HELLFIRE

ARMY RESEARCH AND DEVELOPMENT

November–December 1975

Army-Industry Missiles Meet Opens Drive For Materiel Manufacturing Cost Savings

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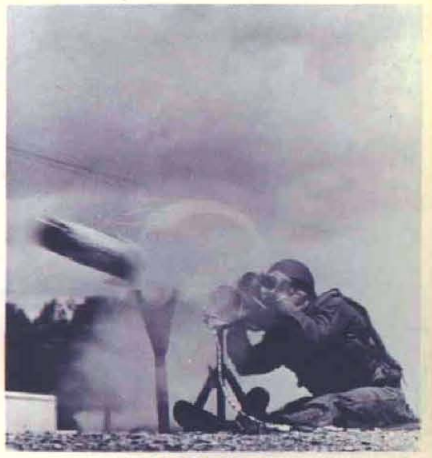

DRAGON

ROLAND

LANCE

STINGER

SPEAKING ON . . .

Manufacturing Technology Gains:

Teamwork Viewed Vital to Materiel Goals

Deputy Secretary of Defense William P. Clements gave a rousing keynote speech to about 255 representatives of Army-industry efforts to achieve critical advances in cost-reduction methodology at the opening of the Missile Manufacturing Technology Conference. This was a week-long intensive consideration of major problem areas and what actions appear most promising to yield the desired ROI (Return on Investment) payoffs. In his opinion, maximum teamwork of defense in-house scientists, engineers and top management, and their counterparts in industry, is essential to high-quality materiel at lowest practicable cost.

William P. Clements

I appreciate the opportunity to share my thoughts with you at the beginning of your manufacturing technology conference. My pleasure in joining you is twofold in that one of my primary responsibilities is to maintain a productive dialogue between industry and the Department of Defense.

Whether you call it the "military industrial complex" or the "arsenal of democracy," the relationship between the military forces and industry is a "partnership" of long standing and one which serves this nation well. In fact, I doubt whether this country could exist as we know it today without these continuing strong ties, and I am convinced our partnership is a great national asset.

I want to declare my support of the objectives of your conference which I define as: "To identify and exploit the possibilities for cost reductions in missile systems, by the development and application of new or improved manufacturing technology."

The reduction of weapon systems cost is an important goal of the Department of Defense. The current downward trend in Defense budget constant dollars, coupled with the record growth of weapon system costs, brings us to the somber realization that unless these budget trends are reversed, or unless new ways are found to reduce acquisition costs and life cycle costs, the United States could make itself a "second-rate" military power!

This year's defense expenditures will be less than six percent of the nation's gross national product, the lowest percentage since World War II demobilization. We now have 600,000 fewer men than the pre-Vietnam War period; the Navy is dropping below 500 ships in the active fleet for the first time since before Pearl Harbor; the Air Force is being reduced to the lowest level since before the Korean War.

All of these reductions must be viewed in terms of military balance with the Soviet Union, which has been moving in the opposite direction. The Soviets are increasing their military expenditures in constant dollars by about 5 percent each year. They are outspending us in every significant category of defense expenditures—25 percent more in procurement, 20 percent more in research and development, 20 percent more in general-purpose forces, *60 percent more* in strategic nuclear forces. They have increased their military force from three million to over four million men.

In the face of these facts, I find it impossible to understand those individuals who continue to insist that we should drastically and unilaterally reduce our defense budget and military forces still further! These people base their arguments upon the promise of detente. It is true that progress is being made in reducing East/West tension, but our defense planning must be based on Soviet capabilities, not their intentions!

This point was underscored by President Ford recently when he said: "Those who claim that America is over-armed and over-spending on defense are dead wrong. We cannot afford to cut any further without endangering our national security."

Most of the factors in the Defense Budget have assigned fixed values. The Defense Department has no control over inflation, nor over the Congressional Budget Committee. The Department does have direction over the manner in which its resources are utilized. "Lean, disciplined and efficient" must become the code words for managing the acquisition- and life-cycle costs of our systems. . . . That's why I support your efforts here. Cost reduction is what this conference is all about!

I congratulate the Army for moving out in this program and for their initiative in engaging so many weapons systems manufacturers in this effort. The gathering here will help us "zero-in" on high-cost factors in the production of missile systems, and will assist in the development of meaningful manufacturing technology projects.

Hopefully, this conference will not only define manufacturing production solutions to cost problems, but will also spotlight additional problems in design, standardization and specifications. Industry participation is vital. I am particularly pleased to see industry taking such an active role here today because weapons systems manufacturers are in the best position to identify and exploit cost-reduction opportunities.

You in industry must develop new or improved manufacturing technology in your own facilities that will accelerate response time and reduce the cost to "scale-up" to a production environment. It is reassuring to see that even though many of you are competitors, you are at the conference table discussing mutual problems and seeking solutions. All of us have a stake in the success of your endeavors. We will all benefit from the results of this conference.

As many of you know, I recently signed a letter to each of the service secretaries expressing concern about the critical cost problems which we face. I asked each of them to report to me regarding their specific actions and plans to reduce weapon systems acquisition costs. The memorandum directed that a new cost-reduction initiative be started to identify and exploit manufacturing technology cost-reduction opportunities.

This initiative will strengthen the thrust of the Department of Defense manufacturing technology program and raise its funding level significantly. The DoD manufacturing technology program is designed to develop and apply new or improved manufacturing techniques, processes, materials and equipment.

The objective is to provide for the production of cost-

(Continued on page 38)

ARMY RESEARCH AND DEVELOPMENT

Vol. 16 No. 6 November-December 1975

ABOUT THE COVER:

Army-Industry partnership effort to make significant advances in efforts to cut costs of producing high-quality combat-ready materiel, characterized by rugged reliability, simplicity of operation and maintainability for reduced training needs, was stressed at a week-long conference devoted to technological advances in missiles manufacturing. Results termed "highly successful" set the stage for similar conferences on other materiel.

GLOSSARY: MANPADS (Man-Portable Air Defense System, possible Stinger alternate), ILAW (Improved Light Antitank Weapon), SEAS (Selected Effects Armament System), CLGP (Cannon Launched Guided Projectile), LRGM (Long Range Guided Missile), TFGM (Tank Fired Guided Missile), TGSM (Terminally Guided Submissile), TOW (Tube Launched, Optically Tracked, Wire Guided Missile), GSRS (General Support Rocket System), ATI (Advanced Terminal Interceptor).

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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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FEATURES

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Selective Scanner . . .

Rumsfeld Appointed Secretary of Defense

Donald Rumsfeld

Donald Rumsfeld has been nominated by President Ford and confirmed by the Senate to succeed James R. Schlesinger as Secretary of Defense.

Rumsfeld has been serving since September 1974 as Assistant to President Ford, following a prior assignment as head of the President's White House transition team.

Graduated from Princeton University in 1954 with a BA degree in politics, Rumsfeld has received honorary law degrees from Park College, Lake Forest College and Illinois College. He was a U.S. Naval aviator from 1954-57.

Listed among his previous government positions are U.S. Congressional Representative from the 13th District of Illinois; Director of the Office of Economic Opportunity; Counsellor to the President; Director of the Cost of Living Council; and U.S. Ambassador to the North Atlantic Treaty Organization.

While assigned as NATO ambassador, he served as the U.S. Permanent Representative to the North Atlantic Council, the Defense Planning Committee, and the Nuclear Planning Group. Rumsfeld was also a cofounder of the Japanese-American Inter-Parliamentary Council.

CDEC Evaluating 3 Key Antitank Weapon Systems

Continuing evaluation of the TOW (Tube-Launched, Optically Tracked, Wire-Guided), the Dragon and the Shillelagh antitank weapon systems is in progress at the U.S. Army Combat Developments Experimentation Command, Fort Ord, CA.

Data being gathered in target evasive maneuvers (three target vehicles, each with a different level of mobility) will be used to analyze the extent of missile performance due to evasion. The question: How well can antitank gunners track evasive targets?

Lowest of the targets in degree of mobility is the M60A1 tank, which provides a base for comparison with the XM-808 "Twister," two bodies joined by a pivotal yoke permitting free pitch, yaw and roll movement, and the tracked XM-800 armored reconnaissance scout vehicle.

All four tracking systems used in the experiment are collocated and will track a single target during a given period. A basis for comparison of resulting data was provided by the Army Materiel Systems Analysis Activity. AMSAA developed computer models to simulate antitank missile firings at targets conducting hundreds of evasive tactics. Each systems's performance was measured, assuming zero gunner tracking error.

Computerization Cuts MICOM Electrical Costs

Computerized management of electrical energy at HQ U.S. Army Missile Command, Redstone Arsenal, AL, accounted for a saving of $59,593.48 for the most recent 30-day billing period—a reduction of 3,376,684 kilowatt hours.

The report states that this economy was accomplished by computerized cut-off of air handling units in 125 buildings for a total of 435 hours of shutdown during weekends and at night. Several days of "down time" for the computer prevented greater economy.

Placed in operation Sept. 1, 1975, the power management computer reportedly was still in only partial operation as of early November. A capability of controlling power consumption according to demand during work days had been used only in test operations at that time.

Savings on heating fuel comparable to the economy on air conditioning units are anticipated when a "winter control strategy" plan goes into effect. Expansion of the system to include an additional 75 buildings (200 total) is in progress to provide a "computer controlled climate" for the arsenal, which is the largest user of electricity in the Army and the fifth largest in the Department of Defense.

MERDC Initiates J-SIIDS Hotline Assistance

Joint-Service Interior Intrusion Detection System assistance can be obtained on a 24-hour basis by calling the J-SIIDS Hotline, Autovon 354-2085 or commercial 703-664-2085. After duty hour calls will be recorded for response the next day.

This Hotline for J-SIIDS users is operated by the system's developers at the U.S. Army Mobility Equipment Research and Development Center (MERDC), Fort Belvoir, VA. J-SIIDS provides protection for arms rooms against actual or attempted intrusion and equipment tampering.

Consisting of a family of intrusion, duress, and pilferage sensors, monitoring and display equipment, J-SIIDS provides a secure data transmission system and an audible alarm. The system is type classified standard for use in arms rooms.

MERDC is a Development Center reporting directly to the Army Materiel Command. Responsibilities include research, development, engineering and first-production buys of materiel for combat, mobility and logistic troop support. This includes physical security, tactical sensors, countermine, camouflage, bridging and wastewater treatment.

EPA Grants $190,000 for Cancer/Pollutants Study

Cancer incidence as related to exposure to industrial pollutants will be investigated under a $190,000 contract awarded recently by the U.S. Environmental Protection Agency.

Results of a 4-year research effort by the National Cancer Institute suggest that a "strong link" does exist between some types of cancer and certain types of industrial pollutants. Similar conclusions have been indicated by the National Academy of Sciences and the Labor Department's National Institute of Occupational Safety and Health.

Building on these earlier efforts, the new EPA study under contract with Systems Sciences Inc. will attempt to identify counties in the United States which have experienced unusually high mortality rates from major types of cancer. Locations of pollutants will then be mapped and correlations clarified.

HQ ARMCOM Modifies Port Firing Weapon

The XM231 Firing Port Weapon is being modified by HQ Army Armament Command engineers to improve reliability and target engagement capability before it enters Phase II development testing in the near future.

Potential of the weapon, basically a modification of the M16A1 rifle, was demonstrated during Development Test I in 1974. The change of the basic M16A1 mechanism resulted from application of Computer Aided Design techniques by the Army Ballistic Research Laboratories, Aberdeen Proving Ground, MD, and has been verified by engineering development testing.

When mounted on the Mechanized Infantry Combat Vehicle (MICV), two weapons on each side and two in the rear will provide suppressive fire required of vehicular-mounted weapons. Standard 5.56mm, M193 and M196 cartridges will be used.

Rodman Laboratory project engineers John Post, Dick Marsyla and Robert Dalquist are credited with carrying major responsibility for advancement of the XM231 at HQ ARMCOM.

AMC Announces 1976-77 Graduate CAD-E Training

Applications are being accepted from U.S. Army Materiel Command civilian employes qualified for the AMC-sponsored 1976-77 Graduate-Level Training Program in Computer Aided Design and Engineering at the University of Michigan.

Requests must be received at AMC headquarters by Jan. 9, 1976 and the 12-month in-residence course at Ann Arbor will begin in June. Selected applicants will be notified in March.

Candidates will be screened by the AMC Research, Development and Engineering Directorate. Final recommendations for selection of 15 to 20 students will be made by the AMC Executive Development Board.

Arranged to meet the needs of AMC civilians working in design and engineering functions, the course provides instruction in the theory of computer operation, programing, and hands-on practical experience. Satisfactory completion of a thesis project is a requirement and a master of engineering or master of science degree is awarded upon graduation.

The CAD-E education program is also planned to prepare the graduate to serve as an advisor/consultant on computer-aided technology within his command or laboratory.

Selection criteria include a minimum of three years recent work experience in design/engineering which reflects employe potential for CAD-E and computer-aided technology functional use within AMC; a bachelor's degree in engineering, chemistry, physical science or mathematics (minor credits in engineering), undergraduate grades of "B" or better (exceptions possible), and Federal Service career status.

Recognized as a U.S. leader in the computer sciences, the University of Michigan was one of the first universities to engage in computer science in a major way, beginning in the late 1950s.

Directive Orders Monthly PMs Status Reports

Deputy Secretary of Defense William P. Clements Jr. has directed project managers of 59 major weapons systems to submit monthly status reports directly to him in order to provide a precise and accurate summary of progress and problems.

PMs are required to write a personal letter to the Deputy Secretary informing him of "those things that in your opinion are pertinent to your program." The nonstructured reports, directed as "candid and forthright," (are) . . . "internal communications."

Deputy Secretary Clements emphasized that he has no intention of relieving the Services of responsibility of correcting problems—that he desires only to "monitor timely program development (and) influence directly a problem before it becomes too serious."

Another objective is to furnish him with information to provide a means to ascertain and share good ideas of each of the Services and to indicate to industrial leaders importance on project managership at the highest DoD levels.

TCS Device May Ease Communications Problems

Mother Nature in her wildest moments of atmospheric turbulence that can raise havoc with ultrahigh or very-high-frequency radio signals is rivaled by a Tactical Channel Simulator.

