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Ceremonies Jan. 31 Commemorate Explorer I's Decade in Orbit

SPACE AGE PIONEERS of U.S. Army Ballistic Missile Agency (now the Army Missile Command), shown after 1958 launching of Explorer I, are (l. to r.) Eberhard Rees, director of ABMA Developmental Operations Division and now deputy to Dr. Wernher von Braun at Marshall Space Flight Center (MSFC); Maj Gen John B. Medaris, then CG of ABMA and now management consultant to Kennedy Space Flight Center; Dr. von Braun; Dr. Ernst Stuhlinger, who then headed ABMA Research Projects Office and currently is director, Space Sciences Lab, MSFC; W. A. Mrazek, then director, ABMA Structures and Mechanics Lab and now assistant director of MSFC Engineering, Industrial Operations; and Dr. Walter Haeussermann, then director of ABMA Structures and Mechanics Laboratory and currently director of MSFC Astrionics Laboratory.

Explorer I will begin its second decade in orbit at 10:56 P.M. (EST) Jan. 31 as the nation's first earth satellite, launched by the U.S. Army as part of America's contribution to scientific research during the International Geophysical Year (IGY).

Expected to continue in orbit for at least another year, Explorer I is circling the earth every 101 minutes. It has been in space longer than any other man-made object.

Explorer I was launched just 84 days after the U.S. Army received Department of Defense authority to attempt placing a satellite in orbit. That phenomenal achievement will be celebrated Jan. 31 in Washington, D.C., by an estimated 1,200 to 1,500 members of the Department of Defense-industry-academic scientific team that combined to make it possible.

The world-renowned Jet Propulsion Laboratory of the California Institute of Technology, which has had a dominant role in the United States space achievements since the "race to the moon" was started, has scheduled a symposium and

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Natick Laboratories Celebrate 25th Anniversary

Celebration of the 25th anniversary of the founding of the U.S. Army Natick (Mass.) Laboratories, Dec. 7-8, provided the occasion for leaders of the Department of Defense, academic institutions and industry to pay tribute to N-Labs' achievements.

"Founder's Day" served particularly to direct meritorious attention to the numerous end products of N-Labs research and development that represent rapid response to critical requirements in Southeast Asia.

In acclaiming that role, as well as the numerous scientific achievements of N-Labs over a quarter century of operation in serving needs of the U.S. Army for progress in providing better food, clothing and materiel for fighting men, visiting dignitaries sparked the pride of N-Labs workers.

Accolades came from Director of Defense Research and Engineering Dr. John S. Foster Jr., Assistant Secretary of the Army (R&D) Dr. Russell D. O'Neal,

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ASSISTANT SECRETARY of the Army (R&D) Russell D. O'Neal pins Army's Outstanding Civilian Service Medal on Brig Gen Georges F. Doriot (Ret.), president, American R&D Corp.

Featured in This Issue . . .

JPL Executive Succeeds Herzfeld as ARPA Head

Dr. Eberhardt Rechtin, a distinguished scientist of the Jet Propulsion Laboratory at the California Institute of Technology for the past 18 years, has succeeded Dr. Charles M. Herzfeld as director of the Advanced Research Projects Agency.

Until he filled the vacancy left by Dr. Herzfeld's resignation to enter private industry, Dr. Rechtin was assistant director of the JPL for Tracking and Data Acquisition. In his new duties he will be

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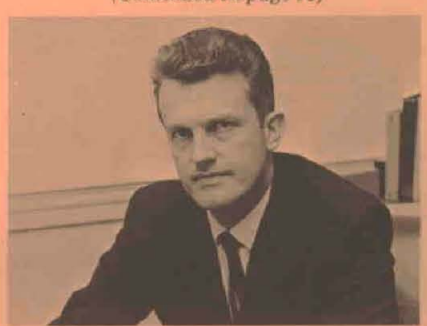

Dr. Eberhardt Rechtin

Army R&D Newsmagazine

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Foster Keynotes N-Labs' 25th Anniversary

Director of Defense Research and Engineering Dr. John Foster Jr. gave the keynote address at the 25th anniversary "Founder's Day" celebration at the U.S. Army Natick (Mass.) Laboratories, Dec. 7-8. The major portion of his address follows:

. . .Today we commemorate the founding of the Natick Laboratories. In short, congratulations! You have been successful; your role has been extremely significant for our country; and you have an important and exciting future.

The Natick Labs are primarily concerned with the combat soldier. We know that his courage, training, morale and effectiveness mean the difference between victory, stalemate or defeat. No matter how sophisticated our weapons and logistic systems, the soldier is the key to combat effectiveness. Vital ground always must be gained and held by foot soldiers who must fight the environment as well as the enemy. So your job — to consider the man and his needs — is absolutely essential.

This Army in-house laboratory is a tribute to the foresight and wisdom of such men as General Doriot, head of the Quartermaster Corps' R&D in 1942 and General Gregory, Quartermaster General in 1945. These men and their associates understood the R&D system. They saw the need to bring together several scattered fragments of the Army's R&D activities, and fashion a full spectrum R&D center, with activities ranging from research through product standardization.

You are now equipped with the most modern tools of science and engineering, concentrating on high-priority programs carefully tuned to the urgent needs of the combat soldier. Many steps being taken today to strengthen other in-house laboratories emulate the concepts underlying the creation of the Natick Laboratories.

Let me try to be quite clear about the fundamental reasons for requiring absolutely first class in-house laboratories in each of the Military Departments. First, we need — and the conflict in Southeast Asia has strongly reinforced our understanding of this need — a technological capability for quick responses to unpredictable needs and opportunities emerging from actual combat.

Second, we need an experienced "coupling agent" between the entire R&D community and the military commanders and planners. This coupling can be achieved best through an in-house lab structure when this structure is carefully designed and astutely managed.

Third, there are some unique military needs which can be most effectively met through an integrated in-house lab team without contractors' support. For example, when we do not expect a large production requirement, a lab may be the most efficient way to fulfill a requirement.

Fourth, there are technical areas and situations in which we have not stimulated, or cannot stimulate, an adequate capability outside the government and we must pursue an orderly program of R&D. For example, much of the work of your lab on the design of field food systems can be regarded as this sort of a problem.

We are enthusiastic about the need and the potential, for in-house labs, now and in the future. There are always difficult administrative problems in any large organization, no matter what its function. But because in-house labs are a critical component in the system to fulfill national security goals, both Secretary of Defense McNamara and I are prepared to provide any member of any in-house lab staff, and any manager influencing any lab's effectiveness, our whole-hearted personal support for the improvements that we all recognize are necessary.

Over the past 18 months, we have worked hard to improve certain technical management procedures and operations of the Defense laboratories. Last week I met with Directors of Laboratories, including Dr. Jay Tol Thomas, to appraise our progress to date. We have made more progress than many thought we would, and we will make more. We are on the verge of solving all the 42 administrative problems identified early last year. Let me summarize, and give you two examples.

At the present time, 80 percent of the identified problems have either been "solved" or we have implemented a time-phased method for solution. We are concentrating on the remainder, and by the end of this month, we will have made a major dent in each of the unsolved ones. Let me cite two examples of problems and actions.

The Problem — Relative lack of involvement of many labs in important systems and military decisions.

The Action — At least five major laboratories in each military department have been given new or augmented assignments with clear responsibilities in an important problem area and with respect to the associated systems.

The Problem — Laboratories do not have adequate local control over their research and exploratory development programs. Control over programs is fragmented.

The Action — In FY 67 we experimented in the Air Force with a concept of "one program element per laboratory." This worked out well. Both the Navy and Army have agreed to select, on a trial basis, three or four of their principal mission-oriented laboratories and to provide single element funding of research and exploratory development with a high

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Natick Laboratories Celebrate 25th Anniversary

(Continued from page 1)

Army Materiel Command Deputy for Research and Laboratories Dr. Jay Tol Thomas, and from noted educators and industrial executives.

(Excerpts from Dr. Foster's keynote address appear on page 2. The principal part of the program was recorded for transcription and distribution to interested agencies by the National Academy of Sciences — National Research Council.)

Problems of clothing and feeding the combat soldier were discussed in major presentations by Dr. Milton Harris, chairman of the American Chemical Society, and Dr. Emit M. Mrak, chancellor, University of California at Davis. "The Environment and Man" was the topic of Dr. Harwood S. Belding, Graduate School of Public Health, University of Pittsburgh.

Dr. William O. Baker, vice president for research, Bell Telephone Laboratories, presided at a series of presentations on "Looking Forward." Speakers were Dr. Herman F. Mark, Polytechnic Institute of Brooklyn, "Polymer Science"; Dr. William B. Reynolds, vice president for research, General Mills, Inc., "Food Science"; Dr. Lloyd M. Beidler, professor of biophysics, Florida State University, "Looking at Physical Sciences, Biological Sciences and Behavioral Sciences."

Assistant Secretary of the Army Dr. Russell D. O'Neal, banquet speaker, lauded N-Labs accomplishments in meeting urgent requirements of combat soldiers in Vietnam. He also reviewed some of the urgent work ahead. N-Labs Scientific Director Dr. Dale H. Sieling presided.

Dr. Jay Tol Thomas expressed the regrets of General Frank S. Besson Jr., CG of the Army Materiel Command, because prior commitments prevented his participation in the celebration.

In commending contributions of N-Labs to materiel needs in Southeast Asia, Dr. Thomas read letters of appreciation and praise from Lt Gen L. W. Walt, U.S. Marine Corps deputy commander, and Maj Gen Charles H. Rodman, MC, commander, HQ Aerospace Division, Air Force Systems Command.

One of the highlights of the ceremonies was a presentation by Brig Gen Georges F. Doriot (USA, Ret.), "Research, Past and Present," in which he discussed the creation of the predecessor organization of the Natick Laboratories. He served as chief of the Military Planning Division that set up the organizational structure in response to urgent requirements in World War II.

The then Col Doriot established the firm foundation for Natick as a well-staffed research and development center for the Quartermaster Corps by bringing in outstanding experts in every field — explorers and scientists who had studied arctic, desert and jungle climates and terrains and also were qualified to mobilize quickly the assistance of industry.

Dr. O'Neal presented Brig Gen Doriot a Certificate of Commendation that recognized him as "The Founder of Army Research and Development in Support of the Combat Soldier."

Great credit was acknowledged at the celebration to the 25-year record of assistance of the National Academy of Sciences-National Research Council. Through the Advisory Board on Military Personnel and its committees, the NAS-NRC provided critical assistance to N-Labs during World War II and has continued in this role.

Particular praise was directed to Dr. W. Lawrence Bass and Dr. W. George Parks, chairman and executive secretary of the NAS-NRC advisory group when N-Labs was founded. Dr. Parks has continued in this capacity for 25 years.

Acknowledgement was made also of the contributions of Dr. Ralph G. H. Siu, now Deputy Director of Development (Plans), U.S. Army Materiel Command, for his research on microbiological deterioration of materiel. Commendation was expressed also for the late Dr. Stuart A. Hunter, whose "energetic and persistent efforts (as scientific director) contributed significantly toward making these laboratories possible."

". . . This organization (consisting currently of about 1,800 employes) has continued to press toward its objective," stated one tribute, "to support the combat soldier with food, clothing and equipment which will make him the most efficient of any fighting man in the world."

World Communications Leader Retires

STRATCOM Commander Maj Gen Richard John Meyer, credited by top leaders in the Department of Defense for outstanding achievement in directing the building of a worldwide Army communications system, will retire this month after almost 39 years military service.

General Meyer has headed the Army Strategic Communications Command since 1964 and also is CG of the U.S. Army Electronic Proving Ground, Fort Huachuca, Ariz., where STRATCOM HQ moved a year ago from Washington, D.C.

STRATCOM now is a global organization of more than 50,000 people in 28 foreign countries. Six general officers and nine major Army communications commands report to General Meyer.

The largest of these, the 1st Signal Brigade in Vietnam, now a part of STRATCOM-PACIFIC, currently has a strength of 20,000 men, the biggest communications organization in Army history.

General Meyer pioneered the "dual hat" relationship throughout his command. Each of his commanders, from Europe to Hawaii and from Alaska to Panama, serves as a deputy chief of staff for communications-electronics for the area Army commander as well as his function as a STRATCOM commander.

General Meyer recently completed three major organizational moves. In coordination with Lt Gen Robert Hackett, commander of the Army Air Defense Command (ARADCOM), he established a STRATCOM Signal Group (Air Defense) at Colorado Springs.

As part of this effort, he established a STRATCOM Sentinel (formerly Nike-X) Resident Office attached to the Sentinel Systems Command at Redstone Arsenal, Huntsville, Ala. Effective Nov. 1, he merged the 1st Signal Brigade in Vietnam with STRATCOM-PACIFIC.

This command operates a massive communications system stretching from Hawaii to Okinawa to Japan, the Philippines, Korea, Thailand, and Vietnam.

General Meyer also has directed the building and operation of ground stations to relay communications from 18 satellites put into orbit 22,000 miles high.

As director of the Army's communications support of the Defense Communication Agency, he was a prime mover in the establishment of extensive wide band, tropospheric scatter and microwave systems that brought tomorrow's communications to the world today.

General Meyer's 39-year career includes services in three branches. He was commissioned in the Field Artillery when he graduated from West Point in 1933. He transferred to the Army Air Corps in 1935 and won his wings in advanced training at Randolph and Kelly Fields. He was detailed to the Signal Corps in 1938 and his first command was Company B, 51st Signal Battalion, Fort Monmouth, N.J.

General Meyer is a former commander of the Army's Signal Training Center at Fort Gordon, Ga. Before he assumed command of STRATCOM, he was deputy chief of staff, Individual Training, Continental Army Command, Fort Monroe, Va.

His decorations include the Legion of Merit, Bronze Star, French Legion d'Honneur, Officer, French Croix de Guerre, and Italian Medal of Valor.

Maj Gen Richard J. Meyer

Ceremonies Jan. 31 Commemorate Explorer I's Decade in Orbit

open house Feb. 1 and 2 in Pasadena.

The National Press Club in Washington will be host to between 200 and 300 U.S. and foreign journalists and selected members of the Explorer I "team" at a lincheon Jan. 31. Dr. Wernher von Braun, Director of the George C. Marshall Space Flight Center (MSFC), and Dr. William H. Pickering, Director of the Jet Propulsion Laboratory (JPL), will be guest speakers.

Present also at the head table will be Dr. James A. Van Allen, the University of Iowa scientist and professor noted for his discovery of the "Van Allen radiation belts" in the upper atmosphere; Maj Gen John Medaris (Ret.), CG of the U.S. Army Ballistic Missile Agency at Redstone which launched the Explorer I, Dr. Kurt Debus, Director of the Kennedy Space Flight Center; and Thomas F. Morrow, vice president, Defense and Space Group (Diversified Products) Chrysler Corp.

Joint sponsors of the reception, expected to draw more than 1,200 persons to the Washington Statler-Hilton Hotel the evening of Jan. 31, are the George Washington Chapter of the Association of the U.S. Army (AUSA) and a group of about 50 space pioneers headed by Senator John J. Sparkman of Alabama as honorary chairman.

General chairman of arrangements is Lt Col Charles M. Parkin Jr., a retired U.S. Army Corps of Engineers officer who is a member of the group of 50 and also of the AUSA. Mayor Glenn H. Hearn of Huntsville and James E. Record, chairman of the Madison County Board of Supervisors, will head a delegation of 200 Alabama "Space Age Pioneers."

Secretary of the Army Stanley R. Resor will present commemorative sterling silver medallions to five men recognized for their outstanding contributions to the launching of Explorer I. Selected for this distinction as a highlight of the reception are Dr. von Braun, Dr. Pickering, General Medaris, Dr. Van Allen and Thomas Morrow.

A further honor for these men will be the presentation of a scroll for achievement. On behalf of 10 representatives of the entire journalistic community reporting on space age activities, Eric Berghaust will present the scroll. Known as the biographer of Dr. von Braun, he is a former editor of *Missiles and Rockets* magazine. Peter S. Hackes, NBC news commentator and a member of the group, will preside as master of ceremonies.

Silver medallions will be presented also to 18 companies that made major contributions to the launching of Explorer I and are supporting the reception, namely: Chrysler Corp., Rocketdyne Corp., Reynolds Metal Co., Design Consultants of New York City, Lear-Siegler Corp. (Halamore Electronics Co.), Diversey Engineering Co. of Chicago, Lockheed Aircraft Corp. (Grand Central Rocket Co.), and

Ford Instrument Co. of Sperry Rand Corp., Marquardt Corp. (Cooper Development Corp.), General Electric Co., Globe Industry, Inc., Waste King Corp., Sprague Electric Corp., Curtiss-Wright Corp., Floturn, Inc. (Lodge and Shipley Corp.), Brown Engineering Co., Inc., R. H. Osbrink Manufacturing Co., and Radiophone Co.

Additional recipients of the commemorative medallion will be 200 individuals who will be nominated by their companies for the roles they played in making possible the launching of Explorer I. The concept of this award is that individuals often go unrecognized for work credited to their firms.

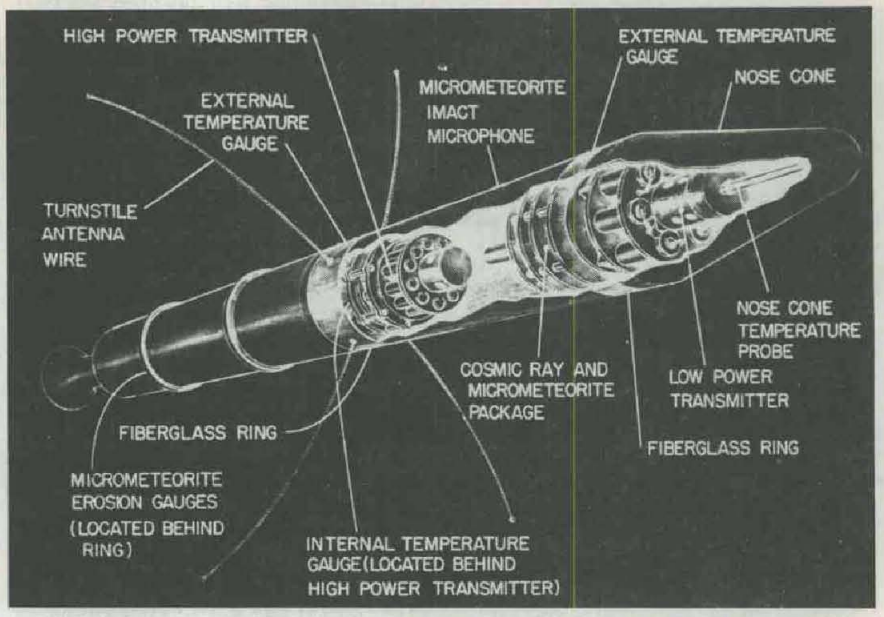
Accompanying each of these medallions, which will be mailed out after the reception, will be a card that will read: "Your name was submitted and you were selected as a Pioneer of the Space Age. Please accept this as a symbol of our appreciation for your dedication, your contributions and your enthusiastic support of the space program."

JET PROPULSION LABORATORY ceremonies in celebration of the launching of Explorer I will include addresses by Dr. Homer Newell, "A Look Ahead in Space Research"; Dr. James Van Allen, "Scientific Consequences of the First Explorer"; and Army Chief of Research and Development, Lt Gen Austin W. Betts. Dr. Joseph Kaplan, professor of physics, University of California at Los Angeles, will discuss the International Geophysical Year from his view as chairman of the U.S. National IGY Committee.

On the night it was launched at Cape Canaveral (now Cape Kennedy), the then unnamed satellite hardly seemed an instrument of destiny. It looked, someone said, like a cedar fence post painted in alternate silver and white stripes. Even from the blockhouse windows 500 feet away, it was difficult to discern the satellite perched atop the 68-foot-tall Jupiter C vehicle. It was immediately lost from mortal view at four seconds before 10:48 P.M. (EST), when the souped up Redstone ballistic missile — first stage of the composite Jupiter C — howled into life, then lifted slowly out of a web of searchlight beams into the darkness above.

Four hundred and 29 seconds later the satellite was injected into orbit, still attached to the burned-out motor case of the Jupiter C's fourth stage. The cylindrical package of satellite and motor case measured 80 inches from tip to tip, and weighed 30.8 pounds. A mere 10.6 pounds of scientific instrumentation was wedged within the 6-inch diameter shell of the satellite. Somewhere in there, too, rode the prestige of the United States.

Initial estimates placed the satellite's orbital lifetime as a few years. Now it is expected to remain in space until 1969 or later. At the low point of its orbit, it is coming within 208 miles of earth. Time and gravity are conspiring to drag it down into the atmosphere which it eventu-



EXPLORER I satellite has been in space longer than any other man-made object. Instrument carrying section (forward) and the final-stage rocket (rear) orbit as a single unit. Fanning out from the midsection is the antenna, made up of whip-like rods with weighted balls on the ends. The rotational spin of the satellite forced the antenna out from the satellite. Vital data was transmitted for 63 days.

ally must re-enter and disintegrate. The satellite seems reluctant to come down, but it had a hard time getting up there in the first place.

The Jupiter C came into being in the shops of the Army Ballistic Missile Agency (ABMA) at Redstone Arsenal, Ala., as a composite vehicle to test-fly small-scale versions of nose cones under development for the Jupiter Intermediate Range Ballistic Missile.

On Nov. 8 the Secretary of Defense gave the Army the go ahead to try a space shot with a Jupiter C as part of the International Geophysical Year program.

While ABMA's Development Operations Division under Dr. von Braun prepared the missile for flight, the Jet Propulsion Laboratory packaged into the cylindrical Explorer shell the radiation experiments designed by Dr. James A. Van Allen, State University of Iowa.

The Jupiter C booster was an elongated Redstone missile. A special fuel raised its thrust level from the Redstone's 78,000 pounds to 83,000 pounds. On top of the Redstone's tapering instrument compartment sat the aptly named "Tub."

Inside the sheet metal "tub" were clustered scaled-down solid-fuel rocket motors using the same propellant composition then under development for the Army's Sergeant ballistic missile. Eleven of these motors comprised the second stage. Nested inside were three more for the third stage. In the very center of the tub was a single solid motor — the fourth stage. On its end was the satellite.

Just prior to launch, electric motors spun the entire "tub" up to 600 rpm to provide spin stabilization for the upper stages between the time of booster cutoff and separation and second stage ignition.

On Jan. 29, the missile and firing crew directed by Dr. Kurt Debus were ready. High winds aloft forced a postponement. On the 30th weather forecasts were still unfavorable. A severe jet stream of 146 knots at 36,000 feet posed a real threat. A countdown began, but was halted when the weather did not improve.

Observations on the 31st still indicated 100 mile-an-hour winds aloft, marginal conditions. Concerned about the effects of further delay on the morale and efficiency of the firing crew, General Medaris gave the order to launch.

The countdown proceeded with only minor delays. Thirteen seconds prior to first stage ignition came the crisis. Instrumentation detected a deflection of one of the booster's jet vanes. It could have been a faulty reading. It could have been disaster. A cocked vane would have sent the launch vehicle off course to certain destruction.

Medaris and Debus at their positions in the blockhouse observation windows looked at one another for a long instant. Then Debus said: "Go ahead."

Seconds later the missile was on its way. One hundred 57 seconds after liftoff, the booster burned out. Five seconds later the booster separated and fell away. The spinning tub coasted silently on into the night, while all eyes in the blockhouse turned to a moving microswitch on the apex predictor.

The switch reached its contact point 403 seconds after liftoff. A radio signal flashed from the Cape to ignite the second stage and a very intent Army captain named Henry C. Paul saw a light flash on a console in front of him, counted "One thousand one, One thousand two" and stabbed a button in front of him to provide the manual backup triggering another radio signal from a tracking station far down range to the upper stage assembly hurtling overhead.

The second stage fired. Then automatic sequencers ignited the third and fourth stages. At fourth stage burnout the satellite had achieved orbital velocity, but no one on the ground knew that for sure. Instrumentation looked okay. Staging had been confirmed. Now all they could do was wait. Shortly after midnight at the Cape, JPL's tracking station on the West Coast acquired the satellite's radio signal as it completed its first circuit of the earth, confirming orbit had been achieved.

A few minutes later, Secretary of the Army Wilbur Brucker called General Medaris at the Cape to inform him that he and General Maxwell Taylor, then Army Chief of Staff, had selected the name Explorer for the Army satellite.

As the news stories began to move from Cape Canaveral and from Washington where Dr. von Braun, Dr. William Pickering, Director of JPL, and Dr. Van Allen met the press, Americans learned that they too had an object in space. In Huntsville, Mayor R. B. ('Spec') Searcy led a snake dance celebration in the city square amidst cheers that were echoed across the nation.

Almost overlooked in the sheer national joy of having matched the Soviets in achievement, if not in weight in orbit, was the point that the tiny Army satellite did the scientific job it was designed to do.

Before its last useable radio transmission, 63 days after launch, Explorer I's instrumentation had detected and provided vital data on the great trapped belts of radiation surrounding the earth. Scientists hailed confirmation of the Van Allen radiation belts as the greatest achievement of the International Geophysical Year.

Space Pioneers Still Hold Key Jobs

America's "First Family" of space pioneers consisted predominantly of Department of Defense employes and scientists and engineers cooperating in exploratory R&D efforts under contract with the U.S. Government. Their names still loom large against the background of the "race to the moon."

The list of achievements in building a strong foundation for the current multibillion-dollar U.S. space program is long and impressive. The tenth anniversary of the first orbital flight of a U.S. space vehicle, launched by the U.S. Army Jan. 31, 1958, provides the occasion for a review of some of the early significant events which led to today's space program, as follows:

- Penetration of outer space with a rocket fired Feb. 24, 1949.
- Successful firing of an intermediate-range ballistic missile, the Jupiter, in May 1957.
- Solution of the problem of reentry heat in August 1957.
- Placing a Free World satellite in orbit around the earth, the Explorer I, Jan. 31, 1958.
- Placing a U.S. satellite in orbit around the sun, Mar. 3, 1959.
- Placing primates into outer space and successfully recovering them, May 28, 1959.

Before the end of World War II, U.S. Army personnel were making progress in rocket development as a result of establishment, in September 1943, of a new organization to manage the field of rockets and guided missiles. With the cooperation of the Jet Propulsion Laboratory (JPL) of the California Institute of Technology, the Army became deeply involved within the following year.

