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Top Priority Materiel Objectives Listed in 'Big Eight' Program

Top priority objectives for development of materiel for the U.S. Army of the future, with emphasis on modern equipment that will substitute qualitative for quantitative superiority, are listed in a mid-November disclosure of "The Big Eight."

Announcement of the objectives was made by the Directorate of Plans and Programs, Office of the Chief of Research and Development, HQ DA.

During the preparation of the FY 1972–76 Army Program, Chief of Staff General William C. Westmoreland issued specific guidance to his staff regarding the most essential materiel developments that will be required by a modern Army, operating in a 1975–80 combat environment.

Throughout the Army General Staff, the grouping of these development objectives is commonly referred to as "The Big Eight." An overview of each

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CRD Betts Retiring, Gribble Moving Up

Lt Gen A. W. Betts

Maj Gen William C. Gribble

Army Chief of Research and Development Lt Gen Austin W. Betts will end over a decade of continuous top-level assignments in the national capital area when he terminates more than 35 years active military duty by retiring Jan. 1.

President Nixon has nominated Maj Gen William C. Gribble to succeed him, with promotion to 3-star rank subject to U.S. Senate confirmation. General Gribble served as Deputy CRD for 15 months in 1966–67 and was returned to the post July 6, 1970, from an assignment as CG of the Army Engineer School and Fort Belvoir, Va.

Few military men have remained longer in the continuous focus of high official life in Washington, D.C., than General Betts. His tenure dates to 1959 when he was assigned as Director of Military Applications, U.S.

(*Continued on page 5*)

HFR&D Meet Emphasizes Manned Control Systems

Effective Manned Command and Control Systems were accented as a prime objective at the Sixteenth Annual U.S. Army Human Factors Research and Development Conference, Oct. 20–22, Army Air Defense Center, Fort Bliss, Tex.

Sponsored by the Chief of R&D, the conference attracted about 200 representatives of Army R&D activities, using agencies, industry, academic institutions, the Air Force, Navy and other U.S. Government agencies. Maj Gen Richard T. Cassidy, CG of the ADC and Fort Bliss was host.

In the keynote address, "Human Factors in Command and Control," Army Chief of R&D Lt Gen Austin W. Betts said that in the days when

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Army Conference Focuses On Design of Experiments

Many of the nation's foremost leaders in statistical technology were among some 100 participants in the 16th annual U.S. Army Conference on the Design of Experiments, Oct. 21–23, at the Army Logistics Management Center, Fort Lee, Va.

Representatives of Department of Defense agencies, industry and the U.S. academic community presented

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Miley Heads AMC, Vaughan Assigned as Deputy CG

(See story on page 9)

General Henry A. Miley

Lt Gen Woodrow W. Vaughan

Featured in This Issue . . .

Army R&D Newsmagazine

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Purpose: To improve informal communication among all segments of the Army scientific community and other Government R&D agencies; to further understanding of Army R&D progress, problem areas and program planning; to stimulate more closely integrated and coordinated effort among Army R&D activities; to express views of leaders, as pertinent to their responsibilities, and to keep personnel informed on matters germane to their welfare and pride of service.

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Betts Tells Attaches About R&D Civilian Benefits

Civilian by-product benefits from Army research and development, with emphasis on saving the lives and improving the health of millions, were listed "only partially" by Chief of R&D Lt Gen A. W. Betts in an Oct. 27 address to the Military Attaches Association of Washington, D.C.

About 80 attaches from foreign governments and U.S. Government agencies, including representatives from the Soviet Union and Iron Curtain countries, heard the address. General Betts stressed that the goal of the military service is to preserve peace honorably. "We can all be proud that we have chosen to serve our countries in search of peace in the world.

"Unfortunately," he said, "the military image painted by news media too often reflects only the weapons aspect of a nation's Armed Forces, a natural thing, since that is the primary product. We in the Armed Services just don't talk enough about the human side of our 'raison d'être.'

"People forget that we are a well-organized, superbly trained, well-equipped body of men who can react rapidly to a variety of crises in a manner that no other organization can.

"Besides the obvious role of perhaps maintaining domestic peace and stability, most significant is the use of military forces in disasters such as earthquakes, floods, or even fighting forest fires.

"Today, the world is restless and changing. There is a more frequent need of armed forces everywhere to assist in maintaining domestic order in the face of riots, uprisings, and other violent actions of those who would choose the route of personal injury, property damage, death and destruction over that of sane, rational discussion and arbitration.

"But there is much more to the human side of the armed forces than stability and peace keeping. The civilian population benefits from many other by-products about which we hear much too little."

General Betts pointed out that some of the most beneficial developments come from military medical research, directed primarily to the goal of preserving the health of military personnel because disease, historically, has "been as much a casualty producer as are the enemy forces.

"History is full of examples: According to Biblical sources, in 708 BC the Assyrians lost 185,000 dead overnight to disease; in 480 BC Xerxes with a force estimated at nearly a million was reduced to 400,000 by plague and dysentery. The reports of Hannibal, Marcus Aurelius, Cortez and Napoleon tell of the terrible effects of disease on their forces.

"Many of the diseases that plagued the armies of history are no longer military or civilian problems because of civilian sponsored research."

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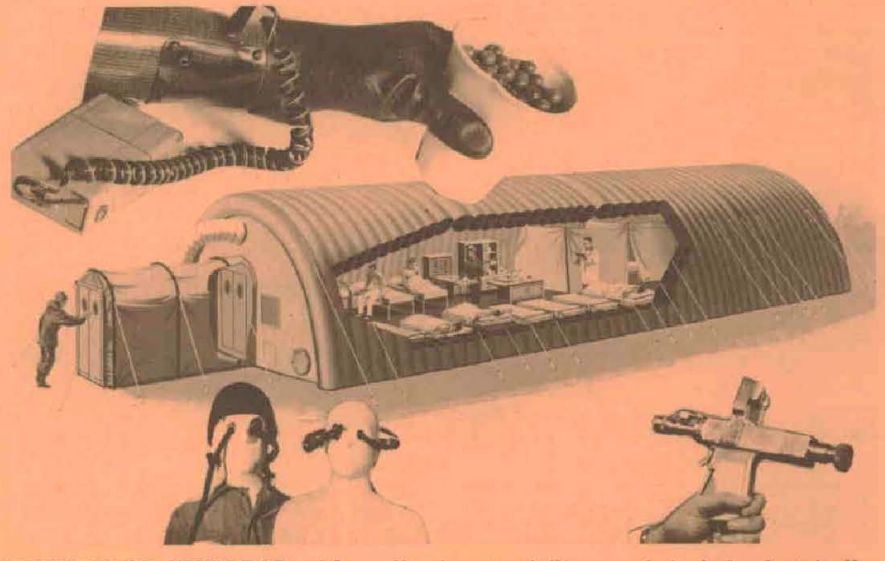

RESULTS OF ARMY R&D with applications to civilian needs include electrically controlled (small battery) hand with sensitive response to requirements for varying pressure, Medical Unit Self-contained Transportable (MUST) hospital unit complete with power and humidity and temperature control units, "Copper Man" units used to provide a scientific basis for design of outer garments, and high-speed immunization "jet injector" that has proved valuable in major disasters.

Congressional Authorization Act Limits Major Weapons, RDT&E

Congressional authorization for major weapons procurement and for research, development, test and evaluation—totaling $19,920,089,000 as against Department of Defense requests aggregating $20,605,489,000—was signed into law by President Nixon in October, but the appropriations battle remains.

Under the accepted rules of procedure, Congress may appropriate the same as or less than amounts in the Authorization Act (PL 91–441).

Authorizations in the specific categories for each of the Armed Forces were decided in a Committee of Conference on disagreeing votes of the House and Senate. The House bill totaled $20,571,489,000 and the Senate lopped $1.329 billion off this amount by approving $19,242,889,000.

Public Law 91–441 authorizes $1,635,600,000 for Army research, development, test and evaluation, with $2,156,300,000 for the Navy (including the Marine Corps), $2,806,900,000 for the Air Force, and $452,800,000 for the Defense Agencies. A DoD emergency fund of $50,000,000 is authorized for RDT&E, procurement or production related thereto.

In major weapon systems breakouts, the Army is authorized $1,059,700,000 for missiles, as compared to $932,400,000 for Navy missiles, $12,800,000 for the Marine Corps and $1,485,400,000 for the Air Force.

For aircraft procurement, the Army authorization is $292,100,000 with $3,255,500,000 for the Air Force and $2,416,700,000 for the Navy and Marines.

The Army is authorized $205,200,000 and the Marine Corps $47,400,000 for tracked vehicles procurement. For other weapons, the Army authorization is $67,200,000, with $2,789,000 for the Navy and $4,400,000 for the Marines.

A stipulation is that none of the funds authorized shall be obligated for procurement of M–16 rifles until the Secretary of the Army has certified to the Congress that at least three active production sources for supplying these weapons will continue to be available in the U.S. during FY 1971. Funding of $27.1 million was approved.

One of the most important provisions of Public Law 91–441 is a change in the wording regarding the requirement, in effect during the past year, that all research and studies supported by the military under contract or grant or in-house have a clearly demonstrated relevancy to a military requirement.

As amended, Section 204 now reads: "None of the funds authorized to be appropriated to the Department of Defense by this or any other Act may be used to finance any research project or study unless such project or study has, in the opinion of the Secretary of Defense, a potential relationship to a military function or operation."

The change to "potential relationship," which still may be subject to considerable controversy during the negotiation of specific appropriations, serves to water down much of the criticism within the Armed Forces regarding the difficulty of establishing clearly the relevancy of research to a military requirement.

Spokesmen of the Military Departments joined frequently in stating their views to Congress, that research will produce results of incalculable importance to the most urgent military requirements—without any reliable way of anticipating such developments in advance. Frequently also, "spinoff" benefits of such technological advances will impact profoundly upon the civilian economy.

Section 205 of the FY 1971 Authorization Act makes the following significant statement: "It is the sense of Congress that—

(1) An increase in Government support of basic scientific research is necessary to preserve and strengthen the sound technological base essential both to protection of the national security and the solution of domestic needs; and

(2) A large share of such support should be provided hereafter through the National Science Foundation."

With respect to the key role of the Army in military construction for the Safeguard ABM System, as well as research, development, test and evaluation of various components, Section 401 of Title IV of the Authorization Act is of prime importance. The limitations imposed are:

(1) Technical and supporting facilities and acquisition of real estate inside the U.S., $322,000,000.

(2) Research, development, test and evaluation facilities at the Kwajalein Missile Range, $3,200,000.

(3) Military family housing, 400 units, $8,800,000, with 200 units at the Safeguard site at Malmstrom, Mont., and 200 units at the Safeguard site at Grand Forks, N.D.

The House authorized $660.4 million for Safeguard program procurement. Conferees approved the Senate's $10 million reduction to $650.4 million.

Limitations on nuclear, chemical and biological warfare agents are prescribed in Section 506, which states:

"None of the funds authorized to be appropriated by this Act shall be used for the procurement of delivery systems specifically designed to disseminate lethal chemical or any biological warfare agents, or for procurement of delivery system parts or components specifically designed for such purposes, unless the President shall certify to the Congress that such procurement is essential to the safety and security of the United States."

A further provision of Section 205 is: "Nothing contained in this section shall be deemed to restrict the transportation or disposal of research quantities of any lethal chemical or any biological warfare agent, or to

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Conferees Weigh Army Role in Anti-Pollution R&D

Identification of what contribution Army research and development can and should make to the national pollution abatement program was the purpose of about 50 officials of Army and other federal agencies at a Nov. 23–24 meeting sponsored by the Army Chief of R&D.

Response to presentations indicated an ethusiastic recognition and acceptance of responsibilities the Army should incorporate as part of its scheduled R&D program, in cooperation with other federal agencies working on pollution abatement problems.

Speakers presented evidence of Army-wide interest and concern in planning for a broadscale Army effort in the fight against pollution. Reports showed numerous control measures are in progress to reduce water and air pollution at fixed Army installations in the continental United States.

General agreement was reached that numerous pollution control problems exist that are unique to the Army that require R&D efforts.

Funding, participants held, should be spread across the line item categories of Army budgeting (6.1 basic and 6.2 applied research on antipollution) and 6.2, 6.3 and 6.4 funding of specific equipment projects to insure integration of antipollution measures as part of a total design package.

Development of formal military requirements by the U.S. Army Combat Developments Command, speakers stated, should include, as an integral

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SIXTEENTH Annual U.S. Army Human Factors Research and Development Conference participants included (from left) Maj Gen Richard T. Cassidy, CG of the Air Defense Center and Fort Bliss, Tex.; Dr. Lynn E. Baker, U.S. Army chief psychologist and general chairman of the conference; Lt Gen A. W. Betts, Chief of R&D; Maj Gen Donn R. Pekke, director, Individual Training, U.S. Continental Army Command; Brig Gen George M. Snead Jr., Director of Army Research; Brig Gen James B. Adamson, chairman of the Army Human Factors Research Advisory Committee and director, Plans, Studies and Budget, Office, Deputy Chief of Staff for Personnel, HQ DA.

Human Factors R&D Meet Emphasizes Manned Control Systems

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he was a second lieutenant and on into the 1940s and 50s, "command and control could refer to nothing else *but* human factors. It is a sign of the times that C^2=ADP (command and control equates to automatic data processing)."

In the 1930s, he said, engineering practice began to reflect some of the common principles that operate in a wide variety of regulating mechanisms. D. S. Harder, in 1936, first used "automation" in referring to "automatic handling of parts between progressive production processes" in the General Motors Corp.

General Betts cited L. Landon Goodman's comment, in 1956 (20 years later), that the purpose of automation is "to utilize the mechanizations of thought and effort to achieve an automatic and, in some cases, a self-regulating chain of processes." (Note the "utilize the mechanization of thought.")

Advances in computer technology in recent years, he said, have been applied to modern industrial operations in production of military materiel, in design, in doctrine and in tactics for employment of materiel by the armies in the field.

Commenting that he does not quarrel with the popular computer programing axiom, "garbage in, garbage out," he said, "I would like to see us applying machines to address a first principle of military manpower development: That in an Army of decreasing size, and perhaps even all volunteer, *quality* becomes all the more important. That goes for the quality of the men, the quality of the materiel, and the quality of their leadership. Let's use machines to enhance that quality, not to supplant it."

Army R&D programs must, he said, be motivated equally by the fact that the substitution of materiel for men can realize appreciable manpower savings.

In citing examples, he held that use of advanced technology in aircraft engine development should yield 20 percent fuel savings and reduction of maintenance manhours by 50 percent —or almost 500 maintenance manhours per flight hour per month of support for each assault helicopter company.

After discussing numerous materiel items on which design engineering properly linked to human factors research results conceivably should contribute greatly to upgrading operational capability and saving of manpower, General Betts launched into what he considers should be areas of new emphasis in human factors R&D.

A significant research effort is warranted in the area of combat arms unit training, he said, pointing to the fact that the growing public concern with ecology presents the probability of problems about training areas.

Numerous related factors indicate that combat arms unit training must have a high priority for applied behavioral and social science affecting human factors in military operations. Specific benefits needed include:

- Improved criteria for evaluation and measurement of unit training and performance effectiveness.
- Improved information systems for reporting and supervising training.
- Improved integration of training cycles as they relate to deployment demands and performance capabilities, rather than to arbitrary fiscal year or calendar year cycles.
- Training simulators and devices that reduce maneuver costs, area, time and personnel support requirements.

Results of human factors research are currently being applied effectively to many of the pressing problems of Army operations, General Betts observed. One area is ongoing work to produce a system that will enable aviation manpower managers to predict more accurately, during individual training, which men are most likely to complete the flight training program.

Similarly, the techniques would be used to determine which aviators will be effective at helicopter gunnery; which ones will perform effectively in combat and which will not; and which aviators will remain in service and which will leave—all with a view to reducing training costs and gaining quality manpower.

"But these benefits for *individual*

(*Continued on page 54*)

Choice of Forsythe to Lead Volunteer Army Program, As Top Priority Effort, Shifts Norton to CG of CDC

Fast-moving events shifted Lt Gen John Norton into command of the U.S. Army Combat Developments Command Oct. 31 instead of a scheduled assignment Nov. 1 as Assistant Chief of Staff for Force Development (ACSFOR).

The *Army Research and Development Newsmagazine* had reported on Secretary of Defense Melvin R. Laird's announcement of selection of General Norton for the ACSFOR assignment and nomination for 3-star rank.

When Lt Gen George I. Forsythe was moved from command of the Combat Developments Command to head the Volunteer Army Project, with assignment in the Pentagon and the objective of ending reliance on the draft by mid-1973, General Norton was selected to fill the position.

Promoted to 4-star rank, General F. C. Weyand vacated the ACSFOR assignment to become Deputy Commander of the U.S. Military Assistance Command Vietnam. Lt Gen Robert R. Williams, his deputy, was promoted to 3-star rank with elevation to the ACSFOR responsibilities.

U.S. Army Chief of Staff General William Westmoreland and Secretary of the Army Stanley R. Resor participated in the change-of-command ceremonies at Fort Belvoir, Va., in which General Forsythe turned over the CDC colors to General Norton.

Choice of General Forsythe, who had headed the CDC since Aug. 29, 1969, as project manager for the Volunteer Army Project followed closely upon General Westmoreland's public announcement that "the Army is committed to an all-out effort in working toward a zero draft—a volunteer force."

In implementing the Volunteer Army policy of the Nixon administration, General Westmoreland, in a speech at the annual meeting of the Association of the United States Army, said, "we will bend every effort to achieve our goal." Support and understanding from the administration, the Congress and citizenry will be needed to accomplish the objective, he stressed.

"We cannot," he said, "attract the kind of soldier we need into an organization denigrated by some, directly attacked by others and half-heartedly supported by many. This country cannot have it both ways."

Touchng upon one of the critical issues of the Volunteer Army concept, General Westmoreland said:

"Unfortunately, few of our volunteers elect the Infantry in Vietnam as their choice. When we give a volunteer his choice, he is more likely to accept some other job. Accordingly, for the near future, we will continue to depend on the draft for most of our replacements. . . ."

Prospects are that it will be necessary to extend the draft beyond its expiration date of June 30, 1971, it was stated, and to take action to double or triple the number of enlistments and reenlistments.

In view of the many problems to be surmounted in achieving the Volunteer Army—and the need for complete support of the American people in establishing a more favorable image of the uniformed services and the type of man they attract—General Westmoreland contended that selective service legislation should remain in force as national insurance.

CRD Betts Retiring, Gribble Moving Up

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Atomic Energy Commission, Germantown, Md., and served until 1961.

General Betts then was selected as military assistant to the Director of Defense Research and Engineering for three years, including one year as Director of the Advanced Research Projects Agency (ARPA).

When Robert S. McNamara, then Secretary of Defense, directed that an in-depth Nike-X Threat Analysis Study be made, General Betts was selected to become special assistant to the Chief of R&D for this task, effective Feb. 7, 1964. He was elevated to Deputy Chief of R&D July 8, 1964.

In recognition of his outstanding leadership of a group of military and industrial leaders who analyzed the various intercontinental ballistic missile threats to the United States, and the possible countermeasures options, General Betts was awarded the Legion of Merit.

Promotion to Army Chief of R&D came to General Betts Mar. 30, 1966, and he has served in this capacity longer than any of his predecessors. His association with Army research and development dates to 1945 with assignment to Los Alamos (N. Mex.) Scientific Laboratory, where he later became associate director.

Among his other major R&D assignments have been: chief, Atomic Energy Branch, Research and Development Division, G–4, HQ DA; executive to the Chief of R&D, Office of the Chief of Staff, HQ DA; chief, Combat Developments Branch, Headquarters U.S. Army Europe; engineer of the newly created U.S. Army Ballistic Missile Agency at Huntsville, Ala.; and special assistant for guided missiles, Office, Secretary of Defense.

Graduated from the United States Military Academy in 1934 with a commission in Coast Artil'ery, he transferred a year later to the Corps of Engineers and remained with this basic branch during his career. He received his first Legion of Merit as engineer of the Fourteenth Air Force in China in World War II.

General Betts was graduated from Massachusetts Institute of Technology with an MS degree in 1938. He is a graduate of the Industrial College of the Armed Forces, Washington, D.C.

Several farewell parties are being planned to honor General Betts, but the big one for the Army and Department of Defense R&D community will take place Dec. 22 at the Fort Belvoir, Va., Officers' Club. Numerous high-ranking dignitaries will participate in the receiving line.

GENERAL GRIBBLE's military assignments and academic training as qualifications for his new assignment as Chief of Research and Development were detailed in the May–June 1970 edition of the *Army R&D Newsmagazine* when he returned for his second assignment as Deputy Chief of R&D.

Recognized as one of the U.S. Army's top experts on atomic power, with numerous key assignments in this field, he is a 1941 graduate of the United States Military Academy. Earlier he was a student at Michigan College of Mining and Technology.

Like General Betts, he had one of his early key R&D assignments as a metallurgical engineer with the Los Alamos Scientific Laboratory (1948–52). That led to a tour of duty with the U.S. Atomic Energy Commission as deputy assistant director, Reactor Development Division (1953–56). Later he received the Legion of Merit for his outstanding achievement in developing the U.S. Army's first nuclear power plant at Fort Belvoir, Va.

General Gribble was Army Materiel Command Director of Research and Development immediately prior to his first assignment as Army Deputy Chief of R&D in 1966. In World War II, he served in a series of engineer assignments in the Pacific Theater during the New Zealand and Luzon campaigns, including duty as commander of the 118th Engineer Battalion, 43d Infantry Division.

Army Conference at ALMC Focuses on Design of Experiments

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technical papers reporting on advances in statistical technology and its application to complex problems in the design of experiments.

The conference was broken down into 10 technical sessions interspersed with clinical and general sessions. Col Bob A. McIlwain, USALMC commandant, welcomed the conferees.

Prof. Solomon Kullback of the Department of Statistics, George Washington University, Washington, D.C., gave the introductory presentation as a guest speaker on "Minimum Discrimination Information Estimation and Application." Dr. Richard J. Kaplan, Management Science Department, Rand Corp., followed with a presentation on "Field Testing."

Other guest speakers included A. Clifford Cohen, University of Georgia, Prof. Gary G. Koch and Prof. Dana Quade, both with the Department of Biostatistics, School of Public Health, University of North Carolina.

Cohen presented "Estimation in Truncated Poisson Distributions with Concomitant Exposure Intervals and Truction Points." Koch spoke on "The Analysis of Complex Contingency Table Data from General Experimental Designs and Sample Surveys." Quade's topic was "Nonparametric Analysis of Covariance."

Dr. Frank E. Grubbs of the U.S. Army Aberdeen (Md.) Research and Development Center gave the banquet address of euology to Prof. George W. Snedecor as the recipient of the Samuel S. Wilks Award. (See separate story on this page for details.)

One of the major technical presentations was "A Complex Split Plot Design for an Experiment Involving STANO Small Live Fire," which described the statistical design used for player control in an experiment conducted by the Army Combat Developments Command Experimentation Command (CDCEC), Fort Ord, Calif.

ASA Presents Wilks Award to Professor Snedecor

Presentation of the Samuel S. Wilks Award to 89-year-old Prof. George W. Snedecor, as the highest honor bestowed by the American Statistical Association, highlighted the 16th annual U.S. Army Conference on the Design of Experiments.

Prof. Oscar Kempthorne of Iowa State University accepted the award on behalf of Prof. Snedecor.

Since 1964 the Wilks Award has been conferred upon a statistician each year in recognition of significant contributions to the theory of experimental design benefiting the U.S. Government, the Department of Defense and the U.S. Army.

Initiated jointly by the Army and the American Statistical Association, the award is a tribute to the Princeton professor who achieved international acclaim as the "Statesman of Statistics" and earned a place in history as one of the greatest U.S. mathematicians.

Prof. Wilks served as a key member of the U.S. Army Mathematics Advisory Panel, later redesignated the Army Mathematics Steering Committee, from its inception in 1954 to his death in 1964.

Funds for the award were donated by Philip G. Rust, retired industrialist. The award consists of a gold medal with a profile of Prof. Wilks, the seal of the American Statistical Association and the name of the recipient on the reverse side, and a citation and honorarium related to the magnitude of the funds held in trust.

Prof. Snedecor is renowned internationally as a pioneer and authority in the field of statistics and related sciences. He was selected by a committee appointed by the American Statistical Association.

The citation accompanying the award to Prof. Snedecor credits him with "pioneering contributions in the development and use of statistical methods, including applications of experimental design to research investigations."

Prof. George W. Snedecor

Acknowledged also in the citation is his achievement of "introducing several generations of statisticians and research workers to the subject of statistics through teaching and the six editions of his world-renowned book, *Statistical Methods*."

Born in 1881 in Memphis, Tenn., he received his education at Alabama Polytechnic Institute, the University of Alabama (1905 BS degree in mathematics and physics) and the University of Michigan (1913 AM degree in physics). He joined the Iowa State University faculty as an assistant professor of mathematics in 1913 and remained on campus for 45 years.

Iowa State's Statistical Laboratory was established in 1933 as a research institute under the president, with George W. Snedecor as its first director. As the first statistical center of its kind in the United States, it provided the impetus for other universities to establish similar research and service institutes in statistics.

Prof. Snedecor collected a staff which earned a reputation for excellence. His diligence in developing cooperative agreements between the Statistical Laboratory and the U.S. Government for research provided funds for expansion of the laboratory staff and projects.

The tribute to Prof. Snedecor states that he inspired his students to achieve their highest goals, and encouraged them to establish even higher goals. The work and contributions of his students alone, it is acknowledged, have given him a reputation as one of the foremost teachers during development of statistical techniques.

College regulations forced him to relinquish administrative responsibilities as director of the Statistical Laboratory at the age of 65 in 1947, when a separate Department of Statistics was established. He continued as a professor of statistics on a part-time basis until his retirement in 1958, and still is affiliated with the university as professor emeritus.

Statistical Methods, first published in 1937, is now in its sixth edition and has sold more than 100,000 copies. It has been translated into Spanish, Hindi, Japanese and Rumanian. A French translation is now in progress and an Indian reprint has been published in English. Prof. Snedecor is the author of three other books and some 50 papers on statistics.

Other Wilks Award recipients are: 1969—Dr. W. J. Youden, retired from the National Bureau of Standards; 1968—Prof. Jerzy Neyman, University of California (Berkeley); 1967—Prof. William G. Cochran, Harvard University; 1966—Maj Gen Leslie E. Simon, USA, Ret.; 1965—Prof. John W. Tukey, Princeton University; 1964—Dr. Frank E. Grubbs, U.S. Army Ballistic Research Laboratories, Aberdeen Proving Ground, Md.

CLINICAL SESSIONS panelists and participants at Design of Experiments conference included (from left) Murray Geisler, RAND Corp.; Prof. Bernard Greenberg, University of North Carolina; Boyd Harshbarger, Virginia Polytechnic Institute; H. L. Lucas and George Nicholson, both of the University of North Carolina; Donald L. Martin Jr., Redstone Arsenal; Dr. Clifford Cohen, University of Georgia; Ronald L. Raciot, Watervliet Arsenal, Watervliet, N.Y.

The design was drawn by Sp/5 Harvey Bunce III, a member of CDCEC's Project Team II, Dr. James S. DeGracie, Dr. David Falkenberry and Timm R. Rodgers of the Litton Scientific Support Laboratory.

Other technical presentations included: A Statistical Analysis of Dynamic Respiration Data, Edward N. Fiske, Edgewood Arsenal, Md.; The Prediction of Individual Military Performance from Laboratory Measures of Performance in Volunteers Exposed to Incapacitating Agents, James S. Ketchum, Philip Shiner, Lorence Gutterman and Philip K. Kysor, Edgewood Arsenal; and

Some Effects on an Improper Screening Technique on the AOQ when Using CSP–1, Fred L. Abraham, U.S. Army Ammunition Procurement and Supply Agency (APSA), Joliet, Ill.; Empirical Bayes Estimators for Some Time Series Parameters, Robert L. Launer, U.S. Army Logistics Management Center (USALMC), Fort Lee, Va.; and

A Statistical Approach to Optimizing the Mechanical Behavior of Composite Materials, Donald L. Martin Jr., U.S. Army Missile Command (MICOM), Redstone Arsenal, Ala.; Systems Vulnerability Due to Multiple Component Drift and Component Failure, W. W. Happ, U.S. Army Corps of Engineers (CE), Champaign, Ill.; and

Time Constrained Reliability Data Development for Helicopter Radio Equipment in a Ground-Based Laboratory, C. E. Deckard and T. K. DeClue, Wyle Laboratories, Huntsville, Ala.; Characteristic Coefficients, Probability and Classification of Wind Profiles (Surface to 25 km), Oskar M. Essenwanger, MICOM; and

Identification of Workers in Biologicals Through Serum Titers by Discriminant Function, Walter D. Foster and Marian W. Jones, Fort Detrick, Md.; Test Design and Data Requirements for Operational Field Testing of Aircraft, Chauncey F. Bell, RAND Corp., Washington, D.C.; and

A Statistical Hierarchical Model for Flight Test Data of a VHF/FM Distance Measuring System (DMS), E. Biser and E. Cornelious, U.S. Army Electronics Command (ECOM), Fort Monmouth, N.J.; A Multivariate Statistical Model for a Semiautomatic Flight Operation Center (SAFOC), Sol Berg and William Patterson, American Electronics Laboratories, Colmar, Pa., and Erwin Biser, Arthur Coppola and Edward Hansen, ECOM;

New Analyses and Methods Leading to Improved Target Acquisition Requirements Involving Systems, Geodetic and Reentry Errors, and Increased Weapons Effectiveness for Conventional Weapons (Part II), Hans G. Baussusvon Luetzow, U.S. Army Engineer Topographic Laboratories (USAETL), Fort Belvoir, Va.;

A Mathematical Model for Artillery Fire Adjustment Analysis, Sidney Gerard, Aberdeen Research and Development Center (ARDC), Aberdeen Proving Ground (APG), Md.; Reliability Testing of Weapon Systems, Ronald L. Raciot, Watervliet (N.Y.) Arsenal; and

Test Procedures for Evaluation of Initiators to the Effect of Nuclear Devices, R. E. Betts and W. B. Thomas, MICOM; Optimal Designs with a Tchebycheffian Spline Regression, V. N. Murty, The Pennsylvania State University; and

Ordinary and Empirical Bayes Approach to Estimation of Reliability in the Weibull Life Testing Model, George C. Canavos, NASA Langley Research Center, and Chris P. Tsokos, Virginia Polytechnic Institute; Second-Order Equi-Radial Designs for Weighted Regression, John A. Cornell, University of Florida; and

System Parameter Optimization Using Response Surface Methodology, Gary W. Barnard, MICOM: Multiple Comparisons Revisited, Clifford J. Maloney, Bethesda, Md.; Design for Estimating the Slope of a Second Order Linear Model, Lyman Ott and William Mendenhall, University of Florida; and

The Application of Biocellular Numbers to the Assessment of Biochemical Trauma in Animal Systems, George I. Lavin, ARDC, APG; A Backward Elimination General Significance Regression Model, Charles E. Colvin, Redstone Arsenal, Ala.; Quick-Reaction Study of Calibration Drift in Radiaometer IM–174 ( ).

DESIGN OF EXPERIMENTS conference participants included (from left) Virginia Perry, local arrangements chairman, Army Logistics Management Center; Dr. Frank E. Grubbs, program committee chairman, Aberdeen (Md.) Proving Ground; Dr. Oscar Kempthorne, Iowa State University, who accepted the Wilks Memorial Medal for Prof. George W. Snedecor; and Fred Frishman, U.S. Army Research Office, Office of the Chief of Research and Development, HQ DA.

CHIEF OF R&D Lt Gen A. W. Betts greets Col Ong-Ard Supamart of the Royal Thai Army during orientation visit by Thai military officers to OCRD. Others (from left) are Col G. J. Akerland, Office of the Secretary of Defense, Advanced Research Projects Agency; Wing Commander Sarayudh Prathipasen, Royal Thai Air Force; Col Somchai Mahasamiti, Royal Thai Army.

ARPA Sponsors R&D Orientation Visit of Thai Officers

Under sponsorship of the Overseas Defense Research Division, Advanced Research Projects Agency (ARPA), three Thai officers from the Joint U.S./Thai Military R&D Center (MRDC) in Bangkok recently completed a 4-week U.S. orientation visit.

The purpose was to introduce the Thai officers to the procedures followed by the U.S. Army for establishing and satisfying requirements for military hardware, including associated studies in the R&D process.

ARPA invited the Research and Analysis Corp. (RAC) to develop and conduct, as a research experiment, a program of orientation and instruction; also, to evaluate effectiveness of the program in furthering the institutional and counterpart development mission of ARPA in Thailand.

Conducted at RAC from Sept. 17 to Oct. 12, the program consisted of lectures and seminars on the U.S. Army research, development, test and evaluation program. The briefings were interspersed with visits to Army R&D staff and command agencies and to selected R&D facilities.

The Thai officers received staff briefings from the Office of the Chief of R&D, HQ DA; the Army Research Office, OCRD; U.S. Army Land Warfare Laboratory; Office of the Assistant Chief of Staff for Force Development, HQ DA; Army Materiel Command; the Test and Evaluation Command; the John F. Kennedy Center for Military Assistance, and the U.S. Army Combat Developments Command.

Army Chief of R&D Lt Gen Austin W. Betts, Director of Army Research Brig Gen George W. Snead and Army Deputy Chief of Staff for Operations Lt Gen Richard G. Stilwell met with the Thai officers and discussed R&D.

Other dignitaries who met with the visitors included Maj Gen E. M. Flanagan, commanding general, JFK Center for Military Assistance; Maj Gen Frank M. Izenour, CG of the Aberdeen (Md.) Proving Ground and the U.S. Army Test and Evaluation Command; and Brig Gen R. E. Connor, chief of staff, Combat Developments Command.

The visitors were Senior Col (equivalent to U.S. brigadier general) Ong-Ard Supamart and Col Somchai Mahasamiti, Royal Thai Army, and Wing Commander (equivalent to lieutenant colonel) Sarayudh Prathipasen, Royal Thai Air Force.

Col Ong-Ard is an ordnance officer and attended ordnance career courses at the U.S. Army Ordnance School, Aberdeen Proving Grounds, in 1955 and 1963. He is now chief of the R&D Materiel Division in the MRDC.

Col Somchai, program manager, MRDC Air Division, received flight training at Fort Rucker, Ala., in 1962. Wing Commander Sarayudh, a project officer in the MRDC Combat Development R&D Division, attended the graduate school of the University of Texas during 1954–56, earning a master's degree in business administration.

Upon their return to the MRDC, it is planned that these officers will develop procedural concepts for performing military RDT&E in Thailand. Concepts will be presented to the Minister of Defense for consideration for implementation by the MRDC and elements of the Royal Thai Military Services.

Skemp Returns to Redstone As Lance Project Manager

Lance, the Army's newest battlefield missile system, is now managed for the U.S. Army Missile Command by Col Samuel C. Skemp Jr., who returned for a second tour of duty at Redstone Arsenal, Ala. His first was in 1956 with the Army Ballistic Missile Agency.

Col Skemp recently completed an assignment in Vietnam as commanding officer of the Army Depot at Cam Rahn Bay. His R&D assignments include 1960–63 service with the Office of the Chief of Research and Development, HQ DA, as well as with the Army Chief of Staff; Office of the Chief of Ordnance, and Aberdeen (Md.) Proving Ground. He has served in Germany, Turkey and France.

He attended the University of Alabama for two years as a premedical student, then transferred to the U.S. Military Academy, graduating in 1946. He did postgraduate work in physics at Johns Hopkins University.

DoD Authorizes Heavy-Lift Helicopter Development

Authorization for development of a helicopter capable of lifting 22.5 tons was granted recently by Secretary of Defense Melvin R. Laird as the first U.S. military helicopter development approved in five years.

Requests for proposals are expected to be submitted to industry this month. Initial development of the Heavy-Lift Helicopter (HLH) will proceed with more than one contractor working on parallel efforts, to allow Department of Defense assessment of competing design concepts.

Secretary Laird decided that only one HLH would be designed for use by both the Army and the Navy.

The proposed HLH capability of 22.5 tons will more than double the capacity of helicopters now in service for the U.S. Armed Forces. The aircraft will be configured for movement of heavy or bulky logistics supplies and tactical equipment.

Developmental responsibility has been assigned to the Army as the lead military service agency, with Col William S. McKeown as program manager. Col McKeown is assigned to the U.S. Army Aviation Systems Command.

The Navy will participate in the development under an agreement to be established between the U.S. Army Materiel Command and the U.S. Navy Material Command.

Miley Heads AMC, Vaughan Assigned as Deputy CG

Elevation of General Henry A. Miley from deputy commander to leadership of the U.S. Army Materiel Command, with promotion to 4-star rank and assumption of responsibilities for directing more than 100 activities and some 80 installations, was effected Nov. 1.

Army Chief of Staff General William C. Westmoreland pinned upon him the insignia of his new rank Nov. 2. Change-of-command ceremonies were conducted Nov. 3 at historic Fort McNair, Washington, D.C.

President Nixon selected General Miley, who had served since June 1969 as AMC deputy commander, to succeed General F. J. Chesarek effective upon his retirement Nov. 1 after more than 30 years active military service. Lt Gen Woodrow W. Vaughan was selected to become the AMC deputy CG.

Leadership of the vast Army Materiel Command, established May 8, 1962, as a consolidation of the materiel functions of six of the Army's seven Technical Services in an Army-wide reorganization, was assumed by General Miley 30 years after he was graduated from the U.S. Military Academy. The AMC has a $28.8 billion inventory and employs about 13,000 military and 139,000 civilian personnel.

During the interim he achieved recognition as one of the U.S. Army's foremost logisticians in a series of progressively responsible assignments. He was Army Assistant Deputy Chief of Staff for Logistics (Programs and Budget), immediately prior to his 1969 move to the Materiel Command, and AMC director of Procurement and Production from 1964 to 1966.

Among other key assignments of General Miley were tank-automotive procurement chief for four years for the Army Chief of Ordnance; ordnance officer, Europe; and commander, Advanced Weapons Support Command, Germany. During World War II, he served in combat in New Guinea and the Philippines, spending 48 months in the Pacific Theater.

Following a year on the Ordnance School faculty, he was selected in 1947 for the Army Graduate Schooling Program. In 1949 he received a master's degree in business administration from Northwestern University and, upon recommendation of officials there, had his tour extended for advanced studies.

After General Miley had completed all academic requirements for his doctorate, the war in Korea interrupted preparation of his dissertation.

In 1950 he was assigned to Frankford Arsenal, Philadelphia, as comptroller and later as public works manager. He supervised manufacture and procurement of small arms ammunition, artillery ammunition and fire-control instruments.

General Miley's decorations include the Distinguished Service Medal with Oak Leaf Cluster, Army Commendation Medal with OLC, American Defense Service Medal, American Campaign Medal, Asiatic Pacific Campaign Medal, and Philippine Liberation Medal.

GENERAL VAUGHAN's qualifications for his duties as deputy CG of the Materiel Command include graduation from the U.S. Military Academy, in the same Class of 1940 as General Miley, a master's degree in business administration from Stanford University, and many key military assignments.

From 1964 to 1966 he commanded the U.S. Army Natick (Mass.) Laboratories. Then he was assigned as deputy director, Defense Supply Agency, followed by duty as commanding general, U.S. Army Communications Zone, Europe.

Key assignments of General Vaughan also have included: Deputy G–4, U.S. Forces, China Theater, World War II; executive officer, Deputy Assistant Chief of Staff, G–4, for Foreign Military Aid; commander, Quartermaster Market Center System, Europe; chief, Programs Division, Office of the Deputy Chief of Staff for Logistics, HQ DA; special assistant for programs, Office of the Joint Chiefs of Staff; and senior logistics adviser, Republic of Korea Army.

Army Completes Tests on 155mm Howitzer System

Final testing of a 155mm self-propelled howitzer, armed with an improved cannon designed and developed by Watervliet (N.Y.) Arsenal, has been completed. The weapon system is expected to be in the hands of troops in the near future.

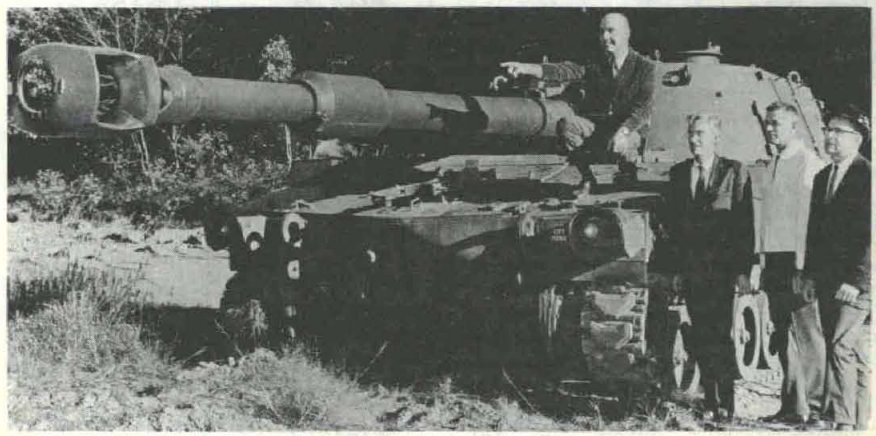
Watervliet Commander Col William Mulheron Jr. announced that the system is about to be added to the U.S. Army's conventional weapons. Maj Gen Charles P. Brown, then CG of Fort Sill, Okla., fired the first test round there two years ago.

The range of the cannon has been increased significantly by its length of 20 feet compared to 12 feet for its predecessor. Another improvement is a can-type bore evacuator that prevents noxious gases from entering the cab of the vehicle, is reportedly more reliable, and requires less maintenance than the 155mm evacuator now used.

Much of the arsenal's engineering design test effort took place at the nearby Malta Test Station, owned by New York State's Atomic and Space Development Authority and operated by the General Electric Co. Ordnance Department.

Use of the Malta site has enabled the arsenal to realize considerable savings in time and money in test projects. By firing inert rounds into sand-filled butts, arsenal engineers are able to secure the same data that formerly had to be obtained by field firing at proving grounds hundreds of miles from Watervliet.

Walter H. Austin Jr., chief of the components development section of the arsenal's Benet Research and Engineering Laboratories headed the development project. He was assisted by mechanical engineer John Busuttil and Matthew Sroczynski, technician.



WATERVLIET ARSENAL engineer John Busuttil points to new 20-foot barrel of cannon developed for 155mm howitzer. Others (from left) are Walter H. Austin Jr., who headed the development project; Matthew Sroczynski, arsenal engineering technician; Fred Ogle, project engineer with the General Electric Co.

MICOM Records Cost Avoidances in Missile Development Tests

Coordinated management actions in the PROMAP–70 project avoided almost $60 million in estimated potential test costs for six missile systems managed by the Missile Command of the U.S. Army Materiel Command.

MICOM announced this economy early in November, claiming more than $40 million in potential test costs in development of the SAM-D surface-to-air missile was eliminated through early coordination with the Army Test and Evaluation Command (TECOM).

TECOM's requirements were satisfied partially by using development and simulation test data that otherwise would have had to be accumulated and proven on tests using actual system hardware.

Estimates of testing costs for components and the total system for a guided missile, the announcement said, may range as high as 40 percent of the completed development costs.

Careful planning—combining tests where possible and screening out potential duplication—has enabled MICOM to record major cost avoidances such as accumulate when required tests are conducted sequentially and independently by each Army agency, the announcement reported.

Testing begins long before a weapon system takes shape, continues throughout its service lifetime, and ends only when the weapon is removed from use. The cycle is long—nine formal series of tests in a normal development program, seven more in production and use, and four others required in whole or in part before an item of materiel is turned over for troop use.

MICOM's successful PROMAP–70 approach brings together all interested elements within the command, as well as other Army and government agencies, in early work to complete a coordinated test program for the materiel item's life cycle.

Combined effort applied to the long-range Pershing Missile, for example, arranged testing to avoid firing several additional missiles that would have cost more than $5 million.

Evaluation of new components in the missile and its ground equipment was successfully conducted during annual service practice firings, when operational units conducted launches under simulated combat conditions.

Still another economy by the Shillelagh project office avoided almost $9 million in test costs, by using missiles held in storage for a prolonged period, to verify the weapon's ability to perform satisfactorily years after manufacture. The requirement was for several hundred rounds to be fired in annual service practice.

Substantial cost avoidances in the Dragon and TOW missile programs were attributed to adherence to the single life cycle concept of testing developed by MICOM. The concept has been implemented in a command regulation combining numerous related regulations in a single document.

Within each project office managing a particular missile system, a single individual has been designated test manager with full responsibility for all testing to be performed on that weapon system.

MICOM's Product Assurance and Test Management Directorate keeps advised of all the command's testing efforts. It provides guidance to assist managers of weapons projects and reviews specific test plans to make sure they conform to established concepts.

Combining test operations is not limited to major items of hardware. MICOM also has avoided costs by testing some of the smaller weapons it manages at its own facilities at its Redstone Arsenal headquarters.

The life cycle approach reportedly works just as well when applied to hardware for weapons that have been in Army use for almost 20 years. The Honest John free rocket has been around that long undergoing periodic technical changes to keep it up to date for service use.

When new launchers were ready for test in actual firing operations, MICOM combined tests with some previously scheduled firings for other purposes and avoided costs of about $82,000.

Environmental Advances Mark Dr. Wilson's Memory

Wherever U.S. Armed Forces may be required to operate under conditions of environmental extremes, terrain conditions unfavorable to mobility, or where meteorological knowledge may become an important factor, Dr. Leonard S. Wilson's role in extending their capabilities may well mark his memory.

Obituaries in the *Army Research and Development Newsmagazine* are limited to those who, in the opinion of working associates, have made monumental contributions to R&D advances in their fields of specialty.

Dr. Wilson's death, on the evening of Dec. 6—more than 28 years after the attack on Pearl Harbor brought him into U.S. Government service—closed a career marked by exceptional contributions in high-level military and civilian positions.

Dr. Leonard Wilson

Since 1955, he had served the U.S. Army as a civilian employe, the last 12 years as chief, Environmental Sciences Division, Office of the Chief of Research and Development, HQ Department of the Army. He served in the Navy as a lieutenant commander during World War II (1943-47).