TCS was developed by Army researchers in the Signal Processing Technical Area of the Electronics Command Communications and Automatic Data Processing Laboratory. The device enables engineers to test and evaluate communications systems in almost all operating conditions under "controlled and repeatable laboratory conditions," ECOM reports.

The TCS simulates adverse radio signal propagation conditions such as multipath transmission and fading; also, actual channel perturbations caused by the effect of slow-moving vehicles, low-flying aircraft, and environmental conditions on a "real-life" communication path.

Evaluation of suggested changes of the Army's AN/VRS-12 vehicular radio set for specific U.S. Marine Corps Requirements was accomplished recently in joint testing. Using the TCS were the Naval Research Laboratory, Electromagnetic Systems Laboratory Inc., and the ECOM Communications/ADP Laboratory.

SAM-D Completes Major Proof of Principle Tests

SAM-D intercepted an unmanned supersonic F-102 jet fighter and knocked it down in flames at White Sands (NM) Missile Range early in November. Test results were so good that the Army was able to skip one minor flight test objective. Test engineers had planned some radar commands to have the missile perform maneuvers after intercept.

During the first 6 firings, SAM-D met test objectives that included intercepts against maneuvering and nonmaneuvering targets, targets flying in formation, and a target at low altitude in ground clutter. The Deparment of Defense has announced the Army's SAM-D air defense missile system "has officially completed all major requirements of its PoP test program."

Army SAM-D Project Manager MG Charles F. Means recently presented special 10-year certificates to 20 of the 55 civilian employees in the original project team formed a decade ago. The SAM-D staff currently numbers 181 civilians and military.

CLGP Launch Achieves 'Major Milestone'

Achievement of a "major milestone" was announced when a cannon launched guided projectile (CLGP) recently scored a direct hit on a stationary target tank located five miles distant during tests at White Sands (NM) Missile Range.

Targeted by a laser beam carried in a small remotely piloted vehicle (RPV), the CLGP is an artillery shell developed for the U.S. Army. Previous used only ground-based laser designators.

Responsibility for the RPV development program is assigned to the U.S. Army Aviation Systems Command (AVSCOM), St. Louis, MO. Designated the PRAEIRE IIA, the mini-RPV used in the recent tests was designed by the Aeronutronic Division of Philco-Ford Corp. The CLPG was developed by Martin-Marietta.

The RPV flew at 1,500 feet at a speed of 50 knots and located the target via a television camera. Technicians monitoring the aircraft activated the RPV's laser beam, thus marking the target's position and signaling the artillery to fire.

The mini-RPV is one of a series now being tested by the Army for possible use in surveillance, target acquisition and reconnaissance, and to improve the effectiveness of the guided artillery round. A successful RPV also could minimize the risk to a forward observer team by permitting them to designate targets for the CLGP from positions located behind the forward edge of the battle area.

COL Frank P. Ragano, HQ U.S. Army Armament Command, Rock Island Arsenal, IL. is assigned as the U.S. Army Materiel Command project manager, Cannon Artillery Weapons Systems.

Researchers Report on Laser Beam Welds of Alloys

Less than a millionth of a second exposure of a laser beam to a weld zone in aluminum and other metal alloys may strengthen it to the same extent as the metals being joined, research under a National Science Foundation grant indicates.

As announced by the NSF, Battelle Columbus Laboratories researchers Drs. Barry P. Fairand and Allan H. Clauer have been investigating this laser beam application in a 2-year study funded by an $85,200 grant. They reported that they have successfully shock-hardened iron and aluminum alloys, and have strengthened aluminum alloy weld zones.

Eventually, they expect that laser beams may be used to shock harden the surface of metals such as gears and ball bearings to increase durability.

Investigations will be extended to new alloys and the researchers expect to develop an improved theoretical model for predicting the shock produced by lasers. Another objective is to treat th surface of metals so laser energy can be more effective.

R&D News . . .

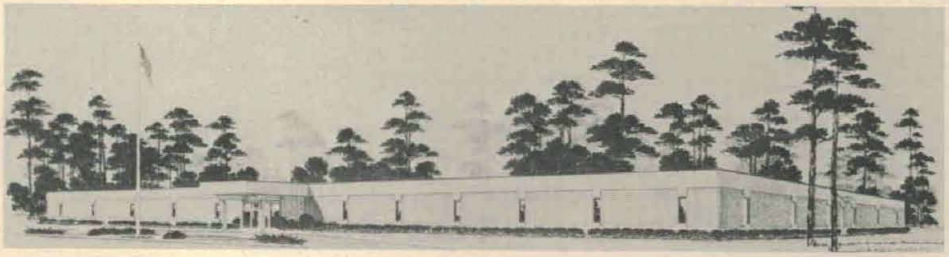
Army Research Office Building Dedicated as Weiss Memorial

Pride is one of those rare words that seldom can be overworked as a motivating factor in making the wheels of progress turn at optimum speed—with respect to manpower, facilities and financial resources—which serves to explain why dedication of the Dr. Richard A. Weiss Building means much to many people.

That pride augurs well for the future of the U.S. Army Research Office in its new home, the Dr. Richard A. Weiss Building in Research Triangle Park. One of the nation's largest (more than 6,500 acres) and most modern scientific and industrial centers, RTP is located about 12 miles from Durham, NC.

Participating in the dedication ceremonies was an imposing array of Department of the Army and Department of Defense dignitaries, as well as a great many friends of the late Dr. Richard A. Weiss. They shared a deeply moving personal feeling; to them he was not only an exceptionally gifted scientific administrator, a research scientist, and inspirational leader of rare talent but always, above all, one of "God's gentlemen" in conduct.

SPECIAL ASSISTANT to the Commanding General, U.S. Army Materiel Command, MG Charles D. Daniel Jr. was luncheon speaker at dedication ceremonies.



Throughout the U.S. Army research and development community in the United States, as well as internationally through his cogent comments with respect to problems pressuring many NATO working groups and committees on which he served for years as a member, Dr. Weiss was regarded as "a friend deserving of trust, and respect and staunch support."

Add that estimable reputation to the proud traditions of the U.S. Army Research Office (originated in 1951 as the U.S. Army Office of Ordnance Research, until redesignated as ARO-D Jan. 16, 1960) and with respect to the future you should have "a winner all the way."

Army Materiel Command leader GEN John R. Deane Jr. recognized this combination and its potential importance to the Army's basic research program of contracts and grants in the future. He participated in the dedicatory flag-raising and ribbon-cutting ceremonies and followed as the keynote speaker at ceremonies in the ARO auditorium.

GEN Deane commented on his satisfaction about being with the success of LTG George Sammet Jr., MG Charles D. Daniel, Jr., Dr. Ivan R. Hershner and numerous other Army R&D leaders in persuading Congress to appropriate money to keep ARO in the Durham area in a new building in Research Triangle Park. When it became necessary to relocate away from the Duke University campus, several sites in other states became contenders.

(LTG Sammet was at that time Deputy Chief of R&D, HQ Department of the Army, and is now Army Materiel Command Deputy CG for Materiel Development. MG Daniel was Director of Army Research and is now special assistant to GEN Deane. Dr. Hershner was chief of the Physical and Engineering Sciences Division, ARO-Washington, later (1973) merged substantially into ARO.

GEN Deane mentioned that his continuing high esteem for Dr. Weiss as a scientific programs administrator began when they became associated on a working basis during the regime of LTG James Gavin as the first Chief of R&D.

Mrs. Richard A. Weiss stands beside plaque honoring her husband. The plaque reads: Dr. Richard A. Weiss (1910-1974) a physicist whose thirty-one years with the Army included pioneer work in nucleonics and on the atomic bomb, leadership of the Army Science Conference from its beginning, and responsibility as Deputy and Scientific Director of Army Research, he will be remembered as a man who achieved the highest in scientific excellence and loyal citizenship, who had both the courage to lead and the humility to serve. In his honor, the Department of the Army dedicates this installation.

WEISS GRANDCHILDREN (front row). Second row: COL William J. Lynch (USA, Ret.), former USARO commander; Mrs. Cathy Cook, daughter of Dr. Weiss; Mrs. Weiss; Dr. Ivan R. Hershner Jr., assistant director for Research Programs, ODCSRDA; and Mrs. Chris Gorman, daughter of Dr. Weiss.

DEDICATION DIGNITARIES (l. to r.) MG Howard H. Cooksey, deputy chief of staff for Research, Development and Acquisition; GEN John R. Deane Jr., AMC commander; COL Lothrop Mittenthal, commander of the U.S. Army Research Office; and LTC Edgar J. Downing Jr., the executive officer of the USARO.

When LTG Arthur J. Trudeau succeeded Gavin and the ARO-Washington was established in early 1958, Dr. Weiss became the first deputy and scientific director of ARO-W—a title he retained until he retired in June 1972. He died Mar. 18, 1974, at age 64.

In referring to ARO's planned continuing importance, including expansion of its functions and funding, GEN Deane stressed that it will perform as a center of the Army's basic research program through contracts and grants. He explained, in part:

"Why do we need ARO? It is clear that we need a strong technology base. In any conceivable major conflict, the U.S. Army will be outnumbered in men, tanks, artillery, and many other weapon systems. In short, we must have superior technology to produce combat materiel of critically superior quality. . . ."

GEN Deane turned to the reliance of the Army—through an effective contracts and grants program administered largely by ARO—upon U.S. leading educational institutions, research institutes and industrial research centers; also, a strong structure of Army in-house laboratory competence for interface in strengthening the cooperative effort in building the technology base.

Among many weapons systems that have been produced as a product of a strong technological base for Army materiel advances, GEN Deane listed the laser-guided bomb ("smart bomb") turned over for Air Force use in the Vietnam War, night vision devices, high-strength steels for cannons and armament, improved combat helicopters, greatly improved munitions, and the SAM-D (Surface to Air Missile Development) defense system.

In view of ARO's excellent record for selection of research efforts that have had outstanding return on investment (ROI) applications in superior combat materiel, GEN Deane said: "We have decided to increase ARO's budget significantly over the next few years. I trust we will continue to get a good return for our investment, and I believe that Dr. Richard A. Weiss would be pleased."

Praise born of a close working relationship with Dr. Weiss came also from Dr. Marvin E. Lasser, Department of the Army Chief Scientist and Director of Army Research. Dr. Lasser succeeded Dr. Harold Weber as Army Chief Scientist in June 1966, and also took over his function as presiding chairman of the Army Science Conference.

Dr. Weiss originated the concept of the ASC, first held in June 1957, and served continuously, until he retired in June 1972, as general chairman of the arrangements. The 1974 ASC was declared a memorial to him.

"First of all, I am proud to say I knew Dick Weiss well. He was great to work with. I am appreciative of the opportunity to honor such a great person," Dr. Lasser said before launching into a discussion of the future as well as the past importance of ARO in R&D.

Dr. Lasser said with respect to ARO's future role, the recent major change in the Army philosophy of management is that ARO now has a lump sum annual budget for the first time, rather than funding for specific programs. This means that ARO has the authority to determine directly how the money shall be spent, and full responsibility for success of its mission.

Representing the Office of the Director of Defense Research and Engineering as guest speaker was Dr. John L. Allen, Deputy Director for Research and Advanced Technology. Introduced by ARO Commander COL Lothrop Mittenthal, who presided as chairman of ceremonies after making welcoming remarks, Dr. Allen added to the acclaim of ARO-sponsored achievements over a long period. His duties in maintaining an oversight of research programs of the Army, Navy, Air Force and Marines, he explained, serve to validate his viewpoint of ARO's excellent performance in programing research that has paid off in a high ROI.

After reviewing briefly his observations regarding how the Military Departments conduct their R&D programs, he concluded by saying that results of detailed evaluations have established ARO's right to be proud of achievements.

The challenge of ARO's programed increases in funding over a period of several years to expand its program of basic research contracts and grants, Dr. Allen stated, is "to continue to run a tight ship, to keep up the fine work."

Army Deputy Chief of Staff for Research, Development and Acquisition LTG Howard H. Cooksey concluded the ceremonies in the Dr. Richard A. Weiss Building auditorium with brief remarks before unveiling the large bronze memorial plaque that will greet all who enter the lobby. He stated:

"Today is a fitting tribute to the memory of Dr. Richard A. Weiss. I knew him well for 20 years. He was unique, as demonstrated by his dynamic leadership, his superior scientific and administrative knowledge, his organization of the Army Science Conference, his judgment in programing research. He led the research efforts of the Army with a dedication that the Army Research Office has inherited. Let us all work to continue successfully this effort."

MG Charles D. Daniel Jr. concluded the dedicatory tributes as the luncheon speaker. He acclaimed the high degree of professional competence of the ARO staff of scientists, pointing particularly to those doing research on their own as well as contributing to the monitoring and evaluation of proposals comprising ARO's over-all program.

Invited Dignitaries attending the ceremonies, in addition to the speakers, included Mrs. Richard A. Weiss (widow of Dr. Weiss), Army Materiel Command Deputy for Science and Technology Norman L. Klein, AMC Deputy Director of Research, Development and Engineering Dr. Richard L. Haley, Army Engineers Chief of R&D William B. Taylor, Chief of Naval Research RAdm Robert K. Geiger, and Director of the Air Force Office of Scientific Research Dr. William L. Lehmann.

Present also were AMC Deputy Director for Research COL John E. Wagner; Assistant Director for Research Programs Dr. Ivan R. Hershner, Office of the Deputy Chief of Staff for Research, Development, and Acquisition, HQ Department of the Army; and mayors of three North Carolina cities close to the Research Triangle Park—Clarence Lightner of Raleigh, Howard Lee of Chapel Hill and James R. Hawkins of Durham.

Army R&D Newsmagazine Marks 15th Anniversary

Skeptics were numerous in predicting in December 1960 when a modest 24-page edition of the *Army Research and Development Newsmagazine* made its introductory appearance—with insignia of the seven Technical Service on the front cover along the binding edge—that it would not long endure.

They doubted that, even as the "voice" of the Army R&D community represented by those Technical Services (six of which were merged with respect to R&D missions into the Army Materiel Command in August 1962), sufficient newsworthy and helpful information could be maintained to interest readers.