In September 1944, London was bombarded by Nazi Germany's devastating new weapon, the V-2 rocket, developed by a team of scientists over an 8-year period at the German research center of Peenemunde.

When the war ended, the late Maj Gen Holger N. Toftoy, then with the U.S. Army Ordnance Technical Intelligence, helped to collect 130 of the key German rocket specialists, headed by Dr. Wernher von Braun, and bring them to the United States. They later became U.S. citizens and gave the United States rocket program a significant boost.

White Sands (N. Mex.) Missile Range, then the White Sands Proving Ground, was buzzing with activity on several Army missile projects by the fall of 1945. One was the firing of America's first liquid-propelled supersonic rocket, the Wac-Corporal, to an altitude of 43 miles. Firing of captured German V-2 rockets began there in May 1946.

The pace of progress was reflected by a 2-stage rocket, a modified V-2 carrying a JPL-developed Wac-Corporal, to an altitude of 259 miles on Feb. 24, 1959 — a record not equalled for eight years. This work provided the basis for the orbital flight of Explorer I.

Brief biographical sketches of some of the key men who made possible this epochal achievement follow:

DR. WERNHER VON BRAUN, head of the team which built the Jupiter C that carried Explorer I into space, was then with the Army Ballistic Missile Agency's Development Operations Division at Redstone (Ala.) Arsenal. He is now

(Continued on page 22.)

Cheyenne Performs Capably in First Public Flight

Dramatic high-speed and high-performance maneuverability capabilities of the Army's AH-56A Cheyenne advanced compound combat helicopter were demonstrated to the public for the first time Dec. 12, except that its devastating firepower was not exhibited.

High-ranking U.S. Government leaders and representatives of 813 subcontractors of Lockheed-California Co. gathered at Van Nuys, Calif., for the first public flight of the Advanced Aerial Fire Support System (AAFSS) aircraft designed to meet needs of modern warfare.

Among top officials who participated were Dr. Finn J. Larsen, Principal Deputy Director of Defense Research and Engineering; General Frank S. Besson Jr., CG, U.S. Army Materiel Command (AMC); Lt Gen Harry W. O. Kinnard, CG, U.S. Army Combat Developments Command; and Brig Gen Howard F. Schiltz, Director of Major Items, AMC.

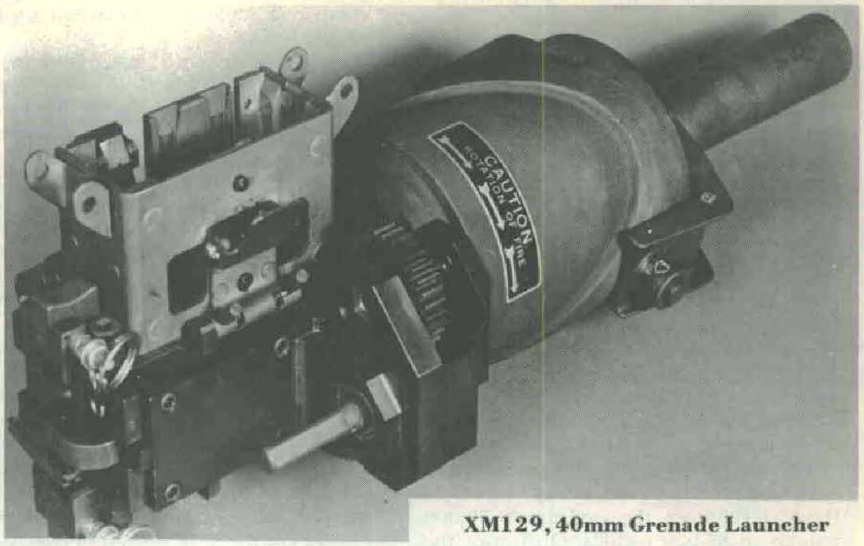
Lockheed Aircraft Corp. principals included Daniel J. Haughton, chairman of the Board and A. Carl Kotchian, president, as well as Charles S. Wagner, president, Lockheed-California Co.; and Jack G. Real, vice president and AH-56A manager, Lockheed-California Co.

Dr. Larsen and Brig Gen Schiltz paid high praise to the Army-industry teamwork, involving about 50 Army contractors other than the 813 subcontractors of Lockheed Aircraft Corp., in keeping the Cheyenne on schedule to its present state of development.

The project of designing and developing a completely new type of combat support aircraft was approved by Cyrus R. Vance, then the Secretary of the Army, in 1963. General Kinnard headed the task force which developed the airmobile concept, and commanded the 1st Cavalry Division (Airmobile) in Vietnam.

With Lockheed engineering test pilot Don Segner at the controls, the AH-56A made speed runs (top rated at 250 m.p.h.), quick stops, climbs and banks. No weapons were carried by the Cheyenne, but when armament is added the "flying tank" is expected to be "the toughest rotorcraft ever to go into action."

The weapons, being produced by industry under contracts from the U.S. Army Weapons Command, Rock Island, Ill., are the XM140 30mm automatic cannon, XM134 7.62mm minigun, and the XM129 40mm grenade launcher.



XM129, 40mm Grenade Launcher

The XM140 is an area and point weapon system for ground targets including personnel, armored personnel carriers, and other lightly armored targets. Rate of fire is 425 rounds per minute. Its round combines lethality over a large area, with the capability of penetrating armor.

The XM129 is a completely new grenade launcher that fires 40mm high-velocity, fragmentation-type ammunition. Its low-recoil forces permit it to be used generally where a caliber .50 or caliber .30 machinegun can be mounted. In the Cheyenne, the XM129 is mounted in a chin turret. It fires at rates of about 440 rounds per minute.

In addition to the above armament, six wing pylons, each with 2,000 pounds capability, can carry 2.75-inch rockets or tube-launched and optically tracked wire-guided (TOW) missiles — or a combination of both or other weapons.

A laser rangefinder will determine range instantly and transmit information to the central fire control computer which will be also integrating inputs from other Cheyenne components at the same time. This precise data gathered on enemy positions would be available also by radio to supporting ground artillery units.

A telescope in the gunner's station periscope sight will achieve a 12-power magnification. This means that from a mile-and-a-half distance, the gunner can sight and fire on an object as small as an automobile radiator cap.

Wearing a special helmet "linked" via infrared light beams to the fire control system, the pilot will have merely to look at a target, and preselected weapons follow his gaze, turning at the same time, aimed and ready to fire.

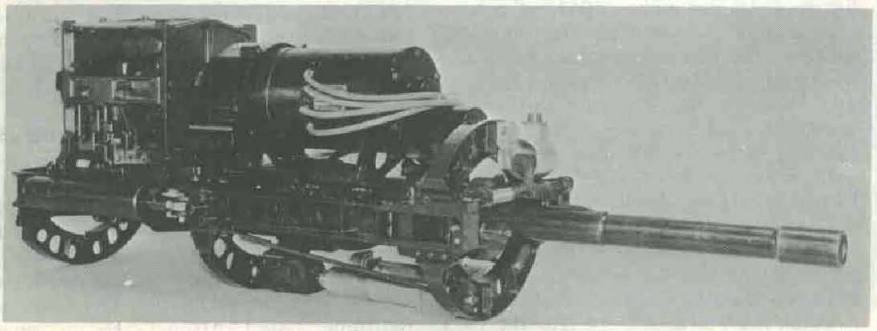
The pilot also will be able to lock the swiveling gunner's station to his helmet sight to designate targets to the gunner, automatically pointing him and weapons toward the target locations.

As the AH-56A Cheyenne winged helicopter took to the sky in its first public demonstration, another full-scale version of the aircraft had already "flown" the equivalent of 10 years, in tests on the ground, according to Lockheed-California Co. engineers.

Veteran of the concentrated testing is an instrumented AH-56A airframe that was subjected to the loads and stresses flying Cheyennes will undergo at various speeds and at different gross weights. These and other AH-56A tests have been underway at the Lockheed Rye Canyon Research Laboratory several miles north of the Burbank and Van Nuys plants.

In the certification fatigue testing, the airframe — fitted with hydraulic jacks and loading fixtures to simulate flight conditions — was under continuous test around the clock for 4,000 hours of projected service life. That is the equivalent of 6,400 flights, which would take the average combat helicopter about 10 years to accumulate.

Now in progress is a second round of the same tests that will "wring out" the same



XM140, 30mm Automatic Gun

airframe — equipped with strain gauges — to another "10 years of flying." The final examination will be the "static ultimate" test, in which the airframe will be subjected over a 3-month period to critical load conditions that are 1½ times as punishing as actual flight.

All dynamic components are tested at the Rye Canyon facility to demonstrate 3,600 hours of projected service life for certification. Rotor blades are evaluated on the world's most powerful rotocraft whirl tower. Communication systems are perfected at the antenna lab.

Before Cheyenne Army service tests start early in 1969, the AH-56A will have completed 2,000 hours of actual flight testing. Lockheed testing will go beyond the Federal Aviation Administration certification tests scheduled in 1968. After FAA certification, the Cheyenne tests will continue on the complete weapons system to comply with stringent Army requirements.

Development of the Cheyenne has been project managed by the Army since its inception in 1963. The Cheyenne program also has utilized the latest Defense Department management techniques of contract definition, evaluation, source selection and the related cost effectiveness/systems analysis studies.

The Cheyenne project has also attracted Defense-wide attention for development and application of the Integrated Technical Data System (ITDS) which is being handled by TRW System, Cleveland, Ohio.

The system features a Data Bank and Project Control Center which alerts management on deadlines, interface problems and a host of other matters requiring key decisions. This has aided in keeping the development on schedule and in assuring that all subsystems are compatible and properly integrated.

Lt Col Emil E. Kluever is Cheyenne project manager for the Army. An accomplished test pilot with Army and NASA experience, he was aboard the aircraft during its maiden flight in September to observe, at first hand, its performance characteristics. (See November issue, page 11, *Army R&D Newsmagazine* for initial test flight story.)

CORRECTION . . .

Annotated Bibliography of CRESS Publications and Reports on page 28 of the November 1967 issue of the *Army R&D Newsmagazine* gave an incorrect acquisition number for procurement from the Defense Documentation Center. The incorrect number was given as AD 851-367 and it should have been AD 815-367. Initial requestors for AD 851-367 may have received rejection notices, as this number had not yet been assigned to a document. Requestors should submit a new request for AD 815-367.

ASAP Schedules Winter Meet on Missile Technology

Army Scientific Advisory Panel members and consultants will consider "The Near-Term Technical Challenges for Missiles in the Army of the '70s" and hear reports of eight ad hoc groups at their joint winter meeting, Feb. 25-28, at Redstone Arsenal, Ala.

About 40 dignitaries from the Department of Defense, U.S. Army Materiel Command the U.S. Army Combat Developments Command, along with members of the Army Missile Command Scientific Advisory Group, will take part in the 4-day meeting. The ASAP consists of 23 members, 5 senior consultants and 40 consultants.

Maj Gen Charles W. Eifler Jr., MICOM commanding general, will be host to the sessions. One of the featured speakers will be General Hamilton H. Howze (USA, Ret.), who will discuss the Israeli campaign as the banquet speaker Feb. 26. Assistant Secretary of the Navy (R&D) Robert A. Frosch will discuss "Navy's Capability for Strategic Deterrence," as dinner speaker Feb. 27.

Other highlights will include swearing in ceremonies for two new members and 10 new consultants. Dr. Harold M. Agnew and Dean E. Fadum have accepted invitations to continue serving another two years as chairman and vice chairman.

Briefings will lay the foundation for discussion of such topics as "Missiles for General Support," "Missiles for Close Support" and "Missiles for Air Defense." The briefings and discussion will deal with a comparison of U.S. Army missile capabilities vis-a-vis those of the enemy.

Other sessions will be devoted to "Field Testimony on the Pershing System" and "Air Defense and Countermeasure Technology." A tour of missile R&D capabilities at Redstone Arsenal is slated.

Two ASAP ad hoc studies which have been used in the Army's formulation of future weapon systems plans will be surveyed relative to their impact on MICOM functions. The reports, "Combat Vehicle Weapons System (Long Range)," by Dr. William C. Tinus, and "Army Tactical Air Defense," by Prof. Lawrence H. O'Neill, have been distributed to the Army staff and major commands for review and comments.

Reports on progress of seven current ad hoc groups will be made by the chairmen, as follows: "Design Criteria for Future Armored Vehicles," Dr. Allen E. Puckett; "Vietnam," Dr. Jacob E. Goldman; "Review of Activities and Plans, Engineer Topographic Laboratory," Willis M. Hawkins; and

"Military Aspects for Geophysical Phenomena," Dr. Antonio Ferri; "Foliage Penetration Radar Systems," Dr. Andrew Longacre; "Developmental Lead Time," Herbert K. Weiss, "Ballistic Missile Defense," Willis M. Hawkins and "Dynamic Armor," Dr. Joseph E. Sternberg.

Dr. Puckett's group is completing its report for presentation to Assistant Secretary of the Army (R&D) Dr. Russell D. O'Neal. The group on Vietnam is charged with continuing studies on priority requirements for the duration of the conflict. The Engineer Topographic Laboratory Group, established in early September, also has forwarded its report to Dr. O'Neal.

Dr. Jack W. Rosengren, associate director, Lawrence Radiation Laboratory, accepted reappointment recently along with seven others who have served five years of more, namely:

Dr. Henrik W. Bode, professor of engineering, Harvard University; Dr. C. Stark Draper, director, Instrumentation Laboratory, Massachusetts Institute of Technology; Dr. William L. Everitt, dean of the College of Engineering, University of Illinois; and

Dr. Ernest J. McCormick, professor of psychology, Purdue University; Dr. Terris Moore, consultant, Cambridge, Mass.; Dr. Daniel E. Noble, vice chairman of the board, Motorola, Inc.; and Lt Gen (USA, Ret.) Arthur G. Trudeau, former Army Chief of Research and Development and now the president of Gulf Research and Development Co.

The former consultants were awarded certificates of appreciation recently signed by Secretary of the Army Stanley R. Resor, namely: Dr. W. George Parks, Maj Gen L. J. Sverdrup, (USAR, Ret.), Richard S. Morse, Dean John R. Dunning, Wilbur S. Hinman Jr., Dr. Charles B. Hitchcock, Dr. Henry G. Houghton, Dean Joseph M. Pettit, Dr. Edward C. Stevenson and Dr. Ernest H. Volwiler.

Training Facility Established For Sentinel System Personnel

Establishment of the Sentinel Central Training Facility at the U.S. Army Air Defense School, Fort Bliss, Tex., to train personnel for the first planned deployment of the Sentinel ABM System was announced recently by the Department of Defense.

Officers, warrant officers and enlisted men will be trained in artillery, ordnance and engineer skills necessary to operate the Sentinel System. In addition to individual job training, the agency will monitor ABM research and development efforts. Col Augustus R. Cavenna Jr. is director of the new agency.

Ultimate size of the agency is still in the planning stage. Activation of the new facility was announced by Maj Gen George V. Underwood Jr., Fort Bliss commanding general.

Adinaro Takes STRATCOM Post

Lt Col Joseph T. Adinaro, new deputy commander of the U.S. Army Strategic Communications Command-CONUS (USASTRATCOM-CONUS), succeeded Lt Col James F. Thornley when he retired.

Lt Col Adinaro was previously chief of the Transmission Branch, Plans Division, Defense Communications Agency. A veteran of World War II, he became in 1964 the first commanding officer of USASTRATCOM-PAC, Taiwan.

Army Evaluating Skills of Dogs for Special Duty

Cross-bred dogs as well as "blue bloods" of pure generic strain are being evaluated in a U.S. Army program to find a "super dog" which can cope with a critical problem in Southeast Asia — tracking the enemy and alerting troops to mines, tunnels, booby-traps and ambush.

Under an Army contract involving the Walter Reed Army Institute of Research (WRAIR) and the University of Maryland, 125 dogs are to be provided by August 1968. Twenty-five dogs in each of five breed categories are to be evaluated.

Col John J. Powell, Veterinary Corps, is chief of the Biological Sensor Team at WRAIR which is working with animal behavioral experts of the university's Canine Behavior Laboratory at College Park, Md.

The Army hopes to evaluate from 500 to 1,000 dogs next year, Col Powell said, using kennels and other spaces to be constructed at Edgewood (Md.) Arsenal, some 50 miles northeast of Washington, D.C.

The WRAIR team, consisting of three Veterinary Corps officers, one Army Medical Service Corps geneticist and enlisted veterinary technicians, will move to Edgewood when facilities are completed. In the meantime, evaluated dogs delivered to the team are kept in temporary kennels at Walter Reed Army Medical Center, Washington, D.C.

Principal investigator of the Army-university project is Dr. Roger W. McIntire, associate professor of the Department of Psychology at Maryland. He has three full-time assistants at the training kennel and about 15 part-time university students interested in animal psychology.

Scout dogs in Vietnam, usually on-leash-trained German shepherds, have been used there even before the U.S. and other nations joined in the conflict, and are now serving the Army and Marine Corps.

All of the U.S. military services use the German shepherd, primarily as sentries. The size, high degree of intelligence and potential viciousness of the dog are characteristics that date far back into history. They served nobly for the Allies in World Wars I and II and in Korea, and once were known as "warrior" dogs.

Handlers have learned from experience that the shepherds vary from dog to dog in signals they give as an "alert." A recent issue of a national magazine quoted a handler whose dog had sensed something in the Vietnam brush ahead. The shepherd wiggled his ears.

"Not yet, not yet," the handler told his platoon. In a few moments, the article said, the dog stiffened, almost as a pointer. "Now!" said the handler, and the soldiers bellied forward and escaped a Viet Cong ambush.

The five strains being evaluated by Dr. McIntire's laboratory are:

- Pure-bred Labrador retrievers (labs), as a hunting dog with excellent field control.
- German shepherds (sheps), the Army's favorite as sentry or "weapon" dog.
- A cross between Labrador retriever and foxhound, combining the lab's field action with the smaller breed noted for its sense of smell. (Cross-breeds differ from mongrels because the sire and dam each are pedigreed or the "family tree" is traceable. The heritage of a mongrel usually is not known. Only cross-breeds are used in this study.)
- Cross-bred German shepherd and small sheep-dog-type-collie with Labrador retriever, for size and combined intelligence.
- Pure-bred standard poodle, for intelligence. (The poodle frequently is the star breed at circuses, preferred by many professional trainers for their ability to learn difficult stunts.)

Dogs used in this research program are either bred at the laboratory kennels or purchased from commercial kennels.

Full evaluation of the dogs at Dr. McIntire's laboratory is performed in five stages and takes about 85 days. They are then sent to WRAIR, where the research team may decide to keep the best-rated dogs as breeding stock. Other suitable dogs are sent to Fort Benning, Ga., Army "canine headquarters," where they receive more training before going to Vietnam. Many Fort Benning shepherds are obtained from Lackland Air Force Base, San Antonio, Tex.

Each Army brigade in Vietnam is authorized one scout dog platoon. If fully complemented, the platoon would have 28-32 dogs controlled on leashes by trained handlers.

Ideally, the platoon's man "on the point" would have a dog trained to range silently within visual distance and give an alert signal to his handler, whether it be for recent presence of the enemy, enemy ambush, a weapons mine or booby trap, or location of a casualty.

An electronic device on the dog's harness, developed at the U.S. Army Limited War Laboratory, Aberdeen (Md.) Proving Ground, has undergone experiments on dogs trained personally by Dr. McIntire in another Army-Maryland project to explore feasibility of electronic detection. Handlers and dogs were sent to Vietnam from Fort Benning for initial testing.

Military dog training today is away from the "one-man, one-dog" concept and the verbal or hand-signal commands are standardized for all handlers. Scout dogs in Vietnam become familiar with each member of its platoon, part of the front-line training.

Use of dogs has been determined the most reliable thus far of the overall

GERMAN shepherd Slugger, well-trained 4-year-old favorite of the University of Maryland's Canine Behavior Laboratory, gently submits to handler Dale Reeves' demonstration of rudimentary method to teach dog to heel by command, hand signal and force.

Army Improved Biological Sensor Program. More than two years ago a meeting of experts in genetics, animal behavior and related fields was held at the U.S. Army Research Office (USARO), Arlington, Va. It was then agreed that no weapons system has been devised that can replace a *good* dog and handler for the specific unusual missions they can perform.

The Life Sciences Division of USARO, Office of the Chief of Research and Development, HQ Department of the Army, is monitoring the current program through the Medical R&D Command.

Training stages at the Maryland laboratory begin when the dog (male or female) is 10 to 12 weeks old:

- *Pretraining.* The handlers spend five days with the puppy to get mutually acquainted. A chain collar is used while the animal becomes accustomed to being handled with new surroundings, new people and new voices.
- *Constant Reinforcement* (CRF): Thirty days of constant petting and verbal reinforcement are employed while attempting to get the dog to respond to basic commands such as sit, come, down, stay and heel.

After the first 18 days of CRF, the dog is introduced to the 5-door maze but only two doors are used. One of the doors opens at the dog's push. CRF, including the 2-door "maze," is continued for 12 days.

(Note: While in training at the behavior lab, dogs are rewarded *only* by much

petting and verbal "good dog," except upon completion of the maze complex when the daily ration of food awaits the subject.)

• *Variable Ratio-6* (VR-6): The CRF continues; the dog is introduced to the 5-door maze. Upon response to the other training commands he is rewarded only after every sixth good performance. VR-6 lasts 18 days.

• *VR-16* (18 days): Continued petting and verbal reinforcement only after each 18 correct responses to commands. The maze confrontation continues. Some dogs master the entire maze in a few days, others sooner, and some spend as long as 45 minutes inside, scratching at incorrect doors and whining to get out.

• *Extinction* (18 days): The final stage when the dog is put through the verbal and hand commands he has learned *without any petting,* but the verbal "good dog" continues.

Rating of the animals is no haphazard affair. Relay programing equipment, a Random Probability Generator, inside the university lab records the seconds required for response, or latency, of the dog. The impulse to the counter comes from a remote button pressed by the trainer as he works the dog. A lighted control panel in the training compound tells the trainer which command the generator is ready to record.

Each dog's latency record is posted from the master counter by the trainers during the entire 89 days.

The maze training area is a series of wire gates, fences, passageways and wooden doors hinged at the top. The apparatus locking the several "incorrect" doors is connected to the indoor recording equipment. When the dog presses against a locked door, the error is recorded. In early periods of maze training, tidbits of food may be placed behind a "correct" door.

When the dog crosses the first threshold, the trainer starts the relay programing equipment. Errors and time in the maze are recorded for comparison.

An *Army Research and Development Newsmagazine* representative poised with camera at the maze exit had to be quick to snap Zeb, a trained Labrador retriever. The dog maneuvered the maze in less than six seconds and his only reward was a shutter click.

* * *

Assisting Dr. McIntire, a 32-year-old PhD from Louisiana State University, are Dale C. Reeves, whose father is a colonel at Fort Meade, and John J. Wagasky, Odenton, Md. Both learned their training skills from Dr. McIntire. In turn, they are teaching 1st Lt Stuart J. Dearing, MSC, a member of the WRAIR research team, to train others when transient troops come through for basic training instruction.

Lt Dearing has a BA degree from Western Maryland College (1964) and will receive an MA degree in genetics from the University of Maryland Medical School in August.

Dr. Hank Davis is a research associate for the laboratory but is not participating directly in the dog training program. He has an AB degree from Columbia University, an AM degree from Boston University and recently received his doctorate from the University of Maryland.

BESRL Details New, Ongoing Programs

New work units as well as ongoing projects are outlined in the FY 1968 work program of the U.S. Army Behavioral Science Research Laboratory, Washington, D. C.

The BESRL is a Class II activity under jurisdiction of the Chief of Research and Development, Department of the Army. Its mission involves investigations of scientific methods of personnel selection to achieve better utilization of acquired skills, to develop efficient training methods, to couple human factors to environmental factors and design of materiel, and to improve military operations.

Staffed with 135 officers and civilians, the BESRL also uses contract personnel for specific functions. Its five divisions are: Support Systems Research, Combat Systems Research, Statistical Research and Analysis, Military Selection Research, and Behavioral Evaluation Research.

Four work units and two independent research projects have been added to the proposed work program for FY 1968, subject to Congressional approval of funding. The new tasks are:

Human Performance in Night Operations (Night Operations). Sponsored by the Office of the Chief of Research and Development, this project is concerned with the human factors problems encountered in the use of the many new night vision devices.

There have been relatively few controlled laboratory or field studies to evaluate performance of the new devices, and few comparative studies of their relative effectiveness.

The Combat Systems Research Division will study who should use specific devices as well as how and under each of the varying combat conditions. Human factors will be considered and emphasis will be on required search time to focus on the enemy.

The next phase of research will be concerned with improvement of human search and perceptual performance with and without night-vision aids.

Studies will determine the effects of terrain, prior familiarization, degraded and partial images, and individual and team procedures upon performance in night operations. Included will be the study of the effect of prolonged activity on performance.

Computerized Models for the Simulation of Policies and Operations of the Personnel Subsystems (SIMPO I). The Statistical Research and Analysis Division job is:

• To analyze the personnel subsystem to determine points at which decisions are made, operations which affect total system effectiveness, and criteria by which systems may be evaluated.

• To simulate the personnel systems in order to predict and assess the total result of policy changes.

(Continued on page 24)

GEOALERT Using New Radio Code

Worldwide GEOALERT radio broadcasts in the familiar "dots and dashes" of the international Morse code are now being transmitted in a new letter-coded system. Effective Jan. 1, it provides more detailed information on solar and geophysical events.

The National Bureau of Standards reported that improved techniques in observing and predicting geophysical events made the code change necessary. Previous codes have been superseded and the new system explained in Circular Letter RWC 101, Sept. 13, 1967, available from Chairman, International Ursigram and World Days Service (IUWDS), Environmental Science Services Administration (ESSA), R4.2, Boulder, Colo. 80302.

The international Morse code (also known as the continental code) GEOALERTS, issued daily by the World Warning Agency of IUWDS, are broadcast as a very slow sequency of dot-dash symbols from radio stations WWV (Fort Collins, Colo.) and WWVH (Maui, Hawaii) on each of the standard radio carrier frequencies.

The messages alert experimenters and researchers in radio, geophysical and solar sciences to outstanding solar or geophysical events expected to occur that day or which began in the preceding 24-hour period.

