Army Materials and Mechanics Research Center (AMMRC), Watertown, Mass.

Fifty times more powerful than those commercially available for research purposes, the "world's highest-power X-ray generator" will be used at AMMRC for both fluorescence analysis and Compton line-shape measurements.

The combination of Compton line-shape measurement and the fluorescent X-rays will make it possible to increase the sensitivity of element analysis by a factor of 50.

Providing an internal means for calibration so that standard samples will not be required for comparison, the Compton line facility will complement the existing neutron-activation facility at AMMRC for absolute element analysis. The 100-kw. generator will be capable of absolute elemental analysis to parts per million for elements of atomic number greater than sodium (atomic number 11).

The Compton line shape will be studied in ferrous metals to obtain accurate information about the binding electron-wave functions. The Compton line shape yields the ground state momentum density of the electrons and this momentum distribution reveals intimate details of the type of bonding.

In metals, for example, the electron bonds are characterized by a sharp discontinuity in momentum density at the Fermi surface. In nonmetals, such details are ionic and covalent bonds are easily seen in the Compton line shape.

Measurements on lithium, beryllium, aluminum, lithium fluoride and boron were reported at the Sept. 5-8 Sagamore conference, yielding details of the electron distributions that were hitherto not obtainable.

The planned 100-kw. X-ray generator will utilize an X-ray target in the form of a truncated cone with the X-rays converging at the specimen placed at the apex of the cone. Estimated $100,000 cost of such a machine, delivering 50 times more intensity, is only about eight times the cost of the latest commercial generators.

Airborne Firepower

AIRBORNE TOW guided missiles, mounted on both sides of a UH-1B helicopter, have scored hits on moving tank targets at ranges over one mile in recent tests at Redstone Arsenal, Ala. Each pod carries three missiles. Developed by Hughes Aircraft Co., the TOW subsystem features a stabilized sight to counter aircraft movement.

Automatic Equipment Cuts Mapmaking Time to 24 Hours

Accurate topographic maps for military use can be produced in a fraction of the time formerly required by using equipment publicly unveiled recently by the Army Engineer Topographic Laboratories (USAETL), formerly GIMRADA, Fort Belvoir, Va.

The Universal Automatic Map Compilation Equipment (UNAMACE) can produce a map within 24 hours of the receipt of aerial photographs, compared to the 6-month to 2-year lead time required by manual procedures. The equipment was demonstrated at Fort Belvoir.

Maj Gen Frederick J. Clarke, deputy chief of the Army Corps of Engineers, said that the development of the UNAMACE is a "fantastic accomplishment" which is "revolutionizing the whole thinking of the Army with respect to the production of maps for military use."

The equipment is already being used to process aerial pictures taken in Vietnam. In addition to the unit at Fort Belvoir, two of the $1 million systems are installed at the Army Map Service in Brookmont, Md., and a fourth is being built.

The UNAMACE is the result of many years of USAETL engineering. Development of the specific equipment took about

Cartographer Lists Potential Applications of UNAMACE

Potential applications of UNAMACE, the Army's new high-speed mapmaking equipment, were outlined at the recent International Symposium on Photomaps and Orthophotomaps. (See related article on this page.)

Speaking at Ottawa, Canada, Robert P. Macchia, chief of the Advanced Mapping Systems Division, U.S. Army Engineer Topographic Laboratories (USAETL), Fort Belvoir, Va., discussed UNAMACE possibilities ranging from war gaming to road building.

The Universal Automatic Map Compilation Equipment (UNAMACE) developed by the Army, he stated, may lead to a less expensive source of color orthophotomaps than is currently available if investigations now under way fulfill expectations.

The capability of UNAMACE to produce elevation data on magnetic tape, providing a continuous record of terrain relief in profile form, also lends itself to several military applications, Macchia said. The USAETL is initiating a program to produce smooth contours from these data, permitting direct use for reproduction and eliminating the time-consuming procedure of tracing contours from the line-drop output.

"Another potential for the taped elevation data is in military war gaming," Macchia said. "Terrain shape is an important element in war gaming, particularly those experiments involving cross-country movement, maneuverability, and the advances and retreat of opposing armies.

"The elevation data from the UNAMACE, with proper reformatting, could be a direct input to the war-gaming computers.

"A further possibility for the taped elevation information would be in developing initial cost estimates for road building. It is not too difficult to perceive reviewing orthophotos to select alternate routes for a new road and querying by computer the elevation data to determine quickly the costs involved for each route based on the required cut or fill. By adding information such as soil type and geological information, it might be possible to use this method for final selection of the best route."

Macchia also mentioned several applications for the orthophoto, an aerial photograph in which inherent distortions have been corrected to make it accurate for use as a map.

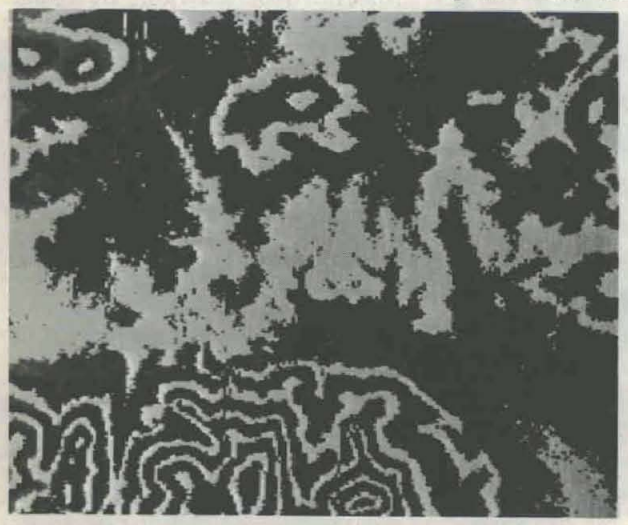
"The orthophoto allows one to view a geometrically accurate presentation having the detail information in the form that the human eye is accustomed to seeing. It will certainly have many more reference features by which one could locate himself and gain a better orientation."

He said that he attended a field exercise in which Army troops positioned weapons and targets using an orthophoto. When questioned as to how the weapons were positioned, the troops referred their position to clumps of trees, bushes, and other landmarks which were immediately evident on the orthophoto.

Macchia added that the orthophoto could have civil applications in easily defining property boundary lines and delineating farm crop, urban and population areas.

"Even though these divisions may not have features defining the lines, such as a fence, these boundaries could be annotated on the othophoto, eliminating to a great extent the work involved in the cartographic color separation process now required to produce the conventional line map."

The UNAMACE also is being utilized, he said, in studying the feasibility of developing an instrument for the rapid revision of currently existing orthophotomaps. Such an instrument would be less complex than the UNAMACE.



UNAMACE OUTPUTS include altitude line-drop chart (left) and orthophoto (right). The line drop chart portrays elevations in various shades of gray. Contours are extracted by tracing boundaries of the shades. The orthophoto is an aerial photograph in which UNAMACE has corrected distortions caused by differences in elevation, angles of light rays, and camera tilt. Contours from the line-drop chart are often overlaid on the orthophoto to produce a printable orthophotomap usable by field troops. The UNAMACE also produces magnetic tape elevation data for contour maps.

six years, while the automation development goes back nearly two decades.

A field version of the equipment being developed by USAETL was described in the May 1967 issue of the *Army R&D Newsmagazine*.

By computerizing the laborious tracing and contouring associated with mapmaking, UNAMACE produces maps with greater accuracy and consistency and with a fraction of the skilled manpower formerly necessary.

Major elements of the system are four identical precision transport (comparator) tables for scanning the input and printing the outputs, a digital computer with associated input/output equipment to control the automatic operation, and a control console for monitoring and manual control.

Products of the system are altitude line-drop charts showing contoured ground elevation, and orthophotomaps, or photographs with corrections for variations in altitude and attitude which make possible their use for measuring distances in the field.

Input to the equipment includes a 3-dimensional pair, or stereopair, of overlapping photographs containing a distorted perspective view of a portion of the earth. Printed on transparent glass positive plates, they may be of any scale or tilt and from any type of camera system, such as frame, convergent or panoramic.

Precomputed mathematical data, which relate each image point of the photographs to its ground coordinates, are also fed into the system.

The operation is based upon the electronic scanning and printing of a series of minute areas. During the scanning, the image information from the input photographs is electronically matched to derive elevation data, which are then used to correct distorted input imagery.

CHIEF OF R&D Lt Gen A. W. Betts and Maj Gen Frederick J. Clark, Deputy Chief of Engineers, view control console of UNAMACE during demonstration of the equipment at the U.S. Army Engineer Topographic Laboratories (USAETL), Fort Belvoir, Va. Also pictured are John Haff (in smock), a USAETL physicist who demonstrated the equipment, and John D. Mayer, one of five USAETL engineer-scientists to whom General Betts recently presented the R&D Achievement Award for their efforts in developing UNAMACE.

Prior to the demonstration, members of the 5-man team which developed the system were presented Department of the Army Achievement Awards.

Recipients of the pins and plaques were Edward R. DeMeter, for the basic specifications and design and for overall supervision of the program; Kent T. Yoritomo, for developments in the area of physics and electronic subelements; Morton Stromberg, for the mathematics and computer programs; John D. Mayer, for map compilation and coordination; and Edward F. Burzynski, for operational tests and analysis.

AMS Investigates Lasers for Aerial Mapping

Aerial mapping by use of a laser beam, designated as the Laser Terrain Profile Recorder, is being investigated by the U.S. Engineer Topographic Laboratories and Army Map Service, Corps of Engineers.

Current research is aimed at determining if the laser beam can yield terrain data with the consistent accuracy and high resolution necessary for contour maps.

In a recent test flight at 2,000 feet, the laser correctly established the height of a light pole at a road intersection as 30 feet and fixed the average height of a row of corn at seven to eight feet.

Army cartographers were particularly interested in the discovery that the laser often accurately identified ground elevations in dense tree growths.

The Airborne Profile Recorder presently used for measuring elevations bounces electronic beams in a cone-shaped configuration from 30,000 feet off an area of about five acres directly beneath the plane.

Under the same conditions, the continuous wave helium-neon gas laser sends out a pencil beam of light and covers an area of a few square inches. The selectivity of the latter produced terrain data with excellent resolution in laser tests conducted at altitudes from 500 to 15,000 feet.

The Aero Service Corp., under military contract, made additional recordings of various terrain features at altitudes up to 15,000 feet in varying weather conditions.

Army Prepares Charts for NASA's 1969 Mars Flyby

Preparation of a new 3-sheet series of charts for use in planning the Mariner Mars 1969 Flyby Mission is being undertaken by the Army Map Service (AMS) for the National Aeronautics and Space Administration.

The charts will show Mars' expected appearance, including the configurations of surface markings and the extent of the polar caps, during the mission period Aug. 1-15, 1969.

Day-by-day position data will be added to aid in the planning of earth-based observations to be made at the approximate time of the flyby.

Photography obtained by the Mariner IV spacecraft in 1965, which gave a closeup look at about one percent of the Martian surface, will be used for partial portrayal. Earth-based photography will be used for the remainder.

Earlier maps of the planet, such as the AMS Pictorial Maps of Mars, have been produced entirely from earth-based photography and show the average appearance of the planet's surface over a period of years.

The primary charts on sheets 1 and 2 will show Martian surface at a scale of 1:12,500,000 on a Mercator Projection extending from 0 to 360 degrees longitude, and from minus 70 to plus 70 degrees latitude.

These sheets will also show four smaller charts, centered at 0, 90, 180 and 270 degrees longitude, respectively, at a scale of 1:25,000,000 on the Equatorial Orthographic Projection. They will show the planet as a globe.

Sheet 3 will have two charts on the Polar Stereographic Projection, one centered on the North Pole and the other on the South Pole, to show the extent of the polar caps.

The prime cartographic effort for planning the Mariner '69 mission, the charts are scheduled for completion in January.

AVCOM Assigns Director For Procurement, Production

Col Clifton O. Duty is the new director of Procurement and Production at the Army Aviation Materiel Command, St. Louis, Mo., a responsibility involving contracts totaling more than $1.3 billion annually.

Until he assumed his new duties in mid-October, Col Duty held the same title at Edgewood Arsenal, Md., where he was charged with contract operations totaling about $150 million annually.

For four years previous, he was in the Contract Division, Office of the Assistant Secretary of the Army, Washington, D.C., following a year in Vietnam with the Military Assistance Advisory Group.

A career chemical officer, Col Duty entered the Army in 1942 after graduating from Texas A&M University with a BS degree in engineering. He earned a master's degree in industrial engineering at Purdue University in 1947. His military schooling includes the Chemical Officers Advanced Course, Fort McClellan, Ala.

Department of Defense Portable Electric Power Plants

One of the current priority areas of Army research and development effort was discussed in hearings from mid-September to early October before the United States Senate Subcommittee on Antitrust and Monopoly.

"Department of Defense Portable Electric Power Plants" was the title of a presentation by Donald J. Looft, acting chief, Electrotechnology Laboratory, R&D Center, U.S. Army Mobility Equipment Command, Fort Belvoir, Va. Currently he is completing a year of leave for advanced studies at George Washington University. This is a substantial portion of his presentation, coauthored by R. E. Hopkins and J. C. Orth of the same laboratory.

Mr. Chairman, in response to your request to the Secretary of Defense, I would like to present a resume of the scope and status of Department of Defense research and development programs in portable electric power sources.

With the advent of modern weapons, communications, and command and control systems, the Department of Defense (DoD) has encountered unprecedented requirements for electric power sources ranging from subminiature batteries to multimegawatt power generation systems.

For example, in the Army, in the field the installed generating capacity in kilowatts per man has increased from .5 in World War II to 2.0 in Vietnam. A critical and significantly large segment of this vast array of power sources is the portable or mobile power plant, essential to successful operations by highly mobile military ground forces.

Since this category of power source is more pertinent than others in the current proceedings of your Committee, my remarks will be limited to DoD programs on portable power plants and the use of technology accruing therefrom in electric propulsion of vehicles.

The Department of Defense requires two classes of portable power plants: A family of ratings ranging from 1.5 to 300 kw. for multipurpose use, and a family of ratings from 0.1 to 15 kw. for tactical use. The physical and performance characteristics desired are tabulated on Table 1.

TABLE 1
Portable Power Source Requirements

	Multipurpose	*Tactical*
Power level	1.5 to 300 kw.	0.1 to 15 kw.
Power density*	21 lb./kw.	50 lb./kw.
Efficiency (fuel consumption)	0.7 lb./kw.-hour	1.0 lb./kw.-hour
Signature:		
Noise	Speech Interference	Inaudible
Radiation	None	None
Reliability	95 percent	95 percent
Life	6000 TBO hours before overhaul	2000 hours
Cost	$0.05/kw.-hour	$0.10/kw.-hour
Fuel*	Military hydrocarbon	Military hydrocarbon
Environment*	-65 to 125 F. 8000 ft. All humidities	Same
Output*	0, 50, 60 400 cps All std. voltage	0, 50, 60 400 cps All std. voltage

The necessity for two types of power sources is dictated by the critical need in many tactical situations for silent power sources, as clearly documented by the Army Materiel Command's Qualitative Materiel Development Objectives (QMDO) Plan. The penalty for achieving this is reflected in the higher weights, shorter life, and higher cost that must be tolerated in order to achieve silent as opposed to low noise level power sources.

In comparing military requirements with those generally accepted in comparable civilian equipment, note the criteria marked with an asterisk in Table 1. These are "military peculiar," that is, features which a civilian user does not require or is indifferent to, though in most cases he would be happy to have such features if they cost him little or nothing. This is an important consideration in the electric power field, since the Department of Defense must depend on the civilian production base for quantities of materiel.

Any difference between the two markets results in delays in availability or excess cost for the more stringent requirement. Department of Defense requirements are therefore carefully conceived based on real needs, with an eye toward ultimate producibility.

Our past experience in this portable power field, however, has shown that many innovations developed to meet military-peculiar needs have been introduced to civilian users as production has expanded and costs were reduced.

As markets expanded from wider civilian use, the military benefited by lower costs and better availability. Electric governors and static excitation and regulation systems are good examples of this type of mutually beneficial technologi-

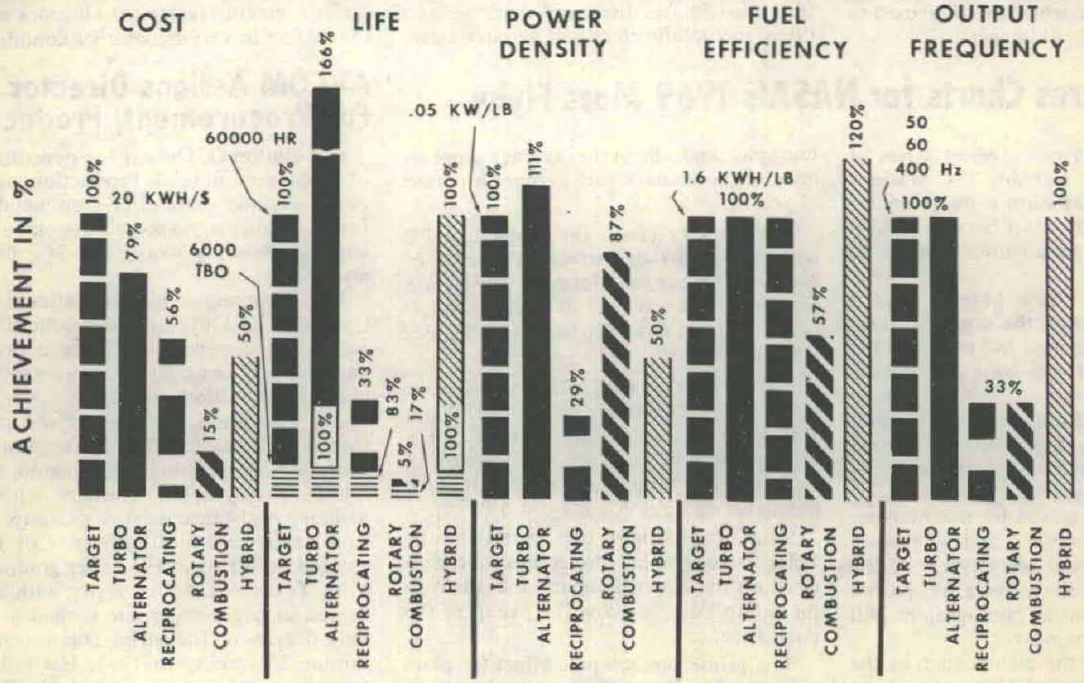


Figure 1. Analysis of Multi-Purpose Power Sources

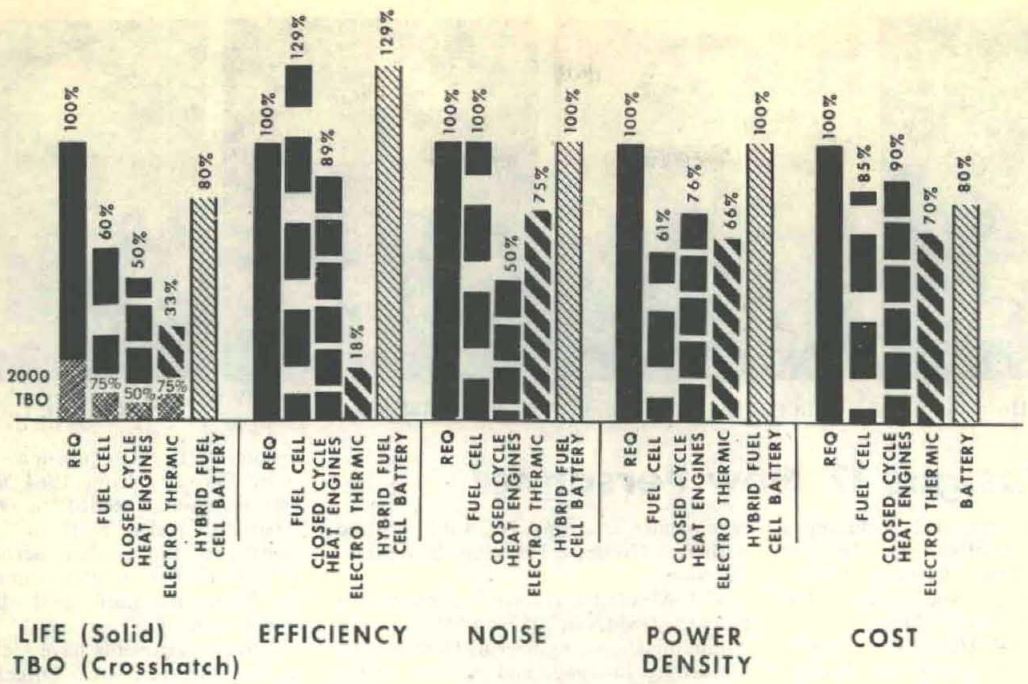


Figure 2. Analysis of Tactical Power Sources

cal progress.

Portable power plants now in the DoD inventory to satisfy the multi-purpose equipment are primarily reciprocating engine-driven systems. . . . Major deficiencies exist in power density, noise level, versatility and life.

There are no tactical power plants in the inventory that approach the requirements for this class of power source (particularly silence) except for storage batteries and expedient hybrid schemes involving batteries, and these, because they involve batteries, are all very low power level (ca < 100 watts continuous). Tactical power sources therefore represent an urgent need.

There are a number of possible approaches under study that offer various degrees of promise for meeting the requirements of the respective types of power plants. These are: *Multipurpose Family* — reciprocating engine-driven generators; turbo-alternator systems; hybrid systems; *Tactical Family* — thermoelectric converters; thermionic converters; fuel cells; closed-cycle heat engines; and hybrid systems.

Figures 1 and 2 show a gross estimate of the potential of each of these approaches for meeting the respective requirements. It is quite difficult to show all interrelated factors on a simple chart, but this does show major comparisons. . . . The turbo-alternator and hybrid combinations, which would involve the turbo-alternator are the most fruitful approaches (as shown in Figure 1) for most nearly meeting all requirements for multipurpose power plants.

Reciprocating engine-driven generators, while acceptable in a number of respects, are seriously limited in terms of power density, output versatility and cost. As shown on Figure 2, fuel cells, and again hybrid combinations based on fuel cells as the prime source, offer the best possibilities in the persent and foreseeable state of technology for tactical power sources.

Electro-thermic generators (thermoelectric, thermonics, thermal-photovoltaics) are limited from standpoints of efficiency, life and reliability and noise; and closed-cycle heat engines from standpoints of noise, efficiency and life. These deficiencies are not temporary, that is, problems which engineering development might reasonably be expected to overcome; they are fundamental and not readily amenable to solution.

The analysis represented by Figures 1 and 2 has been made in considerable depth. Based on this, the major research and development efforts for portable power plants has been concentrated on turbo-alternators and fuel cells and hybrid systems based on these two most promising techniques. I would like to discuss in some detail the status of efforts on these two approaches.

It should be noted that though the turbo-alternator and fuel cell are the most promising, lower-level efforts are being continued on other techniques such as thermoelectrics, closed-cycle engines and thermionics, so that any development which may alter the basis for the judgment to concentrate on turbo-alternators and fuel cells is not overlooked, and also to utilize other techniques in highly specialized applications for which they may be ideally suited.

Turbo Alternator Systems: The gas turbine is the lightest in weight and smallest in size (therefore, highest power density) of any practical heat engine. Its performance and reliability have been dramatically demonstrated by the military and commercial aircraft experience. With its rapid-start capability over wide ambient temperature ranges, few moving parts, multifuel capability and long total life, it is an ideal prime mover for military electric power plants as well as civilian standby power plants.

In the lower horsepower ranges (ca < 500 hp.), which is the region of high-density in military electric power plants, presently available hardware, however, suffers in comparison with available reciprocating engines from the standpoints of initial cost (factor of 2) and fuel consumption (factor of 2).

Research and development spearheaded by the Department of Defense clearly shows great promise to solve the fuel consumption problem within the next several years by means such as reusing exhaust gases and higher temperature and pressure ratios.

The high cost is in large measure due to relatively low volume production. However, once more competitive fuel consumption levels are achieved, greater markets and greater production — and hence lower costs — are anticipated.