Our profound appreciation goes, upon the occasion of our 15th anniversary edition, to the continued loyal support of our readers—even though we went through a rather thorough "face-lifting," consistent with advancing age, in January 1972 and a much more severe "operation" by the Army Ad Hoc Periodicals Authorization Review Committee.

When the latter "catastrophe" for the editorial staff occurred, our distribution (by demand certified on DA Form 12-4 by using installations) was consistently around 60,000 copies monthly. Monthly editions were 52 pages. That same committee, however, granted special permission for this anniversary edition to return from 36 to 52 pages, for which we are most grateful.

The editor's appreciation goes also to a great many unpaid contributors of byline articles, to information and public affairs officers at all Army R&D activities, and many other news sources who have helped to provide material of consistently valuable interest in communicating R&D "events or happenings."

Finally, the editor gives a public Pat-on-the Back (shoulder high) to editorial staff members Mrs. Thelma Heisler, 15 years service; George Makuta, 14 years; and Harvey Bleicher, 4 years. The staff of four is the same in size as in 1960.

The Newsmagazine started as a Department of the Army periodical and is still chartered to be equally responsive to R&D activities of the Army Materiel Command, the Army Medical R&D Command of the Office of the Surgeon General, and Office, Chief of Engineers.

Comments on how well we are or are not performing our mission are invited.

Engineering Development Competition Ends . . .

NVL Awards Contract for DT/OT II Sights

Competitive contractor Engineering Development (ED) over 14 months to procure Development Test/Operational Test II units of four night vision sight systems ended with the recent award of a contract by the Night Vision Laboratory of the Electronics Command, a part of the Army Materiel Command.

The contract with Texas Instruments Inc. provides for delivery of DT/OT II NV sights for TOW (Tube Launched, Optically Tracked, Wire Guided Missile), NODLR (Night Observation Device, Long Range), and GLLD (Ground Laser Locator Designator) systems.

Procurement of a night-vision sight for the Dragon Antitank Weapon is delayed pending successful completion of the interface bracket design, being performed under separate contract. Modification of the contract to include DT/OT II units is expected early in CY 1976.

The May-June 1974 edition of the *Army Research and Development Newsmagazine* featured Army efforts, as assigned by the Department of Defense, to develop a new family of advanced night vision systems having commonality of major components for differing requirements of U.S. Armed Services.

Initiated and conducted by the NVL, selected in 1974 as the "Army In-House Laboratory of the Year," this effort is directed to development of a basic set of building block components to meet thermal imaging system needs in a broad variety of applications.

The goal is to make systems available to the services at an "affordable" price by reducing: initial acquisition costs through volume production of basic components; maintenance support and training costs through standardization of system design and parts; future R&D costs by controling proliferation of alternate design; and requiring the use of standard building blocks wherever feasible.

The concept and objectives were endorsed formally by the DoD Joint Logistics Commanders on July 9, 1974. Initial objectives have been realized for manportable class applications, following successful completion of the ED competitive phase for three of the four basic systems.

Commonality modules development for the manportable class will result in procurement of approximately 17,000 night sights over the next five years. The photo at the right shows the common modules—detector, cooler, scanner, display, electronics, and internal optics. The TOW night sight, mounted above the day tracker, is shown on the outside back cover. This engineering development of high-performance common modules reportedly meets user requirements at one-half the cost estimated for a TOW thermal night sight tailored to this application.

Manportable-Class Commonality Modules

Total commonality of high-technology components across all manportable systems promises significant savings in life-cycle operating costs, in addition to initial procurement economies.

The parallel scan modules selected for use in the manportable family are already in use by the Navy in the Mark 68, A–7, OV–10 and P–3 programs, and in the Air Force AAQ–9 program. They also are under consideration for other DoD programs (see TIRE in this issue).

Army NVL officials, stated that during this time of decreasing military budgets, this successful effort on the part of the developer to provide full functional units at reduced cost is extremely encouraging, as is the cooperation among the U.S. Armed Forces to provide this potent new night vision capability for continuous 24-hour combat operations.

TIRE Sensor Upgrades Night Combat Operations

Improvement in night operational capability of combat vehicles is represented by the Tank Infrared Elbow (TIRE), an upgraded far infrared night vision sensor under Army Night Vision Laboratory development.

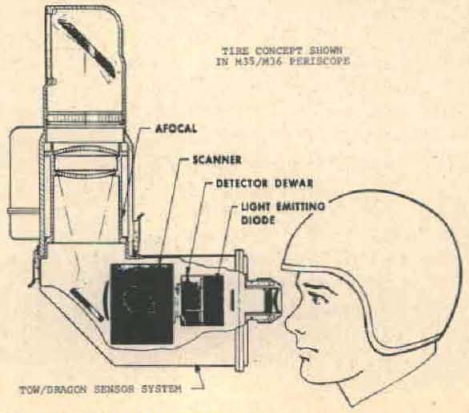
NVL established feasibility of the TIRE concept during FY75 with a technical analysis of performance, cost, risk and logistic trade-offs. This 3-5 micron system, using for expediency components developed under another program, displayed improved performance compared to the other periscopes tested.

The emergence of newer 8-14 micron technology, and the expected cost reduction due to large quantity production of common modules, makes the current TIRE concept a more viable approach under ambient conditions further degraded by smoke, dust and weapon muzzle flash.

TIRE will utilize far inrared common modules designed primarily for man/portable night sight applications, such as the TOW and Dragon missile systems. By taking advantage of this large-volume production, a high-performance far infrared sensor for combat vehicles can be produced at relatively low cost.

Current plans call for configuring TIRE as a direct replacement for the near infrared channel common in all M32, M35 and M36 periscopes on combat vehicles employing conventional fire control. Possible use in serving as a night elbow for future combat vehicle periscopes is being investigated.

Typical candidate combat vehicles for TIRE applications include the product-improved M48A5 Tank, the Standard M60 Series Tank, and the XM723 Mechanized Infantry Combat Vehicle (MICV). Additionally, the TIRE concept can be applied to the night channel of an integrated day/night periscope designed for use on the M60A2 Tank and the M551 Armored Reconnaissance Airborned Assault Vehicle (ARAAV).



Utilizing the common infrared components of the TOW Thermal Night Sight (TTNS), TIRE is also a prime candidate night channel for periscopes currently under consideration for TOW Under-Armor System Application.

TIRE is not being considered for Main Battle Tank applications like the M60A1(PI) and XM1 since these vehicles require a full fire control capability and greater performance than the TIRE can provide. Main battle tank night applications will be provided by the Tank Thermal Sight being developed by NVL for the Project Manager, M60.

Target Signature Workshop

The Night Vision Laboratory conducted a Nov. 18-19 Target Thermal Signature Workshop under the auspicies of the Technical Cooperation Program (TTCP) Subgroup WAG-1 at Fort Belvoir, VA. The workshop included presentations by representatives from Australia, Canada, United Kingdom and the U.S.

Searchlights for Combat Vehicles

Development of high-powered searchlights for armored vehicles is a part of the Army Night Vision Laboratory's over-all mission of providing adequate illumination for all night combat situations. Evolutionary progress in recent years has centered on smaller, lighter, brighter, low-voltage-start lights.

NVL scientists developed the first fully automatic high-intensity searchlights in the 1960s, including a pioneering compact xenon arc lamp. The photo at right shows, in decreasing order of size, the AN/VSS-3A, AN/VSS-1, and AN/VSS-4 XE. Technological advances have achieved reduction in size and weight without reducing capability; the newest is a low-voltage-start xenon arc lamp.

The first family of sealed-beam xenon arc lamps based on ceramic-metal technology was developed by the NVL in 1970. These extremely rugged lamps are produced by automated methods.

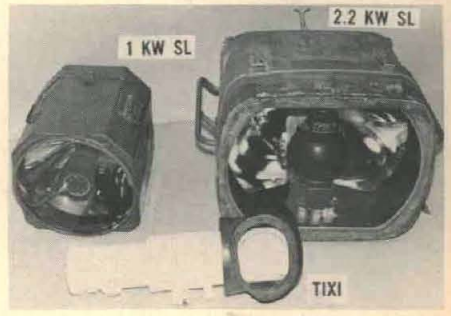
Curently under development for M60 tanks is the first model of a new family. Shown on our outside back cover is the AN/VSS-4 searchlight set integrated into the turret of the M60A1(PI) tank. This mounting significantly increases survivability of the lamp as compared to the AN/VSS-3A gun mantlet mount.

The AN/VSS-4 development thrust is toward two armored configurations based on use of common components. The first configuration is designed for integration under armor in the M60A1E3 tank turret. An armor blister has a window and a manually operated rotating armor shutter that protects the searchlight when not in use.

The second configuration will have the optical unit inserted into an armor cylindrical shell designed for mounting on the exterior of combat vehicles such as the M60A2 and the M48A5 tanks. The searchlights will enter development in FY 1976, with completion scheduled in FY 1978 and delivery in 1979.

Beamspread of the AN/VSS-4 can be changed automatically from two to six degrees in azimuth, it has visible and near-infrared modes of operation, and it has the advantage of automatic slaving of its beam to track with the line-of-sight of the gunner's periscope.

Armor doctrine specifies that tank-mounted searchlights will perform operations including illumination of targets for engagement by other tanks and supporting weapons; illumination of an objective during assault by elements of a tank-infantry combined arms team; illumination of position to blind the enemy and screen movement of friendly forces; and illumination of objectives, routes and unit boundaries as a control measure during movement.



Brief Review of NV Devices Progress

Advances in the state-of-the-art of image intensification equipment for night operations have made it possible to introduce a new generation of smaller, lighter and more effective systems to improve combat requirements.

The Sniperscope, a "zero generation" NV device, was fielded during World War II. Succeeding equipment required a power-consuming, near-infrared light source used in conjunction with an infrared (IR) image converter tube. One of the drawbacks was their detection by simple devices like the Metascope.

The first passive night-vision system was fielded in the early 1960s, following development of the image intensifier tube by the U.S. Army Electronic Command's Night Vision Laboratory. This tube consisted of three cascaded stages of photocathodes, phosphors and focusing electronics, and provided light gains up to 100,000. Dependent upon ambient night night illumination of starlight, moonlight or skyglow, this system intensifies the reflected light (Fig. 1).

The first-generation AN/PVS–2 Individual Served Weapon Sight, AN/TVS-2 Crew Served Weapon Sight and the medium-range AN/TVS–4 Night Observation Device provided troops with a passive night capability to fire weapons and conduct surveillance. They "took the night away from Charlie" in Vietnam. (See July-August 1966 Army R&D Newsmagazine.)

Field use and laboratory evaluations detected deficiencies such as streaking and blooming effects of image tubes during weapons firing and while viewing bright light sources. The need for size and weight reductions also was clear. R&D was continued on a new generation of devices.

Single-stage microchannel image intensifier tubes, half the size of their predecessors, were developed through NVL research. These second-generation types included the wafer tube with a fiber optic twist that flips the image 180°; also, an inverter tube that internally flips the electronic image before it enters the microchannel plate electro-optical amplifier, Fig. 2.

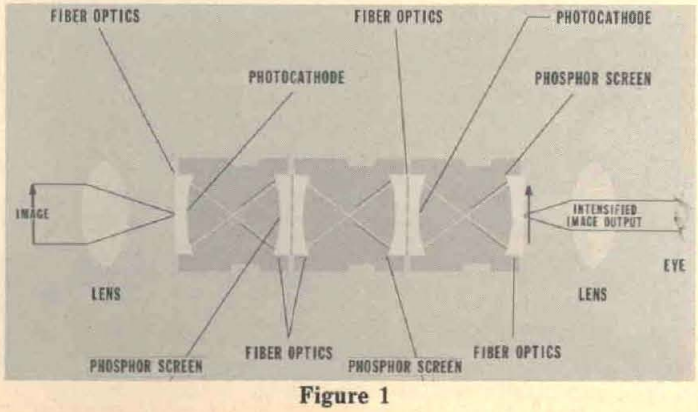


Figure 1

This new technology advance led to a second generation of image intensification equipment including the AN/PVS–4 Individual Served Weapon Sight and the AN/TVS–5 Crew Served Weapon Sight that will be fielded in FY 1976.

The AN/PVS–5 Night Vision Goggles are being fielded. (See outside back cover.) Weighing only 1.9 pounds, the head-mounted unit can be used in a hands-free operation to perform many tasks such as map reading, providing medical assistance, and driving vehicles. A user evaluation test conducted by the Cobra project manager in conjunction with MASSTER resulted in a recommendation for use as a pilot's interim aid in nap-of-the-earth helicopter flying.

An AN/VSS–2 Driver's Viewer is a second-generation image intensifier in a periscope configuration that will provide the first passive closed-hatch night-driving capability in a tank (see outside back cover). Predecessors (M19 and M24 periscopes) required IR headlight assist for operation. Atmospheric interferences, such as smoke or haze, limited effectiveness.

The AN/VSS–2 has been type classified Standard for the M60A1 (P1) tank and will be ready for installation in early 1977. The viewer uses the same intensifier tube as the AN/PVS–4 and AN/TVS–5. The gunner and commander sights on the M60A1 (P1) tank will be upgraded by replacing the "zero generation" tube with a second-generation inverter tube.

Thus, in 1977 the Army will begin to equip its troops with a new generation of NV equipment featuring reduced size and weight, improved performance, and additional operations.

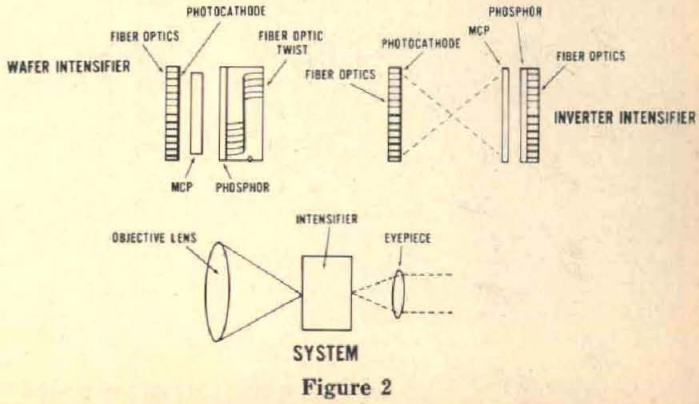


Figure 2

HLH Turbine Effort Cited as Design to Cost Example

Scattered criticism of the Army Design to Cost Program for development of military materiel has surfaced in recent months, but an example demonstrating practicality of the concept is cited by Conrad W. Faber, HQ U.S. Army Aviation Systems Command, St. Louis, MO.