Highlights of Dr. Wilson's distinguished career in U.S. Government service might be summarized succinctly: 1942, chief, Map Information Section, Coordinator of Information; 1943 (U.S. Navy), deputy chief, Map Division, Office of Strategic Services and, later, chief, Map Intelligence Service, U.S. Department of State; 1945, map officer, United Nations Conference on International Organizations; 1946, geographic adviser, International Secretariat, United Nations, New York City; 1946-53, chief, Geographic Section, G2, Far East Command and, later, chief, Strategic Branch; 1955, chief, Environmental Research Branch, Office of the Chief of R&D, U.S. Army.

Dr. Wilson's reputation as one of the nation's leading geographers mounted rapidly during the war years. Listing of the numerous high-level study and working groups on which he served (Army, joint Armed Forces, and other joint efforts of U.S. Government agencies) would require substantially more space than a listing of his key career assignments.

In the minds of working associates, Dr. Wilson's record of achievements is long and impressive. Known as a "rugged individualist" with an unfailing sense of humor for all occasions, he was recognized as an imaginative, innovative scientific leader who laid the groundwork formany of the Army's major advances in environmental research.

For example, he was selected for a lead role in U.S. Army participation in the International Geophysical Year, and was a chief planner for Army research in atmospheric and terrestrial aspects of the Arctic and Antarctic and other regions during the IGY.

Dr. Wilson also was instrumental in developing plans for the U.S. Army meteorological research program, using high-altitude probing rockets, at

(*Continued on page 50*)

Myrtle W. Burnette

James P. Trant Jr.

John L. Shipley

Francis S. Rogers

AVLABS Honor 4 Employes for Achievements in 1970

Assistant Secretary of the Army for R&D Robert L. Johnson was guest speaker at the Fifth U.S. Army Aviation Materiel Laboratories Awards Banquet, Oct. 29, at which four employees were honored for 1970 contributions to AVLABS programs.

Ceremonies were held for the first time under a new reorganization where AVLABS, headquartered at Fort Eustis, Va., is now a subordinate activity of the newly created U.S. Army Air Mobility R&D Complex at Moffett Field, Calif.

AVLABS previously reported to the Research, Engineering and Data Activity of the U.S. Army Aviation Systems Command (AVSCOM), St. Louis, Mo. Col John R. Adie is the AVLABS commander.

JAMES P. TRANT JR., an aerospace engineer in the Preliminary Design Division, received the Director's Award for Technological Achievement, consisting of a citation, an engraved plaque, a lapel pin and a check for $350. AVLABS Technical Director Larry M. Hewin presented the award, which recognizes technical effort by a scientist or engineer.

JOHN L. SHIPLEY, an aerospace engineer in the Aeromechanics Division, was awarded the Commander's Award for Exceptional Service for performing a service over and above normal job requirements. Paul F. Yaggy, director of the U.S. Army Air Mobility R&D Complex, presented the award, consisting of an engraved plaque, a lapel pin and $350.

FRANCIS S. ROGERS, a management technician in the Management and Computer Science Office, was honored with the Commander's Award for General Excellence. This recognizes individual performance of duties without regard to level of responsibility or difficulty of the position.

The Honorable Thomas N. Downing, U.S. Representative for the First Congressional District of Virginia, presented the award, also consisting of a plaque, lapel pin and $350.

MRS. MYRTLE W. BURNETTE, an accounting technician in the Comptroller and Programs Office, received an elaborate scroll and an engraved plaque as the Special Award recognizing ability to meet complications and complexities in a diversified organization, meanwhile maintaining a cheerful and aggressive outlook. Meade H. Mitchell Jr., deputy director of AVLABS, made the presentation.

Distinguished guests, in addition to those presenting the awards, included Maj Gen Howard F. Schiltz, CG of the U.S. Army Transportation Center at Fort Eustis; Edgar M. Cortright, director of NASA-Langley Research Center in Hampton; and Dr. Robert B. Dillaway, U.S. Army Materiel Command Deputy for Laboratories.

BRL Presents 1970 Kent Award to Dr. Masaitis

Presentation of the Kent Award for 1970 to Dr. Ceslovas Masaitis, deputy chief of the Applied Mathematics Divison, U.S. Army Ballistics Research Laboratories, Aberdeen (Md.) Proving Ground, recently recognized achievements in several scientific areas.

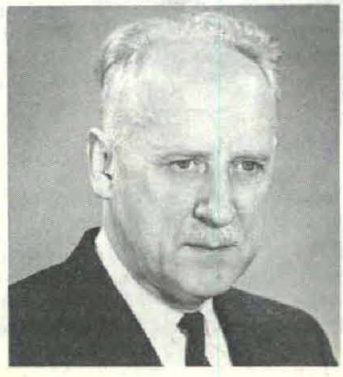
Established in 1956, the award honors Dr. Robert H. Kent who served for many years as assistant technical director of the Army Ordnance Ballistics Research Laboratories until he retired in 1956. He died in February 1961.

Army Materiel Command Deputy for Laboratories Dr. Robert B. Dillaway was guest speaker at the ceremony. Robert J. Eichelberger, BRL technical director, presented the award, BRL's highest annual commendation for achievement in scientific or engineering fields.

Dr. Masaitis was chosen for contributions to design improvements for the Pershing missile, his work on missile firing tables, research in the theory of photogrammetry, development of methods for reducing satellite orbit data, and for studies of stabilizing devices, wound ballistics and effects of climatology on missile performance.

Born and educated in Lithuania, Dr. Masaitis attended the University of Kaunas, where he majored in mathematics and physics. After receiving his MA degree in 1937, he served until 1940 at that university as an assistant in astronomy. From 1940 until 1944, he was an assistant in astronomy and mathematics at the University of Vilnius.

He came to the United States in 1950 and became an instructor in physics and mathematics at Nazareth College, Ky., and in 1952–53 was an instructor at the University of Kentucky. During the next three years he earned his PhD degree in mathematics at the University of Tennessee. Employed as a research mathematician in the Computing Laboratory at BRL for eight years, he became chief of the Applied Mathematics Branch in 1964 and in 1968 he was promoted to his present position.



Dr. Ceslovas Masaitis

Since 1957 he has taught graduate courses in mathematics for the University of Delaware extension division at BRL and for seven years has served as a consultant to the surgical department of the medical school of the University of Maryland (since 1969 as assistant professor, Department of Thoracic Surgery).

USAETL Employes Gain Honors For Scientific, Leadership Roles

Contributions to an Advanced Automatic Compilation System (AACS) and leadership in Project Sand are recognized in the 1970 selection of Commanding Officer's Scientific and Leadership Award winners at the U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Va.

Ernest M. Stiffler, an electronics technician in the Automated Mapping Division, received the Scientific Achievement Award. Leadership Award winner is Donald G. Orr, a project engineer in the Geographic Sciences Division.

Lt Col George N. Simcox, acting commanding officer, presented plaques and $75 to each of the winners at a recent ceremony at which nine other nominees for the two awards received certificates and $25 awards.

Stiffler was selected for his contributions to the basic concept evaluation studies, preliminary and detailed design, and the personal development and fabrication of the scan system, interfaces and computer installation for feasibility evaluation of the AACS.

Successful development of the AACS will provide the Army with a flexible mapping system that will produce an orthophoto with higher resolution, in much less time; also, with a considerable reduction in equipment size and weight, when compared with the Universal Automatic Map Compilation Equipment (UNAMACE).

Employed at the laboratories since 1961, Stiffler has a diploma in radio, television and electronic engineering from the Devry Technical Institute, Chicago, Ill. He has studied advanced electronics engineering at Capital Radio Engineering Institute (CREI), Washington, D.C.

Other nominees for the scientific achievement award were Kent T. Yoritomo, for his work on utilization of radar for mapping; Melvin Crowell, for his work on a field artillery survey equipment development plan; Robert S. Pazak for assembling two programs for the UNIVAC 1108 computer; James E. Stilwell, for contributions to sequential estimation as applied in analytical photogrammetry; and Richard A. Hevenor, for his work on side-looking radar for military geographic intelligence.

Orr was selected over four other nominees for the leadership award. Cited was his work in planning, organizing and executing Project Sand to locate suitable sand and gravel in the Mekong Delta area of Vietnam; also, for his monitorship of three hardware contracts and preparation of contract papers and trip reports.

Since graduating with a BS degree in geology from the University of Nebraska (1959), he has taken courses in advanced electronic theory at the U.S. Department of Agriculture Graduate School and in photo interpretation at the University of Illinois.

Following his release from active military duty (1959–61), during which he was assigned to the U.S. Army Mobility Equipment Research and Development Center, Fort Belvoir, Va., he accepted a civilian position at the center. He was employed in the Intrusion Detection and Sensor Laboratory until he transferred to the Topographic Laboratories.

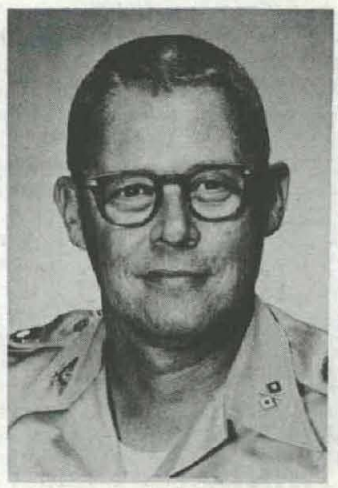
Other nominees for the leadership award were J. Wiley Halbrook, chief of the Mechanics and Optics Branch in the Topographic Engineering Division; Oscar W. Bowker, chief of the Inertial Survey Branch, Surveying and Geodesy Division; Dale E. Howell, chief of the Applications Division; and Dr. Kenneth R. Kothe, chief of the Geographic Sciences Division.

SCIENTIFIC & LEADERSHIP AWARDS were presented recently for achievements at the U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Va. Donald G. Orr receives congratulations and a plaque from Lt Col George N. Simcox, acting USAETL commander, after winning the leadership award. Ernest M. Stiffler (center, right) received the scientific award. Standing by is Dr. K. R. Kothe, a nominee.

Col Medinger Takes Command of NCC, Provisional

Col John N. Medinger is the new CO of the National Communications Command (NCC), Provisional, following completion of a tour of duty as chief of staff for the U.S. Army Strategic Communications Command (STRATCOM) 1st Signal Brigade, Southeast Asia.

The assignment makes him responsible for supporting, operating and maintaining the Army portion of the Defense Communications System (DCS) within the Continental United States (CONUS). Headquartered in Alexandria, Va., the NCC comprises a coast-to-coast network of telecommunications facilities, including satellite terminals at Fort Dix, N.J., and Camp Roberts, Calif.



Col John N. Medinger

Two other major NCC operations are the East Coast Telecommunications Center at Fort Detrick, Md., and the Pentagon Telecommunications Center, Washington, D.C.

A former deputy commander of STRATCOM-Europe, Col Medinger headed STRATCOM-CONUS from 1964 to 1966. In 1969, STRATCOM-CONUS and the Army Joint Support Command at Fort Ritchie, Md., consolidated into the NCC.

Commissioned in 1942, he served in the European Theater and in recent years has held key assignments in communications-electronics at the Joint Chiefs of Staff and Department of Army levels.

From 1950 to 1952, he participated in seven campaigns of the Korean War, serving as signal officer for the 7th Infantry Division. He has been awarded the second Oak Leaf Cluster to the Bronze Star Medal and the Legion of Merit, the Army Commendation Medal with OLC, and Joint Services Commendation Medal.

Army Materiel Command Conducts Risk Analysis of 8 Army Equipment Items

An unusual managerial X-ray was made recently by the U.S. Army Materiel Command of the Armored Reconnaissance Scout Vehicle (ARSV) and seven other proposed new items of Army equipment.

A "Risk Analysis" was completed on the mobility portion of the ARSV in an intensive effort to identify technical, cost and schedule risks involved in meeting performance requirements. The in-depth study is continuing on the remainder of the system.

Risk analyses also have been completed on such items in the materiel life cycle development and production phase as the Cheyenne advanced aerial fire support system, the Loran Airborne Navigation System, the 27.4M Armored Vehicle Launched Bridge, Mine (AT) Subsystem XM 56, 155mm Howitzer (Towed) XM198, 10 kilowatt Turbo-Alternator and the Forward Looking Infrared.

Risk analysis of these items completes the first phase of pilot studies of equipment as represented by each of AMC's commodity commands.

Detailed reports of the technical, cost and schedule risks of the proposed hardware are a compendium of "lessons learned," and will be used as ready reference throughout AMC as major installations initiate the second phase of risk analysis.

This phase will involve project-managed systems in concept formulation, contract definition, or engineering/operational systems development which are essential elements of major weapon system development.

HQ AMC considers risk analysis to be one of the most important elements of the command's "Program for the Refinement of the Materiel Acquisition Process" (PROMAP–70). This is the Army's current campaign to eliminate cost growth in weapons systems programs and develop better methods for procuring equipment of improved durability, simplicity and reliability.

Under the impetus of PROMAP–70, a Risk Analysis Task Force was formed at HQ AMC under the directorship of Roger W. Hanson in the Directorate of Research, Development and Engineering.

The risk analysis program implements Deputy Secretary of Defense David Packard's emphasis to the Military Services on minimizing technical risks of new equipment procurement.

The objective is to improve the quality of analysis of technical, cost and schedule risks by optimizing trade-offs among variables and to provide an improved basis for decision.

AMC's task force on Risk Analysis was faced initially with the problem of deciding which analytical techniques were most applicable to acquisition management and how they should be applied. These techniques included probability theory, network theory, decision "trees," Monte Carlo simulation, and utility theory.

For example, it was decided to use the decision tree as a basis for methodically laying out acts, events and alternatives in the acquisition process. A tree is constructed by tracing through from start to finish the consequences of each possible decision at various points in materiel acquisition. The payoff of each route through the decision tree is calculated.

In addition, the performance (technical) risk is assessed. Resulting impacts in cost and schedule then are combined into the total project risk to produce a broad planning model for the entire system—not just the individual components that can be used for decision making.

This necessitates a multi-disciplined team approach since no single individual has a sufficiently broad spectrum of expertise. Members of the team may include the project engineer for the system, a risk analyst, a procurement specialist, a representative of the user, a cost analyst, an integrated logistic support specialist and a test specialist.

To accomplish this new program, HQ AMC has started what it considers to be the key to its success—the training of engineers and other technical personnel who will actually be doing risk analysis.

Orientation courses were held at the Army Logistics Management Center (ALMC), Fort Lee, Va., in May and June for 66 top level AMC staff and project management personnel. The first in-depth 2-week training course on risk analysis was completed at HQ U.S. Army Electronics Command, Fort Monmouth, N.J., in September.

HQ Weapons Command, Rock Island, Ill., and HQ Tank-Automotive Command, Warren, Mich., were the sites of the second and third class in September and early October.

The course will be held at all of the remaining AMC major subordinate commodity commands by the end of this year: Missile Command, Redstone (Ala.) Arsenal, Oct. 12–23; HQ Munitions Command, Picatinny Arsenal, Dover, N.J., Oct. 26–Nov. 6; HQ Aviation Systems Command and HQ Mobility Equipment Command, St. Louis, Mo., Nov. 12–25; Mobility Equipment Research and Development Center, Fort Belvoir, Va., and HQ AMC, Washington, D.C., Nov. 30–Dec. 11.

Theory and background of risk analysis are discussed during the first week of the course and the second week is devoted to real life case study work to provide actual experience in risk analysis.

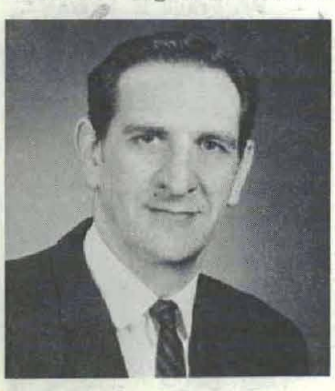
Starting in March 1971, the course will be conducted on a quarterly basis at Fort Lee, Va., AMC's Army Logistics Management Center.

ECOM Selects Linden as Power Sources Division Chief

David Linden, known internationally as an expert on electrical power systems for military field equipment, is the new chief of the Power Sources Division, Electronic Components Laboratory, U.S. Army Electronics Command (ECOM), Fort Monmouth, N.J.

Linden has served 28 years with ECOM and is credited with major contributions to numerous advances in portable electronic sources. Results of his work include new types of batteries, fuel cells, thermo-electric devices and solar energy systems used to power instruments in a number of early satellites.

He has a bachelor of science degree from City University of New York and a master's degree in science from the Polytechnic Institute of Brooklyn. He is a Fellow of the American Institute of Chemists and a member of the American Chemical Society and the Electrochemical Society.



David Linden

Linden has served with a number of national and international groups, including the power sources committee of the Institute of Electrical and Electronics Engineers and the American Institute of Astronautics and Aeronautics. He has been the U.S. representative to the NATO Group of Experts in Electrical Power Sources.

Linden is chairman of the Power Sources Symposium, annually the largest international meeting of its kind, and chairman of the Electrochemical Working Group of the Interagency Advanced Power Group, a U.S. Government organization.

AMMRC Studies Strengthening of Titanium Through Texturing

In response to an ever-increasing need for higher-strength materials for critical applications, studies are being conducted at the U.S. Army Materials and Mechanics Research Center (AMMRC), Watertown, Mass., with the goal of enhancing strength-to-weight properties of titanium.

Dr. Frank R. Larson, supervisory research metallurgist, and Anthone Zarkades, research materials engineer, in a recent report on their experiments, say that the AMMRC has established that crystallographic anisotropy or texture control can provide a breakthrough in obtaining significant property improvement in both uniaxial and biaxial stressed components.

Titanium alloys such as Ti–6A1–4V now being utilized at tensile strength levels of 160,000 psi could effectively be utilized at 240,000 psi. With this material improvement, a weight savings of approximately 50 percent would be realized in many Army components such as rocket motor cases, pressure vessels or recoilless rifle barrels.

Controlled anisotropy could also upgrade the ballistic resistance of armor plate. Improvements in the drawability or forming characteristics can be attributed to texturing, which also would make titanium a leading candidate for the "Seige" lightweight combat helmet.

The basis for this strengthening and general improvement of the elastic and plastic properties has been shown to be due to the structural characteristics of the titanium single crystal; also, to the fact that the predominant mode of deformation is slip on the prismatic, pyramidal and basal planes with an identical <1120> slip direction.

Thus, in a titanium sheet which has the ideal texture of basal planes lying in the rolling plane, there is no operative slip systems for yielding in the through-the-thickness direction.

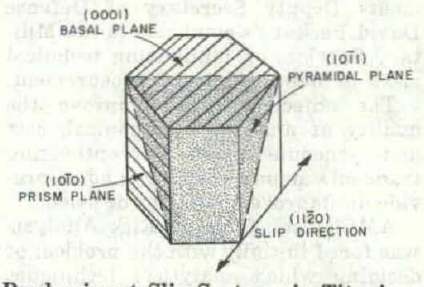
Analysis conducted at the AMMRC relative to the theories of yielding for anisotropic materials and their application to certain end items has promised major strength improvements.

Application of single-crystal theories to the elasticity and plasticity of simple texture of sheet material has shown that a model which represents the polycrystalline texture as a single point in the pole figure will predict accurately the anisotropy of the elastic and plastic properties.

Yielding in a two-to-one biaxial stress field will occur at about 1.15 times the uniaxial strength for the isotropic case. Based on this knowledge, it is predicted that it will occur at 1.60 or greater for certain anisotropic materials and that as much as a 40 percent increase in yield strength can be obtained.

Data on textured titanium tested at the AMMRC has manifested 30 percent increases. Improvement of a very important mechanical property, Young's modulus, has also been revealed. Analysis of single crystal data has shown a maximum modulus of 21.0 x 10^6 psi is possible.

Uniaxial tensile tests of a textured commercial titanium alloy have shown a maximum modulus of 20.6 x 10^6 psi to be obtainable. These property improvements mean lighter yet stronger structures for increased range and payload.



Predominant Slip Systems in Titanium

To realize the many benefits and exploit this phenomenon of texture hardening, one must be able to develop and control the desired textures in a practical 2-phased production material.

Recent advances in this area have been accomplished through a study on cold rolled sheet entitled "Twinning and Texture Transition in Titanium Solid Solution Alloys." This work was conducted under the leadership of Dr. F. R. Larson, Army Fellowship recipient at Brown University.

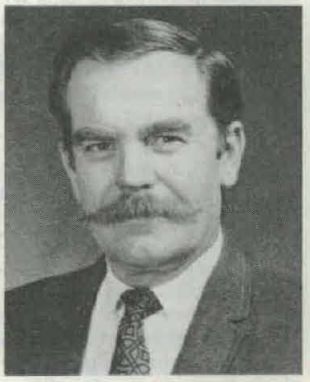
Significant results of the program suggest that increasing additions of beta solid solution stabilizer alloying elements causes a texture transition when the retained beta is in excess of approximately 15 volume percent. This texture transition for the basal pole may be described as a transition from titanium to zinc type texture.

Alloy additions of copper were exceptions. It was observed that with small additions of copper, a tendency to form the ideal {0001} <1010>

DR. FRANK R. LARSON received a BS degree in chemical engineering from Tufts University in 1945. Under a Secretary of the Army's Research and Study Fellowship Award, he studied at Brown University, Providence, R.I. (1968–70) for a PhD in materials science.

While employed as a metallurgist with General Electric Co., Lynn, Mass., he received its highest recognition, the Charles A. Coffin Award, for his work in creep and rupture parameters.

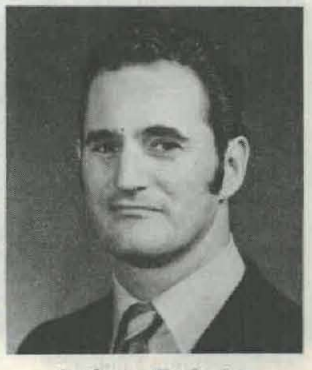
Dr. Larson transferred to U.S. Government service in 1951. Currently chief of the Metals Divison at AMMRC, he is recognized as an expert in failure analysis and in texture strengthening. He has published about 80 reports in government and technical journals, and is an active member of several American Society for Metals and American Society for Testing Materials committees. He has received several citations and awards, the most recent being the Meritorious Civilian Service Award for metallurgical investigations of the 175mm gun tube failures.



Dr. Frank R. Larson

ANTHONE ZARKADES is a research materials engineer in the Materials Research Laboratory at the Army Materials and Mechanics Research Center, Watertown, Mass. He graduated in 1966 from Northeastern University, Boston, Mass., with a BS degree.

Since 1969 he has worked on a variety of metallurgical research programs involving failure analysis investigation of military components. His primary interest has been in texture strengthening, a field in which he is credited with significant contributions by establishing the effect of texturing; also, relating the structural characteristics of the hexagonal close-packed single crystal to the elastic and plastic properties of titanium. Author of several U.S. Government publications, he is the recipient of numerous Army awards for outstanding performance.



Anthone Zarkades

type texture through suppression of the (11–2) twining existed.

Neutral alloying elements such as tin and zirconium were found to have little effect on the cold-rolled texture of titanium.

To facilitate present and future programs in texturing, a new instrument was invented and developed at the AMMRC in coordination with A. G. Martin, electronic engineer. Used in conjunction with an X-ray diffractometer, the instrument will directly plot pole figures, indicating preferred orientations in eight discrete levels as rapidly as the specimen can be scanned.

This unique equipment has eliminated tedious and time-consuming hand-plotting of recorded data and has alleviated a serious bottleneck in the development of reliable preferred orientation pole figure data.

From the research and developmental work done at the AMMRC, it is now apparent that the anisotropic characteristics of materials can be utilized for improved structural designs through the control of texture.

Initial observations of large plastic flow anisotropy were made at AMMRC's Metals Division Laboratories. Many research programs have since been initiated throughout the United States and abroad. Further advances in the state-of-the-art are expected to result in materiel with increased efficiency, reliability and integrity.

U.S. Withdraws From 4-Nation Mallard Project, Still Seeks Its Goals

United States withdrawal from the multimillion-dollar Mallard Project, a 4-nation cooperative research and development effort initiated in 1967 to establish a tactical communications network for field armies, was announced recently.

The Mallard concept also calls for use of the system by associated Air Force formations and, where applicable, elements of the Navy.

Director of Defense Research and Engineering Dr. John S. Foster Jr. explained the action in letters to the governments of the United Kingdom, Canada and Australia. The U.S. Department of Defense, he said, had not been able to win Congressional support for continued United States participation in the program.

The United States had spent $16.6 million in the cooperative effort and $9.6 million in unilateral support activities. Dr. Foster termed the Mallard Project an extremely productive development whose international character enhanced its ideas and productivity.

In accordance with a Memorandum of Understanding signed by the partners in April 1967, they shared the cost of R&D of an advanced tactical multichannel communications system intended to provide the same equipment and standards for the armies and air forces of the four nations.

When the announcement of termination of U.S. participation was made, the Mallard Project had progressed to the point where preprototype models of system components were being constructed to test the feasibility of the system design.

The United States Government has been consulting with its Mallard partners on the mechanics for terminating the project. The schedule had called for introduction of Mallard standard equipments into the operating forces of the participating nations in 1978.

Dr. Foster indicated to the Mallard partners that the United States plans to conduct an extensive review of its particular requirements for tactical communications during 1971.

Assurance was given in the letters to the governments of the partners that the United States will continue to work for compatibility of tactical communications and for common technical and operation standards with the United Kingdom, Canada, Australia and major NATO nations.

The United States center for the Mallard Project was established in April 1967 at Fort Monmouth, N.J., HQ of the U.S. Army Electronics Command. Brig Gen (now Maj Gen) Paul A. Feyereisen was U.S. project/program manager. He is now Army Materiel Command Deputy CG for Materiel Acquisition and head of the Program for Refinement of the Materiel Acquisition Process (PROMAP–70), a high priority area of effort. The current project/program manager is Brig Gen Harold Rice.

Col Arnold Assigned as Project Manager for AACOMS

Project manager for Army Area Communications Systems (AACOMS) is the new title of Col Emmett R. Arnold at HQ U.S. Army Electronics Command (ECOM), Fort Monmouth, N.J.

Col Dana S. Prescott, his predecessor, is now chief of Communications-Electronics, Sixth Army, The Presidio, San Francisco.

Col Arnold was until recently deputy commandant of the Southeastern Signal School at Fort Gordon, Ga., where he also served in 1956 with the 379th Signal Battalion and in 1951 on the faculty.

When he returned from Vietnam in 1967, Col Arnold was assigned to the Office of the Assistant Chief of Staff for Communications-Electronics, serving successively as chief, Tactical Communications Division and deputy director, Tactical Systems Directorate.

He has served at Supreme HQ Allied Powers Europe (SHAPE); HQ Eighth Army, Korea; in the Panama Canal Zone; with the Third U.S. Army, Europe; the Pentagon; and at Fort Carson, Colo.

Commissioned in the Signal Corps upon graduation from OCS in 1942, he completed the Signal Officers Advanced Course in 1953 and has graduated from the Command and General Staff College (1956) and the Army War College (1964). He has received master's degrees in business administration and also in international affairs.

Col Arnold has received the Legion of Merit with Oak Leaf Cluster, Meritorious Service Medal, Bronze Star Medal with OLCs, Army Commendation Medal and Purple Heart.

Col Emmett R. Arnold

Maj Gen Shedd Succeeds Scott As DASA Deputy Director (O&A)

Maj Gen William E. Shedd III, U.S. Army, has succeeded Brig Gen Richard M. Scott, U.S. Air Force, as deputy director (Operations and Administration) of the Defense Atomic Support Agency (DASA). General Scott, with DASA since June 1968, retired recently.

General Shedd recently completed a tour of duty as chief of staff, XXIV Corps, subsequent to a tour of duty as assistant commander of the 1st Cavalry (Airmobile) Division in Vietnam.

The tour in Vietnam followed an assignment in the Office of the Joint Chiefs of Staff as deputy director for Operations in the Operations Directorate. He is a graduate of the U.S. Military Academy, Army War College and the Command and General Staff College.

Laird Says Defense Budget Cuts Have Reached End for Security

Secretary of Defense Melvin R. Laird stressed that the United States is in a transition from war to peace, and that reductions in the defense budget have gone about as far as they can without jeopardizing national security, in three recent addresses.

In an Oct. 22 speech to the Chicago (Ill.) Council on Foreign Relations, Secretary Laird said, "The strategy by which we hope to realize our goal of peace is summarized in three pillars of President Nixon's Foreign Policy for the 1970s—partnership, strength, and a willingness to negotiate.

"The course which the President has chosen to attain this goal is the course of shared responsibility. It is not the path of isolationism—which history has taught us does not lead to peace in the world.

"Nor is it the path of the pax Americana, which would impose on our country the burden of bearing principal responsibility for the safeguarding of peace everywhere in the world against all possible threats.

"The President's course is the path of meaningful negotiation. It is not the inflexible intransigence of non-negotiable demands, nor is it a mindless willingness to barter away our rights —or the rights of any other nation— in order to achieve agreement. . . ."

Secretary Laird cited the sending of the Sixth Fleet to the Middle East as a contribution to the cease-fire and an "episode that graphically illustrates how military power serves the cause of peace. It shows why President Nixon regards *strength* as one of the three pillars of a strategy of peace.

"And so I emphasize at every opportunity the importance of maintaining a military capability that will constitute a credible deterrent—a deterrent to any breach of the peace that would affect the security of the American people or their vital interests.

"I want to emphasize that we have been able to cut back on our military spending in 1969 and in 1970 largely as a result of progress in Vietnamization. But I must clearly point out that the cuts we have programed go as far and as fast as we dare go in reducing our military forces at the present time. I hope that when Congress meets again, it will fund fully the budget requests made by the President for our national defense. . . ."

Speaking to the San Antonio (Tex.) Chamber of Commerce, Secretary Laird also discussed the transition from war to peace activities of President Nixon. Much of his address was devoted to the defense budget.

Before launching into these major issues, however, he commented on the success of the San Antonio pilot project "for our program to work with civilian health officials in applying the lessons we have learned in Vietnam to the medical emergencies we face here in the United States.

"As you know, the largest killer in the United States of people 37 years or under is highway traffic accidents. That is why, as a member of Congress, I urged that we seek new means to deliver timely medical assistance to the trauma victims on our highways." (See page 2 article of De-

DMIC Reviews Low Temperature Properties of Metals

The Defense Metals Information center (DMIC), which functions under direction of the Office of the Director of Defense Research and Engineering, recently published the first edition of a quarterly periodical, *Review on Low Temperature Properties of Metals.*

Being published under joint sponsorship with the Metal Properties Council (MPC), the review is the result of a recommendation by Charles F. Hickey Jr., chairman of the Joint Low Temperature Panel of the American Society for Test Materials, the American Society for Mechanical Engineering and the MPC. Hickey is employed at the Army Materials and Mechanics Research Center, Watertown, Mass.

The publication presents summaries of information in the low-temperature area which have become available to DMIC in the preceding 3-month period. Examples of subject areas in the first issue include "Fracture Toughness of Alloy Steels at Low Temperatures," "Effect of Cryogenic Temperatures on the Properties of Titanium Alloys Produced from Alloy Powders," "Review of Russian Literature on the Low Temperature Properties of Metals," and a "New Tensile Cryostat Design."

James E. Campbell of Battelle Memorial Institute, Columbus, Ohio, is the editor of the publication. The current distribution list, which includes government and industrial personnel, numbers approximately 4,000.

A. O. Schaefer, executive director of the MPC, states that MPC thinks so highly of this type of review that consideration is being given to the possibility of extending it to other areas of the properties of metals.

The Low Temperature Panel is one of seven panels within the framework of the ASTM-ASME-MPC Joint Committee on The Effect of Temperature on the Properties of Metals.

Additional areas in which the panel is involved include a funded program on fracture toughness, a technical session at the 1970 Annual ASTM meeting on "Fracture Toughness Testing at Cryogenic Temperatures," and a session on "Fracture Toughness and Low Temperature Properties of Composite Materials" scheduled for the 1971 meeting.

Review of these and related programs is of direct interest to the Army because of the increasing application of fracture toughness as a design tool and the possible utilization of composite materials in future Army aircraft.

CHARLES F. HICKEY JR. is a metallurgist in the AMMRC Metals Division of the Materials Research Laboratory. He received a BS degree in mineral preparation engineering from Pennsylvania State University in 1956 and has taken graduate courses in physical metallurgy at Northeastern University.

During 13 years of AMMRC employment (including two years of military duty), he has authored some 30 technical publications, devoted principally to mechanical properties and fracture toughness of titanium alloys and maraging steel, and has made numerous presentations at technical society meetings.

In addition to chairing the Joint Low Temperature Panel, Hickey is a member of the ASTM-ASME-MPC Technical Advisory and Main Committee, a member of ASTM and ASM, and a contributing editor to the Aerospace Structural Metals Handbook.

cember 1969 edition of *Army Research and Development Newsmagazine.)*

"When I became Secretary of Defense, I appointed a group to work with the Department of Transportation and the Department of Health, Education and Welfare to establish a test program. This culminated in Project MAST—Military Assistance for Safety in Traffic—and we initiated the program right here in San Antonio last July.

"Since then we have extended the test program to serve other areas throughout the United States. I look forward this afternoon to meeting with our helicopter rescue groups, most of whom have served in Vietnam, and to receive an updated report on results of this promising test program. . . ."

In referring to the "historic change in our national priorities" effected by President Nixon in February 1970, when defense spending was dropped for the first time in 21 years from the biggest category of federal spending, Secretary Laird stated:

"This year, more of the federal budget is devoted to human resource programs than to defense. This year —for the first time in 20 years—defense spending is less than 40 percent of total federal spending. This year, more than one dollar out of every three disbursed by the Federal Treasury is being spent for defense. . . .

"While Defense spending in dollars of constant purchasing power was reduced more than $17 billion since 1968, spending for non-Defense federal programs in constant dollars increased by $18.4 billion. Thus a so-called peace dividend for the domestic sector has already resulted from reduced defense spending.

" . . . The planned reductions and cutbacks in defense go as far as we can in the present world environment without exposing ourselves to imprudent risk. We must never close our eyes to the threat which our Armed Forces must be prepared to face. That threat has not diminished. Quite the opposite, it continues to grow. . . ."

This viewpoint was reemphasized by Secretary Laird in an address to Duluth (Minn.) Civic Clubs. He said:

". . . I want to take the opportunity at this important forum to reiterate my conviction that the budget now pending before Congress for the fiscal year which began last July 1 is a 'rock-bottom, bare-bones' budget. Any major cuts in our proposed funding, particularly in view of the momentum of the Soviet weapons and research and development buildup, could take us below the threshold of tolerable risk. . . ."

MERDC Uses Waste Heat for New Air Conditioner

An advanced air conditioner powered by waste heat from turbine exhaust is being tested by the U.S. Army Mobility Equipment Research and Development Center, Fort Belvoir, Va.

Designed for use with the Army's missile fire-control vans and other mobile shelters requiring controlled environment, the experimental model operates from exhaust heat of a 15 kw. military turbine generator set to produce five tons of cooling.

A fuel savings of 40 percent and a size and weight reduction of 30 percent for combined power and environmental control equipment are anticipated through application of the waste heat recovery units.

The experimental model incorporates a "double loop" design consisting of a power loop and a refrigeration loop, both operating with R–11 fluid with a common condenser circuit.

Heat from the exhaust gases is transferred to the power loop fluid by means of a vapor generator heat exchanger. Exhaust gas energy thus recovered is transferred to the refrigeration loop by expanding the heated power fluid through a turbine, which drives the refrigeration loop compressor.

The power loop operates on the Rankine power cycle principle, with the fluid circulating through a vapor generator, turbine, condenser and pump. The refrigeration loop is a conventional vapor compression type consisting of a condenser, expansion device, evaporator and condenser.

In the experimental model, which as a military unit must provide complete environmental control, heating and cooling are controlled by fully modulating bypass valves to maintain a constant return air temperature from full cooling to full heating conditions. Fluid-process bearings and new high-temperature lubricants are used to enable the fluids to operate at high-vapor generator temperatures without decomposition.

The experimental unit was designed and fabricated by the Garrett Corp., AiResearch Manufacturing Co., under a contract with the Mobility Equipment R&D Center.

NLABS' Scientist Authors Life Processes Books

Quantitative Cellular Biology: An Approach to the Quantitative of Life Processes is the title of a new textbook authored by Dr. Ferdinand Heinmets of the Pioneering Research Laboratory, Natick (Mass.) Laboratories.

Published by Marcell Dekker, Inc., 95 Madison Ave., New York City, the 344-page book is priced at $17.50. It is described as a basic text for teaching quantitative biology at graduate and post-graduate level. It deals essentially with processes of biology, enzyme synthesis and cellular growth.

Concepts and Models of Biomathematics: Simulation Techniques and Methods, also edited by Dr. Heinmets, was announced simultaneously as a new book by the same publishing firm. The 316-page book sells for $16.75. It is described as a text that will be useful to all scientists and students who want to develop an understanding of biological processes at a quantitative level.

The contents include Simulation of Glycolytic Systems, *David Garfinkel;* The Analysis of Electron Kinetics in Mitochondria, *M. Pring;* Fourier Transform Analysis of Tracer Data, *Stephen M. Pizer, Alan B. Ashare, Arthur B. Callahan, Gordon L. Brownell;* and

Blood Glucose Regulation and Diabetes, *E. Ackerman, L. C. Gatewood, J. W. Rosevear and G. D. Molnar;* Analysis of Cellular Growth Process, *F. Heinmets;* Modeling of Adrenocortical Secretory Dynamics, *Ching-Chung Li* and *John Urquhart;* Simulating the Grazing Situation, *David W. Goodall;* and A Model for Selection on Systems of Species Competition, *Bruce R. Levin.*

ASM Picks Army Man for Unit On Environment Microbiology

Appointment of Dr. Carl Lamanna to its recently established Committee on Environmental Microbiology has been announced by the American Society for Microbiology. Dr. Lamanna is deputy chief, Life Sciences Division, U.S. Army Research Office, Office of the Chief of Research and Development, HQ Department of the Army.

The new committee is charged with activities to insure that the science of microbiology is not neglected by the ad hoc committee of the International Council of Scientific Unions on Problems of the Human Environment. The ASM group will make studies and recommendations to the ASM for actions to protect the role of microbiologists in generation of programs in international efforts for pollution abatement.

14 Officers, 2 Civilians Report for New Assignments With OCRD

Fourteen officers and two civilians reported recently for new assignments with the Office of the Chief of Research and Development, HQ Department of the Army.

Col Wallace H. Hubbard completed a tour of duty as operations chief, J3, HQ U.S. Military Assistance Command Vietnam (MACV), before assuming his third tour of duty with the Office of the Chief of R&D.

Assigned as deputy chief of the Environmental Sciences Division, U.S. Army Research Office (USARO), OCRD, Col Hubbard served from 1967 to 1969 as an R&D coordinator with the Combat Materiel Division, and with the Missiles and Space Division (1961–64). He was executive officer, U.S. Army Section, Joint U.S. Military Aid Group (JUSMAG), Greece (1964–67).

Graduated from the U.S. Military Academy (USMA) in 1948, he earned an MS degree in mechanical engineering from the University of Southern California in 1960. He has completed courses at the Command and General Staff College (C&GSC) and the Armed Forces Staff College (AFSC).

His awards and citations include the Bronze Star Medal (BSM), Meritorious Service Medal (MSM), Joint Services Commendation Medal (JSCOM) and the Army Commendation Medal (ARCOM).

Lt Col Melvin C. Snyder is assigned to the Management Evaluation Division. In Vietnam until recently, he served as commander of the 5th Battalion, 46th Infantry, Americal Division, and senior adviser, 6th ARVN Regiment.

From 1967 to 1969, he was assigned to the OCRD Studies and Analysis Division, subsequent to a year with the G–1 Division, Eighth Army headquarters, Seoul, Korea. From 1962 to 1965, he was with the Defense Atomic Support Agency, Sandia Base, N. Mex.

A 1951 graduate of the USMA, he earned an MS degree in nuclear physics from Tulane University in 1962 and completed the C&GSC course in 1966.

He holds the Distinguished Flying Cross (DFC), BSM with "V" device and Oak Leaf Cluster (OLC), MSM, ARCOM with "V" device and OLC, Air Medal (AM) with 10 OLC, Vietnamese Cross for Gallantry with two gold stars and one bronze star.

Lt Col James E. McMurrer is the new deputy chief of the Data Management Division, U.S. Army R&D Information Systems Office (ISO).

In Vietnam during the past year he was commanding officer of the 1st Battalion, 83d Field Artillery and later the chief of the Materiel Systems Branch Office of the Assistant Chief of Staff, G–3, HQ USARV.

During 1968–69 he commanded the 6th Battalion, 9th Field Artillery, U.S. Army Europe (USAREUR), following assignment as chief of the Cannon Branch, U.S. Army Combat Developments Command (CDC), Field Artillery Agency.

Col McMurrer earned a BS degree in mechanical engineering from Virginia Polytechnic Institute in 1951 and an MS degree in power and fuels engineering from VPI in 1952. He completed the C&GSC course in 1965.

His decorations and awards include the Legion of Merit (LOM) with OLC, BSM, AM with OLC, and ARCOM with OLC.

Lt Col Thomas R. Laube was assigned recently to the USARO with duty station with the U.S. Army Research Unit, Korea, following a 3-year tour of duty with the TACFIRE Branch, U.S. Army Field Artillery Board, Fort Sill, Okla.

From October 1964 to April 1967, he served with the 30th Air Defense Brigade in Okinawa, following four years as an ROTC instructor at Eastern Washington State College. For three years (1957–60), he was attached to the 4th Armored Division in Germany.

Lt Col Laube has a BS degree in mathematics from Utah State (1950).

Lt Col St. Julien R. Marshall Jr. served a year as commander, 2d Battalion, 76th Artillery in Korea, prior to his recent assignment as chief, Low Altitude Systems Branch, Air Defense and Missiles Division, OCRD.

He graduated with a BS degree in

Taylor Heads Army Medical R&D Command

Brig Gen Richard R. Taylor, who recently assumed office as commanding general of the U.S. Army Medical Research and Development Command, was command surgeon, Military Assistance Command in Vietnam until he departed for his current assignment.

The Medical R&D Command includes 17 research laboratories and teams located throughout the world, with responsibilities for which General Taylor has been trained by a succession of key assignments since he earned a medical degree from the University of Chicago in 1946.

From 1966 to 1969, he served in the Office of the Secretary of Defense as chief of the Biomedical Sciences Division, Office of the Director of Defense Research and Engineering. He was assigned as surgeon of the Joint U.S. Military Group in Thailand after serving at USAMRDC HQ (1959–64) as chief of various divisions and as deputy commander.

Brig Gen Richard R. Taylor

General Taylor has served at the Army-Navy Hospital, Hot Springs, Ark., Letterman General Hospital in San Francisco, Calif., and has commanded the 7th Medical Battalion, 7th Infantry Division, in Korea.

While at Fitzsimons General Hospital in Denver, Colo., he was also appointed assistant clinical professor of medicine at the University of Colorado School of Medicine. He then became deputy commander, Medical Research and Nutrition Laboratory at Fitzsimons, serving until assigned to the USAMRDC HQ staff, Washington, D.C., in 1959.

In 1963 he won the John Shaw Billings Award from the Association of Military Suregons for outstanding leadership and demonstrated potential for advancement in executive medicine.

General Taylor has won several decorations for military service, including the Distinguished Service Medal, the Legion of Merit and the Bronze Star Medal. He has twice been awarded the Joint Services Commendation Medal and the Army Commendation Medal, and has received the Vietnamese Distinguished Service Order First Class and the Public Health Service Medal First Class.

Author of 19 professional publications, he is a Fellow of the American College of Physicians and the American College of Chest Physicians and a member of the National Research Council representing the Department of the Army in the Division of Medical Sciences.

chemistry from the Virginia Military Institute in 1951 and in 1962 received two MS degrees, in aeronautical and astronautical engineering, and in instrumentation engineering from the University of Michigan. He completed the C&GSC course in 1966.

He served as chief, Plans Branch, Army Advisory Group, MACTHAI, Thailand (1967–69) and chief, Air Defense Section, Missile Branch, R&D Directorate, HQ Army Materiel Command, Washington, D.C. (1962–65).

His decorations include the BSM, AM, ARCOM and Purple Heart.

Lt Col George N. Stenehjem served a year in Vietnam prior to his current assignment to the Management Branch, Management Evaluation Division, OCRD. In Vietnam he was for three months assistant division aviation officer, 101st Airborne Division, for six months commander of the 158th Assault Helicopter Battalion, 101st ABN Div., and then chief, Operations Branch, USARV.

A 1954 graduate of the USMA, he earned an MBA degree in industrial engineering/transportation from the University of Tennessee in 1964. He completed the C&GSC in 1968, subsequent to a year in Vietnam with the 25th Infantry Division and a year as chief, Operations Branch, Deputy Chief of Staff for Operations, HQ U.S. Continental Army Command.

He has been awarded the LOM, Distinguished Flying Cross (DFC), Soldier's Medal, MSM, AM with 38 OLCs and the ARCOM.

Lt Col Ronald N. Bowman was assigned recently as a staff officer in the Life Sciences Division, USARO, following a tour of duty with the 101st Airborne Division in Vietnam. There he served as commander of the 426th Supply and Service Battalion and executive officer, Division Support Command.

In 1966–67 he served in Vietnam as special assistant to the Chief of Staff, HQ Area Command in Saigon, and then was assigned to the Organization and Training Directorate, Assistant Chief of Staff for Force Development (ACSFOR) at HQ DA in Washington, D.C.

Graduated from the University of Vermont with a BS degree in agricultural education in 1954, he earned a master's degree in food science from Cornell University in 1960 and completed the C&GSC course in 1966.

He holds the LOM with OLC, MSM, AM, and the ARCOM with 2 OLCs.

Maj Robert H. Alsheimer, a new staff officer with the Management Information Division, ISO, recently earned an MS degree in systems analysis from the University of Rochester. He graduated from the USMA in 1957 and completed the C&GSC course in 1969.

After an assignment as assistant professor of military science at the Virginia Military Institute (1964–67), he was a senior adviser with the Ranger Training Center in Vietnam.

From 1960 to 1963, he was stationed with the 1st Battalion, 509th Infantry in Mainz, Germany, following a tour of duty with the XVIIIth Airborne Corps at Fort Bragg, N.C. He has been awarded the BSM, ARCOM with OLC, and the Purple Heart.

Maj Charles F. Moore earned an MS degree in systems analysis from the University of Rochester prior to his new assignment as a staff officer in the Studies Branch, Studies and Analyses Division, USARO. He received his BS in physics from North Georgia College in 1958 and completed the Armed Forces Staff College (AFSC) course in 1968.

He has served as senior adviser at the RVN Armed Forces Signal School (1968–69); plans officer and assistant division chief, G–3, U.S. Army Schools/Training Center, Fort Gordon, Ga. (1966–67); and division radio officer, HQ 8th Infantry Division, Germany (1964–66).