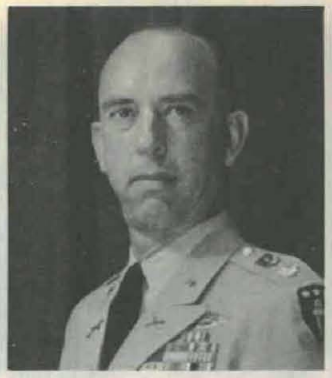
The gas turbine, in its present status, is a classic example of the situation previously mentioned wherein many customers would prefer the turbine even with its adverse fuel consumption if it could be produced at costs comparable to reciprocating engines. In order to achieve those costs, producers must have the volume represented by those markets.

Applied in military electric power

(Continued on page 38)

Col T.B. Hobson

Lt Col R.L. Alexander



Lt Col A.R. Clark

Lt Col J.D. Donnelly

OCRD Assigns 17 New Personnel

Seventeen new personnel, including a division chief, a civilian, and the new adjutant of the Army Research Office, have been assigned to the Office of the Chief of Research and Development.

COL THOMAS B. HOBSON, assigned as chief of the Programs and Budget Division, recently returned from Sofia, Bulgaria, where he was defense attache since 1965. His prior assignment was commander of the 3d Medium Tank Battalion, 33d Armor Division.

He served in 1962-63 with HQ Eighth U.S. Army Korea as chief of the Finance and Accounting Policy Division, following four years with the Financial Management Working Group, Comptroller of the Army.

Col Hobson has a BS degree in business administration from Ohio State University (1940) and an MBA degree in the same field from Syracuse University (1955). In 1962, he attended the Command and General Staff College (C&GSC) and he completed the Armored Officers Advanced Course in 1953.

LT COL ROBERT L. ALEXANDER is assigned to the Studies Branch, Studies and Analysis Division, following a year in Vietnam as an adviser with the U.S. Military Advisory Command.

From 1962 to 1965, he taught in the Department of Electricity at the U.S. Military Academy (USMA), following two years at Fort Benning, Ga., as a commander, company, 2/23d Infantry and with Test Group, G3 Section, 2d Infantry Division.

Col Alexander received a BS degree from the USMA in 1953, an MS degree in communications engineering from Purdue University in 1962, and was graduated from the C&GSC in 1966.

LT COL ALPHUS CLARK is a new staff officer in the Mid-Range Plans Branch, Plans Division, and was last assigned to Fort Ord, Calif. There he held successive assignments as plans officer, G3 Section, U.S. Army Combat Developments Command Experimentation Command, and commanding officer, 4th Battalion (M), 41st Infantry.

He has served as a senior member of the Joint Observation Teams, United Nations Military Armistice Commission, Korea, an instructor at the C&GSC and a staff officer in the Office of the Assistant Chief of Staff for Intelligence, Department of the Army.

Col Clark holds a BS degree from the University of Maryland (1959), an MS degree in international affairs from George Washington University (1965), and has attended the C&GSC, the Armed Forces Staff College and the Army War College.

LT COL JAMES D. DONNELLY has been assigned to the Physical and Engineering Sciences Division as an action officer for combat surveillance, night vision, and target acquisition.

In Germany from 1964 to 1967, he established and headed the Office of the Assistant Chief of Staff for Communications and Electronics, Berlin Brigade, U.S. Army Berlin, after commanding the 1st Signal Battalion, Seventh Army, at Boeblingen.

Other assignments have included: electronics engineer, R&D Directorate, U.S. Army Missile Command, Redstone Arsenal, Ala., 1963-64; communications engineer with HQ U.S. Army Ballistics Missile Agency, Redstone Arsenal, 1962-63; stock control adviser for the Republic of Korea Army, U.S. Army Advisory Group, Korea, 1960-61; electronic engineer, Combat Surveillance and Target Acquisition, Branch, OCSigO, 1959-60.

Col Donnelly received a BS degree in mathematics and physics from Georgetown University in 1943, has done graduate work at George Washington University, has attended the C&GSC, and has completed the Advanced Signal Officers Course.

LT COL PETER B. FARRELL, a new staff officer in the Nike-X Branch of the Nike-X and Space Division, includes among his qualifications three master's degrees in addition to being a 1950 graduate of the USMA.

He received an MA degree in education from Eastern Michigan University in 1960, and MS degrees in aeronautical and astronautical engineering and in instrumentation engineering from the University of Michigan, both in 1961.

Lt Col P.B. Farrell

Lt Col W.J. Henderson

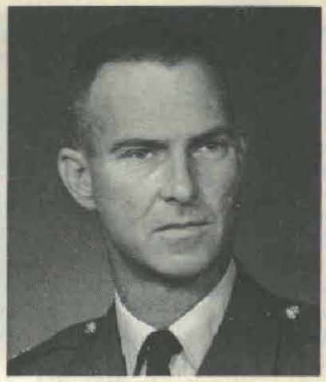
Lt Col F.H. Henk

Lt Col W.C. Hiestand

Lt Col D.B. Knight Jr.

Lt Col W.E. Phillips

Lt Col M. C. Snyder Jr.



Lt Col C. Wheeler

Col Farrell's previous assignment was commander of the 6th Battalion, 56th Artillery, in Vietnam. Prior to that, he was a missile staff officer, Joint Task Force 2, Sandia Base, N. Mex., 1965-66.

Before attending the C&GSC in 1964, Col Farrell served three years as Nike-X plans officer, HQ U.S. Army Air Defense Command, Colorado Springs, Colo.

LT COL WILLIAM J. HENDERSON is a new staff officer in the Chemical-Biological Branch of the Nuclear-Chemical-Biological Division, following a year in Vietnam as G3 operations officer and chemical officer with the 4th Infantry Division.

From 1965 to 1966, he was stationed at Ent AFB, Colo., as chemical officer with the Army Air Defense Command. He has served as project officer with the Special Warfare Agency, Combat Developments Command, Fort Bragg, N.C., and S3 with the 518th Chemical Battalion, Fort McClellan, Ala.

Lt Col Henderson has a BS degree in botany and plant pathology from Colorado State University (1952), an MS degree in plant pathology from the University of California at Davis (1954), and has attended the C&GSC.

LT COL FLOYD H. HENK, assigned to the Nike-X and Space Division as chief of the Range Branch, last served in Korea as commander of the 13th Engineer Battalion, 7th Infantry Division.

In recent years he has served as a research and development coordinator with the Defense Atomic Support Agency and in the Alaska and Fort Worth, Tex., Districts with the Corps of Engineers.

A graduate of Texas A&M University with a degree in civil engineering (1950), Col Henk has an MS degree from the University of Illinois in the same field (1959), and has attended the C&GSC.

LT COL WILLIAM C. HIESTAND reported recently to the Combat Materiel Division as a staff officer in the General Materiel Branch following two assignments in Germany.

From 1964 to 1966, he was with the Materiel Readiness Division, Office of the Deputy Chief of Staff for Logistics, HQ U.S. Army Europe (USAREUR), in Heidelberg, before being assigned as commander of the 1st Battalion, 32d Armor, 3d Division in Friedberg.

A 1949 graduate of the USMA, Col Hiestand attended the C&GSC in 1962 and received an MA degree in mechanical engineering from the University of Michigan in 1964.

LT COL DANIEL B. KNIGHT JR., U.S. member of the Primary Standardization Office of the OCRD International Office, returned in August from a year in Vietnam as executive officer of the 11th Combat Aviation Battalion.

Other assignments have included: executive officer, 5th Battalion, 31st Infantry, Fort Rucker, Ala. (1964-65); executive officer (1961-62) and commanding officer (1962-64), 21st Aviation Company, Fort Rucker, Ala.; and commanding officer, Detachment L, U.S. Army Advisory Group, Korea (1960-61).

A graduate of the USMA, Col Knight has also attended the C&GSC and the Infantry Advanced Course.

LT COL WENDELL E. PHILLIPS has been assigned to the Fire Support Branch of the Air Defense and Missiles Division following a year as commander of the 5th (Sergeant Missile) Battalion, 73d Artillery, in Europe.

He was chief of the Combat Developments Section, Operations Division, HQ USAREUR, 1964-66, and Sergeant missile project officer with the U.S. Army Artillery Board, 1960-63.

A 1950 graduate of the USMA, Lt Col Phillips has an MS degree in electrical engineering from the Georgia Institute of Technology (1960) and has attended the C&GSC,

LT COL MELVIN C. SNYDER JR., until recently chief of the Personnel Services Division, G1 Section, HQ Eighth U.S. Army Korea, has been assigned to the Studies and Analyses Division.

Other assignments have included chief, Nuclear Branch, Atomic Weapons Training Group, Defense Atomic Support Agency (DASA), Sandia Base, N. Mex. (1962-65), and plans officer, G3 Division, Base Section, Communications Zone France (1957-60).

Col Snyder has a BS degree from the USMA (1951), an MS degree in physics from Tulane University (1962), and has attended the C&GSC.

LT COL CHRISTOPHER WHEELER, newly assigned staff officer in the

(Continued on page 18)

Maj H.D. Fleming

Maj P. Miller Jr.

Maj R.J. Thomas

Earl A. Shepard

OCRD Assigns 17 New Personnel

(Continued from page 17)

Mid-Range Plans Branch of the Plans Division, last served as a personnel management officer in the Office of Personnel Operations, the Pentagon.

He has served in Vietnam as a management analyst with the Military Advisory Command and as a combat arms studies officer with the Military Assistance Advisory Group. From 1959 to 1961, he was with the Army Air Defense Command, Fort Totten, N.Y., as HQ commandant and assistant G1, 1st Region.

Col Wheeler holds a BA degree in political science from Harvard College and has attended the C&GSC and the Armed Forces Staff College.

MAJ HEWELL D. FLEMING is a new staff officer in the Standardization Branch of the International Office, following a tour of duty as project officer with the Army Concept Team in Vietnam. He also served there as an aviation staff officer in the 11th Armored Cavalry Regiment.

A senior Army aviator, Maj Fleming has served as S3 with the 16th Aviation Battalion in Germany, company commander with the 1st Armored Division at Fort Hood, Tex., division aviation officer with the 1st Cavalry Division in Korea, and flight instructor at the U.S. Army Aviation School, Fort Rucker, Ala.

A graduate of the University of Omaha with a degree in general engineering, Maj Fleming has attended the C&GSC in addition to Flight School and Aviation Staff Officers Course at Fort Rucker, Ala.

MAJ PAUL MILLER JR. was assigned to the Physical and Engineering Sciences Division, Army Research Office, upon his return from Vietnam, where he served as S-3 and executive officer of the 1/21st Artillery Bn and was assistant G1 with the 1st Cavalry Division.

From 1959 to 1966 he was a student in the Artillery Advanced Course and at Pennsylvania State University (MS degree in chemistry), and assistant professor at the USMA.

After studying chemistry for two years at the University of California, Los Angeles, he was selected for the USMA and was graduated in 1954.

MAJ ROBERT J. THOMAS brings to his new assignment in the Special Warfare Division recent experience gained in Vietnam as executive officer and assistant G1, 1st Battalion, 12th Cavalry, and assistant G1, 1st Cavalry Division.

Before his two years in Southeast Asia, he was a quality assurance engineer with HQ Field Command, DASA, Sandia Base, N. Mex., 1962-65. He was an ROTC instructor at Montana State University (1958-60) and team leader with the 1st Special Forces Group (Airborne).

Maj Thomas received a BS degree in engineering from the USMA in 1953 and did graduate work in nuclear engineering at the University of Arizona. He attended the C&GSC in 1966.

CAPT ARTHUR W. REED, new adjutant in the Army Research Office, OCRD, is backed by 11 years experience with the Special Forces.

Assigned as assistant adjutant to the 7th Special Forces Group, Fort Bragg, N.C., as an officer in the Regular Army in 1963, he served two years in a variety of assignments with the 5th Special Forces Group. During a tour in Vietnam, he earned seven decorations.

Upon his return to the U.S., he was assigned to Fort Campbell, Ky., as adjutant, 1/321st Artillery, 101st Airborne Division, and chief of the Personnel Records Branch for the 101st.

Capt Reed has attended North Carolina State (two years) and the University of New Mexico.

EARL A. SHEPARD is a new staff member of the Programs Branch of the Research Programs Office, ARO.

After completing the Army Management Intern training program in 1964, he worked until recently in the Iroquois Project Manager's Office, HQ U.S. Army Materiel Command, as a program analyst/program specialist. Before entering U.S. Government service, he owned and operated an insurance agency. He has an associate of science degree in business administration from Southeastern Univ.

Shira Named Assistant SG, Dental Corps Chief

Maj Gen Robert B. Shira Jr., former director of Dental Activities at Walter Reed Army Medical Center (WRAMC), became Assistant Surgeon General and Chief of the Dental Corps upon retirement of Maj Gen Joseph L. Bernier.

General Shira was named to the positions on an "acting" basis in September and has served at WRAMC since November 1966, following two years as Dental Surgeon, U.S. Army Europe. From 1954 to 1964, he was chief of Oral Surgery at Walter Reed General Hospital.

Chief of Oral Surgery, Letterman General Hospital, San Francisco from 1947 to 1954, he then served six years with the Gorgas Hospital, where he was in charge of all dental clinics operated by the Panama Canal Zone Administration.

He received his DDS degree in 1932 from Kansas City Western Dental College, and practiced in Oklahoma until entering the Army Dental Corps in 1938.

General Shira is a member of the American Dental Association, the American Academy of Oral Surgeons, and the American Academy of Oral Pathology, and is a Fellow of the American College of Dentists and a Diplomate of the American Board of Oral Surgery.

He has received the Order of the Sword of Hope, the highest individual award of the American Cancer Society's Pennsylvania Division.

Maj Gen R.B. Shira Jr.

Lt Col Van Auken Named Dragon Project Manager

Assignment of Lt Col Kenneth C. Van Auken as project manager for the Dragon, the Army's shoulder-fired weapon system for destruction of tanks and infantry targets, was announced recently by the Army Missile Command.

Graduated recently from the Army War College, Col Van Auken is a graduate of the United States Military Academy at West Point, N.Y., and has a master's degree from Purdue University, where he specialized in turbines and jet propulsion.

He is also a graduate of the Command and General Staff College, the Armed Forces Staff College, the Infantry School at Fort Benning, Ga., and the Ordnance School at Aberdeen Proving Ground, Md.

Col Van Auken has served with the Office of the Chief of Ordnance, Washington, D.C.; Ordnance Section, HQ Eighth U.S. Army in Korea; 547th and 701st Ordnance Companies in Germany; Logistics Division, HQ SHAPE, in France; and White Sands (N Mex.) Missile Range.

11 RIA Personnel Seeking PhDs, MAs in Army Program

Nine Army Weapons Command scientists and engineers and two employes of the Army Management Engineering Training Center at HQ WECOM, Rock Island (Ill.) Arsenal, are participating in Army-sponsored programs leading to advanced degrees.

WECOM scientists and engineers studying at the University of Iowa are Donald Keckler, Ronald Freeman, Robert Walljasper, Claude Comer, Jimmy Williams, Roscoe Wrenn, Robert Seamonds and Lanny Wells. Robert Hellum is enrolled at Arizona State University, Frank Kozzisek at the University of Wisconsin and Darrell White at the University of Purdue.

Walljasper, Williams and Seamonds are seeking PhD degrees. The others are candidates for master's degrees.

Survey Documents Acceptance of Value Engineering

Value engineering (VE), the art of reducing costs by simplifying design, is now "firmly established and recognized as a management level profession by top corporate executives" according to a survey of 200 contractors with VE programs.

The study was undertaken in April 1967 by the National Defense Education Institute (NDEI), cofounded by the National Security Industrial Association and by Harbridge House, Inc.

The report compiled by Harbridge House showed that 57 percent of the respondees said their VE program was operated as a separate department; 30 percent reported no connection between cost reduction functions and VE; 54 percent operated parallel cost reduction and VE programs, combining them only for management reporting purposes.

All but nine percent of the programs provided guidance to other internal company functions conducting value studies. Sixty-seven percent of the firms had a formal value education program for their personnel, conducted in 65 percent of these cases by their own VE staffs.

Another indication of professional acceptance of the field was the salary and management structure within the VE departments sampled. At least 40 percent earned $10,000 to $20,000 annually.

When asked to what organizational level their value program reported, 31.5 percent answered the executive level, including vice presidents and general managers, while 29 percent said engineering departments.

In terms of actual performance requirements, management officials showed in 27 percent of the cases sampled that they were satisfied with a break-even point in savings to have a proposal implemented. Forty percent expected a ratio of 2 to 1 savings, while 18 percent expected a 5 to 1 saving.

On the question of whether the programs had a budget to support development or test costs of potentially worthy value proposals, 54.5 percent said they did, while 45.5 percent said they did not.

Because so many value engineering programs are geared to meet government VE incentive and program contract clauses, responses in this area were considered of major significance in determining how fully the benefits allowed by the provisions were being utilized.

The average ratio between contracts containing incentive clauses normally enabling the contractor to share equally in profits was 12 to 1 over those containing the more restrictive program clauses providing for an approximate 25 percent contractor participation in savings.

Nearly 70 percent also contained future acquisition provisions under royalty and 80 percent included collateral savings programs for field operations savings after performance of the contract.

Asked to state their use of Value Engineering Change Proposals (VECPs), the response varied widely. Although the average number submitted per company during the past year was 14, over one third of the respondees stated they had never submitted VECPs.

Respondees noted that although the government was required to notify of acceptance or rejection of a VECP in 65 days, renegotiation of the contract might actually take as long as 210 days.

The incidence of Class I and Class II proposals among respondees was documented by the survey. Under Class I proposals, special permission must be obtained from the government for design changes not specified in the contract which are expected to effect cost savings. The contractor is also required to share these savings with the government.

Class II proposals, on the other hand, permit modifications to be made within a broader specification framework for which savings may be fully realized by the contractor. He is not required to report the savings separately, although the final benefits become part of his overall contractual performance.

The survey showed that Class II proposals had been obtained in 69.8 percent of the cases reported, as a result of value studies.

In compiling the report, Harbridge House noted that a "surprisingly small" amount of the VE savings program has filtered through to the subcontractor level. Only half of the 60 percent of the contractors who reported VE programs with subcontractors had training provisions incorporated into these agreements.

Missile Command Miniaturizes LAW for Training

Miniaturization of the LAW (Light Antitank Weapon) for training purposes by the U.S. Army Missile Command, Redstone Arsenal, Ala., is expected to save the U.S. Government an estimated $39 on each firing — $3 each as compared to $42.

The training kit for the M-72 weapon is installed in the basic LAW launcher to fire a miniature training rocket, about eight inches long and one-half inch in diameter, which simulates the performance of the LAW rocket and carries a spotting head which flashes to mark a target hit.

Normally the launcher is discarded after the rocket is fired, but the training kit will enable it to be reused. Each of the training rounds cost about $3. Cost of the full-size rocket and launcher is $42.

Later in the program, the Missile Command Test and Reliability Evaluation Laboratory will conduct an extensive test program, under a variety of conditions, on the training system.

Management of the training device program is being directed by Howard Cox of the Land Combat Commodity Office at the Missile Command. Jim Howison of the Small Rockets and Aircraft Armaments Branch, Development Division, R&D Directorate, is project engineer.

Deployed with the U.S. Army in Vietnam and elsewhere, the LAW is a versatile weapon which weighs less than five pounds, is shoulder fired, and can be used against bunkers, snipers or field fortifications.

LAW was developed and deployed under Missile Command management and subsequently turned over to the Army Munitions Command. Hesse-Eastern Division of Norris Industries, development contractor for LAW, also is doing work on the new training device.

PROJECT ENGINEER James Howison compares normal round for M72 weapon system and miniature developed by the U.S. Army Missile Command to give soldiers realistic firing experience—at a saving of about $39 a firing.

Laser Range Instrumentation Theme of WSMR Seminar

"Laser Range Instrumentation" was the theme of a 2-day seminar sponsored by the White Sands Missile Range (WSMR) chapter, Photo-Optical Instrumentation Engineers, Oct. 16-17, at El Paso, Tex.

Maj Gen H. G. Davisson, WSMR commander, presented the opening address and William Russell, WSMR Systems Development Directorate, National Range Operations, seminar chairman, welcomed participants.

Fourteen speakers discussed the employment of lasers in such diverse applications as target, satellite and lunar distance measurements, gyroscopes, and high resolution angular encoders.

Army Contracts Total $666,110,769

U.S. Army contracts for research, development, test, evaluation, and procurement for the period Sept. 11 to Oct. 10 exceeding $1 million totaled $666,110,769.

Uniroyal, Inc., received a $74,455,016 modification to a contract for explosives, 105mm projectiles, and maintenance and support services, and a $1,168,352 contract for fuel tanks for UH-1 helicopters.

The Olin Mathieson Chemical Corp. was awarded modifications totaling $73,466,975 for propellant charges, powder and support services. Day and Zimmermann, Inc.. will load, assemble and pack miscellaneous medium caliber items and their components on a $62,370,874 modification.

Western Electric Co. received a $43,425,000 modification for additional effort on the Nike-X research and development program necessary to support implementation of the decision to produce and deploy an antiballistic system. Work also will be performed by the General Electric Co., Bell Telephone Laboratories, Raytheon Co. and Martin Marietta.

Western Electric also received a $6,918,054 contract for FY 1968 Nike Hercules engineering services. Ford Motor Co. was issued a $34,840,925 initial increment to a $99,310,857 3-year buy for ¼-ton utility trucks, and a $1,250,000 contract for production engineering services for 5-ton trucks.

Seven contracts with General Motors Corp. will purchase projectile parts, radio transmitters and receivers, tank engines and transmissions, and howitzers for a total of $28,869,578. The Federal Republic of Germany, Bundesamt fuer Wehrtechnik und Beschaffung, Koblenz, Germany, received three contracts totaling $27,794,839 for 20mm automatic guns, ammunition and spare parts.

A. O. Smith Corp. was awarded a $19,110,700 contract for 750-pound bombs. Hercules, Inc., will manufacture miscellaneous propellants and explosives for $16,948,393. General Electric Co. will provide klystron tubes for high-power acquisition radar for Nike Hercules, spare parts for the 7.62mm aircraft machinegun and pod, and M-73E1 machineguns on contracts totaling $16,224,559.

Page Aircraft Maintenance, Inc., received a $15,700,000 contract for maintenance of rotary- and fixed-wing aircraft at two Army bases. Honeywell, Inc., was awarded four contracts totaling $11,595,238 for electronics equipment, grenade fuzes, and parts for 20mm cartridges. Kisco Co., Inc., will furnish 105mm cartridge cases for $10,650,000.

National Presto Industries, Inc., was issued a $10,000,000 contract for metal parts for 105mm projectiles. The Philco-Ford Corp. was awarded modifications totaling $9,548,594 for extension of engineering services on the Shillelagh missile system and for major improvements on the Chaparrel air defense system.

Boeing Co. will furnish rotary heads for CH-47 Chinook helicopters, new helicopters, and CH-47A inspection and repair services for $8,454,254. National Gypsum Co. received an $8,386,800 modification for loading, assembling, and packing ammunition and components.

Chamberlain Manufacturing Corp. will provide 155mm projectiles and metal parts for 2.75-inch rocket warheads for $8,127,284. Mine Safety Appliance Co. will supply field protective masks on an $8,046,417 modification. For $7,705,525, Firestone Tire and Rubber Co. will furnish track shoes for tanks.

A $7,690,024 modification was issued to Kentron Hawaii, Ltd., for operation, maintenance and development of Kwajalein Test Site Technical facilities. AVCO Corp. will receive $7,659,137 for Iroquois aircraft engines, conversion kits to modify Chinook engines, and repair parts and support equipment for Chinooks.

Litton Systems, Inc., was awarded contracts totaling $7,266,520 for data converters, airborne navigation systems for Mohawk aircraft, and scientific and technical effort to support the Combat Developments Command Experimentation Center during fiscal year 1968.

ATAC Trainees Develop Lightweight Transporter

Development of a small cargo-carrying vehicle for use in snow and mud is an objective of an unusual program involving engineer trainees at HQ U.S. Army Tank-Automotive Command, Warren, Mich.

Herman Nadler, head of the Development and Engineering Directorate, Foreign Vehicle Evaluation Office, originated the idea and developed the concept.

The trainees, each with a BS degree in mechanical engineering, are David Tripp, 23, of Michigan Tech, Robert Kaczmarek, 26, of Western Michigan University, and John Thomson, 24, University of Michigan graduate. They have developed a collapsible, air-droppable cargo carrier that can be used as either a wheeled or tracked vehicle.