Forecasts are made each day at 0400 UT (Universal Time) at the World Warning Agency at ESSA, Boulder. GEOALERTS for a given day are first broadcast at 0418 UT on station WWV and at 0448 UT on WWVH. The broadcasts are repeated at hourly intervals until a new alert is issued.

Each message beginning with the letters GEO in Morse code means a solar or geophysical message to be followed by the coded information in three sets of letters repeated three times in slow Morse code.

The first set concerns either *forecasts* of the event or the observation and *prediction* for the next day of a stratospheric warming (STRATWARM). The second and third sets of letters pertain to the occurence and approximate time of observed solar or geophysical events.

CE Project Aims to Stimulate Appalachian Economy

Six Appalachian counties in eastern Kentucky are the heart of a U.S. Army Corps of Engineers pilot project recommended to stimulate economic growth through development of water power and related resources.

Approval of the report on the Upper Licking River basin in Kentucky, the first report submitted to the Board of Engineers for Rivers and Harbors in response to the Appalachian Regional Development Act of 1965, was announced Dec. 1. It awaits Congressional approval.

The Board of Engineers for Rivers and Harbors is an independent review agency established by Congress to "scrutinize Army Corps of Engineer project proposals."

The board chairman is Maj Gen Robert G. MacDonnell, president of the Mississippi River Commission, Vicksburg, Miss. Other members are Army general officers from various U.S. geographical locations except for the Corps' resident member in Washington.

The pilot report on the Upper Licking River was submitted "to demonstrate the role which water resource development may play in stimulating growth and progress in an economically distressed area, and to test the new evaluation criteria. . .being formulated to measure the total performance and economic impact of a water resource plan."

The report is focused explicitly on economic growth and social well-being. It is termed a "radical departure" from the traditional water resource development reports of the Corps of Engineers and policies are being formulated to meet the new objectives.

Effectiveness of the plan to achieve economic growth depends to a large extent on the initiative and vigor of non-federal interests in attracting industry to the improved area.

Non-federal costs for water supply, recreation and other projects will be repaid by local interests to the U.S. Government, which will bear the initial

School Studies CAI for Electronics Training

In response to a requirement of the Chief of Research and Development, the U.S. Army Signal Center and School at Fort Monmouth, N.J., is spearheading a study to determine if Computer Assisted Instruction (CAI) can be used to accelerate training of electronic technicians.

A contract for conducting the feasibility study recently was awarded to the International Business Machines (IBM) Corp., which is using the 1500 Instructional System — the corporation's first system specifically designed for Computer Assisted Instruction.

CAI uses the computer as an aid for teaching and learning. It instructs the student, gives him problems to solve and grades the results. It has a capability to seek out the best learning path for each student's needs and aptitudes and provides a unique learning path for each student. CAI also gathers detailed data about the progress each student makes, and gives the instructor more time for proctoring.

The current feasibility study is geared to practical application of electronics training. Taken from the Signal School's conventional instruction, the lessons have been converted to a CAI format and are being presented for actual classroom evaluation.

Brig Gen Thomas M. Rienzi, commandant of the center and school, recently established the CAI Project Office, to direct development and evaluation of the program. The staff consists of education specialists and classroom instructors from the Signal School. Col Walter G. Runte is project manager and Dr. Vincent P. Cieri is technical director.

Based on the completion and review of the feasibility study, a decision will be reached as to the desirability of proceeding with expanded development of CAI in electronics training at the Signal School.

If the feasibility of such training is established, it is anticipated that it will have far-reaching effects of future military training and education.

The Office of the Deputy Chief of Staff for Individual Training, U.S. Continental Army Command, is coordinating the CAI project between the Signal School and the Department of the Army

COMPUTER ASSISTED INSTRUCTION holds possibilities for converting assignments to meet the student's learning capacity. Here a Signal School student gets help from his proctor, using a board showing a basic circuit.

MERDC Teaches R&D Briefing

"Effective R&D Briefing" has been inaugurated by the U.S. Army Mobility Equipment Research and Development Center, Fort Belvoir, Va., as a part of its employe development program.

The overall objective of the special course is to train senior engineers and others to present effective briefings. It is designed primarily for key personnel who often are called upon for significant presentations.

Melvin C. Shetler of Arlington, Va., now a consultant to industry and government following his retirement from government service a few years ago, is serving as instructor.

MICOM Names Col Miller New SAM-D Project Manager

Col James C. Miller Jr. is the new project manager for development of the SAM-D (Surface-toAir-Missile Development) defense system at HQ U.S. Army Missile Command, Redstone Arsenal, Ala.

Scheduled to be fielded in the 1970s, SAM-D will have a capability of simultaneously acquiring, identifying, tracking and destroying multiple targets.

A 1943 graduate of the U.S. Military Academy, Col Miller is a veteran Army R&D missile officer. He served from 1955 to 1959 as a staff officer with the Air Defense Division, Office of the Chief of Research and Development.

His most recent tour of duty was with the Weapons Systems Evaluation Group, Office of the Secretary of Defense in Washington, D.C. He was awarded the Joint Service Commendation Medal for outstanding service.

During World War II, Col Miller took part in the Normandy, Rhineland and Central Europe campaigns, winning the Bronze Star Medal and the Combat Infantryman's Badge. He won a second Bronze Star in 1952 as an Ordnance officer in Korea.

He served tours as executive officer of the Ordnance Research and Development Rocket Sub Office at Fort Bliss, Tex., and with the Military Assistance Advisory Group to the United Kingdom as Ordnance officer and as guided missile adviser.

Col Miller holds a master's degree in mechanical engineering from the University of Southern California and is a graduate of the Army Command and General Staff College.

Col J. C. Miller Jr.

costs to permit economic development as planned.

The Upper Licking River was selected for study as being reasonably typical of the central Appalachian region, with a limited potential for economic growth that can be partly offset by water-resource development.

The Office of Appalachian Studies will later submit a report on development of similar resources in other parts of the Appalachian region, which includes all or part of 12 states from New York to Mississippi.

The study showed that population and total employment in the six counties has decreased more than 50 percent since 1940. Personal income is reported low in comparison with average incomes in the state, the Appalachian region and the nation.

Any significant industrial development in the study area is precluded by the lack of level, flood-free lands. The area has a low-level of public services with a characteristically low tax base.

The most valuable resource in the 6-county area is its potential labor force. Example: when a small industrial plant opened at Salyersville, Ky., 500 people applied for 80 to 100 jobs.

The recommended Upper Licking River basin plan includes five elements. The first two involve the Corps of Engineers construction of a $29 million dam upstream from Salyersville, near Royalton, and improvement of the channel capacity of 14.7 miles of the Licking River and the lower 1.18 miles of the State Road Fork, estimated at $4.2 million. This would provide flood protection to the lands expected to be developed for industrial uses. Stream banks below the 1,000-acre Royalton reservoir also would be preserved and beautified.

The Soil Conservation Service of the U.S. Department of Agriculture will provide three small dams (total cost $2.4 million) on tributary streams, and will act to accelerate land treatment in the basin. A 60-acre recreation pool is included.

The combined estimated first cost of the first four elements of the proposed plan is $37.2 million. The fifth element provides for development of about 1,800 acres of land for industrial, commercial and residential uses. This development would be regulated and sponsored by a public, quasi-public or private nonprofit organization over 50 years.

Total estimated investment from 1970 to 2020 is about $208 million.

Army Engineers Direct Sentinel Construction

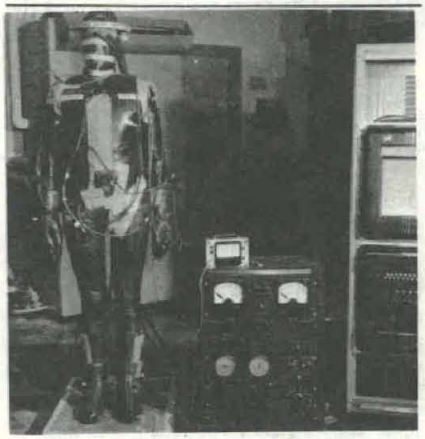
The U.S. Army Corps of Engineers will direct the design and construction for deployment of the Sentinel antiballistic missile system, the Department of the Army has announced.

The work will be performed by the newly organized Huntsville Engineer Division with support from other divisions and District Engineer offices throughout the Corps.

Temporarily headquartered in Alexandria, Va., the new division ultimately will be located at Huntsville, Ala., adjacent to the Sentinel System Command at Redstone Arsenal which is responsible for development of the ABM system.

Brig Gen Robert P. Young, former head of the Army Engineer Command, Europe, is the new Division Engineer. Col George A. Rebh, Tulsa District Engineer, has been named Deputy Division Engineer.

As construction proceeds, an area engineer will be appointed at each Sentinel site to manage the construction.



"COPPER MAN" used by the U.S. Army Research Institute of Environmental Medicine, Natick, Mass., to test suitability of apparel worn by members of the Armed Forces under different climatic conditions. The manikin is dressed in a skin diver's suit proposed for use in the Sealab II Program. Skin temperature control console is in center, and at right is the skin temperature recorder. Data obtained from this manikin have been used in the design of hot weather uniforms, body armor, raincoats and specialized protective clothing at the Army Natick Labs.

Army Engineers Allocated $1.3 Billion for Civil Works

Congress has appropriated $1,300,329,000 for FY 1968 Civil Works projects of the U.S. Army Corps of Engineers in all 50 states, the District of Columbia, Puerto Rico and in the Virgin Islands of the U.S.

The General Construction Program is funded at $967.5 million for 299 projects. Operation and Maintenance totals $190 million and $87.1 million will support flood control along the Mississippi River and its tributaries.

The FY 1968 state-by-state summary compiled by the Office of the Chief of Engineers, Department of the Army, states: "At this time, there is a suspension on the advertisement and award of new contracts for construction.

"Both the Administration and the Congress are considering a review of the Government's obligation and expenditure programs for the Fiscal Year 1968. Until final decisions are reached, it is not known to what extent the projects and amounts shown on the State-by State List will be affected."

Appropriations in each of seven states exceed $50 million. Others range downward to $54,000 for Utah for a comprehensive basin survey. Wyoming has no projects but benefits from such civil works programs as flood control, navigation and power projects on waterways and tributaries of neighboring states.

The appropriation for the Virgin Islands (western islands of the V.I. group, including St. Croix, St. John and the St. Thomas seaport Charlotte Amalie) is $65,000 for flood control. For Puerto Rico, the flood control and navigational project appropriation is $580,000.

The largest of state appropriations, listed by millions, are: Arkansas, $151.9; Washington, $126.06; Illinois, $67.3; California, $65.79; Ohio, $61.96; Texas, $58.7; and Oklahoma, $57.7.

Col Vandever Heads CDC Materiel Division at APG

Col James M. Vandever was assigned as chief of the Materiel Division, U.S. Army Combat Developments Command Maintenance Agency at Aberdeen (Md.) Proving Ground, following a 2-year tour as director, Command and Staff Training Department, U.S. Army Ordnance Center and School.

Prior to his assignment at the USAOC&S, Col Vandever served a tour as director, International Programs and Systems, Office of the Assistant Secretary of the Army (Installations and Logistics). From 1958 to 1961 he served as senior ordnance adviser, Military Assistance Advisory Group, Japan.

He is a graduate of the Command and General Staff College, Fort Leavenworth, Kans.; Army Management Engineering Course, Rock Island Arsenal, Ill.; Ordnance Officer Advanced Course, Aberdeen Proving Ground; and the Industrial College of the Armed Forces, Washington, D.C.

Col James M. Vandever

DoD, EJC Publish Comprehensive Scientific Thesaurus

The Making of TEST (Thesaurus of Engineering and Scientific Terms) is a 176-page "Final Report of Project LEX," culminating 29 months of collaborative effort by Department of Defense agencies and the Engineers Joint Council (EJC).

Authored by J. Heston Heald of the Office of Naval Research in his capacity as chairman of the Project LEX working group, the report is expected off the press this month or next. The thesaurus is an interdisciplinary vocabulary of more than 23,000 main terms.

The document provides the standardized language for indexing subject contents of scientific and engineering information. It fixes the meaning and scope of these terms when used in communications between libraries and users of information systems.

Heald explained that some delays in preparation of the final report were experienced in the testing and "debugging" of programs of computer-controlled typesetting on the Linotron, the new high-speed equipment installed by the U.S. Government Printing Office. The report is the first publication of its kind to be printed with this GPO equipment.

When published, the report will be obtainable from the Defense Documentation Center, following primary distribution to government sources. The document number is AD 661001.

Project LEX officially started Dec. 13, 1965, and Heald details its history and the inside working mechanisms in his report. Space for a basic work force of 12 to 14 full-time employes and equipment was provided in Tempo E Building in Washington, D.C.

The joint project with the EJC developed after a short time when it was realized that the EJC revision of its first (1964) edition of the *Thesaurus of Engineering Terms* and the Department of Defense project had parallel objectives.

Similar publications were reviewed in establishing the need for a modern TEST, including the work of the Defense Documentation Center (DDC), formerly the Armed Services Technical Information Agency (ASTIA). In 1958 ASTIA began converting major operations to automated systems. That led to publication of a Thesaurus of ASTIA descriptors and the reindexing of 180,000 reports dating back to 1953.

The American Institute of Chemical Engineers (AIChE) published the *Chemical Engineering Thesaurus* in 1961 and, although unknown by either organization, ASTIA and AIChE followed similar patterns.

ASTIA published a second edition in two years and, in 1964, the Engineers Joint Council published its thesaurus, broadening the base of AIChE's lead to include essentially all engineering disciplines. Thesauri were cropping up on many fronts by 1964, especially in the fields of research and development.

Becoming prevalent were microthesauri, that is, specific expansions in narrow subject fields. There was no central guide to follow and no two thesauri were built the same way, creating barriers of communication that inhibited networks.

Recognizing the need for a government-wide guide, the Committee on Scientific and Technical Information (COSATI), under the Federal Council for Science and Technology, developed the COSATI *Subject Category List* (SCL), published in December 1964.

The SCL was made purposely on a broad subject scale, with 22 major scientific and technical fields subdivided into 178 groups. It provided "a base upon which any activity could build a more specific terminology."

Director of Defense Research and Engineering Dr. John S. Foster Jr. set forth the mission and called for three products in a 10-page memorandum issued Oct. 12, 1965. He requested a manual setting forth DoD conventions for thesaurus building, a thesaurus of scientific and technical descriptors, and recommendations for any changes to the *COSATI Subject Category List* that might become apparent during the course of work.

The selection of the "code word" LEX (not designated in the DDR&E memo) was a carefully thought-out term which rapidly became a key word in the total effort. It assisted in communications, alignment of panels, procurement of supplies and terminology. It was a simple unique reference to the entire effort.

"LEX" was selected as the first syllable of "lexicon," since a thesaurus is a form of lexicon. "LEX" also means law or authority, the nature of the end product. Another connotation, "in full," is suggested by the broad coverage of TEST.

The Foster memorandum established an estimated requirement for 910 man-weeks (17½ man-years) of civil service employe time from the assigned staff. The project actually used 876 man-weeks.

The best authorities available each spent several or many hours to assist Project LEX. Heald lists the bibliography of reference material on more than 23 pages of *The Making of TEST*. More than seven pages list the LEX panel participants. Complete appendixes confirm the authoritative nature of the project. More than 100 existing systems are melded into TEST.

Explicit techniques that may well serve with COSATI's SCL as a model plan for future government or industry efforts when a "Project Colossus" is directed are delineated in the "Final Report of Project LEX."

Installations Utilize Young Scientific Talent

Young scientific talent being gainfully employed by men in Army uniforms is illustrated by 1st Lt Rudolph H. Kizer Jr. and Sp/4 Robert L. Bowen Jr. of Aberdeen (Md.) Proving Ground and 1st Lt William Haile Jr., Redstone (Ala.) Arsenal.

Lt Kizer has a master of science degree in ceramic engineering from Clemson University. Assigned to Aberdeen as a proof officer in the Development and Proof Services, he is conducting tests on armament and vehicles to insure that they satisfy specified Army requirements.

Specialist Bowen, who has a bachelor of science degree from West Virginia Institute of Technology, works with Lt Kizer as a test director. He is responsible for seeing that U.S. Army Test and Evaluation Command materiel tested under his direction meets the Master Test Plan standards.

"We spend an average of 45 days testing each vehicle," Specialist Bowmen said. "During that time a vehicle may find itself in just about every situation it ever will meet."

Comparison tests also are run at Development and Proof Services on vehicles and equipment already in use by the Army. The items are chosen at random to insure that each performs absolutely the way it is supposed to do.

Lt Haile uses his doctorate in mechanical engineering at the Missile Command in studies of missile performance, with computer simulation playing a major role. He works in the Systems Dynamics Branch, Advanced Systems Laboratory, Research and Development Directorate.

Lt Rudolph H. Kizer Jr. and Sp/4 Robert L. Bowen Jr. examine armament material at Aberdeen Proving Ground.

ECOM Plans Antenna Workshop

The U.S. Army Electronics Command (ECOM) has scheduled a workshop Feb. 13-15 to bring together researchers and electronic idea-men from various government agencies, universities and industrial firms to discuss tactical antennas for VHF man-pack radio sets.

The meeting will be held at Fort Monmouth, N.J., under sponsorship of the ECOM Communications and Automatic Data Processing Laboratory.

Rippey Succeeds Goldenthal at SATCOM

Col George E. Rippey became commander of the U.S. Army Satellite Communications (SATCOM) Agency, Fort Monmouth, N.J., when Col Mitchel Goldenthal was assigned recently to J-5 (Plans and Policy), Office of the Joint Chiefs of Staff.

Col Rippey served as SATCOM Agency deputy commander from August to December 1967. In his new assignment he also is serving as Army project manager for Satellite Communications, exercising full line authority and responsibility of the commanding general, U.S. Army Materiel Command.

Col Rippey is a graduate of the University of Kansas with a degree in electrical engineering. His military schooling includes the Coast Artillery School, Signal School Advanced Officer's Course, the Command and General Staff College, and Defense Weapons Systems Management Course.

Listed in *Who's Who in Engineering* as a teacher and leader in the field of communications who has made outstanding contributions to research and development, he holds the Army Commendation Medal, the Joint Service Commendation Medal and the Greek War Cross.

Col Rippey entered the Army in 1940. From 1943 to 1946, he served as Signal officer in the Mediterranean and European Theaters. In 1947, he became chief of the Communications Division at Second Army Headquarters, Fort Meade, Md., later he was Signal adviser to the Greek 9th Mountain Division and was decorated by the government of Greece for outstanding service.

The colonel subsequently served as an instructor with the 28th Infantry Division of the Pennsylvania National Guard and the ROTC unit of the University of Michigan. Then he was a Plans officer in the Office of the Chief Signal Officer in Washington, D.C.

Other assignments: special project officer at Fort Huachuca, Ariz.; deputy Signal officer of the U.S. Army in Hawaii; Division Signal officer, 25th Infantry Division and commanding officer of the 125th Signal Battalion in Hawaii; chief, Systems Engineering Division at the Defense Communications Agency in Washington, D.C.; and Corps Signal officer of I Corps in Korea.

Col George E. Rippey

NBS Reactor Provides New Research Facility

Critical reaction of the National Bureau of Standards Reactor (NBSR) was achieved Dec. 7, providing laboratories in the Washington, D.C., area with an important new fundamental research facility as the climax of more than nine years planning.

Located at the NBS laboratories at Gaithersburg, Md., the new reactor facility was under construction for more than four years. It will be operated at low power for testing purposes until funds become available for operation at its full power of 10 megawatts.

NBS officials announced that the reactor was designed to provide NBS and other laboratories in the Washington area "with an extensive central facility where neutron beams can be used for fundamental research on materials of all kinds."

The primary need of these laboratories, it was explained, is for high-intensity thermal and subthermal neutrons to measure properties of ordinary matter, such as the location of atoms in a crystal or the force between atoms. New knowledge is needed to provide more precise standards for industry and new tools for research.

Now that the reactor has attained a critical reaction, fuel loading and core configuration tests must be conducted to determine flux effects for special applications. In addition, precise maps of the flux in the core must be made under a variety of operating conditions so that accurate predictions of fuel burnup can be calculated and the power decay in the core determined as a basis for full-scale operation.

LWL Technical Director Resigns

Internationally known optics expert Edward K. Kaprelian, technical director of the U.S. Army Limited War Laboratory (LWL) at Aberdeen (Md.) Proving Ground since its establishment in 1962, will resign Dec. 31 to become vice president and technical director of Keuffel and Esser Co.

Established in New York City 100 years ago, K&E is one of the world's leading manufacturers of engineering supplies and equipment. Kaprelian will work in Hoboken, N.J., where the main offices and major plant are located.

Kaprelian holds more than 50 patents for optical, photographic, electronic and chemical processes and devices in the U.S., Great Britain, Germany, France and Switzerland.

(This number exceeds that of 40 patents reported for Dr. Henry P. Kalmus of Harry Diamond Laboratories in the December edition of the *Army Research and Development Newsmagazine* unofficial contest to find "The Man with the Mostest." However, Kaprelian has not filed a documented claim for the honor.)

Kaprelian served on the LWL Planning Group responsible for staffing, planning, coordination and execution of the LWL research and development programs. In five years, the LWL has provided more than 60 new or improved materiel items to the U.S. Army in Southeast Asia for operational use or evaluation.

Kaprelian was personally responsible for the analysis of a large collection of photographic lenses brought from Germany after World War II and he made available to American industry the formulas and characteristics of the valuable designs.

His many accomplishments include the development of U.S. Army cameras for long-range ground photography in both the infrared and visible spectrums. He also was responsible for the development of motion picture and still cameras, processors and processes for silver halide materials, ultra-high-speed lenses, and xerographic materials and processes.

Kaprelian was deputy director of research at the Army Signal Research and Development Laboratory, Fort Monmouth, N.J., before joining the Limited War Laboratory. Other positions include director of Research and Engineering, Kalart Co. (1952-55); and chief of R&D in photography and optics for the old Army Signal Corps (1946-1952). A Fellow, former president, and director of the Society of Photographic Scientists and Engineers, Kaprelian also is a Fellow of the Physical Society of London and a senior member of the Institute of Electrical and Electronic Engineers.

He served as a member of the National Research Council, National Academy of Sciences, from 1957-1965. He is a member of the American Society of Mechanical Engineers; Optical Society of America; New York Patent Law Association, and several honorary scientific societies.

He received the Army's highest commendation, the Exceptional Civilian Service Award, in 1963.

Kaprelian graduated from the Stevens Institute of Technology in 1934 with a mechanical engineering degree. He studied law and physics at George Washington University.

Edward K. Kaprelian

Aerodynamics Discussed at Rocket Ballistics Meet

Aerodynamic forces which influence trajectories were discussed by 100 scientists at the Army-sponsored Unguided Rocket Ballistics Conference held recently at the New Mexico State University at Las Cruces.

The host for conference was the Atmospheric Sciences Office of White Sands (N.Mex.) Missile Range, which is approximately 25 miles from Las Cruces. The office is part of the Atmospheric Sciences Laboratory, Army Electronics Command, Fort Monmouth, N.J.

Representatives from universities, private industry and Department of Defense agencies presented 24 technical papers which focused primary concern on how the wind velocity and air density create aerodynamic forces that critically influence the trajectories of rockets.

Capability of accurately estimating an unguided rocket's flight is of particular concern to Army atmospheric scientists at WSMR, since they are responsible for predicting the point of impact of all burned-out stages and the payload section of all rockets fired at the range complex.

Presently the most complicated predictions are for the U.S. Air Force Athena unguided rockets which are fired from the Green River, Utah, launching site and impacted at WSMR approximately 400 miles away. If wind direction and speed are not accurately estimated along the rocket's flight path, WSMR safety requirements necessitate destruction of the test vehicle.

On several occasions the impact point, due to wind direction and speed, was more than 150 miles from the uncorrected impact point, if there were no wind present. Ninety consecutive successful flights of the Athene rocket have been made by applying wind corrections to the rocket's trajectory.

The unguided reentry vehicles which will be tested in the near future at higher altitudes and over longer distances will require continued refinements in the techniques for predetermining the rocket's impact point.

Leading aerodynamicists and meteorologists presented papers on results from recent wind tunnel research and results from operational testing of rockets which have added to the overall knowledge on rockets, bombs and missiles as influenced by aerodynamic forces.

A 1968 conference on advances in research to correct ballistic rocket trajectories through improved methods of observing and computing the variable factors influencing their flight will be held late this fall (date and location undecided).

ECOM, Canadian Scientists Plan Annual Meet

Exchange of information between the Canadian Defense Research Board and the U.S. Army Electronics Command on the state-of-the-art in electronic research and development is being facilitated as an outgrowth of a meeting at Fort Monmouth, N.J.

ECOM Science Deputy and Chief Scientist Dr. Hans K. Ziegler, who arranged the 4-day session, said it is now planned as an annual event, based on the view of participants that it was highly successful in promoting improved understanding.

"All of us seem to agree," he said, "that the meeting was mutually profitable in the very large areas of military electronics and related research and development in which the U.S. and Canada share common interests."

Dr. Robert C. Langille, leader of the 20-member Canadian team that visited Fort Monmouth, and Deputy Chief Superintendent (Programs) in the Defense Research Telecommunications Establishment, reiterated Dr. Ziegler's views in a letter to Maj Gen William B. Latta, commanding general of ECOM.

The Fort Monmouth meeting was arranged as a counterpart of participation of ECOM scientists in the electronic portion of the annual symposium conducted in Ottawa by the Canadian Defence Research Board.

Dr. Ziegler attended the 1967 session in Ottawa and Dr. Robert S. Wiseman, director of ECOM's Combat Surveillance, Night Vision and Target Acquisition Laboratories, presented a technical paper on night vision.

In addition to visits to ECOM laboratories and briefings on their activities, the Canadian team was briefed at the U.S. Army Satellite Communications Agency (STATCOM) and at headquarters of the Mallard Project.

This is an 8-year multibillion-dollar project to develop a tactical communication system for field armies, navies and air forces of the United Kingdom, Canada, Australia and United States.

The Canadian group included many of the country's leading scientists and defense program administrators, including Dr. Guy Giroux, Dr. Derek Pletter, Dr. Jacques Bealieu, Albert Laflamme and John Higgins of the Armament R&D Establishment.

Representatives of the Defence Research Telecommunications Establishment included Dr. John N. Barry, Roy McG. Dohoo, Walter L. Hatton, Donald F. Page, Keith W. Lacey and Donald R. McCaskill.