In 1963–64 he was signal company commander, 82d Airborne Division, Fort Bragg, N.C., following a year as company executive officer, 1st Cavalry Division, Korea.

Maj Moore has been awarded the BSM and the ARCOM with OLC.

Maj Donald E. Gauntner completed the C&GSC course prior to his current assignemnt to the Program Management Office, U.S. Army Advanced Ballistic Missile Defense Agency (ABMDA). He has a 1957 BS degree in education from Indiana State University of Pennsylvania.

Maj Gauntner was a program and budget adviser to the Korean Military Assistance Group (KMAG) HQ Korea (1967–69), following two years as chief, Air Delivery Liaison Office, U.S. Army Aviation Systems Command, St. Louis, Mo., with duty station at the Airborne Electronics and Special Warfare Board, Fort Bragg, N.C.

An assignment as CO of Operation "A" Detachment, 5th Special Forces in Vietnam (1964–65), followed duty as S3 and later as adjutant with the 1st Airborne Battle Group, 504th Infantry, Germany.

Among his awards and decorations are the AM with OLC, ARCOM with OLC, Purple Heart, Combat Infantryman Badge (CIB), and Master Parachutist Badge.

Maj Joe J. Breedlove, newly assigned military assistant for Data Processing, Data Processing Division, ABMDA, recently earned an MBA degree from the University of Georgia. He has a 1958 BS degree in business administration from North Georgia College, and completed the C&GSC course in 1969.

His military assignments have included staff aviation officer, U.S. Army Support Thailand (1967–68); company commander, 10th Aviation Group, Fort Benning, Ga. (1966–67); and S–3 operations officer, 11th Avia-

(*Continued on page 20*)

Knipp Assigned as Picatinny Deputy Commander

Picatinny Arsenal's new deputy commander is Lt Col Arthur L. Knipp Jr., who was until recently a member of the Special Review Board, Office of the Deputy Chief of Staff for Personnel in Washington, D.C.

Col Knipp is a participant in the Army Atomic Energy Officer Program with degrees in chemistry (1949) from the University of Louisville, Ky., and in physics (1959) from the U.S. Naval Postgraduate School at Monterey, Calif. He is a graduate of the Air War College nonresident program and the Armed Forces Staff College.

Military career assignments have included duty as chief, Chemical-Biological Briefing Team, Office of the Assistant Chief of Staff for Force Development, 1968–69; NBC staff officer at Supreme HQ Allied Powers Europe, 1965–68; chief, Radiological Safety Branch of Joint Task Force Eight, 1962–65; and deputy commander of the Nuclear Defense Laboratory at Edgewood (Md.) Arsenal, 1959–62.

Col Knipp's decorations and awards include the Meritorious Service Medal, Joint Service Commendation Medal, Army Commendation Medal with two Oak Leaf Clusters, U.S. Army Meritorious Unit Citation and Republic of Korea Presidentail Unit Citation.

He is a member of the Scientific Research Society of America and the American Ordnance Association.

Lt Col Arthur L. Knipp

14 Officers, 2 Civilians Assigned to OCRD Staff

(*Continued from page 19*)

tion Group, 1st Air Cavalry Division, RVN (1965–66). In 1962–63 he served in Vietnam as a member of the 45th Aviation Battalion in support of the senior MAAG adviser for the RVN II Corps.

He was S–3 operations officer, 228th Assault Support Helicopter Battalion, 11th Air Assault Division, Fort Benning, Ga. (1964–65) following completion of the Artillery officer career courses at Fort Sill, Okla., and Fort Bliss, Tex.

Maj Breedlove's military honors include the BSM, AM with 13 OLC and "V" device, and ARCOM with OLC.

Maj Alfred A. Arbogast Jr. is assigned as a new intelligence research analyst in the Support Systems Research Division, U.S. Army Manpower Resources Research and Development Center. Returned recently from Vietnam, he served as CO of Detachments A and E, 1st Military Intelligence (MI) Battalion.

From 1967 to 1969, he was an instructor at the Department of Counterintelligence, Fort Holabird, Md. For two years previously, he was a requirements officer at the Combined Military Interrogation Center in Saigon, following a tour of duty as CO and counterintelligence officer, 181st MI Detachment, 1st Brigade, 101st Airborne Division, RVN.

He has a BS degree in commerce from the University of Virginia, where he also completed a law course. He has been awarded the BSM with 2 OLC and the ARCOM.

Capt Herbert W. Head completed a tour in Vietnam as a battalion signal officer with the 9th Infantry and 1st Cavalry Divisions prior to his new assignment as a staff officer in the Physics, Electronics and Mechanics Branch, Physical and Engineering Sciences Division, USARO.

From January 1966 to March 1967, he served as executive and operations officer with the 313th Signal Company, 1st Signal Group, U.S. Army Communications Zone, Europe.

He has a BSEE degree from Worcester Polytechnic Institute (1964) and an MS degree in physics from the Naval Postgraduate School (1969). His citations and awards include the BSM with OLC, AM, ARCOM and the Republic of Vietnam Campaign Medal.

Capt Karl J. Miller is a new staff officer in the Atmospheric Sciences Branch, Environmental Sciences Division, USARO, following a tour in Vietnam as a chemical adviser in the II Corps Tactical Zone.

In 1968–69 he was a student and an instructor at the U.S. Army Chemical Center and School at Fort McClellan, Ala., following his first tour in Vietnam as adjutant, intelligence officer, and chemical officer.

Other assignments include service as commanding officer of the U.S. Army Meteorological Team (RDT&E and Support) at Fort Monmouth, N.J., project officer with the U.S. Army Electronics R&D Activity (Meteorology Department), Fort Huachuca, Ariz., and chemical supply officer for the 15th Support Brigade at Fort Hood, Tex.

Capt Miller earned a BS degree in meteorology from Texas A&M in 1964. Among his military honors are the Bronze Star Medal, AM with OLC, ARCOM, Vietnam Gallantry Cross with Bronze Star, and Vietnam Technical Service Medal (1st Class).

Andrew H. Lamothe, newly assigned to the Contracts and Grants Branch, Research Programs Office, has been a civilian employe with the Army since he retired in 1957 with 20 years military service.

He has worked with the Office of the Surgeon General in Washington, D.C. (1967–70); U.S. Army Strategic Communications Command (STRATCOM), Silverhill, Md. (1966–69); and DeWitt Army Hospital, Fort Belvoir, Va. (1957–66).

His military career included duty with the U.S. Army Medical Department and Service Corps in Japan, Korea, Okinawa, Panama Canal Zone and the Continental United States.

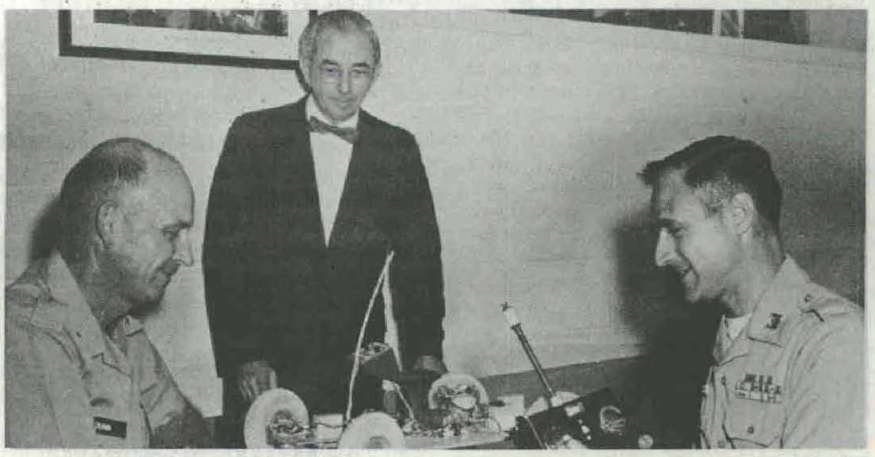
Lamothe has completed various military courses in financing, procurement and management. He has received the Sustained Superior Performance Award and four Outstanding Performance Ratings.

Melton R. Boone is employed as a computer systems analyst, Systems Design and Development Branch, Management Information Division, ISO, OCRD.

During 1969–1970, Boone was employed as an analyst with the Deputy Chief of Staff for Individual Training at Fort Monroe, Va., following seven years as a computer systems administrator and analyst with the Office of the Comptroller at Homestead Air Force Base, Fla., and Fort Bragg, N.C.

Boone served in the U.S. Air Force (1949–55) and completed military courses in radio operations and passive defense instructor. Civilian schooling includes the ADP Systems Analysis Course at Fort Benjamin Harrison, Ind., and the ADP Systems Analysis for Staff Officers, at Fort Monmouth, N.J.

He also completed the training program for digital computer system analysts at Fort Bragg, N.C., and earned diplomas in junior and senior accounting from the Carolina College of Commerce, Rocky Mount, N.C.



SCALE MODEL OF LUNAR ROVING VEHICLE, now being built for travel on the moon, is examined by Deputy Chief of Engineers Maj Gen C. H. Dunn, Col Ernest D. Peixotto, director, U.S. Army Engineer Waterways Experiment Station (WES), and W. G. Shockley, chief, WES Mobility and Environmental Division. Col Peixotto holds the remote control system which allows an operator to steer in any direction through control of front and rear wheels at speeds up to 5 mph. The model, 11 inches wide and 22 inches long, is one-sixth the size of the vehicle that will be built to carry two astronauts, their gear and samples they gather on future moon missions. Plans call for running tests with the scale model to examine slope stability, climbing capability, stopping distance and handling problems. Tests will be conducted on crushed basalt with the same grain-size distribution as samples collected on previous moon missions and thought to have the same shear behavior as soil on which the lunar vehicle will run.

Dr. Jagdish Chandra

Dr. Mikael Ciftan

Dr. Arthur Dodd

Dr. Horst R. Wittman

Capt Robert Sims

ARO-D Announces 5 Appointments to Key Positions

Four scientists with PhD degrees were appointed to key positions and a new adjutant recently joined the staff of the U.S. Army Research Office-Durham (ARO-D), Durham, N.C., including a replacement for Dr. William Van Royen, who retired as director of the Environmental Sciences Division.

Dr. Arthur Dodd, who came to ARO-D from the Natick (Mass.) Laboratories in 1968 and has served as chief of the Atmospheric Sciences Branch, was selected to succeed Dr. Van Royen, who had served since 1966 as the first director of the ES Division.

Dr. Dodd's field of specialty with the Natick Laboratories was the application of climatic information to military clothing and materiel programs. He is a graduate of Pennsylvania State University and has graduate degrees from Penn State and from Boston University.

Dr. Jagdish Chandra was assigned as chief of the Applied Mathematics Branch, Mathematics Division, and came to ARO-D from the U.S. Army's Watervliet (N.Y.) Arsenal. He specialized there as a research mathematician in basic mathematical analysis of nonlinear systems and has authored about 15 articles in national and international scientific journals.

Dr. Chandra has a PhD degree from Rensselaer Polytechnic Institute and BA and MA degrees from Osmania University in Hyderabad, India. His area of expertise includes stability theory of differential equations, nonlinear oscillations, and realted boundary value problems for discontinuous nonlinear differential and operator equations in partially ordered spaces.

Dr. Mikael Ciftan was assigned as a physicist and manager of the theoretical physics program, Physics Division. He has shared in some of the early experimental work on optical pumping of the ruby laser, and has studied materials requirements of the gallium arsenide injection laser.

Dr. Ciftan has a BS degree in engineering from the Robert Engineering School in Istanbul, Turkey, MS degree in experimental physics from Massachusetts Institute of Technology (1959) and a 1967 PhD from Duke University in theoretical physics. His theoretical work includes research on energy level transition probabilities in gaseous injections, a group theoretical approach to nuclear forces, the combinatorial structure of state vectors, and the basic physical character of the phonon.

Dr. Horst R. Wittman, newly assigned as chief, Electronics Branch, Engineering Sciences Division, came to ARO-D from the Army Missile Command, Redstone (Ala.) Arsenal.

With MICOM he was a research physicist in the Physical Sciences Laboratory, serving as leader of the Semiconductor Laser Group in conducting optical emission studies under several parameters.

Some of the experiments tried to reveal the energy band structure and the recombination mechanism in the active area. He developed and built a spectrogram with a narrow band, temperature-tunable GaAs laser diode as a source. This represents what is believed to be the first application of a laser light source in the spectroscopic field.

Dr. Wittman did graduate work at the Universities of Erlangen, Germany, and Graz, Austria, receiving a PhD in experimental physics in 1964 from the latter institution.

Capt Robert M. Sims, ARO-D's new adjutant, recently completed a tour of duty in ASCOM Korea as CO of the 176th Replacement Co., HQ and HQ Detachment, 38th Replacement Battalion and HQ and HQ Co., 20th General Support Group. He has a bachelor's degree from Texas A&M Univ.

STRATCOM Assigns Col Sharp as New Deputy CofS

Col Sam H. Sharp

Col Sam H. Sharp took over as the new deputy chief of staff, U.S. Army Strategic Communications Command at Fort Huachuca, Ariz., when Col Emil V. B. Edmond retired.

Col Sharp was until recently the deputy inspector general, HQ Military Assistance Command Vietnam (MACV), and also has served in Korea.

His career has included assignments as operations officer, National Military Command Center, Joint Chiefs of Staff; instructor at the Canadian Army Staff College; instructor (following graduation) at the U.S. Army Command and General Staff College; World War II service with the 7th Armored Division in Europe; and European Occupation Forces.

Col Sharp entered the Army in 1943 following graduation from Oklahoma A&M with a bachelor of military science degree, and was commissioned as an Infantry officer after completing OCS at Fort Hood, Tex.

Among his military honors are the Legion of Merit, Bronze Star Medal (with two OLCs), Joint Service Commendation Medal (two awards), and the Combat Infantryman Badge.

Major Army RDT&E, Procurement Contracts Exceed $548 Million

Safeguard ABM Systems contract modifications totaling $223,624,514 with Western Electric Co. accounted for a major portion of Army RDT&E and procurement orders totaling $548,511,422 from Sept. 1 to Nov. 1. Only contracts exceeding $1 million are listed.

The Safeguard awards cover data collection, systems and technology studies and production of components.

An $18,037,221 contract for AN/VRC–12 radio set components went to LTV Electrosystems, Inc. AVCO Corp. was awarded four contracts totaling $16,678,452 for modification kits in support of UH–1 aircraft gas turbines, overhaul and modification of engines, parts for projectiles, and remote-control matched-channel HF receivers and ancillary items.

Olin Corp. will receive $15,843,431 for operation and maintenance of a government-owned ammunition facility. Kisco Co., Inc., was awarded $14,758,318 (two contracts) for parts for cartridge cases.

Bell Helicopter Co. is receiving $13,607,928 under three contracts for fuel cell modification kits for helicopters, repair of crash-damaged aircraft, and for UH–1N helicopters.

Martin Marietta Corp. received two contracts totaling $13,064,513 for engineering services, installation of modification kits and modified equipment training for the Pershing missile system.

Federal Electric Corp. was awarded $11,191,947 for operations, maintenance, communications engineering and training services, including operation of two separate area maintenance facilities in support of the integrated communication systems in the Republic of Vietnam.

R. G. LeTourneau, Inc., was awarded $11,068,680 for bomb parts and Norris Industries, $11,047,300 for cartridge case parts. Kentron Hawaii, Ltd., subsidiary of LTV Aerospace Corp., was issued a $10,981,356 contract modification for operation, maintenance and development of Kwajalein Missile Range technical facilities.

Heckethorne Manufacturing Co. will receive $10,140,090 for projectile parts. McDonnell Douglas Corp. was issued $10,111,787 for flight test experiments to develop missile technology for ABM application.

Contracts under $10 million. General Motors Corp., $7,672,270 (three contracts) for diesel engines and production and engineering services for tanks; Norris Industries, Inc., $7,512,440 (two contracts) for projectile parts; AFM, Inc., $6,906,960 for bomb parts; and

Hercules, Inc., $6,513,328 for operation and maintenance of a propellant production facility; Remington Arms Co., Inc., $6,171,295 for operation of a government-owned ammunition producing facility; and

Orweld Steel Products Corp., $5,909,973 for projectile parts; Raytheon Co., $5,231,206 (three contracts) for engineering services and technical publications for the improved Hawk missile system, and for advanced development of the Sam–D missile system; and

Futuronics Corp., $5,168,476 for radio receivers, transmitters and amplifiers; Sperry Rand Corp., $5,158,991 (two contracts) for computer time and services for the Safeguard System Evaluation Agency and for

'Copter Prototype Increases Lift Capability

Production of a prototype aircraft capable of a 40 percent increased payload over present medium-size tactical helicopters was announced recently.

Textron's Bell Helicopter Co. said the aircraft—designed to improve the squad-lift capability of the U.S. Army/Bell UH–1H Huey—will begin flight tests at Fort Worth, Tex.

Carrying the Bell designation of Model 214 Huey Plus, the prototype model was announced at the annual meeting of the Association of the U.S. Army, nine months following the go-ahead for the project.

In addition to having an increased gross weight of 1,500 pounds, the Huey Plus is said to offer improved safety, reliability and survivability characteristics over the present UH–1H standard Army utility transport.

Utilizing a strengthened H Model airframe with a 1,900-shaft horsepower Lycoming T53 engine, the prototype has an improved drive system with a 2,000-horsepower transmission.

The main rotor has been enlarged to 50-foot diameter and 27-inch chord (compared to the UH–1H's 48-foot diameter and 21-inch chord rotor). Maximum gross weight is increased from 9,500 to 11,000 pounds.

Model 214 at maximum gross weight will hover out of ground effect at 4,000 feet altitude at 95 degrees Fahrenheit. Under these conditions, it will have a cruise speed of about 120 knots and a mission radius of 75 nautical miles plus reserve.

The advanced Huey can move a standard 10-man squad, pilot and copilot, two gunners and the related mission equipment.

Incorporation of the Huey Plus into the military inventory could be made on a retrofit basis, Bell officials said, with changes being coordinated with major overhauls.

The airframe is the most experienced in the rotary-wing industry, having accumulated more than 7,750,000 combat flight hours in Southeast Asia. The proposed drive system has been flying in the Bell HueyTug for more than two years and now has over 700 flight hours.

The engine is a growth version of Lycoming's proven T53 powerplant. It has 1,800 hours of running time on a related model and over 13,000,000 flying hours on predecessor versions.

Bell Model 214 Huey Plus

loading, assembling and packing ammunition; TRW, Inc., $5,000,000 for electronic research and development.

Contracts under $5 million. Pace Co., $4,986,319 (two contracts) for parachute signals and for loading, assembling and packing ammunition; Sylvania Electric Products, Inc., $4,677,265 for radio sets; and

FTS Corp., $4,593,000 (two contracts) for nozzle and fin assemblies for 2.75-inch rocket motors; Harvey Aluminum, Inc., $4,387,382 for 40mm cartridge cases; REDM Corp., $4,104,000 for head assemblies for fuzes; Uniroyal, Inc., $4,021,491 (two contracts) for pneumatic tires for trucks and for operation of a TNT manufacturing facility; and

Northrop Corp., $3,784,508 (two contracts) for fleshette and 2.75-inch warheads; Stanford Research Institute, $3,437,380 for research and development studies of the ABM defense system; and

Page Communications Engineers, Inc., $3.077,607 for electronic equipment; McDonnell Douglas Astronautics Co., $3,049,200 for services, engineering and development of the Dragon missile maintenance set; and

Motorola, Inc., $2,781,384 for design, fabrication, testing and delivery of one Long Range Positioning Determining System; Bulova Watch Co., Inc., $2,729,592 (two contracts) for metal parts for fuzes; and

Muncie Gear Works, Inc., $2,696,772 for nozzle and fin assemblies for 2.75-inch rocket motors; Bowen-McLaughlin-York Co., $2,612,550 for M107 self-propelled vehicles and M578 tank-recovery vehicles; Rocky Mountain Arsenal, $2,522,000 for impregnation of shirts, trouser liners and other clothing items; and

Union Carbide Corp., $2,501,571 for dry batteries, ancillary items, and high-low temperature and internal pressure production testing; Batesville Manufacturing Co., $2,434,350 (two contracts) for rocket and bomb fuze parts; and

Chamberlain Manufacturing Corp., $2,386,400 for projectile parts; Aerojet Solid Propulsion Co., $2,287,010 for loading motors for improved Hawk missiles; Hughes Aircraft Co., $2,150,629 for 12 months of TOW antitank missile engineering; and

Honeywell, Inc., $2,149,655 for grenade fuzes; FMC Corp., $2,106,000 for inspection and production engineering in support of the M113A1 self-propelled, full-tracked vehicle.

Contracts under $2 million. Stewart Warner Corp., $1,990,900 for adapter booster parts; White Motor Corp., $1,874,724 for engineering services for the M39 truck; UNeCO, $1,705,443 for metal parts for projectiles; Hamilton Watch Co., $1,701,000 for fuze parts; and

Control Data Corp., $1,688,874 for systems development for MACV civil operations rural development support; General Time Corp., $1,672,020 for fuze parts; Hoffman Electronics Corp., $1,668,000 for nozzle and fin assemblies for 2.75-inch rocket motors; and

Brown Engineering Co., $1,656,931 for ballistic aerial targets; Thiokol Chemical Corp., $1,637,434 for cartridges; Tasker Industries, $1,625,160 for illuminating projectiles; Varo, Inc., $1,523,843 for radio sets; Chamberlain Manufacturing Corp., $1,509,800 for warhead parts; IBM, Inc., $1,500,000 for electronics equipment;

Gibbs Manufacturing and Research Corp., $1,465,000 for metal parts for fuzes; Applied Devices Corp., $1,460,640 for modification kits for Hawk missile simulators; Tasker Industries, $1,374,450 for igniters for 2.75-inch rockets; and

Sperry Rand Corp., $1,260,000 for engineering services for the Sergeant missile system; Scovill Manufacturing Co., $1,244,410 for grenade fuzes; Ralph M. Parsons Co., $1,234,553 for architectural and engineering services for the Safeguard missile site; and

Westinghouse Electric Corp., $1,203,707 for design, manufacture, shop test and delivery of power transformers; Computer Sciences Corp., $1,176,428 for automatic data processing services for the Logistics ADP System in Vietnam and Thailand; and

Kaman Nuclear Corp., $1,142,183 for lethality and vulnerability analysis for the Safeguard system; Dirilyte Co. of America, Inc., 1,134,803 for fin blades for 2.75-inch rockets; Eureka Williams Co., $1,113,710 for bomb fuze parts; American Institutes for Research $1,063,000 for research and scientific studies in support of the Army Social Science Research Program; and U.S. Components Corp., $1,007,868 for bomb parts.

Army Tests Booster Pump for Universal Application

An experimental gas turbine-powered 900-hp. pump, expected to have universal application as a booster pump for all Army fuel transportation pipelines, is undergoing engineer design tests by the U.S. Army Mobility Equipment Research and Development Center (MERDC).

The unit is the only military pipeline pump designed to pressurize not only the 6- and 8-inch cross-country pipelines, but also the 12-inch and larger lines used to unload tankers in ship-to-shore operations. It is applicable to both low- and high-pressure systems.

Singly, the pump will pressurize 30 miles of 8-inch pipeline where a series of diesel-powered units would be required. It has a flow capacity of 1,100 gallons per minute at 2,750 feet total head, with pump operation at 10,000 rpm. Its 2-stage design, with dual suction and dual discharge, permits operation of the two stages in series or parallel, providing 2,200 gpm at 1,375 feet total head when required.

Skid-mounted, the universal pump measures 18x8x7 feet and wieghs 8½ tons. It was built under contract by Solar Division of International Harvester. Following tests at the MERDC, engineer design tests will be continued by the Test and Evaluation Command at Fort Lee, Va.

DESIGN MODIFICATIONS SAVE $789,600. J. Reginald Lewis (left) an engineer with Picatinny Arsenal's Value Engineering Division, Ammunition Engineering Directorate, holds M-904E2 bomb fuze with old nose and vane assembly and Richard Oatley, mechanical engineering technician, Methods Engineering Division, Industrial Services Directorate, displays fuze with nose and vane assembly redesigned in their joint effort with contractor personnel. The VE modification, eliminates several parts, saving the Army's customer—the Air Force—$238,600 in first-year and more than $551,000 in second-year production, based on estimates.

HumRRO Lists 42 Army R&D Projects in Work Program for FY 1971

Forty-two research and development projects requiring an estimated 80.8 basic man-years of effort under contract with the U.S. Army are listed in the Human Resources Research Organization FY 1971 work program.

Approved recently by Army Chief of Research and Development Lt Gen Austin W. Betts, the HumRRO program contains 17 new projects and 25 continued from the FY 1970 schedule.

A major portion of the program will consist of *Work Units*, which are full-scale research efforts designed to produce specific information or products directed toward solution of Army problems. New Work Units and their objectives are:

MEDIA: Improving Media Implementation in Army Training Programs. *Objective:* To develop methodology for improved media implementation to meet specified objectives in Army training programs.

READNEED: Metholodogy for Evaluating Reading Requirements of Army Jobs. *Objective:* To further develop and refine a methodology for determining reading tasks in Army jobs; to apply this methodology for several military occupational specialties; and to determine reading skill levels sufficient for performing job-related reading tasks.

SKYGUARD: Curriculum and Instructional Improvements for the Air Defense Artillery Officer Advanced Course.

FIELD PORTABLE FLUOROMETRIC COMPARATOR, developed to detect the presence of crude oil in soils, is examined by Brig Gen Curtis W. Chapman Jr., director of Military Engineering, Office of the Chief of Engineers, during an orientation at the U.S. Army Cold Regions Research and Engineering Laboratory, Hanover, N.H. The comparator is used by CRREL for ecological studies in Alaska. Observing are Lt Col Joseph F. Castro, CO/director of CRREL, and Col J. S. C. Smith, Directorate of Military Construction, Office, Chief of Engineers, HQ DA.

SUM: A Study of the Use of Marijuana Within the Army. *Objective:* To collect and analyze information concerning the incidence, circumstances of and effects of marijuana usage within the Army.

AIRSCOUT: Training Requirements and Concepts for Air Cavalry Training. *Objective:* To identify training requirements and to specify methods and concepts for training materials to support an aeroscout observer and aeroscout aviator program.

CADRE: A Prototype Course in Training Techniques for ATC Instructor Cadre. *Objective:* To develop and evaluate an entirely new Methods of Instruction (MOI) for Army Training Center instructor cadre.

ESPRIT: Development of Methods for Improving Soldier Adjustment to the Army. *Objective:* To develop and evaluate an attitude/personality data program that will provide a continuing informational base, concerning areas of conflict between soldiers' motivational needs and Army goals, to those agencies responsible for the selection, training and career management of enlisted personnel; also, to develop remedial information/training methods for lessening need-goal conflicts.

FOLLOWTHRU: Characteristics of Men Tested in Work Unit UTILITY Who Remain in the Army. *Objective:* To determine, through an analysis of HumRRO Work Unit UTILITY and Army records, (1) the performance characteristics of those men studied in UTILITY who have remained in the Army, and (2) the likelihood of men of lower mental ability increasing their effectiveness.

LISTEN: Development of Automated Programs to Improve Listening Skills Required in Army Jobs. *Objective:* To develop automated audiovisual programs for improving critical listening skills across a wide range of aptitude levels of men in Army jobs; and to evaluate the effects of training in critical listening as an adjunct to reading in preparatory training.

The FY 1971 Work Program for the Army includes one new basic research effort, which at HumRRO is that category of effort dealing with selected problems in the psychological and social sciences in which an increase in knowledge would (1) have special application to human factors problems in the military environment, and (2) contribute to the present body of facts and principles bearing upon training.

BR–20 is titled An Approach to Facilitating Racial Harmony in the Military. Its objective is to develop a method for improving racial attitudes among military personnel through a process of "vicarious attitude change."

An exploratory research effort at HumRRO is an evaluation of the feasibility of engaging in a major research activity on a particular Army problem. New exploratory efforts in the FY 1971 Work Program are:

ER–80: Methods and Media for Army Training. *Objective:* To determine cost criteria that are relevant to the selection of methods and media for Army instruction; also, to develop cost/effectiveness models for use in the learning-analysis phase of the CONARC systems engineering of training.

ER–81: Training U.S. Army Security Agency Operators. *Objective:* To determine the feasibility of developing a method for identifying the characteristics of training equipment families that produce maximum transfer of skills for USASA operators.

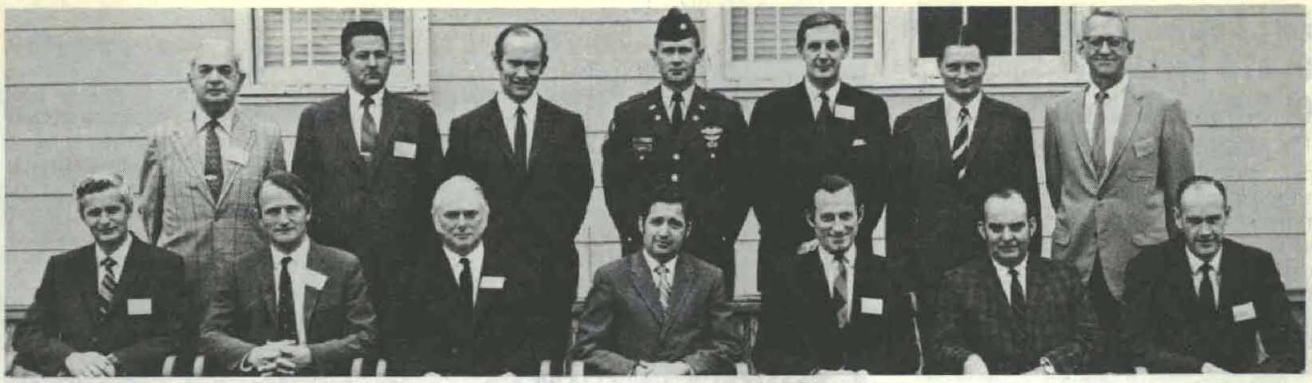
ER–82: Low-Cost Simulation in Military Training. *Objective:* To determine the feasibility of conducting a research program for developing methods of training with low-cost simulation (i.e., photographic replicas of panels) as a supplement to training with the corresponding operational equipment, and for establishing task characteristics that distinguish the appropriateness of methods.

ER—83: GED Program for the Army. *Objective:* To determine the feasibility of developing a functionally oriented General Educational Development (GED) program.

ER–84: Retention of Army Flying Skills. *Objective:* To determine the nature and rates of loss, and the rates of reacquisition, of flying skills by Army aviators who have been in flight excusal or proficiency flying (Category B) status for periods of up to three years.

ER–85: Army Flight Skill Learning Curves. *Objective:* To develop objective data describing how and at what rate Army aviation students learn various flight skills.

ER–86: Performance of NCOs in Army Training Centers. *Objective:* To determine the feasibility of conducting a research program that would compare the effectiveness of noncommissioned officers in Mental Category IV and other mental categories in supervisory, instructional, and managerial positions within the Army Training Center.



ATTENDEES at 4th meeting of Quadripartite Working Group on Army Operational Research (QWG/AOR) included (seated, from left) Oscar Wells, Study and Analysis Advisory Office, HQ U.S. Army Combat Developments Command (CDC), Fort Belvoir, Va.; J. C. M. Jones, Army Operational Research Group, Australian Army HQ, Canberra; Lynn F. Jones, Assistant Director for Operational Analysis, Ministry of Defense, Army (senior United Kingdom delegate); Dr. John G. Honig, Weapons Systems Methodology and Concepts Office, Weapons Systems Analysis Directorate, Office of the Assistant Vice Chief of Staff, U.S. Army (QWG/AOR chairman); Dr. Nigel J. Hopkins, Director of Land Operational Research, Canadian Forces HQ (senior Canadian delegate); Dr. Wilbur B. Payne, Deputy Under Secretary of the Army (Operations Research); Lt Col James A. Cotter, War Games Section, Directorate of Land Operational Research, Canadian Forces HQ. Standing (from left) are Dr. Bernard B. Watson, Research Analysis Corp., McLean, Va.; Keith Meyer, Army Materiel Systems Analysis Agency, U.S. Army R&D Center, Aberdeen Proving Ground, Md.; Bruce Poulter, Defense Operational Analysis Establishment, Ministry of Defense (Army) United Kingdom; Lt Col Willys E. Davis, Studies and Analyses Division, Office of the Chief of R&D, U.S. Army; John Ashton Booth, Systems Analysis Branch, Royal Armaments R&D Establishment, UK; Eric Strong, Defence Operational Analysis Establishment, Ministry of Defense (Army) UK; L. P. Withers, Institute of System Analysis, U.S. Army.

4-Nation Working Group Views Operational Research

United Kingdom, Canadian, Australian and United States members of the Quadripartite Working Group on Army Operational Research (QWG/AOR) conducted their fourth meeting Oct. 12–23, convening a week in Washington, D.C. and then at Fort Ord, Calif.

The chairman for the QWG/AOR is provided by the host Army and meetings are rotated between member countries. Dr. John G. Honig, chief, Weapons Systems Methodology and Concepts Office, Weapons Systems Analysis Directorate, Office of the Assistant Vice Chief of Staff, U.S. Army, was 1970 conference chairman.

QWG/AOR meetings are concerned primarily with promoting cooperative research appropriate to fulfill objectives of the Basic Standardization Agreement between member nations.

Included among QWG/AOR areas of responsibility are determination and identification of areas within the standardization program where operational research can be applied beneficially; also, suggesting means of strengthening analytical approaches to problems.

The first week of the 1970 meeting consisted of visits to and briefings by U.S. Army and contractor organizations providing operational research support in the Washington, D.C., area.

Briefings were given by the Research Analysis Corp., the Human Resources Research Organization, Behavior Systems Research Laboratory, U.S. Army Test and Evaluation Command, U.S. Army Materiel System Analysis Agency, Aberdeen (Md.) Research and Development Center, Corps of Engineers Strategic Studies Group, Strategy Tactics and Analysis Group of the Office of the Deputy of Staff for Operations, and two major agencies of the U.S. Army Combat Developments Command, the Institute of System Analysis and the Institute of Land Combat.

The second week of the conference held at Fort Ord coincided with the ninth meeting of the Quadripartite Working Group on Combat Developments (QWG/CD). One QWG/AOR/CD meeting was a discussion of ongoing efforts, problems and objectives of mutual interest and concern.

The 1971 QWG/AOR meeting is tentatively scheduled in Australia.

The Combat Experimentation Command, an element of the Combat Developments Command, was host to the second part of the QWG/AOR meet.

Known as the "field laboratory" to test realistically the practicality of methods and concepts evolved by the Combat Developments Command and other U.S. Army agencies, the Combat Experimentation Command is concerned with determinations of manpower, techniques and equipment that will prove most effective in meeting combat capability goals.

Stumm Assigned to Mobility Equipment R&D Center

Lt Col Thomas A. Stumm, recently returned from Vietnam, has been assigned as special item manager for Commercial Construction Equipment at the U.S. Army Mobility Equipment Research and Development Center (MERDC).

Lt Col Thomas A. Stumm

In Vietnam he was executive officer of the 79th Engineer Group and commanding officer of the 558th Engineer Battalion (Combat). He has served in Korea, Germany, and as adviser to the Royal Thai Engineer School in Rajburi, Thailand.

Stateside assignments have included instructor at the U.S. Military Academy (USMA), staff officer in the Office of the Chief of Engineers, and R&D coordinator with the Defense Atomic Support Agency.

Graduated from the USMA in 1951, he earned a master's degree in electrical engineering from Purdue University in 1956. Included in his awards and decordations are the Bronze Star Medal with two Oak Leaf Clusters, Air Medal, Joint Service Commendation Medal with OLC, and the Army Commendation Medal.

Fort Detrick Begins Operation Of ATC System for Support Of Defense Communications

Operation of an Automated Technical Control (ATC) system, designed to support defense communications, and representing the latest in the state-of-the-art in computerized communications, began in October at Fort Detrick, Md.

As part of the East Coast Telecommunications Center at Frederick, Md., the ATC is a computer-controlled system that monitors, tests, reroutes, restores and provides status reports on communications equipment and systems. The ATC is similar to another Army system at Coltano, Italy.

The East Coast Telecommunications Center (ECTC) is a vital link in the worldwide defense communications system (DCS). The ECTC operates an automated switching center as part of the DCS automatic digital network (AUTODIN), processing more than 100,000 messages daily.

The ECTC is part of the U.S. Army's worldwide Strategic Communications Command (STRATCOM), headquartered at Fort Huachuca, Ariz., and its National Communications Command. STRATCOM manages Army communications around the world. STRATCOM also provides communications support to the White House, State Department, NASA and other U.S. Government agencies.

The DCS AUTODIN network passes through the ECTC over more than 1,000 circuits including satellite, transoceanic cable and radio. Other systems supported by the center include AUTOSEVOCOM (Automatic Secure Voice Communications) and contingency interface communications.

These systems are backed by an automated technical control that monitors all in/out lines (about 300) and is programed to alert the operator so he can take remedial action in the event of circuit failure.

Real-time equipment status reports are provided by a high speed printer at the rate of 1,200 lines per minute. This type printer reduces the job of printing out 40,000 characters from 90 minutes on conventional equipment to less than a minute.

VIEW of Automatic Technical Control (ATC) facility installed at East Coast Telecommunications Center, Frederick, Md., shows computerized operation.

Picatinny Adds Antennas to Data Acquisition System

Recent additions to Picatinny Arsenal's microwave data acquisition system are two huge parabolic disc antennas installed atop the 105-foot drop tower at Dover, N.J.

When a weapon is test fired, the antennas transmit the pressure curves to data handling facilities such as the computers in Bldgs. 350 and 352. Bill Conway, chief, Instrumentation Division, Technical Services Directorate, said the new system provides engineers with test data by using the most advanced technology.

Data is provided on-line, that is, almost simultaneously with the test firing of weapons. The evaluated data provides the engineer with key information, eliminating the need for double magnetic tape handling.

The microwave communication data link furnishes a teletype printout at a fixed data acquisition site. Test engineers may obtain data as experiments are conducted. The new system also determines the need for continuance of test firings.

A transmitter mounted on a mobile van makes the entire arsenal perimeter and intersurface a test site for data acquisition. One of the new antennas receives the wave sent from the transmitter; the other retransmits the received microwaves to the receiver's antenna.

The receiver restores the microwave from the relay link to its analog form and feeds it into the computer, where the analog signal is converted into computer language and analyzed in accordance with preprogramed instructions.

The system eventually may be extended wherever desired to establish a testing communication link from any point on the arsenal through the computer facility, to providing real-time test results.

A team of engineers under Peter Roumes and Technical Services Directorate and Installation Support Office millwrights supervised by Charles Bobinyec did the installing.

STRATCOM Announces Assignment of Storment to ECTC

HQ U.S. Army Strategic Communications Command, Fort Huachuca, Ariz., announced recently the assignment of Lt Col Calvin A. Storment as commander of the East Coast Telecommunications Center, Fort Detrick, Md.

The ECTC was located on a 20-acre site in 1961 and now operates an automatic switching center as part of the Defense Communications System (DCS) Automatic Digital Network (AUTODIN). More than 100,000 messages are processed daily.

Lt Col Calvin A. Storment

Col Storment graduated recently from the Army Command and General Staff College. In 1968–69 he was chief of the Communications Section, 21st Signal Group and chief, Management Services Division, HQ STRATCOM 1st Signal Brigade in Vietnam.

His military career began as an enlisted man in 1944 at Aberdeen (Md.) Proving Ground and he served during World War II as a depot supply officer in the Pacific Theater. His career has included assignments as commander of A Company, Eighth U.S. Army Signal Long Lines Battalion in Korea and from 1944 to 1966 with NATO forces in Izmir, Turkey.

Col Storment has been awarded the Bronze Star Medal, Joint Service Commendation Medal and Army Commendation Medal.

Canine Caution Warns Troops of Concealed Dangers

Canine consciousness of concealed danger may have saved the lives of many American soldiers engaged in combat in Southeast Asia through a program initiated and conducted by the U.S. Army Land Warfare Laboratory, Aberdeen (Md.) Proving Ground.

Involving the use of trained dogs, the program had its beginning as early as 1967 when LWL scientists first attacked the problem of detecting enemy personnel lurking in ambush. Several methods were explored and developed to counteract hidden hazards—ambush, land mines, trip-fire-actuated devices and tunnels—claiming the lives of servicemen at that time.

LWL developed the initial program for trained dogs to range off-leash far ahead of a patrol, out of sight of the handlers. Through a small FM radio receiver on the soldier-handler's helmet, sounds were heard from a motion-sensing transmitter attached to a harness worn by the canine.

When a reconnaissance dog detected people in hiding it stopped, causing the signal from the transmitter to change, thereby informing the handler that an enemy was ahead. The dogs ranged sufficiently far ahead to give troops time needed to counter the danger.

In 1967 the Army Chief of Research and Development directed that a study be made of the feasibility of training dogs to detect and give early warning of concealed dangers that were a major threat to U.S. troops in South Vietnam.

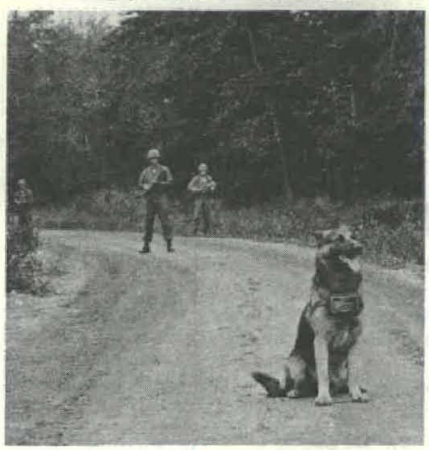
A small group of handlers used dogs of various breeds obtained from outside sources. Dogs later were purchased from contracting agencies, which completed the animals' training prior to delivery.

Building upon success of the initial program, which used the 60th Infantry Platoon (Scout Dog), LWL initiated a new project for the canine detection of mines and tunnels.

Working off-leash at distances of 25 to 30 meters for the detection of tunnels, and up to 100 meters for the detection of mines, the non-aggressive war dogs now are trained to respond to a detection by sitting, unless otherwise directed by the handler.

While early research under the project involved the use of radio transmitters, recent innovations now have the dogs responding to both hand and voice signals. Training was done at Fort Benning, Ga., the Army Infantry Center, with technical assistance from LWL personnel. Training of the final platoon of dogs is seeking to broaden the variety of duties they can perform, such as detection of buried M14 plastic antipersonnel mines, TNT or dynamite.

The dogs, whose motivation is based on food reinforcement, are conditioned to respond to underground cavities, trip wires, land mines and various other types of ordnance items and their components.



CANINE CAUTION, indicating enemy ambush, hidden mines or other ordnance items, is signaled from motion-sensing transmitter worn by scout dog to radio-receiver attached to soldier-handler's helmet when the animal stops.

Handlers say it is still a matter of conjecture as to which of a dog's senses account for its uncanny ability to locate enemy personnel and destructive devices. However, that innate faculty enables the trained animal to avoid any contact with the object of its search.

An unknown number of these dogs are currently engaged in the Vietnam project. An additional shipment of 60 of the animals was transported recently from the U.S. to increase the complement of those now serving American soldiers.

Considered to be one of the most impressive demonstrations of canine intelligence applied to the protection of their handlers, the project was carried out at LWL by John J. Romba, a research psychologist, under the direction of Dr. Max Krauss, chief of the LWL Biological Science Branch. Both men recently received Department of the Army commendations for meritorious service in recognition of their work on the project.

HDL Chief Scientist Receives ISA's Sperry Award

One of the U.S. Army's top scientists, an inventor with more than 40 patents and a prolific contributor to professional publications, is the 1970 recipient of the Albert F. Sperry Award, the Instrument Society of America's highest annual honor.

Dr. Henry P. Kalmus, chief scientist of the Harry Diamond Laboratories since 1962, was presented with a gold medal, a $1,000 honorarium and a certificate of outstanding achievement Oct. 27 at the ISA's annual awards banquet in Philadelphia, Pa.

Established in 1965, the Albert F. Sperry Award is presented to an individual in recognition of outstanding, technical, educational or philosophical contributions to the science and technology of instrumentation.

Dr. Kalmus was cited for basic research, numerous inventions of mechanical devices and electronic measurement instruments, and especially for his advances in techniques of radar signal processing.

In July 1970 he was one of two Army recipients of the Department of Defense Distinguished Civilian Service Award. His impressive list of honors since he emigrated to the United States from Vienna, Austria, in 1941 and joined the staff of the Zenith Radio Corp., includes gold medal awards for Exceptional Civilian Service from the Department of Commerce and the Department of the Army.

His U.S. Government career began in 1948 with the Ordnance Electronics Division of the National Bureau of Standards. In 1953 a nucleus of highly trained scientists and engineers was made available to the Army by the NBS for the establishment of the Diamond Ordnance Fuze Laboratories (since redesignated the Harry Diamond Laboratories). Dr. Kalmus was among them and was promoted to associate technical director in 1958.

Dr. Henry P. Kalmus

ABMDA Scientist Edits Journal Special Edition on BMD Interceptors

One of the primary functions of the U.S. Army Advanced Ballistic Missile Defense Agency is to develop the advanced concepts and technology that may be needed to counter the evolving ballistic missile threat.

In this evolutionary process of missile defense, ABMDA and its predecessor, the Project Defender group of the Advanced Research Projects Agency (ARPA), conceived and investigated many intercept system concepts. The more useful appearing ones were carried on to various degrees of feasibility determination.

Some significant findings will be summarized in a 200-page special March 1970 edition of the *Journal of Defense Research*, a scientific quarterly produced for ARPA by the Institute for Defense Analyses.

Devoted entirely to the theme of "Advanced Technology for BMD Interceptors," the issue is edited by V. S. Kupelian, assistant director of ABMDA and chief of its Missile Development Division. It includes six technical papers prepared by managers of the various programs.

Two general BMD intercept areas are discussed: (a) The terminal regime with its primary attraction of atmospheric filtering of penaids and close-in radar acquisition and guidance, and its special case of hardsite defense; and (b) the mid-course exo regime, with optical homing guidance intercept.

Much of the early BMD work was concerned with flight and control within the terminal regime—issues of high-acceleration maneuverable boost in attempts to get the high-average velocities needed to extend the battle space. This was the genesis of the HiBEX program, which demonstrated the feasibility of a very-high-acceleration maneuverable booster for hardsite defense, hot-fired from a closed-breech silo.