Faber is chief of the Operations Research Division, Office of the Project Manager for the Heavy Lift Helicopter Program. He reports that Army-industry cooperation in developing an 8,079-shaft horsepower gas-turbine engine for the HLH is "proof that the Design to Cost Program can work with top level management support and a candid exchange of information."

Results of this 2½-year effort are evidenced successfully, he states, in that the Army Award Fee Board for the contract with Detroit Diesel Allison Division of GMC "found Allison's efforts and results to be superlative in every respect and, accordingly, granted 100 percent of the total award fee."

Factors contributing to this award included "surpassing a challenging unit production cost target by an additional four percent." Improvements in reliability and maintainability further reduced ownership costs. This was achieved by the "emphasis and importance attached to DTC by Allison's management at all levels. An excellent DTC team held weekly meetings to provide continuity and direction to all efforts.

"Although the program was in a developmental environment, manufacturing disciplines were represented which provided an interdisciplinary approach. This methodology generated productive ideas early in development where flexibility of design changes is greatest and most cost-effective."

Faber explains that almost half of the changes were incorporated and tested in the development engines. Changes not incorporated, because of prior design parts on hand or over-all program schedule constraints, were adequately tested to verify the technical base for future use. All costs were supported by actual vendor quotations or audited in-house labor hour routings.

Moreover, Faber states, the DTC was conducted "with a minimum of government reports through timely cooperation between the contractor and the government. The contractor developed his internal record system in a manner which was acceptable and adequate for use by the contractor and the government."

Summary progress reports used by the contractor to report to his management constituted the bulk of formal reports received by the government. Complete and open access to the contractor's files provided the government necessary detailed data with which to verify and evaluate progress.

ARMCOM Personnel Get Patents for Gun Test Devices

Three patents for inventions resulting in improvements in gun-tube testing procedures and one for an improvement in the submerged arc-welding technique were issued recently to U.S. Army Armament Command (ARMCOM) personnel at the Benet Weapons Laboratory, Watervliet Arsenal, NY.

Bruce B. Brown, a research mechanical engineer, received his second patent for invention of a gauge that measures circumferential expansion of a gun tube when subjected to internal pressure. A roller link chain surrounds the expendable tube with a predetermined tautness and permits calibration simply, swiftly and accurately during expansion.

Mechanical engineers Richard B. Hasenbein and Edward Ryan and designer Louis P. Rigaud share a patent for development of a thermal device that measures cannon-tube temperature to warn gun crews of excessive temperatures. A mercury-filled power sensor, does not need an external power source.

Metallurgist James J. Miller and electronics engineer Donald C. Winters received a patent for a device that continuously locates and records the position of cracks discovered by a search probe during random ultrasonic scanning of large-caliber gun-tube exteriors.

Prior to this invention, recording of ultrasonic inspection data required the use of a grease pencil, straight edge and protractor. Data that had to be manually transmitted to a computer is now done automatically with more accuracy.

Joseph Ropitsky, a mechanical engineering technician, was issued a patent for a new method of tailoring the chemical compositions of the consumable electrode and the natural welding flux in a manner that enables gun steel to be welded with joints or seams that will have the same strength, ductility and impact resistance as that of the steel alloy being welded.

Bruce B. Brown demonstrates gauge used for measuring circumferential expansion of gun tubes at Watervliet Arsenal, NY.

James J. Miller (r.) and Donald C. Winters displays their patented device that has improved ultrasonic testing of gun tubes.

Directorate Consolidates MICOM Laser Programs

Laser technology programs at the U.S. Army Missile Command (MICOM) Research, Development and Engineering Laboratory are being consolidated within a new High Energy Laser Directorate at Redstone Arsenal, AL.

"We're focusing the people, talent and facilities within the laboratory to support the High Energy Laser Systems (HELS) Project Office and the Ballistic Missile Defense Advanced Technology Center (BMDATC)," said Dr. John L. McDaniel, director, RD&E Laboratory.

Dr. Thomas Honeycutt is acting director of the new directorate, staffed by 70 people about equally divided between a Laser Science Division and an Advanced Laser Technology Division.

Headed by Dr. Thomas E. Horton, the Laser Science Division will conduct basic research and exploratory development to provide and maintain a technology base for Army high-energy efforts.

The Advanced Laser Technology Division, under leadership of Dr. Joseph Luguire, will be concerned with specific applications of research results. Honeycutt said the Army also is talking with laser scientists across the country, some of the most outstanding men in their fields, to provide leadership and fill positions in the new directorate.

MICOM also has an advisory staff of consultants headed by Nobel Prize winner Dr. Willis Lamb, now with the University of Alabama at Huntsville, to assist the directorate. Other members include Dr. Larry O'Neill, Riverside Research Laboratory; Dr. Ed Gerry, Advanced Research Projects Agency; and Dr. J. P. Minton, Ohio State University.

MICOM is planning a series of national meetings to bring together the top talent in lasser technology for discussions of specific laser topics and problems. Plans also call for a new building for the directorate. Personnel are now in scattered facilities at the arsenal.

MICOM began research on laser guidance techniques in the early 1960s and pioneered the technology and experimental hardware used by the Air Force in development of its laser-guided "smart bomb." MICOM laser researchers also gave birth to current Army programs such as Hellfire and Cannon Launched Guided Projectiles.

UTTAS Qualification Testing Reaches 'Peak Level'

Contractors aspiring for the UTTAS (Utility Tactical Transport Aircraft Systems) multimillion-dollar procurement award are engaging in increasingly intensive airworthiness qualification testing as they prepare for the decisive Government Competitive Test Phase.

The U.S. Army Aviation Systems Command, headquartered at St. Louis, MO, reports that qualification testing has reached "peak level," and that all prototype aircraft have been in flight test more than 500 hours.

Additionally, drive system bench testing, structural, static and fatigue testing, and Ground Test Vehicle operations exceeding those on previous programs reportedly "have been in full swing to insure that significant strides in reliability and maintainability are achieved by both contractors."

AVSCOM's Systems Development and Qualification Division, part of the Directorate for Research, Development and Engineering, has been performing the qualification functions for UTTAS Project Manager MG Jerry B. Lauer. The process was highlighted recently by the beginning of Army Preliminary Evaluations.

Entries in the competition are the YUH-60A prototype, produced by the Sikorsky Division of United Technologies Corp., and the Boeing Vertol YUH-61A. Preliminary evaluations are being accomplished by the AVSCOM Aviation Engineering Flight Activity, Edwards AFB, CA.

About 25 flight hours are being conducted on each design at the contractors' facilities to evaluate airworthiness in the "flying qualities area." This is a specific prerequisite of the contract prior to delivery of the aircraft for user testing by the Test and Evaluation Command's Aviation Test Board, Fort Rucker, AL, and the Operation Test Evaluation Agency, Fort Campbell, KY.

Scheduling calls for the Government Competitive Test Phase to begin about Feb. 1, 1976, and extend through August.

Because of U.S. Navy interest in the basic UTTAS designs, a test pilot from the Naval Air Test Center, Patuxent River, MD, is participating with the Army teams in the flying qualities evaluation testing.

AVSCOM reports that the UTTAS competition "represents the Army's largest development/qualification effort to date. It is the first time that the Army has independently qualified a helicopter of a completely new design for limited production and ultimate troop development.

"The winning UTTAS is expected to have greater performance margins, the highest level of survivability, and more inherent reliability and maintainability features than any aircraft ever deployed by the U.S. Army."

MICOM Making Improvements To Extend Life of Chaparral

Extension of the life cycle of the Chaparral air defense missile system well into the 1980s is the objective of major system improvements under way at HQ U.S. Army Missile Command (MICOM), Redstone Arsenal, AL.

In advanced development is a smokeless motor for the heat-seeking missile and an Identification Friend or Foe System (IFF). Future development plans call for an antiglint canopy on the Chaparral self-propelled tracked vehicle launcher. More immediate modifications include a new guidance package and improved warheads and fuzes.

MICOM also is buying improved Forward Area Alerting Radar (FAAR) equipment. FAAR is a highly mobile radar system that detects low-flying aircraft and relays information to the Chaparral firing system.

Chief of the Chaparral-FAAR Management Office LTC Howard C. Whittaker has commented: "We are improving Chaparral's intercept and kill capability while providing the gunners better protection and concealment, and more positive identification on incoming targets."

Boeing Vertol YUH-61A

Sikorsky YUH-60A

Competitors Complete AAH Initial Flight Tests

One of the Army's "Big 5" priority R&D programs passed a major milestone recently when prototype competitors for production of the Advanced Attack Helicopter (AAH), announced completion of initial flight tests of proposed aircraft.

The YAH–63 was flown at the Bell Helicopter Co. flight test facility near Fort Worth, TX, by Gene L. Colvin, assistant chief experimental pilot, with Ronald G. Erhart as copilot. Test pilots Robert G. Ferry and Raleigh E. Fletcher flew the Hughes YAH–64 helicopter at the Hughes Flight Test Center, Palomer Airport, Carlsbad, CA.

Competitive development contract awards were issued in June 1973. The next major milestone in Phase I of the development program will be delivery of two prototype aircraft by each of the companies by May 31, 1976, for a competitive fly-off. The winner is scheduled to be selected in the fall of 1976. Further development and production contracts will follow. Initial U.S. Army procurement plans are for 472 aircraft.

The AAH is expected to fulfill Army needs for a highly mobile airborne weapons platform with a capability to find, identify and attack enemy tanks and a wide range of other targets in all types of terrain, in day or night operations, and under extreme weather conditions.

Design requirements call for survivability against enemy weapons, and an armament configuration to include the TOW (Tube-launched, Optically tracked, Wire-guided) missile system, a 30mm cannon, and a 2.75-inch rocket system.

Bell YAH-63 Advanced Attack Helicopter

Hughes YAH-64 Advanced Attack Helicopter

Army Expanding Suppressive Shielding Technology Applications

Suppressive Shielding, considered a radically innovative concept with "interesting potential" for a diversity of applications in munitions manufacture, handling and storage when first reported to our readers by Edgewood Arsenal, is progressing as anticipated.

During the past three years, the concept reportedly has advanced a long way in technology applications to the Army Materiel Command base modernization program. Expansion in development and usage is assigned to an arsenal team of engineers.

The project involves research and development of a family of lightweight shields to provide improved protection to operators, equipment and structures against blast effects, fire damage and flying fragments from accidental explosions of high-power munitions.

Protective qualities of Suppressive Shielding have been demonstrated in applications to mortar fuzing operations at the Milan (TN) Army Ammunition Plant, and to "primer trays" at Frankford Arsenal in Philadelphia.

Additional shielding devices/systems developed by the arsenal's Manufacturing Technology Directorate (MTD) for on-site disposal of chemical munitions and pipe bombs have been tested successfully. A trailer has been built that permits removal of explosive devices from occupied areas without endangering operating or disposal personnel.

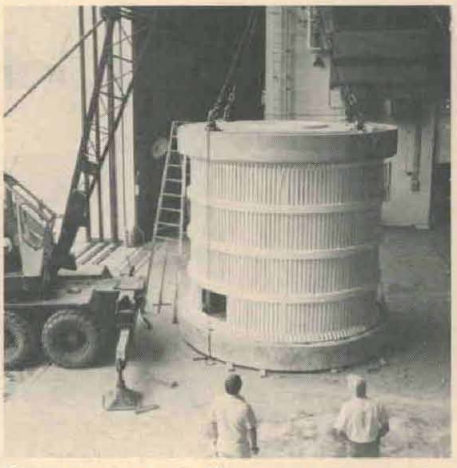
Arsenal engineers are now designing protective shields for propellant-charge loading, black-powder mixing, high-explosive melting and numerous other hazardous munitions loading operations.

David J. Katsanis, chief of the MTD Suppressive Shielding Branch, stated:

"The new low-cost safety concept consists of a specific arrangement of layers of angle iron and perforated steel plates that retain fragments from an explosive reaction. Wire screens also are used to absorb the heat and limit the size of the fireball. Shielding is made from standard structural shapes. Fabricated sheet materials are joined by routine welding and bolting procedures."

Cost-effectiveness studies, he said, have shown that suppressive shielding is competitive with standard reinforced concrete cubicles used in existing ammunition manufacturing and storage facilities.

W. Paul Henderson, one of the program's pioneers, recently stated: "The need for operational shielding becomes obvious when one considers the quantities of explosive compositions and ordnance type items that are manufactured, transported and stored by the Army each year.



One-quarter-scale Category 1 Suppressive Shield Designed for Melt-Pour Facilities.

Recognizing diverse adaptability and potential dollar savings of the arsenal's initial efforts, the U.S. Army Materiel Command (AMC) gave Edgewood Arsenal authority to expand and intensify protective shielding technology for the AMC base production and modernization program.

The suppressive shielding concept was initiated at the arsenal in 1970. Extensive study and testing were required, however, to determine the hazardous characteristics of different munitions prior to development effort.

Initially, six different shields were designed and produced for extensive testing to provide a reference base for further development. This was done in cooperation with the U.S. Navy and other U.S. Army activities. Much of the work was accomplished under a National Aeronautics and Space Administration contract with the Mississippi Test Support Department of the General Electric Co., Bay St. Louis, MI.

Suppressive shields have been proof-tested with a 46-pound explosive charge. In many areas of investigation, however, no previous research had been conducted nor were suitable test procedures and equipment available.

Procedural concepts and test equipment had to be developed to obtain the wide range of information needed. Engineers required specific data such as the size of the fireball, its growth rate and duration, the volume of pressure created during a specific blast, how long it would last, what was the extent of its shock wave? Needed also was accurate information relative to the size, weight, velocity and pattern of fragments.