Six months ago they were given two Belgian tricycle-type vehicles and told to use the parts to design and fabricate a new-type vehicle. While in training they have limited hardware design, development and fabrication activities, but Nadler's project has been a welcome supplement to their prescribed routine.

Designated the AS-24, All-Terrain Cargo Carrier, their vehicle is 6 feet long, 64 inches wide and about 48 inches high. Powered by a 305cc motorcycle engine, the chain-driven 4-speed transmission vehicle carries a payload of 1,000 pounds or a driver and three fully equipped fighting men. It has a top speed of about 30 m.p.h., operates on the skid steer principle and is controlled by two stick-type levers. Braking is achieved by pulling back on both levers.

The original body, an open box structure of steel, is being replaced by an aluminum body. It will be fabricated in two sections to provide a capability for sliding the two body sections together, thus compacting it for more convenient air transportability.

When in use as a wheeled vehicle, the AS-24 rolls on four 22x12 low-pressure Lipsoid tires of German design. When tracks are used, they are slipped over the tires and held in place by two road-wheels that are mounted to the frame.

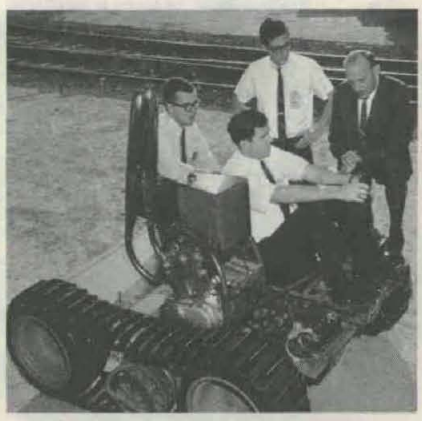
The road wheels exert tension on the tracks so that they maintain contact with the ground and do not slip off the tires. Air in the tires also acts as the vehicle's suspension system. The track consists of 52 nylon links, to which the track grousers, also of nylon, are fastened.

In an assessment of the projects, Nadler said that tests on the vehicle when it is fully completed could lead to a new item in the inventory, adding:

"We have a need for a small, highly mobile vehicle that provides greater versatility while performing the same functions of the one-quarter-ton Army Mule. It could just be that these young men, given the opportunity to apply their imagination and know-how, might come up with what we're looking for."

Nadler said that in any event the trainees will have profited from the experience. He emphasized that no expense has been involved to the government. All the hardware used in the program was salvaged from vehicles, components or other material used in test programs and fabrication work that is continually being done at the ATAC.

Formal development of the same type of vehicle would cost a minimum of $200,000, he said, and predicted that a vehicle of this type could be produced at a unit price of about $1,000.



ENGINEER TRAINEES Robert Kaczmarek, John Thomson, David Tripp, and ATAC chief of the Foreign Vehicle Evaluation Office, Herman Nadler exchange views on vehicle concept the trio is developing from salvaged parts.

Four months of advanced production engineering effort and engineering services for the Dragon missile system will be furnished by the McDonnell-Douglas Corp. on a $5,500,000 letter contract.

Continental Motors Corp. will provide 5-ton truck engines on a $5,416,668 modification and R. G. LeTourneau, Inc., was awarded a $5,366,150 modification for 750-pound demolition bombs.

Martin Marietta Corp. received contracts totaling $5,352,954 for a power station and modifications kits for the Pershing missile system. Modifications totaling $5,080,000 with the United Aircraft Corp. will procure crew armor kits and engine air particle separators for CH-54A helicopters.

Raytheon Co. will furnish communications equipment for $4,902,000. Page Communications Engineers, Inc., received a $4,797,053 modification for maintenance and operation services in connection with the Integrated Wide-Band Communications System in Southeast Asia.

Radio sets will be provided by General Dynamics Corp. for $4,669,062. Kennedy Van Saun Corp. will provide metal parts for 105mm projectiles for $4,628,200. LSI Service Corp. received a $3,895,794 order for maintenance of Army aircraft in Southeast Asia.

Lear Seigler, Inc., won a $3,500,000 contract for electronics equipment and Zenith Radio Corp. will provide metal parts for 66mm rocket fuzes for $3,363,680. Grumman Aircraft Engineering Corp. received a $3,216,600 definitization for modification of OV-1B and OV-1C Mohawk aircraft and related testing, data and reports, and support for one year.

Canadian Commercial Corp. will furnish 105mm cartridge cases for $3,174,875. Brads Machine Products Inc. was awarded a $3,062,040 modification for booster and safety devices for artillery fuzes. Metal parts for 750-pound bomb nose fuzes will be supplied by the Supreme Products Corp. for $3,019,100.

FMC Corp. was awarded a $2,979,249 modification for production of a classified agent and for maintenance and support services. Dynalectron Corp. received a $2,938,932 delivery order for maintenance of Army aircraft in Southeast Asia.

Sylvania Electric Products, Inc., will provide light observation helicopter avionics packages on a $2,788,718 modification. P. R. Mallory Co., Inc., will furnish dry batteries for night-vision site weapons for $2,521,079.

Ravenna Arsenal, Inc., was issued a $2,363,390 modification for maintenance and support services. Litton Industries received $596,450 as the first increment of a $2,215,950 contract for electron tubes for the Nike Hercules missile system. Rulon Co. gained a $2,150,000 modification for metal parts for fuzes.

Minnesota Mining and Manufacturing Co. received a $2,110,406 contract for periscope sets with equipment and spare parts for the General Sheridan tank.

Stanford Research Institute will continue study for the antimissile missile system on a $2,098,784 modification. Chrysler Corp. will supply fork-lift trucks for $1,954,064. Columbus Milpar Manufacturing Co. will furnish metal parts for 81mm cartridge point detonating fuzes on a $1,917,000 modification.

Bell Helicopter Co. was awarded a $1,895,600 modification for UH-1 helicopters, Philco Corp. received a $1,749,049 definitization for a secure voice access system and ancillary items, and Hupp Corp. will supply 20-horsepower industrial engines on a $1,737,791 contract.

Other contracts and modifications are Bethlehem Steel Corp., $1,651,511 for components for 175mm guns; Standard Container Co., Inc., $1,650,000 for ammunition packing boxes; Gibbs Manufacturing and Research Corp., $1,638,000 for metal parts for 2.75-inch rocket fuzes; Stewart-Warner Corp., $1,618,617 for metal parts for 750-pound bomb fuzes;

American Cystoscope Makers, Inc., $1,603,750 for periscopes for use on main battle tanks; Lockheed Georgia Co., $1,570,207 for gun tubes for 105mm cannons; Electro-Optical Systems, Inc., $1,500,000 for night-vision equipment;

Electro-Mechanics, Inc., $1,464,820 for cable assemblies for 250- and 500-pound bombs; Medico Industries, Inc., $1,404,000 for 2.75-inch rocket warheads; Avionics, Inc., $1,375,544 for cable assemblies for bombs; General Time Corp., $1,335,000 for booster and safety devices for artillery fuzes; and

Privitt Plastics, Inc., $1,300,024 for plastic grommets for 155mm shells; Buchmann Spark Wheel Corp., $1,293,290 for cartridge container extensions for the 4.2 cartridge; Atlas Chemical Industries, $1,292,500 for detonators; John Wood Co., $1,237,248 for fin assemblies. with crates for the 750-pound bomb; and

Nash-Hammond, Inc., $1,222,787 for plastic canisters for the tactical fighter dispensing munitions program; Vitro Corp. of America, $1,166,944 for design, development, fabrication, installation and testing of three fixed and two mobile telemetry acquisition systems for the system test facility range at Fort Huachuca, Ariz.; and

Weatherhead Co., $1,164,596 for pressure plates for 4.2-inch cartridge assemblies; Technical Operations, Inc., $1,133,000 for scientific and technical effort for the Army Combat Development Command; Eltra Corp., $1,120,593 for generators for tactical trucks; and

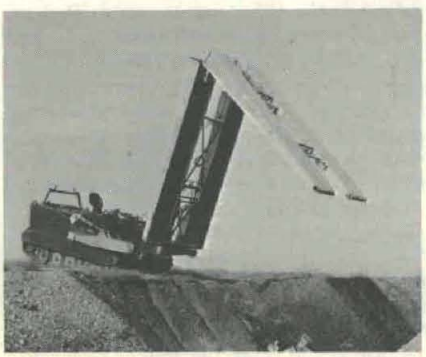
Hechethorn Manufacturing Co., $1,106,389 for metal parts for hand grenades; Kollsman Instrument Corp., $1,062,026 for firing devices for antipersonnel mines; Hol-Gar Manufacturing Co., $1,058,750 for 28-volt generator sets; Leonhard Liedel K.G., Mannheim, Germany, $1,029,160 for coal; and

Anthony Co., $1,028,950 for forklift trucks; Bulova Watch Co., $1,026,000 for metal parts for fuzes; Grand Machining Co., $1,014,000 for 81mm mortar fin assemblies; Lockheed Aircraft Corp., $1,005,063 for work on the Integrated Wide-Band Communication System being installed in Southeast Asia; Johnson Corp., $1,000,754 for cargo trailers; and Radio Corp. of America, $1,000,000 for electronics equipment.

Lightweight Assault Bridge May Aid Swamp Operations

Military operations in the marginal terrain of the Vietnam rice paddies and swamps may be facilitated by a new lightweight assault bridge being developed by the U.S. Army Mobility Equipment Research and Development Center, Fort Belvoir, Va.

Limited procurement of the bridge and launcher is planned. The projected date of shipment to Vietnam has not been announced, but a procurement order for 29 units is expected to be awarded this month



ASSAULT BRIDGE for marginal terrain on M113 personnel carrier.

Mounted on the Infantry's workhorse, the M-113 armored personnel carrier, the folding-type weldable aluminum alloy bridge weights 2,700 pounds. It can be employed where heavier bridge equipment would bog down to span ditches and drainage canals, and is capable of supporting 15-ton loads over 33 foot spans.

Transported in the folded position at convoy speeds of 35 m.p.h., the bridge does not alter the normal 3.5 m.p.h. swim capability of the unmodified personnel carrier. It can be emplaced hydraulically in less than two minutes without exposure of personnel, and can be retrieved by the carrier after crossing it.

Instead of the traditional stringer floor beam design, the bridge uses an extruded orthotropic plate deck which makes the roadway surface the primary load-carrying member. The cross-section configuration is in the form of an open box, with two tapered sections hinged together to form one treadway.

Two treadways are joined by bolted cross braces to form the roadway. A double centered noneccentric hinge at the folding point provides a flush-bottom flange when the bridge is open.

Corps of Engineers Great Lakes Research Continuous Since 1841

By Louis D. Kirshner
Technical Director, Lake Survey District

NOTE: This article is the fourth of a series that started in the July-August edition on the Army Corps of Engineers' extensive R&D activities. *See page 28 for related article.*

U.S. Army Corps of Engineers research on the Great Lakes has been continuous for more than 100 years. The early efforts evolved from the initial mission of the U.S. Lake Survey, a district of the Corps of Engineers' North Central Division, to provide Great Lakes navigation charts.

In 1841, Congress appropriated $15,000 for "a hydrographical survey of the Northern and Northwestern Lakes." The task was assigned to the Army Corps of Topographical Engineers, which was conducting surveys on the Great Lakes to determine the feasibility of constructing harbors.

Systematic measurements of the levels of the lakes were started in 1859 and reliable records are available since that year. Observations have included barometric pressures, wind directions and velocities, relative humidities, air temperatures, and rain and snow falls.

Reasons for the year-to-year variations in lake levels prompted much early conjecture. Douglass Houghton, state geologist of Michigan, in 1839 commented:

". . . At one time the belief was very general that these changes take place at regular intervals, rising for a space of seven years, and subsiding for a similar length of time; a belief which would appear to be in consonance with that of the Indians upon the peninsula, and with whom it no doubt originated. Is it not wonderful that a subject, the causes of which are so little comprehended by our natives, should be invested with an air of mystery. . . ."

Some 20 years later, the superintendent and engineer of the Detroit Water Works said:

"It is possible that the rise and fall of the water in our lakes may solely depend on the rainfall and prevalent direction of winds. But, before any satisfactory conclusion can be arrived at, observations must be made, for a series of years, of the rainfall, daily height of the water, and the direction of prevailing winds, at various points, not only along the chain of lakes, but also at remote points from them, within the area of the great basin drained by them."

Research on flows in the rivers connecting the lakes started about the same time as the systematic recording of the water levels. The first measurements were made using floats to trace the direction and velocity of the currents. D. Farrand Henry, one of the Lake Survey's engineers, was not satisfied with the precision of this method. An electric current meter he devised came into widespread use, as did his theories of open channel flow.

Subsequent developments in current meters and water-level gauges were made by engineers who followed Henry. Probably the best-known were those of E. E. Haskell. His propeller-type current meter and recording water-level gauge were produced commercially and used throughout the United States and Canada.

Recognized as an authority on hydraulics and hydrology, Haskell left the Lake Survey to become dean of engineering at Cornell University in 1906. Francis C. Shenehon (for whom the research vessel Shenehon was named) also contributed greatly in the hydraulic studies at the Lake Survey. He left the staff to become dean of engineering at the University of Minnesota in 1910.

The water-level gauging led into another avenue of investigation. About 1920, Sherman Moore began an investigation of the steadily increasing difference between the elevation measured by one gauge and that measured by others on the same lake.

Moore concluded that the earth's crust in the Great Lakes region was moving vertically at rates measurable through the use of the water levels. The July 1948 issue of the *Bulletin of the Geological Society of America* published his findings. Crustal movement studies have been extended periodically by his successors.

***Shenehon* Lake Survey Vessel**

A program of studies established in 1936 culminated in 1937 with the publication of a report, "Evaporation from the Great Lakes," followed in 1938 by "Hydrology of the Great Lakes."

In the early 1950s, several special investigations were undertaken, including a study of the precipitation over the surface of Lake Michigan in comparison with that at perimeter mainland stations.

About the same time, wave gauges were established on several of the lakes to study the relationship between the lake winds and wave heights. The precipitation study is continuing, but the wave study was discontinued after several years.

Other studies were made in the fields of littoral transport, wind and wave lake level set-ups, short-period water-level fluctuations, statistical forecasting of lake levels, over-water wind, and regulation of lake levels and outflows.

These investigations comprise but a few of the Lake Survey scientific endeavors that followed the initial research. Measurements of flows were made at intervals on all of the rivers feeding into the lakes, and the methods and theories developed in the early investigations were refined.

Studies also compared performance of various current meters, including propeller and differential-cup types, and on vertical distributions of velocities at various points on the hydraulic sections.

Research was conducted to improve lake-level forecasts to provide users with vitally needed information. The current 6-month forecast, made monthly in the winter and semimonthly in the navigation season, is a direct outgrowth of these studies. The water-level gauge network now includes 50 permanent installations.

In August 1959, to formalize the Lake Survey's investigations, the Army Chief of Engineers established a project titled Lake Hydrology Studies, including the following subprojects: Effects of Snowmelt on Water Supplies; Inflow from

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LOUIS D. KIRSHNER worked five years with the Duluth (Minn.) District Corps of Engineers, U.S. Army, prior to transferring in 1935 to the U.S. Lake Survey at Detroit, Mich. At Duluth, he participated in mapping, hydrographic surveying, pier and breakwater construction, and dredging, in both the field and office operations.

Kirshner worked directly with the district engineer at Detroit on a study of Great Lakes hydrology, then headed a newly organized Revisory Section that during the next 10 years charted surveys of the U.S., certain Canadian waters of the Great Lakes and rivers.

Appointed assistant chief of the Engineering Division in 1946, he became assistant chief, Engineering Division, and special assistant to the District Engineer for International Boards in 1948, serving also with the International Joint Commission.

In 1962, Kirshner was assigned as chief of the Engineering Division and chief technical assistant until January 1967, when he was named technical director of the U.S. Lake Survey.

Run-Off; Inflow from Groundwater Sources; Precipitation Quantities Over the Lakes; Evaporation from the Lakes; Forecasting Water Supplies and Lake Stages; and Waves, Wind Tides and Seiches.

The next expansion in Lake Survey research came in July 1962. Lt Gen William F. Cassidy, then director of Civil Works, Office of the Chief of Engineers, directed that a comprehensive research program be drawn up and that a Research Division be established.

In May 1966, the Research Division was reorganized and designated the Great Lakes Research Center. Current investigations and studies in five separate fields, funded under the Civil Works Operations and Maintenance budget, are as follows:

Water Motion. Waves, tides, surges, seiches, currents, energy exchange at the air-water interface, and flows in the lakes and associated channels.

Shore Processes. Character and amount of sediments, energy acting on the sediments, and sediment-energy relationships resulting in transport of materials to or from a particular area. Also, study of longterm shoreline changes due to vertical movement of the earth's crust.

Water Characteristics. Physical and chemical characteristics of the lake water, including radiological contamination and sound propagation; definition properties indicating the characteristics and quality; and installation of permanent automatic monitoring stations.

Water Quantity. Factors affecting the quantity of water in the lakes, such as inflow, outflow, precipitation and evaporation.

Ice and Snow. Ice and snow formation, accumulation, areal distribution in time, temperature gradient, decay and physical characteristics, and analyses of data in conjunction with hydrometeorological conditions.

Data collections and studies in these five research fields include:

- Aerial reconnaissance, aerial photography, and satellite imagery to map the Great Lakes ice cover each winter (started in the winter of 1962-63).

RESEARCH TOWER on Lake Huron is instrumented to collect data in connection with U.S. Lake Survey shore study.

- Current measurements in harbors — four in Lake Michigan, three in Lake Erie, one in Lake Superior, and one in Lake Huron.
- Operation of 16 special water-level gauges on Lake Michigan and 8 on Lake Erie to study short-period water-level disturbances.
- Operation of precipitation gauges on five islands in northern Lake Michigan and two in western Lake Erie to study the relationship of over-water and over-land precipitation.
- Collection of data related to shore processes at two places on Lake Superior, at the foot of Lake Huron in the head of the St. Clair River, and on Lake Michigan.
- Measurement of deep-water waves at two sites on Lake Superior, two on Lake Michigan, and one on Lake Erie, in support of the Society of Naval Architects and Marine Engineers in its study of hull stresses in larger lake freighters.
- Wave hindcasting studies on contract to the University of Michigan.
- Recording of hydrometeorological parameters on South Manitou Island in Lake Michigan in connection with determination of precipitation over and evaporation from the lake.
- Sampling of ice characteristics on Whitefish Bay in Lake Superior for correlation with ice formation, distribution and break-up.
- Periodic collection of water characteristics data at 63 stations on Lake Erie and at 76 on Lake Huron by the research vessel *Shenehon*; sampling in the harbors and in the vicinity of dumping of dredged material in connection with the Corps of Engineers — Federal Water Pollution Control Administration study of the effects of such dumping.

U.S. LAKE SURVEY project scientist, Dr. E. W. Marshall examines petrographic characteristics of lake-ice.

The future Lake Survey research program will be generally within the framework of the five fields of research listed. Modifications will be made as indicated by the results achieved. The paramount objective is to provide the knowledge required for optimum use of the Great Lakes.

ARPA Completes Study of Missile Firing Control Techniques

The Advanced Research Projects Agency (ARPA) recently completed Project PRESTAGE, a series of missile firings which began early this year at White Sands (N. Mex.) Missile Range to study new control techniques for high-performance vehicles.

The program was part of the agency's Project Defender Program — a continuing series of research experiments in ballistic missile defense systems. ARPA officials said test objectives of PRESTAGE were met.

During the tests, payloads were boosted into a high-velocity trajectory by a 2-stage rocket, Nike Ajax for the first stage and a Tomahawk for the second.

The Douglas Missile and Space Systems Division of the McDonnell-Douglas Corp. designed and launched the payloads under contract to the U.S. Army Missile Command, Redstone Arsenal, Ala., which manages the program for ARPA, an agency of the office of the Director of Defense Research and Engineering.

Edgewood Antidote Aids Poisoning Victims

Victims of the recent mass food poisoning at Tijuana, Mexico, were treated with an Army-developed antidote produced after more than eight years of clinical research at Edgewood Arsenal, Md.

When it was determined that the nerve-attacking insecticide Parathion was in bread that left 17 dead and hundreds hospitalized, medical authorities on the West Coast called Dr. Van M. Sim, chief scientist at Edgewood's Medical Research Laboratory, for assistance.

The symptoms and treatment of poisoning caused by pesticides are very similar to those of exposure to nerve agents, Edgewood medical researchers explained. The antidote used for treating poisoning from insecticides and nerve agents is PAM Chloride (2-PAM-cl), which was developed at the arsenal by a civilian-military team of scientists and technicians.

The white, oderless nonhygroscopic crystalline powder is produced by a number of drug manufacturers and is stockpiled by the military for use in the event nerve agents are used against U.S. troops.

Dr. Frederick R. Sidell, of the Medical Research Laboratory staff, explained that poisoning from insecticides is fairly common among farmers, crop dusters and manufacturers of the toxics, although the Tijuana incident is the first reported case of mass poisonings.

Col Nicholas G. Bottiglieri, chief of the Medical Research Laboratory, commented: "While pesticides may be deadly, they are extremely useful in combatting disease-carrying and crop-destroying insects. They are safe when used properly."

ACSC-E Lotz Discusses New Trends in Communications

Redesignation of the Chief of Communications-Electronics (CC-E) as the Assistant Chief of Staff for Communications-Electronics (ACSC-E) last month raised the communications function to Army General Staff level.

Maj Gen Walter E. Lotz Jr. now will report directly to the Army Chief of Staff. As head of CC-E, a special staff agency, he formerly operated under the Deputy Chief of Staff for Military Operations.

The redesignation resulted from an Army study which recommended elevation of the communications staff function to a higher level. The purpose is to improve the agency's capability to coordinate and manage the expanding communication facilities within the Army, as well as with other Military Departments and U.S. Government agencies.

Maj Gen Lotz was Director of Army Research, Office of the Chief of Research and Development, October 1963 to September 1965, when he went to Vietnam as Assistant Chief of Staff, Communications-Electronics, U.S. Military Assistance Command. He became Chief of Communications-Electronics, Department of the Army, in September 1966.

Speaking on "New Trends in Army Communications" at the 13th Annual Meeting of the Association of the United States Army, Oct. 10, General Lotz mentioned such developments as:

- More widespread use of voice radio in command and control of combat units.
- The breakdown of established distinctions between strategic and tactical communications.
- The need for universal compatibility of military communications systems.
- A pressing need for combat-qualified officers who can technically cope with sophisticated communications systems.

Noting that there is a significant trend in tactical communications toward the use of voice radio as opposed to written messages as the primary means of command and control within the division, General Lotz said:

"This is possible because the Army has in inventory effective tactical voice radio equipment that is reliable, flexible and secure when necessary."

He recalled that "over a year ago, a senior Army general, upon return from a visit to Vietnam, stated that *the* item of equipment which had provided the greatest improvement in ground combat was the radio set AN/PRC-25," which, with its vehicular counterpart the AN/VRC-12 and its aircraft version, is providing "effective voice communications at all echelons within the division and over the extended ranges required by tactical units. . . .

"To this family. . .has been added. . .the lightweight Infantry set. It improves significantly radio command and control from platoon to squad." Since the first models were sent to Vietnam in the summer, "the demand for this set has been overwhelming.

"An ingenious variation of the tactical FM family has been used to great advantage in Vietnam — the airborne command and control console. It consists of three standard vehicular radios mounted behind the pilot's seat in a helicopter.

"With this console a commander can maintain contact with his own and superior headquarters and with any of his subordinate units. From his vantage point in the helicopter, he can reconnoiter the battlefield and control all the elements of the battle, including maneuver, coordination of firepower, and commitment of reserves and support."

Maj Gen Walter E. Lotz Jr.

General Lotz noted that in Vietnam commanders do not normally resort to written orders as frequently as in previous combat situations because they have reliable voice radio to initiate and control operations. "Thus," he said, "the full mobility of Army forces can be exploited. . . ."

Eyeing the future, he said that the next generation of tactical voice radios should consist of one basic set of modules which can be assembled in various combinations to meet all manpack, vehicular and aircraft needs.

Among current communications problems, he listed the use of manual tactical telephone switchboards of World War II vintage, which are "inherently slow and inefficient. . .and costly in manpower."

He said that automatic electronic switches overcome these disadvantages and may make possible many service features not available on cord-type boards, such as elimination of operator interruptions and erroneous disconnection.