Evolution of such a booster required development of a number of new guidance, control and propulsion technologies—fast-burning propellants, grains to stand high accelerations and understanding of their viscoelastic characteristic, energy management and thrust vector control for hot-fire and rapid trajectory stabilization, guidance, control and instrumentation in a high-acceleration mode.

The HiBEX experiment and its find-

WES Using Gas-Fired Gun for Concrete Research

Scientific research linked to the 1962 moratorium on nuclear testing and the present treaty banning in-the-air explosions has spawned many new procedures and techniques for obtaining information on blast and shock phenomena from underground charges. Some of this knowledge is proving increasingly useful for civilian economy requirements.

One problem was to match the material holding the instruments in place to the geological formation of the area where tests were being made so that reliable readings could be obtained on the yield of atomic weapons.

Another problem of engineers and scientists at the U.S. Army Engineer Waterways Experiment Station was in designing a piece of test equipment which would measure the shock response of the materials. This was met by building a gas-fired gun with a metal plate at the end of the projectile which, when fired out of the gun into a sample, generates a shock-stress wave into the specimen at the Vicksburg, Miss., installation.

The response is monitored with stress and particle velocity gauges. Upon impact a shock runs through the sample and measurements are recorded on an oscilloscope—all within one-millionth of a second.

Procedures developed for gathering and analyzing the data are considered scientific advances in research. By knowing the initial density of a material and the compressibility at respective stress levels, concrete specialists could tailor grout materials to match such widely varying geologic formations as a salt dome in Mississippi or a granite mass in Utah. Instruments coupled to the formations in these areas with the special grouting materials yielded reliable information from explosive charges.

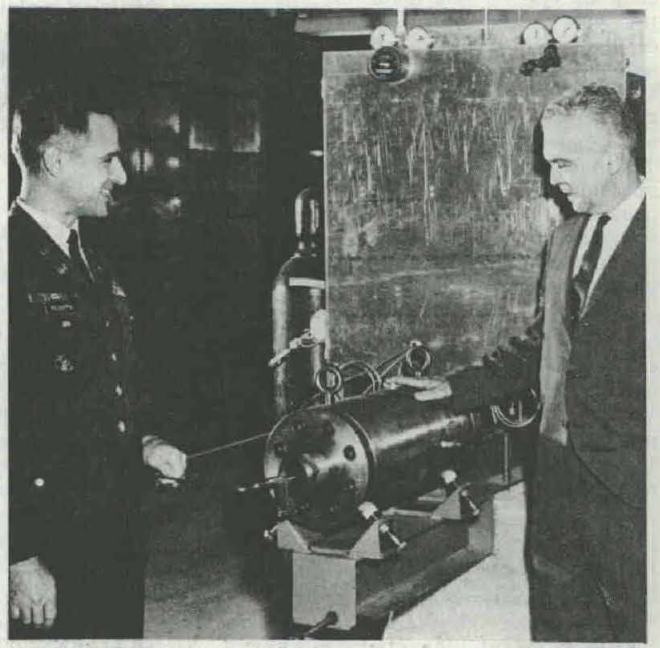
Information gained from use of this gas gun and another air gun has not been limited to this one application. Data, put into computer codes, are useful in selecting sites for missile silos and other hardened structures to lessen the blast and shock threats from near hits.

Penetration measurements of low-density concretes are expected to extend the applications of these materials in both civilian and military construction where materials are required to absorb energy, reflect shock waves, and retain their shapes under stress.

Although the low-density concretes are being used mainly as roof and floor fills, possible applications include energy-absorbing highway barriers; industrial safety walls, backfills for tunnels, pipelines, missile silos, and buried structures; and protection of reactor foundations from seismic instability.

A cubical explosive storage complex may in the future have sandwich-type walls filled with a material to absorb energy. This proposed type of construction would minimize the possibility of explosives detonating in one room, sending spalls splitting out of the far side of a solid wall, and flying across to an adjacent room to set off another blast.

The Corps of Engineers uses more concrete in construction than any other agency in the world. Most of the research to improve the qualities of concrete and methods of using it for construction purposes is done at the Waterways Experiment Station.



DEPUTY CHIEF of Research and Development Maj Gen William C. Gribble views gas-fired gun used for concrete research at the U.S. Army Engineer Waterways Experiment Station (WES), Vicksburg, Miss., during orientation tour conducted by WES Director Col Ernest D. Peixotto.

ings are discussed in the *Journal of Defense Research* by C. R. Smith of the Boeing Co. in "The HiBEX—an Experiment in High-Acceleration Boost for Ballistic Missile Defense."

Propulsion issues of fast-burning propellants, high-strength grains, lightweight cases and related combustion and test work are discussed by A. Jacobs of Hercules, Inc., in "Interceptor Propulsion Technology," which deals also with controllable solid propulsion for application to the exo-atmospheric homing interceptor.

Such high-performance endo-atmospheric intercept modes also indicated the need for new control techniques to achieve the high-force, short-response required to engage evasive and poorly predicted targets, as well as to survive both the natural and nuclear environment.

This requirement led to evolution of the atmospheric reaction force generation techniques for hypersonic flight control: (a) external burning (EB) using pyrophoric fuels reacting with the surrounding air; (b) jet interaction (JI), with forces amplified via interaction with the surrounding hypersonic flow; and (c) a possible combination of both with the potential for a single endo-exo control system. These control force generation systems are discussed by D. B. Harmon of McDonnell Douglas in "Reaction Controls for Interceptor Missiles."

These control force techniques were coupled with the controllability of hypersonic lifting bodies and new concepts in guidance policies and instrumentation to form the basis for the UpSTAGE program, a terminal intercept flight experiment now being mechanized and to be flown next year. This is a highly maneuverable upper stage to be used with the HiBEX booster in closed-loop, guided-flight experiments, primarily to develop technology for advanced hardsite systems.

Hence, the initial three papers are concerned primarily with advanced technologies in support of the severe terminal intercept mode which is to work in the worst-case target, communication and environment situations, particularly within the hardsite defense regime.

The primary design intent of an interceptor is obviously to achieve a miss distance commensurate with the lethality of its warhead; for nonnuclear kill mechanisms, this requires small miss distances, seemingly achievable only via some homing techniques.

The homing guidance issues to achieve such small miss distances are a strong function of the intercept regime. The endo or terminal interceptor homer must work in a high-temperature, pressure and acceleration environment and perhaps within the water layer.

The issues of mechanizing and using such a terminal homing system have received considerable study in the various ARPA/ABMDA RHOGI programs.

Findings are summarized in "Homing Guidance for Missile Intercept in the Atmosphere," by W. B. Browne of Westinghouse Corp.

The issues of exo homing and interceptor mechanization in an expanded area homing intercept system are explored in a paper based on the ABMDA LoRAH effort—"Issues of Exo-Atmospheric Homing," by L. D. Montague and C. Smith of Lockheed.

In a homing system, a spinner-type mechanization may eliminate many of the subsystems required by the conventional homing interceptor—stabilization systems, attitude control systems, scanning and gimbal systems, etc. As a consequence, it can be made lighter, less noisy, and with shorter response than the conventional mechanization—hence the potential for a smaller miss distance and reduced weight.

Homing interceptor issues are discussed in a paper derived from the ABMDA HIT program, "An Unconventional Interceptor," by J. D. Billingsly and associates of Ling Tempco Vought Aerospace.

These six papers will appear in the initial special issue of the *Journal of Defense Research*. Further papers in the series on Advanced Technology for BMD Interceptors are planned for subsequent issues.

V. S. Kupelian

Forthcoming articles will include "Control of Hypersonic Interceptors," by H. Radt of the Cornell Aeronautical Laboratory; "Command Guidance of BRV Interceptors," by G. W. Egbert of McDonnell Douglas; "Experimental Evaluation of High Performance Interceptor Heat Shield," by J. M. Potts and W. A. Gray of the Martin Marietta Corp.; and

"Dust and Debris—A Status Report," by S. R. Alexander of ABMDA, and F. H. Shelton and J. L. Harper of Kaman Nuclear; and "Nonnuclear Kill of Reentry Vehicles," by J. P. Wade of ARPA and R. A. Stein and Associates from Battelle Memorial Institute.

WECOM Engineers Produce VADS Training Device

Vulcan Air Defense System fire control presented a problem of effectively training gunners for which collaborative efforts of Army Weapons Command and Frankford Arsenal enginers rapidly produced a device that is currently being tested.

The gunner is an integral part of VADS in that his inputs by hand control are part of the fire control solution of the lead angle and the superelevation—requiring that he be "on target" in the smooth tracking of an aircraft prior to firing the gun.

Success of VADS depends upon effective training and evaluation of gunner performance, and early in 1970 it appeared that the necessary Vulcan mount simulator or gunner tracker evaluator was still some time in the future.

Aware of the need for a rapid-response solution, WECOM engineers at Rock Island, Ill., attacked the problem of providing a cockpit arrangement to ensure that the instructor sees the same sight picture as the gunner.

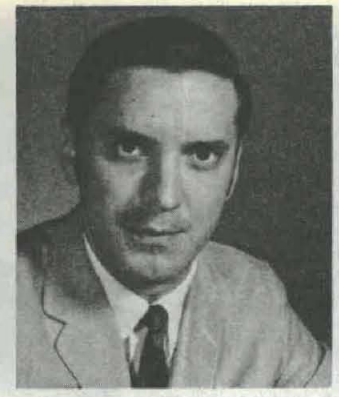
VADS engineers conceived the idea of a small periscope with a one-way mirror permitting the gunner and the instructor riding piggyback to see things the same.

Engineers of the Fire Control Laboratory at Frankford Arsenal went to work on the training sight. They developed a prismatic device of ground optical glass that does not reduce the gunner's ability to see the target but still lets an observer view the same sight pattern.

The device has no moving parts, can be attached in seconds and does not detract from the gunner's ability to track targets. In testing to date, it shows promise as an excellent training device.

Three of the devices have been built. Two are being evaluated at the Air Defense Center at Fort Bliss by U.S. Continental Army Command and the other sent for evaluation by HQ U.S. Army European Command.

Dr. Joseph A. Lannon



Robert J. Schlenner

Spencer S. Hirshman

Joseph T. Lehman

Publication Recognizes 4 Frankford R&D Employes

Outstanding Young Men of America, 1970 edition, lists two physicists and two engineers employed at the U.S. Army's Frankford (Pa.) Arsenal who have distinguished themselves in research and development activities.

Nominated earlier this year, Dr. Joseph A. Lannon, Robert J. Schlenner, Spencer S. Hirshman and Joseph T. Lehman are recognized in the recent publication for achievements related to the Army's R&D objectives.

Dr. Lannon is a physical chemist in the arsenal's Pitman-Dunn Research Laboratories and is engaged in spectroscopy studies related to ignition research. Dr. Lannon, who gained his advanced education at St. Joseph's College and at the University of Pennsylvania, has been employed at Frankford 3½ years.

Schlenner is a physicist in the Ammunition Development and Engineering Laboratories, engaged in R&D of lightweight machinegun concepts and the theory of penetration of small-caliber projectiles into armor plate. He has a BS degree in physics from St. Joseph's College, an MS in mathematics from Drexel University, and has been employed four years at Frankford Arsenal.

Hirshman is a mechanical engineer in the Ammunition Development and Engineering Laboratories. Engaged in artillery muntions design and development of new and improved techniques for analysis and design, he began his U.S. Government service career at Frankford in 1955 under the Drexel University Cooperative Education Program. This permits students to work in arsenal laboratories while raising their educational level. He has BS and MS degrees in mechanical engineering from Drexel.

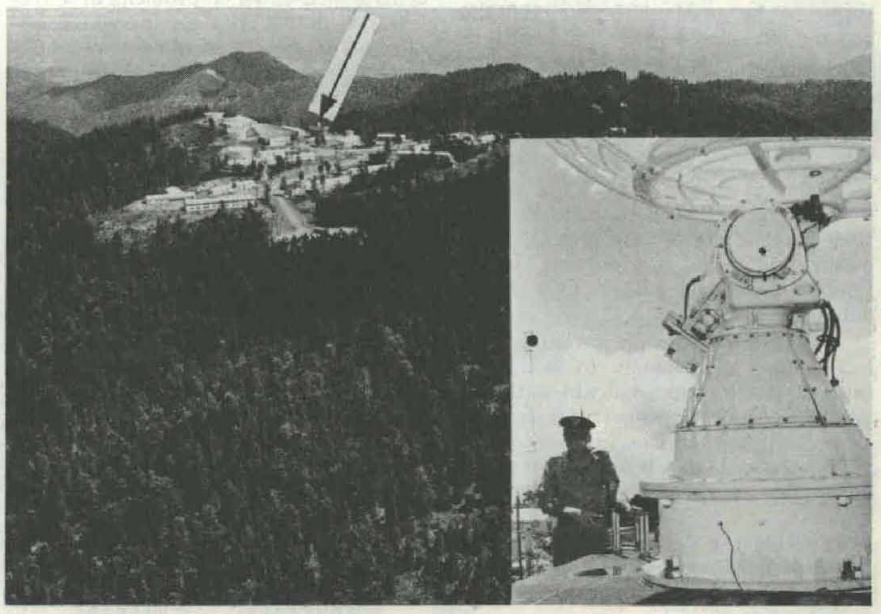
Lehman is an electronics engineer in the Fire Control Development and Engineering Laboratories. He works on infrared fire control systems and electro-optical and radar systems for close-in personnel protection systems. He has a BS degree in physics and electronics from St. Joseph's College and MS degree in physics from Temple University.

Outstanding Young Men of America is an annual awards volume, now in its seventh year, sponsored by leading men's civic and service organizations. Its purpose is to recognize and honor the young men of our country who are working toward excellence in their careers and in community service activities.

Each year more than 5,000 young men between the ages of 21 and 35 are nominated for the awards publication by Jaycee chapters, civic organizations, college alumni associations and military commandants. Criteria for selection include a man's service to others, professional excellence, business advancement, charitable activities, and civic and professional recognition.

President Richard M. Nixon has said of the awards volume, "*Outstanding Young Men of America* presents a most fitting testimonial, not only to the success of many of our young people, but also to their awareness of the debt which they owe our free society."

OPERATION OF THE HIGHEST TRACKING RADAR in the continental United States, on 9,200-foot Mt. Lemmon near Tucson, Ariz., was announced recently by Col Wallace O. Enderle, commander of the U.S. Army Electronic Proving Ground at Fort Huachuca. The radar covers 500,000 square miles, including all of Arizona, most of New Mexico and parts of California, Nevada, Utah, and Texas—greatly increasing the Proving Ground's capability to track aircraft during flight tests of new navigation equipment and other instrumentation. It is operated by Bell Aero Systems under contract with the Department of the Army.



Laird Announces Major Information Policy Changes

Actions to accelerate achievement of the Department of Defense objective of providing more information to the public and the technical community, consistent with national security, were announced Oct. 15 by Secretary of Defense Melvin R. Laird. Specifically stated actions include:

1. Institution of procedures to assure that only that defense technology which clearly needs to be protected in the national interest bear a security classification, and that such security classifications be retained for the shortest possible time.

This new policy means that security classification decisions will be reached only after consideration of competing advantages and disadvantages.

Major emphasis for classification in the past has generally been placed on the possible benefit of the information to potential enemies, without consideration of the benefits which could accrue to the United States Government, industry and domestic community, and our allies through open and effective technology dissemination. Now, both reasons must be considered in making the classification decision.

2. Initiation of a number of programs designed to declassify existing technological information which no longer needs to be classified.

These actions, which will reduce or avoid costs within the DoD and industry by eliminating a significant amount of security maintenance expenses, will also make many previously classified technical reports available to the scientific, academic and technical community.

3. Virtual elimination on technical reports of the use of statements which limit distribution of those documents, whether classified or unclassified, to only selected segments of the U.S. Government community. These limiting statements have previously restricted certain documents to small project or special interest groups.

The impact of this action can be judged by the number of DoD technical reports now being withheld, because of limiting statements, from the Department of Commerce's National Technical Information Service (NTIS), the primary outlet for Department of Defense technical information to the public.

Of the approximately 45,000 Defense technical documents prepared each year, some 17 percent are withheld for security classification reasons while some 39 percent are unclassified but withheld because the originator has placed a limitation on the report's distribution.

The net result of these major policy changes, it was stated, will be a revitalization of applying all the factors involved in the Department of Defense security procedures, and more effective transfer of Department of Defense technology within government and the private sector. Also, these actions will assist in further reducing technology communications barriers with our allies and enhance international cooperation.

FCSTI Redesignated NTIS With Change in Operations

Under a new name of the National Technical Information Service, the former Federal Clearinghouse for Scientific and Technical Information has been lifted from the National Bureau of Standards to the status of a "primary operating unit" of the U.S. Department of Commerce.

The NTIS director, who had not been selected as this publication went to press early in November, will report directly to Myron Tribus, Assistant Secretary of Commerce for Science and Technology. Peter Urbach, NTIS deputy director, is serving as acting director.

NTIS is charged with "making results of technological research and development more readily available"; also, searching for, collecting, classifying, coordinating, integrating, recording and cataloging scientific, technical and engineering information from whatever source, foreign and domestic, that may be available.

NTIS also is responsible for making collected information available to business and industry, to federal agencies, to foreign, state and local governments, and to the general public, through the preparation of abstracts, digests, translations, bibliographies, indexes, and microforms and other reproductions, for distribution either directly or by utilization of business, trade technical and scientific publications and services.

The NTIS will assist operating units in the effective dissemination of business and statistical information produced by them. This includes acquiring, abstracting, indexing, announcing and, as appropriate, distributing such information to business, industry, federal agencies, state and local governments, and the public.

DoD Report Gives Microfiche Systems Specifications

Design specifications for two low-cost microfiche storage and retrieval systems applicable to the special needs of small libraries and research groups are available in a recent Department of Defense report.

"Microfiche Storage and Retrieval System Study" was produced by the System Development Corp., Falls Church, Va., for the Defense Documentation Center of the Defense Supply Agency, Alexandria, Va.

The report is a result of a 6-month study to determine user requirements; also, to develop design objectives and specifications concerning such systems for the growing number of small libraries and research activities.

Designed for organizations with collections of between 3,000 and 10,000 microfiche, the smaller system uses cartridges for storing and handling microfiche. A larger, fully automated, modular system uses tray storage, which provides for on-line operation of a variety of output devices, including reader-printers, duplication units and remote terminals. This system was designed to handle up to 18,000 microfiche, but can be expanded to accommodate 30,000.

The report's specifications are sufficiently detailed to permit initiation of engineering analysis and generation of engineering drawings for the construction of prototype systems.

Five specific tasks were performed by the study group:

- A survey of 50 small Defense Documentation Center users to determine requirements of small users for microfiche storage and retrieval systems.
- A survey of the market as represented by the 50 selected DDC users.
- Examination of present and projected state-of-the-art of microfiche storage and retrieval equipment.
- Identification and description of current research in the area of microform storage and retrieval technology that might negate present development efforts.
- Development of design objectives and specifications for a low-cost microfiche storage and retrieval system appropriate for use by small DoD field installations.

Each task, the report states, was performed in accordance with a "time-phased plan developed during the pre-contract period."

Copies of the report (Control No. AD–710 000) are available from the National Technical Information Service (NTIS), U.S. Department of Commerce, Springfield, Va. 22151. The cost is $3 for paper copies or 65 cents for microfiche copies. Organizations registered with the Defense Documentation Center may obtain a microfiche copy without charge.

Francis W. Collins

Dr. H. E. Sauberlich

William J. Donovan

SARS Fellowships Awarded to 3 Army Employes

Secretary of the Army Research and Study Fellowships awarded recently to three U.S. Army employes recognize outstanding job performance and their potential for career development important to future R&D assignments.

The awards enable carefully selected Army civilian employes to pursue research studies on specific projects for one year in the United States or abroad.

SARS fellowships recipients, as reported recently, are Dr. Howerde E. Sauberlich, Army Medical Research and Nutrition Laboratory (USAMRNL), Fitzsimons General Hospital, Denver, Colo.; William J. Donovan, HQ DA, Directorate of Civil Works, Office, Chief of Engineers, Washington, D.C.; and Francis W. Collins, Rock Island (Ill.) District, Corps of Engineers.

DR. SAUBERLICH, chief of the Chemistry Division at USAMRNL, is engaged in research on new techniques and concepts of human nutrition, clinical investigation and nutritional biochemistry and toxicology at Vanderbilt University in Nashville, Tenn.

Internationally known as one of the leading experts in the field of nutrition, the PL–313 scientist is investigating nutrition and metabolism as factors in health and disease. He is experimenting with microorganisms, laboratory animals and human beings.

Prior to entering U.S. Civil Service in 1959 as chief of the USAMRNL Chemistry Division, Dr. Sauberlich was an associate professor at Iowa State University. He also has served as a professor of animal husbandry and nutrition at the University of Kentucky, University of Indonesia at Bogor, and at Auburn University.

He received a BA degree (1944) in physical chemistry from Lawrence University, Appleton, Wisc., MS (1946) and PhD (1948) degrees in biochemistry, nutrition and medical sciences from the University of Wisconisin at Madison, and continued postgraduate studies (1951) at the University of Tennessee at Knoxville.

Author or coauthor of more than 100 publications in nutritional biochemistry and toxicology, Dr. Sauberlich in 1952 received the Meade-Johnson Award for outstanding research on the vitamin B complex.

In 1964 he received an Army Meritorious Civilian Service Award for his work on the wholesomeness of irradiated foods. The Association of Military Surgeons recognized his human nutrition research with the McLester Award in 1965.

DONOVAN is a GS–14 regional economist in the Office, Chief of Engineers, Civil Works Directorate. His SARS Fellowship selection was based on his outstanding record of achievement since 1963 in planning for utilization of natural resources, and a SARS proposal of a project for an appraisal and evaluation of the multi-objective approach in water resources planning.

Enrolled at Colorado State University, his SARS project is to study how to reflect appropriately the environmental and ecological objectives in formulation and evaluation of water resource projects of the Corps of Engineers Civil Works Program.

Donovan obtained his bachelor's degree in forest management from the State University at Syracuse, N.Y., in 1952. He earned a master's degree in public administration from Harvard University in 1960, majoring in natural resources policy and land economics.

Since 1952 he has supplemented his full-time residence education by night school work at George Washington University, the American University and the U.S. Department of Agriculture Graduate School. His academic honors include the Zellerbach Conservation Fellowship from Harvard University.

Donovan began his federal Civil Service career in 1951 (while a student at Syracuse) as a GS–2 forestry aide for the U.S. Department of Agriculture. From 1952 to 1963, he was employed by the Department of Interior, first as a forester and then as a resource planning specialist, advancing from GS–5 to GS–13.

From 1966 through 1967, he was employed in the Bureau of the Budget as a budget examiner (Water Resources, GS–13), until he transferred to the Chief of Engineers, Civil Works Directorate.

COLLINS is chief of the Environmental Resources Section, U.S. Army Engineer District, Rock Island, Ill. His SARS project is a comprehensive environmental study and formulation of a plan for development of a headwater stream in the Rock River Basin in Wisconsin.

He recently began his research and study fellowship at the University of Wisconsin, under direction and supervision of Dr. Phil Lewis, chairman of the Department of Landscape Architecture and director of the Environmental Awareness Center.

Collins has a BS degree in agriculture from Michigan State University and MS degree (1955) in biology from the University of Louisville. His career includes service as area manager in training, Missouri Conservation Commission (1958–59).

Following military service with the U.S. Air Force (1943–46), he was employed as a foreman with the Michigan Department of Conservation (1949–50); wildlife biologist, Kentucky Department of Fish and Wildlife Resources (1950–56); and field director, Kentucky Reclamation Association (1956–58).

ASM Honors ARO-D Employe

Fellowship in the American Society for Metals (ASM) was conferred Oct. 18 on Dr. Henry M. Davis, director, Metallurgy and Ceramics Division, U.S. Army Research Office-Durham (ARO-D), N.C., at a convocation of ASM Fellows in Metals Park, Ohio.

Fellowship in the American Society recognizes distinguished contributions in research and development of metals and materials, and develops a broadly based forum for technical and professional leaders to serve as advisers.

Dr. Davis was selected because of "distinguished leadership and significant contributions in increasing the understanding of the principles governing behavior of materials, and for his noteworthy direction of a program of basic research in metallurgy and ceramics."

STRATCOM-Europe Utilizes 'Quick Erect Antennas'

Miniaturized equipment capable of reliably performing important jobs has been a continuing objective of U.S. Army research and development in recent years. Two small communications antennas atop Breitsol Mountain in Germany are good examples.

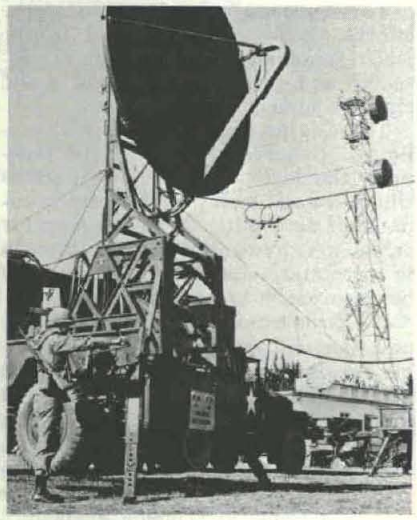
This new equipment, labeled QRC–1s, is providing a strategic communications link for the troops maneuvering between Breitsol and a similar site across the mountains in STRATCOM-Europe's support of REFORGER II exercises. Only 10 feet in diameter, the tropo-scatter dishes are designed to replace the 28-foot, less mobile Kennedy antennas.

Men of the 72d Signal Battalion's Transportable Communications Company are operating the QRC–1s. Their commitment to REFORGER II constitutes the initial step of a lengthy testing schedule for the first antennas of their type to go into the field.

The extruded aluminum parabolic dishes are being acclaimed as near perfect electrically, with sophistication realized in practical terms.

Compact in size and greatly reduced in weight, the antennas can be moved rapidly. Two men can have one operating in less than an hour; the 28-foot dish the QRC–1s replace took six men five times that long.

Commented SFC Robert C. MacDonald, the team chief at Breitsol, "We put these things up Sunday in the rain and nobody even got wet." QRC–1s fall into the category of "Quick Erect Antennas."



RADIO OPERATOR adjusts pitch of tropo dish with a simple hand crank during exercises atop Breitsol Mountain in Germany. The QRC–1 dish is so sensitive it needs to be aimed only within a 20-degree service tolerance.

High-frequency messages are bounced off the upper layers of the atmosphere through the process of tropo-scatter. At each end of the link as little as one-millionth of the original transmission is picked up by the antennas, increased to an audible level, and relayed over the right wire.

For this to take place, the Kennedy dish had to be aimed to within three degrees of the transmitting site. Demanding only a 20-degree range of accuracy, the QRC–1s can be positioned with a hand compass.

Even the traditional nuts and bolts have been replaced by quick insert pins. The dish swings off its trailer into a vertical position by means of a simple hand crank. A veteran of field communications, SFC MacDonald commented, "Unless someone devises an entirely new way of carrying on this type of mobile communications, they're as good as they can be."

Before the completion of REFORGER II, STRATCOM-Europe plans to set up another pair of the antennas at the other end of the link.

Edgewood Applies 'Try Before Buy' Concept to XM687

"Try Before Buy" concept principles are being applied to the XM687, a 155mm binary chemical projectile being developed at Edgewood (Md.) Arsenal as part of a new comprehensive binary weapons system for U.S. Armed Forces.

The idea of the binary weapons system is to enable maintenance of an effective and flexible chemical agent deterrent retaliatory capability without the necessity of producing, transporting and stockpiling lethal materials.

Under this concept, two nonhazardous constituents are stored separately in polymeric containers encased in steel canisters and are inserted into the basic artillery shell just before firing. When fired, the setback forces and spin-up of the projectile provide the mixing action necessary to produce a lethal agent.

Edgewood Arsenal, a major element of the U.S. Army Materiel Command, anticipates that the new field of binary weapons technology will eventually replace existing chemical stockpiles with non-lethal substances.

The objective of the concept is to provide more effective chemical munitions safety, eliminate any disaster potential, reduce chemical munitions obsolescence and improve military flexibility.

Twelve additional projects selected for the AMC "Try Before Buy" as one of the basic principles of PROMAP–70 (Program for Refinement of the Materiel Procurement Process) were listed in the September-October edition, page 49, of the *Army Research and Development Newsmagazine.*

The projects are ultrareliable area radio, tactical radio communications system, forward-looking infrared sensor, cargo containers, family of power conditioners, 5 and 10-kilowatt generator sets, diagnostic test equipment for UH–1 helicopter, ammunition for general purpose machinegun, high-performance fuze, under-water vehicle mining system, remote aerial mine, and antipersonnel mine.

LaCroix Assigned as Edgewood Executive Officer

Edgewood Arsenal's new executive officer is Lt Col James P. LaCroix, who succeeded Col Herbert H. Freeman when he was reassigned as special assistant to the commanding officer.

Lt Col LaCroix served until recently as chief of the Doctrine and Studies Branch in the Army Combat Developments Command (CDC) CBR Agency at Fort McClellan, Ala., following duty as project officer with the CDC Combat Arms Group at Fort Leavenworth, Kans.

In Hawaii from 1960 to 1963 he was deputy chemical officer with HQ U.S. Army, Pacific, following a 4-year tour as a project officer in the Pentagon, Washington, D.C. Prior to that duty he completed the resident course at the Army Command and General Staff College.

After attending the University of Maryland, he began his Army career as an enlisted man with the Corps of Engineers in 1942. Commissioned a second lieutenant in the Army Chemical Corps, he drew duty with the Air Force (1947–49). Then he served as a chemical officer in Japan and Korea until 1951, when he was assigned as operations officer with the Chemical Corps School at Fort McClellan, Ala., until September 1955.

Lt Col James P. LaCroix

Perish Discusses Lightweight Structure Needs at AMMRC Meet

In the keynote address to the second biennial U.S. Army Symposium on Solid Mechanics at the Army Materials and Mechanics Research Center (see article on page 35), Deputy for Materials and Structures Jerome Persh, Office of the Assistant Director for Engineering Technology, Office of the Director of Defense Research and Engineering, spoke as follows.

* * *

I am extremely glad to have the opportunity to speak to this group today because of the timeliness of both the theme of the meeting and the comprehensive coordination activities which are just getting under way in this technology area.

The area of lightweight structures, particularly composites, has been the subject of many meetings and symposia in the past few years. Many have dealt with the large weight savings that are achievable through their use.

The aircraft area has received the most attention. It has been demonstrated in several actual aircraft applications that boron or graphite fiber-epoxy matrix composites result in weight savings of up to 20 percent when substituted directly for aluminum on aerodynamic surfaces. Furthermore, even greater weight savings are predicted if the entire structure is designed using these composites.

The predicted savings in weight through the use of graphite-fiber-aluminum-matrix composites is just as dramatic for other applications.

The very attractive payoffs that will accrue through the use of composites are stimulating much effort in the development of advanced fibers and matrix material. The strength and modulus achieved in new graphite fibers have skyrocketed in the last few years. Recently glass fibers with moduli in excess of 20 million psi and tensile strength of almost a million psi have been reported. The vast concentration of effort on composites is a cause for some concern, however.

We do have to be careful that we are not drawn into the syndrome where the subject of lightweight structures becomes synonymous with composites. The Department of Defense has innumerable applications where the light metals, such as beryllium and magnesium, or ceramic-metal combinations are needed because of requirements over and above those of strength-to-weight ratio.

These materials may have attributes which cannot be achieved in composites. The capability to design efficient lightweight structures with these relatively brittle materials must be achieved to provide us with design options which may be needed.

In a recent study by the National Academy of Sciences (NAS) National Materials Advisory Board (NMAB) of a missile structural application which requires very high stiffness, it was cautioned that both the composite and metal options should be kept open until adequate research and development had been accomplished to indicate clear, demonstrable superiority of one over the other.

To go one step further, lightweight structures do not necessarily connote low-density materials. We have innumerable other applications where the strength and toughness of steel and titanium will be required. In essence, the phrase lightweight structures means efficient structural design using the most appropriate materials in the most effective way possible.

Dr. John S. Foster Jr., Director of Defense Research and Engineering, in his recent Air Force Materials Laboratory Symposium banquet speech, placed another emphasis on the subject. In effect, he stated that lightweight materials and structures are indeed much sought-after goals because the complexity and sophistication of our new weapons systems require reduction in structural weight fraction; but they must be competitive price-wise.

Dr. Foster pointed out that costs must be calculated, not only on a raw material basis, but must include the research and development costs, the fabrication costs, the inspection costs, as well as the installation, testing, maintenance, and replacement costs.

He further emphasized that in today's fiscal climate, a few percent weight saving or less cost is insufficient to impress systems managers so that they will risk a new material or structural concept in a weapon system that can be built using conventional materials and structures.

Another important point he made is that new materials and structural concepts which will give us large weight savings will not be used unless they are competitive price-wise. If necessary, performance requirements will be relaxed to keep the price down. Simply, price will have as much priority as performance.

It would seem that this presents an awesome challenge to the technical community assembled here. You must develop that technology needed to keep many options open to the designers of new systems. You are confronted with the immense problem of developing lighter weight structural concepts and criteria for new materials which we know are more expensive than conventional materials.

Jerome Persh

Your job is to develop the knowledge by which efficient structures can be designed with these new materials at over-all costs which are less than those for conventional materials to provide the balance.

While this is a tremendous technical challenge, it also requires that we modify and intensify our coordination responsibilities within DoD and the Military Departments. I say this because these technological goals can only be reached, in today's fiscal climate, by consolidation and integration of the efforts of the many scientists and engineers involved in this area, irrespective of the Service they are in or their contracting agency.

This "pooling" and focusing of the efforts of the many engaged in the DoD structures and dynamics research and development is clearly and simply a management problem.

There is no question that, with unlimited resources, the talent and ingenuity that exist across the DoD scientific and engineering community is capable of developing the technology for achieving substantial weight savings in the materials and structures of our new equipment at reasonable costs.

We do not have unlimited resources now, nor will we have in the foreseeable future, even though our technical problems are getting tougher and tougher. This means that we must implement management mechanisms whereby the work of many at the DoD labs, universities and in industry can be directed at common goals.

The first step to be taken is to develop a plan of action. This has been done. The Deputy Secretary of Defense, Mr. Packard, has directed that Service-wide technology plans be prepared by the Office of the Director of

Defense Research and Engineering (ODDR&E) in cooperation with the Military Departments.

These technology plans, which are called Technology Coordinating Papers (TCPs), will describe the technical developments the DoD technology community must achieve in order that our military forces will be equipped with the best possible weapons in the late 70s and early 80s. They will also identify the future potential systems where the greatest technological inadequacies lie, the critical and pacing problems associated with these systems, and specific milestones that must be met.

Another important function these documents will provide is information to the systems development managers as to what new technology to expect, and when.

We hope this information will provide a basis for better systems planning. We fully realize that TCPs are not a complete solution to our problems, but hope they will measurably increase the effectiveness of our limited R&D resources.

One of the first of these TCPs is on materials. We have been working on this document for over a year. It has gone through numerous rewrites and revisions and is nearing completion.

During this preparation time period, we have achieved an unprecedented degree of coordination and cooperation between the Military Departments. This could only have come about by the necessity for the Services to work together side-by-side in the writing of the document. No coordination "show and tell" sessions could be as effective as the Services sitting down and working together with a common objective.

In the future, we intend to make industry and the universities aware of the information in this document to inform and try to orient this entire technological community to our directions and needs. By doing this we hope to marshall and focus the expertise outside of the DoD in-house community.

Recently we started preparation of a TCP on Structures and Dynamics. The lessons we learned during the preparation of the materials TCP will be of most value, just as the TCP on Rocket Propulsion helped immeasurably in preparing the materials TCP.

This is an evolutionary process which we plan to move faster because of the pressures imposed by the rapid acceleration of foreign technology. I hope that the degree of coordination and cooperation achieved by the DoD materials community is surpassed in the structures and dynamics areas, and that we can accomplish this task quicker than the last one.

In summary, I would like to leave several important thoughts with you.

First—Lightweight structures do not, and should not, imply only the use of composites. Despite the fantastic advantages and the overwhelming challenge of developing structural analyses for these types of materials, there are innumerable applications in DoD where conventional materials can be efficiently used in a cost-effective and weight-competitive manner.

Second—In the planning of new systems, the cost will be very carefully reviewed against the effectiveness. Since the cost of the structural subsystem often represents an appreciable fraction of the total, it is important that we have as many materials/structural options as possible open to us so that realistic tradeoffs can be made. This means that effective, sophisticated, structural analyses must be developed to cover many options.

Third—In this day of declining defense budgets and ascending system performance requirements, we must make every effort to get the most R&D for our dollars. Structural analysis is one area where, in my view, much work is needed to provide the tools to the designers of new systems which will enable them to meet the specific performance goals.

To utilize most effectively the available funds, we must enforce tight coordination and cooperation among our researchers in this area, whatever their affiliations, to reinforce mutually the efforts of all.

You and I have a job to do. We cannot do it alone; neither can you. It is too big a job. A new feeling of unity of purpose and responsibility must be instilled at all management and technical levels in Washington and in the field. We must make every penny count. This means getting everybody in this technological community pulling together, or else we will no longer have the technological leadership that now exists.

AMMRC Conducts Solid Mechanics Symposium

Lightweight structures was the theme of the second biennial U.S. Army Symposium on Solid Mechanics at the Army Materials and Mechanics Research Center (AMMRC), Watertown, Mass., Oct. 13–14.

Sessions were sponsored by the Technical Working Group for Mechanics of Materials, one of several TWGs of the U.S. Army Materiel Command Materials Advisory Group.

The purpose was to provide a forum for Army designers and researchers to discuss current programs, progress and problem areas, with a view to reductions in lead time for development of new weapon systems and equipment.

Symposium chairman J. I. Blum, acting chairman, AMMRC Theoretical and Applied Mechanics Research Laboratory, presented the opening remarks. AMMRC Commander Lt Col J. W. Gillespie welcomed the 143 participants, stressing the need for continuing communication between designers and scientists.

Attendees included engineers and scientists from U.S. Army, Navy and Air Force installations, universities and industrial organizations.

In the keynote address, Deputy for Materials and Structures Jerome Persh, Office of the Director of Defense Research and Engineering, emphasized the essentiality of focusing efforts of the entire DoD team engaged in structures R&D toward common goals—to achieve the technological base for effective and economical lightweight systems.

Dr. H. M. El-Bisi, chief, Research Division, Army Materiel Command, was chairman of Session 1, featuring four commodity-oriented technical papers. Presentations focused on critical problems anticipated in development of lightweight structures for missiles, aircraft, munition and weapon systems.

Research papers on structural behavior, optimization and material response were presented at three sessions. The papers reported recent studies at six U.S. Army laboratories and nine universities and institutes under Army contracts or grants.

Six papers related to structural behavior studies were presented in Session II, chaired by Richard L. Ballard of the Physical and Engineering Sciences Division, Army Research Office, Office of the Chief of Research and Development, HQ DA.

Session III, chaired by Prof. J. J. Connor of the Massachusetts Institute of Technology, was featured by six papers on optimization. Prof. J. Rice of Brown University was chairman of Session IV, devoted to six papers on material response.

Symposium proceedings will be distributed early in 1971 as an AMMRC monograph series report. Six papers that were not scheduled for presentation at the symposium because of time limitations also will be published.

Planning will be initiated shortly for the 1972 symposium. Suggestions for the theme may be directed to the Army Materials and Mechanics Research Center, Watertown, Mass. 02172, ATTN: AMXMR-T.

Top Priority Materiel Objectives Listed in 'Big Eight' Program

(*Continued from page 1*)
development is here discussed, including a consideration of subordinate developments and alternative options where and when applicable.

Modernized Gunship. The Army's number one research and development priority is a gunship, an aircraft that "can see at night" and is armed with an antitank capability. In order to counter the Warsaw Pact armor threat, a quick-reaction capability must be developed that is highly mobile under poor weather conditions and possesses antiarmor and night-vision systems.

In situations where airmobile units will be required to operate over large frontages in order to block or delay enemy infantry or armored attacks, a missile-firing attack helicopter is viewed as an essential ingredient to those units.

The AH–56A, known as the Cheyenne, will contain all of the aforementioned characteristics and is presently in operational systems development. A lesser capability can be attained by improving the current AH–1G (Cobra) fleet. However, a modified Cobra will possess only one-third the combat power of one Cheyenne aircraft.

Helicopter Lift Fleet. The program requires that these aircraft be modernized to replace the current UH–1 family of aircraft. Although the "Huey" is considered a very dependable utility helicopter, and the Army's "workhorse" in Vietnam, the current fleet will be employing 20-year-old technology by 1980.

Development of the Utility Tactical Transport Aircraft System (UTTAS), still in the early design phase, will seek to reduce the quantity of aircraft required to lift a typical combat battalion and also reduce maintenance manhours per flight by approximately 50 percent.

If, after concept formulation, it is decided that UTTAS development is not considered practical, the UH–1 fleet will have to be modified in order to upgrade its present performance. Stringent funding constraints may also dictate this latter course of action.

Antitank Defense. In order to improve antitank defense posture, particularly in Europe, the U.S. Army must develop an effective tank killer for the dismounted infantry. An improved family of antitank weapons with a marked increase in range, hit and kill probability, and mobility, will be developed to replace the outmoded LAW, 90mm and 106mm recoilless rifles.

The TOW, Advanced LAW, and the Dragon systems have demonstrated they will provide this increased capability. All three systems will be designed to at least double the effective range and hit probabilities of the current antitank systems. The TOW and Dragon will also provide the infantryman with much lighter weapons.

The Army considers that TOW, a wire-guided system, is at this time the leading candidate of the three systems, primarily because it is in production and is very adaptable to the attack helicopter. The Advanced LAW and Dragon are in the R&D program.

Tank Improvement. The Big Eight program requires development of a tank with a stabilized gun and night-firing capability "because we may be unable to match enemy forces on a tank-for-tank basis." The MBT–70/XM803 is considered the only tank that will be adequately able to challenge this threat since it "has an ability to see at night, shoot on the move, and fire a missile for long-range kills."

The MBT–70/XM803 is currently in operational systems development and is programed as an addition to the Army's weapons systems inventory in the 1970s. Product improvement of the current M–60 tank series, it was stated, will not provide a comparable capability.

Surface-to-Air Missile. Viewed as imperative by Army R&D leaders is the development of a modern surface-to-air missile system to replace aging Hercules and Hawk systems. These two systems, the Army said, are still using the technology of the 1950s and are obsolete even when modified to their uppermost limit. The SAM-D will be designed to provide a replacement air defense system to meet the emerging air threat of the late 1970s.

Major achievements expected from this development are SAM-D's increased firepower, ability to defeat a simultaneous engagement of several aircraft attacking a defended area, increased capability against electronic countermeasures, increased mobility, and a reduction in manpower and maintenance.

The SAM-D uses a multifunction phased-array radar, rated as a significant technological advancement over the old dish radar, and is primarily needed to engage simultaneously several attacking aircraft. Stringent funding constraints may necessitate the development of an austere system.

Digital Transmission and Switching System. Development of this system is considered the principal Army communications requirement for the future. Its creation is expected to provide an integrated and totally interfaced capability that will be a more practical and economical approach than developments of the past.

The Mallard Project was the only system under development, until funds were deleted recently by Congress, that potentially met these requirements. Any system developed to succeed Mallard, the Army said, must be capable of providing full security and immediate access to any network addressee.

The objective of such a system is to ensure improved maintainability and reliability at greatly reduced operating costs; also, to interface totally the field communications systems of all the U.S. military services.

Improvement of the Army Area Communications Systems (AACOMS) is an alternative to the development of an acceptable digital switching system. However, the Army said it will not meet all requirements specified for Mallard or a successor system.

Artillery Ammunition. Increasing the range and lethality of artillery is an objective that entails the development of more effective ammunition, including Improved Conventional Ammunition (ICM) and Rocket-Assisted Projectiles (RAP). ICM munitions have proved much more effective than the heretofore-used standard high-explosive munitions.

Development of RAP to increase the range of current artillery weapons systems is termed "essential." These munitions are regarded as capable of mass fire against enemy targets at ranges equal to or greater than comparable enemy systems.

STANO, TACFIRE, TOS. Finding the enemy is of primary concern to Army ground forces. After the acquisition process, the destruction of the target will hinge upon efficient command post operations and accurate artillery fire support. STANO, TACFIRE and TOS efforts are planned to fulfill this requirement.

Army R&D Newsmagazine Thanks All Assistants on Anniversary

Ten years ago, in December 1960, the *Army Research and Development Newsmagazine* made its first appearance as a 24-page publication.

The intitial editorial staff consisted of five persons; for more than 2½ years, the staff has been down to the chief of the Publications Branch, Information Systems Branch, and one assistant—which explains why recent editions have been late frequently, and sometimes combined for two months.

Along with its "MERRY CHRISTMAS TO ALL," the editorial staff expresses profound thanks for assistance from information officers in the field and contributions of feature articles.

The Surveillance, Target Acquisition and Night Observation (STANO) program was established to insure that all battlefield reconnaissance and surveillance activities are coordinated. The use of sensors, radars, special-purpose detectors, and night-vision devices is intended to assure detection of targets under all weather conditions and in all types of terrain.