"To fill these existing knowledge gaps," explained R. G. Thresher, chief of the MTD Mechanical Process Technical Division, "Edgewood Arsenal engineers tackled the problem with the old 'what, where, why and how' approach."

The first task was to seek basic knowledge and technology of the many hazardous compositions and munitions that burn suddenly and violently—as in the flash or fireball that accompanies an explosion. A review of production processes also was required to satisfy the "what" requirements.

Continuous monitoring of production and storage facilities, and reviewing the plans for plant modernization and expansion, enabled the developmental team to determine where hazardous materials were or should be located.

The "why" question was answered by observing preplanned explosions and calculating sensitivity, energy output and motion data. Engineering development of prototype hardware and establishing of improved procedures contributed to "lessons learned" on how a problem can be solved.

The suppressive shielding program is

Test Project Seeks Improved Helicopter Weapons

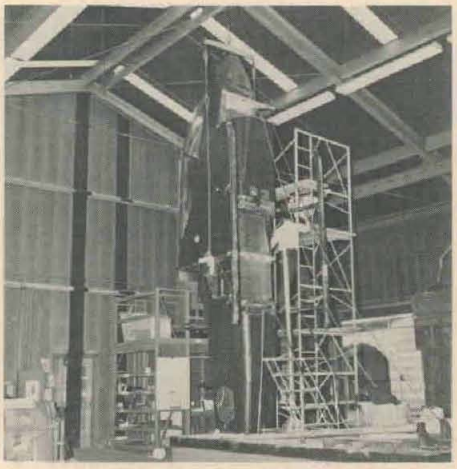
Development of helicopter-mounted weapons which will not interfere with aircraft operating performance is the objective of a jointly sponsored test project at the U.S. Army Armament Command's Rodman Laboratories, Rock Island (IL) Arsenal.

Funded by the Army Air Mobility R&D Laboratories, headquartered at Moffet Field, CA, the project consists of mounting a AH-1G Cobra helicopter fuselage in a nose-up position and joining it to a steel plate where the tail section is normally attached.

Forces are applied at various points on the helicopter and information is gathered relative to interactions between the aircraft and its weapons. Deflections are electronically monitored.

In addition to developing noninterference type weapons, the team conducting experiments hopes that helicopters can be modified to absorb excessive vibrations. These vibrations may cause damage to the aircraft and also can produce cannon and aircraft control system malfunctions.

Test results will be used to validate a National Aeronautics and Space Administration structural analysis model of the helicopter and provide spring-rate data for use during weapons firing tests from the Degree of Freedom Simulator. Linked to a computer data acquisition and reduction system, the DFS reduces testing costs by an order of magnitude below field testing.



AH-1G Cobra fuselage is being used in a Rodman Laboratory project to test weapon systems and interaction with helicopters.

being conducted in five phases: category shields, operational application, support engineering, applied technology, and the compilation of an engineering design handbook.

During the category shield phase, MTD engineers surveyed critical steps in munition manufacturing and handling to determine the extent of the hazard and the degree of shielding required. Seven categories of shielding were based on various blast pressures and range of fragmentation.

The most critical shielding was designed for 105mm projectile filling operations and others having similar hazards. In the event of such an explosion, the shielding was designed to provide complete protection against blast pressures ranging from 500 to 1,200 pounds per square inch and against severe fragmentation.

Thresher pointed out that the support engineering phase is also complex, requiring a continuing review of all shield designs in an effort to reduce cost and provide increased protection. Studies of procedures are required regularly to keep shields operating successfully, and to develop standardized procedures to put shields back into operation in minimal time when an explosion occurs.

Included in the engineering phase is the introduction of controls and utilities lines through the shield walls; design and development of "liners" to control pyrotechnic and explosive ducts; developing methods to eliminate or reduce corrosion; and determining when, and if, it will affect the shield's structure.

The applied technology and design engineering handbook phases are directly related in that results of the applied technology program will form the basis for preparation of a handbook that will outline suppressive shielding design principles for munitions plants.

Thresher said the MTD engineers made an extensive study of effects of an "accidental" explosion of 8,600 pounds of TNT. Results indicated that a large-scale shield could be developed that would be cost-effective—that a $1.1 million shield would save $5.5 million in damages.

Katsanis predicts that suppressive shielding can be successfully applied to all aspects of munitions handling, from manufacturing to shipping, storage and eventual on-site disposal. MTD engineers have designed a "transportainer" for safe in-plant movement of some munitions and they believe it may prove economical for land, air and sea transportation; also, that it can be used to store munitions at their destination.

Lightweight suppressive shields placed around each round of ammunition are packed in specially designed containers. This provides protection for those working around the container; it also reduces the hazard of chain-reaction of ammunition in the container if one round explodes during handling or storage.

The shielding being used in mortar fuzing operations at the Milan Ammunition Plant is only 2½ inches thick, but Katsanis said it will provide complete protection to workers within five feet of the shield—even if as many as six 81mm mortar rounds on the production line were to explode accidentally at the same time.

Project engineers state that they foresee few if any limitations, and predict widespread application of Suppressive Shielding. They believe it will be beneficial at plants where real estate is at a premium; wherever required auxiliary systems have optional limitations due to being subject to high-blast pressures; where explosives are stored; and wherever people must work in a hazardous environment.

To gain full use of the concept, however, they point out that new approaches must be taken in regard to safe distances between structures, people, etc. Existing safe distances are determined by the weight and type of explosive or pyrotechnic materials within a given operation or building.

Based on the effectiveness of the shielding, new safety distances will make possible a significant reduction in real estate needs for ammunition plants.

Due to the cost effectiveness of the suppressive shielding compared with reinforced concrete construction, project engineers estimate that plant construction costs can be reduced by 30 to 40 percent. They also predict that future ammunition plant operations will be housed in lightweight structures.

Katsanis said that due to the reduced wall space required for applications of Suppressive Shielding, production lines requiring many barricaded operations could also be reduced in length. Applications will also enable greater amounts of explosive materials to be stored in a small space and will also permit greater occupation and use of buildings in the immediate area, he concluded.

Air-Cushion Vehicle Development Tests Scheduled

Will the U.S. Army's 20-year R&D investigation of amphibious air-cushion vehicles for heavy-load transport, over choppy waters or rough terrain in various environmental extremes, yield a satisfactory payoff in development tests of a 30-ton-cargo prototype LACV-30?

That is the question to be answered when testing programed to extend over 11 months begins next April at Aberdeen Proving Ground, MD. Objectively, conversion to the LACV-30 (Lighter Amphibious Air-Cushion Vehicle), as a replacement for the currently used LARC-5 and LARC-15, will begin by 1980. Neither of the latter amphibious vehicles travels on a cushion of air.

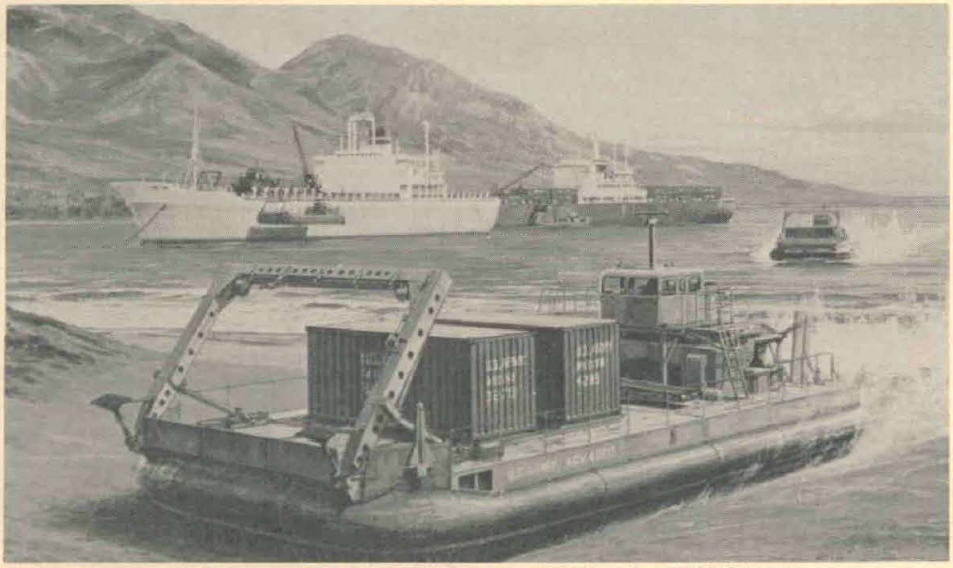
Similar in design and operational characteristics to the Voyageur ACVs manufactured by Bell Aerospace of Ontario, Canada, the Bell Voyageur is being modified to meet the U.S. Army LACV-30 requirement. The contract requires 18 major changes from Voyageur specifications.

Jerry Nook, senior test director for the Materiel Testing Directorate of the Army Test and Evaluation Command (TECOM) at Aberdeen PG, said the prototype will have an over-all length of 76½ feet, width of 36 feet 9 inches, and hovering height of 28 feet 11 inches.

When carrying its maximum 30-ton payload, the LACV-30 gross weight will be 115,000 pounds, including a self-unloading crane. The twin-pack gas-turbine engines each will be rated at 1,800 shaft horsepower.

Specified capabilities include clearing verticle obstacles three feet high, climbing 20 percent slopes, maneuvering over six percent side slopes, crossing ditches up to 12 feet wide and 10 feet deep, cruising with full payload over water at 50 mph and burst speeds up to 60 mph.

Among additional required capabilities are a 1,000 to 2,000-foot turning radius at 50 mph, stopping within 12 seconds at 50 mph, operating in surging surf up to 8 feet, maneuvering in 30 to 50 mph winds, and get-home power in the event one engine fails. A 5-hour cruise fuel tank is specified. The cargo deck will be 50 by 33 feet—large enough to carry a 30-ton vehicle as well as containerized loads up to 30 tons.



LACV-30 (Lighter Amphibious Air-Cushion Vehicle)

AN/TPQ-36, AN/TPQ-37 Tests Termed 'Spectacular'

Test results described as "spectacular" by observers were recorded recently for the Mortar Locating Radar AN/TPQ-36 and the Artillery Locating Radar AN/TPQ-37. Both development models were featured in exhibits at the recent meeting of the Association of the United States Army in Washington, DC.

COL William J. Harrison, project manager for Mortar/Artillery Locating Radars (MALOR), HQ U.S. Army Electronics Command, Fort Monmouth, NJ, announced the highly successful tests at Yuma (AZ) Proving Ground and Fort Sill, OK.

Designed for use close to the front lines in combat, the AN/TPQ-36 finished nine weeks of prototype qualificating testing of the first engineering development model at Yuma. This lightweight, mobile system was designed by the Ground Systems Group of Hughes Air-

More than 2,000 mortar rounds and small rockets were tracked by the AN/TPQ-36 at ranges and accuracies which surpassed specified requirements. The system automatically detects, tracks and locates multiple weapons being fired simultaneously, providing the data for a first-round destructive hit.

Developed under a design-to-cost program incorporating a "hindsight" engineering concept, the AN/TPQ-36 is termed an outstanding success of this approach that is projected to cost about $500,000 for each radar.

Currently, Hughes engineers are evaluating the initial development model to identify additional design and producibility cost reductions for incorporation into the remaining four models to be built under the current contract.

Development testing of the AN/TPQ-37 Artillery Locating Radar was completed recently. Competitive designs were developed by Hughes Aircraft and the Sperry Gyroscope Division of Sperry Rand. This is a larger and more complex radar system designed to detect long-range artillery and large rockets.

More than 15,000 rounds of artillery and rockets were observed by two of these radars during a development test program that began in February 1975. Operational testing was initiated in mid-October and will continue into December. One contractor then will be selected to continue the program into production.

Linked with the Army's TACFIRE computerized fire direction center for the recent demonstrations, the AN/TPQ-37 quickly and accurately located targets and transferred data to a simulated counterfire battery. Less than a minute was used for detection and counter-fire.

Extensive additional testing of the AN/TPQ-36 Mortar Locating Radar is scheduled during a period of several months, both in the field and at the contractor's facilities, in preparation for formal development and operational testing scheduled to begin in August 1976.

Fielding of both the AN/TPQ-36 and the AN/TPQ-37 is projected for the 1970-80 time frame. Potentially they represent a solution to one of the most difficult problems of modern warfare, that of locating, for rapid and accurate countermeasures, the major indirect fire weapons of the enemy.

MORTAR SEEKING antenna of AN/TPQ-36 Mortar Locating Radar is erected from its flat travel position and is bore-sighted prior to operation. The antenna trailer also carries the beam-steering computer, transmitter, part of the receiver and the prime power unit. In the background, the operations shelter contains an all-digital signal processor, a mini-computer, display and integrated communications facilities.

2 DA Employes Share Patent for Mortar Realignment Sensor

Invention of a device that offers promise of eventually easing the job of future mortarmen recently earned a patent award for Department of the Army employes Maurice A. Ryan, Rock Island Arsenal, IL, and Morton A. Barron, Harry Diamond Laboratories.

Termed a Mortar Realignment Sensor, the device was conceived by Ryan in 1970 to provide a close-in sensor which eliminates aiming posts and lights while requiring only slight modification to the existing sensor. The September-October 1973 edition of the *Army R&D Newsmagazine* reported on this concept.

Features include a weight reduction of about 20 pounds per 81mm and continuous display of gun tube direction. A light beam placed at display center reflects a pointing cross to the sight unit. Fine tuning of the firing tube and sensor places the reflected pointing cross in the display source cross.

Barron further developed the concept with introduction of a working model in 1972. Following issuance of the patent, additional tests were conducted at the U.S. Army Infantry School, Fort Benning, GA.

Mortar Realignment Sensor

Ceramics Engineer Uses Diamond Dust Substrate

Conversion of diamond dust (powder) into an exceptionally high quality ceramic substrate for applications in solid-state electronic devices is an innovative idea that has been demonstrated as feasible by Sam DiVita, a ceramics engineer at HQ U.S. Army Electronics Command, Fort Monmouth, NJ.