Dr. Bertram C. Blevis, Dr. John E. Mayhood and Jean-Charles Baril represented the Canadian Defence Research Staff (Washington). The Canadian Forces HQ was represented by Capt Paul Renaud, vice chief, Defence Staff Branch, Capt Ronald T. Shiga and Douglas H. J. Norman. LT Col Alexander C. Smart and Maj John Kirk Robertson attended from the Technical Services Branch.

ECOM Appoints Liaison for West Coast

Improved liaison between the research interests of West Coast universities and the Army Electronics Command has been brought about by establishment of a permanent office at Stanford University.

The command's liaison officer in the McCullough Building of Stanford Electronics Laboratory, is Pete H. Hudson of ECOM's Electronic Components Laboratory.

Hudson is a candidate for a doctorate in electrical engineering. He is doing his postgraduate study and research at the Solid State-Electronics Laboratory, a part of the Stanford Electronics Laboratory, and is considered one of ECOM's leading authorities on integrated circuitry.

ECOM Science Deputy and Chief Scientist Dr. Hans K. Ziegler said that the continuity provided by a highly qualified permanent representative on the West Coast will improve the already strong scientific ties of the ECOM with the universities and related research institutions of the region.

"Creation of the new office," he added, "will help to remove some of the inconveniences of geographic separation in the speedy exchange of advanced information between the academic community of the Pacific area and Electronics Command technical people."

Pete H. Hudson

Air Force Colonel Selected As Mallard Project Deputy

Col Gardner W. Engel of the U.S. Air Force is the new assistant U.S. deputy program/project manager of the Mallard Project under the Army's Brig Gen Paul A. Feyereisen.

Col Engel formerly was stationed at headquarters of the Electronic Systems Division at L.G. Hanscom Field, Mass.

Contract Orders Compass R&D

The U.S. Army Mobility Equipment Research and Development Center, Fort Belvoir, Va., awarded a $29,528 contract to Luminous Products Division, New England Nuclear Corp., for R&D on the luminous materials used in compasses. The radioactive material, Tritium (Hydrogen^3) and Promethium-147, will be molded into the plastic dial.

Ellis Assumes Duties As ATAC Deputy CO; Callahan Heads HDL

Confirmed by the U.S. Senate for promotion to brigadier general, Col Vincent H. Ellis is the new deputy commander of the Army Tank Automotive Command (ATAC), Warren, Mich.

He was succeeded recently as commanding officer of the Harry Diamond Laboratories (HDL), Washington, D.C., by Col Leslie G. Callahan, who had served since August 1965 as director of the U.S. Army Electronics Command's Avionics Laboratory, Fort Monmouth, N.J.

An Army ordnance officer for more than 25 years, Col Ellis has commanded the HDL since May 1967 and has served all but one year since 1959 in research and development assignments.

From June 1964 to April 1967, he was assigned to the U.S. Army Materiel Command, Washington, D.C., first as chief of the Infantry Weapons Branch, then as chief of the Weapons Branch in the Development Division, Directorate of Research and Development. In 1962-63, he was an AMC staff officer and a project manager for combat vehicles.

Col Leslie G. Callahan

Col Vincent H. Ellis

For three years previous, he was with the Office of the Chief of Ordnance in Washington, D.C. He served as assistant to the chief, Artillery and Vehicle Systems Branch and later as chief of the Artillery Section.

From 1957 to 1959, he was a special assistant to the senior ordnance officer and later a maintenance adviser to the Turkish Ordnance Department, Joint U.S Military Mission for Aid in Turkey.

Col Ellis has a BS degree from Kansas State University and an MS degree from Cornell University. He has attended the Command and General Staff College and the Air War College.

COL CALLAHAN is a 1944 graduate of the U.S. Military Academy and holds MS (1951) and PhD (1961) degrees in electrical engineering from the University of Pennsylvania. He also is a graduate of the Command and General Staff College, the Industrial College of the Armed Forces, and the Army Signal School Advanced Signal Officers' course.

Prior to his Electronics Command assignment at Fort Monmouth, N.J., Col Callahan commanded the 51st Signal Battalion (Corps) in Korea. He has served as executive officer of the Army Research Office at Durham, N.C.; technical operations officer of the Army Liaison Group, Project Michigan at the University of Michigan; and research and development coordinator for the Continental Army Command, Fort Monroe, Va.

MICOM Uses Moire Patterns in Missile Tests

An "optical illusion of great precision" is being used by the U.S. Army Missile Command (MICOM), Redstone Arsenal, Ala., as a tool for strain analysis of missile components.

The quoted description applies to moire patterns, which are a current vogue in art for producing wild optical effects.

The moire fringe phenomenon appears as patterns of alternating light and dark fringes whenever a repetitive structure is overlayed with another structure and the line elements are nearly superimposed.

The effect can be seen, for example, when two mismatched window screens are superimposed. The patterns change wildly when the two structures are moved in relation to each other. (The word "moire" is from the French word for watered or moire silk, such as the Chinese produced in ancient times.)

At MICOM, Judson Griffin and other engineers in the Propulsion Laboratory of the Research and Development Directorate are using the phenomenon to explore methods of insuring structural reliability of materials for missile motors.

The traditional analysis approach has been with strain gauges. A major disadvantage of the gauge, however, is that it is physically attached to the object being measured, and changes in the attached gauge mask the changes in the object being measured.

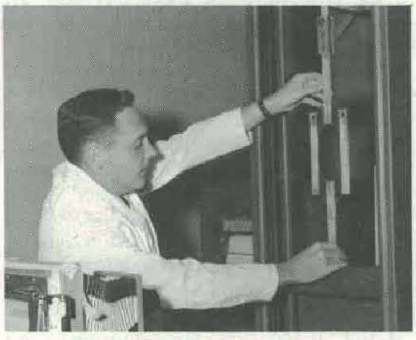
Gauges are also ineffective at high temperatures, while the moire technique, an optical strain gauge, is readily adaptable to temperature changes.

The technique now being used in the Propulsion Laboratory is to print grid lines on one side of the specimen to be tested and place it before a camera with the grid toward the lens. A special ground glass, on which a grid is printed identical to that on the specimen, is located at the camera back.

When strain is applied to the specimen, the lines change in relation to those on the glass plate, and the rapidly changing moire patterns show on the ground glass.

A high-speed camera records the patterns, enabling the variation of strains on the specimen to be determined.

Griffin said that by determining structural reliability of missile components in the laboratory, the need for some full-scale testing eventually may be eliminated. Another application would be a simple "go, no-go" instrument using the moire principle to test missiles suspect of being damaged in the field.



IN SEARCH OF A PATTERN, Judson Griffin, Missile Command engineer applies strain to a specimen. The moire patterns serve to analyze strain effects.

CDC Commander to Preside At 2 National Aviation Meets

Lt Gen Harry W. O. Kinnard, CG, U.S. Army Combat Developments Command, Fort Belvoir, Va., has accepted the chairmanship for two national aviation meetings in Washington, D.C.

His first gavel-wielding will be as program chairman of the American Helicopter Society's annual technical symposium in May. In October, following the 14th annual meeting of the Association of the U.S. Army, the Army airmobility pioneer will be chairman of the conference of the American Association of Army Aviators.

The former commander of the First Cavalry Division (Airmobile) was the dinner speaker at the recent American Helicopter Association Technical Symposium held at Fort Monroe, Va. He gave the audience of helicopter engineers some of his views on the role of the helicopter today and in the future.

Lt Col J. A. Holman Jr.

Lt Col R. T. O'Brien

1st Lt. P. R. Wozniak

CW4 J. E. Whalen

R. A. Wilburn

OCRD Announces 5 Personnel Assignments

New personnel in the Office of the Chief of Research and Development include Lt Col Jonathan L. Holman Jr., Lt Col Robert T. O'Brien, 1st Lt Paul R. Wozniak, CW4 John E. Whalen, and Roland A. Wilburn.

LT COL HOLMAN, formerly CO of the 185th Maintenance Battalion, Long Binh, Vietnam, is now with the Technical Development Division, Sentinel System.

From 1963 to 1965 he was deputy chief, Systems Engineering Division, Pershing Project, U.S. Missile Command, Redstone Arsenal, Ala. He was with the 2d Battalion, 92d Artillery, Germany, in successive assignments as B-Battery Commander and S-3 in 1961-62.

A 1951 graduate of the U.S. Military Academy (USMA), he received an MS degree in mechanical engineering from the University of Southern California in 1956. He has also completed the Artillery Advanced Course and has attended the Command and General Staff College (C&GSC).

LT COL O'BRIEN is the new chief of the Communications Branch, Communications-Electronics Division. He served as chief of the Welfare Branch, Personnel Services Division, G-1, U.S. Army, Vietnam, October 1966 to July 1967, following two months as commander of the 121st Signal Battalion, 1st Infantry Division.

Other assignments have included chief of Field Operations, Instrumentation Support Group, U.S. Army Combat Developments Command Experimentation Support Group, U.S. Army Combat Developments Command Experimentation Command (USACDCEC), August 1965 to January 1966, and project officer, Electronics and Instrumentation Office, USACDCEC, July 1963 to August 1965. From May 1959 to July 1962, he was operations officer, HQ Signal Office, Supreme Headquarters Allied Powers Europe.

A 1949 graduate of the USMA, Lt Col O'Brien received an MS degree in electronics engineering in 1959 from Stanford University. He has attended the C&GSC and the Armed Forces Staff College.

1st LT WOZNIAK has been assigned to the Army Research Office as a staff officer in the Behavioral Sciences Division. He earned a PhD degree in sociology from the University of Massachusetts in 1967.

A Reserve Officer Training Corps cadet while an undergraduate at Canisius College, Lt Wozniak was commissioned in 1963 and deferred from Army duty while studying on a fellowship. He recently completed the Infantry Officers' Basic Course No. 3 at Fort Benning, Ga.

Lt Wozniak, who specialized in demography and minority group relations, wrote his dissertation on "Assimilation Into a Pan-Catholic Sub-Society."

CW4 WHALEN was administrative assistant to the North Atlantic Treaty Organization Military Committee for 11 months before assignment as administrative officer in the Office of the Executive for Administration. He succeeds CW4 Joe C. Garner, who has been assigned to Vietnam after OCRD duty since 1961.

CW4 Whalen served as administrative assistant to the commanding general, Eighth Army Korea, 1966 to 1967; personnel officer, Yuma Proving Ground, Ariz., 1964-1965, and administrative officer, Medical Division, U.S. Army Europe, 1959 to 1964.

MR. WILBURN brings to his position as contract specialist in the Contracts and Grants Branch, Research Programs Office, 18 years of government experience.

From 1963 to 1967 he was a contract specialist and contract price analyst with the U.S. Army Materiel Command, following five years in the U.S. Army Signal Corps Finance Office. He also worked nine years as a contract examiner with the General Accounting Office.

He attended Southeastern University of Law and Accounting in Washington, D.C., and has completed 14 government-sponsored financial courses, including 12 given by the U.S. Army Finance School, Fort Benjamin Harrison, Ind.

Steering Committee Seeks Numerical Analysis Papers

The U.S. Army Mathematics Steering Committee (AMSC) is inviting Army employes to contribute papers on numerical analysis, and related fields of computation or scientific data processing, for presentation at the 1968 Army Numerical Analysis Conference, Apr. 25-26, at Fort Monmouth, N. J.

Sponsored by the AMSC on behalf of the office of the Chief of Research and Development, the meeting is organized to exchange information of interest to the scientific and technical staffs and to the managers of Army computers.

Dr. John H. Giese, chief of the Computing Laboratory, Ballistic Research Laboratories, Aberdeen Proving Ground, Md., is chairman of the AMSC Subcommittee on Numerical Analysis and Computers.

The organizing committee is planning one-hour addresses on applications of symbol manipulation programs, computer graphics and numerical analysis.

It is anticipated that papers will be presented on applications of the Fast Fourier Transform, and on the recently installed time-shared computing system at the U.S. Army Electronics Command.

Interested organizations that have not received invitations to prior Army Numerical Analysis Conferences are urged to contact Dr. Francis Dressel, Army Research Office-Durham, Box CM, Duke Station, Durham, N.C. 27706.

JPL Leader Succeeds Herzfeld as ARPA Head

(Continued from page 1)

responsible for planning, initiating and directing R&D programs as assigned by Dr. John S. Foster Jr., Director of Defense Research and Engineering.

Presented with NASA's Space Act Award in recognition of pioneering work in space communications systems, Dr. Rechtin also received the Medal for Exceptional Scientific Achievement for outstanding contributions in the design, development and operation of NASA's Deep Space Network for tracking, communications and control of the U.S. lunar and planetory exploratory spacecraft.

Graduated from California Institute of Technology with a BS degree in 1946, he continued his studies there and received a PhD cum laude in 1950. Among his many honors are fellowships in the American Institute of Aeronautics and Astronautics and the Institute of Electrical and Electronic Engineers.

Dr. Rechtin has traveled to many parts of the world as a member of the NATO Advisory Group on Aeronautical R&D Avionics Panel and as director of the NASA Deep Space Network.

5 Depart OCRD for New Positions, Retirement

Five key personnel terminated service recently with the U. S. Army Research Office (USARO), Office of the Chief of Research and Development, to accept new assignments and positions.

COL TYRON E. HUBER ended seven years as chief of the Life Sciences Division when he retired recently from the service to accept the position of technical consultant to the head of the Federation of American Societies for Experimental Biology.

Col Huber was deputy director of the Walter Reed Army Institute of Research (WRAIR) from 1958 to 1960. His career also included assignments as special assistant to the director, WRAIR; chief, Medical Research Branch Research and Development Division, Office of The Surgeon General; chief, Medical Service and deputy commander, U. S. Army Hospital, Yokohama, Japan; and tours at Brooke Army Hospital, Madigan Army Hospital, and Camp Seibert, Ala.

He graduated from the St. Louis University School of Medicine in 1940.

COL GUY H. DREWRY Jr., who was deputy chief of the Physical and Engineering Sciences Division since 1965, has been assigned to the Office of the Deputy Director of Defense Research and Engineering (Research and Technology). He is staff assistant for special studies, Office of the Assistant Director, Laboratory Management.

Col Drewry succeeds Col Raymond S. Isenson, also formerly of USARO, who has been assigned to the staff of the Military Assistance Advisory Group, Bonn, Germany, as a research and development officer.

Before his USARO assignment, Col Drewry was chief of the Nuclear-Chemical-Biological Division, Research and Engineering Directorate, U. S. Army Munitions Command, Dover, N. J.

He holds a BS degree in electrical engineering from the Virginia Military Institute, an MS degree in aeronautical engineering from the California Institute of Technology, and has done graduate work in nuclear physics at Johns Hopkins University. He has also attended the Command and General Staff College.

MAJ DIANE DICKE, staff officer in the Human Factors and Operations Research (later Behavioral Sciences) Division, since October 1965, has departed to take the Officers' Advanced Course at the U. S. Women's Army Corps Center, Fort McClellan, Ala.

Following completion of the 24-week course, she will be assigned to the WAC School. Former assignments included chief of the Reception-Processing Division of the WAC Center, and WAC selection officer, St. Louis, Mo.

A 1953 graduate of Lindenwood College, she holds an MBA degree from the University of Washington. Before entering the Army in 1961, she was dean of women at Westminster College, Salt Lake City, Utah.

ROY D. GREENE, chief of the Research Programs Branch, Research Programs Office, since 1963, has transferred to the Army Materiel Command as chief of the Program Authorization Branch, Program Management Division, Development Directorate.

Greene has been with the Research Programs Branch since 1961, when he came to USARO through the management intern program. A graduate of Western Kentucky State College, he holds a master's degree in public administration from American University, which he earned on a special study program initiated by the Secretary of Defense.

He received the Meritorious Civilian Service Award last fall.

FRANK H. WRIGHT, a technical information program coordinator in the Programs and Concepts Branch of the Scientific and Technical Information Division since 1962, retired Dec. 29. A retired Army colonel whose military career spanned 40 years, he served in both world wars.

Preprototype Dragon System Undergoes First Firing Tests

All test objectives were accomplished in the firing of the Dragon antitank weapon system Dec. 11, in what project officials described as the first in a series "to evaluate all components and operational characteristics of preprototype hardware."

Fired from a fixed launcher, the missile impacted on the target with bullseye accuracy, test officials said. The launching was conducted by McDonnell-Douglas Corp., Dragon system prime contractor, with support from the U.S. Army Missile Command Test and Reliability Evaluation Laboratory.

In preparing for these tests, subsystem components have been tested at Cape Kennedy. Later in the program, Army gunners at Redstone (Ala.) Arsenal will conduct more advanced testing, including firings at both stationary and moving targets using live warheads.

The 28-pound, shoulder-fired Dragon is powerful enough to "kill" armor and other field fortifications, and can be carried anywhere a soldier can pack a rifle. It will replace the 90mm recoilless rifle and is reported to be far superior in range, accuracy and lethality. It will be deployed at platoon level.

Lt Col Kenneth C. Van Auken is project manager and Allan Platt is deputy manager.

Edgewood Arsenal Gains 3 Key Personnel

New personnel at Edgewood Arsenal, Md., include a new director and two new division heads.

Col Sidney L. Wells is director of Technical Support, Lt Col Janice A. Mendelson is on the Research Laboratories Wound Ballistics Survey Team, and Lt Col Albrecht F.J.W. Sommer is chief of the Occupational Health Division of the Army Environmental Hygiene Agency.

Col Wells last served in Korea as deputy commander of the U. S. Army Procurement Agency. Other assignments have included chief of the Management Logistic Division of the Army Chemical Schools Command, Fort McClellan, Ala., 1963 to 1966, and chemical officer for the 3d Infantry Division and in the Chemical Division, HQ U. S. Army Europe, Heidelberg, Germany, 1961 to 1963. He is a graduate of the University of Maryland.

Lt Col Mendelson has returned to Edgewood after a 10-month tour at Fort Sam Houston, Tex. She is currently chief of the Wound Data and Munitions Effect Team (CONUS) at the Medical Research Laboratory, Edgewood. She served at Edgewood for eight years as a general surgeon and chief of the Trauma Investigation Branch, Biophysics Division, Medical Research Laboratories.

Graduated from Wilson Teachers College in 1943, she received her medical degree from the University of Pittsburgh in 1947 and earned a master's degree in medical science from Ohio State University in 1952.

Col Sommer joined Edgewood as chief of the Occupational Health Division following an 8-month residency in preventive medicine at Watson Army Hospital, Fort Dix, N. J., where he also completed a global medicine course.

A 1950 graduate of Johns Hopkins University, he received a master's degree in anatomy (1952) and a medical degree (1956) from the University of Colorado. He then went on to earn a master's degree in public health from the University of Minnesota (1964), following three years as a dermatologist at the Army's 34th General Hospital in France.

Col S. L. Wells

Lt Col J. A. Mendelson

Lt Col A. F. J. W. Sommer

Researching Blast Effects of Nuclear Explosions

By Branch Chiefs Leo Ingram, John Strange, William Flathau
U.S. Army Engineer Waterways Experiment Station, Vicksburg, Miss.

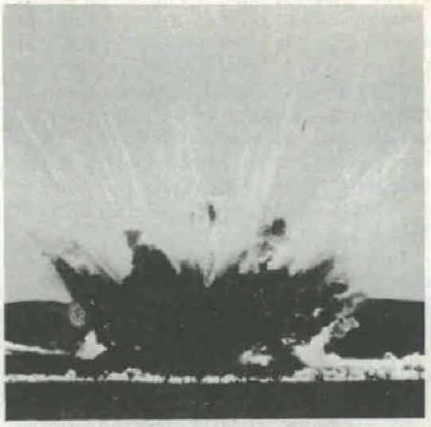
From the 13th Century, when gunpowder was first produced, until World War II, explosion yields were measured in quantities seldom larger than a few thousand pounds. The advent of nuclear energy changed this picture drastically. Conversion of a small amount of mass into the radiant and mechanical energies of nuclear explosions boosted yields to levels that are measurable in kilotons and megatons.

To determine in measurable units the destructive capabilities of such weapons and to understand fully the hazards involved in their employment, the Pacific Proving Ground (PPG) and the Nevada Test Site (NTS) were established. Full-scale nuclear field tests are conducted at these sites for the purpose of developing weapons effects and employment knowledge.

Since certain mechanical (blast and shock) effects of nuclear explosions are quite well simulated by the detonation of conventional high explosives, such explosions are used to model or scale the mechanical effects of nuclear explosions. High-explosive testing, along with theoretical and analytical studies, are used extensively today to develop basic knowledge.

RESEARCH AT WES. Explosion effects research was introduced at the U. S. Army Engineer Waterways Experiment Station (WES) in December 1950 with a study of explosion effects in shallow water to include definition of the propagation-attenuation characteristics of the water shock wave, airblast, and water surface waves emanating from the high explosive (TNT) energy sources. Underwater crater measurements were also obtained during the initial study.

Explosion effects research at WES has continued uninterrupted since that time and includes the study of all blast and shock phenomena arising from detonations in the atmosphere relative to the coupling of explosion energy into the earth (water, rock, or soil), detonations on the surface of the earth, and detonations at various depths of burial or depths of submergence.



SURFACE EXPLOSION on exposed limestone during Operation Flat Top, Nevada Test Site, at which cratering and ground motion were studied.

Shock interaction effects on such targets as buried protective structures, dams and tunnels also are being studied. WES research also includes management of and /or participation in a number of large-scale field tests at the PPG, NTS, and the Defense Research Establishment, Suffield in Canada.

Nearly all explosion effects research at WES is characterized by a common first approach, that is, the development of a theoretical-analytical solution if the problem is amenable to theoretical formulation. Experiments are then conducted to provide numerical results for validating the theory. Where a particular problem is so complex as to render theoretical solution impracticable, an empirical solution is sought by conducting experiments over a range of explosion yields.

The ultimate objective of all nuclear weapons effects research accomplished by the Nuclear Weapons Effects Division at WES is aimed at deriving procedures for predicting blast or shock loading information at any given point resulting from a nuclear explosion near, on, or beneath the earth's surface. In certain areas, for example underground protective structures, the major objective is to be able to predict the response of a given system structure or structural element to the effects of a given detonation.

Because the explosion effects are highly transient in nature, they are measured electrically by using a wide variety of transducers peculiarly suited to the characteristics of the blast-time disturbance. A considerable effort is devoted to development of these transducers as well as measurement techniques. Typical measurements involve the recording of time histories of such variables as pressure (stress), strain, acceleration and velocity.

The two major sponsors of research at WES are the Department of Defense-established agency for all nuclear weapons effects research, the Defense Atomic Support Agency, and the Department of the Army through its RDT&E project, "Military Engineering Applications of Nuclear Weapons Effects Research." Other sponsors include the Department of the Air Force through its Ballistics Systems Command, the Atomic Energy Commission, the Advanced Research Projects Agency, the Defense Intelligence Agency, the Office of Civil Defense, the Office of Naval Research and the Naval Ordnance Laboratory.

UNDERWATER EXPLOSION EFFECTS. Basic underwater explosion phenomena consist of the following: (1) the underwater explosion bubble; (2) propagation of the generated shock wave; (3) reflection of the shock wave from boundaries such as the bottom, the free surface, and underwater targets, etc.; (4) the explosion plume, dome and base surge; (5) the production of water surface waves; (6) shock refraction due to the anisotropic properties of the fluid media, and finally, (7) bulk cavitation phenomena associated with shock reflection from the free surface. Studies of the effects of underwater explosions at WES are concerned principally with Items 2, 3 and 5.

Shock Propagation. In a "free-water" environment (one where no boundaries are present to influence the manner of shock propagation), the peak pressure of the shock wave varies inversely as the distance from the explosion raised to the 1.13 power. In a "free-field" environment (one where only horizontal boundaries, namely, the free surface and bottom, are present), the laws governing the propagation of a shock wave are highly dependent upon water depth as well as distance from the explosion.

Due to these factors, a main point of concern of WES research in underwater explosion effects is that of evaluating shock propagation characteristics in vari-

John N. Strange, chief of the Engineering Research Branch, Nuclear Weapons Effects Division, U. S. Army Engineer Waterways Experiment Station, is engaged in the study of underwater and underground explosion effects applied to conventional and nuclear weapons.

A native of Arkansas, he holds a BS degree from the University of Arkansas and did graduate work at the University of Texas. He joined the staff of the Waterways Experiment Station in 1948 and was the recipient of the Department of the Army Certificate for Outstanding Achievement in 1962. During World War II he received the Army Air Corps Air Medal with eight clusters and Purple Heart with Oak Leaf Cluster.

ous scaled water depths. Because this area of study does not lend itself readily to analytical solution, experiments are conducted to provide a direct empirical solution as well as to furnish quantitative data as input to continuing efforts to define the phenomena analytically.

Shock Reflection. The study of shock reflection is being coordinated through an interservice committee made up of representatives from the Defense Atomic Support Agency, the Naval Ordnance Laboratory, the Office of Naval Research and the WES. Appropriate consultant-type services are provided by experts in the general field of hydrodynamics.

Although not officially constituted, this group (sometimes referred to as the Shock Reflection Task Group) is responsible for planning and coordinating all research dealing with the problem of shock reflection in an underwater environment.

The research in this area has been divided into logical components: (1) pursuit of a rigorous theoretical formulation, (2) verification experiments at laboratory scale, and (3) intermediate-scale experiments for additional input to theoretical formulations and/or development of an empirical solution which is descriptive of shock reflection from typical, natural-bottom materials. WES is mainly responsible for item (3) above.

Reflection from the bottom generally acts to enhance the incident shock while reflection from the free surface detracts from the incident shock. The interplay between the direct shock wave and the reflected waves (from the free surface and bottom) makes it necessary to study in considerable detail shock propagation in shallow water.

The net effect of the interplay is determined mainly by the water depth and by the vertical location of the gage point in the water depth (one-quarter depth, mid-depth, or three-quarter depth).

In any event, it is the effect of water shock loading as a function of range from an explosion that is of critical importance. Response of targets situated in the free field of water cannot be calculated unless the effective shock loading is known for that location.

Explosion-Generated Waves. The WES has conducted a major portion of the high-explosive experimental research aimed at developing a means of predicting accurately the water surface waves that are formed as the result of a surface or underwater explosion. Unlike blast and shock effects, which attenuate rather rapidly, water surface waves propagate for rather long distances. Although their amplitudes decay with distance traveled in deep water, upon entering shallow water areas the waves shoal, and this phenomenon produces a buildup in wave height.