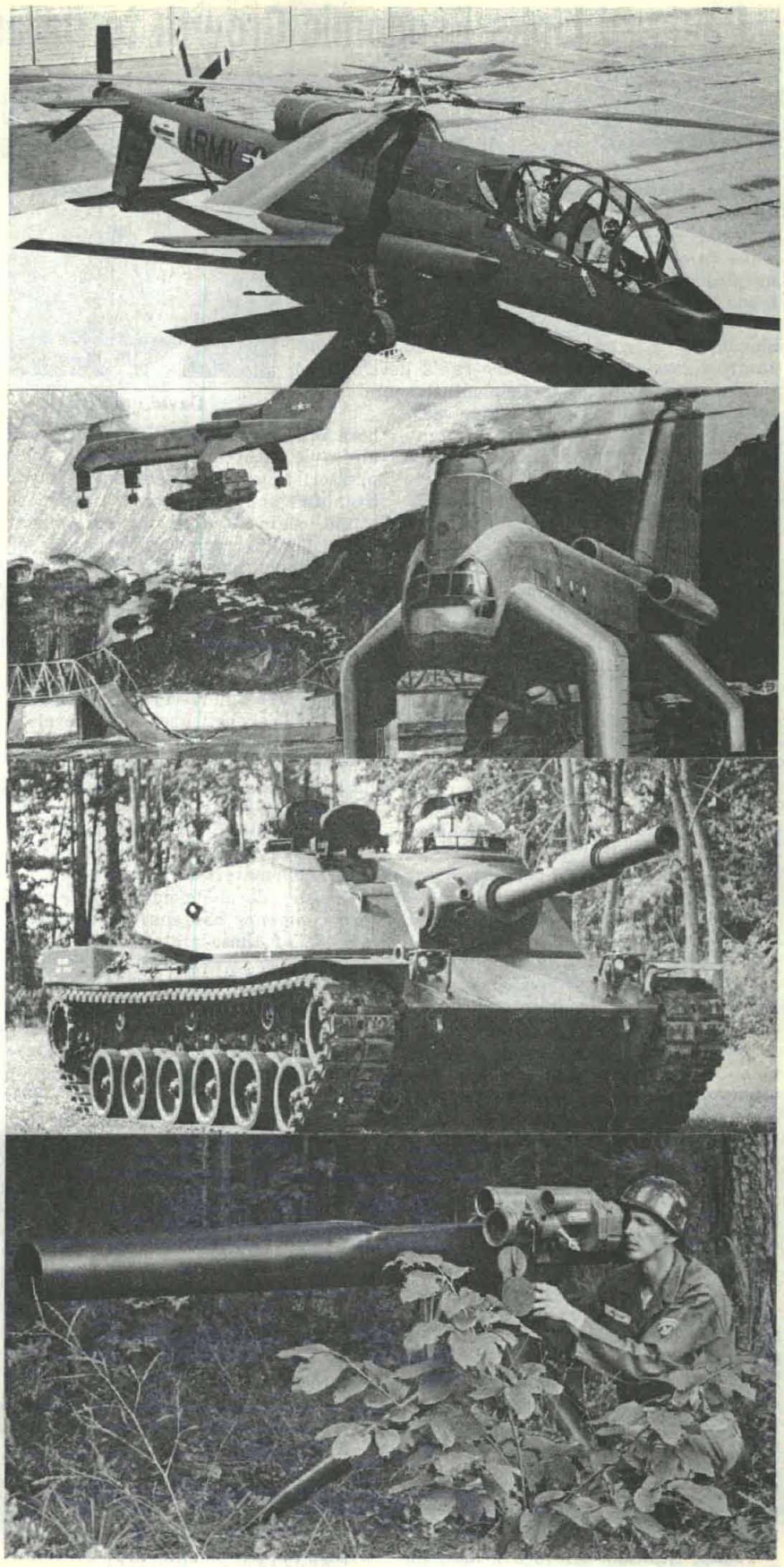
The objective of the Tactical Fire Direction System (TACFIRE) is to apply the advantages of automatic data processing to artillery fire support. The purpose is to increase effectiveness through increased accuracy, improved target information, reduced reaction time and greater efficiency in allocation of fire support.

The Tactical Operations System (TOS) is an information storage and retrieval system for automating functions of operations, intelligence and fire-support coordination within the division up through field army level.

Integration of the STANO/TACFIRE/TOS systems to automate many of the present manual operations is being designed to increase the Army's ability to seek out and destroy the enemy.

Each element of "The Big Eight" now carries Chief of Staff approval as a validated requirement to modernize effectively the U.S. Army, thereby providing the means to accomplish more with decreased manpower. Each of the aforementioned technological advances is programed to assure that increased capability.

The Big Eight, R&D leaders state, comprises only the minimum number of developments that must be vigorously pursued if the Army of the future is to become a modern Army.



REPRESENTATIVE of top priority objectives for development of materiel for the U.S. Army of the future are night-vision devices, AH-56A Cheyenne, Heavy-Lift Helicopters, MBT-70/XM803 Tank, and the TOW Missile System.

Packard Links Economic Growth to Defense-Supported R&D

Deputy Secretary of Defense David Packard presented a strong endorsement of defense-supported research and development in industry, academic institutions and other avenues of scientific investigation in an Oct. 26 address to the Instrument Society of America, as follows:

* * *

David Packard

I am pleased to be with you here today at the kickoff of the Silver Jubilee Conference and Exhibit of the Instrument Society of America. I want to congratulate this Society and all of its members for the great contribution that has been made to the development of instrumentation during the last 25 years. Having spent my professional career in this field, I have had the opportunity to see at first-hand the rapid development in the whole area of instrumentation and measurement in which you are involved.

As I thought about what I might discuss with you this morning, I quite naturally wanted to make my comments in the perspective of the 21 months I have spent in the Department of Defense.

I am, of course, well aware that research and development supported by the Department of Defense has been a very strong factor—if not the key factor—in the development of measurement technology over the last quarter century. I plan, therefore, to talk today about where we have been and where we might be going in Department of Defense-supported research and development.

Ever since the end of World War II, research and development supported by the Department of Defense has provided the major support for expansion of nearly all U.S. technology. This clearly has been true in the field of electronics. There defense programs have provided the main support for the rapid development of radar, new communication technology and computers.

In addition, a great deal of the technical progress in aviation has come from DoD-supported research and development. All turbojet and turbofan engines used in commercial aircraft have evolved from military R&D programs. The Boeing 707 was derived directly from the Air Force C–135. Light observation helicopters developed for the Army have found many civil applications.

Somewhat less well-known is the part Defense has played in developing materials. Aluminum is found today in thousands of every-day products, but it was developed from a rare and costly metal to its widespread use today by work founded on the military need for aluminum in aircraft. Similarly, the current titanium industry is a direct consequence of Department of Defense-sponsored materials research and development.

Today, titanium alloys are used in both military and civilian aircraft as airframe structures and in the compressor stages of the engines. Without titanium, no supersonic transport would begin to meet its operational demands. The corrosion resistance of titanium has put it into such civilian applications as food and chemical processing. Titanium uses in the near future will include desalination plants, steam power generating equipment, and equipment for the entire transportation industry.

In yet another area, the development of glass-reinforced plastics was the first important product in the class of materials known as composites. Rocket cases for both stages of the Polaris missile as well as for the third stage of the Minuteman missile utilize this material.

Military development of glass-reinforced plastics has spurred the civilian use of these materials in boats, truck cabs, trailer bodies, fishing poles, shotgun barrels, pipe, battery cases, storage tanks, and aerial booms for utility trucks. Glass-flake reinforced plastics are found in electrical insulation, as are polyethylene laminates in waterproof liners and containers.

It is estimated that in the next five years there will be a growth of more than 300 percent in the commercial use of glass-reinforced plastics. Examples of estimated 1975 uses include auto, railroad and truck parts; shipping containers; mobile homes; farm equipment; tanks; pipe; ducting; boat hulls and other marine equipment; and electrical and utility equipment—an estimated annual total usage of over two billion pounds.

The use of satellites for communication, navigation, mapping and weather observations was initiated by the Department of Defense. This technology was rapidly transferred to the civilian sector—for example, the Comsat Corp. The Federal Communications Commission is now considering an industrially operated satellite system to provide a television and communication transmission capability for the entire United States.

Medical contributions such as greatly improved treatment for severely burned patients, helicopter evacuation and subsequent treatment for serious traumatic injury, and a vaccine for meningitis are valuable advances grounded in DoD research, and I could cite many other examples.

This rapidly developing technology clearly gave great impetus to progress and growth in instrumentation and measurement.

It is well known that, from World War II until 1960, U.S. military research and development was by far the major part of the total technological effort of our country. In 1960, for example, the DoD R&D budget was $5.6 billion of a total U.S. Federal R&D level of about $8.7 billion.

The space program, together with expanding defense research, brought the total U.S. Government research and development expenditures to a peak of about $13 billion in 1966 and 1967; defense was about half of that.

But now in 1970 the total U.S. Government research and development is going down to a level of around $11 billion, with both space and defense declining rapidly and with defense still about half the total.

I cannot emphasize too strongly the fact that I am very concerned about this decline in our country's total research and development effort. The R&D decline has grave implications for the future military strength of the entire Free World. It has grave implications for the future economic growth of the United States, because defense-supported research over the past 25 years has been a decisive factor in both this country's military capability and its economic growth.

The men who set the pattern for military research and development in the United States after World War II had great vision and wisdom. They had seen the United States leap to the forefront in world technology during that war. They recongized that technology was a basic reason why the Allies won the war; that it was such things as radar, the proximity fuze and nuclear technology that largely made the difference.

They realized that a major, well-conceived program of defense research and development could help assure for the United States the military strength necessary for world leadership.

More important, they recognized

that defense research and development required the broadest possible base of technology and technical education. They recognized that research and education are the job of this nation's universities—that this was where the pay-off would be the best.

I saw this military-supported combination of research and education blossom at Stanford, just as it blossomed at MIT, Cal Tech, and other universities throughout the country. It was Department of Defense support for research-and-engineering education at Stanford which enabled that university to develop into one of the great engineering schools of the world. The same progress occurred at dozens of major universities throughout the country.

The benefits from Defense-supported research and development seeped far and wide into the national economy. Your industry is a good example. There was a great deal of work during this entire period in the field of instrumentation that was not directly supported by defense funding.

On close examination, however, one can find very few areas in the field of instrumentation and measurement which did not in some way, either directly or indirectly, greatly benefit by this significant level of Defense research and development.

This span of 25 years, which covers the history of your society, has been the era of greatest progress in instrumentation and measurement, as well as in nearly every other field of technology. The great technical progress of this era has, without any doubt, been the direct result of a continually increasing level of research and development in the United States.

But, the level of research and development is, as I said and as you know, now going down. It began to go down with the reduction in space programs. And now we are faced with the prospect of a reduction in defense programs which are still over half of the total research and development effort.

We were reaching the end of an era of increasing research and development budgets for the United States beginning in January 1969, as I first took on this job, but let me assure you this was not and is not my objective.

Nevertheless, we face the possibility of continually decreasing Defense Department expenditures for research and development because of radically —and I mean that in a strict definition—changed attitudes in the universities, in the scientific community, and among some elements of the general population.

These attitudes are reflected, of course, in the Congress; and they seem to be bringing about a response which, in my opinion, could result in a significant and dangerous change from the quarter century of great technological progress of the past in the United States.

There are two questions of great concern to me about this situation: First, what does it mean for the future military capability and, therefore, the security of our country? Second, what does it mean for the future technological and educational base of the country and, therefore, for its potential for economic and social development?

Let me address, first, the impact of a lower national research and development effort on our future defense capability.

Clearly, the world is no less hostile than it has been. In fact, the threat of conflict and violence is, if anything, increasing. The Soviet Union has been building up its development and production of military weapons. At the present time the Soviet build-up of strategic nuclear forces and naval forces is more rapid than it ever has been.

One can hardly deny that forces of subversion and revolution inside the boundaries of many Free World countries are expanding at an alarming rate, not only in traditionally troubled areas like the Middle East, but even right here at home in the United States, in Canada and in South America.

At the present time we are from two to four years ahead of the Soviet Union in every important area of weapons technology. In strategic forces we now have better ICBMs,

(*Continued on page 40*)

Maloy Directs Logistics at Aberdeen Proving Ground

Col Richard E. Maloy, new director of the Logistics Directorate at Aberdeen (Md.) Proving Ground, is a veteran of 27 years of Army service.

Col Maloy was commanding officer of Logistics Doctrine Systems and Readiness Agency, New Cumberland, Pa., until he assumed his present duties, and from 1967 to 1969 commanded the U.S. Army Inventory Management Center in Korea.

Upon obtaining his bachelor of science degree from the University of Massachusetts in June 1943, he enlisted in the U.S. Cavalry and completed the Cavalry Officers Candidate School at Fort Riley, Kans., in November.

During World War II, he served in three campaigns in Europe as a reconnaissance platoon leader with the 15th Cavalry Group. He was assistant G–4 with the 25th Infantry Division in Korea (1953–54) and for the next four years was assigned to the Quartermaster School Staff and Faculty, Fort Lee, Va.

Other assignments have included chief, Quartermaster Service, HQ U.S. Army Europe; executive officer, Natick (Mass.) Laboratories; G–4 1st Cavalry Division, Korea; and chief, Materiel Division, Combat Developments Command Supply Agency.

Col Richard E. Maloy

ARPA Picks Willis to Head Nuclear Monitoring Research

Advanced Research Projects Agency (ARPA) activities in nuclear explosion detection and location, on earth and in space, recently became the responsibility of Dr. Eric H. Willis as the new Director of Nuclear Monitoring Research.

Until he accepted the ARPA appointment in the Office of the Director of Defense Research and Engineering, Dr. Willis was vice president and director of research, Westwood Laboratories of Teledyne Corp., Westwood, N.J.

Born in England, the 42-year-old scientist received a 1947 BS degree in physics from Kings College, London, and a 1956 PhD in radio-chemistry from the University of Cambridge.

Dr. Willis did research in chemical dosimetry for the Nucleonic and Radiological Development Laboratories, under auspices of the United Kingdom Atomic Energy Authority, prior to becoming assistant director of research at the University of Cambridge in 1962.

Credited with establishing one of the first radioactive carbon dating laboratories in England, he is president of the Commission on the Absolute Age of Quaternary Deposits of the International Quaternary Association. He is a member of the American Geophysical Union, the Geochemical Society and the American Management Association.

Packard Links Economic Growth to Defense-Supported R&D

(*Continued from page 39*)

better ABM technology and better equipment at every level of detail that is important.

The Soviets have larger missiles now because they have chosen to go that way, not because their technology is better. We now have better ships, better submarines and so forth, across the board, in nearly every area.

Our weapons are better now because we developed a substantial lead in technology during World War II. And we have maintained high enough levels of research and development to stay ahead ever since. We had a scare with Sputnik but that was the result of a wrong decision on our part, not a lack of technology.

There may be a Sputnik now and then in the future, but this will pose no danger as long as we maintain our lead in technology. If we ever lose the lead we now have in all major areas of military technology, we will inevitably face the prospect of having to accept a Sputnik not just in one or two unimportant areas now and then, but the prospect of a Sputnik in every important area of military weapons, in strategic nuclear forces, in naval forces, and in conventional ground forces.

No responsible administration official nor any member of Congress can afford, in my opinion, to take that gamble with the future security of our nation and the future safety of our people.

Now, I would like to make it quite clear at this point I am not just reviewing this situation to make a case for higher military budgets. In planning our military forces and developing our budgets for the future, we already have recognized the desire of President Nixon and of our people to have fewer dollars spent on defense, and more federal dollars available for nondefense programs.

We have recognized the fact that nearly all our Free World friends and allies have rapidly growing economies, and can therefore be expected to carry a larger share of our mutual defense burden. We have recognized that through negotiation it may be possible to reduce the levels of armament, particularly in the strategic areas. We also believe negotiation is the best way to resolve the problems of the Middle East and of Southeast Asia.

Given all these factors, I believe we can afford to at least level off our expenditures for military forces, and indeed reduce them to some extent—and Secretary Laird and I have done just that.

But, as we have lower levels of forces we cannot afford to have at the same time inferior weapons. We have superior weapons now, and the reason we do is that up until this time we have had a larger and better military research and development program than the Soviet Union.

Unfortunately, the House has cut back this year our request for research and development funds, and unless we can reverse this trend there will be only one possible result—the Soviet Union will come to have a larger and better military R&D effort, and in due course, will have superior weapons in every category.

I realize that, with regard to the impact of research and development on the growth of the economy, it is not necessary that R&D be supported by the Defense Department. It can be supported by other federal funds. However, we must remind ourselves that we get a double benefit from defense-supported research and development.

A high level of R&D is the only way we can be assured of superior weapons in the future. And on the average, a defense dollar supporting R&D will contribute to this country's economic and social progress just as effectively as a nondefense dollar supporting R&D.

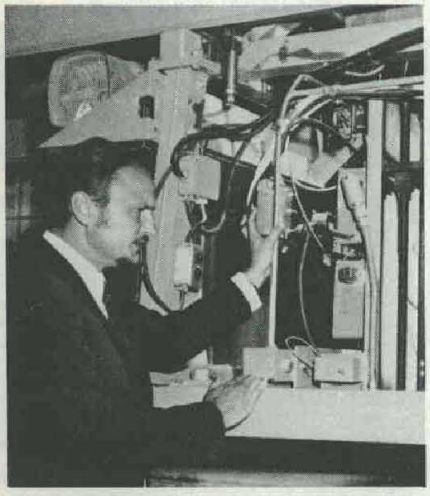
I am not particularly troubled that a few university faculties have chosen not to support defense-funded research. I do not think that has much effect on our ability to get the necessary R&D done. There are many other universities where defense support is welcome, and there are many scientists and engineers to do the work.

In summary, research and development has been a key element of our nation's strength, the sources of a better life for our people and the decisive element in assuring their security. Our society and the world around us present ever increasing demands on our imagination and technical excellence. Mel Laird and I accept our responsibility to see that these demands are accurately described to Congress and the American people.

In the final analysis, you of the Instrument Society of America and your counterparts in other areas of technology, carry both the challenge and the ability to meet these demands. I am confident that you will join us in stepping up to these responsibilities.

2 WES Employes Participate in Netherlands Conference

Ground mobility research conducted at the U.S. Army Engineer Waterways Experiment Station was reported recently by Dr. Klaus-Jurgen Melzer as one of two U.S. scientists invited to the International Commission for Agricultural Engineering Conference in The Netherlands.



IN A PAPER presented at the International Commission for Agricultural Engineering, Dr. Klaus-Jurgen Melzer discussed research conducted with this mechanized cone penetrometer which measures soil strength before and after traffic at Waterways Experiment Station.

Delegates from 16 nations, including three Iron Curtain countries, participated in the exchange of technical information. Dr. Melzer's paper on ground mobility research on military vehicles pointed to the practical applications for other types of equipment.

Particular attention was devoted to the potential for using knowledge gained from military ground mobility research in the design of agricultural machines which have to operate in difficult soil conditions. He described the use of a cone penetrometer for establishing valid relations between vehicle performance and solid properties.

Dr. Melzer joined the staff of the WES Mobility and Environmental Division of the U.S. Army Corps of Engineers installation at Vicksburg, Miss., in 1968, and is a registered professional engineer in the State of Mississippi. All of his degrees, in civil engineering, soil mechanics and foundation engineering, are from the Technical University in Aachen, Federal Republic of Germany.

JSHS Council Welcomes Appointees, Plans 1971 Program

Junior Science and Humanities Symposia (JSHS) Advisory Council members welcomed six new appointees to the body at their recent fall meeting, and discussed a tentative program for the 1971 National JSHS at the U.S. Military Academy, May 5–8.

Army Chief of Research and Development Lt Gen Austin W. Betts highlighted the meeting with the presentation of an Army Certificate of Appreciation for Patriotic Service to Dr. A. Paul Wishart, a special guest of the council.

The award recognized Dr. Wishart for "a major contribution to the outstanding success" of the 1970 National JSHS, as the over-all coordinator for the University of Tennessee, host to the meeting.

Council Chairman Dr. Ernst Weber, president emeritus of Polytechnic Institute of Brooklyn, N.Y., welcomed as new council members Dr. Gerald Acker, director, Ohio Junior Academy of Science; Mrs. Adalie Brent, director, Louisiana Arts and Science Center, Baton Rouge; and

Dr. Edward M. Eyring, associate professor of chemistry, University of Utah; Franklin Kizer, science supervisor, Virginia State Department of Education; Robert Rines, president, The Academy of Applied Science, Belmont, Mass.; and the Reverend John Wilson, assistant chaplain, U.S. Military Academy.

General Betts reiterated his belief in and support of the JSHS Program as a significant factor in enabling high school science students to see the Army in a proper perspective.

The general objective of the 1971 National JSHS, it was announced, will be to increase the level of active student participation by the use of panels and seminars; also, to decrease passive activities, such as addresses.

Considerable discussion developed relative to a suggestion to have selected students present their technical papers at the symposium, instead of merely having the papers published in abstract form. A committee was appointed to consider "How Students Look Upon Competitive Aspects of a Sumposium." It will report findings to the council for action.

The council acted favorably upon a proposed exchange of National JSHS students with London (England) Youth Science Fortnight selected students. The proposal calls for exchange of five students from each program.

The International Youth Science Fortnight is an annual event in England similar to the National JSHS in the United States. It is a constituent part of a program of international events aimed at bringing together young people from all nations, and is organized annually by the Council for International Contact.

Details of the method of selecting the JSHS students to attend the London International Youth Science Fortnight, July 28-August 11, 1971, will be decided in coming months.

JSHS Council members expressed accord on a suggestion that representatives of industry (at least two) should be invited to serve on the council. Army Director of Research Brig Gen George M. Snead Jr., a member of the council, said that General Betts, who had departed earlier, would welcome recommendations.

The council accepted "with regret" the resignation of Dr. Ralph Gibson, who has stated he is still much interested in the JSHS program. However, pressure of other duties prevents him from devoting the time required.

4-Man AMETA Team Provides Training Program in Vietnam

Training provided by members of an Army agency at the Rock Island Arsenal is reported to be having a "tremendous impact" on part of the Vietnamization program.

The training program in Saigon was conducted by members of the Army Management Engineering Training Agency (AMETA) for more than 80 top- and middle-level Vietnamese military officers.

A. Lynn Bryant, AMETA director, said the 4-man AMETA team provided training in modern American management techniques to a wide spectrum of Vietnamese military personnel to assist them in performing vital managerial functions for themselves, thereby aiding reduction of American forces in Vietnam.

Army Maj Gen Raymond C. Conroy, assistant chief of staff for logistics of the U.S. Military Assistance Command, Vietnam, commented that "The instruction . . . will have a tremendous impact on the logistics improvement portion of the Vietnamization program."

Chesarek Retires as AMC CG With 32 Years Service

Announcement by General F. J. Chesarek of his retirement effective Nov. 1 as commanding general, U.S. Army Materiel Command, a position he had held since March 1969, came after more than 32 years service.

General Chesarek succeeded General Frank S. Besson Jr., who had served almost seven years as the first CG of the Materiel Command since it was established in 1962 as part of an Army-wide reorganization.

General Besson, who also headed the planning group for development of the AMC organization, retired from the Army Sept. 30, 1970.

In announcing the termination of his distinguished military career, during which he commanded combat units in World War II and the Korean War, General Chesarek gave no indication of future plans except that he felt "compelled" to provide his family "with my attention and effort at a time when they need it the most."

In a farewell letter addressed to all members of the AMC team, he said:

"The work we have undertaken together will, of course, go forward. It was only made possible by your devoted and inspired effort. Key to all is teamwork. Only by pulling together for common objectives could we have done the job with the resources provided.

"Your accomplishments these past years have been impressive. Continued support of the war effort has demonstrated in full measure the traits that make the organization great: dedication, professional planning and follow-through.

"During the difficult period of financial retrenchment, we have developed innovations of substance which permit us to do better with less. Here again, the same support has come forth as was provided during the buildup.

"No greater honor was ever accorded to me than to have the privilege of commanding the Army Materiel Command as my last active duty assignment. God bless you."

SCIENTIFIC CALENDAR

Nuclear Science Symposium, sponsored by IEEE, N.Y.C., Nov. 4–6.

40th Annual International Meeting of the Society of Exploration Geophysicists, New Orleans, La., Nov. 8–12.

Symposium on Man-Machine Systems, sponsored by AAI Corp., Florida, Nov. 12–13.

Joint Meeting of the American Nuclear Society and the Atomic Industrial Forum and Atomic Fair, Washington, D.C., Nov. 15–19.

1970 Annual Conference on Engineering in Medicine and Biology, Washington, D.C., Nov. 15–19.

Tactical Warfare Research Advisory Committee Land Warfare Symposium, Fort Benning, Ga., Nov. 16–18.

Observations and Predictions of Solar Activity Conference, sponsored by AIAA, Huntsville, Ala., Nov. 16–18.

Fall Computer Conference, sponsored by AFIPS, Houston, Tex., Nov. 17–19.

19th Conference on Prevention of Microbiological Deterioration of Military Materiel, sponsored by AMC, Natick, Mass., Nov. 17–19.

Conference on Magnetism and Magnetic Materials, sponsored by IEEE, Hollywood Beach, Fla., Nov. 17–20.

Symposium on Titanium, sponsored by ASTM, Williamsburg, Va., Nov. 19–20.

Fall Meeting of the American Physical Society, New Orleans, La., Nov. 23–25.

ASA (R&D) Johnson Views Austerity as Challenge for Materiel Progress

"Military requirements and industrial costs, in an environment of declining troop strengths and fewer dollars, must be realistic, rock-bottom necessities adequate to provide appropriately for our national defense."

Assistant Secretary of the Army (R&D) Robert L. Johnson made this statement at the outset of his address to the AUSA Annual Meeting Sustaining Members Luncheon. He followed by quoting from Secretary of the Army Stanley R. Resor's keynote address:

"'We know that we cannot let the quality of our force decline with its number. We must develop the weapon systems which we will need by the end of the decade. We also must balance our needs for development against our procurement requirements so that we do not slight either of the vital interests involved."

The remainder of Mr. Johnson's address follows:

* * *

It is clear that we cannot attempt to carry through development and deployment of nearly all the attractive schemes for new systems. Just because a very difficult, expensive, challenging project seems possible and some people want to do it is not in itself a sufficient reason for its undertaking. There must be a better reason for allocation of scarce resources.

One of the things we can do is to be selective as we attempt to focus short program dollars. We should only start development programs that we can finish. Those which we start ought to very clearly have the highest priority so that, in fact, they are well established and we can maintain funding.

Slipping of funding, dropping of funding, slowing of funding are major causes of cost growth and wasted money. So, clearly, a better job of selectivity for the real requirements is something we can do.

Industry can structure its independent R&D program to provide support of the pivotal technologies that we will need in the future. Industry must be as selective as the Military Services in deciding which programs or projects will be fully funded, because benefits accrue to both parties.

A thorough trade-off analysis should be made before development of a new major weapons system is started. After examination and analysis of all pertinent factors, an acceptable solution may be improvement of existing systems or an increased deployment of the fielded system.

Very few weapons systems are so essential that they must be developed regardless of cost. The atomic bomb was such a weapon. The ballistic missile and the Polaris submarine may be in the same category; however, weapons systems of this importance do not come along very often.

One of the very best ways to reduce costs is to scrub our requirements to insure that new capabilities are limited to essentials. This has the added advantage of reducing complexity of new weapon systems.

We must remove every nonessential item that does not contribute to combat effectiveness. In some cases, we may even have to accept a degradation of effectiveness we think would be nice to have in order to achieve a significant increase in capabilities.

We must resist major changes in requirements once the engineering development program has started. Trade-offs to solve problems arising during development must be made, but major changes to meet major changes in requirements cannot be done without loss of time and considerable increases in cost. If we have done our homework properly before the project is initiated, major changes in requirements will not be necessary.

In addition to the many performance requirements which must guide system and detail design, I would like to propose several more that flow directly from reduced strengths and lower budget. This will mean fewer men to man our systems and conscious action must be taken to reduce the number of men required to operate and maintain them in the field.

This is also one aspect of reducing life cycle costs, which is another area requiring attention. Then there is the problem of the magnitude of initial acquisition costs. Between systems which have equal life cycle costs, that system with the lower initial acquisition cost will almost always be preferred because of the pressures of near-term budgets.

The ever-present problems of reliability and quality assurance are those which industry is uniquely qualified to address. Techniques of system and detail design for reliability, proper component and sub-system environmental testing, and the array of quality control activities, are specialties which must be properly applied. Equipment which operates properly over the expected span is the hallmark of a company of high integrity.

We should adopt contracting procedures consistent with development unknowns. We must recognize the uncertainties inherent in any significant development program involving substantial departures from prior designs.

Our methods of contracting must allow the flexibility required on the part of industry and the U.S. Government, implying a considerable dependence on cost-plus-incentive contracts.

In the past we, perhaps, relied too much on paper studies in lieu of testing hardware. You probably remember the catch phrase: "Paper costs less than metal." I would be the first to admit paper studies have their place, but some full-scale engineering tests are necessary to resolve certain high technical risk elements of a program. Such testing is included in the concept presently identified by the phrase: "Fly before you buy."

We must have adequate testing be-

ASSISTANT SECRETARY of the Army (R&D) Robert L. Johnson toured activities of the Thailand Military R&D Center and U.S. Army components of the SEATO Medical Laboratory in Bangkok during an observation visit to Army installations in Southeast Asia. Shown with Secretary Johnson are Maj Gen William C. Gribble, Deputy Chief of R&D; Maj Gen Prasart Mikkaves, CG of the Thailand Military R&D Center; and Robert Yee of the Thailand Field Office.

fore production. A test program that produces the data we need for decisions can be developed without becoming an unnecessarily long time-consuming program.

I know that some in both the military and in industry view the forthcoming decade with great anticipation and, in some cases, horror, at the thought of austere budgets and forces. I, however, view it quite differently. I see the period as a most challenging and exciting era, in which we are all called upon to put forth our greatest talents in meeting the Army's contribution to the defense of the nation. I look forward confident of success.

ASAP Members Briefed On Project MASSTER

Project MASSTER (Mobile Army Sensor Systems Test, Evaluation and Review) briefings on progress and problems were given to Army Scientific Advisory Panel (ASAP) members at their recent fall meeting at Fort Hood, Tex.

Members of the Ground Warfare Panel of the President's Scientific Advisory Committee Panel also participated.

Lt Gen Beverley E. Powell, commanding general of the III Corps and director of Project MASSTER, was host to the meeting. Lawrence H. O'Neill presided for the first time since he succeeded Dr. Harold M. Agnew as chairman of the ASAP. Dr. Agnew became director of the Los Alamos Scientific Laboratory Sept. 1.

Maj Gen John R. Deane Jr., director of the Defense Communciations Planning Group, gave one of the featured presentations on past and present communications systems and concepts.

Army STANO (Surveillance, Target Acquisition and Night Observation) program activities and progress were reported by Maj Gen William B. Fulton, systems manager for STANO.

Maj Gen John Norton, then deptuy director of Project MASSTER and since promoted to 3-star rank as CG of the U.S. Army Combat Developments Command, gave a presentation on the project mission, objectives and ongoing tasks.

Other briefings on Project MASSTER were given by Lt Col Donald E. Bates, who reported on results of materials tests, and Lt Col William J. Lumpkins, who described field tests.

Maj Gen E. P. Smith, Deputy Assistant Chief of Staff for Force Development, gave the final briefing on the Integrated Battlefield Control System, identified briefly as IBCS.

Pacific Test Program Demonstrates Merit Of Roll-on, Roll-off Ship Cargo Handling

Extensive testing for the past 18 months in the Pacific theater of operations has established that a specialized RO/RO (Roll-on/Roll-off) truck-tractor achieves substantial time savings in loading and unloading semitrailers from ocean-going vessels.

Built for the U.S. Army Mobility Equipment Research and Development Center (MERDC), Fort Belvoir, Va.—as part of the continuing effort to improve military logistics through more efficient cargo-handling methods—the bobtail vehicle can tow semitrailers all the way aboard ship and spot them in much less time than commercial or military tractors.

For example, a ship holding 117 semitrailers was loaded on Okinawa in nine hours, compared to the normal 18 to 24 hours. Similar time savings were reported at other Pacific ports.

Size, maneuverability and performance of the extra-heavy-duty, 4-wheel-drive, 4-wheel-steer RO/RO tractor have been tailored to semitrailer handling in confined spaces. The over-all length is 198 inches and its 80-inch wheel base is the same as a jeep-type vehicle. It can make a 360-degree turn in 33 feet and it has independent front and rear hydrostatic power steering systems for maximum maneuverability.

At gross combination weight rating (GCW) of 83,000 pounds, with 60,000-pound semitrailer, the tractor approaches nearly equal weight distribution, front and rear, to insure usable 4-wheel-drive traction, despite the steep grades and low tire friction encountered in a ship-board environment. It descends longitudinal 30 percent grades at 2 mph, and rolls up 3 percent grades at 30 mph. It can maintain highway speeds of 35 mph.

The RO/RO tractor was built by the FWD Corp. under contract with the MERDC.

APG Continuing Program Of Pollution Abatement

Four years before pollution control became a matter of great concern to millions of Americans, Aberdeen (Md.) Proving Ground, acting under a Department of Defense directive to local commanders, began a program of expanding abatement efforts.

The DoD directive stated that "pollution of the environment by the operation of military installations, facilities or buildings shall be controlled." In response, the APG made modification of its sewage treatment plant one of the prime objectives.

Recently the APG announced that its modernized facility (cost $942,000) has a secondary treatment operation that provides for complete treatment of organic wastes.

Aberdeen Proving Ground leaders also have taken other pollution control actions. A new smoke control system was installed at the main post power plant. Total elimination of open burning was enforced. All post heating was converted from coal to oil. Sanitary landfills and covered dumps were initiated.

The Aberdeen announcement of pollution control activities pointed out that other Army installations are taking similar measures, and that Army manuals on materiel management, dating back to World War I, have placed "repeated emphasis on proper disposal or reuse of waste materials."

MICOM Realigns Elements To Standard AMC Structure

Organization realignment of the U.S. Army Missile Command began Oct. 29 when Maj Gen Edwin I. Donley, commanding general, addressed a letter to some 7,900 employes, and is scheduled for completion Feb. 4, 1971.

General Donley explained that the reorganization is not to reduce the number of employes, but to shift MICOM elements into a standard structure being adopted by each of the major commodity commands of the U.S. Army Materiel Command. He estimated that 7,000 civilian employes will continue in the same jobs at the same pay.

Others will be moved to similar jobs at the same pay they are now receiving. Civil Service and Army regulations will be invoked in cases where employes may be adversely affected, such as shifting from supervisory to nonsupervisory jobs, or changing to positions at a lower salary, "to assure a fair shake to everyone in a reassignment."

Some new command elements—offices and directorates—are being created while many others remain unchanged. New elements will be staffed by transferring personnel with functions they are now performing, and by filling vacancies with individuals excess to needs of other MICOM elements.

General Donley said that for the great majority of the military and civilian personnel, the reorganization involves merely a new title for the element where they work and a move from one office to another.

COMMUNICATIONS TERMINALS developed by the Army for tactical operations also have considerable appeal for civilian applications. Tactical Satellite Communications (TACSATCOM) Project terminals were used in the Apollo 9 through 13 moon missions to provide some of the prime recovery communication links. They also have provided live television coverage from the continental United States to Alaska, and have indicated many other possibilities of considerable interest. Shown above is the JEEP satellite communications terminal and cross-polarized yagi antenna (left) and a special collapsible bifilar helix antenna. Moved in a ¾-ton vehicle, the antenna can be set within a half hour.

Betts Tells Attaches About R&D Civilian Benefits

(*Continued from page 2*)

General Betts said that malaria, however, has continued to be one of the persistent medical problems of military forces, even though the disease has been no problem in the U.S. since the turn of the century.

"Malaria in World War II," he said, "cost the U.S. Army 300,000,000 man-days. General MacArthur reported in 1943 that he felt he had one division in the line, one division down with malaria, and a third division recovering from malaria."

Since then various drugs have been developed by military medical researchers which have proved effective against certain types of malaria, but which have not worked on strains of malaria found to be present in 11 countries worldwide. Dapsone, one of the newest drugs, reduced the attack rate 50 percent. Other combinations and derivatives are under test.

General Betts said the implication of this U.S. Army medical research, in search of effective means of combatting the strains of malaria that are resistant to present drugs, are of vast importance to the civilian population throughout the world as well as to personnel in the armed forces.

Mass inoculation against disease, important in emergencies such as earthquakes, floods and other great catastrophes, has been accomplished effectively with a high-speed "jet injector" developed by the U.S. Army at its Medical Equipment R&D Laboratory, Fort Totten, N.Y.

U.S. Army pioneering research in treatment of burns previously fatal, disfiguring or crippling, including the development of antibiotic salves that materially reduce the chance of infection, is also of great significance to the civilian population in catastrophic fires, General Betts said.

Military research on treatment of severe burns has been directed, in large part, to the relief of victims of plane crashes during combat or other military missions. In this connection, the Army is now beginning to receive the payoff of long years of research to minimize the hazard of fires due to fuel spillage, caused by ruptured fuel systems.

General Betts cited the success of the Army in experimenting with fire-resistant aircraft and vehicle fuels. Deaths due to post-crash fires in U.S. Army aircraft are expected to be reduced significantly (some estimates more than 70 percent) by installation of a new crash-resistant fuel system (CRFS) to be installed in about 11,600 Army aircraft by 1975.

"Needless to say," General Betts pointed out, "there are obvious civilian applications of this device."

Similarly, it was explained that many civilian applications are being found for U.S. Army prosthetic devices developed after long years of effort, such as artificial limbs and an electrically controlled (by small batteries) hand with remarkable sensitive response to requirements for varying pressure.

New also and proved highly effective in emergency applications to patients in Vietnam who otherwise would have bled to death is a new adhesive spray that reduces hemorrhaging, thereby facilitating the surgeon's ability to repair the damage.

"The U.S. Army is very proud," General Betts said, "of a medical development we call MUST (standing for Medical Unit Self-contained Transportable). The MUST is an air-inflated series of units or modules, complete with their own power and humidity and temperature control units.

"In a disaster situation, such as an earthquake, a MUST hospital can be set up and receive patients in only four to six hours. The units are cellular so that a puncture in one cell will not cause the collapse of the whole unit. . . ."

Spinal meningitis in the military service is a greater infectious hazard than in civilian life because of the difference in environment, General Betts said. Consequently, the Army "felt obligated to search for a vaccine. We have found one, we believe, though it is not yet certified for civilian use."

A portable, battery-powered X-ray machine, light enough to be carried easily by one man, has been developed by the U.S. Army for field use in early detection of fractures and imbedded metallic objects. This unit likewise has civilian applications for use in disasters where normal X-ray equipment is not available as rapidly as may be desired.

General Betts also explained how a delicately instrumented "copper foot" is being used by the U.S. Army to measure the effects of extreme heat,

cold and high terrestrial altitude on lower extremities of the body and functional capacity, in search of ways to reduce these effects.

Results of this study (part of a more comprehensive study of the whole body using a "Copper Man" developed by the U.S. Army Institute of Environmental Medicine) are being used to provide a scientific basis for design of shoes, socks and other garments. Findings naturally will have applications to civilian requirements.

Conversion of waste cellulose products to glucose sugar, using such products as paper, rags and the like, can be accomplished at relatively high rates by employing a continuous system developed by U.S. Army scientists at the Natick (Mass.) Laboratories, General Betts disclosed.

"Application of this discovery to the problem of waste utilization," he said, "in a world concerned about pollution and food shortages . . . should have obvious civilian use."

Cited among other results of Army R&D finding widespread application to civilian needs are advances in food processing, preservation and packaging—all directed primarily to the goal of providing the best food possible for the military man despite difficult environmental factors.

In addition to mentioning the Army's pioneering efforts in freeze-dried and other dehydrated foods, to provide a package that is lighter and more compact than a conventional canned version, General Betts referred to investigation of a concept of a "Speed Feed Kitchen."

Featuring a microwave cooking unit, along with new packaged foods and disposable eating utensils, the kitchen is expected to have a capability of feeding 250 men under field conditions in 30 minutes. Again, it was pointed out, such a rapid feeding system would have civilian utility as part of a disaster relief unit.

General Betts also discussed the U.S. Army's tremendous contributions through R&D toward advancing techniques of aerial photography, including technology to make a radar image of terrain covered by dense cloud patterns, for topographic mapping needs.

Considerable attention was given in his address to the U.S. Army's R&D contributions to the improvement of communications for specific requirements under a wide range of environmental conditions, and designed for installation in many types of vehicles.

Following the demonstrated success of satellites for long-haul, point-to-point communications, General Betts said the next logical step was to determine practicality of this technique for application to small, highly mobile users such as trucks, aircraft and ships for tactical communications.

This led to the Tactical Satellite Communications (TACSATCOM) Project, an experimental program of joint effort by the Army, Navy and Air Force on which operational testing is continuing. General Betts stated:

"We do know that the TACSATCOM technique can free one from the limitations of terrain and weather. TACSATCOM terminals work equally well whether they are separated by high mountains, by a hundred feet of dense jungle or a thousand miles across a desert—provided each terminal can see the satellite overhead.

"There are many, many applications for this technique beyond the pure military one. TACSATCOM was used in the Apollo 9 through 13 moon missions to provide some of the prime recovery communications links.

"It has considerable appeal for the air traffic control problem, where all-weather, 24-hour-a-day high reliability is a must. It has also provided live television coverage from the continental United States to Alaska, and has indicated many possibilities of considerable interest.

"Another aspect of our space-connected activities is navigational satellites. Here again, the effort is multi-Service. The Department of Defense NAVSAT System calls for design and production of a family of user equipment. When used in conjunction with a constellation of three or more satellites, it could provide civilian as well as military users with position location and navigation service.

"We foresee receivers being developed for use in all types of rotary- and fixed-wing aircraft, all varieties of vehicles, to ships of any size, and even to small size receivers capable of being man-packed.

"Such receivers will be self-contained, completely passive, have a worldwide and all-weather capability; but of more importance, they will provide a 3-dimensional fix and a velocity determination with high accuracy."

General Betts stated that requirements of modern armies for improved electric power sources are escalating in line with worldwide needs for electric power. Much effort is being devoted by the U.S. Army to meeting its requirements with new power sources —ultimately with chemical fuel cells or other sources.

Currently, he said, primary efforts are directed toward reducing size, weight and improving reliability of conventional hydrocarbon-fueled generators. He commented that size, weight and long trouble-free life power generators are not as much a concern to the civilian world as to the military, but that improved portability and reliability can play an important role in disaster relief.

Military requirements for the most efficient and effective methods of training personnel for an exceptionally broad range of skills have resulted in development of techniques now being used widely by the civilian community, General Betts stated. Military methods have been geared to training large numbers of personnel "in a relatively short time."

In concluding, he stated:

"The list of our contributions is long. I could cite examples of new materials that have evolved from missile technology; reduction in size of electronic componentry is the direct result of military developments.

"I could list devices that allow man to see at night with near daylight efficiency, or even the electronic data processing industry that got its start from Army Ordnance development of the ENIAC computer.

"The thread that runs through this whole discussion is the fact that the military services are *not* a world apart from the civilian community. We have very deep ties to the countries we serve, and even deeper ties to our civilian counterparts from whom we sprung and to whose numbers we will one day return.

"We are strongest when we have the full understanding and support of the people, and our governments are strongest when they support adequate military forces. As far as I am concerned, we can be proud that we have chosen to be part of such a successfully, mutually rewarding arrangement."

Laird Announces Appointment Of Selden to Deputy Position

Selection of Armistead I. Selden Jr. as the principal deputy to Dr. G. Warren Nutter, Assistant Secretary of Defense (International Security Affairs), was announced recently by Secretary of Defense Melvin R. Laird.

Selden has an AB degree from the University of the South, Sewanee, Tenn., and an LLB degree from the University of Alabama. He is a member of the Alabama, District of Columbia and American Bar Associations.

Following service in the Alabama State Legislature, Selden was elected to the 83d Congress in 1952 and continued to serve until he retired voluntarily in 1969. While a member of Congress, he served on the House Committee on Foreign Affairs and was chairman of the Subcommittee on Inter-American Affairs.

Kudos

EXCEPTIONAL SERVICE. The Exceptional Civilian Service Medal, the Army's highest award to a civilian employe, was presented to *Gilbert G. Lorenz* by Col John R. Oswalt Jr., acting CO of the U.S. Army Topographic Command.

Lorenz was honored for service as technical director of the Corps of Engineers Topographic Command Laboratories at Fort Belvoir, Va. He has more than 30 years of civilian and military service with the Corps of Engineers, and gained the distinction of being the first TOPO Labs' employe to receive the ECSM.

His citation states, in part: "His extraordinary leadership, judgment, adminstrative ability and professional skill were instrumental in effecting a major redirection of programs. . . .

Gilbert Lorenz and Col John Oswalt

"The replacement of classical techniques and manually operated mapping, surveying and geodetic equipment . . . by automated systems employing electronics, digital computers and highly accurate optical and mechanical components are the fruition of his efforts. These, and many other outstanding achievements, have contributed significantly to the topographic missions of the U.S. Army Corps of Engineers."

MERITORIOUS SERVICE. The Meritorious Civilian Service Award (MCSA) was presented recently to six Picatinny Arsenal (Dover, N.J.) employes for achievements in the Igloo White program, a high-priority project under former Defense Secretary Robert S. McNamara.

Seymour Fleischnick, Earl Buchanan, Thomas Norton and *Donald Seeger* are with the Ammunition Engineering Directorate (AED). *Charles Knapp* is with the Feltman Research Laboratories. *Donald Shaw,* who was with AED's Fuze R&D Laboratory when working on Igloo White, is now assigned to the Office of the Technical Director.

Igloo White was the major munitions project with which Picatinny was associated in the 1966–68 period and is described on each award citation as ". . . one of the most critical and prestigious projects ever assigned to this command."

The program is said to have placed unprecedented demands on the arsenal engineering staff with its requirement for development and fielding of a new family of munitions in an extremely short time. This meant formulating the concepts, development, engineering for production, tool-up and production, in some cases concurrently, to meet deadlines.

LEGION OF MERIT. *Lt Col Herbert H. Freeman* received the LOM from Col George W. Connell, Edgewood (Md.) Arsenal CO, for service as special assistant to the CO, direc-

Mather of WES Gains Concrete Research Honors

Dual distinction was gained by Bryant Mather, chief of the Concrete Division, U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, Miss., at the recent International Seminar on Concrete for Nuclear Reactors in Berlin, Germany.

Mather participated as the only representative of a government agency selected for the U.S. delegation, composed also of three persons from business corporations and three university professors.

In addition, he was the only member of the U.S. delegation chosen to chair one of the 18 technical sessions. He presided at the session on Behavior of Concrete and Concrete Structures under Long-Term Thermal Influence—a field in which he has gained international renown.

Bryant Mather

Mather discussed his work at the Waterways Experiment Station on high-strength, high-density concrete for radiation shielding, effects of temperature on creep of concrete, moisture migration in concrete, and inelastic volume changes due to stress and temperature for prestressed concrete nuclear reactor containment vessels.

Delegations from Germany, France, Belgium, The Netherlands, Austria, Canada, Czechoslovakia, Finland, Italy, Japan, Norway, South Africa, Sweden, Switzerland, the Soviet Union, the United Kingdom, Yugoslavia and the United States participated.

Mather visited several European concrete research centers and lectured on frost resistance of concrete in Holderbank, Switzerland.

WSMR Contractor Wins Cogswell Award for Security Effort

White Sands (N. Mex.) Missile Range has announced that one of the James S. Cogswell awards for 1970 for outstanding performance in the Defense Department industrial security program was won by its Raytheon Co. facility.