Traditionally, diamonds are associated with romance and glamor, as nearly every woman knows, but they have some very special qualities that make them valuable in electronics. Much better heat conductors than cooper, the metallic standard for conducting heat, diamonds also are excellent dielectrics (electrical insulators).

These qualities make them valuable as substrates, or bases, for high-power transistors and power diodes that heat up and must be cooled through heat conduction in the substrate. Single crystal diamonds, either natural or manufactured, are most desirable for these industrial applications.

Sam DiVita reasoned that because single crystal diamonds are expensive and not available in sizes larger than one millimeter square for substrate use, he should investigate methods of developing a comparatively low-cost high-thermal-conductivity diamond ceramic for electronic applications.

An Electronics Command contract was award to Brigham Young University, Provo, UT, for development of microwave substrates from low-cost diamond powders. The result demonstrated that, through proper selection of diamond powders and pressure sintering, a ceramic substrate with twice the thermal conductivity of copper could be produced. Presure of one million pounds per square inch at temperature about 4,000 degrees F. is used to achieve desired high density.

Tests reportedly have established that the diamond ceramic is an excellent dielectric and almost as good a heat conductor as a single crystal diamond—twice as good as copper, and three to four times as good as Beryllia, another ceramic used in substrates.

An additional advantage is that the diamond substrate can be molded into the desired shape with single crystals must be cut or ground into shape.

Engineer in Residence Program Proving Merit

Trip reports from an Engineer in Residence Program initiated early in 1975 by the U.S. Army Materiel Command are providing impressive evidence of substantial success in ferreting out materiel deficiencies and widespread or persistent maintenance problems.

Field trips by the AMC commander in 1974 have served to identify a requirement for expansion of occasional visits by design engineers of AMC's major commands to check on operational deficiencies and maintenance problems. In this manner, engineers acquire first-hand knowledge that can also serve for improved design of more advanced weapons.

Accordingly, in a Dec. 17, 1974 letter to each of the major commanders, LTG W. W. Vaughan, AMC deputy commander, directed that they prepare a plan, for submission to him in January, to establish schedules "for our key people in the development of weapons process to have a first-hand feel for the environment in which the soldier and his equipment live and function."

LTG Vaughan further explained that the engineers in residence (three from each major command for about a minimum of a month) "ought to live with the unit, eat with the unit and train with it." During this time they would observe the use of equipment in the field, its functioning, and the maintenance problems encountered. Trip and quarterly reports on results were ordered.

While serving as Assistant Secretary of the Army for Research and Development, current Under Secretary of the Army Norman R. Augustine also had emphasized the need for reports from the operating forces to the Army R&D community on future equipment needs and inadequacies of existing equipment.

A letter from LTG Vaughan to AMC field commanders dated Feb. 28, 1975, further advised them that "current travel restrictions should not preclude initiation of the program," and the progress would be monitored by MG George Sammet Jr. (promoted in late October to 3-star rank as AMC Deputy CG for Materiel Development).

During recent months, field soldiers have become accustomed to seeing the "engineers in residence" painstakingly observing every facet of operational use of materiel under a variety of conditions reliability, maintainability and durability.

Literally, "every crook and cranny" of components of tanks, aircraft and weapon systems has been thoroughly examined. Users have been queried thoroughly on operational and maintenance problems, and encouraged to offer comments for design improvements, or actions to upgrade maintainability. Moreover, suggestions are being thoroughly evaluated for application in design of improved or new materiel.

LTG Vaughan's letters emphasized that the 1975 Engineers in Residence Program would be an exploratory venture and that "at the end of 1975 we will take stock of the program and see whether or not it has been useful."

Trip reports indicate that results will be evaluated as meritorious.

DSARC Ponders SAM-D For Full-Scale ED Phase

The Defense Systems Acquisition Review Council (DSARC) will decide in January whether the Army's SAM-D (Surface-to-Air Missile Development) is ready for full engineering development.

The defense system recently successfully intercepted a low-flying pilotless drone at White Sands Missile Range (WSMR), NM, to satisfy the Army's last major objective in meeting test criteria ordered by the Department of Defense in 1974 to demonstrate the track-via-missile (TVM) guidance.

MG Charles F. Means, SAM-D project manager at HQ U.S. Army Missile Command, Redstone Arsenal, AL, commented: "We have done everything the Department of Defense directed us to do. We accomplished all the major test objectives established for the 16-missile proof-of-principle flight test program."

The first six firings called for intercepts against a non-maneuvering and a maneuvering target, a target flying in formation, and a target at low altitude in ground clutter.

During the remainder of the test program, the Army will continue to fire SAM-D against high-speed, high-altitude, and long-range targets, low-altitude formations and maneuvering targets.

The key to SAM-D's TVM guidance is the fire control group which features a phased-array radar and digital computer. The radar acquires the target, tracks and illuminates it, and tracks the missile into its mid-course flight path.

During the terminal mode, the missile acquires the illuminated target and, aided by the ground-based computer, tracks on illumination until intercept.

Designed to replace the Nike Hercules and the Hawk air-defense systems, the mobile, all-weather SAM-D will provide the Army a substantial increase in air defense against multiple and maneuvering targets in an electronic countermeasures environment.

Prime contractor for SAM-D is the Missile Systems Division, Raytheon Co. at Bedford, MA. Martin Marietta Aerospace, Orlando, FL, is principal subcontractor for the missile airframe, control system and launcher. Thiokol Chemical Corp. is subcontractor for the propulsion system.

elements—the missile and the launcher.

Target detection is accomplished by the naked eye, with audible and visible signals indicating when infrared acquisition of the target has been made. When Redeye electronics indicate that a target is within intercept range, the missile is fired and the warhead explodes on impact or penetration.

Army Evaluates Redeye Air-to-Air Applications

A report on effectiveness of linking the Redeye guided missile system with helicopters for air defense will be completed by the end of the year, following a year of simulation studies and intensive flight testing completed recently.

The U.S. Army Materiel Systems Analysis Activity (AMSAA) at Aberdeen Proving Ground, MD, said that the ground-to-air missile had not been considered in air-to-air situations until tests by AMSAA and other Army agencies established feasibility of linking the missile system with helicopters.

During the year of simulation studies, "We had a computer setup looking at the missile being launched from a helicopter to an attacking close-support aircraft, and to attacking something on the ground," project director Bill Pibil said.

"Results indicated it was promising, but there were some things that we couldn't do in this computer simulation. That's why we went to flight tests."

Flight testing measured interaction between the helicopter pilot and the Redeye missile during the time period between target acquisition and the actual missile launch. The helicopters were equipped with instrumentation that measured relative motion, range and infrared energy. Test crews matched the data with flight profiles selected to compare with computer simulations.

Flight tests were conducted at Phillips Army Airfield by a team from the Aircraft Systems Evaluation Branch of AMSAA's Air Warfare Division. Pibil said results will be incorporated into future computer simulations to refine prior calculations.

Redeye is a portable, shoulder-fired air defense weapon employed worldwide to protect front-line Army units from low-flying attack aircraft, and to deny the enemy a capability of operating observation aircraft over forward elements.

Operated by 2-man teams assigned to company-size units of each combat arm, the system is composed of two basic

ADJUSTMENTS TO REDEYE guided missile system simulator are made by physicist Doug Smith (kneeling) and electronic technicians Don White (right) and John Mann, prior to helicopter flight test program at Phillips Army Airfield.

Fuze Development Progress . . .

Harry Diamond Laboratories Seek to Upgrade Rocket Lethality

Rocket fuzing has often been a limiting factor in combat tactics employed by Army aviators. More often than not, the fuzing mode is selected prior to the aviator's encounter with his target. With today's modern arsenal of weapons, the utilization of less than optimum scenarios can not only endanger the aviator, but simultaneously reduce his ability to deliver optimum lethality.

This user concern has been addressed by a variety of R&D projects at the U.S. Army's Harry Diamond Laboratories (HDL). Basically, these systems improve the flexibility of the aviator by improving potential deliverable lethality.

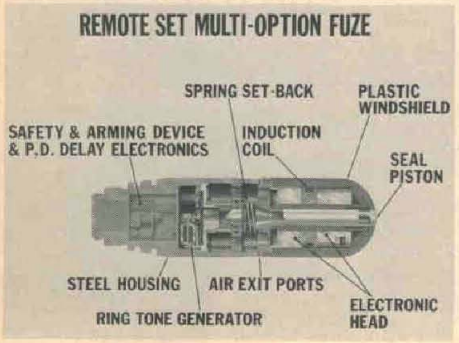
Some of this flexibility was shown in September 1974 when HDL demonstrated this country's first slant-range optical fuze. Tested at Fort Rucker, AL, on a Cobra "Q" helicopter, the fuzes were mounted on 2.75-inch rounds and fired at an altitude of 1,100 feet into a target of tree tops at a range of 6,000 feet.

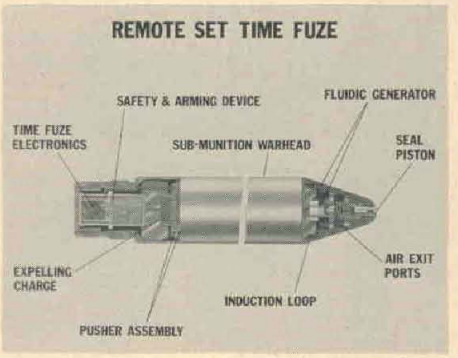
The test successfully demonstrated advantages of a laser optical system that automatically determines slant range and initiates the warhead when it is at the predetermined distance to the target. Compatible with the Army's Selected Effects Armaments Subsystem (SEAS), this system uses a refractive optical transmitter that employs a 30-W GaAs injection laser.

In a related project, HDL has developed a hard-wire data link system applicable to both fixed-wing and rotary-wing aircraft under sponsorship of the 2.75" Rocket Project Manager's Office. The system is being developed for planned replacement at a later date by a "linkless" system, meaning in this case no umbilical connection between the fuze and the setter.

Development of the hard-wire system stems from an anticipated increase in the use of cargo-carrying rounds; also, from a desire to take advantage of improved rangefinders and fire-control systems capable of providing a continuous update of the optimum time for fuze function.

This system allows the pilot to select a mix of fuzes and warheads as different targets of opportunity are encountered. Selection of the warhead is accomplished by communicating with one of two fuzes —a time fuze for submunition and





flechette rounds or a multioption fuze for HE (high-explosive) rounds.

The multioption fuze increases effectiveness of HE warheads, in that the fuze can be set in flight for proximity firing, point detonating (PD) upon impact or impact-delay function.

This means that the optimum fuze/warhead combination can be selected as the target is encountered, rather than preselecting the fuze when the rockets are loaded prior to aircraft takeoff.

Development of a linkless remote set system will use a setting panel and a transmitted data message from the aircraft to the rocket fuzes located in the launcher. The message link is carried by a large coil positioned in the front of the rocket pod and a smaller coil in the fuze. This system provides adequate energy transfer at the rate sufficient to set the fuze in less than the fastest ripple-fire rate (about 60 milliseconds).

The primary component of the multifunction fuze is a fluidic generator that performs three distinct functions. During the rocket flight, it provides the electrical power for the fuze electronics. Second, since the generator performs as a velocity sensor, it is used to provide a measure of a safe-arming distance.

Finally, in addition to providing power and second-signature arming, the generator offers an impact function. Arrival of the rocket at the target is detected by a function-on-generator-stop (FOGS) circuit, which senses the sudden decrease of generator-produced voltage.

Multioption fuzing modes are obtainable by using current state-of-the-art electronic circuits whose high reliability and decreasing costs can substantially improve performance by providing at least one fuzing function backup to the pilot's selection. In addition, the fluidic generator provides, as mentioned earlier, the second environmental safety signature previously unavailable to many rocket weapon systems.

The remote-set concept is to transmit data to a rocket immediately prior to firing of the round. Data can be used to control the fuze function mode and/or an electronic time setting. In the most promising design considered, the data is transmitted to the fuze via an inductively coupled link. Sufficient energy is extracted from the signal to charge a capacitor, which then supplies power to CMOS logic devices.

No battery power is required before the power supply is activated. CMOS devices powered by the charged capacitor store the data until after the round is fired and the power supply is activated. Additional logic circuitry powered by the fuze then processes the data to set the fuze function height or function time. The inductive loop system consists of a setter, sending loop, receiving loop, and fuze logic.

As these projects become more advanced, the pilot's ability to select his fuzing option will not only increase his own flexibility, but simultaneously reduce the logistical requirements that must support him.

Duncan Named RCC Executive Committee Chairman

Dr. Richard H. Duncan, White Sands (NM) Missile Range technical director and chief scientist, has assumed duties as chairman of the executive committee, Range Commanders Council, composed of commanders of the nation's missile ranges and test and development centers.

WSMR representative on the committee since it was formed in 1970, Dr. Richardson presided for the first time as chairman at its recent tenth meeting at Yuma Proving Ground, AZ. He succeeds C. J. DiPol, Naval Weapons Centerd, China Lake, CA. The committee's function is to supervise and direct technical and administrative work of the council for the range commanders.

The council, founded in 1951, maintains its office and staff, known as the RCC secretariat, at White Sands Missile Range. Other elements include 11 different working groups composed of specialists in the various technical fields of common interest, employes of member installations and associated agencies.

With about 300 members representing all of the participating organizations, the working groups are involved in the fields of telemetry, telecommunications, optics and photography, range documentation, data reduction and computing, frequency management, electronic trajectory measurements, meteorology, range safety, underwater systems and range instrumentation accuracy.

In addition to WSMR, Yuma Proving Ground, Pacific Missile Test Center and the Naval Weapons Centers, members of the RCC include the Air Force Eastern Test Range, Space and Missile Test Center, Kwajalein Missile Range, Air Force Satellite Control Facility, Atlantic Fleet Weapons Training Center, Naval Air Test Center, Tactical Fighter Weapons Center, Air Force Flight Test Center and Armament Development TC.

Analysis of Rocket-Assist Aspects of Infantry Antitank Weapons

Fig. 1. RPG-7 Soviet Antitank Weapon With Rocket-Assisted Projectile

By Dr. Thomas H. Dawson

Conventional infantry recoilless antitank weapons, it has long been recognized, are severely limited in range and accuracy by low muzzle velocities of only 100 m/s or so.