"With the help of industry, we must at an early date provide an interim system which will improve service and provide an orderly transition to the digital transmission and computer switches planned in the future."

General Lotz noted that the trend toward the breakdown of established distinctions between strategic and tactical communications also derived from communications in Vietnam.

This development is illustrated in the Integrated Wideband Communications System (IWCS), a system of multichannel radio and submarine cables which provide long distance trunks between centers of military interest through Southeast Asia.

Representing an investment of several

TROOP INGENUITY in Vietnam was responsible for a "quick reaction" project that resulted in adapting a speaker for the AN/PRC-25 from the helmet-mounted receiver (AN/PRR-9) of the miniature squad radio. The radio operators, who began tying a 4-pound speaker to the top of the AN/PRC-25 back-pack radios, can now monitor communications with their hands free to use their weapons. The new lightweight speakers are being produced by Delco Division of General Motors under a plan developed by Frank E. Kovalski, an engineer with the U.S. Army Electronics Command's Communication and Automatic Data Processing Lab.

hundreds of millions of dollars, the IWCS is being engineered, installed, operated and maintained primarily by the U.S. Army Strategic Communications Command.

"It represents a truly magnificent effort by Army strategic communicators in responding to urgent operational needs," the ACSC-E said. "The magnitude and complexity of this system were aptly described by a senior official of the American Telephone and Telegraph Co.

"He stated that the Army had undertaken to provide in Southeast Asia *in a few years* what the Bell System had undertaken to provide on a much larger scale in the United States for the past 80 years."

With its extensions, the IWCS interconnects bases, headquarters, airfields and depots. Its circuits provide high-speed data, long distance telephone dialing, radio programs, and message service within Southeast Asia and it interconnects with other Pacific bases and CONUS.

In addition to being a fixed strategic communications system, designed to Defense Communications System specifications and serving all the military services and other agencies, the IWCS also provides tactical connections between widely dispersed low-level combat, service and support units.

". . . In this sense" General Lotz said, "it is a tactical communications system replacing a major portion of the Army area communication system.

"Ordinarily tactical communications doctrine provides for interconnections between Army tactical communications and the theater strategic communications at the rear of the field army. The IWCS has over 75 such interconnections well forward of the senior Army headquarters.

"Many serious engineering, equipment and personnel problems are encountered when numerous tactical interconnections are provided to strategic communications. Tactical circuits must be capable of rapid rearrangement, reconnection and reengineering to be responsive to the changing tactical needs. Strategic communications equipment and procedures were not designed with this flexibility."

Incompatibilities in the technical standards in the two types of equipment, he said, result in complex interface equipment being required. "This adds to the cost and complexity of the system, complicates the training of. . .personnel and reduces the time response of the system in a highly transient combat environment.

"Experience with the IWCS and with similar wideband networks. . . elsewhere shows conclusively we cannot differentiate, operationally and technically, between strategic and tactical communications. There must be only one set of engineering standards, a single system design philosophy, common operating procedures, common personnel and training, and compatible organization structures for all Army communications.

"We must design an integrated communications system with interconnectable networks from the highest level in the command hierarchy to the lowest."

General Lotz also pointed out a need for "compatibility — even commonality — of joint, combined and other agency communications in the combat zone," in light of the many joint service operations in Vietnam.

"There is nothing new about interconnecting service systems or using common or joint communications. . . . The Secretary of Defense just a few months ago directed the establishment of a joint commonality and compatibility program for tactical command, control and communications that is tying together the efforts of the military services."

Noting that Project Mallard is also receiving the active participation of the Air Force, the Navy and the Marine Corps, he said that these programs are "but two of many interactions and programs that are reshaping the nature of tactical communications in a manner similar to that of the Defense Communications Agency in the strategic area."

General Lotz also said that the most significant trend in Army communications concerns the communicators themselves.

He noted that following a review of Signal Corps branch structure and officer careers, the Chief of Staff approved in June 1966 the officer functions which were derived from the rationale:

"The Signal Corps is an arm and as such Signal officers must be qualified to serve as an integral member of the combined arms team. They must be qualified and proficient in all aspects of combat planning and operations in order to participate effectively and render the necessary communications and electronics capabilities required. . . ."

The Chief of Staff at the time designated all staff communications positions in the battalion headquarters of the other branch units as Signal Corps assignments.

"Now, with the assignment of Signal Corps officers to serve as battalion communications officers. . ." General Lotz said, "communications personnel have become a part of the combat team."

He said that since January 1967 the communications officers consolidated course at Fort Sill has been reoriented more havily toward tactics of basic combat units, and that "the communications officer receives as much training on the combined arms team as does the Artillery officer.

He noted that in Vietnam, many key communications sites must be on isolated mountain tops — many of these in Viet Cong-controlled areas. "Signal personnel organize and defend their sites and conduct reconnaissance patrols. They are proving themselves as soldiers as well as communicators."

Army Testing Man-Packed Tent in Desert Environment

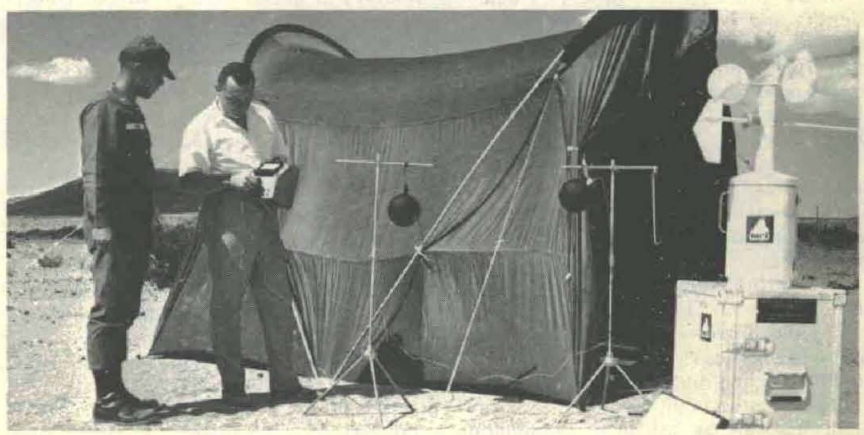
Two prototypes of a 32-pound, man-packed tent are being subjected in tests to the hot, dry climate and occasional high winds of the Army's Armor and Desert Training Center, Fort Irwin, Calif.

Development of the tent is being conducted by the U.S. Army Limited War Laboratory (LWL), Aberdeen Proving Ground, Md., in cooperation with Avis Products, originator of the basic concept.

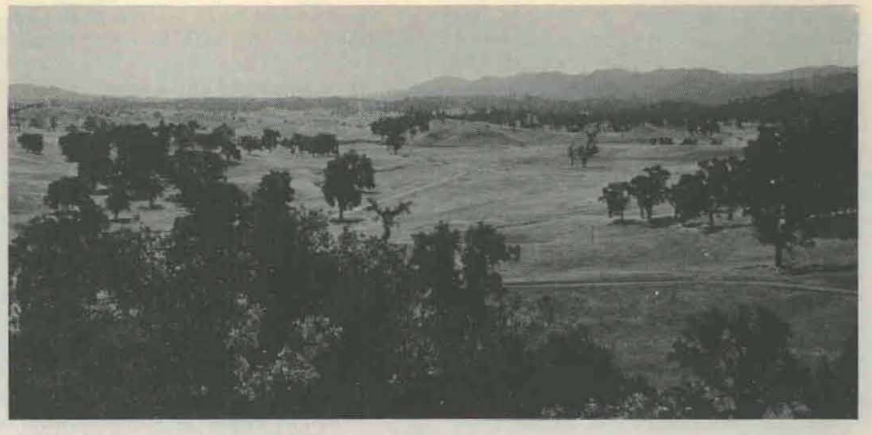
The tent is designed to be used as a medical treatment center or operating room in forward support areas when evacuation is not possible or would take too long. It is 10 feet wide, 12 feet long, 6 feet high, and can be back-packed by one man, who can erect it in 6 minutes.

Derek W. A. Peters, a British exchange scientist at LWL who conducted the testing, said the aim is to develop a tent weighing only 24 pounds with poles, good ventilation, and blackout proof.

The tent will also be tested in a jungle environment.



BRITISH EXCHANGE SCIENTIST Derek W. A. Peters explains equipment and procedures used to test new forward-area medical tent to Lt Richard L. Stoller.



GROUND OBSERVER AND RECORDER acquire various target arrays from a vantage point overlooking the Gabilan Impact Area (shown at the right) during Phase I of Experiment 31.1. The experiment is being conducted by the U.S. Army Combat Developments Command Experimentation Command's Project Team III at Fort Ord, California.

USACDCEC Team Studies Ground Observer Performance

Ground Observer Probabilities of Acquisition and Adjustment, identified officially as Experiment 31.1, are being investigated by Project Team III, U.S. Army Combat Developments Command Experimentation Command.

Data derived from the study will provide answers to such questions as: How well does the ground observer detect, identify and locate his target? How efficiently does he call for and adjust fire on that target? How do changing conditions — light level, range, toxicity of environment, target size and complexity — affect observer performance?

Project Team III is headed by Col William M. Delay and Lt Col Robert F. Levergood is assigned as project chief of Experiment 31.1. Sixty observers are being used, 30 Artillery commissioned officers and 30 noncommissioned officers trained in mortar techniques. Extensive training courses for all personnel preceded the experiment field trials.

Phase 1 of the experiment involves target acquisition, nonfiring; Phase 2 is concerned with adjustment of live fire on the target.

In the initial phase, observers detect, identify and locate real targets representative of personnel and equipment typical of a true combat situation. All observers are exposed to the target arrays for a definite period, such as 10 minutes, during which they must acquire the target.

Estimates as to the identity and location of the target arrays are sent to the Data Compilation Center for plotting and scoring for deviation, range error and radial error.

Actual fire, however, does not occur until Phase 2. Live targets then are replaced by material adjusting points, such as old car bodies, and trials are conducted in both day and night conditions.

Observers at night perform in natural light as well as artificial illumination situations, with and without the aid of passive night-vision devices. Nontoxic and toxic-threat situations also appear in the experiment.

During the toxic-threat situation, observers will be equipped with gas masks, hoods and gloves. These trials provide a measure of the degradation of observer performance caused by wearing toxic protective equipment over a defined period of time.

In phase 2, the initial adjusting rounds are fired at a distance from the target that was computed as the average location error (or miss distance) contained in the observers' acquisition reports from Phase 1. Adjustment continues until the simulated targets are, in effect, neutralized as immediate threats to "friendly forces."

The multiple-observer technique, a composite adjustment procedure specially designed for Experiment 31.1, allows several observers with the same or similar corrections to adjust simultaneously. In this live-fire phase, 155mm and 8-inch howitzers will be used.

Prior to Experiment 31.1 initiation, two research tasks were performed: SCAN — Search in a Multiple Target Situation, and ELM — Evaluation of Location Methods.

Factors examined in these experiments will gauge the speed and accuracy of an observer's target acquisition and adjustment performance, effects of changes in target and environmental conditions on performance, and the observer's use of accepted target-location methods.

Through experiments such as these, the so-called "field laboratory research," the U.S. Army Combat Development Command seeks continuously to ascertain and prepare realistically for the combinations of manpower, techniques and equipment that will prove most effective in future combat.

Vietnam War Reverses Roles of Infantry, Armor Units

Conventional combat roles of U.S. Infantry and Armor units are being reversed in the Vietnam War, according to findings of a U.S. Army Combat Developments Command study.

Results of the MACOV (Mechanized and Armor Combat Operations in Vietnam) Study were reported at the 13th annual meeting of the Association of the United States Army, Oct. 9-11, in Washington, D.C.

Under the direction of Maj Gen Arthur L. West Jr., of the Combat Developments Command, a group of 100 officers and civilian scientists spent four months in Vietnam observing and recording data on battalion, squadron, and company/troop-level combat operations.

All of the data collectors were field grade officers with combat experience and were representative of the Armor, Infantry, Artillery, Ordnance, Engineer and Signal branches. There were supported by four motion-picture camera crews.

Lt Gen Harry W. O. Kinnard, commanding general of the Combat Developments Command and the first CG of the famed First Cavalry Division (Airmobile) in Vietnam, showed some of the outstanding combat pictures collected during the study in his presentation to the AUSA meeting.

The MACOV Study had among its various objectives a determination of how well U.S. Army equipment, doctrine, techniques, organization and maintenance are meeting requirements in Vietnam. The evaluation clearly established the effectiveness of Armor in Vietnam-type operations. One evaluator commented:

"However, the way it's employed is not in anybody's book. There just is no book yet — for us or for Charlie. For example, the Infantry was traditionally the pressure force, with Armor going in as the shock-action force. Now it's Armor that holds pressure on Charlie, with the Infantry slashing in from helicopters."

4 at AVLABS Receive High Honors at Awards Banquet

Notable achievements in gas-turbine engine and tactical aircraft guidance system development, along with general excellence and outstanding performance of duties, earned four employes recognition at the AVLABS Second Annual Awards Banquet.

Assistant Secretary of the Army (R&D) Dr. Russell D. O'Neal paid tribute to the award winners as guest speaker at the Army Aviation Materiel Laboratories honorary ceremonies at Fort Eustis, Va.

Dr. Jay Tol Thomas, Deputy for Research and Laboratories, Army Materiel Command, introduced the guest speaker.

". . . It is perhaps in the very best tradition of research and development," Dr. O'Neal stated, "that we find AVLABS had anticipated the demand for improved gas turbines by initiating a program in advanced turbine, compressor and regenerator technology some five years ago — which has resulted in the 1,500 Horsepower Demonstrator Engine Program.

"This program is now directed to reducing this advanced technology to practice, and advancing it to a stage where minimum effort will be required before engineering development and production can begin to fulfill our requirements of the future."

The Director's Award for Technological Achievement was presented to Nicholas C. Kailos for his "outstanding leadership in the development and prosecution of the Army 1,500 Horsepower Demonstrator Gas Turbine Engine Program, and for the excellence of his technical support to various Army research and development programs."

Kailos has been an aerospace engineer in the AVLABS Propulsion Division since 1958, following graduation from Virginia Polytechnic Institute with a BS degree in mechanical engineering.

His present position entails basic and applied research in the phenomena of aerospace science as it relates to integrated aircraft propulsion systems. He is currently involved in the advancement of lightweight, high-effectiveness regenerator technology.

The Commander's Award for Exceptional Service recognized James T. Matthews Jr. for his professional leadership and major contributions to advancement of the technology and concept of a unique and highly significant VTOL Tactical Aircraft Guidance System.

Matthews is a 1946 aeronautical engineering graduate of Alabama Polytechnic Institute and has been with AVLABS since 1958. As chief of the Flight Dynamics and Technology Branch, Applied Aeronautics Division, he plans, analyzes, conducts and supervises analytical experimental research and exploratory development programs in the area of advanced flight-control systems and associated technology.

Dr. O'Neal commended Matthews for his work on the Tactical Aircraft Guidance System, saying:

"Involved here is a concept of VTOL flight control which is unique and original, and which may well drastically revise our traditional concepts of flight control. The Department of Defense and other government agencies, and indeed the aircraft industry, plan great emphasis on advancing our technology in this highly important area.

"As many of you in the research and development business well know, innovation is of great value — yet at the same time it is, in a large organization, not always exactly welcomed with open arms. It takes an amount of dogged determination, a belief in the value of the concept, and the scientific and technological skill to make the concept work as a practical, economical device."

The Commander's Award for General Excellence is given to an individual for a degree of excellence in performing a given set of duties without regard to level of responsibility, supervision, or difficulty of position.

Woodrow W. Robbins, AVCOM buildings and grounds manager, Support Office, received the award and was commended for his performance of duty characterized by such proficiency and initiative as to elevate him above his contemporaries.

Winners of the three major awards were granted a citation, an engraved plaque, a lapel pin, and $300 in cash. The fourth award, a *Special Award Citation,* went to Ted Ramer, chief of the Technical Illustration Section, Engineering and Technical Services Division.

This award, which symbolizes dedication of an AVLABS employe in surmounting unusual obstacles in the execution of his duties, recognized Ramer for his sense of humor and perspective in performing duties in an outstanding manner.

AVLABS Second Annual Awards winners (l. to r.) are Ted Ramer, Special Award Citation; Woodrow Robbins, Commander's Award for General Excellence; Nicholas Kailos, Director's Award for Technological Achievement; and James Matthews Jr., Commander's Award for Exceptional Service.

NATO Military Committee Moves From U.S. to Belgium

After operating for 16 years in Washington, D.C., the North Atlantic Treaty Organization Military Committee, NATO's highest military authority, has moved to Evere, Belgium, where its first meeting was held Oct. 19.

In the Brussels suburb, it will be located with the North Atlantic Council in a new, joint headquarters complex nearing completion.

The committee's first meeting was Oct. 6, 1949, in Washington and its last formal meeting at the Pentagon was held Sept. 28. Committee chairman Lt Gen Baron Charles P. de Cumont, Belgian Army, former chief of staff of the Belgian Armed Forces, will continue in this position at Evere.

The International Military Staff, composed of officers of the nations which contribute to NATO's military forces, moved with the committee and will continue to serve as its executive agent.

10-Volume Vietnam War History

An official U.S. Army history of the war in Vietnam will be published in at least 10 volumes. The Army's Office of the Chief of Military History said the compendiums will include administrative, logistical, engineering, and medical activities along with the combat and advisory roles of Army personnel. Publication date for the first volume has not been announced.

CE Studying Movement of Beach Sand

The U.S. Army Corps of Engineers has embarked on an unusual study project in California to trace the movement of harmless radioactively tagged sand along the nation's coastlines.

Using a detection device similar to a Geiger counter to follow sand movement, the Engineers expect to increase their knowledge of coastal obstructions and their effects on sand supply. This information is desired to aid in planning harbors and other coastal construction, and for planning protection and restoration of beaches.

The program is under the direction of Dr. David Duane, chief of the Geology Branch of the Corps of Engineers Coastal Engineering Research Center, Washington, D.C. The Los Angeles District Engineer provides administrative support and coordinates field activities.

Cooperating with the Corps of Engineers are the Atomic Energy Commission, National Aeronautics and Space Administration, the Navy, Air Force and State of California.

For the initial tests, sand grains have been injected with a harmless, low-level radioisotope of xenon, which is chemically inert and biologically inactive so that no danger is involved in its use.

The extremely short effective life and low radiation of the isotope being used has increased the problems of the test, both because of the sensitive instruments required and the fact that the experimenters must work very rapidly once the test sand has been activated.

The study is being undertaken in the vicinity of Point Conception, Calif. For the test, several hundred pounds of sand are taken from the Point Conception beach, flown to the AEC's Oak Ridge National Laboratory in Tennessee, and treated with the isotope. The sand then is flown to the Vandenberg Air Force Base and put back on its native beach. From there, its movement is tracked.

The tracking is done with newly developed detection equipment, suspended in a cylindrical pierced steel basket which will ride along the ocean bottom. It will be pulled by amphibious trucks used for hydrographic surveys.

The trucks are equipped with electronic sounding devices so that constant record may be kept of the testing depth. The first tests are being run from the water's edge to depths of about 100 feet.

In nature, beach sand is moved along the coast by the forces of waves breaking against the shore. As waves break, part of their dissipated energy moves parallel to the shore. This alongshore force of the water is called the "littoral current," and engineers refer to the sand movement at "littoral drift."

The forces of the littoral current vary greatly from place to place along the coast, both in direction and intensity. In Southern California, the drift is generally southward and sand movement varies from about 30,000 to as much as 70,000 cubic yards a year at various points along the coast.

CRESS Lists Publication Reports In New Biennial Bibliography

The Center for Research in Social Systems (CRESS), an Army contract agency, recently published its biennial *Annotated Bibliography of CRESS Publications and Reports.*

Classified *For Official Use Only*, it can be obtained under accession number AD 851367 from the Defense Documentation Center, Cameron Station, Va.

The publication includes annotated citations for all reports published since the forerunner to CRESS was established in 1957 as an element of American University, Washington, D.C. Technical reports emanate from its Cultural Information Analysis Center (CINFAC) and its Social Science Research Institute (SSRI).

CINFAC prepares rapid responses to requests for information from the Department of Defense, U.S. Government, and contract organizations serving federal agencies. Responses for which requests are numerous often are published as technical reports.

CINFAC also provides a quarterly annotated bibliographic review of available literature on unconventional warfare, counterinsurgency, and psychological operations.

The SSRI publishes technical reports on the research it conducts on internal defense/development, unconventional warfare, psychological operations, and military assistance. It also publishes studies and evaluations of foreign societies.

Can Any Army R&D Man Top 28 Patents?

Rock Island Arsenal Engineer Rises to Challenge

Competition among the "creators" for the distinction of being "The Man with the Mostest" in patents awarded to employes in Army research and development activities promises to be a long-run feature of the *Army Research and Development Newsmagazine.*

The September 1967 edition of this publication threw down the gauntlet, so to speak, by carrying an article on page 17 about the 16 patents awarded to Dr. Helmut L. Brueckmann of the U.S. Army Electronics Command. The article invited inventors to challenge his claim.

"You don't even have a legitimate contender" was the tone of a letter to the editor from Patrick L. Klein, chief of the Information Office at Rock Island (Ill.) Arsenal, soon after the Newsmagazine was distributed.

Earl Harvey, who "left federal service with the announcement that Springfield Armory would close," holds 34 patents in the small arms field. However, Fred Reed of the Research and Engineering Division, Rock Island Arsenal, Army Weapons Command, has 28 patents.

Admittedly, in view of inventiveness applied to military requirements (one of the criteria set by the editors in tossing a challenge to those able to dispute Dr. Brueckmann's claim to fame), it appears that Reed is a worthy contender for "The Man with the Mostest" title.

Furthermore, his claim is fully documented by a listing of the title, patent number and type of weapon. On .50-caliber weapons, for example, he has invented nine improvement devices — precisely the same number of patents he has been granted on .30-caliber weapons. Other patents are on the M14 rifle, the 20mm XM69 spotter, the SPIW 5.62mm and 50mm and 60mm weapons.

Just to fortify his claim, Reed has been issued another patent, for which the number was not available at press time, and he has five patent applications pending. Do you think that makes him a winner?

The answer is an emphatic "NO!" from a candidate at the Harry Diamond Laboratories, Washington, D.C., but he was not able to document his claim in time to make this edition.

Natick Microbiologist Gains Society Post

Morris R. Rogers of the Applied Microbiology Group at the U.S. Army Natick (Mass.) Laboratories, was recently elected vice president of the Society for Industrial Microbiology (SIM) for the 1967-68 term.

Founded in 1949, SIM is a nonprofit scientific organization dedicated to the advancement of microbiological sciences as applied to industrial materials and processes.

Rogers received a BS degree in microbiology from Syracuse University in 1950 and MA degree from Hofstra University in 1952.

Since 1950, he has served in progressively responsible positions with SIM. He presented a technical paper and was coauthor of a second paper presented in August 1967 at the 24th meeting of SIM at the University of Western Ontario, London, Canada.

Morris R. Rogers

Army Library Lists Latest Scientific Acquisitions

From the list of current acquisitions of the Army Library in the Pentagon, the following books were selected as being of possible interest to *Army R&D Newsmagazine* readers.

Annotated Bibliography on the Design of Instructional Systems, An, Robert G. Smith (HumRRO), U 15 .G34a 67-5.

Anthropometry of the Latin-America Armed Forces: Interim Report, D. A. Dobbins and C. M. Kindrick (U.S. Army Tropic Test Center), GN 59 .S7 D63.

Arms to Developing Countries: 1945-1965, John L. Sutton and Geoffrey Kemp (London, Institute for Strategic Studies), JX 1974 .L84 no. 28.

Background Information Relating to Southeast Asia and Vietnam, U.S. Congress, Senate Committee on Foreign Relations, KA 61 .F71 89:2 S4B1.

Bibliography of Materials on Selected Groups in the Republic of Vietnam, American University Cultural Information Analysis Center, Z 3228 .V6 U587.

Challenge and Response in Internal Conflict, 3 v., American University Center for Research in Social Systems, JC 491 .A513.

Changing Strategic Military Balance: USA vs. USSR, The, American Security Council, UA 23 .A53.

Cobol Logic and Programing, Fritz A. McCameron, QA 76.5 .M12.

Content Analysis of Communications Within Army Small-Unit Patrolling Operations, Ronald L. Brown (HumRRO), U 15 .G34a 67-7.