Presentation of the award was made at WSMR by Col Harold Yount, commander of the Defense Contract Administration Services Region, Dallas, to John F. Cram, local Raytheon manager.

In winning the recognition, the company competed with about 13,000 industrial firms having Defense Department Security clearances to perform on classified contracts. Only 18 other companies were presented outstanding awards, the highest of two given by Defense Supply Agency.

The Raytheon Co. performs research, development and evaluaton of the Hawk missile system at the national missile range under contract with the Army Missile Command.

John Cram and Col Harold Yount

tor of Installation Services, and executive officer at the arsenal from July 1965 to October 1970.

His commendation reads, in part: "His professional knowledge, dynamic leadership and managerial ability were significant factors in accomplishing a major program of materially increased logistics and facilities support to mission elements and tenant activities at the Arsenal.

"Through his personal example and leadership, Col Freeman contributed substantially to the ability of the arsenal to meet high-priority research, development, testing and manufacturing requirements for weapons, munitions and equipment imposed by the Southeast Asian conflict."

Lt Col Dean M. Dickey received the LOM, upon retirement from the Army with more than 28 years service, in recognition of meritorious service as CO of the Technical Escort Center at Edgewood Arsenal from August 1965 to June 1970.

"During this period," his citation states, "Col Dickey displayed outstanding leadership qualities and unparalleled understanding of operational and technical problems facing him. It was his decisive and accurate reorganization of the Army Materiel Command's escort service which created one of the Army's most unique and effective units."

Lt Col Jay E. Luther was awarded the LOM for services at the U.S. Army Mobility Equipment R&D Center (MERDC), Fort Belvoir, Va., upon retirement after 23 years of Army service.

Col Bennett L. Lewis, MERDC CO, presented the award to Lt Col Luther for services in 1969–70 as special item manager and R&D coordinator for commercial construction equipment.

Luther was cited for overcoming a multitude of complex problems in developing and initiating a new concept for equipping the U.S. Army engineer construction units with commercial construction equipment.

Lt Col Robert L. Bergquist was honored with a second Oak Leaf Cluster to the LOM for "demonstrating expert guidance and vigilant supervision in carrying out varied staff functions with professional skill, efficiency, clarity and dispatch." The award recognized achievements as special assistant for project management to the commanding general of the Army Materiel Command.

Maj Gen Paul A. Feyereisen, AMC deputy commanding general for Materiel Acquisition, made the presentation to Col Bergquist now a student at the Industrial College of the Armed Forces.

COMMENDATIONS. Office of the Chief of Research and Development, HQ DA, Certificates for Outstanding Performance Ratings were presented recently to *Thomas G. Bracken* and *Mrs. Mildred N. Kern*, Office of the Chief of Administration, and to *Clarence T. Smith*, chief of the Publications Branch, Data Management Division, U.S. Army R&D Information Systems Office.

37 ACC&S Graduates Characterized by S&E Degrees

Scientific or engineering degrees were the rule rather than the exception among 37 recent graduates from the chemical officer basic course at the U.S. Army Chemical Center and School, Fort McClellan, Ala.

Col John J. Osick, deputy director, Chemical, Biological, Radiological and Nuclear Operations Directorate, Office of the Assistant Chief of Staff for Force Development, HQ DA, gave the graduation address and congratulated each of the honor graduates.

Cited as the first distinguished graduate was Lt Michael A. Neschleba, Binghamton, N.Y., for obtaining the highest academic rating in the class. Lt Neschleba, 23, is a graduate from Massachusetts Institute of Technology with BS and MS degrees in chemistry. He received an ROTC commission in July 1970.

Honor graduates were 2d Lt Steven J. Wade, Tucson, Ariz., BS degree from the University of Arizona; 1st Lt Dwight S. Springer, Middletown, Pa., BS degree in chemical engineering from the University of Delaware; 1st Lt Henry T. Davis, Frankfort, Ill., BS degree in chemical engineering from Purdue University; and 2d Lt Loyce A. Ardemagni, Tontitown, Ark., BS degree in chemistry from the University of Arkansas.

Selected as the outstanding officer in the 9-week course was 2d Lt Philip P. Payne, Huntsville, Ala., with a BS degree from University of Alabama.

FIRST DISTINGUISHED GRADUATE from Army chemical officer basic course, Lt Michael A. Neschleba, is congratulated by Col John J. Osick.

University of Toledo Honors TSG Jennings With Gold 'T'

Election to membership in the exclusive Halsted Society recognized Lt Gen Hal B. Jennings Jr., The Army Surgeon General, along with the University of Toledo Gold "T" Award of the Alumni Association, as he concluded his first year in office.

Formed in 1924, the Halsted Society perpetuates the memory of Dr. William Stewart Halsted, and is committed to furthering the scientific principles and ideals for which he stood. Membership, limited to 75 persons, is by invitation only and includes such well-known physicians as Dr. Heaton, Dr. Louis M. Rousselot, Dr. Frank B. Berry and Dr. Michael E. DeBakey.

The Gold "T" Award is reserved for Toledo alumni who reflect great credit upon the university and themselves through public service in a chosen field of endeavor. Dr. Jennings, a Diplomate of the American Board of Plastic Surgeons, graduated from the U. of Toledo and the U. of Michigan Medical School.

While at Toledo he was president of the University Student Council and taught in the Biology Department. After graduating from Michigan Medical School, General Jennings took specialized plastic surgery training at the Barnes Hospital at the Washington University School of Medicine in St. Louis, Mo.

AUTODIN Installation Ideas Pay Off for STRATCOM Employe

Suggestions for circuit modifications and installations for telephone central offices have paid off for B. J. Bryant, a U.S. Army Strategic Communications employe with more than 20 years of experience in communications electronics engineering.

Bryant's latest idea saved the U.S. Government more than $700,000, by substantially reducing the time required for AUTODIN installations, and earned him a $1,350 award in the Army Incentive Awards Program.

In five years Bryant has had five of his money-saving ideas adopted. Three suggestions adopted in 1970 are credited with saving the government more than $1 million. He is employed in the STRATCOM Communications Electronics Engineering Installation Agency (CEEIA).

AMMRC Develops Improved Ultrasonic Imaging Technique

By Robert C. Grubinskas

In this era of numerous "Zero Defects" programs for Army weapons and equipment, increasing emphasis has been placed upon the nondestructive evaluation of the integrity of materials and structures, to insure that acceptance levels and standards are being met.

Consequently, it has become desirable and, in some cases, mandatory to obtain image-like characterizations of internal flaws and materials anomalies.

Radiographic methods have been able for many years to fulfill adequately these requirements. Complexity of materials inspection problems has increased, however, with approportionate increase in the need for the development of additional defect imaging techniques.

From the variety of possible methods, those employing high-frequency sound appeared to be the most promising in consideration of adequate sensitivity, resolution and speed of response. The Army Materials and Mechanics Research Center (AMMRC) at Watertown, Mass., selected the liquid surface approach as an appropriate and effective means for ultrasonic imaging.

Results of a current investigation, which has led to the evolvement of several significant improvements for enhancing the application of this technique to the field of nondestructive testing, will be discussed in this article.

Important to stress at this point is that the liquid-surface ultrasonic imaging technique, or any other technique when sufficiently developed, will not necessarily displace older nondestructive testing techniques. Instead, advances will supplement and serve to enlarge the current scope of nondestructive testing capabilities.

Before an ultrasonic field can be imaged optically, it must first be detected by some means. In the liquid-surface approach, an ultrasonic beam is sensed by the mechanical deformation of a free liquid surface, resulting from the radiation pressure associated with an impinging ultrasonic beam.

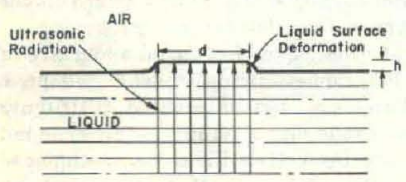


Fig. 1. Liquid Surface Deformation Effect

Robert C. Grubinskas is a physicist in the Nondestructive Testing (NDT) Branch of the Army Materials and Mechanics Research Center in Watertown. After receiving a BS degree from Northeastern University in 1958, he spent four years with the Radiation Physics Branch of the Army Natick (Mass.) Laboratories. There he was involved with problems relating to electron-beam dosimetry and ionization distributions in electron-irradiated materials.

In 1962, he joined the NDT Branch of AMMRC, where he has specialized in development of NDT procedures and techniques—specifically those relating to application of electromagnetic and ultrasonic imaging techniques to materials evaluation.

During October and November 1969, Grubinskas participated in the 175mm M113 E1 Gun Tube Special Test for Service Life in Vietnam, where he served as leader of AMMRC's Magnetic Recording Borescoping Team.

Currently he is monitoring and serving as technical supervisor of an Advanced Research Projects Agency-sponsored contract with the University of Michigan, dealing with the investigation of holographic testing techniques.

Grubinskas has authored and contributed to 12 technical reports and three open literature papers. He is a member of the American Physical Society, the American Society for Nondestructive Testing, the American Ordnance Association, and the AMC Materials Advisory Group TWG on Electronic Materials.

* * *

A liquid-surface deformation pattern corresponding to a normally incident beam of ultrasonic radiation of uniform intensity and diameter "d," illustrated in Fig. 1, constitutes a stationary relief pattern.

For any given point within this relief pattern, an equilibrium is established wherein the sonic force inherent in the radiation pressure, acting upon the liquid surface, exactly counteracts the restoring forces of gravity and surface tension.

As the particle displacement "h" is directly proportional to the radiation pressure which, in turn, is directly proprotional to the intensity of the radiation field, it follows intuitively that the stationary relief pattern does, indeed, represent the intensity profile of the impinging ultrasonic radiation.

At this point, it should be added that the particle displacement "h" is of a sufficient order of magnitude to enable the liquid surface deformation pattern to be detected readily with suitable optical means.

In previous ultrasonic image-detection methods utilizing the liquid-surface deformation effect, application of an immersion technique, in which the immersion liquid also acted as the conversion fluid, was always the principal requirement.

In comparison, the system developed by the AMMRC (patent pending) employs a new type of image converter permitting use of contact testing procedures. Inherently simpler and more convenient to apply than the immersion technique, the contact method is more readily adapted to practical nondestructive testing procedures.

The Liquid Surface Ultrasonic Imaging System is shown in Fig. 2. An ultrasonic through-transmission system, comprising an ultrasonic transmitter, test specimen and image converter, is shown in the enlarged insert.

The ultrasonic transmitter is coupled acoustically by means of glycerine to one side of a test specimen possessing at least one pair of flat parallel surfaces. The image converter, consisting mainly of a vessel with a thin plastic membrane supporting a shallow layer of conversion fluid, is coupled by means of glycerine to the opposite side of the specimen.

Internal defects such as cavities or inclusions of foreign matter, which scatter or absorb ultrasound, modify the intensity profile of the transmitted ultrasonic radiation, producing stationary, characteristic relief patterns on the surface of the conversion fluid in real-time; i.e., all image elements are produced at the same instant.

With this arrangement, the inconveniences and bulk associated with earlier systems using immersion techniques are eliminated. Use of acoustical lenses is no longer required.

Generation of spurious signals due to reflections from the walls of the tank and to reverberations in the

water path between system components is avoided. Finally, the frequency response of the image converter is not limited to fundamental frequency or to the harmonics of the transmitting transducer.

The liquid surface deformations, not ordinarily discernible to the human eye, are rendered visible by means of the electro-optical system shown to the right of the insert in Fig. 2. A 100-watt mercury vapor arc lamp with an arc diameter of 0.3mm is used as a light source of small diameter. Light emanating from this lamp is passed through the beamsplitting mirror, rendered parallel by the collimating lens, and directed normally onto the surface of the image converter liquid.

In the absence of ultrasonic excitation, the collimation of the light beam is unaffected by the reflection at the perfectly horizontal surface elements of the converter liquid.

Consequently, when the reflected beam returns through the collimating lens, it is converged to form a sharp image of the total illuminated area of the liquid surface. After deflection by the beamsplitting mirror, this surface image is now located on the optical axis of the television camera lens.

An opaque screen containing a circular aperture of slightly larger dimensions (0.5mm) than the arc diameter of the mercury vapor lamp, when positioned within this focal plane, will pass all of the light reflected from the liquid surface. This light, intercepted by the closed-circuit television camera lens, results in the display of a circular light field of uniform intensity on the screen of a television monitor.

In the presence of ultrasonic excitation an ultrasonic surface relief pattern is formed, causing certain elements of the conversion liquid surface to become inclined with respect to the horizontal. As a result, the light reflected by these elements will be only partially focused onto the area of the aperture, or not at all, depending upon their degree of inclination.

The optical image displayed upon the screen of a closed-circuit television monitor therefore exhibits a brightness modulation corresponding largely to the ultrasonic surface relief pattern.

To illustrate the capabilities of the ultrasonic imaging system for this article, a commercially available test block, shown in Fig. 3, was selected.

This test block contains a 3-row by 10-column array of concealed flat bottom holes of 3.2mm, 2.0mm, and 1.2mm (8/64", 5/64" and 3/64" diameter introduced from the bottom side.

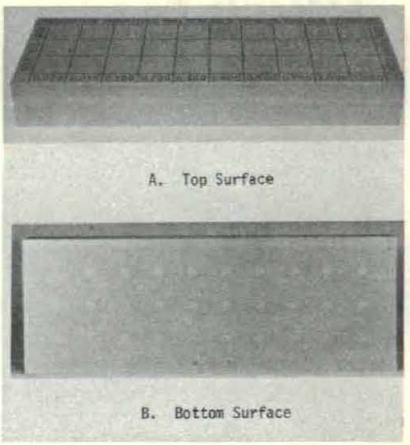


Fig. 3. Aluminum Test Block

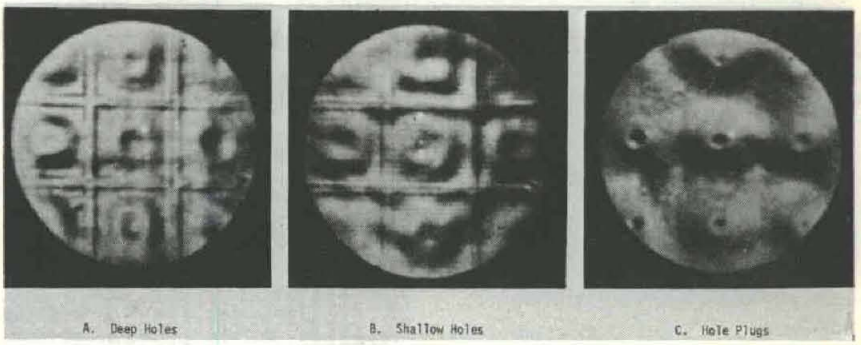


Fig. 4. Ultrasonic Images of Aluminum Test Block

The numbers at the lower edge of the top surface of the test block indicate decimally the increasing distance in inches between the top surface and the top of the three flat bottom holes located in any particular column.

The hole depth decreases as one proceeds from the left to the right side of the block; 6mm diameter metal plugs used to seal off the bottom of the drill holes are clearly indicated in Fig. 3B.

Ultrasonic images of the aluminum test block are shown in Fig. 4. Portrayed in 4A and 4B are results obtained by acoustically coupling the top surface of the test block to the image converter and a 1-MHz, 3-inch diameter ultrasonic transmitter to the left and right ends of the lower surface of the block.

A frequency-modulated transmitter excitation signal was used to generate these and the remaining ultrasonic images selected for this article. What is of significance here is that the concealed holes are clearly indicated, as are the one-inch square checkerboard

(*Continued on page 50*)

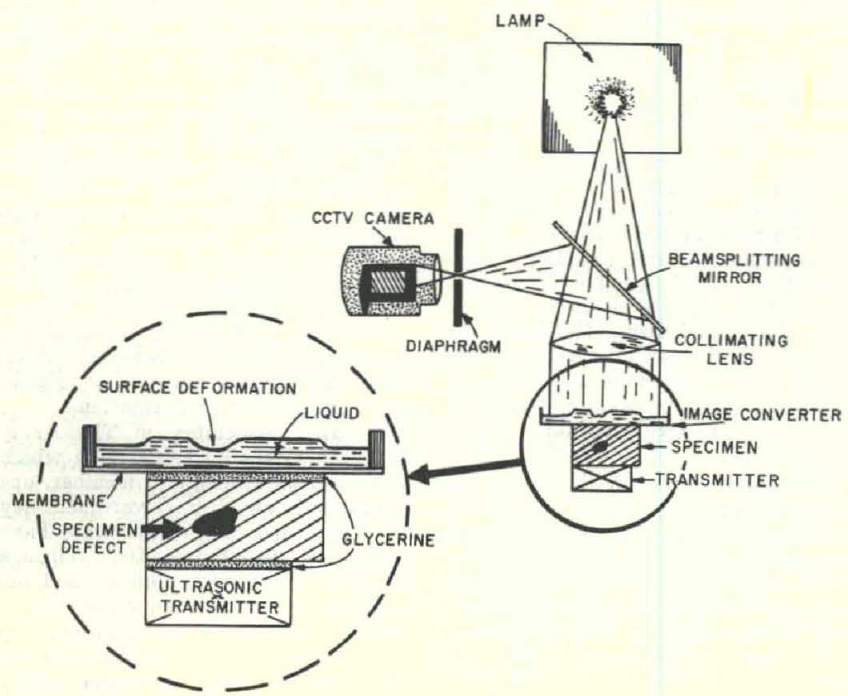
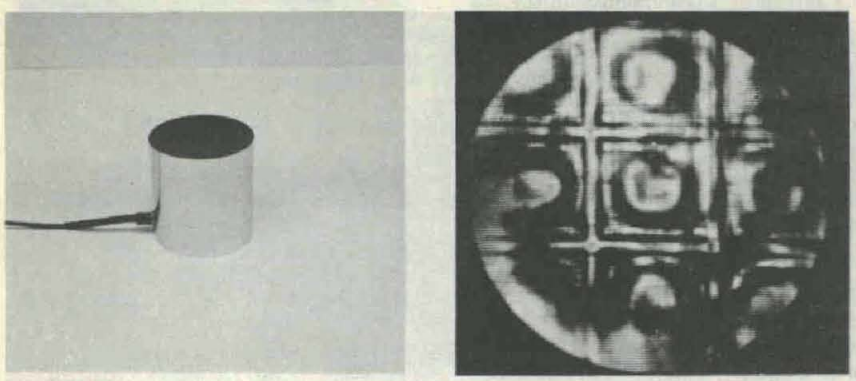
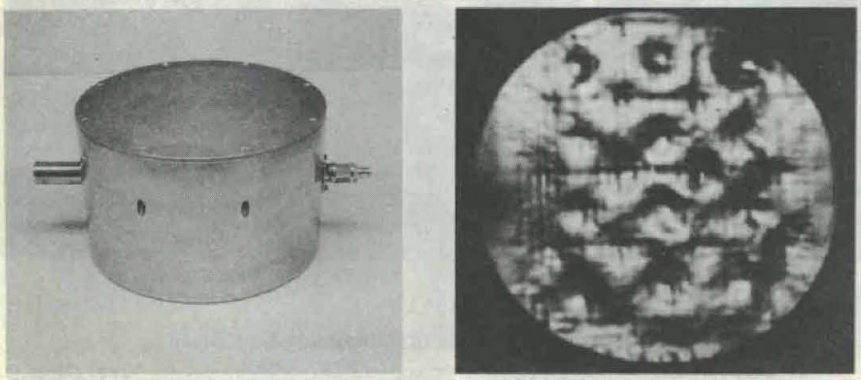


Fig. 2. Liquid Surface Ultrasonic Imaging System Developed by AMMRC

AMMRC Develops Improved Ultrasonic Imaging Technique



A. Three-Inch Diameter 1 MHz Transmitter And Its Corresponding Image



B. Six-Inch Diameter 1 MHz Transmitter And Its Corresponding Image

Fig. 5. Comparison of Large Field Ultrasonic Images of Aluminum Test Block and Transmitters Used to Generate Them

(*Continued from page 49*)

lines milled into the upper surface and used to demarcate the hole regions. These lines are 0.22mm (0.0009") deep and 0.78mm (0.031") wide.

The fact that these engraved lines can be seen points to the use of the image converter for the detection of surface imperfections. In Fig. 4B, the nature of the defect indications are now more strongly influenced by the lower boundaries of the holes superimposed upon the upper hole boundaries. Also, the vertical and horizontal fringes associated with the milled slots should be noted..

In Fig. 4C is shown an FM-generated ultrasonic image obtained by coupling the bottom surface of the test block to the image converter and a 1-MHz, 3-inch diameter ultrasonic transmitter to the opposite side.

Observe also that the defect indications are of approximately the same size—attributable to the fact that the metal plugs used to seal off the bottom of the drill holes are of equal size. In an ultrasonic sense, they behave as if they were defects located at the surface of the bottom of the test block.

Recent developmental work on the imaging system has been directed primarily toward enlargement of the useful ultrasonic beam width to interrogate nondestructively a larger fraction of the total specimen cross-section, rather than a bit at a time as with scanning devices. The basis for accomplishing this goal was the development of practicable, custom-built, large-diameter, ultrasonic transmitters of 1-MHz frequency and 152mm (6") diameter.

Ultrasonic images of the aluminum test block produced by using both 3-inch and 6-inch diameter, 1-MHz transmitters are shown in Fig. 5—along with the transmitters themselves for comparison purposes, where the fourfold increase in useful ultrasonic beam area achieved is quite evident.

Progress is being made in developing new techniques for enhancement of defect indications, generation of colored ultrasonic images, and application of the liquid surface deformation technique toward relevant Army problems.

Wilson's Memory Marked By Environmental Gains

(*Continued from page 10*)

Fort Churchill, Canada, for sounding of upper atmosphere conditions.

The U.S. Army's extensive program of research in Greenland, including construction of Camp Century (the "City Under the Ice") and other experimental work on the Greenland Icecap, was in large measure attributable to Dr. Wilson's initiative. He developed plans for the technical requirements, including installation of a nuclear power plant.

For many years Dr. Wilson presented plans for and explained the purpose of cold regions research to officials of the Danish government in an annual conference with them. Likewise, in dealings with U.S. Government and with other foreign governments, he was a leader in stimulating interest in cold regions research, as pertinent to effective military operations.

Problems of military mobility under all conditions of terrain and climate received his continuing study, and he developed programs of research for the tropical areas as well as for other environmental regions. His credo was that the U.S. Army must be equipped, trained and fully knowledgeable of conditions to "live and fight anywhere in the world."

Dr. Wilson's concern about optimizing the capabilities of the Army to achieve this objective extended into every aspect of operations, including studies of methods of weather control and environmental conditions relevant to accurate firing of weapons. He was one of the formulators of plans for the Project HARP program, which used high-altitude gun probes to gain upper atmosphere information.

Working associates on The Army Research Council (TARC), on which he served as an original member, are among the many U.S. Government key scientists and engineers who have joined in acclaiming Dr. Wilson's skills as a program planner and organizer. As one of them stated:

"His numerous contributions to Army research and development on problems of operations related to the environment must be recognized as pioneering and greatly significant."

Cooperative Endeavors of M-I Complex Advance Night-Vision RDT&E

By James J. Thrower

Relevancy of Army research programs to military requirements is of prime concern to Congress, and is mandatory under Section 203 of the 1970 Authorization Act, but unforeseen "spin-off" benefits frequently impact profoundly for the benefit of the civilian community.

Military-industrial cooperation in the research, development, test, evaluation and production process has been under continuing criticism during the past year. However, this cooperation also has contributed greatly to many of the spin-off benefits.

An outstanding example is the Army Night-Vision Research Program—of paramount importance to Southeast Asia operations but with many emerging benefits for the civilian population.

Prior to establishment of the Army program, little had been accomplished in the development of night-vision equipment and ancillary components. The fiber optics and photocathode industries were aware of the potential of night-vision devices, but little had been done to solve production problems.

As the Army prepared night-vision equipment procurement data packages to support multimillion-dollar contracts, it was aware that the infant industry would be stressed to its limit to meet the performance standards set by Army R&D laboratories as being essential.

Success of the Army night-vision R&D activities can be attributed to the working relationship that developed between the military and industry during the earlier years of the program.

Theoretical and speculative use of fiber optics dates back to the 1940s and 1950s. Little if any practical application existed until the later part of the 1950s and 1960s, when the U.S. Army established tasks for development of vacuum-tight fiber-optic plates.

Only with the availability of high-vacuum fiber-optic plates did cascade image intensifier tubes become a practical endeavor. Today, progress is serving the computer and medical equipment industry and will shortly be meeting needs of the photographic, automotive and communications industry.

In order for the Army night-vision program to succeed, the photocathode industry had to produce consistently surfaces with light-sensitivity far beyond those in existence. Although this was one of the more difficult tasks,

James J. Thrower has been chief of the Technical Management Division, Night-Vision Project Manager's Office, for four of his nine years employment with the Army's Night-Vision Laboratory at Fort Belvoir, Va.

For the first five years he was employed on development and production of night-vision devices. He returned recently from a trip to Southeast Asia in the interest of reviewing with field commanders the effectiveness of night-vision devices and possibilities for improvements.

After earning a bachelor's degree in electrical engineering from Johns Hopkins University in 1955, he was employed briefly with the Bendix Corp. until he entered the Army as a second lieutenant.

During his tour of duty he was assigned to the Department of Training Publication at Fort Belvoir. Following release from military service, he was employed for four years with the Airplane Simulator Department, Melpar Inc.

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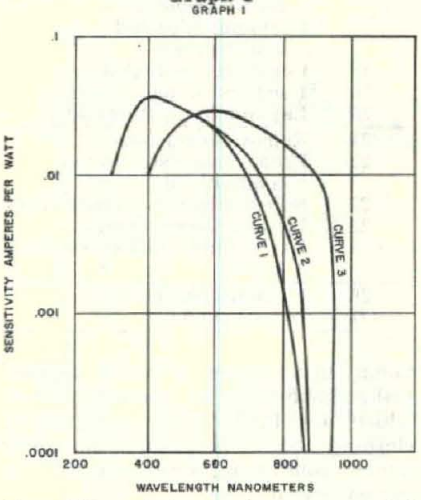
Graph 1



the military-industry teams succeeded in meeting the goals set in the procurement data packages.

Industry is now routinely processing photocathodes that exceed the Army's minimum requirement by a factor of two and three for luminous sensitivity. This increase in luminous sensitivity cannot be seen from Graph 1; however, the increase in photocathode radiant sensitivity can be seen.

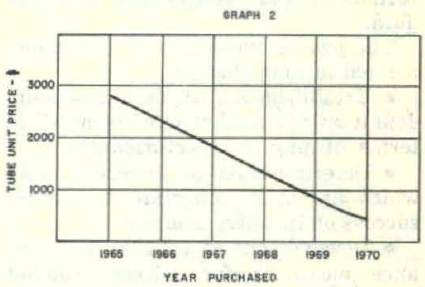
Curve 1 in graph 1 represents the early S–20 photocathode response. In an attempt to achieve greater sensitivity in the infrared region, the Army Night-Vision Laboratory at Fort Belvoir, Va., working with industry, increased the sensitivity at 800 nanometers from .001 amperes per watt to .006 amperes per watt, as shown by curve 2.

Curve 3 is a typical response of the extended red S–20 cathodes being produced by industry at the present time. Increased sensitivity in the long wavelength represents a major improvement in the infrared region. Shifting of the photocathode sensitivity into the red spectrum has significantly increased performance of night-vision devices by showing greater contrasts in targets being viewed.

Graph 2 is a plot of image tube unit price versus year procured. It can be noted that although performance standards increased, material costs decreased. During the 6-year period shown in the graph, cost of image tubes has declined from $2,800 each to $385. Perhaps more than any other factor, this demonstrates the gains achieved under cooperative effort of government and industry.

Military requirements have continually been stressed as urgent in the acceleration of the Army night-vision R&D activities, and results have met requirements in Vietnam and around

Graph 2



the world. This achievement was possible only through the cooperative endeavors of the military-industrial complex. Had it not been for this mutual interest and spirit of cooperation, the goals achieved today would still be the dream of things to come.

USAGETA Develops Test Facility for Effects of Equipment on Efficiency

By Dr. Howard W. Hembree

Development of a test facility which will, for the first time, provide quantitative engineering data on the effects of protective clothing and personal equipment on the combat efficiency of individual soldiers is a notable achievement of the U.S. Army General Equipment Test Activity (USAGETA), Fort Lee, Va.

Engineering tests of clothing and personal equipment traditionally have measured such characteristics as functional adequacy, degree of protection, compatibility, durability and comfort. However, for today's Army requirements for protection are frequently not compatible with requirements for effective performance, making it imperative to identify and to evaluate the effects of such equipment on the performance of the soldier.

Evaluation has been based on subjective data. Objective data can be obtained now with the USAGETA facility which will provide a quantitative basis for sound decisions where trade-offs between protection and performance may be a critical factor.

The Clothing and Equipment Test Facility (CETF) at Camp Pickett, Va., is the culmination of a research project conducted for USAGETA by Dunlap and Associates. CETF consists of a series of integrated test courses designed to measure and record the relative ability of soldiers to perform Infantry combat tasks.

Performance is measured primarily in terms of time and accuracy. Logging and summarizing large quantities of data generated daily is accomplished by a high-speed digital computer. The computer is the nucleus of a complex data collection and analysis system which controls the flow of troops on the courses, monitors course operations, records test subject performance, and reduces and analyzes data.

The project was planned and implemented in four phases:

- Establishment of an operational definition of "combat effectiveness" in terms of physical performance.
- Determination of criterion tasks which are most important to combat success of Infantry soldiers.
- Development of reliable performance measures for selected combat tasks.
- Development of an operational test facility for measurement of the effects of clothing and equipment on task performance.

USAGETA established a working definition of "combat effectiveness" as "a composite of performance of individual infantrymen in those physical tasks important to combat success which are likely to be affected by clothing and personal equipment under conditions representative of combat situations."

The project was limited to Infantry riflemen in the temperate zone to keep the problem within resources. Success here would provide a base from which other functional groups and other climates could be patterned.

Relative Importance of Physical Combat Tasks As Ranked by Veterans of Each Theater

Overall rank	Task	Europe N=71	Pacific N=28	Korea N=115	Vietnam N=62
1	Fire weapon	1	1	1	1
2	Observe, detect, locate, identify hostile targets	2	2	2	3
3	Load (reload) weapon	5	4	3	2
4	Perform reconnaissance	4	3	5	4
5	Maneuver	3	5	4	5
6	Use concealment and camouflage	6	6	9	7
7	Use cover	8	8	7	6
8	Construct hasty fighting positions	7	7	6	11
9	Clear fields of fire	9	12	8	9
10	March move	11	11	13	8
11	Use grenades	10	9	10	15
12	Use radio telephone	14	10	12	12
13	Lay, detect, neutralize mines, booby traps, warning, and illuminating devices	13	16	14	10
14	Hand to hand combat	12	15	11	17
15	Use compass	17	13	16	13
16	Construct shelters, emplacements, trenches	15	17	15	14
17	Carry supplies and ammunition	16	14	17	19
18	Construct obstacles	20	19	19	16
19	Use hand signals	19	18	20	18
20	Lay communications wire	18	22	18	22
21	Remove obstacles	21	20.5	21	20
22	Prepare, adjust, arrange combat load	22	20.5	22	21
23	Splice communications wire	23	24	23	24.5
24	Load/unload supplies	24	23	24	24.5
25	Carry, load, paddle assault boat	25	25	25	23
26	Use CBR equipment	26	6	26	26
27	Drive vehicle	27	27	27	27

A preliminary list of combat tasks performed by infantrymen was compiled from combat films, interviews with veterans, action reports, field manuals, training manuals, and Human Resources Research Organizaton (HumRRO) reports. This list was screened to eliminate nonphysical activities and activities not likely to be affected by clothing and personal equipment.

The resultant 27 criterion tasks

PHOTOCELLS and pressure pads monitor progress of test participants over the maneuver course at the Combat Effectiveness Test Facility, Camp Pickett, Va. Under actual conditions, the sensors that relay signals to the control and data-logging center for recording and analysis are camouflaged to avoid detection.

were systematically rated by 208 highly qualified Infantry combat veterans for their relative importance in defeating the enemy. Officers and NCOs from such widely varying theaters as Vietnam and World War I (Europe) agreed substantially on the rankings of the tasks.

The high degree of agreement, as shown in the table, indicated that fundamental infantrymen's tasks had been defined and that a sound basis had been established for proceeding with the development of a measurement system. Thirteen of the most important combat tasks were selected and combined into nine elements for inclusion in a measurement system.

Measures for each test were developed to satisfy four primary requirements:

- They had to contain the basic ingredients of the tasks as commonly performed under combat conditions.
- They had to contain as much face validity as possible.
- Permit reliable performance measurements under reproducible conditions.
- Be sensitive to differences in clothing and equipment.

Three secondary requirements were also established:

Essential ingredients of each criterion task were established, based upon the definitions used in the original selection. Again, training literature, interviews with combat veterans and observations of the actual performance of similar tasks in training and maneuver operations were used to establish the important aspects of the tasks.

A testing situation was planned which appeared to satisfy the requirements and performance was measured using manual data collection. Only after positive demonstration that a measurement system met the criteria was it selected for inclusion into an operational test facility.

In 1964, construction of nine integrated test courses and an administrative area was started at Camp Pickett. The courses are the Maneuver, March/Move, Hilly Terrain and Flat Track, Grenade Emplacement, Grenade Window, Hasty Fighting Positions, Fire and Reload, Target Detection, and Reconnaissance. Construction of the facility is complete and acceptance tests of the data collection and control system were completed in May 1969.

A typical test group consists of one 12-man infantry squad which spends two weeks at the facility, performing daily the physical activities constituting the essential elements of each combat task. The relative ability of each squad member individually to maneuver on the battlefield is measured and recorded as he negotiates a 500-yard obstacle course containing various elements, which require running 50-yard dashes, scaling a log wall, negotiating simulated windows, swinging down an instrumented overhead ladder, climbing and descending a debarkation net, and crawling 50 yards.

Ability to move over unimproved trails is determined during a self-paced march on a 2½-mile flat track and a one-mile hilly track. Ability to use grenades against a ground-level emplacement target is measured on a course that records throwing times and accuracy of a 20-meter prone throw and a 35-meter standing throw.

Performance on the other grenade course requires the soldier to dash between specified points and throw hand grenades at six instrumented window targets. Time to dig a hasty fighting position (foxhole) is measured in terms of the time required to transfer 700 and 1,400 pounds of soil.

Time and accuracy of firing and reloading individual weapons is ascertained on a course involving an array of eight pop-up targets at 100 and 250 meters from eight firing positions.

Ability to use cover and concealment, to operate a compass and radio telephone, and to detect and identify battlefield targets is measured.

Performance measures are obtained by digital input devices, photo-electric cells, manual event switches, sonic round counters, pressure sensitive pads concealed in paths and tracks, and automatic pop-up targets with acoustical miss-distance indicators.

Signals are transmitted from these sensors to the central control and data logging center where recording and summation of data is performed by the digital computer. Performance data are printed out immediately at the control center on both magnetic tape and on a high-speed line printer.

USAGETA plans to add physiological telemetry capability to the facility to provide continuous safety monitoring of the test participants. Recording of heart rate, deep body temperature, and other physiological factors could provide a means for studying the possible effects of equipment items on the soldier's physiological energy expenditure.

USAGETA also is studying the need for adding special areas for measuring such task performances as operations under swampy conditions and at night.

The test facility has been used to evaluate items developed as a part of the Lightweight Individual Combat Clothing and Equipment (LINCLOE) System. Compatibility of the Hayes-Stewart helmet was determined when worn with the standard fatigue uniform, with and without fragmentation body armor for neck and torso, and a protective field mask. An experimental lightweight body armor was also evaluated. Another item tested was the lightweight intrenching tool.

Clearly established by these activities is that the Clothing and Equipment Test Facility provides the Army with a reliable tool for determining the probable effects on an individual in combat of the protective clothing and equipment he must wear for survival and for efficient performance.

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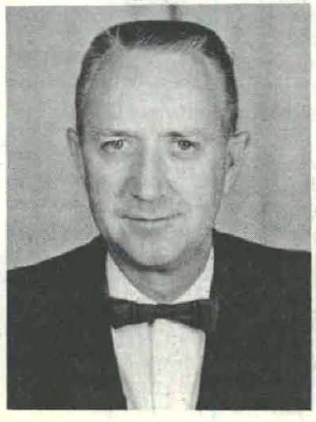
DR. HOWARD W. HEMBREE, technical adviser, U.S. Army General Equipment Test Activity (USAGETA), has been at Fort Lee, Va., since 1955, when he joined the Quartermaster Research and Engineering Field Evaluation Agency (forerunner to USAGETA) as scientific director.

During 1952 he served as a research psychologist with the Climatic Research Laboratory, Lawrence, Mass., with duty station in Washington D.C., assigned to the R&D Division of the Office of the Quartermaster General. In 1953, he returned to Lawrence and, subsequently, to Natick, Mass., where he became chief of the Human Engineering Section, Environmental Protection Division.



Honorably discharged from the U.S. Air Force in 1945, with combat duty in North Africa, Sicily and Italy, Dr. Hembree graduated with honors from the University of Arkansas in 1948. He earned his master's degree in psychology from the same university in 1949 and obtained his doctoral degree in the field of psychology from the University of Maryland in 1952.

Recipient of the Department of the Army's Meritorious Civilian Service Award, Dr. Hembree is a member of various scientific and professional organizations and is listed in Leaders of American Science, American Men of Science, Who's Who in the South and Southwest, and Dictionary of International Biography.

Human Factors R&D Meet Emphasizes Manned Control Systems

(*Continued from page 4*)

selection for capabilities assessment," General Betts continued, "must also be realized for command and control of combat units at the squad, platoon, battalion and even the division level. Let's look at the three pieces of this problem.

"One-third relates to tactical operations, another to combat support, and the third to what we may call—for simplicity's sake—intelligence.

In support of each of these broad areas, we have a variety of programs —such as TACFIRE for the operations side; CS_3 for the support side; and for the intelligence third perhaps we should list Project MASSTER.

"It is in the integration of these three (pieces of the problem) that I believe human factors can make a major contribution. Technology tells us that it is conceivable that a commander can receive, with the push of a button, literally miles of detailed photographic coverage. Simultaneously, a mix of other sensors can provide him additional real-time data.

"Thus we have a very real human problem—that of prompt, real-time intelligence processing and evaluation. How do we solve this?

"Another human factors problem is at the unit level. Behavioral science must take account of the fact that it is as obvious as the rising sun that major sociological changes are occurring in the nation with ever-increasing momentum.

"Since the Army is in major degree a reflection of the nation, it is imperative that the longer-range effect of these changes be understood and taken into account in Army programs and policies of (a) individual recruitment, selection and training; and (b) our doctrine and practice of the arts of unit command, leadership and control.

"Commencing early in World War II, a major sociological research effort titled *The American Soldier* was undertaken by the Army. This project involved over 130 behavioral scientists. It was initiated with the personal approval of General George C. Marshall and the support of the General Officer Corps. Research detachments were established in Europe, the Mediterranean, Central Pacific and India-Burma, with smaller units in the Philippines, Panama, Alaska and the Southwest Pacific.

"For four years, this massive effort recorded the attitudes and values of a half-million American youths toward a variety of military topics. Major policy and legislative decisions were based on this eminently useful research; its best known achievements were the 'Point System' of demobilization and GI Bill cost estimates.

"The range of research topics was very broad indeed and included, for example, analysis of: psychiatric casualties (combat motivation and control of fear), winter clothing preferences, medical care, fraternization policies; attitudes toward the Women's Army Corps, special assignments, promotion policies, job assignment policies, and weapons preferences.

"A monumental 4-volume work was issued from the research effort dealing with adjustment to Army life, special problems of combat and its aftermath, experimental studies of communication, and methodological problems of attitude measurement and prediction.

"With demobilization, the social scientists returned to their campuses; the study of military attitudes and values was allowed to lapse. It must now be revived. For these and other reasons, we have recently established, as a Class II activity of the Office of the Chief of Research and Development, a new agency known as the Manpower Resources Research and Development Center (MRRDC).

"The function of this new agency will be to build upon and complement the advances that you are already providing with respect to the *individual* soldier by comparable advances in *unit* training, *unit* performance assessment, *unit* motivation and leadership.

"In summary, I must emphasize, for Army R&D affecting human factors in command and control, the importance of the principles that:

- In an Army of decreasing size, and perhaps all-volunteer, *quality* becoms increasingly important.
- The substitution of materiel for men can realize appreciable manpower savings, *but* it is the increased power and precision at the cutting edge that justifies acceptance of calculated increase in manpower support requirements.
- Our advances from behavioral science applications to individual selection, classification and training must now be extended and complemented by advances in unit training, unit performance assessment, and unit motivation and leadership.

". . . You people have the capacity and the capability to assist the Army materially in the years ahead as it changes in composition. There are a number of unknowns, in terms of skill levels, quantities and qualities of a future all-volunteer Army. You can assist the country and the U.S. Army in a very great way if you devote your efforts wholeheartedly and realistically to the future problems as well as today's problems."

SPONSOR'S CHARGE. Brig. Gen. James B. Adamson, chairman of the Army Human Factors Research Advisory Committee (AHFRAC) and director, Plans, Studies and Budget, Office of the Deputy Chief of Staff for Personnel, HQ DA, gave the address traditionally known as the Sponsor's Charge.

Stating that his address was intended to enlist efforts of his audience in developing practical approaches "to some very serious Army problems," General Adamson said they are expected to continue—the communications gap at the face-to-face level, drug abuse and race relations.

Although these problems now appear to be those of the off-duty environment, he said, "such roadblocks to effective human relationships must be analyzed for their effects upon the command and control of Army operations."

Seeking information relevant to anticipated problems in the transition from the draft to an all-volunteer Army, General Adamson recently made several trips to "many areas of the world where our troops are deployed. . . .

"As a result of this mission, I feel that complete examination of the soldier of today, his attitudes and his environment is basic to such a major change as the Volunteer Army. My travels have led me to many interesting conclusions. Let me share a few of them with you.

"In the Army today, manpower is being well managed—perhaps better managed than ever in the past. But it is only with great difficulty that the soldier of today is being *led.*

"I cannot but draw a parallel with the once-great Roman Empire, which in its day was probably better equipped and better managed than any empire in the world. The empire crumbled before the might of less sophisticated peoples who were less well equipped and rather poorly managed. They were merely *led.*

"The Romans of that day were imbedded in the culture of an affluent society, one which allowed time for each person to do his thing. When the chips were down, it developed that the nature of each individual's thing did not contribute to adequate collective defense.

"Today, in the Army, we have serious problems in spite of all the scientific advances we have experienced. We have a communications gap at the

face-to-face level. To be sure, we have communications equipment, computers to program our options, and more technological improvements are under development.

"Important as they are, these are sometimes not the most crucial aspects of communication. We have the problem of the private communicating with his squad leader. It just isn't being done adequately. The platoon sergeant and first sergeant are even more removed from the thoughts and insights of the private.

"This communications gap is paralleled by the distance between the junior officer and the senior officer. Communications are polarized by the age of the soldiers. On the one hand, the senior officers and noncommissioned officers have rapport. On the other hand, the junior officers and enlisted men communicate.

"There are age and cultural differences to overcome between groups before a unified Army society can be achieved more effectively. Perhaps you realize that this condition is a mirror image of American society today."

General Adamson termed the problem of drug abuse a sign of the vacuum of values or a lack of personal goals. Then he asked:

"Could inspirational leadership create values which would challenge today's youth to the point that they would not seek escape through drugs? How can the on-duty operational situation provide or support these goals while achieving mission performance? How can the off-duty situation re-enforce these goals?

"Still another problem, although not unrelated with the previous two, is the racial problem. In spite of enlightened leadership in the field of race relations for a quarter of a century, the Army is faced daily with charges of real and imagined discrimination against minority groups.

"How can the Army inspire and utilize the best efforts of all of its soldiers? What environmental changes, command actions, job designs and career systems are needed?"

General Adamson contended that the Vietnam war is not the cause of these major problems—"merely a convenient happening to which we are tempted to attribute our problems. Our problems are much deeper than any specific political or military act upon which objections are voiced.

"We face the problems of monumental social change that accompanies a scientific revolution. The change promises to be equally traumatic as that of the industrial revolution. . . .

"From my own parochial standpoint, I need to know what changes must be made in the Army now in order that it will become known as a good place to live and work. If our soldiers are to be voluntary recruits, this is fundamental.

"The design and development of new command and control systems must appreciate the individuals and groups who operate and support these systems. Job design must challenge and satisfy the goals of individuals as well as meet technical requirements.

"Job aids, tools and test equipment must be realistic in terms of the skills and abilities of soldiers and their needs of on-the-job training. Units must be designed to enhance individual development and leadership as well as mission performance.

"From a larger standpoint, we must concentrate upon developing, through systematic general studies, blueprints for dynamic enlightened leadership to bridge the gap and barriers presently found among the Army's major groups. This leadership reform is an absolute must if our Army is to endure and remain capable of responsibily answering the demands of our nation's defense.

"One approach to this reform is described by Maj John D. Elliot in his article in this month's *Military Review*. He sees the need for what he calls an 'open military society,' with face-to-face communication encouraging free expression of opinion.

"Innovative change would be expected. The nation's youth would be challenged to become the building blocks and provide a basis for establishing an Army on what General Westmoreland has called a new 'Thinking Plateau.'

"I charge you to devote your thoughts to developing a sound blueprint for the changes that must be made. It is from the talents of you assembled here today that such guidelines must come. We have here at stake an issue for which today's solutions are rapidly showing themselves inadequate.

"Our problem is not so much to change the young to value the mores of the old, but to adapt the leadership to meet the challenges found in the present environment. What we need is a transition from the leadership practices of yesterday to those that will be required in the near future.

"This task requires the best efforts of the human factors research community. Development of a useful solution to this problem may be one of the greatest challenges you have ever undertaken."

Computer-based Command and Control Systems. Brig Gen Wilson R. Reed, CG of the U.S. Army Computer Systems Command (USACSC) headquartered at Fort Belvoir, Va., discussed this topic in another of the featured addresses.

In describing special requirements imposed on computer systems by battlefield conditions, he stressed that the systems must be rugged, mobile and operable by nontechnical soldiers.

Development goals of the 1980s must be geared to requirements for collection, processing, integrating and disseminating information in real-time to permit commanders to make decisions influencing the action.

General Reed said the current battlefield information system is characterized by an information overload, with consequent lost opportunities for action or reaction. Among the USACSC responses to this situation he listed is the automation of selected battlefield functions through Project ADSAF (Automated Data Systems within the Army in the Field).