The Soviets deviated from conventional design in the 1960s in an effort to remedy this deficiency by introducing a rocket-assisted projectile into their new RPG-7 antitank weapon (Figure 1). The goal was to increase velocity to about 300 m/s during flight. Recently, the West Germans have also reported similar developments for their lightweight Panzerfaust antitank weapon.

The use of rocket assist (RA) appears, at first sight, to be an obvious solution to the range accuracy problem of recoilless weapons. A flatter flight trajectory for the projectile significantly reduces the effect of the major error source of range estimation on the system performance.

Rocket assist, however, also increases the effect of crosswind on the system by driving the wind-cocked projectile off course. Thus the net gain in accuracy is less than might be expected.

The over-all improvement in the performance of infantry antitank weapons firing rocket-assisted rather than conventional projectiles has been studied at the Army Foreign Science and Technology Center Charlottesville, VA.

The work involved analysis of a typical rocket-assisted antitank weapon of the Soviet RPG-7 class and a comparison of its performance with that which would exist without RA. Parameters describing the rocket-assisted projectile assumed in the work are listed below.

In the interest of simplicity, only the effects of the major error sources of ranging, crosswind and round-to-round dispersion on the system accuracy were considered in the analysis. The ranging error arises in any firing from the inability of the gunner to determine the precise distance to the target and is equivalent to an aiming elevation error.

The crosswind error, in contrast, arises from the action of prevailing transverse wind on the projectile flight and is equivalent to a deflection error in aiming. Finally, the round-to-round dispersion error arises because of unavoidable differences which exist between rounds of supposedly identical ammunition and is equivalent to both elevation and deflection errors in aiming.

Table 2 lists typical standard deviation values associated with error sources.

TABLE 1. Projectile Parameters

Parameter	Value
Initial velocity	100 m/s
Burnout velocity	300 m/s
Initial mass	2.0 kg
Burnout mass	1.8 kg
Rocket thrust	980 N
Burn time	0.4 sec
Maximum diameter	76 mm
Drag coefficient	0.2

TABLE 2. System Errors

Error Source	Nominal Value
Ranging	15%
Crosswind	3 m/s
Round-to-Round	0.002 rad

Assuming random errors obeying normal distributions, these values have the interpretation that 68 percent of the cases existing in a large number of firings on different occasions will have ranging errors within 15 percent of the actual range of the target; also, crosswinds within 3 m/s and angular elevation and deflection round-to-round dispersion errors within 0.002 radians (i.e., 2 mils).

Using calculated exterior-ballistics characteristics of the rocket-assisted round, the ranging error given in Table 2 can be converted to its equivalent angular elevation error in aiming. The crosswind value can be converted to its equivalent angular deflection error. Results are shown in Figure 2.

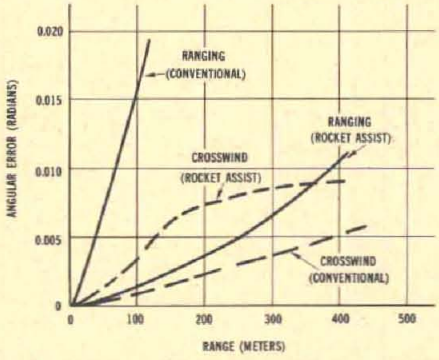


Fig. 2. Equivalent Angular Aiming Errors From Ranging Error and Crosswind.

In calculating the angular deflection error from the crosswind, a worst-case situation was assumed such that the projectile aligned itself with the relative wind and the rocket motor fired immediately after launching.

Figure 2 also shows corresponding angular errors for a similar conventional round having a muzzle velocity of 100 m/s and a mass of 2 kg. Comparison indicates that the RA effect is to decrease the angular elevation (ranging) error of the conventional round by a factor of more than 10 while increasing the angular deflection (crosswind) error by only about a third of this amount. When it is remembered that the crosswind error refers to a worst-case calculation, RA advantages appear significant.

To gain a fuller understanding of the increased RA performance, the angular errors of Figure 2 together with the round-to-round dispersion values of Table 2 were combined and used to determine the first-round hit probability against a frontal tank target of 2.3 x 2.3 meter dimensions.

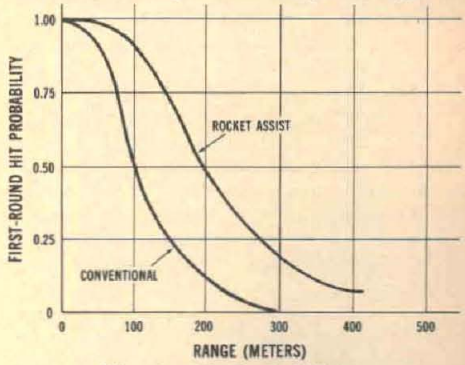


Fig. 3. Hit Probabilities

Figure 3 shows results for various ranges, most importantly that RA increases accuracy of the system by almost 100 percent as compared with firing without RA. The range corresponding to a hit probability of 0.50 for the rocket-assisted round is, for example, nearly 200 meters while that for the conventional round is only about 100 meters.

The obvious conclusion is that use of RA projectiles in infantry antitank recoilless weapons is clearly worthwhile insofar as range and accuracy considerations alone are concerned. Results indicate that rationale behind recent foreign developments in such weapons.

DR. THOMAS H. DAWSON joined the U.S. Army Foreign Science and Technology Center staff in 1971 as an engineering consultant. He received his PhD from Johns Hopkins in 1968 and served as a member of the faculty of the University of Virginia until 1975 when he joined the engineering faculty at the U.S. Naval Academy. He has authored several articles on the effectiveness of foreign weapons and a number of papers on applied mechanics.

NDC FY75 Posture Report Lists R&D Achievements

Enzymatic conversion of cellulose waste to glucose, which can be converted into useful hydrocarbon compounds, and advances in radiation preservation of foods are listed among noteworthy accaccomplishments in the FY75 posture report of the U.S. Army Natick (MA) Development Center.

During this period, the cellulose enzymatic conversion process was translated into a prepilot plant operation capable of monthly conversion of 1,000 pounds of discarded newspaper into 500 pounds of glucose.

The food preservation and packaging program, for which the NDC is assigned Department of Defense Joint Services responsibility, was advanced and will be accelerated as a result of recent successes. They include provision of 27 irradiated, freeze-dried or thermoprocessed items to astronauts in the joint United States-Soviet Apollo-Soyuz space flight link-up in July 1975.

Twenty-one of the food items are representative of a U.S. prototype military ration, the individual ready-to-eat meal recently type classified as standard, which means the meal is ready for production and distribution as satisfactory for military use.

Space does not permit presentation of the numerous tasks and work units that make up the NDC research, development, test and engineering program. A concise summary of technical achievements of the four major laboratories and the Operations Research/Systems Analysis Office follows.

Aero-Mechanical Engineering Laboratories. Among 10 major accomplishments in the area of airdrop of personnel, supplies and equipment, the laboratory successfully tested a new airdrop configuration, in efforts to develop an ultimate High-Level Container Airdrop System (HLCADS).

Fielding of this system is expected to give commanders the opportunity to provide, without prohibitive losses, accurate resupply airdrops from whatever altitude the tactical situation requires.

The laboratory also conducted investigations on guidance, control, and flight performance of gliding decelerators; high-speed airdrop technology; digital simulation of the extraction tumble process; and

Opening dynamics of large-cargo parachutes; 2-stage parachute sensors; MC1-1 maneuverable parachute with anti-inversion net; Joint Service airdrop platform; free-fall steerable parachute; and G-11A vent control cargo parachute.

Representatives of investigations in the area of shelters and organization of equipment is the laboratory's expansion of its finite element structural analysis computer program for frame-supported tents.

The laboratory conducted investigations on the effect of wind loads on full-size air-supported tents and prototype expandable accordion shelters. Other significant efforts included development of glass-fiber reinforced structural foam board; development of one-side and two-side expandable ISO shelters;

Test and evaluation of combustion toilets; investigation of new combustion and heat transfer concept for non-powered liquid-fuel space heaters; air-transportable extreme-cold-climate shelter; foreign-language type fonts and type masters; and emergency repair shelter for the CH-47 helicopter.

In-house Laboratory Independent Research (ILIR) by the Aero-Mechanical Engineering Laboratory included stability study of pressure-stabilized arches and structural assemblies.

Clothing, Equipment & Materials Engineering Laboratory. Development of substitute or alternative materials in response to a need for improved properties, cost savings, or to meet shortages of naturally occurring materials is typical of the accomplishment of this laboratory. Listed among advancements in clothing and equipment technology is the accumulation of considerable information on the phenomenon of laser-induced luminescence of organic dye molecules.

The report states that continuing study of the luminescenice spectra of these molecules, coupled with studies on natural vegetative backgrounds and chlorophyll, will make is possible to design dye molecules with desirable response characteristics similar to those in nature. Hopefully, this could eliminate or minimize isolation or neutralization of the soldier's basic camouflage.

The laboratory also conducted studies on electrochemical approaches to adaptive camouflage; organic and physical chemistry of dye molecules and interactions with natural and synthetic fabrics; and radar-absorbing materials for clothing.

Highlights of the program include development of a free-moving articulated armor vest; study of the utilization of photo- and electro-chemical phenomena in organic and inorganic systems for eye protective devices; response of organic polymers to flame and other high-density thermal energy flux to develop flame-resistant textile and ancillary clothing systems; and

Engineering of synthetic materials to develop clothing and textile items with improved properties, such as insulation, wear, abrasion, resistance and functionality. Interaction of picosecond laser pulses with military systems was studied as an ILIR effort.

Food Engineering Laboratory. Investigations by this laboratory yielded results of substantial importance across a broad front. Food compaction studies were of special interest because of problems posed by the limited space available for dry storage on a nuclear submarine.

Work on reversibly compressed foods reportedly is making possible a remarkable reduction in the space normally occupied by food items—up to a 7-fold reduction in some cases. A 40-percent reduction was achieved in the volume occupied by frozen beef roasts.

Tests of radiation-sterilized beef are approaching completion with no indication to date of unfavorable effects. Interest is now focused on additional foods, including accelerated work to develop radiation-preserved ham, pork and chicken.

Field tests have shown the new ready-to-eat individual meal is fully acceptable, and is superior to the standard individual combat meal. Formulation of the initial technical requirements needed for introduction of the new meal into the supply system is completed.

Food preparation in the field has been simplified by the mobile field kitchen trailer, an expandable, self-contained, trailer-mounted, food service system designed to feed up to 200 men per meal.

Food processing and preservation successes include research on quality parameters in processed foods; control of flavor

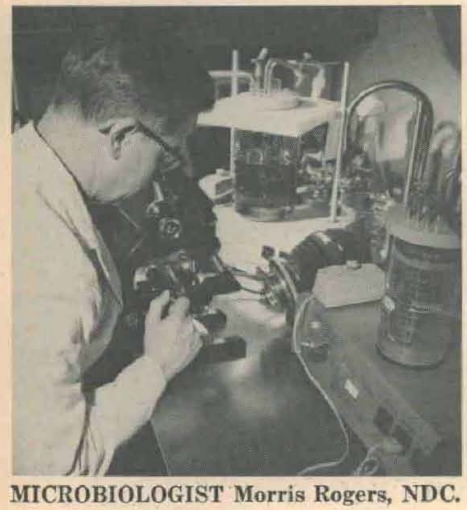
Natick Microbiologist Receives SIM's Charles Porter Award

Achievements in applied microbiology and service to the Society for Industrial Michobiology (SIM) recently earned the Charles Porter Award for Morris Rogers, U.S. Army Natick (MA) Development Center.

An active SIM member for several years, Rogers was vice president during 1967-68, president-elect (1968-69) and president (1969-70). He is a charter member of the New England section of SIM.

William H. Leathen, national president of SIM, presented the award to Rogers. SIM was established in 1949 as a professional association dedicated to the advancement of microbiological sciences, especially as applied to industrial materials, products and related problems.

Author of numerous technical papers, Rogers holds several U.S. and Canadian patents. He is a member of the American Society of Microbiology, American Institute of Biological Sciences, and the Research Society of America.



MICROBIOLOGIST Morris Rogers, NDC.

intensity in compressed foods; and applications of microenergy in the sterilization of meat items in flexible pouches.

Projects on garrison and field food service equipment included investigations of new breadmaking techniques, and an improved heating system for the individual combat ration. Research was conducted on the resistance of subsistence packaging to insect penetration, and improved flexible packages for thermoprocessed foods.

Food Sciences Laboratory. The Food Acceptance Group provided consumer-type sensory evaluation services to technologists responsiblt for developing and improving food items, packaging materials, and operational and garrison food-service systems. Over 300 separate tests were conducted to isolate food-related variables of potential importance to the military consumer.

The laboratory is developing a line of intermediate-moisture foods that do not require canning or refrigeration. They are almost immune to microbial damage, due to lowering of water activity by use of high levels of free glycerol.

Further research on military foods and feeding systems was conducted on decomposition of polyunsaturated fats; development of rapid-assay techniques for microbial toxins; texture properties of ration items; and

Flavor perception: sensory capacity, acceptance, and appetite control in man; factors affecting biological availability of nutrients; and utilization of food and food components after ingestion.

Studies of qualitative and hedonic shifts in odor and taste mixtures, and dual wavelength spectroscopy for *in situ* food analysis projects were conducted as in-house lab independent research.

Operations Research/Systems Analysis Office. Representatives of the headquarters' food service staff from all four services, DDR&E, OASD (I&L), OASD (Comptroller), Surgeon General, and GAO, were briefed on the Uniform Ration Cost System (URCS) program. Seven URCS reports have been published and three more on completed projects will be published soon.

A study was conducted to determine advisibility of realigning Navy ashore appropriated food service facilities to an all-cash basis with individual item and/or meal pricing, and, subsequently, to develop a phase-in system that will provide for cash collection, portion count and inventory control.

The analysis of current field feeding systems for the Army and Marine Corps was completed and results documented. This includes a detailed cost and performance analysis as well as identification of problem areas.

Analysis of the Marine Amphibious Force has also been completed. Compared to the present Army system, their total meal costs are lower while worker productivity is higher. This improvement in performance is due principally to the fact that the Marine Corps has larger battalion-size kitchens that permit operational economies.