Contracting for Atoms: A Study of Public Issues Posed by the Atomic Energy Commission's Contracting for Research, Development, and Managerial Savings, Harold Orlans (Brookings Institution), HD 9698 .U5 071.

Cost-Effectiveness Analysis: New Approaches to Decision-Making, Thomas A. G. Goldman (Washington Operations Research Council), HD 47 .W31.

Effects of Grammatical Factors and Amount of Material on Memorizing Paragraphs, Sentences, and Word Lists, Joseph F. Follettie and Ann F. Wesemann (HumRRO), U 15 .G34a 67-9.

Electronic Engineering Measurements Filebook, Staff of EEE Magazine (ed.) TK 7882 .M38 E11 1967.

Fiscal Program for a Balanced Federalism, A, Committee for Economic Development, HJ 257 .C731.

Gobbledygook Has Gotta Go, John O'Hayre (Dept. of the Interior), PE 1460 .036.

Growth of Strategic Studies Outside the United States (London, Institute for Strategic Studies), JX 1974 .L84 no. 31.

Guidelines for the Commander, Bruce C. Clarke (C&GSC), UB 210 .C591.

Information Systems for Management Planning and Control, Thomas R. Prince, HF 5548.2 .P95.

International Relations Among Communists, Robert H. McNeal, HX 44 .M16.

NATO Without France, The Military Implications, K. Hunt (London, Institute for Strategic Studies), JX 1974 .L84 no. 32.

Performance of Ground Observers in Detecting, Recognizing and Estimating Range to Low-Altitude Aircraft, A. Dean Wright (HumRRO), U 15 .G34a 66-19.

PLANET, Part I — Availability and Base Cadre Simulator, Bernard J. Voosen and David Goldman (Rand), Q 180 .A1 R18 no. 4659.

PLANET, Part II — Bench Repair Simulator, Bernard J. Voosen and Myron H. Buchanan (Rand), Q 180 .A1 R18 no. 4660.

Preliminary Assessment of Three NCO Leadership Preparation Training Systems, Paul D. Hood (HumRRO), U 15 .G34a 67-8.

Role of the Chinese Army, The, John Gittings, UA 835 .G53.

Science, Technology, and American Foreign Policy, Eugene B. Skolnikoff, E 744 .S62.

Scientists in Organizations: Productive Climates for Research and Development, Donald C. Pelz and Frank M. Andrews, Q 147 .P39.

Short Course in Fortran IV Programing, Based on IBM Operating System/360, Basic Fortran IV, R. M. Lee, QA 76.5 .L475.

Soviet Bloc, Unity and Conflict, The Zbigniew K. Brzezinski (Harvard University Russian Research Center), D 847 .B91 1967.

Technological Trends in Major American Industries, U.S. Bureau of Labor Statistics, HD 8051 .A62 no. 1474.

Test Ban Treaty: Military, Technological, and Political Implications, James H. McBride, JX 1974.7 .M11.

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CIDS Operation Depicted In Exploratory Development

Ten copies of a 24-minute film depicting operation of the Army Chemical Information Data System (CIDS) have been prepared by Edgewood (Md.) Arsenal for selective distribution as requested.

The film shows the present state of the exploratory development effort, which is under the staff supervision of the Director of Army Research, Office of the Chief of Research and Development. The U.S. Army Materiel Command has primary responsibility and has delegated project execution to the U.S. Army Munitions Command.

The concept of CIDS, as shown in the film, is that it will provide, on a rapid retrieval basis, the compound structure, substructure, nomenclature and bibliographic references for several million chemical compounds of interest to the Army, when system developmental efforts are completed.

Information in response to inquiries of the research chemist will be provided through a computer-linked communication network of sources geographically located to serve Army requirements.

NBS Announces 2 Publications of General Scientific Interest

Two publications of general scientific interest have been issued by the National Bureau of Standards (NBS), U.S. Department of Commerce.

Bibliography of Temperature Measurement — July 1960 to December 1965, Supplement 2 to NBS Monograph 27, lists 1,200 additional references to the original monograph covering 1953-1960.

Included are titles from foreign and domestic scientific and technical journals, as well as reports of investigations sponsored by government agencies.

Nuclear Science and Technology for Ceramists — Proceedings of the American Ceramic Society Symposium 1966 (NBS Miscellaneous Pamphlet 285), is the fourth published proceedings of the symposia sponsored by the NBS, the American Ceramic Society, and the Office of Naval Research.

The purpose of the 1966 symposium was to provide an introductory survey of properties involved in the choice and use of materials in nuclear reactor technology.

The subjects covered included radiation fields present in reactors, the solid-state physics of radiation damage processes, and the development of nuclear fields and structural and moderator materials.

The publications are available from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Va. 22151, or from local U.S. Department of Commerce Field Offices. When purchased from the field offices, the *Bibliography of Temperature Measurement* Supplement 2 is $ .35; the *Nuclear Science and Technology for Ceramists — Proceedings of the American Ceramic Society Symposium 1966* is $1.75.

Submerged Fuel Survives Blast Tests

Underwater storage of petroleum products in flexible containers to provide security in a combat theater or in the event of a nuclear attack can be accomplished economically, the U.S. Army Corps of Engineers reports.

In addition to concealment and effective protection from thermal radiation and blast, underwater containers can withstand shock of large-scale TNT underwater explosions, precluding necessity of large underground construction efforts, the report stated.

Studies and tests of underwater POL storage have been conducted by the Corps' Waterways Experiment Station (WES), Vicksburg, Miss.

The most recent tests were made at Mono Lake, Calif., using a submersible fuel storage "envelope" developed by a commercial rubber company for the Office of Naval Research in 1959. Scale models of a 50,000-gallon container came through the explosion tests undamaged.

Preliminary tests at Mono Lake and at Lake Ouachita in Arkansas, using smaller charges and commercially available models, also were successful and led to the use of multiton TNT explosions.

The Navy had previously tested the underwater containers' capability to withstand natural sea environment in the Gulf of Mexico during seasonal storms. The storms produced no significant damage to the 69x22x5.5-foot container. The harnessed anchorage also came through undamaged.

Knowing that such storage systems were able to withstand the natural sea environment, WES aimed its tests at evaluating the containers' response to underwater explosion shock waves.

Army emphasis on mobility has greatly increased the consumption of POL products as well as POL storage requirements. During World War II and the Korean War, POL products were stored mainly in fuel dumps on the ground, easy targets for enemy bombers.

In Vietnam, the Engineers have built huge tank farms to store fuel, but these have been free from enemy attacks. If bombed or subjected to nuclear attack, neither dumps nor tank farms would be suitable.

Reed Succeeds Lilly as CG of ADFSC

Brig Gen Wilson R. Reed succeeded Brig Gen Roger M. Lilly as CG of the Automatic Data Field Systems Command (ADFSC) Nov. 1 when General Lilly became CG, 2nd Region, Army Air Defense Command upon the retirement of Maj Gen Kermit L. Davis.

General Reed was deputy secretary of the Army General Staff until he moved to his new duties at Fort Belvoir, Va. General Lilly had commanded the ADFSC since it was established Aug. 1, 1965 (assigned to the formative unit Apr. 1, 1965) and has been nominated for promotion to 2-star rank.

Graduated from the U.S. Military Academy in 1941, General Reed served several key assignments with the Office of the Chief of Research and Development, including assistant director, Developments, June-December 1965, and chairman of the OCRD Planning Group for Army-wide reorganization in 1962. Following two years in the Army Chief of Staff's office, he went to Korea (1964-65) as commander of the 1st Calvary Division Artillery.

General Lilly is a 1939 graduate of the U.S. Military Academy and has a 1952 MS degree in mechanical engineering from the University of Michigan. Prior to the ADFSC assignment, he served nearly three years in the Office of the Chief of Research and Development. He was commander of the Army Task Group of Joint Task Force SEVEN at Eniwetok Atoll, Marshall Islands, and for three years was with the Combat Development Department of the U.S. Artillery and Missile School, Fort Sill, Okla.

$1.8 Million Contract Let For Chaparral Components

Production of components for the U.S. Army's new Chaparral guided missile system is ordered by a $1.8 million contract awarded recently to the Aeronutronic Division of Philco-Ford Corp.

Presently in the initial production phase, the Chaparral uses a modified Sidewinder 1C missile in a multiple mount on a highly mobile XM-730 self-propelled tracked vehicle. It is being developed to provide a forward area air-defense system; and has been selected to arm new air-defense battalions.

Col R. C. Daly, stationed in Washington, D.C., is the Vulcan-Chaparral project manager for the Army Materiel Command. The Army Missile Command management office at Redstone (Ala.) Arsenal is headed by Lt Col Donald Steenburn.

Army Orders 3 Fast Vehicles Propelled on Air Cushion

Another procurement first in the Army's continuing effort to improve combat mobility for all conditions of terrain and water was recorded with a recent purchase order for three air-cushion vehicles issued by the Army Aviation Materiel Command, St. Louis, Mo.

Familiarly known as ground effects machines (GEM), the high-speed amphibious craft will be capable of hovering or traveling over land, water, snow and marshes, AVCOM reported. The vehicle, however, is incapable of rising more than a few inches above the surface over which it travels.

The contract with the Bell Aerosystems Co., Buffalo, N.Y., carries an initial funding of $800,000 and provides for procurement of the Bell SK-5 vehicles, spare parts, training of Army personnel in operation and maintenance, and technical services support following delivery.

In a Hot Haze . . . Yearning for 'Good Old Days'?

So the boss had you in a panicky sweat today on a hot project, your pressure-reaction ulcers are kicking up a huge fuss, and you are disposed to think there must be better ways of earning a living! Perhaps you even yearn for the "good old days" when life was sedate, less demanding.

AVCOM Plane Talk, newspaper of the U.S. Army Aviation Materiel Command, St. Louis, Mo., recently reprinted an item from the *Boston Globe* which may give you heart to face another day. The article reported on office rules posted in 1872 by the owner of a carriage works to guide his white collar workers, as follows:

1. Office employees will daily sweep the floors, dust the furniture, shelves and showcases.

2. Each day fill lamps, clean chimneys, and trim wicks. Wash the windows once a week.

3. Each clerk will bring in a bucket of water and scuttle of coal for the day's business.

4. Mark your pens carefully. You may whittle nibs to individual taste.

5. This office will open at 7:00 a.m. and close at 8:00 p.m. except on the Sabbath, on which day we will remain closed. Each employee is expected to spend the Sabbath by attending church and contributing liberally to the cause of the Lord.

6. Men employees will be given an evening off each week for courting purposes, or two evenings a week if they go regularly to church.

7. After an employee has spent his 13 hours of labor in the office, he should spend the remaining time reading the Bible and other good books.

8. Every employee should lay aside from each pay a goodly sum of his earnings for his benefit during his reclining years, so that he will not become a burden on society or his betters.

9. Any employee who smokes Spanish cigars, uses liquor in any form, or frequents pool and public halls, or gets shaved in a barber shop, will give me good reason to suspect his worth, intentions, integrity and honesty.

10. The employee who has performed his labors faithfully and without a fault for five years will be given an increase of five cents per day in his pay, providing profits from the business permit it.

Okinawa Becomes 9th Link in IDCSS Global Net

Okinawa became the ninth link in the Initial Defense Communication Satellite System (IDCSS) Sept. 30 when the seventh AN/MSC-46 satellite communications ground-link terminal was dedicated in the Ryukyu Islands.

High Commissioner of the Ryukyu Islands Lt Gen F. T. Unger formally joined the terminal to the global communications network when he telephoned Admiral U. S. Grant Sharp Jr., Commander-in-Chief, Pacific, in Hawaii.

The medium-transportable terminal with a 40-foot antenna will send and receive voice and teletype message traffic through 17 operational orbiting satellite relays that circle the earth at approximately 18,000 nautical miles above the equator.

AN/MSC-46 terminals are strategically located also in Hawaii, West Germany, Ethiopia, the Philippines and two in South Vietnam. Another will soon be deployed to Guam. The IDCSS employs two AN/FSC-9 fixed-terminals with 60-foot-diameter antennas at Fort Monmouth, N.J., and Camp Roberts, Calif.

The IDCSS project in military communications is a joint venture, involving all the military departments and the communications-electronics industry of the United States.

The satellites were developed and launched by the Air Force with Philco Radio Corp. as the prime contractor. The Navy is developing and operating shipboard-terminals with Hughes Aircraft Co. as prime contractor. The Army is developing and operating earth-terminals built by the Hughes Co. Also, the Army is developing a new transportable earth terminal with Radiation Inc.

Responsibility for operation of the IDCSS rests with all the Military Departments, under direction of Defense Communications Agency Director Lt Gen Alfred D. Starbird.

The U.S. Army Strategic Communications Command (STRATCOM) operates the earth terminals at Fort Monmouth and Camp Roberts as well as those in West Germany, Ethiopia, Vietnam and Okinawa. The Navy operates the terminal in Hawaii and will be responsible for the one in Guam. The Air Force operates the earth-terminal in the Republic of the Philippines.

New 6-Pound Inflatable Boat Developed at LWL for Vietnam

Designed for patrol crossings of the numerous bodies of water in Vietnam is a new inflatable boat weighing less than six pounds and capable of carrying four men or 1,000 pounds.

The U.S. Army Limited War Laboratory at Aberdeen Proving Ground, Md., reported on the development at the recent 13th Annual Meeting of the Association of the United States Army in Washington, D.C.

The fabric boat is water-ballast stabilized and can be blown up by a 4-man crew in about five minutes. Ten inflation outlets are provided for the compartmentalized construction, assuring utility even if some sections become punctured.

The low-silhouette craft is 9 feet long, 38 inches wide and 10 inches high. Deflated, it is a 15x10x6-inch package.

Improved Hawk 'Kills' With Solid-State Guidance Package

An intercept of a target drone by a new Hawk missile at White Sands (N. Mex.) Missile Range in mid-October demonstrated the effectiveness of a new guidance package using solid-state components developed in the Hawk Improvement Program.

The "kill" marked the first attempt to intercept a target by a Hawk missile using the new design package. Under the "wooden round" concept, solid-state components eliminate the need for maintenance and adjustments in the field.

The improved Hawks with a larger warhead and better propellant are being fired at a variety of targets in tests over White Sands Missile Range. Ground electronics equipment is being modified. Once a firing unit is set up, the improved continuous-wave acquisition radar will search the low altitude in the area of defense.

When an enemy aircraft is detected, its position will be relayed to the high-power illuminator radar, which will "light" the target with a beam of radio waves. These waves bounce back to a receiver in the missile and the Hawk interceptor tracks the target automatically by homing along the radar beam.

'Big Charge' at Dugway Handles 1,000 Batteries Daily

Dugway Proving Ground, Utah, the U.S. Army's main testing site for CBR munitions and defensive materials, has come up with "The Big Charge" — as applied to the problem of keeping 2,500 batteries at full power. A newly installed automatic charger can handle 1,000 batteries daily.

Specialists use the batteries to operate chemical and biological samplers. When the batteries run down, the technicians take them to the new charger, which then turns them out either fully charged or tagged incapable of taking a full charge.

Small trailers especially designed for the operation speed handling of the 70-pound batteries to the charger. Before loading for the return trip, they are washed, decontaminated and inspected.

Electricians rewired the former laboratory which houses the charger to handle 400-kilowatt lines. Other specialists put in a new ventilating system to remove oxygen and hydrogen byproducts of charging.

Experts in the grounds Design and Development Division came up with the idea. Engineers of the Utah Research and Development Corp. of Salt Lake City, built and installed the charger.

STRATCOM Holds Conference Of Worldwide Commanders

Commanding officers from Vietnam, Alaska, Hawaii, Panama and Germany joined with stateside leaders at the Fourth Annual Commanders Conference of the Army Strategic Communications Command, Fort Huachuca, Ariz., Oct. 17-20.

Maj Gen Walter E. Lotz, Army Assistant Chief of Staff for Communications-Electronics and former Director of Army Research, was a featured speaker. His address reviewed the rapid technological advances in communications, including the global satellite systems, in recent years.

Brig Gen Joyce B. James, Deputy Assistant Chief of Staff for Communications-Electronics, North American Air Defense Command, and Brig Gen Hugh F. Foster Jr., CG of the Army Communications System Agency, also gave featured talks, as did Brig Gen Robert D. Terry, CG of STRATCOM-Pacific, and Brig Gen John E. Kelsey, CG of STRATCOM Europe.

Among other leading speakers were Col John B. McKinney, 1st Signal Brigade (STRATCOM), Vietnam: Col Clark O. Irving, commander of STRATCOM-Alaska; Col Earl D. Harris, commander of STRATCOM-South; Col William Van Sandt, commander of STRATCOM-Conus; Col George W. Rhyne, CO of the Joint Support Command; and Col Thomas B. Richey, 11th Signal Group, Fort Huachuca.

Edgewood's Cost Reduction Saves $8.79 Million in FY 67

The final tally of Army Cost Reduction Program savings at Edgewood (Md.) Arsenal for FY 67 showed verified savings to the U.S. Government of $8.79 million, exceeding the arsenal's goal by more than 30 percent.

Savings resulted from 248 actions on employe suggestions, work measurement, work simplification and contractor participation in Value Engineering.

Edgewood CG, Brig Gen William W. Stone Jr., presented Cost Reduction Commendations to the contributing activities at the arsenal shortly before departing for a new assignment as Assistant Deputy for Research and Laboratories, U.S. Army Materiel Command.

Nearly 100 percent of the Edgewood elements participated. Accepted suggestions in three directorates and offices exceeded $1 million each.

Harvard Professor Receives Samuel S. Wilks Award

(Continued from page 3)

Prof. Cochran was president of the ASA in 1946 and still is an active member. A long-time member of the International Statistical Institute, he is its 1967 president, an honorary Fellow of the Royal Statistical Society, England, and chairman of the Panel of Consultants on Sampling of the U.S. Bureau of the Census

Members of the 1967 Wilks Award Committee were Dr. Grubbs, chairman; Prof. Robert E. Bechhofer, Cornell University; Dr. Francis G. Dressel, Army Research Office-Durham, N.C. (Duke University); Dr. Churchill Eisenhart, National Bureau of Standards, U.S. Department of Commerce; Prof. Oscar Kempthorne, Iowa State University; Dr. Alexander M. Mood, U.S. Office of Education; and General Simon.

PROGRAM. The 1967 conference on the Design of Experiments in Army Research, Development and Testing featured technical presentations by many leading statisticians, representative of academic institutions, industry and the Department of Defense.

Prof. K. A. Brownlee, Statistics Research Center, University of Chicago, discussed "Some Comments on Matching," and Yale University Prof. Francis J. Anscombe, Department of Statistics, spoke on "Regression Analysis."

"On the Analysis of a Massive Medical Survey" was presented by John C. Atkinson, Harvard Computing Center, Medical Branch, and Lt Col Janice A. Mendelson, Edgewood (Md.) Arsenal. Walter D. Foster, Biomathematics Division, U.S. Army Biological Laboratories, Fort Detrick, Md., talked on "Components of Variance of a Linear Function in Repeated Trials."

Guest speaker presentations included "Some Statistical Methods in Machine Intelligence Research," Prof. I. J. Good, Virginia Polytechnic Institute; "Maximum Likelihood Estimation of Reliability," Dr. Frank Proschan, Mathematics Research Laboratory, Boeing Scientific Research Laboratories, Boeing Co., Seattle, Wash.; and "Data Analysis," Dr. M. W. Wilk, Statistics and Data Analysis Research Department, Bell Telephone Laboratories, Murray Hill, N. J.

Other presentations included: "The Derivation of the Operating Characteristic Curve of a Skip Lot Sampling Plan," Allen C. Endres, U.S. Army Ammunition Procurement and Supply Agency, Joliet, Ill.; "A Model for the Formulation of Quality Incentive Clauses for Items Procured According to Acceptance Criteria Involving Single Sampling Plans by Attributes," Roger E. Rymer and Eugene Dutoit, Picatinny Arsenal, Dover, N. J.; and

"Optimum Sampling Plans for Grading Binomial Populations," Paul B. Nickens, Surveillance and Reliability Laboratory, Ballistic Research Laboratories (BRL), Aberdeen (Md.) Proving Ground (APG); "Methodology of Assessment of Biocellular Reactions to Absorbed Energy," George I. Lavin, Terminal Ballistic Laboratory, APG; "The Effect of Inventory Forecasting Upon Supply Effectiveness," Patsy Courtney, U.S. Army Aviation Materiel Command, St. Louis, Mo.; "The Abba Sequence: A Sequential Procedure for Comparison Testing," Arthur Pillersdorf, BRL, APG; and

"On Expected Probabilities of Misclassification in Discriminant Analysis," P. A. Lachenbruch, School of Public Health, Department of Biostatistics, University of North Carolina; "Intra-Profile Variance," Claude F. Bridges, Institutional Research Division, Office of Research, U.S. Military Academy at West Point, N.Y.; and

"On Fitting of the Weibull Distribution with Non-Zero Location Parameters and Some Applications," Oskar M. Essenwanger, Physical Sciences Laboratory, R&D Division, Redstone (Ala.) Arsenal; "A Statistical Test of Two Hypothetical Reliability Growth Curves of the Logistic Form in the Discrete Case," William P. Henke, Research Analysis Corp., McLean, Va.; and

"An Error Analysis of Sound Ranging Arrays," Robert P. Lee, and "An Experiment on the Meteorological Effects on Sound Ranging," William H. Hatch, Atmospheric Sciences Office, U.S. Army Electronics Command, White Sands (N. Mex.) Missile Range; "Determination of TBO by Weibull Probability Parameters for Repairable Components," John L. Mundy, U.S. Army Aviation Materiel Command, St. Louis, Mo.; and

A Technique for Interpreting High-Order Interactions," Melvin O. Braaten and John Tonzetich, Duke University, representing Shaw AFB, S.C., and the North Carolina Operations Analysis Standby Unit, University of N.C.; "A Simplified Method for Finding Optimum Experimental Designs," Melvin O. Braaten, Ray L. Miller Jr. of Shaw AFB, and Fred W. Judge, Wood-Ivey Systems Corp., Winter Park, Fla.; and

"Definitive Calibration of an Aerial Camera in Its Operating Environment," Lawrence A. Gambino, U.S. Army Topographic Laboratories, Fort Belvoir, Va.; "Design and Analysis of a Statistical Experiment on High-Voltage Breakdown in Vacuum," M. M. Chrepta, G. W. Taylor and M. H. Zinn, U.S. Army Electronics Command, Fort Monmouth, N. J.; and

"A Moderately Distribution-Free Technique for Small Sample Reliability Estimation," Michael G. Billings, U.S. Army Chemical Corps, Dugway Proving Ground, Utah; "Use of Reference Component Mixture Designs in a Calibration Application," Raymond H. Myers, Department of Statistics, Virginia Polytechnic Institute, Blacksburg, Va., and Bernard J. Alley, U.S. Army Missile Command (MICOM), Redstone Arsenal; and

"Parameters in R&D in Relation to Cost/Accuracy Investigation," Robert G. Conrad, Systems Evaluation Branch, Advanced Systems Laboratory, R&D Directorate, MICOM; "On Experiments Concerned with the Sampling Distribution of Lanchester's Parameters," David R. Howes, U.S. Army Strategy and Tactics Analysis Group, Bethesda, Md.; and

"Estimates of $P(Y>X)$ and Their Application to Reliability Problems for Both Continuous and Quantal Response Date," Bernard Harris and J. D. Church, Mathematics Research Center, U.S. Army, University of Wisconsin; "Numbers Needed for Detecting Important Differences in Chi-Square Tests," C. J. Maloney and F. M. Wadley, Division of Biologics Standards, National Institutes of Health, Bethesda, Md.; and

"On a Statistically Consistent Estimate of an Average Cumulative Quantal Response Function," George W. Evans II and Robert C. McCarty, Stanford Research Institute, Menlo Park, Calif., representing the U.S. Army Research Office-Durham, N.C.; "Designs of Experiments as Telescoping Sequences of Blocks," Arthur G. Holms, National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio; and

"On a Class of Nonparametric Tests for Interactions in Factorial Experiments," P. K. Sen, School of Public Health, Department of Biostatistics, University of N. C.; and "On the Rank Mod p of the Design Matrix of a Difference Set," Jessie MacWilliams and Henry B. Mann, Mathematics Research Center, U.S. Army.