This effort involves TOS (Tactical Operations System), TACFIRE (Tactical Fire Direction System) and CS_3 (Combat Services Support System).

Important tasks for human factors technology to assume in development of computer-based command and control information systems, he said, are (1) seek to maximize the usefulness of information available from an automated system and (2) seek to reduce the maintenance and operational burdens of automated systems on the combat user.

Address of Welcome. In his welcoming remarks as host, Maj Gen Richard T. Cassidy, CG of the Air Defense Center (ADC) and Fort Bliss, said he considered the ADC a most appropriate location for the conference "because of its concern with human factors of military operations. . . . The conference will contribute to solution of the problems of information for commander's decisions."

Army Director of Research Brig Gen George M. Snead Jr. commented on the conference: "What I have seen has encouraged me. Future conferences must facilitate even more the direct dialogue between the behavioral sciences and the military operational commanders."

From Data to Decision: Human Factors and Interfaces in Command Systems. Robert S. Andrews, U.S. Army Behavior and Sytems Research Laboratory (BESRL), presided at this session and gave an integrated overview. Five technical papers were:

- Acorns in Flowerpots/Psychologists in the Field, in which James D. Baker of BESRL discussed human factors R&D operations at the re-

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search applications interface—sketched broadly to reveal methods, resultant products, and failures encountered.

• Human Decision-Making Behavior as a Predictor of Decision Quality, by Dr. Richard L. Krumm, Universal Information Technlogies, McLean, Va. —a discussion of decision-making patterns expressed as a composite Decision Process Pattern (DPP) score, and shown to relate to performance quality criterion measures.

• Data Input and Modification, by Lewis F. Hanes of National Cash Register Co.—a review of data entry process operator actions and tasks in manual data input and data base modification, including results of selected studies of operator performance.

• State of the Display Technology, by Dr. Anthony Debons, University of Pittsburgh—an explanation of how the future of display hardware technology rests on knowing how to get the individuals to use such displays effectively.

• Some Comments on Software Development, by Raymond S. Nickerson of Bolt, Beranek and Newman, Inc., Cambridge, Mass.—a review of software program types, computer language and evaluation, the activity of programing, software for information systems, and the difficulties and importance of estimating development costs.

Host Session (Secret-Noforn). Air Defense in the Field Army, by Lt Col Harry B. Stoudemire, Maj Francis C. Collins and Maj Thomas J. LeClair, U.S. Army Air Defense School, Fort Bliss, Tex. HELBAT 1, by Gary L. Horley, Human Engineering Laboratories, Aberdeen (Md.) Proving Ground.

Human Factors in Training. Introduction by chairman, Col Edward M. Hudak, U.S. Army Continental Army Command, Fort Monroe, Va.

• Description of Safeguard System and Plans for Training, by Lt Col Harold C. Ferguson, Safeguard Training Facility, Fort Bliss, Tex.—an explanation of Safeguard System objectives, related system characteristics and deployment concepts; also, new equipment training phase, resident training phase, and on-site training phase.

• Human Factors Considerations in Safeguard System, by Harold L. Oliver, Office of Deputy Chief of Staff for Individual Training, HQ CONARC—a review of human factors efforts contributing to the development of Safeguard training plans; also, identification of major difficulties encountered in obtaining human factors information, including incorporation into training plans.

Command and Control for Safeguard ABM. Dr. Albert R. Kubala, Human Resources Research Organization (HumRRO), Fort Bliss, Tex., presided and gave the introductory presentation at this session. Other presentations:

• Man in Control, by Drs. Harry L. Ammerman and William H. Melching, HumRRO, Fort Bliss—a discussion of integrated flow of man factors consideration in early development stages, emphasizing man's role, training and the design of job positions; also, statements of task activities and practical formats for analysis of each position for varieties of contingencies.

• Manual Intervention Facility for Conducting Human Factors Evaluation, by Drs. Gilbert S. Neal and Robert O. Wood, Safeguard System Evaluation Agency, White Sands (N. Mex.) Missile Range—a description of the facility and its organizational functions.

Banquet Session. Dr. Lynn E. Baker, U.S. Amy chief psychologist and general chairman of the conference, presided at this session. Dr. Chester W. Clark (Maj Gen, USA, Ret.), former Director of Army Research and now vice president for research, Research Triangle Institute, Durham, N.C., gave the main address on "Military Social Science: Challenge for the Future." He discussed problems of long-range planning for Army social science R&D.

Behavioral Science Support of System Development: Night Observation. Dr. Donald F. Haggard, HumRRO, Fort Knox, Ky., presided and introduced this session by discussing command and control in the human factors R&D for Army operations. Presentations were:

• Vision: Monocular, Bi-ocular, Binocular, by Dr. George S. Harker, Experimental Psychology Division, U.S. Army Medical Research Laboratory, Fort Knox, Ky.—a review of the selective mechanisms for stated modes of visual function, binocular and stereoscopic vision, and design considerations and research requirements affecting these.

• Hardware Parameters Related to Operator Training, by Dr. Harold P. Bishop, HumRRO, Fort Knox, Ky.—a review of research conducted in *Nightsights*, a HumRRO task to identify critical factors in the use of night-observation devices and to develop effective techniques for training in their use.

• Environmental Factors Affecting Visual Perception, by Dr. John L. Kobrick, U.S.Army Research Institute of Environmental Medicine, Natick, Mass.—a review of types of influence that produce visual decrements and relative magnitudes of these.

• BESRL Field Experiments on Performance Effectiveness with Night Operational Systems, by Jack J. Sternberg, Behavioral Science and Systems Research Laboratory, Fort Ord, Calif.—a report on clear-cut evidence of the effectiveness of the devices, critical factors affecting use, and methods for increasing effectiveness.

Human Factors in the Design, Development and Testing of Command and Control Systems. The chairman's introductory comments were given by John Erickson, Human Engineering Laboratories (HEL), Aberdeen (Md.) Proving Ground. The presentations were:

• Brief History and Preview of Human Factors Engineering in Safeguard Systems Command and Control, by Dr. Arthur S. Kamlett, Bell Telephone Laboratories, Whippany, N.J. —a discussion of how man is considered as manager and controller, rather than operator. In consequence, test and evaluation require high orders of cooperation among all research, development, test and evaluation agencies concerned.

• Human Factors Testing of Unattended Ground Sensors, by Capts Edgar N. Johnson and Gerald P. Kreuger, HEL—a review of the support HEL has provided in the development of certain ground sensor systems.

• Human Factors Engineering for TACFIRE, by Dr. Alfred F. Hertzka, Litton Systems Inc., Van Nuys, Calif. —an overview of contractor's human factors engineering effort during development of TACFIRE command and control systems.

• The Effects of Tank Design on Command and Control, by Dr. Andrew J. Eckles III of HEL—an explanation of how aspects of tank design that affect command and control influence tank combat performance more than do design changes affecting hit probabilities, rates of fire, ballistics, engine horsepower, or armor protection.

Participating Organizations. One hundred organizations or agencies participated in the conference, namely: Advanced Materiel Concepts Agency; Air Force Deputy Chief of Staff R&D; Air Force Human Resources Laboratory; American Insti-

tutes for Research (CRESS); British Army Personnel Research Establishment; Bell Telephone Laboratory;

The Boeing Co.; Bolt, Beranec & Newman, Inc.; The Bunker-Ramo Corp.; Canadian Defence Research Staff, Washington, D.C.; Defence Research Establishment, Toronto, Canada; Ent Air Force Base, Colo.; General Leonard Wood Army Hospital; HQ First U.S. Army; Honeywell, Inc.; McDonnell Aircraft Co.; MITRE Corp.; National Cash Register, Inc.; Naval Electronics Laboratory Center; Naval Training Device Center; New Mexico State University; 95th Civil Affairs Group, U.S. Army;

Office of the Deputy Chief of Staff for Personnel, Army; Office of the Surgeon General, Army; Project MASSTER, Army; Raytheon Co.; Research Triangle Institute; Safeguard Central Training Facility, Army; STANO Systems Office, Army; Hugh Swofford & Associates; Texas Tech University;

University of Louisville; University of Pittsburgh; U.S. Air Defense Board; U.S. Army Behavior and Systems Research Laboratory; U.S. Army Combat Developments Command; Air Defense Agency; CDC Combat Experimentation Center, Army; Doctrine Directorate, Army Engineer Agency; Army Field Artillery Agency; Army Institute of Land Combat; Army Institute of Combined Arms and Support; Army Institute of Advanced Studies;

Army Institute of Nuclear Studies; Army Institute of Strategic and Stability Operations; Army Medical Service Agency; HQ U.S. Army Continental Army Command; Army Air Defense Center and School; Air Defense Human Research Unit; Armor Human Research Unit, Army; Institute for Military Assistance, Army; U.S. Army Manpower Resources Research and Development Center;

HQ U.S. Army Materiel Command and its following elements: Edgewood (Md.) Arsenal; Electronics Command; Human Engineering Laboratories; Natick (Mass.) Laboratories; Night Vision Laboratory; Picatinny Arsenal; Project Manager for Main Battle Tank; Tropic Test Center; Weapons Command;

U.S. Army Office of the Assistant Chief of Staff for Force Development (ACSFOR); U.S. Army Office of the Chief of Research and Development; U.S. Army Safeguard System Command; U.S. Army Security Agency; and White Sands (N. Mex.) Missile Range.

Proceedings. A report on proceedings of the 16th Annual U.S. Army Human Factors Research and Development Conference is available in limited quantity. Requests should be addressed to: Chief, Behavioral Sciences Division, U.S. Army Research Office, Office of the Chief of Research and Development, Washington, D.C. 20310.

Chapman Assigned CE Director of Military Engineering

Brig Gen Curtis W. Chapman's recent assignment as director, Military Engineering, Office of the Chief of Engineers, HQ DA, is backed by an Army career that began in 1941 and has included two 3-year research and development assignments.

His new duties make him responsible for technical staff supervision of all R&D pertaining to engineer techniques and the equipment required for combat and combat support services. He is concerned with organization, doctrine and design of equipment for Corps of Engineers troop units, including planning for military operations.

When the Japanese attacked Pearl Harbor, General Chapman received his baptism of fire as a company commander assigned to construction of Fort Hase on the Island of Oahu. After serving in the Central, Southwest and Western Pacific Theaters of Operations, he returned to the U.S. in 1946.

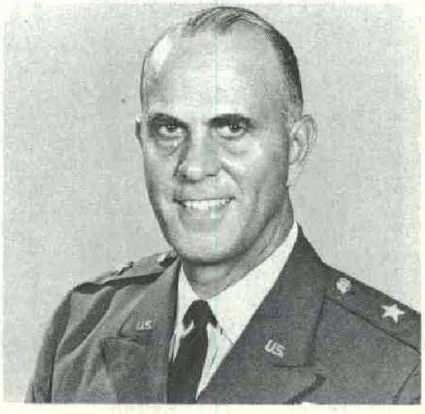
Following graduation from California Institute of Technology in 1948 with an MS degree in civil engineering, he was assigned to research and development, Army General Staff, in the Pentagon for three years. He was graduated from the U.S. Military Academy with a BS degree in 1941.

Upon conclusion of a 3-year tour as chief, Operations Division and later as deputy division engineer, Mediterranean Division—during which he supervised construction of air and communications facilities in Morocco, Libya, Greece, Turkey, Arabia and Ethiopia—Col Chapman returned to civilian life for five years.

In 1959, after receiving a bachelor's degree in business administration from the University of Hartford, Conn., he returned to active duty and served three years in the Directorate of Research and Development, Office of the Chief of Engineers, HQ DA. In 1962-63, he commanded the 36th Engineer Group (Combat) in Korea, and in 1964 was graduated from the Industrial College of the Armed Forces.

Following a 2-year tour of duty as executive to the Chief of Engineers, he served with the Joint Chiefs of Staff until assigned to Vietnam as CG of the 20th Engineer Brigade. He became division engineer, U.S. Army Pacific Division in November 1968.

General Chapman's military honors include the Distinguished Service Medal, Silver Star, Legion of Merit, Bronze Star, Air Medal (with two OLCs), Joint Services Commendation Medal, Army Commendation Medal (with OLC) and various Korean and Vietnamese decorations.



Brig Gen Curtis W. Chapman

Conferees Weigh Army Role In Anti-Pollution R&D

(*Continued from page 3*)

part of each document, proper attention to pollution abatement.

Another point emphasized strongly was that unique capabilities and equipments exist in several Army in-house laboratories that have a demonstrated potential for use by other U.S. Government agencies in R&D programs for pollution abatement.

Cited particularly as examples were the Natick (Mass.) Laboratories, the Cold Regions Research and Engineering Laboratories at Hanover, N.H., and the Army Corps of Engineers Waterways Experiment Station (WES), Vicksburg, Miss.

Army Director of Research Brig Gen George M. Snead Jr. opened the meeting in the U.S. Army Research Office, Arlington, Va., by welcoming participants and explaining the planned objectives of discussion.

Dr. Carl Lamanna, deputy chief, Life Sciences Division, Office of the Chief of R&D, HQ, DA, keynoted the discussion, saying in part:

"We hope by probing the experience of all segments of the Army—operational, staff, in the field and at the laboratory bench—to make sure we get a realistic view of what the needs are as perceived at the various echelons of command, experience and responsibility.

"Now we might ask if the Army concern with pollution abatement isn't a little overdone, or if the combat

(*Continued on page 70*)

Coliform Aerosols Emitted by Sewage Treatment Plants

Pollution of the air by various products resulting from man's habitation of the Earth and the resultant adverse effect upon human health have been of rapidly increasing concern to the nation in recent years—as publicity regarding contaminants has exposed the mounting seriousness of the problem.

Modern sewage treatment plants have been designed to dispose safely of the liquid and solid wastes of a human population. They have failed to take into account, however, the potential hazard of biological air pollution arising from the various disposal processes.

Two U.S. Army scientists have reported on biological air pollution originating from sewage treatment plants, in the Sept. 18 issue of Science (Vol. 169, pp. 1218–1220). Funds to support the research were provided by the Army In-House Laboratory Independent Research (ILIR) Program. The investigators findings of intestinal organisms being aerosolized from trickling filter type sewage plants may present a worrisome factor to our national health.

By Drs. A. Paul Adams and J. Clifton Spendlove

The association of pathogenic microorganisms with water and sewage has been known since 1855 when John Snow in London traced the source of a cholera epidemic to a sewage-contaminated well.[1] Since that time human fecal waste has been found to contain the specific etiologic agents of several diseases. Many of these are intestinal diseases.

Although these diseases are commonly transmitted through the mouth, experimental infection of some chimpanzees by inhalation of large numbers of aerosolized typhoid organisms has been demonstrated.[2]

Other organisms, whose human respiratory dosage is comparatively low, are excreted in the fecal waste of infected persons. Some of these are: various respiratory viruses, brucellosis, encephalitis, hepatitis, poliomyelitis, psittacosis and tuberculosis.

Development of the science of aerobiology in the last few years has provided a tool which has encouraged us to investigate potential sources of aerosolized microorganisms.

In 1943, for example, Schultze studied the fallout of small droplets resulting from watering crops with liquid raw sewage from an overhead sprinkling irrigation system in Germany.[3] Using a primitive sampling technique, he placed open Petri dishes at varying distances downwind from the sprinklers and was able to demonstrate presence of *Escherichia coli* in airborne droplets.

In 1956, Spendlove[4] demonstrated the aerosolization of bacteria from a rendering plant and was able to recover airborne organisms downwind from the plant using Andersen samplers. Albrecht in 1958, at the University of Florida, wrote a master's thesis[5] on biological air pollution from sewage plants, but apparently did not pursue the work further.

Randall and Ledbetter[6], working with activated sludge units, found large numbers of microorganisms aerosolized. They stated that 10.5 percent of the total bacteria emitted were of the potentially dangerous Klebsiella group.

Adams and Spendlove[7] first reported emission of aerosols from trickling filter sewage treatment plants, and it is this work upon which this report is based.

Modern trickling filter sewage treatment plants, because of the nature of their design, may be an exceptional source of aerosolized microorganisms. As we contemplated the spectrum of potential aerosols, it became plausible that the variety of organisms which may be aerosolized is almost unlimited.

The trickling filter used in the secondary treatment of sewage sprinkles raw sewage into the open air onto a rock ballast to dose the filter bed. Sprinkling raw sewage into the air would be expected to aerosolize a portion of the material and create micron-size particles (Figure 1).

Sewage varies considerably in its microbial count, but counts of 10^6 to 10^7 organisms per milliliter are common.[8] A sewage plant processing several million gallons of sewage per day has the potential, therefore, of providing a microbial aerosol source of considerable magnitude on a continuous basis.

Two municipal sewage plants in the Intermountain West, ranging in treatment capacity from 6 to 25 million gallons of sewage per day, were studied in May 1970 as a part of the U.S. Army In-House Laboratory Independent Research Program.

Andersen samplers[9, 10] (Figure 2) connected to a portable field vacuum source, were used to collect the aerosols near and downwind of sewage treatment plants. The Andersen sampler moves air at the rate of one cubic foot (28.3l) per minute and impinges the collected organisms on a nutrient medium placed in Petri plates positioned within stages of the sampler.

Fig. 1. Trickling filter bed. Note droplet formation along the boom.

1. J. Snow, London. J. Churchill, 2d Edition (1855).
2. Crozier, D. and Woodward, T. E. Military Med. *127*, No. 9, 701 (1962).
3. K. Schultze, Archiv., für Hygiene and Bakteriologie, *130*, 244 (1943).
4. J. C. Spendlove, Public Health Reports, *72*, No.2, 176 (1967).
5. C. R. Albrecht, Master's Thesis, University of Florida (1958).
6. C. W. Randall and J. O. Ledbetter, Am. Indust. Hyg. Jour., *27*, 506 (1966).
7. A. P. Adams and J. C. Spendlove, Science *169*, 1218 (1970).
8. L. A. Allen, E. Brooks, and I. L. Williams, J. Hygiene, *47*, 303 (1949).
9. Andersen Sampler distributed by 2000, Inc., 5899 South State Street, Salt Lake City, Utah 84107.
10. A. A. Andersen, Jour. of Bact., *76*, No. 5, 471 (1958).
11. A. D. Brown, Australian Jour. Biol. Sci., *7*, 444 (1954).

Each stage collects particles of a different size range, with stage 1 collecting the largest particles and stage 6 collecting the smallest particles.

Three different media were used in the studies. Casitone agar was used for the collection and growth of the general microbial population. Endo's medium and eosin methylene blue medium were used for the selective growth of the coliform organisms. Samples were taken from points in the immediate vicinity of the trickling filters and up to distances of 0.8 mile downwind.

Collections of aerosols were made during daytime and nighttime, varying from five minutes to one hour in duration. Upwind controls were collected on each test with the same types of media used in the downwind sampling. All plates of nutrient media were incubated for a minimum of 24 hours at 37° C.

Substantial numbers of coliforms were aerosolized from the trickling filters. The concentration of aerosol particles collected near the source seemed to be most affected by the size of the source and the windspeed.

Plant 1 had only two small trickling filter beds separated by some distance. Plant 2 had two sets of four beds each, with each set of four located in close proximity to each other. As the emitted particles traveled downwind, the relative humidity became more important. If the test were conducted during daylight hours, solar radiation had a deleterious effect. Overcast skies could be expected to reduce somewhat the effect of solar radiation.

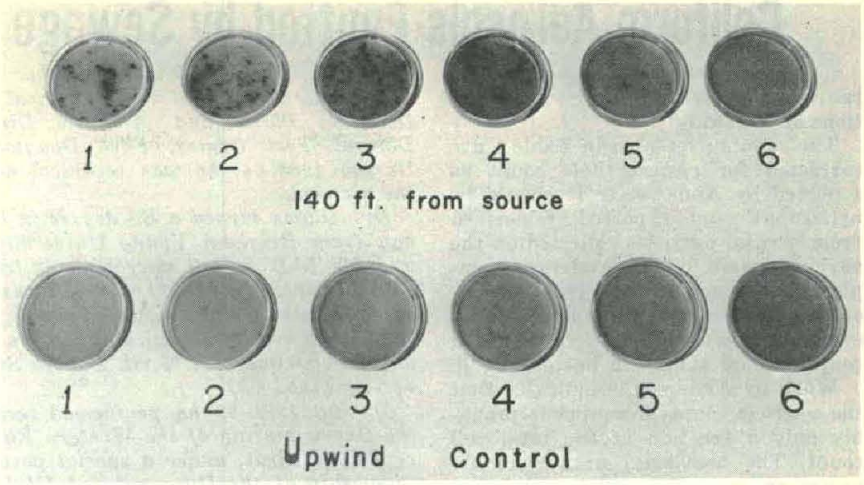


Fig. 2. Petri dishes from various stages of Andersen sampler, containing Endo's medium. Note high concentration of coliform colonies on upper set, which were located downwind from the filter bed shown in Fig. 1.

Generally speaking, high windspeeds, high relative humidity, darkness, and low temperatures would be expected to give the greatest recoveries, both close in and at greater downwind distances. Relative humidity is known to have a pronounced effect on the survival of airborne *E. coli*; generally, the humidity during these studies was low.

Low humidities were shown by Brown[11] to have a strongly adverse effect on survival of aerosolized *E. coli*. Positive recoveries of coliform organisms were made at night up to a distance of 0.8 mile from the source (the maximum distance sampled).

Greater distances of downwind travel may be expected under more ideal conditions. Although only a qualitative investigation of aerosol generation has been made to date, Table 1 shows the number of coliform colonies and total bacterial colonies

(*Continued on page 60*)

Table 1. Coliform and total bacterial aerosol particle count from trickling filters (1 foot = 0.3 m, 1 yard = 0.9 m).

Plant	Distance from source	Test conditions				Coliform particles per cubic meter		Total viable particles per cubic meter	
		Wind speed (mile/hr)	Relative humidity (%)	Temp. (°F)	Time of day	Downwind	Upwind control	Downwind	Upwind control
1	50 feet	2–4	25	70 (21.1°C)	10:00 a.m.	364		3,911	
1	50 feet	1–3	25	70	10:30 p.m.	300		19,737	
1	0.25 mile	1–3	25	70	10:30 p.m.	5			
1	110 feet	10–15	70	50	11:00 a.m.	867	0	3,692	51
1	200 yards	10–15	70	50	11:00 a.m.	30	0		
1	130 feet	8–10	65	46	8:30 p.m.	490	0	2,435	574
1	300 yards	8–10	65	46	8:30 p.m.	183	0	3,396	574
1	0.5 mile	8–10	65	46	8:30 p.m.	109	0	622	574
1	130 feet	5–10	25	65	8:30 p.m.	105	0	2,493	1,676
1	200 yards	5–10	25	65	8:30 p.m.	42	0	1,400	1,676
2	300 yards	5–10	25	65	8:30 p.m.	193	1		
2	600 yards	5–10	25	65	8:30 p.m.	26	1		
2	0.8 mile	5–10	25	65	8:30 p.m.	4	1		
2	100 yards	5–10	15	68	9:00 p.m.	159	1	914	607
2	300 yards	5–10	15	68	9:00 p.m.	70	1	817	607
2	600 yards	5–10	15	68	9:00 p.m.	7	1	389	607
2	0.8 mile	5–10	15	68	9:00 p.m.	3	1	856	607
2	140 feet	3–7	55	59	10:00 p.m.	934	1		
2	300 yards	3–7	55	59	10:00 p.m.	73	1		

Coliform Aerosols Emitted by Sewage Treatment Plants

(*Continued from page 59*)

recovered under the various conditions of the study.

The counts presented in Table 1 are corrected for positive hole count as reported by Andersen.[10] It should be noted that counts reported are derived from aerosol particles collected on the various stages of an Andersen sampler. Each particle collected theoretically gives rise to one colony; however, most of the particles collected contain more than one bacterial cell.

Work by Andersen,[10] indicates that the particle count presented is probably only a fraction of the total cell count. The heaviest counts were observed on stages 2, 3 and 4, with lower counts on stages 1 and 5.

Few if any colonies were observed on stage 6. Particles recovered on stages 3 and below represent those in the respirable size range and hence, if pathogens were present, they would be the most infective.

Particles larger than 5 microns in diameter (i.e., on stages 1 and 2) would deposit in the upper respiratory tract, but also could be swallowed and enter the gastrointestinal tract where many enteric pathogens are effective.

Since *E. coli* and other coliforms are the universal indicator of fecal pollution, it is apparent that the discovery of aerosolized coliform organisms arising from sewage treatment plants may portend a public health concern. It follows that if *E. coli* is aerosolized, other organisms found in sewage that may be pathogenic are also aerosolized.

Studies are under way to investigate further this source of microbiological aerosols. Investigations will be conducted to attempt to identify other pathogenic bacterial and viral aerosols generated by sewage plants.

DR. A. PAUL ADAMS has been serving since 1964 as chief of the Biological Systems Division, Plans and Analysis Directorate, Deseret Test Center, Fort Douglas, Utah. During 1963–64, he was technical adviser in the division.

Dr. Adams earned a BS degree in bacteriology from Brigham Young University (1948) and his PhD in soil microbiology from Iowa State University (1953). He did research on bacterial aerosols at Dugway Proving Grounds (1953–54) and was chairman of the Bacteriology Department at North Dakota State University (1954–63).

During 1961–62 he performed research on the Overwintering of the Western Equine Encephalitis Virus, under a special post-doctoral fellowship at the University of Utah.

DR. J. CLIFTON SPENDLOVE has served as technical director of the Plans and Evaluation Directorate at Deseret Test Center from 1962 until 1968, and since then has been assigned as biological science administrator for the command.

Dr. Spendlove earned BS (1949) and MS (1950) degrees in bacteriology from Brigham Young University and his 1953 PhD degree in industrial microbiology from Ohio State University.

From 1953 to 1956 he worked as a research supervisor at Dugway Proving Grounds and from 1956 to 1962 he was an operations research analyst at Edgewood Arsenal, Md.

Competition Narrows for DoD Computer Systems Contract

Competition for what is expected to be the largest computer systems contract ever awarded by the Department of Defense was narrowed recently with selection of 17 firms for submission of proposals for the Worldwide Military Command and Control System.

The RFP (Request for Proposal) action put an end to the extensive series of industrial briefings for potential competitors for the contract, which is scheduled to be awarded in May or June of 1971. The 17 firms selected have until Feb. 1 to supply bids for replacement as well as new data processing equipment for WWMCCS intelligence data systems.

The Air Force has been directed by Deputy Secretary of Defense David Packard to serve as the WWMCCS procurement agent. The General Services Administration will negotiate the final contract. Allocation of equipment will be made by the Joint Chiefs of Staff.

The contract will involve a minimum of 15 new standardized computing systems for the WWMCCS program, with an additional 20 computers slated for purchase in FY 1972 and 1973. Plans call for procurement of nine systems in FY 1972.

Firms which have been invited to submit proposals are Burroughs Corp., Collins Radio Co., Control Data Corp., Delta Data Systems Corp., Digital Equipment Corp., F&M Systems Co., Electronic Associates Inc., General Electric Co., Honeywell Inc., IBM Corp., Kollsman Instrument Co., Philco-Ford Corp., RCA Corp., Sanders Associates Inc., Xerox Data Systems, Sylvania Electronic Systems, and Univac Div., Sperry Rand Corp.

New ECOM Facility Keyed to 5-Year ADP Program

Construction of a $133,790 computer facility building for the U.S. Army Electronics Command started in mid-October at Fort Monmouth, N.J. and is scheduled to be completed in February 1971.

The building will provide 7,200 square feet of floor space to house the most modern computer equipment available, complemented by an extensive magnetic tape and disc library.

Construction of the facility is keyed to the Army Materiel Command's 5-year automatic data processing program. Computing equipment will be linked to another ECOM computer built to the latest state-of-the-art at Philadelphia via a high-speed, wideband data link. This will provide real-time communication of digital data between the two locations so that the total configuration will be a single command computer system. On-line encryption equipment will assure proper safeguarding for communication of classified data between facilities.

Anticipated benefits of the new real-time system are to provide faster and more accurate information to the many users of ECOM's ADP services. By taking advantage of modern telecommunications, it also will insure an even closer interaction between functions performed by elements of ECOM located at Fort Monmouth and at Philadelphia.

Col Cramer Assigned as PM for Containerization

Development of a totally integrated containerization system for Army-wide application is an ultimate goal of the U.S. Army Materiel Command in designation of a product manager to accelerate the program.

Product manager is Col Raymond A. Cramer Jr., a transportation and supply distribution expert. Product management status is reserved for items of equipment or systems accorded special intensive attention for reasons of criticality of mission, urgency, complexity or high-level interest.

Col Cramer reports directly to the commanding general of AMC and has management responsibility for development of material and plans, as well as execution of life cycle pilot operations in supply distribution.

Objectives are to develop a total systems concept, wholesale supply doctrine, plans for supply distribution, operations and directive documentation. Col Cramer's task is to develop, test, procure, and place into operation containerization systems, to include related materials handling equipment, which will provide the Army with an effective and economic logistic distribution capability.

The Army spent about $2 billion in FY 1970 for the transportation of persons, materiel and supplies. Associated costs of packaging, packing, marking, in-transit losses, loading and unloading and other factors drive that figure much higher, making it a prime target for cost reduction and improved efficiency.

Credited with pioneering efforts in containerization, the Army introduced its all-steel CONEX (Container Express) container fleet 18 years ago. This was a relatively small (roughly an 8-foot cube) steel box utilized for consolidating into a unitized load the many small packages which characterize the Army's supply system.

Since May 1970, the Army has had in use a fleet of more than 1,300 leased units of the larger 20-foot size for shipments from West Coast Depots to Vietnam. An additional 1,300 are being leased to extend container service to Thailand and Okinawa and return of retrograde cargo to the U.S.

The overseas containerized shipment of ammunition was demonstrated successfully by the AMC from December 1969 through January 1970. Efforts are now under way to establish a total Containerized Ammunition Distribution System Army-wide.

A development and acquisition program for an Army-owned fleet of inter-modal containers conforming to U.S. and international standards (8'x8'x20') is in progress. The first production model from a procurement order of 6,700 is undergoing production tests.

The Army considers a universal containerized logistics distribution system, with associated standardized materials handling equipment and documentation procedures, as paving the way for "through-put" supply—from depots or factories direct to field units.

Significant savings in transportation costs and manpower, and substantially increased efficiency in operations, are the ultimate objective.

Col Raymond A. Cramer Jr.

ALMC Announces Changes in Orientation Course

A major revision of the 5-day Army Test and Evaluation Orientation Course, which has been taught for two years at the Army Materiel Command's Army Logistics Management Center, Fort Lee, Va., has been approved by Department of the Army.

The new offering will be a 9-day Test and Evaluation Management Seminar, intended to serve better the training needs of test and evaluation managers throughout the Army. The seminar will be a student-oriented vehicle to furnish educational experiences at the post-graduate level.

Minimum grade prerequisites for attendance have been raised to GS–12 for civilians and rank of major for military personnel to satisfy experienced manager requirements. Scheduled to start Feb. 1, 1971, the seminar will include case studies, work shops, panel discussions, and guided discussions on coordinated test programs, test plans, test reports, product assurance, in-process reviews, and type classification.

Management information systems, financial management and statistics, as well as management of scientific and engineering personnel, will be considered.

Seminar participants are expected from offices of the Chief of Research and Development, Assistant Chief of Staff for Force Development, Deputy Chief of Staff for Logistics, HQ Army Materiel Command, Combat Developments Command, and Continental Army Command; also, from CDC groups, institutes and agencies, AMC commodity commands and separate laboratories, HQ Test and Evaluation Command, TECOM agencies, Project MASSTER, and the Safeguard Logistics Command.

Navy Capt Thomas E. Killebrew is dean of the School of Acquisition Management at the center. Leo Rachmel is chairman of the Research Development Test and Evaluation Department and Alan R. Loper is the course director.

For additional information, write: Commandant, U.S. Army Logistics Management Center, ATTN: AMXMC-A-R, Fort Lee, Va. 23801.

Col Hill Assumes Duties as ECOM Deputy for C-E Systems

Col Henry W. Hill is the new deputy for Communications-Electronics Systems at the U.S. Army Electronics Command (ECOM) and Theodore W. Pfeiffer, acting deputy since 1969, has resumed his duties as technical director.

Col Hill served until recently as commanding officer, Strategic Army Communications (STRATCOM) Signal Group, Taiwan. His Army career has included tours of duty in the Philippines, Korea, Panama, Vietnam and the Office of the Chief Signal Officer in Washington, D.C.

Col Henry W. Hill

A 1947 graduate of the U.S. Military Academy, he also has completed the Signal Corps Officers Advanced Course at Fort Monmouth, N.J., the Command and General Staff College resident course, and the Naval War College course. He received an MBA degree from George Washington University in 1959.

Awarded the Bronze Star Medal with "V" device and the Legion of Merit for 1968 service in Vietnam, he also holds the Army Commendation Medal with Oak Leaf Cluster and the Joint Service Commendation Medal.

AUSA Speakers Stress Progressive Efforts to Offset Cutbacks

Participants and exhibits in the 1970 Annual Meeting of the Association of the United States Army (AUSA) reflected current Department of Defense budgetary cutbacks, but the will to do more with less resources was predominant in speeches.

Missing was some of the exuberance that has characterized the outward show of the serious purpose of the annual rally of U.S. Army leaders, from all parts of the world, and representatives of industrial organizations united in the defense effort.

Lacking also was the traditional big show of the most dramatic items of new military materiel in front of the Sheraton Park Hotel, scene of AUSA meeting for many years. Even the indoor exhibits were less ostentatious than customary—as one observer phrased it, "rather low-key."

Secretary of the Army Stanley R. Resor's keynote address accented the positive, with respect to progress being made in Vietnam, Korea and in maintenance of security in Europe through NATO forces, as well as it pertains to the outlook for the future.

"...Under budgetary pressures, we are taking massive manpower cuts," he said. "In part, they reflect diminished requirements in Vietnam and elsewhere. In part, they are necessary in order to assure funds for essential research and development.

"We know we cannot let the quality of our force decline with its numbers. We must develop the weapons systems which the Army will need by the end of the decade. We also must balance our needs for advanced development against current procurement requirements.

"Even so, our program is austere. We are facing first-class modern military equipment around the world. The Soviets have been providing excellent new equipment and weapons to themselves and their client states. So there is a level below which we dare not go in modernization, and we are approaching it.

"...There is a limit to the amount the Army can safely be cut in personnel. Without a minimum level of credible, usable military strength, the United States cannot have an effective foreign policy...."

In speaking of a current problem of race relations, without in any way linking it to the recruitment of an all-volunteer Army as a top-priority effort of the future, he said:

"Few problems in the area of race relations, or in troop morale and discipline generally, cannot be handled by confident and sensitive officer and noncommissioned officer leadership. We must make sure that our leaders meet the highest standards, and are trained to give the quality of leadership which the times require."

Secretary Resor commented on the "remarkable success" of the Vietnamization Program—"accomplishments . . . demonstrate that our policy of a phased, orderly withdrawal of United States forces is the right one and should be adhered to. On the military side, our troops have responded outstandingly to their changing mission. . . .

". . . Some 18,000 of our most dedicated officers and noncommissioned officers have continued to work in small teams as advisers, helping communities to make lives more secure and productive, or assisting the Vietnamese in the conduct of the war. As Vietnamization goes forward, the American adviser becomes increasingly important.

"The Vietnamese have taken over significantly more of the combat and security role. They have expanded their armed forces from 700,000 in April 1968 to over 1,000,000 today, an increase of 40 percent in 2½ years. They have continued to upgrade the quality of their senior military leadership.

"...Local government is increasing in capability. Provincial and municipal councils have been elected for the first time.... Many of the village and hamlet officials are now graduates of the government's special training center at Vung Tau. Ninety-five percent of the villages and hamlets have elected officials, and these officials have more responsibility and authority than ever before.

"Major land reform continues. In 1969 the government redistributed 184,000 acres, almost four times the amount in 1968. Through August of this year another 126,000 acres have been distributed....

"Vietnamese riceland is becoming increasingly productive through the IR–8 rice, which our advisers have helped introduce. This new variety increases yields up to three times those of ordinary rice.... This year South Vietnam should become self-sufficient in rice production for the first time since 1964.

"...Over-all, Vietnamization has been more successful than we could have hoped. This is reflected in our withdrawal of 165,500 troops from Vietnam during the 17 months since President Nixon's May 1969 announcement.

"This is a 30 percent reduction in our troop commitment and, more importantly, a 41 percent reduction in U.S. ground combat strength. The 100,000 more troops to be withdrawn by next May will reduce U.S. strength to half what it was when the Nixon administration took over.

AUSA President Frank Pace Jr. presents George C. Catlett Marshall Medal to General Lyman L. Lemnitzer (USA, Ret.) at the General Marshall Memorial Dinner, climax of the AUSA meeting.

". . . U.S. casualties have been reduced to less than one-half of what they were during the same period in 1969. Incremental budgetary costs attributable to Vietnam will be $11 billion in FY 71 as compared to $21.5 billion in FY 69, a decrease of 53 percent over the 2-year period...."

Speaking of the current situation in Korea, Secretary Resor said, "There we see living proof of the success of the U.S. postwar police and collective security, and the magnificent contribution of the United States aid, Korea today has the fastest growing economy of any Free World country —a 15 percent annual growth rate...."

Turning to the drastic reductions in military manpower, Secretary Resor said, "Next June we will have an Army of 13⅓ divisions, as compared with 19⅔ at the peak of combat activity in Vietnam. It will be 2⅔ divisions smaller than in the period immediately before the Vietnam War began."

Secretary Resor said the shift in European defense, now that "neither we nor the Soviets can use strategic nuclear weapons against the other without grave risk of being destroyed in the exchange...will be to the use of conventional forces...for exerting either military or diplomatic pressure....

"In light of these circumstances, our maintenance of adequate conven-

tional forces becomes increasingly vital. Thus the effectiveness of our foreign policy will be related increasingly to our conventional military power. That power is centered in the Army."

Praising the U.S. strength of 4⅓ combat divisions, as part of a total force of 285,000 men in Europe as the U.S. contribution to NATO defense, Secretary Resor said "they are the best-trained, best-equipped and best-supported forces in NATO today....

"These forces are more necessary than ever to preserve the stability of that region. The U.S. divisions now in Europe represent a share of NATO's total conventional capability which is greater than their numerical proportion—not only by virtue of their firepower and readiness, but because they are visible evidence of our commitment to the defense of Europe.

"The credibility of NATO's conventional deterrent lies chiefly in the United States forces now deployed. A reduction in the combat capability of these forces would reduce this credibility.

"After 25 years of rigid confrontation in Europe, East and West are making preliminary overtures across the lines which separate the forces of NATO and the Warsaw Pact. We may now have an opportunity to advance gradually toward substantial political resolution of the forces dividing Europe and toward a mutual reduction of military forces.

"However understandable our objectives, if by ill-considered actions we disrupt the current balance, we may lose for many years the opportunity that is before us. Yet some Americans are sincerely arguing that we no longer can afford to maintain our forces in Europe. I think that argument cannot withstand analysis."

Secretary Resor then defended the cost of maintaining our forces in NATO, saying that "Most of the $14 billion—$11.4 billion of it—is associated with the maintenance of additional forces in the United States ready to support and reinforce those deployed in Europe.

"Only the remaining $2.6 billion is the operating cost of the troops in Europe... Many of those who argue that we should reduce our deployments in Europe nevertheless agree that we must maintain these forces ready to reinforce our NATO Allies in time of crisis."

Secretary Resor said that "If overall national security requires a force this size, it costs no more, and probably costs less, to maintain some of these divisions in Europe instead of in the United States.

"Our forces in Europe are as responsive to emergencies elsewhere as are forces stationed in the continental United States. During the recent Middle Eastern crisis, the first Army combat unit alerted was in Europe. The hospital unit that was sent to Jordan came from our forces in Europe...."

Secretary Resor closed with: "This is a time of great adjustment for our Army. The drastic reductions in troop levels are not easy to manage, but the Army is doing so. The Vietnamization of the war is an enormous challenge, but the Army is meeting it.

"The mission of providing national security with diminished resources in the face of a more powerful threat is a difficult one, but the Army will fulfill it. I am confident that out of this transitional period will emerge a newer, smaller, tougher, high-quality Army—An Army that will continue, as it has in the past, to meet superbly every demand that is placed upon it."

ARMY CHIEF OF STAFF General William C. Westmoreland's AUSA address was focused principally upon the All-Volunteer Army Program.

"We cannot have the Army our nation needs," he said, "without good people. We need quality as well as quantity—and in the appropriate skills to meet our needs. This is our primary task—we accept it as a matter of the highest priority and utmost importance...."

General Westmoreland said success will require that "those of us in uniform in positions of high responsibility in the Army must attack this problem with all of the vigor, imagination and dedication we can muster, and we must apply ourselves intensively to the task...."

(Several of the most significant statements made by General Westmoreland are incorporated in a separate article on the appointment of Lt Gen George I. Forsythe to head the All-Volunteer Army Program. See page 5.)

General Forsythe also was one of the principal speakers. He emphasized importance of the ROTC program in American colleges and universities as a training ground for the nation's future military leaders. Commenting upon continuing public criticism of ROTC, he said:

"One of the most effective methods of attack against an institution is to try to undermine its worth as perceived by the people from whom it ultimately must draw its support. We can reasonably expect to see a continuation of the effort to chip away at the morale and integrity of the Army, and, in turn, ROTC, upon which the Army depends so greatly....

"Late last month I visited Continental Army Command Headquarters. In a conference room there were two 4-star generals; four 3-stars, and 31 additional stars—all dedicated to the proposition that ROTC can be made better yet—that in order to attract the young men the Army needs for the decades ahead, even more remarkable innovations are needed.

"The Army will change—procedures, techniques, organization, policies—but what will never change are the fundamental values that give form and substance to this profession—duty, honor and country...."

GENERAL WILLIAM B. ROSSON, speaking as Commander-in-Chief of the U.S. Army, Pacific, reviewed in detail the methods and procedures used in developing and implementing the Vietnamization Program.

His address covered training programs and materiel modernization, current problem areas, the contributions of U.S. military advisers, other support factors, and the remarkable success achieved to date.

LT GEN RICHARD G. STILWELL, Deputy Chief of Staff for Military Operations, discussed "National Strategy and the Army in the 70s," as set forth by President Nixon in February 1970.

"...With some risk of oversimplification," General Stilwell said, the essence of operative national strategy can be capsulized in four N's. He listed as first, Nuclear or Strategic Sufficiency, followed by the role of NATO in safeguarding Western civilization, then the Nixon Doctrine, and the fourth N of Negotiations.

The Nixon Doctrine, he said, has three elements:

(1) The United States will keep all of its treaty commitments; (2) The United States will provide a shield if a nuclear power threatens the freedom of a nation allied with us or a nation whose survival we consider vital to our security;

(3) In cases involving other types of aggression, we shall furnish military and economic assistance when requested and as appropriate. But we shall look to the nation directly threatened to assume the primary responsibility of providing the manpower for its own defense.

General Stilwell interprets the Nixon Doctrine as being, in essence, "neither isolationism nor disengagement. Rather it provides the basis for a long-term engagement in the world, and an engagement consistent with political and military realities.

"The goal is one of partnership rather than predominance, for, as the President has said, 'The nations of

(*Continued on page 64*)

Speakers Stress Progressive Effort to Offset Cutbacks

(*Continued from page 63*)

each part of the world should assume the prime responsibility for their own well-being; and they themselves should determine the terms of that well-being.'"

In examining "the world canvas" on which the national objectives are to be sought, and the scene in which the Army of the 70s must be prepared to operate, General Stilwell dwelt upon the role of the Safeguard ABM system in national defense; also, the Strategic Arms Limitation Talks (SALT) scheduled to resume in Helsinki, Finland, next month.

Turning to the U.S. Army's role in the defense of Western Europe, he said, "NATO will continue to be the capstone of our collective security." He said that for the balance of the 70s, the Middle East is "likely to be the world's most complex and explosive region.... The basic challenge will be to ensure that any peacekeeping operation truly brings an end to military conflict in this tormented area, and that the possibility of any confrontation between the super-powers is avoided...."

In respect to the United States role in Southeast and in Northeast Asia, General Stilwell said "Our partnership with Japan is vital to the peace and security of the Pacific."

Other speakers. Lt Gen Joseph M. Heiser Jr., Army Deputy Chief of Staff for Logistics, discussed "U.S. Army Logistics for the 70s," and Lt Gen Walter T. Kerwin Jr., Army Deputy Chief of Staff for Personnel, spoke on "Guidelines for a Quality Army."

Under Secretary of the Army Thaddeus Beal was the speaker at the Corporate Members Luncheon, ASA (R&D) Johnson's address on the role of R&D is carried on page 42.

MARSHALL MEMORIAL AWARD. General Lyman L. Lemnitzer, who retired recently after serving as NATO Commander-in-Chief, was honored by the presentation of the prestigious General George C. Marshall Award at the climax of the Marshall Memorial Dinner.

Toastmaster Frank Pace Jr., former Secretary of the Army and current AUSA president, eulogized General Lemnitzer's outstanding contributions to the Army and to the public service in presenting the award.

The Anthony J. Drexel Biddle Medal, awarded annually for service to the AUSA, was presented to Arthur C. Kaufman.

RESOLUTIONS. The AUSA's No. 1 resolution was "that to meet the requirement of the U.S. global strategy, to fulfill U.S. international policies, treaties and commitments, including its support of its NATO obligations, and to insure its national defense, that

(1) The U.S. Army, consisting of the Active Army, National Guard and U.S. Army Reserve, be maintained at strength and effectiveness levels capable of providing trained and equipped forces for immediate response to U.S. national and international requirements;

(2) The U.S. Army vigorously implement measures to insure a cohesive, motivated, disciplined military force, high in esprit and dedication, knowledgeable in the perils it faces, capable of accomplishing its assigned missions;

(3) The Army, regardless of projected budgetary limitations, assign priorities to procurement and research and development requirements to insure that all elements are equipped with the most modern and superior materiel for rapid and effective fulfillment of the Army's mission.

Another resolution committed the AUSA to support of the President's programs designed to base the redeployment of U.S. Forces from the Republic of Vietnam upon progress in Vietnamization, developments in the peace negotiation, and the intensity of enemy activity.

A resolution was adopted in support of a widespread publicity campaign to call the attention of the world to the plight of U.S. prisoners of war and those of other nations held by the North Vietnamese and Viet Cong...sufficient to persuade the enemy to adopt more humane practices and hasten the return of prisoners of war to their homes.

The Association went on record expressing its sympathy "in behalf of all its members to the gallant wives, families and loved ones of these prisoners."