Wave research at WES is aimed at evaluating the whole of the wave problem; namely, (1) wave generation mechanisms, including studies of the effects of submergence depth on efficiency of wave generation, (2) propagation characteristics in deep water, (3) wave shoaling phenomena, (4) wave breaking and reforming characteristics and (5) wave runup and inundation potential.

Explosion-generated wave research within the Department of Defense is coordinated by the Wave Task Group which is composed of representatives from the Defense Atomic Support Agency, the Office of Naval Research, the David Taylor Model Basin, and WES with consultation from selected experts in the field.

CRATERING. Explosions that occur slightly above, on, or beneath the ground surface produce craters whose size is mainly a function of the explosion yield, the charge position (relative to the ground surface), and the type material. Generally, the crater size is proportional to between the third and fourth root of the charge weight; however, the charge position can affect crater size by a factor of approximately 10, while the type material (soil or rock) can affect crater size by a factor of about 2.

In a practical way, knowledge of cratering phenomena and effects is important in assessing damage to nearby underground structures, in assessing the effectiveness of craters as barriers to vehicular mobility, and in evaluating the feasibility of using crater-producing explosions as a means of mass excavation.

UNDERWATER EXPLOSION at Mono Lake, Calif. Test series studies surface wave generation and propagation.

Craters are also effective in the production of a large amount of throwout material, generally called ejecta. The widespread distribution of ejecta constitutes a hazard to surface structures, to missile-sensitive targets, and to hatch-opening operations at underground silos.

The WES has participated in a number of large-scale field experiments as well as full-scale tests in an effort to provide an empirical solution and to provide data for a more rigorous mathematical model of the overall ejecta problem.

Current research in cratering is chiefly the responsibility of the Nuclear Cratering Group. This group was established in June 1962 by the Office of the Chief of Engineers for the purpose of working with the Atomic Energy Commission in the determination of the mechanics of crater formation by nuclear explosives and the feasibility, cost and other factors involved in the use of nuclear methods for the large mass movement of earth for construction purposes. The Nuclear Cratering Group is located at the Livermore Radiation Laboratory, Livermore, Calif.

GROUND-SHOCK EFFECTS. Ground-shock effects of nuclear explosions are of vital concern to the military in that all surface or below-surface installations in the general vicinity of a nuclear explosion will feel the shock environment that is coupled into the ground.

Consideration must be given to both directly coupled ground shock and earth motions produced by passage of the airblast wave over the surface; relative contributions of these effects are dependent upon weapon yield, geometry and properties of the earth.

The goal of current WES research is to define the underground free-field environment (stresses and motions) for a variety of threats involving different yields, heights (or depths) of burst and geologic conditions.

A multiple approach is being used. Computer codes, which have been devel-

(Continued on page 20)

Leo F. Ingram, chief of the Physical Sciences Branch, Nuclear Weapons Effects Division, U. S. Army Engineer Waterways Experiment Station, Vicksburg, Miss., is engaged in research on underwater and underground explosion effects, with special emphasis on blast and shock phenomena and special measurement techniques.

Ingram holds a bachelor of science degree in physics from Tulane University and received a commission from the Navy Midshipman School, Columbia University. He served three years with the Navy during World War II.

He is a registered professional engineer in the State of Mississippi and holds membership in several professional societies.

Researching Nuclear Blast Effects

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oped largely by DASA, are being evaluated to determine their value in predicting ground shock. An important adjunct concerns determination of soil and rock properties used as input to the codes. Laboratory tests are made to determine time-dependent strength and deformation properties of earth materials under various loading and boundary conditions.

Quantitative measurements of ground shock are obtained by active participation in underground nuclear tests as well as large-scale high-explosive (HE) tests conducted above and below ground. Ground-shock measurements have been obtained by WES on several nuclear tests conducted at PPG, NTS and Alaska; WES has also participated in numerous HE tests conducted in Canada, Greenland and several continental U. S. sites.

The HE data are useful in scaling certain effects to larger yields. Scaling validity investigations and correlation of empirical data with analytical results are being made continuously. By such a process, it is hoped that satisfactory analytical prediction methods will be developed.

PROTECTIVE STRUCTURES. Strategic structures, depending on their mission, must not only be able to withstand the shock environment of a nuclear detonation, but, in most cases, must be designed so that the shock level within the structure is tolerable for both personnel and equipment.

Generally, protective structures can be classed in three categories; i.e., above ground, shallow-buried and deeply buried. These categories are defined by economics and the shock environment that must be safely withstood. Above-ground structures are usually located in blast pressure fields of less than 30 p.s.i. At pressure levels greater than 30 p.s.i., it is generally more economical to resort to underground construction.

Shallow-buried structures at depths down to several hundred feet are located in regions of ground surface-pressure levels ranging from 30 to say 1,500 p.s.i. Deeply buried structures are at depths on the order of thousands of feet primarily in rock. The ground surface above such installations may be exposed to peak pressures as high as several thousand p.s.i.

There is a wide variety of types of protective systems; i.e., austere field shelters for troops in the field, fallout and modest blast shelters for the civilian population, complex missile and communications sites, and highly invulnerable command centers.

Because the loads associated with nuclear weapons are transient, i.e., the load prevails for periods of from several milliseconds to several seconds, the response of the structural system is dynamic. Hence, the force-time system and its ability to accelerate the overall structure must be considered. It is the acceleration-time history that produces the severe shock environments within structures. Currently, there is a fair understanding of the behavior of above-ground structures. The behavior of shallow or deeply buried systems is not as well defined.

In order to assess the response of protective structure systems, many theoretical and experimental programs have been conducted. In addition, highly sophisticated computer programs have been developed to predict free-field loading environments and the response of buried structural systems.

Generally, these calculations are possible only when simplifying assumptions are made; e.g., material properties are assumed to be homogeneous, isotropic, elastic, etc. Large-scale test results have shown that many computer programs do not match the real physical conditions associated with a protective system, particularly as to overall response.

To look further into the complex problems of soil-structure interaction, it has been necessary to conduct tests in the field under both nuclear and HE conditions and in the laboratory under simulated conditions. By coupling the experimental and theoretical work, analytical expressions are being developed that offer considerable promise of defining in a quantitative way the response of structural systems.

LABORATORY SIMULATION. The moratorium on nuclear field tests forced planners and researchers not only to consider, but to build devices that could simulate various blast loads in the laboratory. The advantages of testing with such a device are many: the input load can be varied, the test geometry can be changed, a variety of soils can be used, tests can be controlled better than in the field, cost is less, etc.

The disadvantages are the limitation on the size of structure that can be tested, and other problems associated with device-imposed boundary conditions. Two blast-load simulators are in operation at the WES—the Large Blast Load Generator (LBLG) and the Small Blast Load Generator (SBLG).

The LBLG is a 3-dimensional device designed primarily to test underground protective structures subjected to overpressure histories similar to those generated by actual nuclear detonations. The test chamber is 23 feet in diameter and 10 feet deep. Pressures from approximately 20 to 500 p.s.i. with a minimum rise time of several milliseconds and maximum durations of greater than 1 sec. can be produced in the generator using high explosives and propellants as the energy source.

The SBLG can contain static pressures to 2,000 p.s.i. and produce dynamic pressures up to 250 p.s.i.; it has a minimum rise time of several milliseconds and durations greater than 1 second. The SBLG has a 9/16-inch-thick steel cylindrical shell with an elliptical dome top which houses two firing tubes and appropriate baffles. The shell is composed of a series of stacked rings of various sizes, which are bolted together, to allow the depth of a soil sample to be varied.

William J. Flathau is chief of the Protective Structures Branch, Nuclear Weapons Effects Division, U. S. Army Engineer Waterways Experiment Station. His responsibilities include study and analysis of problems and the planning of R&D programs and projects involving effects of nuclear weapons on structures.

Specifically, he is concerned with structural dynamics as related to protective construction, the dynamic properties of materials and elements, protective works for military purposes, and problems of civil defense.

Flathau holds a bachelor of science degree in civil engineering from the University of Illinois and is a registered professional engineer in the State of Mississippi. He is a member of the American Society of Civil Engineers, Mississippi Society of Professional Engineers, and the American Military Engineers.

Lightweight Assault Bridges Slated For Vietnam Delivery

Twenty-nine lightweight assault bridges designed and developed by the U.S. Army Mobility Equipment Research and Development Center, Fort Belvoir, Va., for use in marginal terrain such as the Vietnam rice paddies and swamps will be supplied for $833,000.

Award of the contract to the Unit Rig and Equipment Co., Tulsa, Okla., one of four firms that submitted bids out of 15 invited to prepare proposals, was announced Jan. 16. Delivery of the first of 24 units to Vietnam will begin in April. Five will be held in the United States for research, development and testing.

The folding-type, weldable extruded aluminum alloy bridge is designed for mounting on the M113 Armored Personnel Carrier. The 2,700-pound unit can be emplaced hydraulically in less than two minutes without exposing personnel to enemy fire. After hook-up of two hydraulic connections, it can be retrieved by reversing the launching procedure.

Transportable in the folded position at convoy speeds of 35 miles an hour, the bridge has the same swim capability as the unmodified carrier, 3.5 mph.

Physical Sciences Progress Reviewed

Significant research, development, testing and evaluation (RDT&E) accomplishments during Calendar Year 1967 monitored through the Physical and Engineering Sciences Division, Office of the Chief of Research and Development, include the following:

Armor Materials. Research in armor materials has resulted in a heat-treatable dual-hardness steel that can defeat a given threat with approximately one-half the weight of homogeneous steel armor of World War II. This dual hardness steel can be fabricated in various configurations at low cost. It is being used for component protection and/or for pilot seats on the CH 47, OH-6, AH-1G and UH-1D helicopters.

Wind Tunnel Testing. Research in the operational problems and techniques in wind tunnel testing of V/STOL aircraft will permit more efficient and accurate testing leading to better understanding, design, and production of these aircraft. Up to now, wind tunnel results have been highly questionable, due to lack of knowledge of the interactions between the model and the tunnel walls.

Research has established that there is a predictable ratio between the tunnel size and the size of the model that can be tested accurately and reliably. For the first time it is possible to design properly tunnels to meet model requirements, and models to meet tunnel restrictions.

The results are used in the Army's test program and have influenced several hundred million dollars worth of testing and new facilities are underway at Boeing, Douglas, Lockheed, British Aircraft, NASA Langley and Air Force Arnold Engineering Development Center. This research was done at the University of Washington.

Electronic Component. A transient-voltage suppressor for standard field-type radio sets (AN/VRC-12 and AN/GRC-106) has been designed, built, tested and forwarded in limited numbers for use in Southeast Asia. This was accomplished in only a few weeks by in-house personnel at the Electronics Components Laboratory at Fort Monmouth, N. J., in response to a request from Vietnam.

Airborne Searchlight. A feasibility model of an airborne searchlight employing a 20-kilowatt xenon compact arc lamp was designed, fabricated and tested. It weights 130 pounds, producers 20 times moonlight illumination from an altitude of 3,000 feet, and has been demonstrated in Vietnam.

Fuel Cells. An experimental portable 500-watt fuel cell, the first in the U. S. to use a standard hydrocarbon fuel, was developed; also, 60-watt and 300-watt fuel cells using hydrazine fuel were developed and are under laboratory test for field evaluation.

Rocket Propellant. A rubber-type propellant ingredient acting as binder and fuel (a hydroxy-terminated polybutadiene) was developed which makes possible propellants that give more reliable behavior under vibration and compression

Lasers. Stimulated emission of light in organic dyes has been achieved with a specially constructed flashlamp, producing peak intensity in 0.3 microseconds and giving a pulse width of 0.8 microseconds. Prior work required a giant pulse ruby laser to pump the dyes. It thus appears that the last major obstacle has been removed for the development of organic dye lasers, using conventional pumping techniques and thereby adding to the variety of wavelengths available from various laser sources.

Statistical Tests. Statistical procedures were devised for economically estimating the reliability of certain missile components. These procedures incorporate the use of laboratory data and thus require few flight tests of the components, thereby reducing test coats.

Solution of a Large Number of Equations. It is not infrequent for a scientist to have to solve simultaneously many equations with many unknowns. Before the advent of the electronic computer, such problems were considered unsolvable and were not attempted. Recent research has resulted in the development of a variety of techniques, each one appropriate under specific circumstances. Several of these techniques have been used by various Army facilities.

Laser Target Designation Systems. A simple Laser Target Designation System was integrated into an armed UH-1 helicopter, resulting in a major increase in the effectiveness and accuracy of the weapons helicopter. The system provides a first-pass attack ability which is currently lacking.

Use of the system should provide more rapid and accurate engagement with the enemy permitting more strikes per mission, less ordnance consumed per strike, less danger to friendly forces and noncombatants in the area, and less danger to the strike aircraft.

Lightweight Electronic-Scan Radar. An experimental surveillance radar, which will ultimately weigh only 40-50 pounds, with the capability of scanning the battlefield without any physical motion of the antenna, has been developed. The radar employs a novel transmitter-local oscillator which serves as both the local oscillator and pulsed transmitter.

This feature simplifies the radar and greatly reduces power consumption. Antenna beam steering is accomplished with ferrite phase shifters and integrated circuitry logic, giving a greater detection capability and increased accuracy.

Friendly Patrol Locator. The Army developed and tested an exploratory development model of a beaconing system for locating friendly patrols with sufficient accuracy and range to permit the patrol to direct artillery fire on attacking enemy forces.

Radiometric-Imagery Improvement and Comparison Study. A dual-mode millimeter equipment consisting of a radar and radiometer was assembled and evaluated. Results showed that the dual-mode operation, employing radar reflections and target-temperature signatures, provides a substantial improvement in identification of targets over those obtained using single-mode techniques.

Detrick Scientists Author 6 Anthrax Papers

Six of 15 papers published recently in the proceedings of the *Conference on Progress in the Understanding of Anthrax* were authored or coauthored by Army investigators from agencies at Fort Detrick, Md.

The conference was organized for the U. S. Army Research Office (USARO), Office of the Chief of Research and Development, by Dr. Wendell H. Griffith, Life Sciences Research Office, Federation of American Societies for Experimental Biology (FASEB).

Editor of the publication is Prof. W. J. Nungester, University of Michigan, a longtime consultant to the Army and member of the Army Scientific Advisory Panel (ASAP). Publication was supported in part by the National Institutes of Health, Public Health Service, and U. S. Department of Health, Education and Welfare.

Dr. Carl Lamanna, deputy chief and scientific adviser, USARO Life Sciences Division, keynoted the conference with a review of the history of *Bacillus anthracis,* causative agent of the deadly disease, in "The Anthrax Question."

Participants in addition to those from Fort Detrick were from the U. S. Army Chemical Center, Edgewood (Md.) Arsenal, FASEB, and several universities and medical centers in the U. S., England, Peru and the Republic of South Africa.

The proceedings represent an authoritative statement on the worldwide distribution of anthrax. Included is material on the occurrence of anthrax in wild animal species as well as domesticated animals.

Discussions summarize what is known about the role of toxins in causing symptoms of disease and death. Problems are identified that must be solved for the prevention of anthrax and improved clinical treatment of anthrax in man.

AVLABS Win Safety Awards

The U.S. Army Aviation Materiel Laboratories (AVLABS), Fort Eustis, Va., received two safety awards for Fiscal Year 1967, the Army Materiel Command Award of Merit for Safety and an Award of Merit plaque from the National Safety Council. James J. Fetzer is Command Safety Officer.

Space Pioneers Still Hold Key Roles

(Continued from page 5)

director of the George C. Marshall Space Flight Center in Huntsville, Ala.

The German-born scientist was technical director of the Peenemunde Rocket Center before coming to the United States in September 1945 under contract to the U.S. Army. He directed high-altitude rocket firings at White Sands Missile Range (WSMR), N. Mex., and also was project director of a guided missile unit at Fort Bliss, Tex., and Huntsville. He became an American citizen in 1955.

Dr. von Braun directed the development of the Redstone missile ("Old Reliable"), the Jupiter IRBM, and the Pershing missile. He has published eight books on space exploration.

Dr. von Braun holds bachelor's and doctoral degrees in physics from the University of Berlin. His many honors include 19 honorary degrees and the Distinguished Federal Civilian Service Award presented by the President of the United States.

MAJ GEN JOHN B. MEDARIS (USA, Ret.) was commanding general of the U.S. Army Ballistic Missile Agency (ABMA) when Explorer I was launched.

In World War II, he identified the first German V-2 rocket fired against the First U.S. Army in Europe. A decade later he was chosen to direct the Army's long-range missile and outer space programs conducted by a team whose core consisted of personnel who developed the V-2.

On Feb. 1, 1956, he activated the ABMA and managed to successful completion the development and production of the Redstone and Jupiter Missile Systems. He left the ABMA Mar. 31, 1958, to become CG of the U.S. Army Ordnance Missile Command, which included the ABMA and several other agencies encompassing all Army ordnance programs in the rocket, guided and ballistic missile and outer space fields.

UNIVERSITY OF IOWA scientist and professor noted for discovery of the "Van Allen radiation belts," Dr. James A. Van Allen (right) and Dr. William Pickering, director of the Jet Propulsion Lab of the California Institute of Technology, answer questions from the press following orbiting of Explorer I.

General Medaris served in both World Wars and retired from the Army in 1960. He became chairman of the board, Electronic Teaching Laboratories, Inc., Washington, D.C., and also was president of the Lionel Corp. from 1960 to 1962, when he became vice chairman of the board. He is persident of Medaris, Cruger and Patterson, a Florida consulting firm.

An alumnus of Ohio State University, he holds five honorary doctorates, is an honorary Fellow of the American Rocket Society, and honorary member of the Association of Ordnance-Industry Physicians, and has a long list of high military and civilian awards.

DR. JAMES A. VAN ALLEN's discover of the radiation belts around the earth, confirmed by the Explorer satellites, is considered the most important discovery of the International Geophysical Year.

Dr. Van Allen has been head of the Department of Physics and Astronomy at the State University of Iowa since 1951, and made one of his first space experiments as a member of the U.S. Army team that launched V-2 rockets at WSMR in 1946. From 1946 to 1950, he was with the Applied Physics Laboratory of Johns Hopkins University, following four years as a Naval officer during World War II.

A pioneer in high-altitude research with rockets, satellites and space probes, he organized and led scientific expeditions studying cosmic radiation in Peru, the Gulf of Alaska, Greenland and Antarctica from 1949 to 1957. Other accomplishments include development of the Aerobee rocket, for which he received the American Rocket Society's C. N. Hickman Medal, and major contributions to development of the radio proximity fuze.

A 1935 graduate of Iowa Wesleyan College, he earned MS and PhD degrees from the State University of Iowa in 1936 and 1939, and holds seven honorary degrees. He has served with the National Defense Research Council, Office of Scientific Research and Development, and since 1959 has been a member of the Space Science Board, National Academy of Sciences.

A prolific contributor to scientific journals, he has received numerous high honors for his professional achievements.

DR. KURT H. DEBUS headed the ABMA Missile Firing Laboratory and gave the "go-ahead" to fire Explorer I as the first U.S. earth satellite. He is now director of the Kennedy Space Center, Cape Kennedy, Fla.

A German scientist who was engaged in the rocket research program at Pennemunde, Dr. Debus came to the United States in 1945 to participate in ballistic missile development programs of the U.S. Army at Fort Bliss, Tex.

Dr. Debus supervised design, development and construction of launch facilities

SECRETARY OF THE ARMY Wilber M. Brucker congratulates Dr. William H. Pickering after they learned that Explorer I has been put in orbit.

at Cape Kennedy for the Redstone, Jupiter, Jupiter C, Juno and Pershing configurations, beginning in 1952, and later the NASA Apollo-Saturn facilities. He directed launching of the first U.S. ballistic missile, the Redstone, in 1953, and subsequent missiles carrying atomic weaheads in the Pacific Ocean during tests.

The organization he directs has conducted more than 150 launches of military missiles and space vehicles, including the first U.S. space probe to orbit the sun, the first flight and return of primates, the first manned suborbital flight, and 10 successful launches of NASA's Saturn I vehicles. He is presently engaged in the Apollo/Saturn program.

Dr. Debus has a PhD degree from Darmstadt University in Germany, and has been awarded the Exceptional Civilian Service Medal by the Department of the Army. He has an honorary doctor of law degree from Rollins College.

THOMAS F. MORROW, vice president of the Chrysler Corp. Defense-Space and Diversified Products Group since April 1938, was assistant group executive, Defense and Special Products, when Explorer I was launched.

For his "distinguished work in the field of rocketry and space flight," he received a special membership award from the American Institute of Aeronautics and Astronautics in 1959.

Morrow started his 32-year career with Chrysler Corp. in 1935 as an assembly line worker. His experience covers a wide range of progressive assignment in the fields of central cost estimating, planning, tool engineering, manufacturing, sales promotion and administration.

In 1947, he was named assistant to the president of Airtemp Division and in 1948 was appointed a staff assistant to the executive in charge of the company's subsidiary activities. In 1952, he became works manager of the Chrysler Detroit Plant and in 1954 he set up Chrysler's Defense Operations Division, serving as general manager until 1956, when he was named assistant group executive, Defense

and Special Products.

He studied civil engineering at New York University and Massachusetts Institute of Technology, and holds an honorary doctor of science degree from the College of Advanced Science.

DR. WILLIAM H. PICKERING has been director of the Jet Propulsion Laboratory of the California Institute of Technology since 1954 and served as a member of the Army Scientific Advisory Panel from 1960 to 1964.

In 1950, four years after he joined the JPL staff, he was assigned responsibility for development of the U.S. Army Corporal missile, America's first long-range, liquid-propelled supersonic missile capable of tactical application. The Sergeant solid-propellant missile also was developed at JPL under his direction.

In recognition of these notable successes, and following the launching of Russia's Sputnik I satellite, the JPL and the Army were selected in November 1957 to attempt the launching of the Explorer I.

The JPL is now responsible for National Aeronautics and Space Administration R&D programs in the unmanned exploration of the moon, planets and interplanetary space.

Dr. Pickering received BS, MS, and PhD degrees in physics from the California Institute of Technology. After receiving his doctorate in 1936, he became a member of the faculty. In addition to his teaching duties, he performed cosmic ray research and studies on Japanese baloon warfare during World War II and in this work was associated with Dr. Robert A. Millikan, Nobel Prize winner.

WILBUR M. BRUCKER, Secretary of the Army 1955 to 1960, initiated administrative shortcuts that aided the Army missile development program. A former governor of Michigan, he had served Department of Defense General Counsel for a year before being sworn in as secretary.

A member of the Detroit firm of Brucker and Brucker, he holds an LLB degree from the University of Michigan and five honorary degrees.

In 1960, he received a special Freedoms Foundation Leadership Award. An officer in World War I, he was awarded the Silver Star for gallentry in action. He is a past national president of the Rainbow Division Veterans.

GENERAL MAXWELL D. TAYLOR (USA, Ret.), Chief of Staff, U.S. Army, 1955 to 1959, shared with Army Secretary Wilbur Brucker the honor of naming the Explorer I earth satellite.

From 1962 to 1964, he was chairman of the Joint Chiefs of Staff, and served 1964 to 1965 as Ambassador to South Vietnam. He is a special consultant to the President.

He retired in 1959 and was recalled to active duty two years later as Military Representative of the President of the United States and member of the Foreign Intelligence Advisory Board.

Thomas F. Morrow

Major assignments in his 37-year military career included U.S. and United Nations Commander in the Far East; Commander, U.S. Forces, Far East; Commander, Eighth Army, Korea, and Deputy Chief of Staff for Operations and Administration of the Army.

A 1922 graduate of the U.S. Military Academy, General Taylor holds honorary doctorates from 12 colleges and universities and has been decorated by the U.S. Army and 18 foreign countries.

LT GEN JAMES M. GAVIN (USA, Ret.) was Army Chief of Research and Development when Explorer I began orbiting the earth.

During a 33-year Army career, he served four years at HQ Department of the Army as Chief of Plans and Operations, and of Plans and Research, and was in the Weapons Systems Evaluation Group for two years.

Following his retirement in 1958, he joined the industrial consultant firm of Arthur D. Little, Inc., and was president in 1960-61. He served in 1961-62 as Ambassador to France, and the following year as president of the Association of the United States Army.

He is a 1929 graduate of the U.S. Military Academy with honorary degrees from Polytechnic Institute of Brooklyn and from Dartmouth College.

LT GEN JOHN P. DALEY (deceased) was director of Special Weapons, Office of the Chief of Research and Development, Department of the Army, from 1955 to 1958, with responsibility for R&D in space projects, guided missiles, air defense and atomics.

Prior to this assignment, he was CG of the III Corps Artillery at Fort Hood, Tex. He departed OCRD to become CG of the U.S. Army Southern European Task Force from 1958 to 1960, then served a year as deputy chief of staff (Operations) and deputy commander for Reserve Affairs at HQ USAREUR in Germany.

In October 1961, he became deputy CG for Developments, HQ U.S. Continental Army Command, Fort Monroe, Va. With the establishment of the U.S. Army Combat Developments Command in 1962, he was assigned as its first CG and served until he died July 21, 1963.

WECOM Elements Draw Praise for Vietnam Aid

In his review of 1967 accomplishments of the U.S. Army Weapons Command, Rock Island, Ill., Brig Gen William J. Durrenberger commended all WECOM elements for successful effort, with emphasis on materiel for the war in Vietnam.

Singled out for special commendation were the personnel of Rock Island Arsenal, Watervliet (N.Y.) Arsenal, Springfield (Mass.) Armory, Frankford Arsenal in Philadelphia, Pa., and the U.S. Army Tank-Automotive Command, Warren, Mich.

WECOM's operating budget for Fiscal Year 1968 is $1.2 billion, he stated by way of showing the magnitude of current activities as the Army's largest logistic operations command. WECOM, for example, supplies rifles for the Army, Air Force, Marines, Navy and Coast Guard.

During 1967, General Durrenberger said WECOM personnel persevered in solving many complex problems and, as one example, quoted from a message sent by Maj Gen George G. O'Connor, CG of the U.S. Army 9th Infantry Division:

"I wish to express my congratulations and appreciation to you and members of your command for the exceptional manner in which you developed, tested and deployed the airmobile artillery platform for use by the 9th Division Artillery."