Natick Biochemist Qualifies As 'Second Youngest PhD'

Capt Billy G. Hudson, U.S. Army Medical Service Corps, the most recent claimant for the informal title of "Youngest PhD in the Army," will have to be satisfied with "First Runner-Up" distinction.

Although younger by 10 months than Capt Michael J. Ram (listed in the April *Army R&D Newsmagazine)*, Capt Hudson's Oct. 16, 1941, birthdate was bested by that of 1st Lt Arthur B. Krewinghaus (September Newsmagazine) by one month, five days. Dr. Kenyon S. Latham Jr., U.S. Army Artillery and Missile School, moves to third place.

Capt Hudson received a doctorate in biochemistry from the University of Iowa in 1966. He entered the Army in September 1966 and is stationed at the U.S. Army Research Institute of Environmental Medicine, Natick, Mass., as a biochemist.

General Besson Commends Vietnam Achievements

(Continued from page 1)

Command, that war is more than a dominant interest — it is the very reason for our being.

"Most of our actions, our thoughts and our time are devoted to supporting that guy at the end of the line, in the steaming jungle of the watery delta — that kid who doesn't make our national policy, but fights and dies, if necessary, to sustain our national objectives and our international posture."

Discussing how the U.S. Army and industry had teamed successfully in responding to the challenge of providing materiel for Vietnam, he said:

". . . I find an awful lot to be proud of when I look back on what we've done. In retrospect, I don't believe that we could ever have projected so successful an operation — had we known the magnitude of the task. . . .

"Here in the United States in the summer of 1965 the civilian economy was operating at unparalleled levels of prosperity and the demands for consumer goods were at an all-time high. Our primary problem at AMC was to try to superimpose an accelerated defense procurement and production program on an industry already saturated with peacetime production. . . ."

That task, General Besson said, increased materiel procurement spending from $7.5 billion in 1965 to almost double, $14.3 billion, in one year.

"Here in Washington," he continued, "we're pretty glib in tossing around this term 'a billion dollars.' But I got to wondering just what a billion dollars looked like. After a little high-level research, I found that it takes a stack of $1,000 bills a little higher than the Washington Monument to make a billion dollars.

"AMC's annual workload adds up to 15 of those monument-sized stacks. In order to spend that $15 billion, someone in AMC peels off one of those $1,000 bills every two seconds, day and night, all year long. In spending our money, which really means getting those things needed to support our fighting machine, we really have a sequence of major problems. . . .

"Our contractual workload has pretty well stabilized — but the level is statistically impressive. We are averaging about 1½ million contractual actions annually. Each contract requires follow-up, a delivery schedule, quality control and a distribution plan. . . . Today we have on our books about $8 billion worth of equipment due in from our contractors.

". . . We examined a list of 161 items most critical to our buildup and support of Southeast Asia. At the end of June 1967, these 161 items involved about $3.5 billion. . . . In dollar value we were only 8.6 percent below schedule. Knowing as I do, the special problems on a couple of missiles and a few other items, that performance is certainly a fine tribute to you of American industry who are so ably supporting the war effort. . . ."

Following a discussion of how logistical problems in Vietnam have been attacked, General Besson continued:

". . . But the problems that we've encountered here in the States are insignificant when you compare them to the problems that our logistics people out in Vietnam had to face.

"We've established a basic postulate in the logistics business. The fighting troops come first. We used to mean that the combat forces got the first crack at equipment, rations and clothing. Then in Vietnam, we found out what the literal translation was.

"When President Johnson made the decision to send the combat troops to Vietnam, they went! The powers-that-be didn't allocate any time for building up a logistics base to support them. Our full-scale entry into the conflict in Vietnam was a far cry from the situation in World War II, when we took three years to build and stock a logistical base in Britain before we risked an invasion of the (European) Continent.

"For the Army's logisticians in Vietnam, the summer of 1965 was the beginning of a nightmare. It was as if Sears and Roebuck had decided to announce a store opening, a giant basement sale and a double stamp day on the same day they tried to stock the new store and train new clerks.

"The problem wasn't confined to a shortage of materiel and facilities in the theater. We didn't have the people over there to do the work, either. In June of 1965, about 50 officers and men of the 1st Logistical Command got off the plane in Saigon, and started setting up the organization that would take charge of the retail logistics business in Vietnam.

"That outfit — the 1st Log — is now the single largest Army unit in Southeast Asia. They have about 60,000 people scattered all over Vietnam, and they're doing a truly magnificent job — but they sure had their work cut out for them when they started out.

"At the same time that the Log Command was getting organized, the Army Engineers were starting to build ports, depot complexes, and airstrips. They *really* were starting from scratch, right out in the jungle or on the beaches. You've just about got to go over there and see what they were facing to appreciate the job they have done. . . ."

After discussing the tremendous problems of unloading supplies at the outset of the buildup, due to lack of harbor facilities, General Besson said:

". . . Within one year we had created five new deep-water ports in Vietnam, like the one that the Engineers carved out of the jungle at Vung Ro Bay, and the port of Qui Nhon, where we dredged out a basin and built a long causeway out to the piers.

"The real showcase of the logistical effort in Vietnam — a modern engineering miracle really — is the modern port and depot complex at Cam Rahn Bay. . . . one of the largest deep-water harbors on the Asian Coast."

General Besson continued his accolade for the Corps of Engineers by reviewing the construction in Vietnam of warehouses, offices, barracks, loading piers, tank farms for POL supplies, airstrips and other facilities.

Then he launched into a tribute to "the fertile GI mind" for producing countless uses for the CONEX containers (a 7-foot metal cube that holds five tons of normal cargo), such as command posts protected with sandbags, dispensaries, supply rooms — "somebody's always coming up with a new idea."

Out of about 100,000 CONEXes, shipped to Vietnam, the general guessed "we haven't gotten more than 100 of them back" — although they originally were under strict serial number control for return to the United States for reuse.

The role of air power in Vietnam operations was discussed at length. More than 200 airfields and heliports are available in South Vietnam he said, including 10 that will handle the big jets and 89 that can take the C-130s, due largely to Corps of Engineers efforts.

In reviewing new equipment that has proved its worth in Vietnam, he mentioned the proved effectiveness of the 175-millimeter gun and the new lightweight 105mm howitzer, as well as the M113 armored personnel carrier.

In conclusion, General Besson again lauded Army-industry cooperation by saying, "Together we have established a logistical system that is unparalleled in the annals of warfare, with more than 300,000 measurement-tons a month pouring into Vietnam from the United States.

"We are extremely proud of that record, but what pleases us most is the judgment of our combat commanders in Vietnam. General Westmoreland summed it up pretty well when he told Congress last spring:

" 'Both the enemy's problems and our success can be attributed in large measure to our unprecedented logistic base development during the last two years.' "

WECOM Sets Up New Office

A Commodity Management Office has been established at HQ U.S. Army Weapons Command (WECOM), Rock Island (Ill.) Arsenal, to manage more effectively the research, development, procurement and worldwide logistic support of Army weapons systems.

WECOM Deputy Program Director John B. Sweeney has been appointed acting chief of the new office. He will manage 15 weapons systems including aircraft armament, machineguns, grenade launchers, minigun, FADAC, gun direction computer, range finders, howitzers and cannons, infantry mortars and recoilless rifles.

Kudos

MERITORIOUS CIVILIAN SERVICE AWARD (MCSA). Dr. William W. Carter, chief scientist of the U.S. Army Missile Command since November 1959, recently received the Decoration for Meritorious Civilian Service, the Army's second highest civilian award.

Dr. and Mrs. William W. Carter look over MCS citation presented by Maj Gen Charles W. Eifler, CG, U.S. Army Missile Command, Redstone Arsenal.

Dr. Carter has accepted a new position as Assistant Director of Defense Research and Engineering (Nuclear Programs), succeeding Frank N. J. Thomas. The MCSA, presented prior to his departure, recognized his "many outstanding scientific contributions in the field of nuclear physics and nuclear propulsion."

Lee C. Luna, chief of the Histropathology Laboratories at the Armed Forces Institute of Pathology (AFIP), Washington, D.C., is the second of two nonphysicians at the AFIP to receive the MCSA in the past four years.

In making the presentation, AFIP Director Capt Bruce H. Smith, MC, (USN) noted that Luna is recognized as one of the country's leaders in histologic techniques, saying:

"The training which he conducts at AFIP is reputed to be the finest found anywhere and the quality and quantity of work performance in the histologic laboratories of the institute is without parallel."

Luna's citation praised him for "developing new techniques, training numerous technicians, and supervising the superior processing of large volumes of histopathological material."

The U.S. Army Materiel Command's technical director of Explosive Ordnance Disposal (EOD) Carleton L. Thulin, received the MCSA for "contributing immeasurably to the field of EOD in the U.S. and other countries."

His citation noted that because of his personal initiative and efforts, the EOD Division transcended its normal sphere of responsibilities and became the recognized focal point within the entire Army for EOD activities.

The citation noted that "Mr. Thulin's outstanding achievements in developing a revitalized EOD program to assure full operational support for all explosive ordnance items or systems, including nuclear weapons, reflect great credit to himself and to the U.S. Army Materiel Command (AMC) and to the federal service."

He assumed the position of EOD technical director in 1962 and more recently has been appointed AMC's senior scientist in long-range R&D planning.

Another AMC employe, Thomas L. Wernecke, received the MCSA for his work as chief of the Technical Management Division, Office of the Iroquois Project Manager. He is the AMC technical director for UH-1 Iroquois and AH-1 Hueycobra helicopter development.

The citation states: "Mr. Wernecke has, with an exceptional degree of success, planned, directed, controlled and coordinated all technical aspects of the Army's largest single aviation program. His broad technical background and competence, managerial excellence and knowledge of the technical intricacies of the Army aircraft system have earned for him the admiration, respect and acclaim of his professional associated within both the military establishement and industry."

JOINT SERVICE COMMENDATION MEDAL (JSCM). Lt Col Walter H. Peacock has received the JSCM for his outstanding performance as senior veterinary adviser with the Joint United States Military Assistance Group, Bangkok, Thailand, July 1965 to July 1967. He is now special assistant to the Director of the Walter Reed Army Institute of Research (WRAIR), with duty at Edgewood Arsenal, Md.

Lt Col Sylvester L. Wilhelmi, recently assigned to the Research Plans Office, Office of the Chief of Research and Development (OCRD), received the JSCM for his service with HQ U.S. Military Assistance Command, Vietnam. His citation, signed by General W. C. Westmoreland, notes that the "initiative, diligence and competence which he demonstrated in the performance of his duties contributed significantly to the overall effectiveness of the counterinsurgency effort in the Republic of Vietnam."

LEGION OF MERIT (LOM). Two commanding generals at the Walter Reed Army Medical Center (WRAMC) recently received first Oak Leaf Clusters (OLC) to the LOM from Army Surgeon General Lt Gen Leonard D. Heaton.

Maj Gen Philip W. Mallory, Commanding General of WRAMC, was honored for his exceptionally meritorious performance of outstanding service while serving as commanding general of Walter Reed General Hospital (WRGH) from 1965 to April 1967, when he assumed his present position.

Carleton L. Thulin, Army Materiel Command (AMC) scientist receives MCS Award from Maj Gen Richard H. Free, acting director of Development.

General Heaton referred to General Mallory as a brilliant physician, administrator, and military leader, and praised him for his unlimited resourcefulness and wise management in achieving extensive improvements in the hospital and enabling it to function at peak efficiency in spite of vastly increased patient loads and chronic personnel shortages.

Brig Gen Frederic J. Hughes Jr., who succeeded General Mallory as commanding general of WRGH, received the award for his outstanding meritorious service as commanding general of William Beaumont General Hospital, El Paso, Tex., 1966 to 1967.

General Heaton noted that General Hughes "enlarged and improved the hospital research program for interns and residents and worked diligently on plans for the renovation of hospital buildings, providing valuable suggestions for a new William Beaumont General Hospital.

Brig Gen Colin F. Vorder Bruegge, MC, commanding general, 9th Hospital Center, Heidelberg, Germany, received the second OLC to the LOM for distinguishing himself in duties as commander

Brig Gen C.F. Vorder Bruegge

of the U.S. Army Medical Research and Development Command and as Special Assistant to The Surgeon General for Research and Development, Washington, D.C., from June 1964 to July 1967.

During this 3-year tour of duty, General Vorder Bruegge guided the expansion of the Medical Research and Development Command from a budget of $36 million to $60 million and an increase of nearly 1,000 personnel. He instituted long-range plans to improve research efforts by consolidating research facilities into three geographical centers and three specialized research laboratories.

Col Joseph W. Cooch, MC, received the LOM when he retired from the Army after serving as director of the Global Medicine Course at WRAIR, Washington, D.C.

Col Ward H. Van Atta, commanding officer of the U.S. Army Map Service, received an OLC to the LOM for his direction of the world's largest mapping agency. He is a former comptroller of the Army Engineer Research and Development Center and has also commanded the Army Engineer Topographic Laboratories.

Lt Col John H. Boyes, recently assigned to duty in Vietnam, received the LOM for "exceptionally meritorious service" while assigned as Dragon project manager at the U.S. Army Missile Command, Redstone Arsenal, Ala.

Lt Col Kent T. Woodward was awarded the LOM for his outstanding work as director of Nuclear Medicine, WRAIR. First assigned to WRAIR in 1956 as chief of the Department of Biophysics, Col Woodward assumed his present duties in 1962.

Lt Col Louis W. Haskell Jr., Lt Col Robert D. Lambourne and CW3 Bobbie J. Sisco, all assigned to the OCRD, were also honored with LOM awards.

Col Haskell, assigned to the Plans Division, was honored for his contribution while serving consecutively as commanding officer, 2d Battalion, 35th Artillery and as officer-in-charge, I Field Force Vietnam Artillery (Forward) (Qui Nhon). In the latter role he organized a headquarters capable of supporting and controlling three artillery battalions "in a superb manner."

Col Lambourne was awarded the LOM upon his retirement. Assigned to the Physical Sciences Division (now Physical and Engineering Sciences Division), he was transferred to the Communications-Electronics Division in July 1965.

CW3 Sisco received the 1st OLC to the LOM upon his retirement as a staff systems analyst in the Nike-X System Office. His April 1967 assignment to OCRD capped many years of association with the Nike program.

SILVER STAR. Lt Col Jay A. Hatch, of OCRD's Management and Evaluation Division, was awarded the Silver Star for "distinguishing himself by exceptionally valorous action on Jan. 27, 1967, while serving as commanding officer of the 2d Battalion, 12th Cavalry, during an air assault operation near Bong Son, Republic of Vietnam."

Col Hatch directed his command and control helicopter into an enbattled area to provide emergency ammunition to two heavily engaged companies. He also received the 11th and 12th OLCs to the Air Medal for more than 25 aerial missions in Vietnam.

BRONZE STAR MEDAL (BSM). Col Arthur F. Pottle Jr., Lance project manager at the U.S. Army Missile Command, Redstone Arsenal, Ala., was awarded the BSM for distinguishing himself by "outstanding meritorious service in connection with ground operations against a hostile force in the Republic of Vietnam during the period Apr. 17, 1967 to May 16, 1967."

Sgt Jack L. Powell, now assigned to WRGH, received the first OLC to the Bronze Star for his work as a medic in Cam Ranh Bay, Vietnam, from May 1966 to May 1967.

ARMY COMMENDATION MEDAL (ACM). Maj James Auzins, a dentist at the U.S. Army Institute of Dental Research, Washington, D.C., received the ACM for performance of exceptionally meritorious service with the 40th Dental Service Detachment (KJ) in Vietnam.

Maj James G. Ton, now assigned to the Physical and Engineering Sciences Division, OCRD, received the 1st OLC to the ACM for his service as resident engineer for the Diyarbakir Residency and Black sea construction sites, U.S. Army Engineer Division, Mediterranean, July 1966 to May 1967 and as area engineer until July 1967.

Two officers at WRAIR also received the ACM. Capt Dorothy E. Istvan, Department of Nursing, was cited for her service as Education and Training Coordinator, Tripler Army Medical Center, Honolulu, and Capt Andrew Whelton, MC, Department of Metabolism Research, was honored for his work in Saigon with the artificial kidney unit.

Dr. Meridith P. Crawford, Director of the Human Resources Research Office (HumRRO) of George Washington University, was presented a plaque from the American Psychological Association (APA) "in recognition of outstanding and meritorious services performed" as national treasurer from 1957 through 1967.

During this period, Dr. Crawford also served terms as president of the Division of Military Psychology, president of the American Psychological Foundation, and member of the APA Board of Directors.

Lasers Test Projectile Mechanisms Inside Gun Tubes

Feasibility of testing projectile mechanism failures inside a gun tube has been demonstrated successfully through the application of laser telemetry to a 75-foot air gun at Picatinny Arsenal, Dover, N.J.

Developed by Lawrence Ouellette, engineering technician with the arsenal's Nuclear Engineering Directorate, the laser telemetry provides a relatively simple way to recover performance data on a projectile component during the acceleration phase of the air gun test.

The Ouellette telemeter uses special electronic techniques to absorb the high-g (700 to 20,000 g's) shock waves and acceleration forces that heretofore have prevented acquisition of accurate performance data. It consists of an ultraminiature semiconductor injection diode laser light source with associated modulating circuits and a light detector.

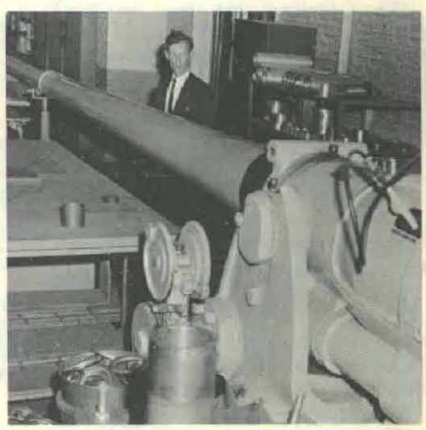
The injection diode lases at a constant-pulse frequency. Information on the behavior of a component (e.g., closing of a switch, accelerometer output, time of component failure, etc.) is transmitted on each light pulse by modulating its intensity.

The pulses are detected at the exit end of the air gun tube by a receiver that consists of a photomultiplier and associated electronic demodulating circuits and recorders.

The laser telemeter has a bandwidth of 300 kilohertz and a capability of 18 subcarrier channels of information. The use of these frequencies permits rapid reduction of data through standard ground station equipment.

Three 18-channel engineering models were test fired in May and June of this year at Frankford Arsenal, Pa. Based on an earlier 5-channel prototype, these models were designed and fabricated under direction of Dr. L. M. Valisse of the ITT Federal Laboratories in Nutley, N.J.

The tests were successful in demonstrating both adequacy of design and feasibility of the concept to air gun and artillery applications. At this time, engineering models are being designed and fabricated for testing and use in the 155mm field artillery piece.



PICATINNY ARSENAL engineer Lawrence Ouellette looks over 75-foot gun adapted for testing projectile mechanism failures inside the tube.

Lectures, Awards to Highlight Military Surgeons Meet

Lectures by distinguished medical leaders and presentation of achievement awards will highlight the 74th Annual Meeting of the Association of Military Surgeons of the United States, Nov. 19-22, in Washington, D.C.

Dr. William S. Middleton, Dean Emeritus, School of Medicine, University of Wisconsin at Madison, will deliver the keynote address, and Dr. Henry W. Brosin, Director, Western Psychiatric Institute and Clinic, University of Pittsburgh School of Medicine, is programed for the William C. Porter lecture on psychiatry.

Panel discussions and presentation of special scientific papers will cover a variety of subjects from highway safety to hospitalization of Vietnam casualties.

The association's Founder's Medal will be presented to Col Wilson A. Swanker and Brig Gen Colin F. Vorder Bruegge, Army Medical Corps, for outstanding contributions to *Military Medicine*, the association's journal, and for meritorious service to the association.

Col Spurgeon H. Neel, MC, USA, is to receive the Maj Gary Wratten Award for outstanding accomplishment in field military medicine. The award was instituted this year to honor the memory of a Medical Corps officer killed in Vietnam when the 45th Surgical Hospital was shelled in November 1966.

Col William R. Beisel, MC, USA, will be presented the Stitt Award for notable work in medicine, and Lt Col Teruo Matsujoto, MC, USA, is to be honored with the Sir Henry Wellcome Medal and Prize for an essay, "Tissue Adhesives in Fatal Hemorrhage from Solid Organs," which will appear in the December edition of *Military Medicine*.

The John Shaw Billings Award for demonstrating outstanding potential in the field of executive medicine will honor Lt Col Marcel E. Conrad Jr., MC, U.S. Army.

Maj Beverly A. K. Glor, ANC, will be recognized with the Federal Nursing Service Award for her essay titled "Falciparum Malaria in Vietnam: Clinical Manifestations and Nursing Care Requirements." Other awards are:

The Gorgas Medal for distinguished work in preventive medicine, to Capt James R. Kingston, MC, USN; the Maj Louis Livingston Seaman Prize, to Lt Col Paul J. Phillippi, MC, USAF, for an essay titled "Persistent Proteinuria in Asymptomatic Individuals"; and

The Sustaining Membership Award, to Cmdr Charles E. Brodine, MC, USN, and Maj John J. McPhaul Jr., MC, USAF, for outstanding contributions to medical research; and the James Clarke White Award to Capt Gustave T. Anderson (USN, Ret.) for outstanding work in dermatology; and

The Andrew Craigie Award, to Pharmacy Director Milton W. Skolaut, U.S. Public Health Service, for outstanding contributions to pharmacy in the Federal Medical Services; and

The Philip Hench Award for outstanding contributions in the field of rheumatology and arthritis, to Lent C. Johnson, MD, a pathologist at the Armed Forces Institute of Pathology, the M. C. Lester Award, to Dr. John E. Vanderveen for outstanding work in the field of nutrition.

NATO Opens Missile Range On Northern Shore of Crete

Dedication ceremonies for a new NATO missile range on the north shore of the Island of Crete were held in October.

The NATO Missile Firing Installation (NAMFI) is operated for the North Atlantic Treaty Organization by the Greek armed forces to conduct practice firings close to the European missile bases.

A Greek Hawk battalion was scheduled to be the first unit to fire at the new Mediterranean range, which also included Nike Hercules and Nike Ajax missiles.

Missile units from Belgium, Denmark, Germany, Greece, Holland and Norway, and along with missilemen assigned to U.S. Army sites in Germany, will conduct annual service practice and receive readiness evaluations at Crete.

NATO missile units can reach NAMFI from their home countries in approximately six hours flying time, contrasted with the 20 to 24 hours flying time necessary to reach McGregor Guided Missile Range in the United States.

Ten Greek officers spent two weeks at the U.S. Army Air Defense Center, Fort Bliss, Tex., for instruction and orientation in the operation of a guided missile range. They also completed training in the Sergeant and Hawk missile systems.

Arsenal Gets New Deputy CO

Rock Island (Ill.) Arsenal has announced appointment of Col Clyde E. Mitchell as deputy commander to succeed Col James P. Luckey.

An Army Reserve officer, Col Mitchell has been on active duty with the Army since he was commissioned as a second lieutenant in 1945, following service during World War II in the Southwest Pacific.

His most recent assignment was a 3-year tour in Germany as ordnance officer and chief of the maintenance division in Berlin. Included among his decorations are two Army Commendation Medals.

SCIENTIFIC CALENDAR

Missile Systems Meeting, sponsored by AIAA, Monterey, Calif., Dec. 4-6.

20th Annual International Air Safety Seminar, Williamsburg, Va., Dec. 4-7.

Vehicular Conference, sponsored by IEEE, N.Y.C., Dec. 5-7.

Theory of Measurement of Atmospheric Turbulence, sponsored by ECOM and Sandia Corp., Albuquerque, N. Mex., Dec. 5-7.

Meeting of the American Nuclear Society, Chicago, Ill., Dec. 5-9.

3d Annual Conference on Operating Metallurgy, sponsored by AIME, Chicago, Ill., Dec. 11-15.

Meeting of the American Association for Advancement of Science, N.Y.C., Dec. 26-31.

Annual Meeting of the Institute of Mathematical Statistics, Washington, D.C., Dec. 27-30.

Meeting of the American Chemical Society, New Orleans, La., Jan. 7-12.

Meeting of the Society of Automative Engineers, Detroit, Mich., Jan. 8-12.

Symposium on Reliability, sponsored by IEEE, Boston, Mass., Jan. 16-18.