Other resolutions urged that, despite the emphasis on the All-Volunteer Army, Selective Service be continued until actual experience has proven that qualified personnel in sufficient numbers properly within services—including the National Guard and Reserves—can be provided without such a system;

That the AUSA strongly endorses the positive action of the President and Congress; that it reaffirm its support of the Safeguard ABM System; that it urge the earliest possible deployment of Safeguard units already approved; and that it recommend expedited action to complete development and initiate production of the SAM-D weapon system;

That action be taken to provide continued support for programs designed to expand and modernize the Merchant Marine and to support the improvement in, and obtainment of, sufficient amounts of strategic airlift, multipurpose ships and other sealift, together with their supporting facilities, required to meet the operational needs of our ground forces.

That the AUSA continue support of the ROTC program and to urge that institutions of higher learning be encouraged to cooperate with military services to upgrade their ROTC programs, and encourage student participation in them by giving academic credit for course work completed;

Further, to urge that institutions continue to provide the military services with an acceptable climate of institutional support for the ROTC program on campus, and to accept the responsibility for education of our military leaders comparable to their responsibility of educating leaders of other segments of our society;

(Also), that the AUSA protest and deplore any attacks of violence upon ROTC personnel and property, and that it strongly urge the vigorous prosecution by the appropriate authorities of any persons, who in committing such an act, violate the law.

The two final resolutions adopted by the AUSA urged the removal of restrictions on federal employment of retired regular military personnel that require them to forfeit part of their retired pay as a condition of employment; and that the AUSA support expansion of facilities of commissaries and post exchanges and, further, that these services provide adequate personnel to maintain properly efficient operation.

DA Circular 624-97 Lists R&D Selectees for Promotion

Department of the Army Circular 624-97, announcing selectees for promotion to rank of full colonel as vacancies occur, carried good news for 13 officers currently assigned and 25 formerly with the Office of the Chief of Research and Development, HQ DA.

Selectees serving as staff officers in OCRD are Lt Cols Florian O. Cornay, Kenneth R. Ebner, Henry C. Evans Jr., John P. Haumersen, John F. Hook, Robert E Ingalls, Elwood A. Lloyd, Stanley R. Meeken Jr., Robert L. Miller Jr. (stationed with U.S. Army Standardization Group, Canada), William C. Stephens, Francis G. Thomas, Norman E. Delbridge and Henry R. Shelton.

Selectees who formerly served in OCRD as staff officers are Lt Cols Boyde W. Allen Jr., Sampson H. Bass Jr., William Burdeshaw, Joseph F. Castro, James F. Culp, Eldon L. Cummings, Jesse B. Doss, Harry L. Dukes Jr., Homer J. Finch, Robert F. Franz Jr., George H. Gardes, Kenneth G. Herring, Marvin J. Krupinsky, Rufus E. Lester Jr., Raymond R. Lunger, Patrick H. Lynch, Charles D. McKeown, David S. I. Meredith, Wayne D. Miller, Alan A Nord, Stanley R. Sheridan, George H. Tucker Jr., Daniel J. Walsh, Patrick W. Wilson and Thomas R. Woodley.

AUSA Reports Feature Products of Army Research, Development

Products of Army research and development reported at the 1970 Annual Meeting of the Association of the United States Army included advances in feeding methods for field troops, new weapons, improved equipment, communications progress, and civilian uses of night-vision devices.

Extensive use of helicopters was said to have made possible the feeding of hot meals to virtually all soldiers in forward or isolated areas. This technique is combined with a new disposable, insulated container being developed by Natick (Mass.) Labs.

NLABS also reported that development is progressing on a modular mobile field kitchen to be used in future Army feeding systems. Tests of units capable of serving rapidly prepared hot meals to 200 soldiers are scheduled during 1971.

Another development reported by NLABS is an improved parachute that uses an 18-inch-wide netting material, added as an anti-inversion barrier, to the skirt of the T-10 canopy; also, the addition of apex centering loops. A study of more than 900,000 jumps over a 3-year period showed 90 percent of T-10 parachute failures resulted from semi-inversions.

Encouraging results have been achieved in testing of the new chute to date—indicating a dramatic improvement in reliability, elimination of increased rate of descent associated with semi-inversions, a reduction in required canopy maintenance, and a lowering of the safe minimum altitude for personnel airdrop.

HQ U.S. Army Weapons Command, Rock Island, Ill., reported that it is "closing in" on its objective of the artilleryman's dream of reliably scoring a first-round hit. The development is the integration of a gun direction computer, a radar chronograph set and a laser range-finder into artillery fire-direction centers.

The U.S. Army Mobility Equipment Research and Development Center, Fort Belvoir, Va., reported that a prototype "ribbon" bridge is scheduled for delivery in January 1971. This may lead to a "new look" at tactical floating bridges.

The prototype bridge is being built under a contract for about $1 million with Pacific Car and Foundry Co. Separate pontoons are eliminated and the bridge is supported by the water in river crossings. Segments 22 feet long can be connected up to 400 feet, with a capability of 60-ton loads.

Improvement in the Vulcan Air Defense System that enables a quick method of evaluation of a gunner's ability during training was reported as a collaborative effort of HQ WECOM and fire control engineers at the Army's Frankford (Pa.) Arsenal. Three of the Dual Vision Viewing Devices have been built for evaluation.

HQ WECOM also reported on release of the M203 Grenade Launcher to Vietnam and to training bases in the United States as the newest small arm to enter the Army inventory.

The 3-pound launcher will replace the present M79 grenade launcher on a one-for-one basis. It has a quadrant sight for accurate aiming to 400 meters and a battle sight for rapid engagement to 250 meters. The launcher is mounted on the M16 rifle.

The U.S. Army Tank-Automotive Command, Warren, Mich., announced an anticipated saving of $18 million to $20 million annually through use of a newly designed trailer to replace seven trailers now in service.

The new vehicle was described as incorporating a number of major design features that will enable it to carry an assortment of cargoes at maximum speed under both highway and off-road conditions.

Known as the M–796, the trailer was designed with the same basic chassis requirements as earlier models, enabling it to be used to carry the Corps of Enginers footbridge system. Pre-production models have passed final Aberdeen Proving Ground tests.

Army-developed night-vision devices credited with "taking the night away from Charlie" in Vietnam are finding numerous applications to civilian requirements, the Army reported.

Many of these uses for the Starlight Scope have been extensively reported in various editions of the *Army Research and Development Newsmagazine.*

These reports have covered studies of the coconut crabs as an ecological factor for persons returning to Pacific islands used for A-bomb tests; also, loan of night-vision devices for a United Nations Food and Agriculture Organization study of vampire bats credited with destroying annually millions of dollars worth of cattle in Latin America. Use by fishermen to detect schools of fish by their bioluminescence also was reported.

Two new uses of Starlight Scopes to apprehend law violators were reported to the AUSA. The U.S. Treasury Department (Alcohol and Tobacco Tax Division) used one of the devices to find nighttime operators of illicit liquor stills. The U.S. National Park Service has been using the scopes to detect alligator poachers in Everglades National Park in Florida.

Other Starlight Scope uses reported at the AUSA meeting included a Maryland Department of Game and Inland Fish project to collect and band approximately 1,000 wood ducks; a Smithsonian Institution study of white-tailed deer; a University of Wisconsin study of life history and ecology of animals; and a Department of Agriculture (Entomology Research Division) study of insects.

The Navy at Lakehurst, N.J., employs the scope to aid in locating aircraft pilots down in water. In Willingford, N.J., a physician uses a night-vision device to help in studying subnormal hospital patients.

The U.S. Army Satellite Communications (SATCOM) Agency, which marked its tenth anniversary a month before the AUSA meeting, carried the story of its achievements during the past 10 years to AUSA participants. (This story was extensively reported in the September-October edition of the *Army Research and Development Newsmagazine*, page 52.)

SATCOM reported among its major achievements the development of 29 ground terminals—located in New Jersey, California, Maryland, Oklahoma, Colorado, Alaska, Hawaii, Okinawa, the Philippines, Guam, Vietnam, Thailand, Australia, Ethiopia, Germany and Turkey.

Current SATCOM efforts are centered on Phase II of the Defense Satellite Communications System, which will involve technological advances based on operational experience.

Anechoic Chamber Constructed For Radio Testing at USAEPG

Construction of an anechoic chamber for testing military radios at the U.S. Army Electronic Proving Ground, Fort Huachuca, Ariz., is beginning under a $95,000 contract with the Sprague Electric Co., North Adams, Mass.

The 22′ x 40′ x 18′ chamber will be large enough to permit testing of equipment mounted on a 2½-ton truck. Inside walls of the chamber will be lined with pyramidal cones of plastic foam to absorb electro-magnetic radiation so that antenna patterns of various transmitters can be studied without disturbing echoes.

An outside layer of sheet steel will prevent low-frequency radiation entering the chamber from outside sources. Engineers at the Proving Ground believe it will be one of the largest such test facilities in Arizona.

Army, Air Force Demonstrate Mobility in Jordanian Mercy Mission

Mobility is a meaningful word in modern warfare, even on mercy missions, as was demonstrated by joint effort of the U.S. Army and Air Force during October when they moved air-transportable hospitals into Jordan at King Hussein's request.

The Army 32d surgical hospital and the Air Force 48th air-transportable hospital arrived in Jordan via huge Air Force transports Sept. 29 and remained until Oct. 31, leaving behind modern medical equipment and hundreds of grateful patients.

Occasional gunfire still sounded through the hills surrounding the oasis near Amman as the units arrived. Shortly thereafter they moved in a convoy under the cover of darkness to the partially completed King Hussein new army hospital, about five miles from Amman.

Tents soon rose outside the Jordanian civil hospital, which as yet had no furnishings, electricity or running water. Installed under canvas were American communications equipment, messing facilities, motor pool, engineering and carpenter shops. Water purification units and laundry facilities worked around the clock.

After hours of preparation and days without sleep, the doctors and medics, now inside the new Jordanian hospital, opened the doors the evening of Sept. 30. The first emergency patient was a baby girl carried on a stretcher. Two women followed, one carrying a screaming baby. In the operating room, doctors began treating injuries, requesting equipment and snapping orders. Their month in Jordan had begun.

"Operation Fig Hill," under the auspices of the International Red Cross, included the treatment of wounded from both sides of the fighting as well as civilians caught in the cross-fire.

One grateful Jordanian woman, fire-scarred and suffering, spoke in broken English: "Ali sent you and the other Americans from heaven. May He bless all of you and watch over you."

Another patient, an old man with a glass eye, was brought to the hospital by an American Baptist missionary. The man had been hit by shrapnel in his one seeing eye. When the two men reached the hospital, the Jordanian broke down in tears, kissing the missionary and thanking him again and again.

A Jordanian Army major said, "This American hospital is fantastic. Never have I seen so much talent and skill as I have seen here. We are so grateful the Americans have such fine surgeons."

When it was over, the American hospital had treated more than 600 patients. More than 180 had been admitted. Surgeons had demonstrated their skill at the operating table some 1,250 times, and 20 percent of those were major surgical procedures.

Nine Americans have remained in Jordan to conclude necessary equipment transfer and cross-training of the Arab medical personnel. They will return to their home units by mid-November.

The American hospital was visited by King Hussein and the Queen Mother, Queen Zeine, and the Jordanian Prime Minister, Wasfi Tal, who presented medals to the Americans as a token of gratitude.

HumRRO Picks Board Members, Elects Ailes New Chairman

Former Secretary of the Army Stephen Ailes has been elected chairman of the board of trustees of the Human Resources Research Organization (HumRRO), succeeding Dr. Meredith P. Crawford, who continues as president of the board.

Dr. Crawford has served as director of HumRRO since its inception in 1951 as a U.S. Army contract element of the George Washington University under the name of the Human Resources Research Office.

When HumRRO was established as a separate nonprofit agency effective Sept. 1, 1969 with increased freedom to serve other federal agencies under contract, Mr. Ailes became a member of the board of trustees; he is also the president-elect of the Association of American Railroads.

Dr. Louis Rader, chairman of the Department of Electrical Engineering at the University of Virginia, was elected vice chairman.

Alan C. Furth, vice president and general counsel for the Southern Pacific Co., San Francisco, Calif., was elected to a 3-year term on the board to succeed General Hugh Harris (USA, Ret.). Furth has been with the SP Co. since 1949. He has a BA (1944) and LLB (1949) degrees from the University of California, Berkeley.

Dr. J. Daniel Lyons, director of HumRRO Division No. 1 (System Operations), and Dr. T. Owen Jacobs, Director of Divison No. 4 at the U.S. Army Infantry Center, Fort Benning, Ga., were elected to one-year terms.

Headquartered in Alexandria, Va., HumRRO has a nationwide network of research and development labs.

MERDL Selects Ismach as Technical Director

Inventions of vast importance to the military and civilian populations, impacting throughout the world in event of medical emergencies, are part of the achievements Aaron Ismach takes into his new job as technical director, U.S. Army Medical Equipment R&D Laboratory, Fort Totten, N.Y.

Ismach has served as chief of USAMERDL's Engineering Division since the establishment of the laboratory in 1957. He was elevated to the top scientific position following the recent retirement of Benjamin D. Pile.

Worldwide recognition first came to Ismach when his invention of a foot-controlled jet injector device for mass immunization, at the rate of 600 to 1,000 patients an hour, was used to immunize victims in the 1963 earthquake disaster in Yugoslavia. Later it was used in Morocco to protect flood victims against the threat of typhoid.

In 1964 he was awarded the Department of the Army Decoration for Exceptional Civilian Service. This award, however, recognized a major improvement to the jet injector device—an intradermal tip accessary that greatly broadens its potential application, such as an anesthesia control device, for smallpox vaccinations, and for tuberculosis testing.

Aaron Ismach

Prior to joining the USAMERDL staff, Ismach was an engineer for 10 years with the Armed Services Medical Procurement Agency in Brooklyn, N.Y. Retired now from the U.S. Naval Reserve, he served during World War II as an Army Air Corps instructor in aircraft hydraulic systems and later as a radio-radar officer with the Navy in the Pacific Theater.

Born in Brooklyn, he received a bachelor's degree in chemical engineering in 1941 from the College of the City of New York, a master's in the same field in 1953 from Polytechnic Institute of Brooklyn, and an MEE degree in 1959 from New York University.

Congressional Authorization Act Limits Major Weapons, RDT&E

(*Continued from page 3*)

delay or prevent, in emergency situations either within or outside the United States, the immediate disposal, together with any necessary associated transportation, of any lethal chemical or any biological warfare agent when compliance with the procedures and requirements of this section would clearly endanger the health or safety of any person."

Section 506 further requires that no chemical or biological warfare agent shall be disposed of within or outside the United States unless such agent has been detoxified or made harmless to man and his environment, unless immediate disposal is clearly necessary, in an emergency, to safeguard human life. In the event of such disposal, an immediate report to Congress is required.

Army Missiles. The $650.4 million authorized for Safeguard ABM System procurement is essentially for missiles and related costs (excluding costs of construction of housing for personnel, workers, etc.) for two more deterrent-protection sites.

For the TOW missile system, the Army requested $106 million. In considering this figure, the House pointed to the possibility of adapting the Shillelagh missile (designed to be fired from tanks) to a ground mode for the use of Infantry troops or to a heliborne mode. Consequently, the House approved $106 million for a heavy antitank weapon, but not specifically for TOW. The Committee on Conference approved $106 million for TOW procurement.

House and Senate differences developed also on the Improved Hawk Missile. The conferees agreed on $81.4 million, a restoration of $28.1 from the reduction voted by the Senate. The Army requested $90.3 million.

Complete accord was reached on the Lance missile, with the House and Senate approving the requested $30.8 million for procurement and $51.9 million for research and development.

The Army request for advanced ballistic missile R&D, totaling $158 million, was approved by the House, but conferees approved the $138 million authorization ($20 million cut) by the Senate.

SAM–D (Surface to Air Missile Development) funding for R&D requested by the Army totaled $89.3 million, a figure approved by the House but reduced to $74.3 million by the Senate. Conferees authorized $83.1 million. An additional $7 million for SAM/HIP was also approved.

Tracked Combat Vehicles. Controversy developed between the House and the Senate regarding the Army M60A1E2 tank development as a modification of the M60A1—primarily the addition of a new turret and barrel to permit firing of the Shillelagh missile and the 152mm caseless round.

The M60A1E2 incorporates the same basic firepower as the Main Battle Tank–70/XM-803. Within five years the Army has invested more than $250 million on M60A1E2 development as an essential interim missile-firing tank pending availability of the MBT–70/XM-803. For continued engineering and service testing, the Army requested $12.1 for FY 1971, a figure approved by the House, deleted by the Senate, but accepted by conferees.

Procurement funding of $67.6 million was requested by the Army for the M60A1 tank, an amount approved by the House, cut to $56.7 by the Senate, and restored fully by conferees.

Full agreement was reached on Army requests for procurement of the Gama Goat, in the amount of $73.0 million, and the M551 Sheridan ARAAV (Armored Reconnaissance Airborne Assault Vehicle) funded at $4.4 million.

R&D and procurement funding of $77.0 million for the MBT–70/XM-803 asked by the Army was approved without disagreement. However, House conferees expressed concern about a proposed engine program they termed a "derated" diesel engine based on technologies of the 1950s or early 1960s.

For this reason, the House conferees strongly urged the Army to proceed with the development of the gas turbine engine for the MBT on a basis "at least equal" to that of the diesel engine development.

Aircraft Procurement. The Army's request for $64.2 million for procurement of the AH-56A *Cheyenne* helicopter) was authorized without disagreement by the Senate and House. Similarly, requests for $41.6 million for the CH–47, of $38.1 million for the UH–1H and $37.0 million for the AH–1G received authorization.

For further research and development of the AH-56A *Cheyenne* helicopter, the Army requested and received authorization for an appropriation of $17.6 million. The Senate first disagreed with the House authorization, voting to delete the amount, terminate the program, and, instead, approving $17 million for R&D on the Advanced Helicopter Development Program.

In conference, the Senate receded from its position and restored fully the requested $17.6 million for further R&D on the Cheyenne.

With respect to allegations of competition for the role of close air support for the Army between the Air Force AX aircraft (for which R&D funding of $27.9 million was authorized), the Harrier aircraft and the Cheyenne, the House Committee on Conference stated:

"The conferees want to make their position perfectly clear and state unequivocally that they see no competition among these aircraft. The House conferees agree with the decision of the Deputy Secretary of Defense that these weapon systems are complementary and not competitive.

Noted in the Committee on Conference report is the acceptance of Senate reductions on all of "some 16 projects" of the Army, involving a total authorization reduction of $126.7 million, except for those on the Cheyenne and the SAM–D.

Defense Agencies. For agencies in this category, the conferees agreed on authorization totaling $452,800,000—$22.9 million less than requested by the Department of Defense and $7.9 million below the amount previously recommended by the House.

Conferees agreed to restore $7.8 million cut by the Senate from the House authorization for the Advanced Research Projects Agency (ARPA). This restoration "would be applied to the Defense Research Sciences Program in the amount of $4.8 million and to the Advanced Engineering Program in the amount of $3.0 million."

Interagency Council. One of the Senate amendments contained in a provision of Section 205 which, if enacted, would have established an Interagency Advisory Council on Domestic Applications of Defense Research, was deleted by the conferees —with the Senate "reluctantly receding from its position."

In discussing the Senate proposal, the point was made that the House bill contained no comparable provision. House conferees contended that there appears to be no need for a statutory council of this type "in view of the research coordinating mechanisms of the existing Federal Council for Science and Technology and, in particular, the Department of Defense-domestic agency study group formed under the Federal Council to accomplish this particular objective."

House conferees also pointed out that no hearings on such a proposal had been conducted by the House Committee on Armed Services.

ASAMRIID Seeks to Develop Therapy for Biological Agents

By Dr. William R. Beisel and Col Dan Crozier, MC

The President of the United States has stated that under no circumstances will this country employ biological weapons. Authority was given, however, to continue our efforts to develop an effective means of defense against these weapons systems.

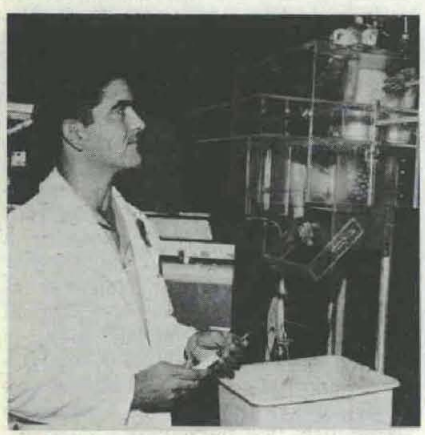
In July 1969, a group of consultant experts on chemical and biological weapons reported to the United Nations, "Effective measures of protection or treatment simply do not exist or cannot be provided on an adequate scale."

The task of developing workable medical defensive measures against biological agents constitutes the basic mission of the U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID), a major element of the U.S. Army Medical Research and Development Command.

Located at Fort Detrick in Frederick, Md., with an additional specialized laboratory at the Forest Glen area of Walter Reed Army Medical Center, Washington, D.C., USAMRIID has grown steadily in size and capability since its inception as the "Walter Reed Unit" at Fort Detrick in 1953.

The institute is administratively an element of Walter Reed Army Medical Center, funded by the U.S. Army Materiel Command, with technical direction a responsibility of The Surgeon General.

Many scientific disciplines are encompassed within the USAMRIID mission. Extensive capabilities have been established in the fields of microbiology, immunology, biochemistry, biophysics, molecular, biology, pathology and physiology, as well as in both human and veterinary medicine.



VETERINARIAN Capt William Harrison measures thyroid hormone responses during an acute infectious illness in rhesus monkey at USAMRIID.

Completion of the first phase of a new laboratory building recently provided three research divisions with a superb facility based upon the most exacting design criteria for studies involving all varieties of highly infectious microorganisms. Second-phase construction to house the remaining divisions of the institute will be completed in 1971.

Problems in the management of infectious diseases are faced by physicians of every specialty; medical aspects of defense against a biological attack must, of necessity, be directed against the same basic problems.

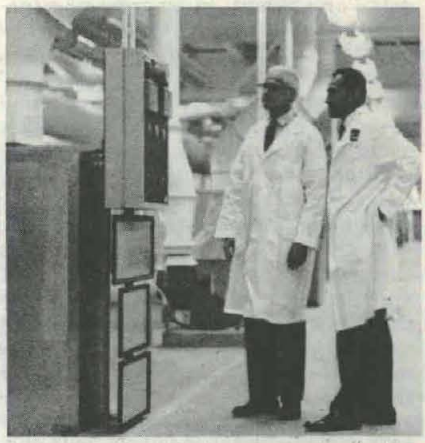
Application of fundamental concepts of therapy to a biological warfare situation will be unique only in that illness will develop unexpectedly in large numbers of people and may, based upon an unusual route of exposure, exhibit an atypical clinical pattern.

Under such circumstances, specific identification of the causative organism is without question the most important problem. The time required for laboratory identification by conventional techniques is simply not acceptable. Rapid identification would allow the physician to approach problems of timely treatment in an exact and specific fashion.

USAMRIID, for this reason, has directed a major portion of its research toward development of rapid diagnostic measures for a patient with an infectious disease. Metabolic responses of the host have been subjected to a detailed series of investigations, in the hope that some biochemical change might become detectable quite soon after invasion of the host by a pathogenic microorganism —even though symptomatic illness might not develop until after an incubation period of days or weeks. Such a change in an apparently healthy individual could indicate the presence of infection before illness is clinically evident.

Information was not available concerning the progression of biochemical events shortly after exposure and during initial phases of infection. Early USAMRIID studies therefore employed classical metabolic balance techniques in a prospective manner.

Extensive baseline control observations were obtained prior to the time of exposure so that even subtle post-exposure changes could be recognized. It was learned that the most prominent, infection-related metabolic responses of the host began in conjunction with the onset of symptomatic illness and were roughly proportional in magnitude to its severity and duration.



USAMRIID CO, Col Dan Crozier (left) and Dr. William R. Beisel, scientific director, check air handling controls in equipment space of new laboratory.

The changes occurring with illness were catabolic (or destructive) in nature and indicated a breakdown of body tissues. These illness-related changes were remarkably stereotyped, in that symptomatic bacterial, viral and rickettsial infections all led to similar patterns of nitrogen, electrolyte and mineral losses from tissues of the host, and a similar pattern of adrenocortical hormone response.

These changes, though prominent, were nonspecific and did not seem of positive value for indicating the presence of replicating or incubating microorganisms prior to the onset of symptomatic illness.

Concurrently, early USAMRIID studies of a metabolic nature provided initial evidence suggesting that other, more subtle biochemical changes were taking place during the early phases of incubating infectious illness.

Additional investigations were designed to learn more about the nature and pathogenesis of these early changes. In this way, a number of distinct biochemical alterations were recognized and are now being studied for application as possible means of determining the presence of an incubating illness.

Changes in tissue enzymes, in the concentration of free amino acids and trace metals in plasma, and in the composition of the plasma proteins have been found to occur during

incubating illness. In addition, invading microorganisms or their toxins cause certain cells of the host to release substances such as interferon and endogenous pyrogen into the blood stream.

Each type of response may be assumed to contribute in some manner to defense of the host. While of small magnitude, such changes indicate that invading organisms stimulate indirect early biochemical responses in many distant tissues and organs. Characteristics of these incubation period changes vary and depend in large measure upon the general classification of invading microorganisms.

An induction of hepatic cell enzymes, such as tryptophan pyrrolase and tyrosine transaminase, is characteristic of bacterial infections. Increases in the activity of these enzymes have been shown to require an increased production of RNA and the organization of necessary polysomes within these cells.

These phenomena require an expenditure of cell energy and are not representative of cellular breakdown, as might be indicated by rises in serum glutamic oxaloacetic transaminase or serum glutamic pyruvic transaminase.

Indirect means can be used to evaluate the activity of hepatic tryptophan pyrrolase in man, by measuring the urinary excretion of breakdown products of tryptophan metabolism. Since the excretion of these products was found to increase more than 10-fold during typhoid fever, these measurements may have diagnostic usefulness.

Other diagnostic possibilities involving enzyme analysis can be based upon changes in the enzyme activity of circulating white blood cells. Such studies are in progress.

BIOCHEMIST Dr. Robert W. Wannemacher Jr. and research assistant analyze plasma amino acids. Such studies have enabled investigators to pinpoint onset of early incubation-period biochemical changes and to correlate metabolic responses of host cells with pathogenic mechanisms of disease.

Whole blood amino acids have been studied during experimentally induced infections in humans by means of a relatively simple paper chromatographic technique. This makes it possible to study large numbers of samples from each individual and to recognize normal daily rhythmic rise and fall in concentration of these substances.

Infection-related changes in amino acid patterns were found to vary depending on the organism under study; some viral infections produced only a loss of normal rhythmicity. Such changes are now being subjected to closer scrutiny to define the role of specific individual amino acids in the pathogenesis of infection by different microorganisms.

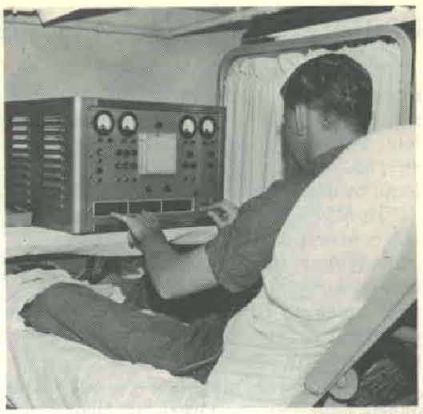
In the metabolism of certain trace elements, changes are among the earliest detectable responses following inoculation of man or an animal host with infectious organisms. USAMRIID studies revealed recently that the long-recognized depression of serum iron during infectious illness actually begins within a few hours of exposure. This abrupt fall in iron is accompanied by a similar depression in serum zinc.

The changes occurred with bacterial and viral infection, as seen in individuals who were shown to have been infected but who remained asymptomatic. Such changes appear to have diagnostic usefulness in that they do occur early, are reproducible, and serve to provide a biochemical indication that an infectious microorganism has entered the body of a host.

Current research seeks to determine if changes in serum iron, zinc and other trace metals are characteristic of invasion by a wide spectrum of microorganisms.

Another approach to the diagnostic problem involves attempts to detect early changes in plasma protein components. Procedures for routine electrophoretic analysis have been modified to permit side-by-side measurements of protein, glycoprotein and lipoprotein fraction.

Serum glycoprotein changes appear to differentiate among bacterial, viral and protozoan infections when symptoms are beginning to develop. Bacterial infections are characterized by a prominent increase in the α_2 glycoprotein fraction, with a smaller increase in α_1 glycoproteins. Changes are absent or are far less marked in viral illnesses.

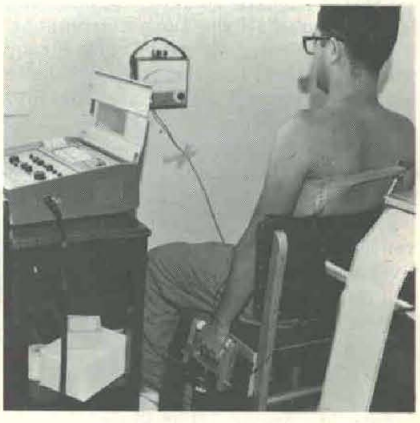


PROJECT WHITECOAT is tested for abilities to perform a battery of automated perceptional and mental tasks while induced with infectious illness.

In contrast, patients with malaria consistently exhibit a large and unique increase of an α_1 glycoprotein component while the α_2 fraction fails to rise or exhibits some decrease.

By means of approaches such as these, alone or in combination, it may become possible to recognize the presence of infection before symptoms have appeared. In such a situation, studies could be initiated to identify the specific causative organism so that early prophylactic and therapeutic measures could be instituted.

While a definitive system for defense against biological warfare has not yet been achieved, it does not mean that some medical care cannot be provided. The broad research program of USAMRIID is providing data upon which more specific defensive measures can be based. This work serves all of medicine by contributing at the same time to the fundamental understanding of infectious disease.



VOLUNTEER uses a hand dynamometer to measure effects of acute infection on his strength and endurance.

Conferees Weigh Army Role in Anti-Pollution R&D

(Continued from page 3)

mission is so important that we can afford to overlook pollution as a problem, since we have so many other and, on the surface, more important problems to deal with.

"In other words, besides our historical concern with military sanitary engineering, and safeguarding the troops against noxious agents, are we well advised to treat the pollution problem in the broadest sense as a military problem?

"The answer must be yes. To the extent we can help create problems, we have a responsibility to solve these problems. The Army, as a part of the democratic society, cannot ignore its responsibility to be responsive to society at large. The Army must be a good citizen. Today this means acting in ways that are responsive to mission and which at the same time do not unnecessarily contribute to pollution.

". . . The exemption of tactical equipment from pollution control standards where combat capability would be impaired is provided for in Executive Order 11507. The requirement for the Army to meet pollution control standards is not in conflict with insuring combat effectiveness.

"Exceptions can be made where abatement practices and designs threaten combat effectiveness; but claims for exemptions should be realistic and not employed as a device to escape the need for pollution control.

"As a scientist, I cannot help but believe that with sufficient imagination and insight we will discover, in designing to prevent pollution, we also are increasing combat effectiveness. However you look at it, pollution is waste. Waste means that you are converting something costly into something useful only in part, the remainder being waste.

"If that waste looks or smells bad, is toxic, or disturbs the environment, it is a polluting waste. Every bit of waste we create means that we have not converted our raw materials into useful end products.

"This means that there is no inherent natural law that says you must sacrifice combat effectiveness to solve pollution problems. If pollution prevention results in loss of combat effectiveness, what it does mean is that you lack the knowledge or imagination to prevent this.

"If it is lack of knowledge, this is what the Army R&D community is here for—to do the work that will eventually provide that knowledge. If it is lack of imagination, this is condemnation of person and organization. A boot in the behind to provide motivation, and retirement to make places available for new untired blood, will overcome the defect. . . ."

In closing, Dr. Lamanna stated: ". . . The onus for neglect should not be on the Army. What the Army can and should do, we have the responsibility of identifying. Today's meeting will help the building of a reasoned base for fiscal support of the Army's role in anti-pollution R&D—a program to be presented to those who have the authority to allocate resources for the effort."

Speaking as a representative of the Environmental Sciences Division, Office of the Chief of R&D, HQ, DA, Mrs. Frances Whedon detailed the functions of the division that are closely related to the problems of scientific control of pollution factors. She cited numerous ways in which the division can cooperate with other federal agencies to alleviate pollutant factors.

The Army Corps of Engineers has a dual responsibility in pollution abatement activities—in respect to military construction and materials and materiel objectives; also, with regards to Civil Works programs.

Fanning M. Baumgardner, deputy chief, Office of Plans, Research and Systems, Office of the Chief of Engineers, gave a presentation on "Impact of Environmental Considerations on Army Military Construction." He told of an in-depth study completed by the OCE on Nov. 4 to define and focus attention on all necessary efforts for responding to the National Environmental Act of 1970 and related executive orders and directives.

"Control of Pollution at Army Ammunition Plants" was the topic of Robert O. Mathern, a general engineer assigned to pollution abatement problems in the Installation and Services Directorate, HQ U.S. Army Munitions Command.

In 1967 when the U.S. Army initiated the 5-year program in air and water pollution abatement under Army Regulation 11–21, he said, the Munitions Command estimate to meet programed objectives was $35,000,000.

In 1970, MUCOM estimated costs are $150,000,000, due to escalation of costs, recognition of problems on a broader scale, and development of standards.

"Explosive manufacturing processes," he said, "produce the most serious problems in pollution abatement on a quantitative basis and from a lack of technology required for the solution of the problems. . . ."

Richard W. Cramer, a research architect in the Army Corps of Engineers' Construction Engineering Research Laboratory (CERL), described a number of the major environmental pollution problems within the purview of the Corps of Engineers.

Specifically cited by Cramer were some of the Corps of Engineers' problems of pollution that may be associated with development of facilities for the Safeguard ABM System. He told of a 1969 survey conducted by the Chief of Engineers that revealed the depth of the pollution problem at military installations, particularly ammunition plants and arsenals.

To cope with the situation, he pointed to "certain unique capabilities" that have been established by the Corps of Engineers; also, of established relationships with the construction design and scientific communities that, in a number of ways, enjoin efforts to solve environmental problems.

"Combat Developments Command Responsibilities and Plans," one of the major presentations, was classified SECRET and was given by Col E. R. Schowalter, chief, Plans and Programs Div., Materiel Directorate.

Responsibilities of the Office of the Army Surgeon General and U.S. Army Medical Service in respect to pollution control efforts were described by Lt Col William F. Gilley, OTSG. Col Donald L. Howie, chief, Life Sciences Division, OCRD, also commented on some of the problems of control of medical services pollution while discussing objectives of the meeting at its outset.

An Army Environmental Hygiene Agency presentation on its plans for pollution abatement R&D was given by Col R. J. Walsh.

Participants in the meeting included Col T. C. Winter as a representative of the Council on Environmental Quality, Executive Office of the President, and Col M. G. Patton, Acting Deputy Assistant Secretary of Defense (Environmental Quality); also, George A. Cunney Jr., a civil engineer serving as Army General Staff central point of contact for environmental quality actions.

Chief scientists or chief scientific advisers of numerous major Army commands or laboratories also participated in the discussion.

Included were Deputy and Scientific Director of Army Research Dr. Richard A. Weiss, Dr. Gilford G. Quarles, Office, Chief of Engineers, and David C. Hardison of the Combat Developments Command;

Also, Dr. Ernest W. Petrick of the Army Tank-Automotive Command, Harry L. Ammlung, Army Coating and Chemical Laboratory, and Dr. D. R. Freitag, WES.

AMMRC Scientists Envision Broadened Applications of Titanium

Broadened application of titanium to materials requirements is envisioned by scientists at the U.S. Army Materials and Mechanics Research Center, Watertown, Mass., with recent development of a potential for reducing its environmental reaction.

Titanium oxidizes at higher temperatures but AMMRC researchers report that it is now on the verge of entering service at temperatures above four-tenths of its melting point.

One task in an AMMRC research program is the examination of creep-resistance and stress-rupture characteristics of titanium-aluminum alloys for high-temperature use.

The AMMRC has been pioneering in titanium-alloy research since the early 1950s and is credited with numerous significant contributions to industrial utilization of such materials for military needs.

One of the anticipated uses resulting from recent research is in the compressor section of a gas-turbine engine (Fig. 1), the reason being that

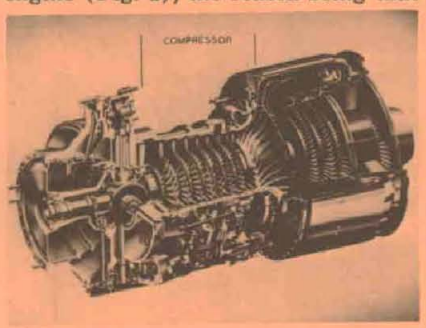


Fig. 1. T55-L-11 Gas Turbine Engine

reliability requirements tend to reduce cost as a critical factor in materiel improvement.

Engine design requirements call for a pressure gradient across the compressor that would create a temperature having a maximum in excess of 1,000° F. With respect to research goals, 1,000° F. is taken to be a minimum temperature at which strength requirements must be met.

Fig. 2 shows the improvement necessary in the strength-weight ratio at higher temperatures. Composites, at the lower temperatures, and nickel-base super alloys at higher temperatures, reduce the useful temperature range of titanium.

Raising the athermal stress component, investigators say, would shift the upper temperature limit to the right, placing titanium in direct competition with superalloys at temperatures around 1,000°F.

The band on the plot representing

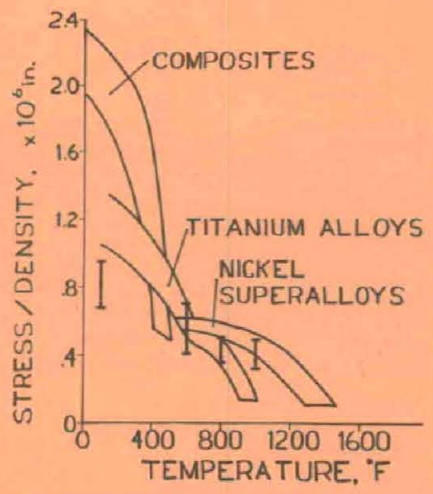


Fig. 2. Improvement Necessary in Strength-Weight Ratio at Higher Temperatures.

titanium includes primarily the alpha plus beta alloys most commonly used. The scatter bars, on the other hand, show a band for all alpha alloys currently in use or under development. The trend toward improvement in high-temperature strength is obvious.

In Fig. 3, the 2-phase diagrams represent additions of typical beta and alpha stabilizers to titanium. In the 2-phase region, the weight fraction of each phase present is dependent on the slope of the boundary lines.

The shallow slope common to the alpha plus beta region indicates a rapid change in the amount of each phase with temperature. Therefore, the size and, in fact, the distribution of a strengthening phase change rapidly with temperature.

For the titanium-aluminum system,

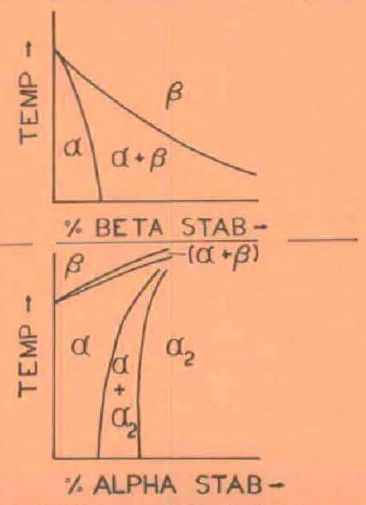


Fig. 3. Additions of Typical Beta and Alpha Stabilizers to Titanium.

multiple advantages for application exist. In Fig. 3b, the addition of an alpha stabilizer (aluminum in this case) ultimately creates a 2-phase region, alpha plus alpha-two. By directing attention to the range of aluminum concentrations about the left phase boundary, researchers can study the effects of: (1) solid-solution strengthening; (2) short-range-order effects near the boundary; and (3) precipitation of a second phase.

Titanium aluminide (alpha-two) is blamed for embrittlement of the 2-phase alpha alloys. This occurs because titanium aluminide is missing one slip system with respect to the surrounding alpha matrix. At high temperatures, however, additional slip systems would come into being that are expected to bypass the low-temperature cracking problems.

Oxidation resistance and erosion resistance required of titanium for use in turbine engine compressors are being examined as part of a companion program.

Research is directed toward utilizing titanium in a temperature region currently beyond its capabilities. Favorable results from the existing program will provide input to a development program to be carried out at the Army Materials and Mechanics Research Center.

WECOM Dedicates $4 Million Testing, Evaluating Facility

Four years of planning effort and a completed cost investment of about $4 million are represented in a new facility for testing and evaluating aircraft and light artillery armament that was dedicated Dec. 1 at HQ Weapons Command, Rock Island, Ill.

The facility houses two 1,000-inch firing ranges and two 100-meter firing ranges together with scientific instruments and devices for measuring and testing. Computers for analysis, data storage, data acquisition and recording have been installed. Environmental chambers are capable of temperature variations from 90° F. to 200 degrees above.

WECOM officials said it is the U.S. Army's first facility for simulating field mounts for weapon testing, and that its scientists will be able to apply modern science and computer techniques to armament development.

The facility is designed to enable WECOM researchers and engineers to develop improved gun-type armament up to 40mm for tanks, self-propelled artillery, armored vehicles and helicopters, more economically and faster.

Joint Service-Oklahoma S. U. Team Tests Fog Dispersion

A multidisciplinary approach to warm fog dissipation was launched recently by a team of Army, Navy and Oklahoma State University researchers at Arcata, Calif.

Present for the first tests were Col Richard C. Chabot, commanding officer and director of the U.S. Army Atmospheric Sciences Laboratory (USAASL), White Sands (N. Mex.) Missile Range (WSMR), and Dr. Pierre Saint-Amand, head of the Earth and Planetary Sciences Division, Naval Weapons Center (NWC), China Lake, Calif.

The joint Army/Navy research task force was led by E. Alex Blomerth Jr., chief Atmospheric Physics Division, USAASL and Dr. Richard Clark, director, Project Foggy Cloud III, Arcata, Calif.

"The better idea" they advanced, in brief, is to electrically charge each droplet of spray water (or other solution) to increase the chances of that droplet colliding and coalescencing with its neighbor.

The theory under test was that the larger the droplet the greater the coalescence cross-section, with correspondingly faster fall, thereby causing the fog to dissipate more rapidly. Studies had shown that it is reasonable to expect an increase in coalescence as the charge on each droplet increases. However, a real-life field test was needed.

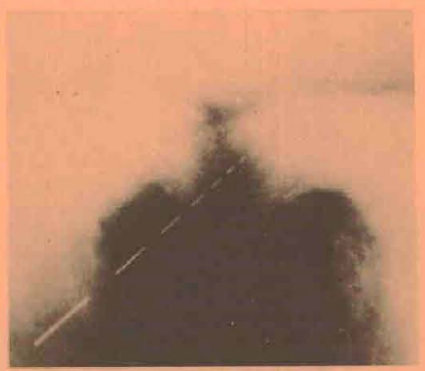
To test the theory, a foggy location with proper sampling equipment was required and Arcata, Calif., has for many years provided this setting. The U.S. Navy has established a fog dispersal test organization at Arcata headed by Dr. Richard Clark. Up to this time, experiments have mainly concentrated on testing various chemicals and water as fog dispersants from fixed-wing aircraft.

ASL brought to Arcata a CH54 Tarhe Skycrane Helicopter and the THEMIS Environmental Center team from Oklahoma State University, experienced in measuring the electrostatic field from an instrumented D–18 "Twin Beech" aircraft.

Flown to Arcata from Fort Sill, Okla., by an Army crew under CWO/4 James Oden, the CH54 added new ingredients to the test program. First was the addition of close station keeping and hovering on a specific point; second was the addition of high-velocity downwash; and third was the capacity to electrify the spray particles as they were released.

This later capability was created, instrumented and directed in a cooperative effort by a U.S. Navy Weapons Center and U.S. Army Atmospheric Sciences joint field team, led by Dr. Clifford Fountain of the NWC and Radon Loveland and David Dixon, USAASL.

Joint Service-Oklahoma State University research team testing fog dispersion theory includes (from left) Col Richard C. Chabot, CO and director of the Atmospheric Sciences Laboratory (ASL), White Sands Missile Range (WSMR), N. Mex.; Dr. Vincent S. Haneman Jr., U.S. Army Scientific Advisory Panel; E. Alex Blomerth, chief, Atmospheric Physics Division, ASL, WSMR; Dr. Richard L. Clark, director of Project Foggy Cloud III, Naval Weapons Center, China Lake, Calif.; E. J. Pybus, associate director, THEMIS Project, Oklahoma S.U.



DISSIPATED FOG shown above was the result of high-velocity downwash from a large helicopter using no other dispersant. Note downward swirl of fog and visibility of the runway caused by the downwash of the helicopter.

The O.S.U. THEMIS team operating the instrumented aircraft was directed by Emmett Pybus. This group normally has worked on severe storm (tornado) sferic studies in the Stillwater, Okla., area. At Arcata, however, their efforts provided the before and after information about the electrostatic field within the stratus clouds of the fog layers.

In addition, other laboratory, photographic and spray-rigged aircraft from Weather Science, Inc. at Norman, Okla., and McDonnell Enterprises of Lancaster, Calif., were used for various missions—ranging from direction of the seeding operations and cloud seeding to measurement of the cloud droplet concentration. Work was under contract with the Naval Weapons Center.

On the ground, a radar team from WSMR operated an M-33/T-33 radar complex that served to track particular seeding or laboratory aircraft as they made their passes. The team also monitored all the airborne traffic for safety of operation, and insured the safety of the aircraft during landing approaches to the foggy Arcata airfield.

The brief test program established that fog can be cleared by a combination of chemical spray into a helicopter downwash. The method works for stratus or fog layers up to 700 feet thick if there is no wind. The fog thickness that can be dispersed decreases as the wind speed of the fog increases.

While just a limited number of tests of the electrified spray apparatus were conducted in fog, tests showed that the local electric field was increased by an order of magnitude. At the same time, the local field did not appreciably spread or "leak off" into the surrounding fog.

In addition to those findings, the Oklahoma State team made further studies of the stratus boundary-layer charge enrichment and the sunrise effect in diminishing the electric field of the lower atmosphere. Researchers said the data obtained is considered significant and of direct benefit to this project.

Enough was learned at Foggy Cloud III, they said, to encourage continued efforts. The next step will be to make these methods operational.

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