In less than six months after receiving the requirement from Vietnam, Rock Island Armory designed, fabricated and delivered the first platforms, which provide a firm structure for firing the M102 105mm howitzer in the swampy delta regions. The platform can be carried to otherwise inaccessible firing positions by helicopters.

Another emergency requirement filled by Rock Island Armory was the design and development of a mobile, air-transportable repair shop for operations in Vietnam.

To ascertain critical requirements and provide liaison with commanders for rapid response, WECOM assigned six full-time employes to Vietnam and during the year sent some 75 employes to provide special technical and advisory assistance.

WECOM personnel also drew praise for the continued development on the 152mm primary weapon for the U.S./Federal Republic of Germany Main Battle Tank of the 1970s. Watervliet Arsenal personnel, General Durrenberger said, contributed to WECOM accomplishments by "tremendous performance in the production of gun tubes, cannons, mounts and recoilless rifles."

With the announced closing of Springfield Armory, the Rock Island Arsenal assumed responsibility for the small arms R&D, procurement and quality assurance activities. RIA also expanded its responsibility for artillery and tank weapons to include aircraft armament and small arms, including those mounted on aircraft.

Center for Research in Social Systems Reports on Projects

The increasing importance of psychological operations and civic action is reflected in new research studies appearing in the Fiscal Year 1968 Work Program of the Center for Research in Social Systems (CRESS) of the American University.

Components of the Army contract research center are the Social Science Research Institute (SSRI) and the Cultural Information Analysis Center (CINFAC). The SSRI specializes in research in support of internal defense and development, unconventional warfare, psychological operations, military assistance programs, and other studies and evaluations of foreign cultures. The CINFAC provides information services concerning foreign areas and cultures to qualified requestors.

The foreword to the work program notes that while much of the 1967 program is being extended, the 1968 program reflects a need for the examination of research tools and methodological orientation.

CRESS rcently started a reexamination of the area of psychological operations and its increasing importance in internal defense and revolutionary development programs.

The work program notes that a systematic approach to this research has been lacking and must be developed if past, present and future work in this area is to achieve maximum usefulness.

An exploratory study, titled *A Systematic Framework for Psychological Operations,* has been added to the work program to facilitate Army integration of the total psychological operations area.

Current relevant scientific thought in psychology, sociology, political and military science, and anthropology will be reviewed and their implications for psychological operations determined. The study will pinpoint research needs and provide background for future researchers.

Areas studied over a 2-year-period will include: the nature of psychological operations and its role within the Army mission; translation of policy and strategic goals into specific psychological operations objectives and their coordination with other means; the psychological operations unit; the psychological message, medium, target and audience; and the measurement of effects.

Another new study added to the work unit on U. S. Defense Operations in Military Assistance and Psychological Operations is *Development of a Methodological Guide for Tactical Use by Psychological Operations Units.*

The object of this research is to develop techniques for quickly obtaining facts on the psychological situation—attitudes, beliefs and motivations—of localized overseas areas and to provide guidelines for their evaluation.

Development of an *Opinion Trend Analysis Methodology Through Quantified Media Analysis* is another new study. It will attempt to develop a system of opinion-trend analysis in foreign cultures that has a high degree of reliability, is inexpensive to operate, and does not require physical access to the population being analyzed.

Investigations in the United States have established that there is a correlation between the relative media strength of personalities and issues and public behavior expressed in tangible situations such as elections.

The concept is that the same principle will apply in all cultures or societies in which public information media are prominent, whether free or controlled.

Experimental analyses will derive factors that influence the degree to which media reflect opinion trends in selected foreign societies, to be used as the basis of continuous analyses of such trends in many foreign areas.

Applicability of Social and Behavioral Science Research to U. S. Army Activities in Developing Countries has been added to the work unit on *Social Processes Relevant to Military Planning for Stability.*

BESRL Details New, Ongoing Programs

(Continued from page 9)

• To develop computer-aided research methods and tools that increase the Army's in-house capability for responding to personnel management research requirements.

Steps will include operational analysis of personnel subsystems, cataloguing and integration of existing models, development of measures of systems effectiveness, development of modeling techques, design and programing of SIMPO I, application and evaluation of computerized models, and development of problem-oriented language for management.

Optimization Models for Manpower Operations Research (Optimization Models) continues the research initiated under the FY 67 Computerized Manpower Systems Task.

The Statistical Research and Analysis Division will seek to solve personnel management problems relating to distribution, training, and career progression and reassignment of personnel; to analyze the personnel problems and identify areas where objective optimization techques can be applied, and to further develop quantitative techniques for management to provide consultative assistance regarding their application.

Development of quantitative models will be undertaken to meet specific requirements of operating agencies.

Development of Culture-Fair Tests for Selection and Classification in Selected Countries (Culture Fair Testing). The Advanced Research Projects Agency has requested the BESRL to develop for the Imperial Iranian Army a personnel selection and classification system while developing general methods and techniques applicable to other selected countries.

The Behavioral Evaluation Research Division will assist in determining the country's qualitative manpower resources in terms of the incidence of general and specific skills; help to determine qualitative Army requirements in terms of the incidence of skills needed to enter the military specialist training program, and in identifying general methods and techniques for use in other countries.

BESRL has also added the following basic research studies to its In-house Laboratory Independent Research (ILIR) Program:

Response Systems in Human Performance. The Combat Systems Research Division will experiment to determine whether, and to what extent, covert response systems can be employed usefully and reliably in human performance systems.

The first investigations will examine and compare the functioning of soldiers' covert and overt response systems in relation to display signals typically employed in military man-machine systems and known motivating and instruction stimuli.

Machine displays, it is believed, may generate influences on the response systems that have not previously been suspected.

Further research will determine whether sensory acuity is superior when covert rather than overt response systems are used to report the presence of a signal, and whether there are changes in covert response systems that characteristically precede specifiable changes in overt behavior.

Psychometric Test — Theoretic Models. This study of the Statistical Research and Analysis Division deals with a certain kind of free response concept in test situations — situations wherein the number of test item alternatives is finite, but idiosyncratic or variable with respect to examinees.

For example, there are a finite number of regions on a photograph for a photo-interpreter to respond to, but the way he responds and the number of regions he divides the photo into are specific to him, or idiosyncratic.

The overall objective of this study is to extend classic theory in psychometrics to this particular kind of free response and learn about reliability, validity, and agreement among raters. Applications are abundant in search and detection problems, command and control processes, and management decision models.

The study will review the Army-sponsored research in the social and behavioral sciences so that it can be evaluated and fully utilized by the Army. Conclusions and recommendations of the research projects will be organized for use as a body of basic references.

The study will include a tabulation of recommendations for use in formulating Army doctrine within the combat developments system and isolation of matters on which highest priority should be assigned for further research.

Criteria for Selection and Assessment of Military Civic Action Programs is one of the new work studies illustrating the importance of this effort to the Army.

Using current social theory, existing literature, and available data and operational reports, a researcher will develop criteria of effectiveness for military civic action. Assessment of the effectiveness of military civic action in two cultures will provide data for the evaluation of the adequacy of the criteria.

After the criteria are modified, the adequacy of the general set of criteria will be tested in a third culture.

ROKA (Republic of Korea Army) Civic Action in Korea is another new study designed to measure the effectiveness of civic action. The objective is to provide an empirical basis for assessment of civic action conducted by the Republic of Korea Army units.

Objectives, motives and techniques of ROKA's civic action program are believed commensurate with those of the United States, but to validate this assumption an extensive study of the ROKA civic actions is necessary.

The study will consist of four phases leading to the identification of the relative strengths, weaknesses, and lessons learned from civic actions of the U. S. Army and ROKA.

Preparation of U. S. Army Officers for Military Advisory Duty is expected to provide an insight into problems of officers on advisory duty in a preinsurgency environment requiring some form of stability operations.

Objectives are to determine some of the major functions common to officers assigned to advisory duty: develop criteria for the selection, preparation and utilization of these officers; and develop guidelines for career patterns that would adequately and relevantly permit the preparation of an officer in his normal training for such assignment.

Motivation and Potential of Military Personnel of Developing Nations to Use Military Assistance Program Equipment Effectively has been added to the work unit on *Military Forces of Developing Nations.*

Much equipment provided to developing nations was designed and manufactured on the assumption that it would be used by men in a relatively literate, highly mechanized armed force with a cultural heritage and personal experience of following instructions in the assembly, operation, maintenance and safeguarding of a wide variety of mechanical devices.

As most of the military personnel in developing areas do not have such an equipment familiarity, the study will evaluate the potential, within a given social environment, for increasing present capability and determine the motivation of personnel to achieve their capability.

Contractor Cost Reduction Program Saves $972 Million

Savings of $972 million on sales of $12.4 billion resulted in Fiscal Year 1967 from the Defense Contractor Cost Reduction Program.

In his annual report to the President, the Secretary of Defense shows that 85 companies, an increase of 13 percent over the previous year, voluntarily participated in the program, estimated to have saved more than $2.7 billion during the three years of its existence.

The 85 companies received more than half of the $39.8 billion awarded by the Defense Department to business firms for work in the United States in 1967. The savings related to defense sales, exclusive of fixed-price contracts.

Increasing emphasis by the Defense Department on the use of incentive-type contracts, competitive procurement and the application of value engineering techniques encourages Defense industry to stress cost reduction and management improvement, the report states.

The proportion of cost-plus-fixed-fee contracts awarded by the department has been reduced from a high of 38 percent in FY 61 to 10.4 percent at the end of FY 67.

During the same period of time, the percentage of total procurement dollars awarded on a price competitive basis by the Defense Department increased from 32.9 to 42.9 percent.

Financial incentives have been increased to encourage contractors to eliminate nonessential design and performance features through value engineering. Recent regulations have improved these contractual incentives by:

- Expanding the opportunities for a contractor to earn a greater share of his value engineering savings — in some cases more than 50 percent.
- Sharing the costs of developing a value engineering change proposal with the contractor where appropriate.
- Shortening the time a contractor must wait for payment of his share of the savings.

The report to the President cited several specific examples of value engineering savings during FY 67. Olin Mathieson Chemical Corp., for example, saved $770,408 by mechanizing a propellant load line used in the production of the charge M67 for the 105mm gun.

Raytheon Co. substituted molded plastic assemblies for individually machined steel assemblies used in the production of the M905 bomb fuze, saving $232,500 on 1,400,000 fuzes.

Philco-Ford Corp.'s Aeronutronics Division replaced an aluminum sand casting used in the Shillelagh missile flight control housing with a less expensive permanent mold casting and saved $698,243. Substitution of a metal film resistor for a more expensive but less reliable wirebound resistor in the missile's control assembly saved an additional $108,793.

Remington Arms Co., Inc. saved $414,833 by reducing size of the carton for the 5.56mm M193 ball and M196 tracer cartridge and eliminating a tray.

A series of joint Defense-industry regional workshops to discuss mutual problems and interests concerning the Defense Contractor Cost Reduction Program held last spring will be repeated this year.

A conclusion of the FY 67 series, attended by more than 1,000 industry and Defense representatives, was that the Contract Program Guidlines issued in May 1964 are still working well.

'Army Medicine in Vietnam' Named Top Medical Film

"Army Medicine in Vietnam," a color documentary produced by the Motion Picture Service Branch of Walter Reed Army Institute of Research, was selected in competition with 34 professional medical films, as the outstanding film of 1967 by the Association of Military Surgeons.

In response to a request from Lt Gen Leonard D. Heaton, Surgeon General of the Army, Harold E. Dixon, chief of the Motion Picture Service Branch, organized and headed a photo team which went to Vietnam in August 1966. Three months were spent photographing surgery in progress, helicopter medical evacuations, the combat medic in action, field hospital operations and innoculation projects.

In addition to the photo team, major contributors to the film were Col William S. Gochenour Jr., VC, technical adviser; George Sangeleer, production assistant; Arnold Solo, film director; Frank Toth, film editor; S. Paul Klein, script writer; and William Ceresa, animator.

The Motion Picture Service Branch circulates 80 copies of the 30-minute film to military installations for briefing military physicians, nurses and corpsmen.

Aquanauts From 4 Navies To Join in SEALAB III

Aquanauts from the navies of Australia, Canada and the United Kingdom will take part in the U.S. Navy's SEALAB III, described by the Department of Defense as the most complex and advanced open-ocean engineering experiment ever attempted.

The 60-day experiment, designed to develop the technology and equipment required to adapt man to a deep sea environment, will be conducted in late summer at depths of 450 to 600 feet off the coast of Southern California.

Five diving teams of eight civilian scientists and Navy divers will occupy an underwater habitat for successive 12-day periods.

BESRL Report Reviews Military Psychology Progress

The state-of-the-art of military psychology is presented in a new report published by the U. S. Army Behavioral Science Research Laboratory (BESRL), *Psychology Research in National Defense Today*.

The 373-page volume, BESRL Technical Report S-1, is an outgrowth of the program of the Division of Military Psychology at the 1964 convention of the American Psychological Association.

Psychologists representing particular services or specialized contract agencies contributed the presentations for the publication, which was edited by Dr. J. E. Uhlaner, director of BESRL and chairman of the APA Military Psychology Division program committee.

Although contributed by psychologists representing particular services or specialized contract agencies, the chapters are written from a Defense-wide standpoint. The result is a broad overview of psychological research programs of the Department of Defense and of specialized agencies serving the separate services.

In an introductory chapter, Dr. Uhlaner outlines today's approaches to military psychological research. Emphasized is research on the "total manned-system" rather than on subfactors.

He notes that the classical criterion or measure of performance effectiveness is typically only a fraction of performance, and therefore valuable primarily "when relative measurement suffices and when a single aspect of the 'personnel subsystem' is of interest, but not sufficient for the modern military user.

"It is the 'mission accomplished' impact the military user is after, and it is this impact that the total systems criterion must reflect. . . . The research scientist or military psychologist of today more and more views man in this newly defined setting.

"Recognizing that to military management the salient concern is effective mission output, the researcher no longer can afford to ask simply: Is man A better than man B? Is training program A better than training program B?

"Rather, he must ask: Do the end products of the developed man-weapon system meet the user's requirements in terms of specified percentages of accuracy, completeness, and rate of output for a given cost?

"Given a specified quality of personnel, specified amount and type of training of these personnel, specified work methods, and specified interface with their equipment, is the probability that Company A can take a specific parcel of terrain a sufficient basis on which the commander can make an effective decision?

"As human factors research moves toward these more sophisticated evaluations, efforts such as these, which we might call 'manned-systems research,' will undoubtedly accelerate. . . ."

He notes that manned-systems approaches build-on techniques and knowledge derived from the classical fractions of military psychology-personnel research, selection research, training research, and human engineering—as well as on such special research programs as work-methods research, fatigue studies, military group dynamics and cost effectiveness.

He goes on to contrast the more classical human engineering approach with today's thinking in a specific systems setting. "In the system involving the extraction of information from photographs, it is customary to use a stereoscope as a specific piece of equipment for the job of interpreting.

"The classical human engineering scientist would have been concerned with providing the design engineer with a basis for improving the stereoscope used in image interpretation, making its mechanical characteristics compatible with the characteristics of the image interpreter.

"The manned-systems researcher, on the other hand, would determine—by measuring output with stereoviewing and without — whether stereoviewing enhanced the accuracy and completeness of the information produced sufficiently to make the instrumentation worthwhile."

"For his part in developing these systems, the military psychologist is asked to assist in establishing appropriate breakdown of functions to be performed, to project the kinds of individuals needed, to establish interrelationships and hierarchies within the system, to look at equipment and help engineers to design it to make functions and jobs easier, to develop programs, devices and aids which will train each individual and the teams to perform the functions required, and to look at the activities performed to see whether he can

"In practice, all the processes in the development of a system may be recycled many times, a contingency which makes human factors research and applications dynamic and often tentative at this stage of behavioral science knowledge."

How do we move toward a more integrated application of behavioral science to the new and expanded interrelationships of men and machines in the military effort? Dr. Uhlaner explains:

"In the forefront is the need for

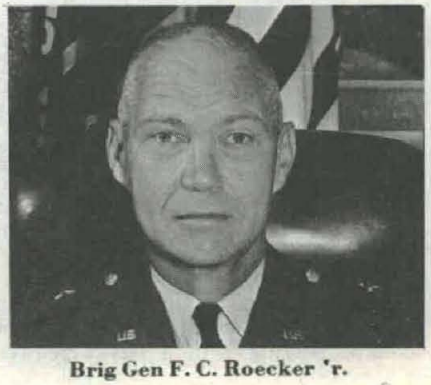
Brig Gen Roecker Designated CDCEC CG

Brig Gen Frederick C. Roecker Jr., new CG of the Combat Developments Command Experimentation Command (CDCEC), Fort Ord, Calif., succeeded Maj Gen George L. Mabry, Jr., now assigned to HQ Seventh Army, U. S. Army Europe.

Since August 1967, General Roecker has served as deputy commander of the U. S. Army Training Center (Infantry) at Ford Ord, following completion of his third tour of duty in Korea in 13 years.

When promoted to his present rank June 21, 1966, he went to Korea as commander of the 7th Infantry Division. He served in Korea from 1953 to 1955 as executive officer, 27th Infantry, and later as adviser to the 25th ROK Division. In 1960-61, he commanded the 1st Battle Group, 31st Infantry in Korea.

General Roecker returned to the U. S. in July 1961 for assignment as J-3, Office of the Joint Chiefs of Staff in the Pentagon, Washington, D. C. Then he became executive officer in the Office of Personnel Operations, Department of the Army, in 1962.



Brig Gen F. C. Roecker Jr.

From October 1956 to August 1959, he was assigned to the Office of the Adjutant General in Washington, D. C., as executive officer in the Infantry Branch, Officer Assignment Division. A year at the National War College as a student then preceded his assignment to Korea.

Graduated from the United States Military Academy in 1942, he distinguished himself in five campaigns during World War II and was decorated six times, winning promotion to lieutenant colonel in two years.

Upon return to the U. S. in 1945, he was assigned as battalion commander in the 5th Infantry Division. After attending the Command and General Staff College, he went to Japan in 1946 as commander of the 2d Battalion, 35th Infantry, 25th Division, and later was regimental executive officer and Division G-3 until 1949.

General Roecker was an instructor in the Department of Mechanics at the United States Military Academy in 1949 prior to attending Harvard University, where he received an MS degree in civil engineering.

He holds the Silver Star Medal, Bronze Star with two Oak Leaf Clusters, the Army Commendation Medal, Combat Infantryman Badge, and the Distinguished Unit Citation, as well as three awards of the Purple Heart.

effective means of testing the value of innovations in a system and changeovers from one system or subsystem to another. Here, the development of reliable, quantifiable and practicable measures of systems output is pertinent.

"In manned-systems evaluation, it is true, many not unfamiliar measurement requirements are encountered. But also encountered are methodological limitations. For example, the reliability and criterion consistency of the effectiveness measure in the systems context present unique difficulties.

"The difficulty of replication depends upon the extent to which the entire system must be involved. Individuals participating in the experiment become practiced, and hence can no longer serve as subjects for replication; equal but unpracticed groups of individuals may be difficult to obtain.

Dr. Uhlaner observes that one of the hallmarks of the manned-systems research is simulation. This calls for "the determined search for general principles derived from human performance experimentation which would be applicable to whole families of systems.

"Simulation used for evaluation of a system must deal with all relevant inputs into the system. The research must deal with the relative values the user places on various outputs.

"Recognizing the extreme costliness of the above approach, and the compelling need for suboptimization from time to time, many military problems of commanding importance should continue to be attacked from the more classical point of view—initial screening, manpower procurement and allocation, training, human engineering. . . ."

The 24 chapters of *Psychology Research in National Defense Today* are divided into 10 parts.

The unit on Screening and Classification includes chapters on "Screening Potential Enlisted Men," by Dr. Edmund F. Fuchs, chief of the Military Selection Research Division, BESRL; "Differential Classification and Optimal Allocation of Personnel in the Military Services," by Dr. Victor Fields, Personnel Research Division, Bureau of Naval Personnel, and "Noncognitive Measures in Selection of Officer Personnel" by Dr. Leland D. Brokaw, Selection and Classification Division, Personnel Research Laboratory, U. S. Air Force, San Antonio, Tex.

One part is titled "Review of Contemporary Military Training Research: the State of Training Technology and Studies of Motivation and Attitudes in Learning." Dr. Meredith P. Crawford, director of the Human Resources Research Office, George Washington University, contributed a chapter on "Training for Leadership, Command and Team Function." Gordon Eckstrand, Behavioral Sciences Research Laboratory, Wright Patterson Air Force Base is the author of "Current Status of the Technology of Training."

Part III deals with "Psychophysiological Factors Influencing Military Performance." Chapters include "Human Performance in Military Systems: Some Situational Factors Influencing Individual Performance," by Dr. Earl Alluisi of the University of Louisville, Dr. W. Dean Chiles of the Aerospace Medical Research Laboratories, and Dr. Richard P. Smith, University of Louisville; and

"Psychophysiological Performance in Acceleration Environments," by Dr. Randall M. Chambers, U. S. Naval Air Development Center, University of Pennsylvania, and "Psychophysiological Parameters of Skill Maintenance," Drs. Saul B. Sells and Nurhan Findikyan, Texas Christian University.

Under "Environmental and Adjustment Factors Influencing Individual Performance" are chapters on "Effects of Climate, Food, Clothing and Protective Devices on Soldier Performance," by Drs. R. Ernest Clark and E. Ralph Dusek, U. S. Army Research Institute of Environmental Medicine, Natick, Mass., and "Adjustment to Military Stress," by Dr. Bernard J. Fine, also of Natick.

"Contributions of Engineering Psychology to Military Systems" are delineated by Dr. Julien M. Christensen of the Aerospace Medical Research Laboratories, Wright-Patterson Air Force Base; Drs. James W. Miller, Marshall J. Farr and Lee R. Beach, Office of Naval Research; and Dr. Leon T. Katchmar, U. S. Army Human Engineering Laboratories, Aberdeen Proving Ground, Md.

Part VI, "Man-Machine Paradigm in Large Information Processing Systems," includes "Military Information Processing Systems," by Dr. Launor F. Carter, Advanced Technology and Research Directorate, Systems Development Corp. (SDC); "A Paradigm for System Analysis of Command and Control Functions," by Dr. Elias H. Porter, SDC, and "The Man-Machine Paradigm in Large Information Processing Systems: The Process of Command Control System Design," by Dr. James W. Singleton, SDC.

Dr. Frederick B. Thompson, General Electric Co., is the author of a chapter on "Nature and Role of Data in Command and Control," which covers the implications of data techniques and information processing methodology.

Part VIII on "Exercising Teams in Military Systems Through the Use of Simulation" is comprised of "Planning for Team Training in the System," by Dr. William C. Biel; "Designing and Implementing the System Model," Dr. Harry H. Harman; and "Evaluation of Training in Simulated Environment," Dr. M. Stephen Sheldon, all of SDC.

"Influence Exerted by U. S. Military Personnel and Systems in Attitudes and Behaviors of Indigenous Peoples Overseas" includes "Psychological Aspects of Social Change Mediated through the Interaction of Military Systems of Two Cultures," by Dr. Theodore R. Vallance, Center for Research in Social Systems (CRESS), American University; "Role of Psychological Operations Within the Military Mission," Dr. Alexander R. Askenasy; and "Research Requirements of Intercultural Communication," Dr. Lorand Szalay, also of CRESS.

For Part X, "Utilizing Posture Strategies and Weapons Systems as Instruments of Influence," Dr. Robert H. Davis, SDC, writes on "International Influence Process: How Relevant is the Contribution of Psychologists?" Dr. Thomas W. Milburn, U. S. Naval Ordnance Station, discusses "Variables of Deterrence."

The volume is available to U. S. Government agencies and the public through the Clearinghouse for Federal Scientific and Technical Information, Springfield, Va. 22150, and to military agencies through the Defense Documentation Center.

Lists of highly selective and authoritative references accompany the chapters.

TECOM Commanders Confer on Materiel Maintainability

General Frank S. Besson Jr., CG of the Army Materiel Command, set the theme for the recent week-long Test and Evaluation Command (TECOM) commanders conference with an address on materiel maintainability.

Maj Gen John M. Wright Jr., CG of the Infantry Center, welcomed the 70 conferees to Fort Benning, Ga. Maj Gen Leland G. Cagwin, CG of TECOM, and commanding officers or their representatives from TECOM's 15 proving grounds, service test boards and environmental test centers participated.

Director of Plans and Programs Brig Gen Thurston T. Paul Jr., Office of the Chief of Research and Development, Department of the Army, discussed a "DA View of Maintainability and Testing." His emphasis was on the origins of maintainability, "how we get it," and "how we know when we have it."

Carlos C. Wood of Sikorsky Aircraft, division of United Aircraft Corp., a member of the TECOM Advisory Panel, spoke on the interrelationships existing between maintainability, reliability and methods of development and testing.

John J. McNally of the Caterpillar Tractor Co. traced its efforts to provide a product with a high degree of serviceability. He also commented on the rising demand of users "for higher machine availability."

The Army Infantry Board test facilities at Fort Benning were reviewed by the conferees. They also flew to Eglin Air Force Base, Fla., for a tour of the Air Proving Ground, and to Fort Rucker, Ala., to visit the Army Aviation Test Board.

TECOM is headquartered at Aberdeen (Md.) Proving Ground.

HumRRO Work Program Outlines Training Research

Ninety-five percent of the FY 1968 work program of the Human Resources Research Office (HumRRO) of George Washington University as an Army contract agency is committed to exploratory advanced development in leadership, motivation and training methods.

Advanced activities are listed in the categories of exploratory studies, work units, and technical advisory service. Five percent of the program is allocated to basic research.

Thirteen work units, six exploratory studies, and three basic research studies have been added, including eight specially funded projects listed for the first time as work units.

HumRRO has been an Army contractor exclusively since its inception 16 years ago, but is diversifying its FY 68 efforts to include research for the Post Office Department.

The Army/HumRRO contract notes:

"It has been determined that, effective 1 July 1967, the interests of the government would best be served by permitting the Human Resources Research Office to perform research and scientific studies for other sponsors in addition to the Department of the Army. . . .

"The Department of the Army shall continue to be the principal sponsoring agency of HumRRO research and development work, and performance of the work under this contract shall continue to receive priority in accordance with available resources and the annual work program."