Conference on Methodologies of Pattern Recognition, sponsored by OAR, Honolulu, Hawaii, Jan. 24-26.

2d International Conference on Photosensitization in Solids, sponsored by AFCRL, ONR, AEC and the Department of HEW, Tuscon, Ariz., Jan. 29-31.

Sweeney Departs Springfield to Command Watervliet

Changes of command at Springfield (Mass.) Armory and Watervliet (N.Y.) Arsenal will become effective Nov. 15 when Col Arthur H. Sweeney Jr. departs the armory to succeed Col Fred Kornet Jr. as Watervliet CO.

Col Sweeney will be succeeded at the armory by Lt Col Charles B. Zumwalt. Col Kornet's new assignment is special assistant for munitions, Office of the Deputy Chief of Staff for Logistics, HQ Department of the Army, the Pentagon, Washington, D.C. He has been nominated for brigadier general.

Commander of the armory since September 1965. Col Sweeney was responsible for the detailed planning necessary to close the Army Weapons Command installation in April 1968, as directed by Secretary of Defense Robert S. McNamara.

Col Sweeney has a BS degree from Massachusetts Institute of Technology and a master's degree in business administration from Harvard University.

Col Zumwalt assumes his new duties after serving at Springfield Armory as deputy for operations. A graduate of Oregon State U. with a BS degree, he has served in France and as adviser to MAAG in Iran and Ethiopia.

Col A.H. Sweeney, Jr.

Col Charles B. Zumwalt

CSC Directs Government-Wide Executive Referral System

Government-wide referral for nearly 4,400 executive positions in the super grades (GS-16 through 18) goes into effect Nov. 17 under the direction of the U.S. Civil Service Commission (CSC) Bureau of Executive Manpower, headed by Seymour S. Berlin.

The Executive Assignment System was outlined by the President and established by Executive Order one year ago. It is largely the result of findings of studies performed by the two Hoover Commissions, the Sixth American Assembly, the Committee for Economic Development, and the Brookings Institution.

Under the program, U.S. Government career employes in grades GS-15 through 18 are now considered for promotions and reassignments to super grade positions throughout the Executive Branch. In the majority of cases, vacant positions at these levels may not be filled within an agency without first considering qualified candidates from other departments through the executive inventory administered by the CSC.

Federal employes in grades 15 through 18 and at equivalent levels have submitted biographical information covering their educational and experience backgrounds. This inventory enables agency heads to draw upon the total resources of career executives in government in filling key positions.

The commission will refer to appointing officers for consideration those persons who have the highest qualifications for the career assignments being filled.

Positions excluded from the system are those not in the Executive Branch, those having special statutory requirements applying to them — such as 10 USC 1581 (PL 313) — Presidential appointees and consultants. Although 10 USC 1581 positions are excluded from the system, information on incumbents of those positions will be afforded assignment opportunities in top positions outside the Army, just as will employes at grades GS-16, 17, 18.

The CSC says the primary objective of the Executive Assignment System is to "bring about greater impact of the top executives in the Civil Service by:

- Making available to agency administrators the most capable executives from within and outside the federal service to staff sop-level positions;
- Providing career executives expanded opportunities to use their talents throughout the government; and
- Beginning a system designed to bring about greater identification on the part of career executives with the overall purposes of the government."

As part of the program, agency heads are required to review periodically with the commission their plans for organizing and staffing executive positions. Reviews will cover both immediate and long-range needs for executive manpower and the types of assignments appropriate.

The system includes merit staffing procedures with flexibility to accommodate emergency and short-term needs. New facilities, including special boards and panels, will be provided to assist agencies in locating talent for executive assignments from outside federal service.

The system will operate under existing legal requirements applying to government employment, classification and pay of positions, and veterans' preference policies. It will not affect such rights, benefits and protections accorded by law in the area of personnel procedures and appeals.

In the planning stage is a program providing training and development opportunities for those already in career executive assignments as well as those in preparation for upper-level jobs. This is handled by the CSC Training Bureau.

ECOM Represented at Austin Meet

"Hydrogen Plasma Resistivity," a technical paper which provides new information for development of superpower switches for electronic uses, was presented at the recent annual meeting of the American Physical Society, Division of Plasma Physics, at Austin, Tex. The paper reports on the work of John E. Creedon, Sol Schneider, and Victor Benedict, researchers of the U.S. Army Electronics Command, Fort Monmouth, N.J.

Natick Chemist Wins Milk Prize

Dr. Martin J. Kronman, a research scientist at the U.S. Army Natick (Mass.) Laboratories, has been awarded $1,000 by the American Chemical Society (ACS) for contributions to knowledge of the chemistry of milk.

Sponsored by the Borden Co. Foundation, Inc., the award will be presented at the 155th national ACS meeting in San Francisco in April 1968.

Dr. Kronman's studies on the molecular conformational changes in a protein (*a* lactalbumin) comprising .5 percent of milk were carried out as part of a program to ascertain factors which influence stability of proteins in food — considered of importance to researchers concerned with changes in the quality of foods during processing.

Since *a* lactalbumin is known to be involved in the synthesis of the important nutrient lactose, a knowledge of its behavior may eventually contribute to understanding of how milk sugar is synthesized in mammary tissue.

Discoveries in Dr. Kronman's studies also provide insight into the general response of protein molecules to changes in their immediate environment. The nomination for the award noted that his "use of absorption, emission and solvent perturbation spectral techniques constitute what is probably the most thorough characterization yet made of the molecular environment of aromatic amino acid residues in proteins.

". . . This study was one of the first to demonstrate the significance of side chain contributions to optical rotation in proteins. He was the first to show that changes in side chain Cotton effects chould give rise to alterations in rotatory parameters seemingly characteristic of changes in helical content. By comparison of the spectral, hydrodynamic and optical rotation dispersion properties of *a* lactalbumin, it was shown that the two 'buried' tryptophans which are located in highly rigid regions of the native *a* lactalbumin molecule, have greater freedom of rotation after the acid or alkaline conformational change. . . ."

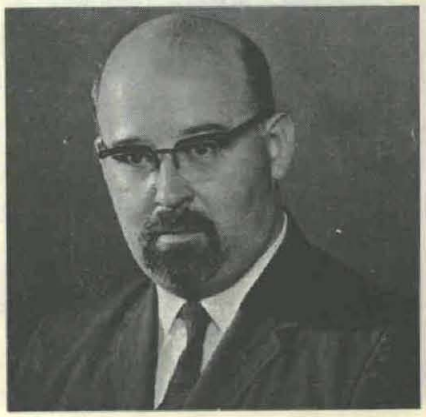
Dr. Kronman initiated his studies of *a* lactalbumin in 1959, while on the staff of the Eastern Regional Research Laboratory, U.S. Department of Agriculture, Wyndmoor, Pa.

In 1961, he joined the staff of the Pioneering Research Laboratory, U.S. Army Natick Laboratories. As head of the Biochemistry Group, he established a research program in biophysical chemistry and brought his studies of *a* lactalbumin to fruition.

Dr Kronman has described his work in recent publications in *Biochemica et Biophysica Acta, Archives of Biochemistry and Biophysics, and Biochemistry.*

Graduated with a BS degree from Rutgers-The State University in 1950 and a PhD degree from Temple University in 1955, he was a National Heart Institute Fellow at Purdue University (1955-56) before beginning work with the Department of Agriculture.

He is a member of the American Chemical Society, the American Association for the Advancement of Science, the honorary scientific society Sigma Xi, and the Society of American Biological Chemists.



Dr. Martin J. Kronman

DoD Portable Electric Power Plants

(Continued from page 15)

plants, the gas turbine, because of its intrinsic high speed, permits the design of high frequency (and thus small size) alternators which, when coupled with solid-state power conditioning, enable a single power plant to provide a variety of output frequencies.

The latter feature has not previously been a practical achievement. The alternator is directly connected to the turbine to produce a high-frequency output which is converted by static electronic devices to the desired output frequency.

In contrast, conventional systems require that the generator be driven at a fixed governed speed to produce a single frequency. The gains of the turbo-alternator concept are quite striking. Figure 3, for example, shows a 10-kw. system under development by the Army. Physical and performance data are given to show the expected gains.

The electrical load is one of the imponderables in military applications of electric power plants not ordinarily found in civilian uses. For example, most weapon systems have loads characterized by long standby periods with relatively short peak loads during actual engagement.

This situation is analogous to having a gun "cocked" ready to fire. The power plant for these systems must now be designed for the peak-load condition, which means long periods of operation at very light loads. (This part-load condition, incidentally, is very detrimental to reciprocating engines because of fouling, while gas turbines are not so affected.)

The part-load problem gives rise to hybrid systems in the design of military power plants. That is a system composed of primary and secondary power sources which can be designed or rated to accommodate the standby power level and simultaneously charge or store a portion of its output over a relatively long period of time for release during shorter peak load periods.

A number of techniques for doing this are under study, such as small turbines piggy-backed on large reciprocating engines or turbines, electrical storage (batteries), mechanical storage (flywheels) and pulsed plasma generators.

To date, there has not been established any clear-cut advantage to any one scheme. Rather, it depends on the load schedule involved. At the present time the most practical scheme is a combination of a large engine or turbine for the average load and a small turbine for peak loads because of the inherent rapid on-line capability of turbines under all conditions.

FUEL CELLS The fuel cell is the only device that directly converts chemical energy in a fuel to electrical energy. Consequently it is a highly efficient device not limited by the heat-cycle barrier. Further, there is no combustion process and no combustion exhaust — only reaction products which are in almost all systems: inert gas and water.

The conversion process in fuel cells is a chemical reaction not accompanied by controlled explosions, such as those in a combustion chamber, so that except for pumps and blowers to bring the fuel and oxidant to the reaction site, remove reaction products, and provide cooling and conditioning as required, the process is silent and static. All these characteristics make fuel cells potentially an ideal power source. . . .

Figure 4 shows power density, life and cost data which can presently be achieved in hydrogen-oxygen fuel cells compared with levels for these factors considered

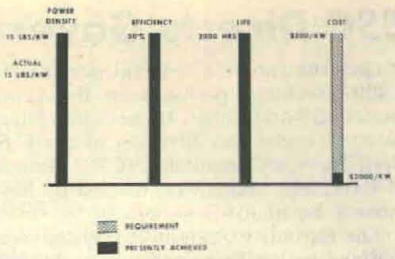


Figure 4.
Status of Hydrogen-Oxygen Fuel Cell Stacks

necessary to make fuel cells a competitive power source. This shows the fuel cell to be in a relatively favorable position except for cost — if one could use pure hydrogen as the fuel and pure oxygen as the oxidant.

The Gemini space flights, which utilized H_2-O_2 fuel cell systems, are indicative of the advanced state of development of such systems. However, the distribution and handling problems attendant with gaseous or cryogenic hydrogen and oxygen preclude their use for terrestrial applications.

The real problem in practical fuel cell systems, therefore, is not the fuel cell per se. Rather, it lies in the means for extracting hydrogen from the hydrocarbon fuel that must be used and oxygen from the ambient air.

The preferred fuel for both military and civilian purposes, though probably to a lesser degree in the latter case, is the liquid hydrocarbon in the forms now in our pipelines (i.e., automotive gasoline, JP-4, CITE and diesel oil). It is a cheap high-energy fuel capable of being readily handled and distributed.

In fuel cells two basic approaches to using hydrocarbons are possible and are under intensive investigation. One is to oxidize the fuel directly at a fuel cell anode; that is, extract the reactive species of the fuel and react them directly on the anode. The second is to extract the hydrogen from the fuel by a separate conditioning stage outside the fuel cell stack, but integral with the power plant system.

The direct approach is by far the preferred method because of its simplicity and potential for high efficiency, but also the most difficult, because of the problem of reacting a chemically complex compound which is not highly reactive electrochemically.

The indirect approach involves the introduction of a heat cycle to condition the fuel, with an attendant loss in efficiency and marked increase in system complexity. The current status in gross terms of these two approaches is summarized on Figure 5.

As shown, these fuel cell power plants are in early development stages. It is estimated that practical indirect power plants for tactical use will be realized by 1975, whereas the availability of practi-

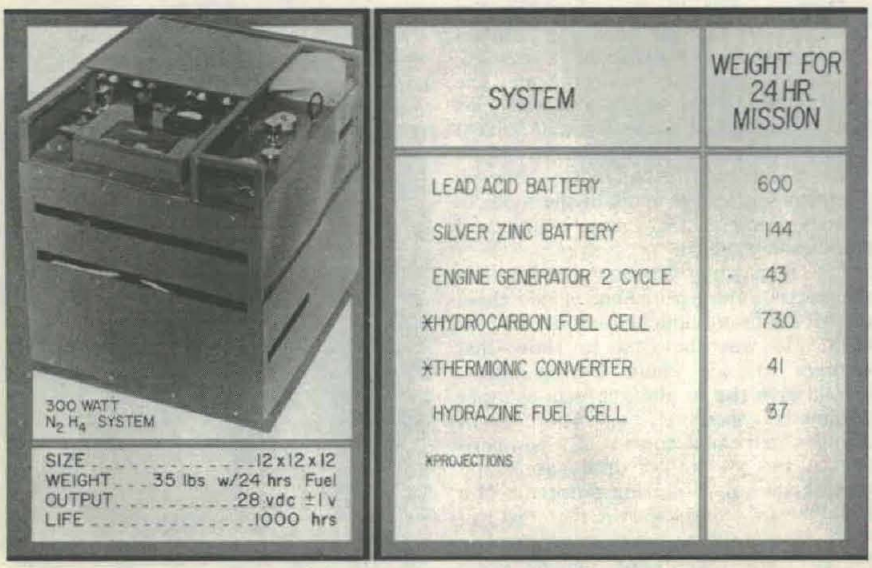


Figure 3. 10-Kw. Alternator Set Comparison

cal direct oxidation systems capable of utilizing existing hydrocarbons cannot at this time be predicted.

There are alternate approaches to the use of existing hydrocarbons, such as tailoring a hydrocarbon fuel cell fuel — that is, removing unreactive species and additives harmful to fuel cells from existing liquid hydro-carbon fuels. These are under study to determine real gains.

Another alternative is the use of nonpetroleum fuels, such as ammonia, hydrazine or methanol, which are more reactive in fuel cells. The Department of Defense has R&D programs underway based on using these special fuels to achieve urgently needed silent-power plants as early as possible. These are considered, however, interim to the ultimate use of hydrocarbon systems.

The most advanced of the special fuel approaches is the hydrazine-air system. Though hydrazine has roughly half the energy per unit weight of hydrocarbons, hydrazine in a water solution is a highly reactive compound and can be oxidized directly on a fuel cell anode.

Sixty-watt, 300-watt and 5-kilowatt systems have been constructed and tested to prove the feasibility of these systems. The 60-watt and 300-watt systems are being further developed to provide hardware for field test. Figure 6 shows the 300-watt system compared with other possible power sources designed for the same mission.

Hydrazine fuel cells are clearly superior to any other available silent-power source. Hydrazine, however, is a potential toxicity hazard in confined spaces and is a high cost ($10 per gallon) fuel.

Toxicity can be controlled for military uses, but might present problems for civilian use. Cost is largely a function of the quantity of fuel produced. Fuel manufacturers estimate that nearly an order of magnitude (10-fold) cost reduction is possible if production is correspondingly increased.

Ammonia-air fuel cells are next in line of possible alternate approaches using special fuels. In the case of ammonia it has not been possible, and probably never will be, to oxidize the fuel directly in the fuel cell, as can be done with hydrazine. The ammonia must be dissociated external to the fuel cell to provide hydrogen. This, however, is a simpler process than conditioning a hydrocarbon, so that complexities introduced by an intermediate step are not a serious limitation.

The Department of Defense has developed and constructed ammonia dissociators but to date has not constructed fuel cell systems for using ammonia since the fuel cell and air side of such a system would be very similar to other systems. A disadvantage of ammonia is the need for pressurized containers to maintain the liquid state.

At least one commercial concern however, is known to have successfully constructed and tested 3-kilowatt ammonia-air fuel-cell systems. Since the production base of ammonia has so greatly expanded in this country (1967 — 12×10^6 tons per year; 1970 estimated 15 — 18×10^6 tons per year) because of its widespread use in agriculture for a source of nitrogen, it has become a low cost ($0.05/lb.) fuel distributed quite widely. Therefore, it would appear to have considerable potential for civilian use as a power source fuel.

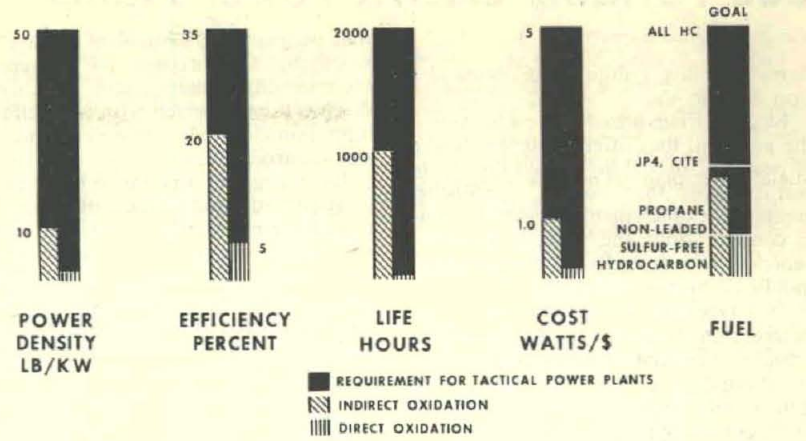


Figure 5. Status of HC Fuel Cell Systems

Methanol has been investigated on the basis of both direct and indirect systems. Because of inherent efficiency limitations and cost, the direct approach appears unattractive. The indirect approach, wherein methanol is reformed or conditioned external to the fuel cell, offers potential because methanol can be more readily reformed than hydrocarbons of interest; methanol does not have the wide range of unreactive or harmful species.

However, the introduction of complexities and efficiency penalties resulting from introduction of a reforming step clearly make methanol systems less attractive than other special fueled approaches.

In summary, of all special fueled fuel cell systems, hydrazine is the nearest practical hardware. The others have varying degrees of limitations. The Department of Defense position on the various alternatives is to concentrate on hydrazine at this time to meet immediate low-density needs, recognizing high cost and handling problems as being offset by most immediate tactical advantage and likewise concentrating on the long-term hydrocarbon systems to achieve power plants that will have broad applications.

ELECTRIC PROPULSION. The power sources and much of the associated control and conversion technology I have been describing have potential application in electric propulsion of vehicles. The Department of Defense has research and exploratory development programs on electric drives underway primarily at the Army Tank Automotive Command at Warren, Mich., and the

(Continued on page 40)

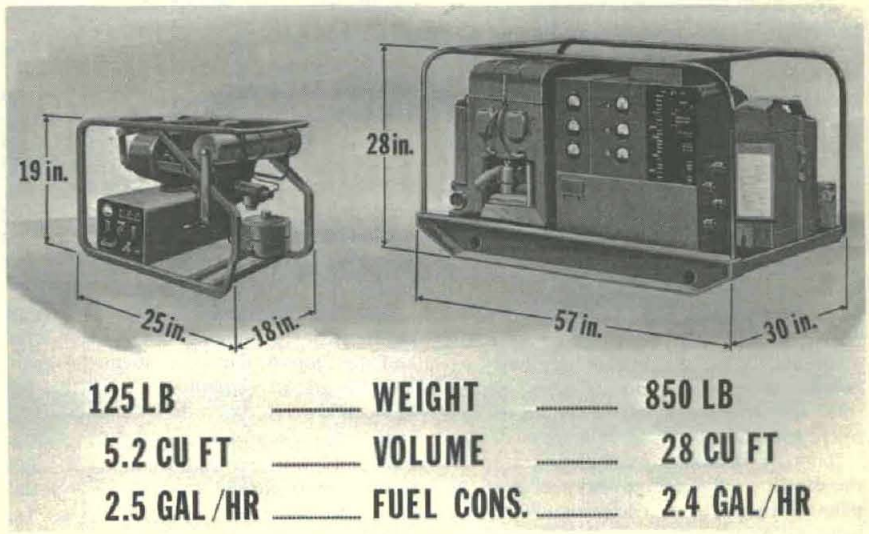


Figure 6. 300-Watt Hydrazine-Air Fuel Cell

DoD Portable Electric Power Plants

(Continued from page 39)

Army Mobility Equipment Command at Fort Belvoir, Va.

Electric drives are of interest because of the potential they offer for better control of power plant and drive, and thus better performance than other approaches; greater flexibility in the design of vehicle configuration; and the fact that each vehicle while at standstill can become a mobile electric power plant.

Two types of propulsion systems have been designed and constructed on test-bed vehicles. The first involves high-frequency alternating current (a.c.) drives designed with reciprocating engines and gas turbines as the prime power plants.

The a.c. system permits substantial size and weight reduction because of the inherent capability to operate a.c. machinery at higher speeds than is possible with direct-current machines.

In this system, driving motors located at each wheel are supplied the current, frequency, voltage and phase angle that the respective load sensors state is required at any given condition. This closed loop control scheme is automatic and can apply or shift power from wheel to wheel instantaneously so that optimum tractive effort independent of action by the operator is assured. In this manner, maximum utilization of power available is achieved.

While electric vehicle drives of this type that have been constructed and tested are strictly test-bed systems, they show in general that under the present state of technology for a given weight class of military vehicle an electric drive, based on a gas turbine as the prime power source, can replace a conventional drive in performance and all other respects without gross weight or payload penalty. The ability to provide power while at standstill is a bonus.

The major drawback is high cost (factor of 3 at this time). This stems from present high costs of controlled rectifiers and high-speed, high-frequency machinery, both presently being made in only pilot quantities, with attendant high indirect costs.

The second type of electric drive constructed and tested utilized a 20-kilowatt, hydrazine-air fuel cell as the main power plant and a standard commercial direct-current series-type motor and appropriate controls.

This system was constructed to study the behavior of fuel cells under rapidly changing load conditions typified by vehicle propulsion and to gain insight into the feasibility of installation and operation of fuel cells in vehicles.

Though installation of the system in the existing vehicle involved a 30 percent penalty in payload, performance results were quite encouraging. Test data accumulated during 500 miles of testing show that performance equivalent to that provided by the original 94 horsepower reciprocating engine and mechanical drive can be expected with a 40-kilowatt (approximately 53 horsepower) fuel cell electric drive system.

It is recognized that this is based on one unoptimized vehicle type, but it is indicative of the more efficient use of available power that is possible with better control. The construction of this test bed, however, shows the extent to which power density must be improved in fuel cells in order to make them an attractive power plant.

Power densities on the order of 10 lbs./kw. are needed; 18 lbs./kw. and 100 lbs./kw., respectively, can presently be achieved with hydrazine-air and hydrocarbon-air fuel cells. Cost is still another factor, but if power density and performance levels that are needed can be achieved, the cost picture can change.

The hybrid power plant, wherein the inherent advantages of various power sources can be beneficially combined, appears particularly advantageous in vehicle propulsion systems, because of the wide range in possible load or power drain conditions.

For example, experiments with the fuel cell system described above show that acceleration performance was greatly enhanced by use of storage batteries to, in effect, "stiffen" the system voltage. The same result can be achieved by increasing the size and rating of the fuel cell system proper but with a much greater penalty in size, weight, cost and complexity than in the batteries involved.

The determining factor in how much benefit can be derived from hybrid systems is, of course, the load or mission profile so that it is difficult to quantize gains. If intermittent peak demands are predictable, of short duration and sufficiently infrequent, considerable reduction in the size of the prime power source is quite possible.

Hybrid systems tailored for changing environments also appear quite feasible. That is a system which may utilize an internal-combustion engine with relatively high-exhaust signature for those areas which can tolerate such exhaust, to propel the vehicle and charge a battery which can subsequently be utilized to propel the vehicle in areas where exhaust cannot be tolerated. Nonnuclear submarine power plants have operated for years this way.

The Department of Defense is participating with the Department of Commerce and the Department of Transportation in analysis and investigations of possible use of electric drives in civilian vehicles.

In this regard, the comparison of civilian and military requirements reveals significant differences which may influence the advent of electric drives for either use. Military requirement for cross country, towed load, extreme environment and standby power capabilities directly influence vehicle power plant and drive characteristics, whereas these are less severe or not required in commercial vehicles.