Purpose of the HumRRO/Post Office Department contract is "to provide the Postal Service with effective methods of recruitment, selection, training and improvements in other areas of personnel management for the three major areas. . . that will result in supplying the Service with a modern and well-qualified maintenance force."

New units added to the Army work program are:

Development of Programed Audio-Visual Instruction for Cross-Cultural Effectiveness (Cope). Division No. 7 (Language and Area Training) will undertake this project to increase the effectiveness of mission officers in their work with foreign personnel through development of programed audio-visual instruction for area training.

Using cultural assumptions and values pinpointed in another work unit, programed filmed instructions will be designed and developed to teach U.S. personnel the concepts that would enable them to recognize cultural assumptions and values reflected in their behavior.

Feasibility Study of a System for Debriefing MAAG Advisers (Debrief). Division 7 will develop and evaluate techniques and instruments for debriefing U.S. military personnel who have served overseas with the Military Assistance Program.

An examination will be made of the feasibility of an expanded system to gather information on adviser experiences and analyze, integrate, and distribute it on a continuing basis to interested commands and training agencies.

Overseas Military Posts and Communities (Sojourn). This study is intended to develop and illustrate the application of methods for obtaining information relevant to the management, organization and planning of overseas American military communities.

As the basic building block in the communities, the military family will receive special emphasis. Division No. 7 will perform the work.

Development of Manual for Community Service Volunteers (Comserve). While general guidelines have enabled the Army Community Service (ACS) to serve over 250,000 individuals in its first 18 months, a manual is needed to provide more specific guidance for staff members who operate the programs for nonprofessional personnel serving on ACS boards.

Subject matter will include recruiting training and effective volunteer utilization. The work study will be subcontracted and monitored by Division No. 7.

Initiated in July 1965, the ACS is dedicated to assisting members of the Army community in meeting personal and family problems which are beyond their own resources.

Implementation and Modification of USMACTHAI Adviser Debriefing Program (Refocus). Division 7 will develop and evaluate techniques for the systematic continuation and modification of the Adviser Debriefing Program in the U.S. Military Assistance Command Thailand (USMACTHAI).

An outgrowth of Exploratory Study 48, in which technical advisory service was provided to U.S. Army Forces Southern Command for the design of a debriefing system, the work unit will focus the debriefing effort upon the local situation, provide for timely revision of data collection instruments to reflect local changes, ensure continuity in data collection, and assist USMACTHAI in interpretating, evaluating, and using information.

Factors in Organizational Effectiveness will be undertaken by Division No. 4 (Infantry) to identify and discover ways of controlling social-psychological factors that influence the effectiveness of military organizations.

A military organization will be simulated, with officers performing the duties of key command and staff personnel. Environmental inputs will be controlled and internal operations monitored to enable researchers to identify and study the organizational processes used in solving problems and taking actions.

Control in Small Infantry Units (Control). Researchers at Division No. 4 will study factors that influence the controllability of small infantry units, with reference to the future unit design.

Development of Comprehensive Test for Signal Terminal Operators (Jack) is being initiated by Division No. 1 (System Operations) as part of Project 100,000. This Department of Defense project is concerned with admitting to all military services 100,000 men who previously could not meet physical or mental standards.

Objective of the specially funded work unit is to develop a comprehensive test to evaluate the effectiveness of the revised course for signal terminal operators prepared by the U.S. Southeastern Signal School.

Evaluation of the Supplyman Training Program (Stock) also has been initiated under Project 100,000. Division No. 1 will evaluate the effectiveness of the revised course prepared by the U.S. Army Quartermaster School. The work unit will identify critical supply training problems caused by the introduction of Project 100,000 personnel.

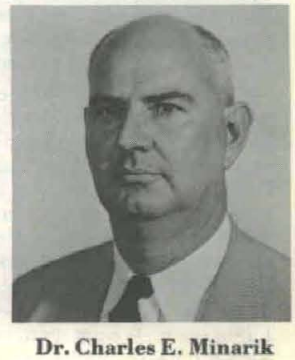
Based on a task inventory prepared by the school from a worldwide survey of

Dr. Minarik Receives Amos A. Fries Medal

Maj Gen Frank G. White, CG of the U.S. Army Munitions Command, recently presented the Amos A. Fries Gold Medal to Dr. Charles E. Minarik, director of the Plant Sciences Laboratory, Fort Detrick, Md., at an American Ordnance Association banquet. The citation states, "An internationally recognized authority in the field of plant physiology and chemistry and a dedicated public servant, Dr. Minarik has made outstanding contributions in the development of anti-plant weapons systems.

"Through his foresight and the brilliant efforts of the research group he has led so efficiently, our military forces in Southeast Asia are equipped with defoliation and anticrop agents. . . ."

Named in honor of Maj Gen Amos A. Fries, who was chief of the Chemical Warfare Service 1920 to 1929, the medal is awarded annually by the American Ordnance Association to an American citizen who has made a significant contribution to the national defense in the field of chemical or biological R&D.



Dr. Charles E. Minarik

supplyman activities, HumRRO will establish for each task appropriate training objectives in terms of speed, accuracy and reliability, for four levels—minimum, advanced, on-the-job, and career.

With this information in a computer data bank, the school will have mechanisms for readily updating the analyses and identifying information related to any particular task. HumRRO will also help revise course content in line with training objectives and prepare programed instructional material.

Curriculum Engineering of Combat Training to Enhance the Soldier's Resistance to Combat Stress (Skillcon). This will follow recommendations made in a HumRRO technical report titled "A Conceptual Model of Behavior Under Stress, with implications for Combat Training." Division No. 3 (Recruit Training) will perform curriculum engineering on specific aspects of instruction in basic combat training and advanced individual training.

Objectives are to produce training that would strengthen the soldier's resistence to stress in combat and hazardous duty situations; also, if feasible, to develop guidelines or procedures that would enable trainers to improve training in other areas of combat or hazardous duty performance.

Technical Assistance in the Design and Execution of JTF-2 Test 2.1/3.5 (Testaid). In this specially funded work unit, Division No. 5 (Air Defense) will provide technical assistance to Joint Task Force Two in the design of field tests and computer modeling of the effectiveness of ground-based air defense weapons.

Study of Men in Lower Mental Categories: Job Performance and the Identification of Potentially Successful and Potentially Unsuccessful Men (Utility). Division No. 3 is to determine why some military personnel in the lowest mental category perform successfully and some do not. Current selection and assignment standards are usually couched in terms of such cognitive characteristics as aptitude test scores and school achievement.

The research team will endeavor to find out whether there are identifiable and measurable *noncognitive* characteristics that determine success for those of low mental ability, and identify the characteristics of the jobs in which such men are successful.

Instructional Model/Prototypes Attainable in Computerized Training (Impact). Researchers at Division No. 1 are developing a prototype computer-administered instructional system with accompanying prototype Multiple-track individualized programs of instruction. The projected system was described in detail in the July-August 1967 *Army Research and Development Newsmagazine*, p. 13.

Additional exploratory studies new to the 1968 program are:

ES-60. Troop Indoctrination. Division No. 4 will determine the feasibility of research to improve effectiveness of troop indoctrination programs. Subject matter and methods used in troop information programs will be examined and scientific literature on mass communications, indoctrination and attitude change will be surveyed.

ES-61. Reconnaissance and Surveillance. Division No. 6 (aviation) will expand an earlier HumRRO task in developing a conceptual framework involving the primary roles served by individual crew members in aerial reconnaissance and surveillance systems.

Conditions that influence crew behavior in the collection of battle area information will be studied and information requirements that might be filled by subsequent training research, oriented toward increased effectiveness, will be determined.

ES-64 Battalion Leadership. Division No. 4 will identify knowledge and skill training requirements for battalion commanders and staff that would provide a basis for the derivation of student performance objectives for the U.S. Army Infantry School course.

ES-69. ATC System. Division No. 3 will explore methods for examining the interrelationships of components of training within the Army's training centers (ATCS) to determine whether these centers are meeting objectives. The present ATC System will be examined with a view to systematic integration of information from various component studies.

ES-70. Longitudinal Analysis. Division No. 6 will probe the feasibility of applying computerized multiple correlation techniques to the prediction of performance of Army aviators beginning with their identification as potential flight trainees and continuing throughout their Army careers.

ES-72. Accident Data Analysis. Division No. 1 will identify variables associated with on-and off-duty accidents to U.S. Army personnel and equipment. Particular attention will be given to accidents occurring in Vietnam. The preliminary study will analyze the Accident Report and the Summary of Accident Exposure.

Three new basic research studies in the FY 68 work program are:

BR-16. Visual Pattern Discrimination. Division No. 5 will perform experiments to determine the extent of which vernier acuity and perception of motion affect pattern discrimination.

BR-18. Reinforcement Management. Division No. 2 (Armor) will determine the suitability of contingency reinforcement techniques for military personnel.

Management of reinforcement that is contingent upon successful performance has been shown to be a powerful motivator of learning for children and emotionally disturbed adolescents. These studies emphasize the reinforcing response, rather than the more historical reinforcing stimulus.

BR-19. Learner-Material Interaction. Division No. 4 will be studying the interaction between instructional files and/or video tapes and various types of audiences to determine the populations for which the medium is the most effective.

Air Defense Command Renamed

The Air Defense Command (ADC) was redesignated as the Aerospace Defense Command (ADC), effective Jan. 15.

The Department of Defense announcement said the new designation better describes the command's primary mission "to discharge Air Force responsibilities for the aerospace defense of the United States" and reflects the increasing emphasis being placed on space surveillance and defense.

The ADC operates from some 480 bases and stations in the United States and around the world, is headquartered at Ent Air Force Base, Colo., and is commanded by Lt Gen Arthur C. Agan Jr., USAF.

AFIP Sets Up 3 Units, 3 Associate Directors

In a major reorganization, the Armed Forces Institute of Pathology has created a new division and two new branches in its Department of Pathology and established three associate directors.

Capt Bruce H. Smith, MC, USN, AFIP director, said the new organization will be more efficient and will improve flexibility within the chain of command.

In the Department of Pathology, a fourth General and Special Pathology Division was added, making a total of 10 divisions. The four General and Special Divisions contain a total of 14 branches; the other six divisions have been expanded to 39 branches. Two new branches are Marine Biopathology in the Military Environmental Pathology Division and Comparative Pathology in the Veterinary Pathology Division.

The position of AFIP scientific director has been redesignated and modified to meet new and increasing professional requirements. In recognition of the multiplying workload, three associate directors have been appointed for Research, Education and Consultation, complementing three special assistants to the director for Veterans Administration Pathology, Public Health Service Pathology and Legal Affairs.

The former Automatic Data Processing Service under the Department of Pathology has become Computer Services Division, operating directly under the Directorate. The Medical Museum has been given a third division and includes Laboratory Service, Archives and Records, and Scientific Exhibits.

The Medical Illustration Service and American Registry of Pathology remain basically unchanged. The new chief of the American Registry of Pathology is Capt Robert M. Drake, MC, USN, who succeeds Claude K. Leeper, USAF, MC.

Foster Keynotes N-Labs' 25th Anniversary

(Continued from page 2)

degree of local reprograming flexibility. I expect this concept to see expanding application.

The Assistant Secretaries of the Services will prepare a summary report to their in-house laboratories delineating all of the problems, and their solutions so far. For the coming year, we plan to solicit from you an additional set of problems to which we should address our attention and energies.

These, plus the observations that emerged from visits by the Civil Service regional directors to laboratories such as yours, will be our action agenda for 1968. We will not be satisfied with "Washington solutions." These new flexibilities must penetrate the hierarchical structure and become operational, a way of life throughout the laboratories.

As a good laboratory generally does, Natick has not only contributed directly to the Army's needs through high quality in-house research and development, but it has also helped to link the technical competence of the nation to the solution of critical military problems.

Your partnership with the National Research Council, the scientific community, and the industrial R&D sector has been productive. We have made impressive strides in coming to grips with the problem of properly equipping and supporting the soldier, protecting him from the hardships of terrain and weapons, with a high degree of efficiency under almost all environmental conditions.

Perhaps as much and as well as any other laboratory, your talents have been applied to Southeast Asia. The fine results of all of your SEA efforts are too comprehensive to describe here. . .

For some time you have contributed to improved food for the Military Departments as well as for NASA. During the coming month, I intend to issue a new DoD Instruction which will clarify the Army's executive agency assignment for the DoD's entire RDT&E program on military foods and related items and functions. This instruction will concentrate at the Natick Laboratories the research and development of foods, feeding systems, and food packaging for all military services.

Let me pause here to say that you have participated in what we see as revolutionary advances in the materials and processing technologies. Many of these advances have already been incorporated into our systems for food and for clothing. Yet much remains to be done.

Our experience in SEA has tested in a demanding way almost all of our tactical (and some strategic) military equipment and concepts. We have experienced great success with comparatively recent combat innovations produced through R&D efforts. We have also learned of many inadequacies in our ability to deter and fight limited wars. Our R&D has yet to give our troops sufficient advantage over the enemy operating in his own environment — a difficult one — with fairly unsophisticated, often primitive, hardware, and usually unconventional military tactics.

From a broader perspective, one of our key problems, a major direction for future R&D, is really a cluster of problems pertaining to people. . .not just combat troops but all of the people with widely varying backgrounds and functions.

All of these people participate in "the systems." But too often our systems do not fit the man. We are too frequently confronted with a magnificent new machine that our men find difficult to use. The machine usually is not poorly designed for *its* function. However, frequently, the man-machine interactions have not been considered carefully.

One of our urgent goals, then, is to develop really matched capabilities for men, equipment and the operational environments. We have begun to expand our efforts in education and training; in human factors engineering; in manpower analyses for equipment in advanced R&D; and in improving our understanding of the environmental conditions affecting man/machine performance. Still greater emphasis is needed.

To meet these goals, we must take advantage of the lessons learned in all areas of technology. We must consider the combat soldier as a total system. He represents the most complex system in "the inventory." We must examine him in relation to his weapons, his sensors, his logistical support, his feeding and his protection — all in an integrated way — if we are to provide major advances in our military capabilities.

What are the functions of the individual infantry soldier in any future military operations? These functions should be-

Sheridan Weapon System Ends Confirmatory Testing

Confirmatory testing of the Army's new Sheridan Weapon System, M551, has been completed by the U.S. Army Armor and Engineering Board (USAAEB) at Fort Knox, Ky.

Trials of the lightly armored, heavily gunned combat vehicle began in December 1966 with the delivery of five early production models. The test series was termed equivalent to a full-scale service test. Results are now being evaluated.

The M551 is intended for use in armored reconnaissance, airborne assault and in combined arms operations. Airportable, it is a 16½-ton, full-tracklaying vehicle powered by a 300-horsepower diesel engine. It includes an integral flotation system for swimming and special vision equipment for night use.

The main armament of the vehicle is a 152mm gun/launcher which can fire the Shillelagh guided missile or conventional ammunition. The conventional ammunition has a combustible cartridge case which eliminates the problem of spent cases in the turret with previous tank ammunition.

The M551 can engage hostile armor, field fortifications and other targets at ranges exceeding the capability of most current weapon systems. Secondary weapons are coaxial and commander-operated machineguns and a grenade launcher system to provide a protective smoke screen.

The USAAEB Armor Division operated each of the test vehicles over some 5,000 miles of cross-country, highway and secondary roads. Evaluation of armament included firing 120 Shillelagh missiles and 800 152mm conventional rounds as well as the tank's 7.62mm and .50-caliber machineguns and the grenade launching system.

The vehicle's communications package, its swimming capabilities and its suitability for night operations were studied. Airdrops from C-130 aircraft were accomplished in coordination with the U.S. Army Airborne, Electronics and Special Warfare Board, Fort Bragg, N.C.

Maintainability and reliability considerations were important elements of confirmatory testing as were human engineering and safety factors. Test soldiers — tankers and maintenance crews representative of troops expected to operate and maintain the equipment in the field — often found themselves being tested right along with the test items.

Project officer for the test was Lt Col Norman A. Keith of the Armor and Engineer Board.

Other elements of the Army Test and Evaluation Command participating in the confirmatory test were Aberdeen Proving Ground, Md.; Airborne, Electronics and Special Warfare Board, Fort Bragg, N.C.; the Tropic Test Center in Panama; and the General Equipment Test Activity, Fort Lee, Va.

SHERIDAN M551 demonstrates its agility in a Kentucky stream during confirmatory tests conducted by the U.S. Army Armor and Engineer Board.

come our goals. Clearly, many tasks will not change: the needs to eat, sleep and survive. Other tasks will change, and these changes will involve Natick Laboratories.

For example, some new opportunities will occur because of improvements being made in miniaturized sensors. Miniaturized electronics can greatly improve man's ability to perceive and communicate. However, these possible improvements in effectiveness may lead to potential increases in the load a man must carry. The military value of this load must be weighed against the value of other loads, and the degradation of performance due to hauling the load around. Thus, the desire for a man to do more things is in direct competition with his physical ability to do them. As you know, this is a common system design problem. Weight reduction becomes an increasingly urgent task for our trade-off analyses of man-in-him-system.

As another related example, consider the Long-Range Reconnaissance Patrols. The information gathered by these small units can have significant benefits for the larger units they support. At present, these units carry a large amount of equipment, which may total as much as 100 pounds per man.

If it were possible to reduce this weight while increasing the ability of the unit to acquire information, obviously the overall effectiveness would be increased. In applying systems engineering to the Patrol equipment, and exploiting the full range of modern materials and packaging technology, why don't you aim to reduce the current weight by a factor of 2?

If we can greatly reduce the weight of any major part of the load, we can consider adding new components to further improve or extend the man's capabilities.

As we see Natick's overall mission, it is this: to provide the combat soldier with an integrated set of equipment, including clothing, personal equipment, lightweight armor and food. These systems must exploit all relevant areas of technology, and must capitalize on all our analytical tools for system design. Man must be at the center, not at the periphery, of our thinking about defense R&D. Natick must help the defense R&D community to understand and apply this guideline.

I have touched briefly on the history of the Laboratory, on some of your recent contributions, and on a few of your goals. Before closing, I should return to the reason for our coming together.

What does it really mean to celebrate a Founder's Day? It is an opportunity to ask the broad questions and attempt to set priorities on the fundamental jobs. Without question, the fundamental job of the military R&D community is to seek and to exploit new ideas to improve our military capability. There is no technological plateau now, and there will be no technological plateau in the future as long as we continue to do this job. But we must continue.

We need all of your new ideas. We need to energize you and your colleagues throughout the DoD who are concerned with "man-in-the-system" to produce more ideas, to sort them out, to test them, and to find those few that are genuinely excellent. You have done this in the past — you are doing it now.

But thinking is tough, and easily postponed by the day-to-day urgencies. The time to explore that brainstorm is today. You recall that striking anecdote about the great French Marshal Lyautey who once asked his gardener to plant a tree. The gardener objected that the tree was slow-growing and would not reach maturity for a hundred years. The Marshal replied that in that case there is no time to lose; plant it this afternoon!

This is precisely how I feel. So many of our R&D goals are so tough that we may tend to postpone action on the argument that "it's going to take a long time, so why hurry." Believe me, you must not fall into this mood. R&D activities are driven successfully by a clear understanding of the objective, and insistence on standards for high quality.

DoD, Industry Form Assets Management Systems Unit

Establishment of a Department of Defense-Industry Assets Management Systems Advisory Committee to provide a channel for industrialists and DoD representatives to discuss resource management systems was announced Dec. 8.

The committee is comprised of representatives of DoD staff offices and components and recognized associations representing defense contractors in aerospace, automotive, electronics and shipbuilding industries.

Assistant Secretary of Defense (Administration) Solis Horwitz approved establishment of the committee for a period ending Nov. 30, 1969.

Systems to be studied are sets of methods and procedures by which a contractor manages his use of labor technical skills, materials and other resources to provide DoD an industrial managers with the information to evaluate a contractor's progress and utilization of resources.

Col Herbert Waldman, U.S. Air Force, director, Assets Management Systems in the Office of the Assistant Secretary of Defense (Comptroller), is chairman. Industry members are Stanley M. Sjosten, assistant to the director, Contractor Services, Melpar, Inc.; William L. Dewey, comptroller, Defense Space Group, Chrysler Corp.; C. Ronald Milliken, assistant comptroller, Systems and Data Processing, United Aircraft Corp.; and

Philip A. Huey, assistant to corporate accounting manager, North American Aviation, Inc.; Gerald R. Marks, special projects coordinator in the Corporate Comptroller's Department, General Dynamics Corp.; and

G. L. Warrick, supervisor, Government Reports and Management and Financial Data Control, Northrop Corp.; Arnold J. Rothstein, manager, Program Management Systems for the Missile and Space Division, General Electric Co., and Charles Macbeth, Hughes Aircraft Co.

ECOM Schedules Symposium For Industry Representatives

Army aviation-electronics prospects and problems will be discussed by scientists and engineers during an advance planning briefing and symposium for industry, Mar. 5-7, at HQ U.S. Army Electronics Command (ECOM), Fort Monmouth, N.J.

ECOM commander Maj Gen William B. Latta, has announced the theme as "Fresh Winds — New Approaches." The meeting is sponsored by ECOM and the Fort Monmouth chapters of the Army Aviation Association of America and the Armed Forces Communications and Electronics Association.

WECOM Selects Chief Systems Engineer

Brig Gen W. J. Durrenberger, CG of the U.S. Army Weapons Command, has announced appointment of Leonard R. Ambrosini as WECOM's chief systems engineer.

Leonard R. Ambrosini

Formerly program director for weapons projects with Lear-Siegler, Inc., Ambrosini will be stationed for two months in Washington, D.C., at HQ Army Materiel Command to work on WECOM activities.

Ambrosini holds a master's degree in aerodynamics and thermodynamics from Swiss Federal Polytechnicum, Zurich, Switzerland.

Among his many notable accomplishments was the development of the first Hispano-Suiza antiaircraft fire director for which four patents have been filed. He also has 52 other inventions, including hydraulic servo valves, encoders, automatic landing devices, homing torpedos, planetary reentry and landing space, hypervelocity guns, hydraulic sonars, fly-by-wire stick sensors, barometric altimeters and gyros.

The main patent he has pending is on an automatic North Seeking Gyro, tentatively scheduled for production in large quantities for the U.S. Army.

Kudos

JOINT SERVICE COMMENDATION MEDAL. Col Charles S. Brice Jr., executive officer in the Army Materiel Command Office of Research and Laboratories, recently received the JSCM. The award was for outstanding service during 1965-67 as test director, CG-1A On-Site Detection of Underground Nuclear Detonations, Project Cloud Gap, U.S. Arms Control and Disarmament Agency.

He was cited for "his exceptional perceptive approach leading to the development of a totally new concept of effective arms control inspection procedures."

MERITORIOUS CIVILIAN SERVICE AWARD. Dr. Arthur V. Dodd, research geographer at the U.S. Army Natick (Mass.) Laboratories, received the MCSA for his scientific leadership in developing new and significant maps of humidity, dew point and vapor pressure phenomena.

He also was cited for his outstanding achievement in unifying climate design criteria in Army documents for use by the Quadripartite Committee, representing the United States, Great Britain, Canada and Australia. Dr. Dodd won the Natick Laboratories Scientific Director's Silver Key Award for Research in 1966.

DISTINGUISHED SERVICE MEDAL. Secretary of the Army Stanley R. Resor presented the DSM to Maj Gen Keith L. Ware, chief of Public Information, Department of the Army, for "eminently meritorious conduct in the performance of outstanding service."

General Ware served as deputy chief and chief of Public Information from September 1964 to November 1967. He also possesses the Medal of Honor, the military's highest award for valor, and is now assigned to U.S. Army, Vietnam.

LEGION OF MERIT. Brig Gen Wilson R. Reed, new CG of the Automatic Data Field Systems Command, Fort Belvoir, Va., received the LOM for "exceptionally meritorious conduct in the outstanding performance of duty from January 1967 to September 1967 as Deputy Secretary of the General Staff, Office of the Chief of Staff, U.S. Army. . . ."

Col John R. M. Covert, Redeye project manager, was awarded the LOM at the U.S. Army Missile Command, Redstone Arsenal, Ala., for outstanding performance as commander of the 69th Artillery Group, within the NATO air defense system, from August 1964 to July 1967.

Col Howard G. Krieger received the LOM when he retired from the Army after serving more than 20 years as a medical officer. His last assignment was staff director to the Defense Medical Materiel Board, Office of the Surgeon General.

Col Henry A. Goodall, U.S. Army Dental Corps, was awarded the LOM when he retired after more than 26 years of active military service.

He was cited for outstanding performance of duty as commanding officer of the 89th Medical Detachment (Dental Service); dental surgeon, Heidelberg Medical Service Area and chief, Dental Division, 9th Hospital Center, U.S. Army, Europe, from July 1964 to October 1967.

Lt Col Donald B. Holland, recently retired, was recognized for service as The Surgeon General's representative to the Nuclear Systems Health and Safety Review Committee from February 1966 to September 1967.

DISTINGUISHED FLYING CROSS. Capt Danny D. Curtis, now chief of the Army Weapons Command Aviation Section, U.S. Army Weapons Command (AWC), Rock Island Arsenal, Ill., received the DFC for extraordinary heroism and gallantry while serving as pilot of an 0-1D aircraft in Binh Dinh Province in Vietnam.

BRONZE STAR MEDAL. President Lyndon B. Johnson pinned the BSM on Maj Marie L. Rodgers, a nurse at Walter Reed General Hospital in Washington, D.C., the same day he signed the bill lifting restrictions on promotions for women officers in the military service. The award recognized her for outstanding service as an operating room nurse with the 24th Evacuation Hospital in Vietnam.

Capt Herbert W. Mylks, Army Weapons Command Commodity Management Office, Rock Island, Ill., received the BSM for service in connection with ground operations against hostile forces in the Republic of Vietnam from April 1966 to March 1967.

DEPARTMENT OF ARMY Certificate of Achievement was presented to Kenneth I. Tapley (right), administrative officer in the Electrotechnology Laboratory at the U.S. Army Mobility Equipment R&D Center, Fort Belvoir, Va., honoring him on retirement after 30 years of federal service. The presentation was made by Oscar P. Cleaver, his long-time "boss" as chief of the Electrotechnology Lab, who is now acting technical director of the center.

THREE of FOUR initial patent awards are presented to Maj Clarence H. Walker (right), now assigned to the Office of Doctrine Review, U.S. Army Ordnance Center and School (USAOC&S), Aberdeen Proving Ground, Md. Brig Gen Erwin M. Graham Jr., USAOC&S commander, presented three citations for patents dealing with new reactants for metals; the fourth was for new armor-piercing projectiles. Maj Walker developed the new products and procedures at the Pitman Dunn Metallurgical Laboratory (PDML), Frankford Arsenal, Pa., while he was assigned as a project engineer and assistant to the technical director of the PDML Research and Development Division.

Capt Joyce G. Johnson, Army nurse now assigned to Walter Reed General Hospital, received the BSM for serving with the 85th and 24th Evacuation Hospitals in Vietnam from August 1966 to August 1967.

Edgewood Arsenal Commander Col Paul R. Cerar presented the BSM to Capt John L. Hicks, SFC Fred L. Beets and S/Sgt Ashley J. Hiett for outstanding performance of duty in Vietnam. Capt Hocks is assigned to the Dental Clinic and the sergeants are in the Technical Escort Unit.

AIR MEDAL. Capt Donald E. Appler, now assigned as aide to the Army Weapons Command deputy commanding general at Rock Island, received the Air Medal for heroism during 1967 in Vietnam.

ARMY COMMENDATION MEDAL. Two Chemical Corps officers and a sergeant, assigned to Edgewood (Md.) Arsenal, received the ACM for service at former duty stations. Col Sidney L. Wells, director of Technical Support, received the first Oak Leaf Cluster to the Commendation Medal for service as deputy commanding officer of the U.S.

Army Procurement Agency in Korea from August 1966 to July 1967.

Maj Garth Wahlquist, assistant inspector general, was honored for service from August 1963 to August 1967 at the Army Chemical Center and School, Fort McClellan, Ala.

M/Sgt Leonard Grzanowski, operations sergeant for the Medical Research Laboratory, was decorated for his efforts as NCO-in-charge of the U.S. Army Southern Command's Chemical, Biological and Radiological Center, Fort Clayton, C.Z.

Col John J. Powell was awarded the first Oak Leaf Cluster to the ACM for his work as deputy assistant for Veterinary Services, Office of the Army Surgeon General, from 1965 to 1967. Since July 1967, he has been serving as special assistant to the director of the Walter Reed Army Institute of Research (WRAIR), Washington, D.C.

Col James O. Darling, newly assigned executive officer of the U.S. Army Surgical Research Unit, was presented the first Oak Leaf Cluster to the ACM by Maj Gen Conn L. Milburn Jr., commanding general of Brooke Army Medical Center, Fort Sam Houston, Tex. He received the decoration for service in Vietnam and as executive officer of WRAIR.

2 Key Positions Established In Secretary Resor's Office

Realignments within the Office of the Secretary of the Army announced Jan. 8 created the positions of Assistant Secretary for Manpower and Reserve Affairs, and Deputy Under Secretary for Operations Research.

The Office of Deputy Under Secretary for Manpower was abolished and Arthur W. Allen Jr., who had headed the office, was named Acting Assistant Secretary for Manpower and Reserve Affairs.

Under provisions of Public Law 90-169, each of the Military Departments is authorized an Assistant Secretary for Manpower and Reserve Affairs.

Dr. Eugene T. Ferraro, who has been Deputy Under Secretary (Manpower) of the Air Force for two years, has been named Acting Assistant Secretary for Manpower and Reserve Affairs (Air Force). The Navy had not announced its selection as this publication went to press.

Dr. Wilbur B. Payne, who has been chief of Operations Research within the Office of the Under Secretary of the Army, has been named Acting Deputy Under Secretary (Operations Research), with functions as follows:

- Establish policy guidance and monitor Army operations research activities.
- Initiate studies of interest to the Army Secretariat and serve as a point of contact of similar activities in the Office of the Secretary of Defense.
- Initiate, conduct, review and monitor studies and analytical reports basic to the justification of Army requirements.

Maj Mozelle R. Breedlove received the ACM for service as head nurse at the Walter Reed General Hospital. Maj Breedlove retired recently after more than 20 years of active duty.

Capt Harris W. Silverman, Walter Reed General Hospital, received the medal for service as a nurse anesthetist with the 93rd Evacuation Hospital in Vietnam from September 1966 to October 1967.

Maj Donald K. Tester, chief of the Literature Division, U.S. Army Combat Developments Command (USACDC) Combat Service Support Group, Fort Lee, Va., was awarded the first Oak Leaf Cluster to the ACM for exceptionally meritorious service in producing TASTA field manuals. TASTA (The Administrative Support, Theater Army) is the Army's new logistics system developed by the USACDC.

3 ECOM Scientists Elected IEEE Fellows

Dr. Harold Jacobs, Kenton Garoff and Dr. James D. Meindl were recently elected Fellows of the Institute of Electrical and Electronics Engineers (IEEE), in recognition of their research work with the U.S. Army Electronics Command (ECOM), Fort Monmouth, N.J.

Dr. Jacobs, senior research scientist in the Solid State and Frequency Control Division of the command's Electronic Components Laboratory, was honored for his contributions in the field of solid-state and semiconductor electronic devices.

Employed by ECOM since 1949, he is now serving as Army deputy member of the Special Group on Optical Masers, and Army member of the Working Group on Low Power Devices sponsored by the Department of Defense.

Dr. Jacobs did undergraduate work at Johns Hopkins University, postgraduate work at New York University, and is currently serving as professor and chairman of the Department of Electronic Engineering at Monmouth College, West Long Branch, N.J.

Listed as a senior member of the IEEE, he is also affiliated with the American Physical Society and the American Society for Engineering Education. He is chairman of the Army Laser Working Group on Materials and has published more than 50 scientific papers. He has received more than 15 patents for electron devices and has several more which are currently being evaluated.

Garoff is chief of the Electronic Components Laboratory's Electron Tubes Division. He was elected to IEEE fellowship for his leadership in planning and executing electron devices R&D programs dealing with high-power tubes for military equipment.

Backed by 25 years of research at ECOM, he has served as either Army deputy member or member of the Defense Department Advisory Group on Electron Tubes since 1955. He also is Army member of the United States, United Kingdom, Canadian Technical Cooperation Committee (Sub-Group I, Electron Devices).

Garoff received a BS degree in chemistry from Brooklyn College in 1940, and has done graduate work in physical chemistry, physics and mathematics. He has served on various IEEE committees since 1954 and was appointed a senior member in 1960.

Dr. Meindl, former chief of the Electronic Components Lab's Integrated Electronics Division, was cited for his contributions in microelectronics and integrated circuitry. He is now an associate professor at Stanford University.

Dr. Meindl received his doctorate in electrical engineering from Carnegie Institute of Technology in 1958. In 1959 he was called to active duty as an Army lieutenant and served in integrated circuit research at Fort Monmouth. When discharged from military service in 1961, he remained with the Electronics Command.

While with ECOM, Dr. Meindl played an important supporting role relating to microelectronics in the formative stages of the Mallard Project. This is an international program in which the United States, United Kingdom, Canada and Australia are developing a communications system for their joint use.

Dr. Harold Jacobs **Kenton Garoff** **Dr. James D. Meindl**

RDT&E, Procurement Contracts Top $500 Million

Army contracts for research, development, test, evaluation and procurement of materiel exceeding $1,000,000 each totaled $505,727,631 for the period Nov. 11 to Dec. 11.

Litton Industries, Inc., accounted for nearly 25 percent of the total with a $122,256,000 "total package procurement" contract for the Tactical Fire Direction System (TACFIRE). Litton received an initial increment of $6,300,000 for this work.

Eastman Kodak Co. gained a $54,412,050 contract modification for explosives. Sperry Rand Corp. will manufacture, load, assemble, and pack ammunition on a $41,241,096 modification, and Harvey Aluminum Sales, Inc., will do the same on a $34,784,577 modification.

Small arms ammunition will be manufactured at the Lake City Army Ammunition Plant, Independence, Mo., by the Remington Arms Co., Inc., on a $32,886,583 modification. AVCO Corp. received contracts totaling $29,952,772 for aircraft engines and combustion chamber assemblies for engines.

General Time Corp. was awarded contracts totaling $14,472,252 for fuzes and parts for detonator boosters. Atlas Chemical Corp. received a $14,081,983 modification for production of TNT and maintenance activities at the Volunteer Army Ammunition Plant, Chattanooga, Tenn. Uniroyal, Inc., will provide explosives and collapsible 10,000-gallon tank assemblies for petroleum on two contracts totaling $13,670,740.

The Raytheon Co. received contracts totaling $12,933,373 for advanced development of the SAM-D missile system, metal parts for bomb fuzes, and advance production engineering for the improved Hawk missile system. Bell Helicopter Co. received contract orders totaling $11,993,746 for rudder rotor blades and rotary wing blades for UH-1 helicopters.

McDonnell Douglas Corp. will receive about $7,000,000 initial funding to develop and conduct experiments on techniques for guidance and control of antiballistic missile defense interceptors.

The Institute for Defense Analyses was issued modifications totaling $6,672,000 for research and analyses of space science, ballistic missile defense, equipment and facilities to achieve military and scientific capabilities, and for evaluation and operational analyses for the Joint Chiefs of Staff and the Director of Defense Research and Engineering.

General Electric Co. will produce armament pods, 7.62mm automatic guns and ancillary equipment for $6,020,654. Eurka-Williams Corp. will furnish metal parts for bomb fuzes for $5,291,500. The Bowen McLaughlin-York Co., division of HARSCO, received a $4,983,954 modification for supplies and services to convert M48A1 tanks to M48A3 tanks.

Sylvania Electric Products, Inc., gained a $4,592,728 classified contract. General Instrument Corp. will supply metal parts for bomb nose fuzes for $4,491,382. Metal parts for artillery fuze boosters will be provided by Brad's Machining Products, Inc., for $4,365,000..

Continental Motors Corp. will get $4,000,000 for rebuilding and/or retrofit of multifuel engines for 5-ton trucks. Chamberlain Manufacturing Co. received modifications totaling $3,922,215 for modernization activities at the Army Ammunition Plant, Scranton, Pa., and for metal parts for 2.75-inch rockets.

General Motors Corp. will furnish 20mm automatic guns and components mounted on aircraft for $3,738,750, and Standard Products Co. will receive $3,571,285 for track assemblies for M114 vehicles. Olin Mathieson Chemical Corp. will supply propellants and related raw materials on a $3,416,922 modification.

Norris Industries, Inc., was awarded $3,319,258 in contracts for 81mm projectiles and maintenance and repair of facilities in support of production of metal projectile parts and cartridge cases. A modification of $3,318,900 was awarded to the National Union Electric Co. for metal parts for mechanical time fuzes for bomblet dispensers.

Contracts totaling $3,301,735 with Honeywell, Inc., are for multiplexers and spare parts and other electronics equipment. I.D. Precision Components Corp. won a $2,856,250 contract for metal parts for boosters, and Amron Corp. will supply cartridge cases for $2,588,070.

Canisters for the aerial mine system will be furnished by the Martin Marietta Corp. for $2,389,258, and Johnson Corp. received a $2,321,701 contract for cargo trailers and trailer chassis. American Machine and Foundry Co. will supply metal parts for 4.2-inch mortar projectiles for $2,267,352. LTV Electrosystems, Inc., won a $2,199,540 contract for lightweight man-packed radio sets.

Canadian Commercial Corp. was awarded contracts totaling $2,120,943 for telescopes and components and 30-caliber ball cartridge propellant. Beech Aircraft Corp. received a $2,070,050 definitization for bomb dispensers.

The Ingraham Co. was awarded a $1,980,633 contract for metal parts for artillery fuze boosters. SCM Corp. will supply teletypewriter components for $1,830,585. Booz-Allen Applied Research, Inc., received a $1,765,721 modication for scientific and technical effort to support continuing studies, evaluation and analyses of military doctrine for the U.S. Army Combat Development Command Institute of Combined Arms and Support at Fort Leavenworth, Kans.

Watkins Johnson Co. will furnish microwave system receivers for technical support of defense programs for $1,678,206, and Rulon Co. received a $1,631,850 contract for sub-components of the M1 delay plunger for the M557 artillery fuze.

Other contracts and modifications are:

FMC Corp., $1,547,656 for Hawk loader transporters; Eastern Tool and Manufacturing Co., $1,536,493 for metal parts for 66mm rocket warheads; Weatherhead Co., $1,492,050 for metal parts for 90mm heat projectiles; Bendix Corp., $1,485,000 for shelters with AN/GRC-147 radio sets installed;

Hughes Aircraft Co., $1,476,500 for the feasibility demonstration project for the TOW/Cheyenne missile system; Magnavox Co., $1,235,300 initial increment to a $1,462,063 contract for advanced development models of ultra-reliable receiver transmitters (RT-246/VRC);

Firestone Tire and Rubber Co, $1,417,525 for track shoe assemblies for M60 tanks; Wilkinson Manufacturing Co., $1,399,905 for fin assemblies for 60mm projectiles; Farmers Chemical Assn., Inc., $1,349,402 for support services for the manufacture of explosives;

Rohm and Haas Co., $1,250,000 for a propellant research program; Model Screw Products, Inc., $1,212,750 for 4.2-inch cartridge containers; McDonnell Co., $1,275,000 for development of a trainer set for the medium antitank assault weapon system;

Brunswick Corp., $1,181,860 for 30mm cartridge launchers; Pace Corp., $1,160,000 for flares; U.S. Steel Corp., $1,063,675 for metal parts for 8-inch projectiles; Northrop Corp., $1,024,860 for fin assemblies for 81mm mortar projectiles; American Fabricated Products Co., Inc., $1,001,278 for containers for assemblies for 4.2-inch cartridges.

SCIENTIFIC CALENDAR

3rd Middle Atlantic Regional Meeting of the American Chemical Society, Philadelphia, Pa., Feb. 1-2.

Meeting of the American Institute of Chemical Engineers, Los Angeles, Calif., Feb. 4-7.

Spacecraft Electromagnetic Interference Workshop, sponsored by NASA, Pasadena, Calif., Feb. 6-8.

Aircraft Design for 1980 Operations Meeting, sponsored by AIAA, Washington, D.C., Feb. 12-14.

Aerospace and Electronic Systems Winter Convention, sponsored by IEEE, Los Angeles, Calif., Feb. 13-15.

International Solid-State Circuits Conference, sponsored by IEEE and the University of Pennsylvania, Philadelphia, Pa., Feb. 14-16.

9th Annual West Coast Reliability Symposium, sponsored by the American Society for Quality Control, Beverly Hills, Calif., Feb. 16.

Working Group on Extraterrestrial Resources, sponsored by AFSC, Brooks AFB, Tex., Feb. 19-21.

Scintillation and Semiconductor Counter Symposium, sponsored by IEEE, AEC and NBS, Washington, D.C., Feb. 28-Mar. 1.

Newsmagazine Lists Key Articles Published During Past Year

Publication of a complete index of all articles published in the Army Research and Development Newsmagazine during the past year admittedly would be desirable. Space available permits a listing of headlines of only the highlight articles.

DECEMBER 1966 — ABCA Armies Streamline Standardization Program Operations.
Services Study Methods of Predicting for R&D.
Impact of Helicopters on Army R&D Effort.
COSATI Achievements Reviewed as Knox Moves.
Joint Commanders Push Standardization.
New Electromechanical Hand Lifts Egg Intact.
NHB Dedicates $120 Million Laboratory Complex at Gaithersburg.
Armed Forces Radiobiology Research Institute Ups Capability.
DDC, Tri-Service STI Leaders Review Information Progress.
Information Matrix Offered as Management Tool.
Army Medical Research, Nutrition Lab Work Affects Millions.
New Radio-Teletypewriter Links Fast-Moving Forces.
Aircraft Post-Crash Fire Retardation Research.
Simulation Pays Off (Accomplishments of ATAC).
Army Dentists Developing Sprayon Oral Bandage.

JANUARY — **ASAP Schedules Meet at Natick to Consider** Combat Soldier Problems.
Ostrom Succeeds Kimball as Army Research Director.
Report on Project Hindsight Details Findings on Study of Research Leading to New Materiel.
The Army Activities in Satellite Communications.
AVLABS Test 'Closed Circuit' Refueling System.
Self-Contained Portable Dental Lab Provides Complete Field Care.
Instrumented Course Tests Troops in Combat Situations.
HumRRO Announces Work Program for FY 1967.
AVLABS Evaluating 2 Aircraft Checkout Systems.
Army Environmental Research Broadens Combat Capability (report on USARIEM activities).
Army R&D Advancing Combat Capability in Environmental Extremes (feature on worldwide program).
U.S.-Canada Defense Development-Sharing.
Army Orders SPEED Kitchens for July Delivery.

FEBRUARY — Defense Department Initiates Project to Spur Academic Science.
Nike-X System Office Centers Developmental Effort.
Approved Plan Provides Revised Concepts for 12 Career Management Fields.
A New Propulsion Age on the Horizon.
Tests of Self-Destructive Rockets Predicted in 2 Years.
DoD Leaders Join AMC Chiefs in Talks on Vietnam.
PSYOP Committee Preparing Report for DCSOPS.
New STAF Discusses Chemical Detection of Personnel.
Economists Foresee Federal R&D Costs Leveling Off.
Panel Evaluates Air Defense Mathematical Models.
Army Advances in Laser R&D Cover Broad Spectrum.
Report Discusses Protective Devices Against Head, Neck Injuries.

MARCH — Memorandum Assigns Roles of Agencies in Structuring Management STI Network.
Army Nominates 8 Civilians, 7 in R&D for Presidential, Defense Top Awards.
Burton Selected to Direct Army Research at Durham.
Project Trend: Environmental Research in Thailand.
Quarles Heads TARC; 5 New Members Named.
Report Summarizes 1966 Space Activities.
Report to Congress Examines Use of Federal R&D Resources.
AMRA Contract Yields Advance in Composite Armor.
High-Temperature Alloys Extruded at Room Temperature.
Project Action Gauges Vietnam Problems by Interviews.
Army Demonstrates Missile Mentor Command Posts.
Research Probes 'Time Bomb' Disease.
ATAC Becomes Major Command.
Agencies Review Energy R&D, National Progress.
MERDL Modernizing Army Field Medical Equipment.
Army Officers Participate in AEC Nuclear Weapons Design.
Low-Cost International Scientific Cooperation.
A New Plan and Goal for Packaging Research.
Vietnam Units First to Get Field Anesthesia Machines.

APRIL — Army Outlines RDT&E Objectives in Proposals to Congress.
ASAP to Review R&D for Night Operations.
Army Orders Design of Advanced Aircraft.
Australia Hosts TTCP for Infrared Review.
Cosponsored Line Islands Satellite Experiment Collects Weather Data.
Picatinny Applies Fluidics to Timers.
Fluidics Hailed as Next Big Payoff of Army R&D to Nation.
R&D Officials Discuss U.S. Army CRREL Expansion.
Panel Reviews Vehicle Research to Alleviate Air Pollution.
ECOM Testing Portable Hydrocarbon Fuel Cell.
Army CDC Maintenance Agency Accents New Ideas.
Natick Laboratories Report Research in Progress.
Engineer Labs Assume 'Mechanical Muscles' Project.
Walking Machine Studies.
Agencies, Industry Help DoD Compile Scientific Thesaurus.
STRATCOM Views Third Year Gains.
Titanium Hardcoating Tested for Helicopter Engines.
USAERDL Nominates 12 Employes for Special Achievement Awards.

MAY — Realignment Affects 4 Divisions in OCRD.
Cheyenne Prototype Tested as Speedy Combat Helicopter.
TARC Updates 5-Year Army Research Plan.
Three Nations Join Efforts on Communication Network.
Army Nurse, Engineer Win Pace Achievement Awards.
Scientists, Engineers Study Colombian Canal Site.
Simplicity of Design Stressed in Electronic Equipment.
NAS Publishes Volume on Research in Rock Mechanics.
This is Picatinny Arsenal (installation feature).
Aeromedical Research Unit Responsive to Vietnam.
Bill Proposes Exchange of Federal, State, Local Personnel.
Army S&TI Plan Outlines Objectives.
Rocket Propulsion Technology, Management Center Unifies Effort.
Military Significance of Mountain Environment Studies.
ECM (Electrochemical Machining) Proves Feasible for Cannon Parts.
ARO-D Council Gives Scientific Expertise.

JUNE — R&D Achievement Awards Recognize 38 In-House Scientists.
SEATO Center Opening as Example of Teamwork.
ECOM Laboratory Plans Visionics Research Facility.
ATAC Schedules Effort to Update Personnel.
Power Sources Meet Chided on Pollution.
Hydroclone Filterless Filter Viewed for Applications to Army Needs.
Studies Reflect Characteristics of RDT&E Personnel.
Device Offers Hope of Early Detection of Prostate Cancer.
IDEEA Aims at Use of Data on Ongoing Research Activities.
Army Selects 10 ISF (International Science Fair) Winners for Special Awards.
RAC Performs Army Operations Research, Systems Analysis.
Detrick Develops Chromosomal Mapping Technique.
New Computer Speeds AFIP Research.
MBT-70 Development Approaches Midpoint.

JULY-AUGUST — ADP Pilot Test Viewed for AMC Application.
AVCOM plans New Engine Tests in LOH.
AMC Notes 5th Anniversary Progress.
TORQUE Presents System of Balancing R&D Program.
Dr. Foster Contends R&D Programing Soundly Based in Addressing Aviation Space Writers Association.
Army Accepts Floating Nuclear Plant MH-1A.
Army Completes High Elevation Field Maneuver Appraisal.
Kinnard Commands CDC; Gribble Named DACSFOR.
Watervliet Studies Applications of Fluidics to Weapons.
MICOM Spending $10 Million for BTE (Battery Terminal Equipment).
HumRRO Launches Project IMPACT, Major Computerized Instruction Program.
ASA (R&D) O'Neal Keynotes Industrial Briefing.
Picatinny Pumps Ruby Laser With Chemical Detonation.
AVLABS Computer Program Aids VTOL Development.
Research & Development in the Corps of Engineers.
USAMRUE Evolves From Research on Nuclear Fallout.
AMC Assumes Management of Generators for Defense.
TDP (Technical Data Package) Presents Government Requirements to Industry.
Advanced Geometry Glass Fiber-Reinforced Plastic Rotor Blades.

SEPTEMBER — ASAP Plans Fall Meet on Aviation Technology.
U.S. Scientist Heads SHAPE Tech Center.
50 THEMIS Grants Broaden Research Base.
Metallic 'Fingerprints' Identify Missiles.
UHF Satellite LES-5 Achieves Tri-Service Tactical Link.
DCA Director Briefs House Subcommittee on IDCSP.
Cancer Institute Modifying MICOM Medical Laser.
SHAPE Nuclear Head Named Army Deputy Chief of Research and Development.
Edgewood Dedicates $3 Million Lab.
OCRD Cosponsors World's Highest ES Research Facility.
BESRL Sets Up Field Unit With TOS in Germany.
Army RDT&E Contracts Exceed $1 Billion.
Redeye Value Engineering Saves $4.9 Million.
Army Engineers Develop Hydraulic Modeling as Precise Science.
8 of 32 on 2-Star List Have Served in R&D.
Army Picks 19 R&D Colonels for Promotion.
Edgewood Arsenal's 15 'Eyes' Aid Medical Research.

OCTOBER — ABM Net Linked to Army Efforts.
MUCOM Briefing Lists Needed R&D Advances.
ASC Slates Panel on Vietnam Needs.
Aircraft Engine Development Pushed.
AMC Shifts Missile Plant from ATAC to MICOM.
CRD Cities R&D Response to Vietnam.
BRL Camera Records Explosions at Almost Incredible Rate.
ASA (R&D) Discusses Importance of Project Management.
ARO-D Publishes Significant Basic Research Results.
CIDS Exploratory Project Nearing Test Phase.
United Kingdom Joins Three Nations in Mallard Project.
Coastal Engineering Research (Army Corps of Engineers).
Report Outlines 20-Year Program to Alleviate World Food Problem.
Natick Pamphlet Details Vietnam Support.
Dr. Larsen Discusses R&D for Vietnam Needs.
Army Role in Fuel Cell R&D Spurs Worldwide Interest.
Demonstrated Destruction of Nuclear Weapons (Project CLOUD GAP).
Mathematics Research Center Lists Academic Staff.
Modified Standard Rifles Fire Caseless Cartridges.

NOVEMBER — McMillan Accepts Bid for Keynote Address at Science Conference.
General Besson Commands Achievements in Vietnam.
Harvard Professor Receives Samuel S. Wilks Award at 13th Annual Conference on Design of Experiments.
Honored Vietnam Veteran Takes Command of ATAC.
DDR&E Executive Discusses Transfer of Technology.
Laser Beams Simulate Practice Round Fire.
APG Constructing Shock Tube Facility.
CRD Discusses MBT, AAFSS, SAM-D.
Army Tests Heavy Equipment Transporter-70.
Army Orders 100kw. X-Ray Generator.
Automatic Equipment Cuts Mapmaking Time to 24 Hours.
Department of Defense Portable Electric Power Plants.
Corps of Engineers Great Lakes Research Continuous Since 1841.
ACSC-E Discusses New Trends in Communications.
USCDCEC Team Studies Ground Observer Performance.
4 at AVLABS Receive High Honors at Awards Banquet.
Submerged Fuel Survives Blast Tests.
Okinawa Becomes 9th Link in IDCSS Global Net.
CSC Directs Government-Wide Executive Referral System.
Army Tests Mountain Sickness Drugs.
Environmental Hygiene Agency Dedicates Lab.

Army Evaluating Skills of Dogs for Special Duty

(For story, turn to page 8)

1. Responding to trainer Dale C. Reeves's hand command only, experienced German shepherd Slugger comes "on the double" across the field.

2. Reeves shows Lt Stuart J. Dearing how to command an untrained dog. Trainer holds wire to activate laboratory programing equipment through electronic command control box at upper left.

3. Labrador retriever Zeb exits final maze door in 6-second-run just to get his picture taken.

4. "Good dog," says trainer Reeves many times as he also rewards cross-breed with petting.

5. Four-year-old Slugger is used primarily as laboratory stud and protector inside the building at night.

6. Kennel area at University of Maryland's Canine Behavior Laboratory, College Park, Md.

7. Well-trained Slugger is always "good dog." Dr. McIntire scratches the shep's cheeks. Looking on are trainers John J. Wagasky, Reeves, and trainer-to-be Lt Dearing.

8. Naive standard poodle gets "count down" during tug from trainer when dog refused "come" command.