Civilian vehicles must meet more rigid exhaust signature levels and cannot anticipate the same level of operator skill and driver maintenance. However, both military and civilian applications face the same problem of high cost. A commitment to exploit electric drives in either community will be mutually beneficial.

In summary, Mr. Chairman, the Department of Defense has extensive requirements for portable electric power sources of two general types: multipurpose and tactical. Primary emphasis in R&D programs is being placed on turboalternators and fuel cells to meet these requirements.

The most critical problem and need at present is for silent tactical power sources. Special fueled fuel cells and other techniques are being developed to meet this need on an interim basis.

Finally, much of the technology being accrued from the total effort is being applied to electric drives for vehicles. The feasibility of the latter has been demonstrated; cost is a major barrier.

Norton Establishes Group Of Scientific Advisers

Creation of a 7-man Aviation Scientific Advisory Group, consisting of recognized leaders in aeronautical research, development and education, has been announced by Maj Gen John Norton, CG of the U.S. Army Aviation Materiel Command (AVCOM), St. Louis, Mo.

AVCOM's FY 1967 funding totaled more than $1.5 billion, substantially due to the Vietnam War requirements for aircraft, principally helicopters. AVCOM conducts research, development, engineering and provides supply and maintenance for more than 8,000 aircraft.

The function of the Aviation Scientific Advisory Group will be to assist General Norton in considering scientific and technological problems involved in AVCOM's global responsibilities.

Members of the group are: Dr. Kurt Hohenemser, professor of Aerospace Engineering at Washington University, and Dean Leon Z. Seltzer, Parks College of Aeronautical Technology, St Louis University. Dr. William Bollay, visiting professor in aeronautics and astronautics from Stanford University; and

Dr. Robert G. Loewy, associate professor, Mechanical and Aerospace Sciences at the University of Rochester, N.Y., and director of the university's Space Science Center; Fred W. Wolcott, vice president of Research Analysis Corp., McLean, Va.; Charles H. Zimmerman, Hampton, Va., a former director of aeronautical research for NASA and chief engineer with HQ Army Materiel Command, when he retired last July.

Army Tests Mountain Sickness Drugs

Studies of three drugs to treat mountain sickness, aimed at improving U.S. Army combat capabilities at high elevations and conducted with soldier volunteers at the 14,100-foot summit of Pikes Peak, Colo., indicate phenoformin is more effective overall than ergotamine or codeine.

Experiments were conducted by teams operating from the U.S. Army Medical Research and Nutrition Laboratory (USAMRNL) at Fitzsimons Hospital, Denver, Colo., and the U.S. Army Research Institute of Environmental Medicine (USARIEM), Natick, Mass.

Mountain sickness usually occurs within 6 to 10 hours after arrival at high elevations and lasts for several days. It is characterized by migraine-type headaches, nausea, vomiting, dizziness, general weakness, and muscle and chest pains.

Evaluations of phenoformin, used for treating diabetics, established that it provides greater overall relief than ergotamine, used in treating migraine headaches, or codeine, a drug to relieve severe pain.

The report emphasized that this conclusion is only the result of an initial study.

The soldier volunteers were selected from Fort Lewis, Wash., where they underwent a wide variety of physiological, psychological and clinical tests to establish their low-altitude characteristics before they were flown to Pikes Peak. After the 5-day series of tests, they were returned to Fort Lewis for final low-altitude recovery tests.

Most of the 36 volunteers experienced mountain sickness shortly after arrival at Pikes Peak, according to Capt Richard P. Carson, USAMRNL Physiology Division, who headed one of the research teams. Miss Joyce House headed the team from USARIEM.

Investigations included blood chemical changes at high altitude, the effect of altitude in blood flow in the limbs, and the relationship of mountain sickness to certain mental functions, as well as physical performance.

The wide variety of physiological and psychological tests that were conducted to measure accurately military skills and overall performance had been rated earlier by veterans of World War II, Korea and Vietnam as being most important to the success of a soldier in combat.

Results of the tests to date, Miss House said, show that complex mental tasks, such as decision making, are more severely affected by high-altitude exposure than the simpler physical tasks, such as running. Findings also showed that mountain sickness varies tremendously from person to person, ranging from no symptoms at all to almost complete incapacitation.

Other field maneuver appraisals at lower elevations of Pikes Peak and other mountains in the Denver, Colo., area were reported in the June 1964 and July-August 1967 editions of the *Army Research and Development Newsmagazine*.

Environmental Hygiene Agency Dedicates Lab

The new $3,200,000 headquarters and principal laboratory of the U.S. Army Environmental Hygiene Agency, the ultramodern Wesley C. Cox Building, was dedicated Oct. 3 at Edgewood Arsenal.

Army Surgeon General (Lt Gen) Leonard D. Heaton, speaking to more than 500 military and civilian leaders in the field of preventive medicine and related health services, termed the facility "a reflection and a symbol of the phenomenal growth of modern medicine and related technology in recent times."

The AEHA headquarters honors the memory of Col Wesley C. Cox, a Medical Corps officer who directed the agency from 1946 to 1953. Col Cox died in 1953, after an Army career that spanned more than 35 years in the field of preventive medicine. The colonel's widow attended the ceremony and assisted in unveiling a commemorative plaque.

Paying tribute to the many contributions to preventive medicine of Col Cox and the men who currently staff the agency, General Heaton noted that "increasing complexity of modern life demands continual reevaluation and adjustment in the basic concepts. . .of preventive medicine.

"We must never forget that good medicine, both in its preventive and therapeutic aspects, does not begin and end in the hospital. It rests heavily on varied disciplines and functions, including the special services provided by the United States Environmental Hygiene Agency."

Emphasizing that "we intend to keep up with the times and to push progress along whenever we can," General Heaton said the Cox Building, ultramodern as it is, "can at best reflect only the current state of the art."

General and staff officers at the dedication included Maj Gen Phillip W. Mallory, director of the Walter Reed Army Medical Center; Brig Gen William A. Hamrick, chief of the Army Medical Service Corps; Col Ingalls H. Simmons, CO of AEHA; Col Herschel E. Griffin, chief of the Preventive Medicine Division, Office of the Surgeon General; and Col Walter J. Davies, acting CO of Edgewood Arsenal.

Among prominent guests were Dr. Homer Lawrence, University of Tennessee, and Dr. Warfield Garson, U.S. Public Health Service, Washington, D.C.

COMMEMORATIVE PLAQUE, honoring Col Wesley C. Cox, is unveiled by the colonel's widow, assisted by Col Ingalls H. Simmons, CO of the U.S. Army Environmental Hygiene Agency.

Digital Network Dedicates Overseas Switching Center

The first overseas Automatic Digital Message Switching Center of the Defense Communications Agency-directed Automatic Digital Network (AUTODIN) was dedicated recently at Clark Air Force Base in the Philippines.

When integrated with the Continental United States AUTODIN system, the overseas AUTODIN will provide the Department of Defense (DoD) with a worldwide capacity for handling the equivalent of 600 million words a day.

AUTODIN is a high-speed, computer-controlled, common-user, secure-data system. It supports DoD communications in the areas of command, supply, inventory control, personnel, finance, budget, operations, intelligence and medicine

Overseas, it will be comprised of the message switching centers for a digital store and forward communications system. Centers are planned for Thailand, South Vietnam (2), Okinawa, Japan, Alaska, Guam, England, Germany and Italy. Eight centers are located in the continental United States, and one was dedicated in Hawaii in April.

The Army is responsible for establishing the overseas AUTODIN complex, under the guidance and direction of the Defense Communications Agency. The center in the Philippines will be operated by the Air Force.

600 Army Nurses Serve in Vietnam

More than 600 Army nurses are serving in Vietnam with the U.S. Army Medical Service Team. They are working with some 50 medical units and teams in fixed installations and in the newly developed MUST (Medical Unit Self-contained Transportable) hospital. The first Vietnam contingent of nurses arrived with the 8th Field Hospital in 1962.

DDR&E Executive Discusses Transfer of Technology

(Continued from page 2)

journals and other technical media. An example was the publication and wide distribution of detailed utilization handbooks on transistors shortly after their development.

Therefore, we conclude that the limiting factor in these first two categories of technology transfer is economics, and this factor may be significantly influenced by defense utilization. For example, few recent technological advances have had as great an impact on an industry as did the transistor. The transistor was an industrial invention, and from the time that it was demonstrated, its performance advantages over the vacuum tube were evident.

The new device was more rugged, consumed less power, promised greater life, and was much smaller. But it was also far more expensive — as much as 10 to 15 times more expensive than the equivalent vacuum tube.

Until the military market, in which performance was far more important than price, demanded enough transistors so that mass production techniques (and the corresponding unit cost reductions) became economically feasible, the transistor was not attractive to the home entertainment electronic industry.

To cite another contemporary example of this economic force, the exploitation of integrated circuits in the private sector is today at the stage that transistors were 10 to 15 years ago. The cost of integrated circuits is not yet fully competitive with that of discrete components.

In the materials field, aluminum provides another excellent historical example. Until the military requirements for a strong, lightweight material led to marked price reductions in the cost of aluminum, there was little commercial interest in this material. But after the DoD sponsored a build-up of aluminum production capability, costs were reduced, and it was practical for houseware, wrapping, and packaging manufacturers to exploit this new technology.

A most important point relevant to the transfer of technology in components and materials is that exploitation can be accomplished most effectively by companies having a research and development capability. Even companies without R&D capabilities are able to capitalize on some of this technology after its initial exploitation, though there will be, in general, a greater time lag.

The transfer of techniques, processes and concepts is the most difficult, both from the government and the recipient points of view. In addition to economic factors, the exploitation of new techniques and processes is controlled to a great extent by the technical understanding, artistry and skill of the recipient's staff. In particular, the availability of written information about the technology is a necessary, but *not* a sufficient, condition for this transfer.

For example, the trade literature has discussed newer manufacturing techniques and processes such as numerically controlled machine tools, plasma deposit of materials, or explosive forming of materials. Undoubtedly, most potential commercial users are generally aware that these techniques exist. However, to accomplish a technology transfer, they need people who understand the techniques.

Our experience has been that for roughly 75 percent of the cases in which a new manufacturing process was successfully transferred within the defense community, direct interaction of people was essential. The other 25 percent was accomplished through technical reports or symposia. I would expect that no less interaction is required for transfers to the commercial sector.

Transferring techniques, processes and concepts is also particularly difficult for a company without an R&D capability. These companies probably find it difficult even to identify a particular technology which could improve their product. Then, if they recognize a potentially useful technology, the technical expertise required to fully appreciate implications for their product line may be missing.

These companies require the assistance of persons — who might be called "translators" or "couplers" — who can help to identify and extract the technology, and then apply it to the company's product line through development, modification or training.

We have looked briefly at the dynamics of the transfer process: the technology itself, the kinds of recipients, and the factors influencing possible transfers. I will turn now to a review of the DoD activities related to technology transfer.

DoD Policy and Procedures. The Department of Defense has policies and procedures directly affecting the transfer of technology to the private sector.

First, we publicize areas of procurement interest through the Department of Commerce Business Daily and the QDRI (Qualitative Development Requirements Information) and other departmental meetings at which DoD R&E interests are exposed. This publicizing of prime and subcontracting opportunities is a catalyst for transfer of technology to potential and interested contractors.

Second, the award of R&D contracts is publicized, along with accompanying data defining the scope of the contractual work statement. This leads contractors to our Defense Documentation Center (DDC) for data and reports; to interface with our engineering and research centers; and to discussions with project engineers.

Third, we permit the sharing of services and facilities available in the defense R&D community (such as wind tunnels and accelerators) which permits some transfer of technology.

The DoD patent policy is designed to assist the prompt passage of scientific and technological developments into the civilian economy. Essentially, the department employs three approaches by the use of different contract clauses to serve the goal of early civilian use of inventions.

The first situation is where the goal will best be served by the government acquiring title, coupled with a liberal licensing policy, such as where the principal purpose of the contract is the exploration into fields which directly concern public health and welfare.

In the second situation, where the contractor has demonstrated a technical competence in the area and an ability to commercialize his inventions, the approach calls for the contractor to obtain title to the resulting patent, subject to a license in the government. In such a situation, the normal incentives provided by the patent system are sufficient guarantee that the inventions will be exploited and developed for civilian use.

In the third and final situation, the decision of patent rights is deferred until the invention is disclosed. This may be necessary where the commercial interests of the contractor are not sufficiently established to give title to the contractor at the time of contracting.

The DoD also has a strong technical information program — aimed at (1) efficiently transferring technical information within the government and among contractors, and (2) making the maximum amount of technical information available to the general public.

During FY 1967, about 330,000 copies of defense technical reports were distributed to the general public through the Department of Commerce's Clearinghouse for Federal Scientific and Technical Information. In addition, over one million copies of defense technical reports were distributed to contractors by the Defense Documentation Center.

DoD reports are published through two mechanisms — the DoD Technical Abstract Bulletin (TAB), published twice a month by the DDC, and the Commerce Department's "U.S. Government Research and Development Report," also published twice a month. The DoD generates over 50,000 new reports per year.

Though the DDC and other defense technical information services were established primarily for government contractors, the technical information has ready routes to the civilian sector. About 2,700 private organizations are registered for DDC services. Most of these companies serve the commercial as well as the federal market.

Another element of the transfer of defense technology is the mobility of scientists and engineers. There are over 300,000 U.S. engineers and scientists involved in the research, development,

production and operation of defense systems. These technical people are a major, highly effective mechanism for technology transfer. We estimate that each year about 36,000 of these defense-connected employes change jobs, and that approximately 10,000 of them move to nondefense industry.

Technology transfer often begins, in a sense, with the need to know who is working, or has worked, in a particular technology area. It is obviously essential to establish direct contact between the individual desiring information and the individual having the information. Technical reports are useful in identifying what has been done and who did it. However, they do not cover ongoing work. To provide the latter information, as well as management data, the DoD instituted a uniform reporting system covering each separately distinguishable "technology effort" (DD Form 1498).

Each technology effort, called a "work unit," is roughly equivalent to one man-year of effort. We currently have over 30,000 work unit records covering DoD and NASA technology efforts in our file. Each work unit record describes the objective of the work and identifies the principal investigator by name, address, in addition to other management data.

In addition to DoD and NASA employing a common work unit reporting system, essentially the same system is being extended to all federal agencies. All unclassified reports are provided to the Smithsonian Institution's Scientific Information Exchange.

In FY 1967, the DDC processed over 3,000 individual requests from the work unit data bank. In addition to the distribution of technical reports and work unit information, the DDC provides over 20,000 bibliographies per year. The total cost of the varied DDC operations is approximately $10 million per year.

Supplementing the DDC, we have established either discipline or subject-oriented "information analysis centers." Typical examples, by technical area, are shock and vibration, human engineering, and ceramic materials. These centers, altogether funded at an annual rate of about $4 million, continually digest the pertinent developments related to their assigned subject or discipline areas.

Users requesting information from any center are given a customized individual response in terms most meaningful to them. Thus, the information analysis centers deal in *information* instead of merely *documents*. Often the centers publish periodic or special reports summarizing certain of the latest developments.

The effectiveness of our information analysis centers as transfer mechanisms is clear, though it is difficult to measure benefits in concrete terms.

For example, the Defense Metals Information Center handled an average of 127 requests per month for technical information. A large percentage (approximately 35 percent) of these requests are from repeat customers. That center also provides the results of their analyses in known areas of general interest to about 3,000 industrial organizations who have requested this type of information.

The Department of Defense also promotes the transfer of technology by encouraging employes to report their scientific and technical findings in appropriate professional journals and meetings.

Finally, an often overlooked mechanism for technology transfer is the professional consultant. We make extensive use of these highly qualified people. DoD consultants are in a position to transfer defense technology both to and through their regular employer, as well as to private companies for which they consult.

CONCLUSION. I have tried to point out our ongoing activities and policies which contribute to the transfer of Defense technology to the private sector.

We are now in the process of exploring seriously a new practice that could significantly help industry. We plan to allow the public to utilize our information analysis centers in conjunction with an appropriate fee structure. The focused technical services of these centers could improve the coupling of potential private users to government technology. They would, in part, serve the "translator-coupler" role that I previously discussed.

Aside from encouraging the transfer of technology, the success of these centers — as measured by the private sectors' willingness to pay for the services — will furnish insight on the advisibility of additional DoD technology transfer actions. We will work closely with all federal agencies to assure that our experience with the information analysis centers is considered along with other experiments in technology transfer.

Total Package Procurement Initiated With TACFIRE

Competition in the Contract Definition Phase of the Tactical Fire Direction System (TACFIRE), the first major Army project under the Department of Defense "Total Package Procurement" plan, has been won by Data Systems Division, Litton Industries.

Maj Gen William B. Latta, CG of the Army Electronics Command (ECOM), headquartered at Fort Monmouth, N.J., and Brig Gen Wilson R. Reed, CG of the Army Automatic Data Field Systems Command (ADFSC), Fort Belvoir, Va., issued a joint announcement of completion of the TACFIRE Project Definition Phase. The contract award is expected next month.

Total Package Procurement is a DoD concept that calls for competitors on a major project to submit technical designs, contract proposals and price quotations, thereby permitting the government to contract for development, production and field support of a delivered system.

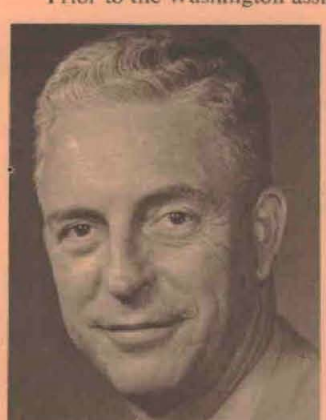
TACFIRE is part of the Army program to exploit new technologies of data processing and subminiature electronics. Dubbed ADSAF (Automatic Data Systems within the Army in the Field), it is a digital computer-based system to increase effectiveness of Army field artillery supporting fires by automation. Design requirements include significantly improved response time and accuracy.

General Reed is the Army project manager for ADSAF. Col Frederick C. Spann, who heads the TACFIRE Directorate at ADFSC, is TACFIRE program director.

STRATCOM Appoints Cauble Deputy CO

Maj Gen Richard J. Meyer's new deputy commander of the U.S. Army Stragegic Communications Command (STRATCOM), Fort Hauchuca, Ariz., is Brig Gen Gordon B. Cauble, who was promoted to one-star rank Nov. 1. He was special assistant to General Meyer in Washington, D.C., during the move of HQ STRATCOM.

Prior to the Washington assignment, Col Cauble served a tour in Vietnam with the 1st Signal Brigade, earning the Legion of Merit, until he became deputy assistant chief of staff, Communications and Electronics, U.S. Military Assistance Command. In the latter assignment, he received the Joint Service Commendation Medal.



Brig Gen Gordon B. Cauble

Col Cauble took over in his new duties from Col David R. Guy, who had served as deputy commander since Brig Gen Joyce B. James was assigned as deputy chief of staff, Communications-Electronics, North American Defense Command.

Commissioned in 1940 after graduating from Georgia Institute of Technology with a BS degree in mechanical engineering, Col Cauble also has a master's degree in business administration from Harvard University.

As a signal officer of the 29th Division during World War II, he participated in the Normandy invasion. He rose from lieutenant to lieutenant colonel in two years and was awarded the Bronze Star Medal as well as the Purple Heart.

Monkeys Shine in Exhibit

Edgewood Vets Create Display, Guidebook

Standards and regulations for the humane handling, care and treatment of animals used in research, as established in Public Law 89-544, have led to the creation of an exhibit and guidebook on subhuman primates by three Edgewood (Md.) Arsenal veterinarians.

The 1966 law specifies that adequate care of research animals shall be established and maintained under the supervision and assistance of a doctor of veterinary medicine.

In an effort to help fellow veterinarians meet the challenges of the added responsibility, Maj Robert A. Whitney Jr. and Capts Donald J. Johnson and W. C. Cole of Edgewood's Medical Research Laboratory embarked upon the guidebook and exhibit project.

Results of their research will be on view Nov. 19-22 at the annual meeting of the Association of Military Surgeons of the U.S. in Washington, D.C., and again next spring at the Federation of American Societies for Experimental Biology annual meeting in Atlantic City, N.J.

The exhibit has been shown at the 104th annual meeting of the American Veterinary Medical Association and received the award for the outstanding scientific exhibit at the 18th annual meeting of the American Association for Laboratory Animal Science, Oct. 2-6, at Washington, D.C.

The exhibit features color pictures of 11 common types of laboratory monkeys which were obtained by placing the animals in a specially built transparent plastic room, complete with tree.

The authors said the guidebook describing the display is not intended as a complete text, but was designed to give the veterinarian a broad familiarity with the subhuman primate and to provide references for more detailed requirements in specific areas.

"The Subhuman Primate: A Guide for the Veterinarian" is available for $3 from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Va. 22151.

Nike-X Test Site Receiving Largest Precise Power Plant

Delivery of the largest precise power plant ever built, a 20,000-kilowatt unit mounted on a converted Navy floating drydock section 240 feet long, will be made to the Nike-X Test Site on Kwajalein Island in the Pacific early in 1968.

The U.S. Army Corps of Engineers has announced the plant is capable of delivering intermittent net power of about 26 million watts for peak-load testing requirements for the developmental radar of the Nike-X antiballistic missile system. It was built by General Electric Co. under a contract for over $9 million.

The single contract included designing of the plant (by Bechtel Corp. of San Francisco, Calif.), modification of the drydock by the Baltimore, Md., plant of Bethlehem Steel Corp. and work by other subcountractors, as well as towing of the plant to Kwajalein, installation, testing and supervision of initial operation. The contract was let in May 1966.

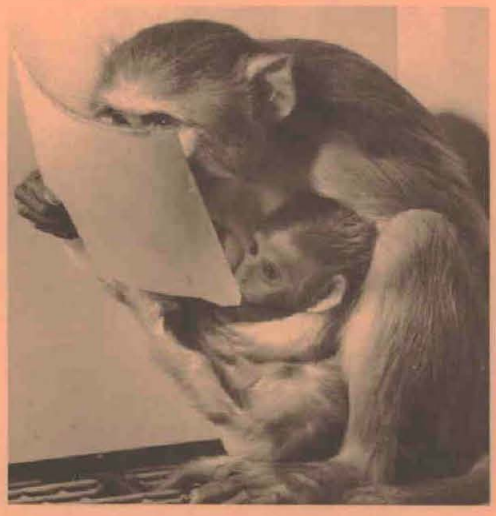
Both diesel and gas-turbine engines are incorporated in the plant. The diesel provides the base power load on a sustained basis and the gas-turbine engine will meet peak-load test requirements.

MECOM Names Chief Engineer

Appointment as chief engineer for the Mobility Equipment Command at St. Louis, Mo., last month ended a 12-year assignment for Lewis L. (Ron) Gober at HQ Army Missile Command, Redstone Arsenal, Ala.

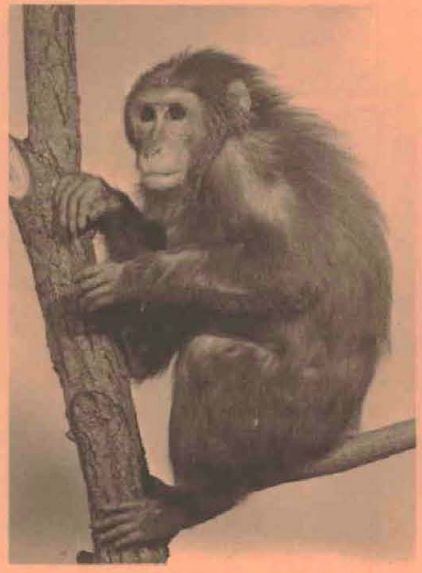
Gober played a prominent role in the development of several missile systems, including the Pershing, Lance, Sergeant, Honest John and Little John, and served more than three years as deputy project manager for the Mauler weapon system. He was chairman of the Missile Support Study Group, Land Combat Support Systems, when he departed Redstone.

NOTE: These are photos of Rhesus, Stumptail Macque and Black-Capped Capuchin monkeys featured in the Edgewood Arsenal exhibit displayed for 1,650 participants in the annual conference of the American Association for Laboratory Animal Science in Washington, D.C. One of the *Army R&D Newsmagazine* editors is responsible (or irresponsible!?) for the questionably facetious captions.



"There must be some mistake. You're *much too young* to report for basic training."

"You cut my appropriation!"



"I was a NASA reject."

"In the end, the root of man's security lies in his mind."