An expedited analysis was performed at the request of the Army project sponsor to determine the potential for food service personnel savings by consolidation of the current Army field feeding system. Completed results indicate a potential of approximately 40 percent savings in food service personnel, and an annual cost reduction of nearly $6 million for each military division.

NDC's FY75 Posture Report also contains narrative and tabular information on management aspects of the center, including program structure, civilian personnel, summary of funding data, organizational configuration, management improvements, and planning.

Appendices contain information on the center's contributions to the advancement of science, technology and engineering; professional and career background of executive personnel; and a profile of the Natick Development Center.

Army Air Mobility R&D Laboratory Issues FY75 Annual Report

U.S. Army Air Mobility Research and Development Laboratory ongoing programs status, technical achievements, test activities, publications, honors and awards, facilities and resources, management improvements and other valuable information are compiled in a recent FY75 Annual Report.

Under control of the U.S. Army Aviation Systems Command, the AMRDL carries out a single unified program despite its geographical disperson. Established in 1970 and headquartered at the Ames Directorate, Moffett Field, CA, the AMRDL includes the Eustis Directorate, Fort Eustis, VA; Langley Directorate, Hampton, VA; and the Lewis Directorate, HQ AVSCOM, Cleveland, OH.

Aircraft Aerodynamics. One of the high-priority AMRDL programs, under a joint Army/National Aeronautics and Space Administration effort, was completion of the design, development and fabrication of a universal helicopter rotor test apparatus.

When used in the 40 x 80-foot NASA Ames Foot Wind Tunnel, the test module permits evaluation of the dynamic, aeroelastic and performance characteristics of full-scale rotors without the risks normally associated in actual flight tests.

Further research was conducted on airfoil sections, oscillating airfoils, transonic flow effects on rotors, rotor flow-field test techniques, aeroelastic stability analysis; also in-flight field noise measurement concepts, turbines, compressors, combustors, new high-strength lightweight structural design and composite materials, and fatigue/fracture control.

Mathematics. Mathematical research efforts of AMRDL are directed to advanced in knowledge applicable to aerodynamics, propulsion, techniques, structures, and operations research decision analysis methods as applicable to computer modeling technology.

An in-house effort was successful in solving the rotor blade bend equation analytically. New mathematical functions termed rotor functions, and their properties were obtained. Extensive information on the static behavior of a rotating helicopter blade was compiled.

Aircraft Structures. Research in this technology is committed primarily to developing new ways of safely and economically transmitting loads throughout the aircraft with minimum weight penalty. A major aspect of this effort is directed toward the application of advanced composite materials. Efforts include a) definition of fatigue damage to composites, b) applications of composites to helicopter airframe structure, c) fracture control in composites for fail safe concepts, and d) design of advanced structural components utilizing advanced composites such as rotor rubs, rotor blades, drive shafting, landing gears and fuselages.

Propulsion Technology. Technical activities in propulsion, including drive trains, are conducted by the Lewis and the Eustis Directorates. Introduction of an inlet particle separator for aircraft engines resulted in substantial reductions in foreign object damage.

A program was completed which provides design criteria and a draft design guide for inlet particle separators for gas-turbine engines. Results are being used in the T-700 engine development program with favorable response.

The design and calibration of a single-stage radial compressor with a 10:1 pressure ratio was completed, showing an efficiency at peak pressure ratio of 78.4 percent. This concept is expected to improve engine performance and fuel economy.

Safety and survivability efforts are currently directed toward the development of techniques for defeating or degrading effects of weapons and target acquisition devices. Areas of interest include "signature" reduction in flight and improved aircraft design.

Ballistic tests were conducted in-house and under contract to examine concepts to protect helicopter fuel tanks. Solutions appear to be in over-all fuel system design and application of advanced materials.

Advanced Technology. Research and development efforts were continued on the Tilt-Rotor Research Aircraft, a joint Army/NASA program. The fuselage structure for the first aircraft has been completed and system installations are under way.

Developmental efforts are continuing on the advancing blade concept, advanced fuselage structure for the AH1G helicopter; advanced composite shafting; and small turbine advanced gas generator with auxiliary power units in the range of 200 to 800 horsepower.

Reliability and Maintainability. A formal maintenance demonstration of repairable/expendable rotor blades was successfuly completed. Significant is the fact that all repairs can be accomplished with rotor blades in place on the aircraft.

Remotely Piloted Vehicles. Formerly termed the "Little R" program, the Aquila Remotely Piloted Vehicle (RPV) Program is funded through the weapon systems manager at AVSCOM and contracted through AMRDL.

Significant features of Aquila include: automated modes, launch and recovery from unimproved sites, a range of 20km (12½ miles), gross weight of 120 pounds, payload of 30 pounds, and endurance in excess of 1½ hours.

Aquila is the first Army program utilizing the Letter of Agreement (LOA) management structure between the developer and user commands. Delivery of the first Aquila system is scheduled for late 1975.

AMRDL's 1975 Annual Report also feasures information relative to laboratory support actions, project/product managers and operational systems, recent patent awards, special activities, and major facilities available for Army and aviation community R&D use.

Included in the appendices are flow charts on aerodynamics, structures, propulsion, reliability and maintainability, safety, mission support, systems synthesis, and advanced technology. Listed also are technical publications and presentation during FY75.

AMRDL was presented with an Award for Excellence by HQ AMC for gaining international recognition as an outstanding organization during the past year, with "unquestionable expertise in the areas of helicopter technology and operations." The laboratory was also cited for its successful implementation of the development of three new Army helicopter programs.

AMRDL's performance was judged on its contributions within mission assignments to the Army's capability and readiness during the previous year. The citation described the laboratory as AMC's primary source of expertise on aircraft teronautics, and the principal Department of Defense agency for small gas-turbine technology.

CDEC Completes DACTS Field Experimentation

DACTS (Dispersion Against Concealed Targets), a field experiment related to development of the Future Rifle System, was completed recently by the U.S. Army Combat Developments Experimentation Command (CDEC) at Hunter Liggett Military Reservation, CA.

The experiment was designed to compare effectiveness of the standard M16A1 in both semiautomatic and automatic modes of fire, and modified M16s in various controlled patterns of automatic fire. Data will be used by the U.S. Army Infantry School for evaluating variations of controlled bursts of fire.

Offensive and defensive scenario comparisons were made through individuals and teams engaging combinations of visible, concealed, moving and stationary targets at ranges up to 550 meters.

A realistic procedure for evaluating the suppressive effects of rifle fire was developed by CDEC and incorporated in the experiment. This involved a target operator (player) positioned in a foxhole. A target attached to a periscope device enabled him to observe the attacking players and the effects of their incoming fire only when he exposed his target.

Equipped with a device to simulate return fire, the target operator used the periscope to observe and engage the attacker without having his target hit by incoming rounds.

Preliminary results indicate that attackers employing semiautomatic fire were more effective than when employing automatic fire in achieving target hits; also, in preventing the target operator from observing them through the periscope and returning simulated fire.

Two side tests were conducted during the experiment. The first examined the ability of POR (Preparation of Overseas Replacement) qualified infantrymen to engage moving targets. Results indicate that these soldiers could accurately engage stationary silhouettes but, without refresher training, had difficulty hitting moving silhouettes.

The second involved evaluating the ways infantry rifle squads utilize terrain during an attack. Each of three squads attacked independently over three different types of terrain. Results showed that approximately 90 percent of the attacking force was concealed from view of defenders at any time. Targets were visible in a stationary form in only one percent of the cases.

Army 'Rotary Forge' May Save $10 Million Annually

Cost savings in cannon tube fabrication of about $10 million annually by use of a new "rotary forge," described as the largest in the United States, are anticipated at Watervliet (NY) Arsenal, where the facility is the payoff of 10 years developmental effort.

Capable of forging cannon tubes up to six times faster than current methods when it becomes fully operational in late 1976, following installation of a heat treatment system, the $14 million (approximate) forge is 195 feet long and weighs 910 tons.

In a recent final pre-production test run of the facility prior to acceptance by the Army, Assistant Secretary of the Army (Installations and Logistics) H. L. Brownman and Congressman Samuel S. Stratton (28th Dist.) viewed production of two 105mm cannon tubes in 12 minutes.

Accompanying them were MG Louis Rachmeler and George E. Dausman, Army Materiel Command, and COLs Arthur Daolas and Peter Kenyon, Office Assistant Secretary of the Army (I&L).

Tapered gun tube forgings are produced, ready for heat treating and the finishing operations of rifling and external machining. Tubes ranging from 60mm to 155mm can be produced.

The rotary forge developmental project is headed by Dr. Robert E. Weigle, director of the arsenal's Benet Weapons Laboratory, and the forge was manufactured by GFM Corp. at Steyr, Austria, where tests were performed prior to delivery for assembly at Watervliet.

Dr. Weigle reports that ultimately the cannon hot forging line will include induction furnaces to raise the temperature of the starting workpiece to about 1,800 degrees F. for heat treatment required to modify the forged tube to the high-strength requirements essential for safety and extended life operation.

Credits for members of the team that worked to procure and "put it all together" go to Len Liuzzi, Fred Campione, Vito Colangelo, Harry Powis, Bob Meinhart, Peter Dembowski, Jack Renslow, Dr. Fran Heiser, Leo Slawsky, Dick Farrara, Bill McEwan, John Lewyta, LT Mike Cronin, Fred Meier, Jerry Knapp, John Kryzok, Paul Enold, John Simpson, Adam Lahut, Bill Forbes, Ed Burg, Don Collins, Ed Burke, the late Fred Meineker, Mike Gilchrist, John Purner, Leo Jette and Abe Laurenzo. CPT Tom Kershaw was project officer.

ROTARY FORGE at Watervliet Arsenal will be capable of forging cannon tubes six times faster than current methods when it is fully operational, expected late in 1976.

Upgraded M48A5 Tanks End Rugged Operations Testing

Current results of Army efforts to upgrade capabilities of 1953-59 vintage tanks were evidenced during eight weeks of comprehensive operational tests of the M48A5 tank completed recently at Yuma Proving Ground, AZ.

Conducted jointly by the Test and Evaluation Command and the Operational Test and Evaluation Agency, the tests included day and night firing, long-range firing, and firing under simulated combat conditions. About 2,000 rounds of ammunition were fired, and a grueling 750-mile road test probed durability of the improved tank.

Assistant Secretary of the Army (Installations and Logistics) Harold L. Brownman observed from the turret as the M48A5 went through the final phase of the tests—conducted in the desert where crewmen from the 4th Infantry Division (Mechanized), Fort Carson, CO, endured temperatures up to 140°F.

Among the first to be converted from former M48A3 models, the tanks are designed to add critically needed prime units to the Army's inventory by supplementing production of the M60A1.

Major modifications include replacing 90mm with 105mm guns and installing improved fire-control systems. The program makes use of existing hull and turret castings, which are critical components and currently in short supply.

About three months are required to convert the M48A3 tank to an M48A5 and an additional month to convert an M48A1. Plans call for conversion of over 1,200 M48 tanks by March 1978.

APG Blends Computer Units

Modification of a former Aberdeen (MD) Proving Ground warehouse, slated for completion late next year, will consolidate APG data processing and communications operations and provide direct access to the U.S. Army Materiel Command computer in Alexandria, VA.

Expansion of the structure will accommodate the Management Information Systems Office (MISO) and the U.S. Army Communication Command Detachment (USACCD), now two miles apart.

MISO is assigned responsibility for automatic data processing services and USACCD provides base communication services to APG tenant activities. MISO will occupy the first and part of the second floor of the new center with the remainder serving the USACC Det.

AORS XIV

Army Leaders Stress Role of Operations Research, Systems Analysis in Decisions

When the nation's top decision-makers wrestle mentally with options in exceedingly complex, controversial considerations of weapons systems and other problems critical to maintaining the strongest possible defense posture—with current austere resources—they rely heavily on operations research and systems analysis.

This was the strongly stated message presented at the 14th annual U.S. Army Operations Research Symposium, Nov. 17-20, by Under Secretary of the Army Norman R. Augustine, Army Materiel Command leader GEN John R. Deane Jr., Army Training and Doctrine Command leader GEN William E. DePuy and other high-ranking dignitaries. (*Augustine's address is summarized on page 22.*)

Themed on Operations Research—Applications to Real Army Problems, the symposium was sponsored jointly by GEN Deane, the AMC Systems Analysis Activity directed by Dr. Joseph Sperrazza and the Army Logistics Management Center under Commandant COL Don A. Wilkinson.

Cohosts for the second consecutive year were MG Dean Van Lydegraf, commander, Army Quartermaster Center, and MG Erwin M. Graham Jr., commander, Army Logistics Center, Fort Lee, VA.

Speaking "off the cuff" as the keynoter, in the intimate, informal style for which he is well known—interspersing intensely serious points with frequent humor, including a rollicking story about a 30-pound Thanksgiving Day turkey—GEN Deane said that thoroughly validated, readily comprehensible operations research and systems analysis data are a major asset in weighing decisions.

Billions of dollars in major weapons systems decision expenditures, GEN Deane emphasized, often may be used wisely or less advantageously, depending on how well practitioners of operations research and systems analysis in the Military Departments, industrial contractors and supporting academic institutions prepare and present critical data.

GEN Deane cited examples of materiel decisions that paid off substantially when operations research and systems analysis served as a valuable tool to aid decision-makers. He also pointed out that this technique may be misused at times unjustifiably to delay decisions to await additional studies.

Operations research and systems analysts, he stressed, must be diligent in "dealing with real world problems." They must build data models with a thorough consideration of actual field and environmental conditions under which weapons systems and other materiel must operate. All essential pros and cons must be objectively presented for consideration by decision-makers and with ethics relevant to national security.

In closing, GEN Deane expressed his belief that in recent years operations research and systems analysis methodology "has come a long way, and has helped greatly to make easier my job of presenting the critical facts for consideration of the Congress. I am grateful. I would stress that your role is vitally important; you can make or break decision-makers."

GEN WILLIAM E. DEPUY's address, following his introduction by Dr. Sperrazza, opened with the comment that "we have been very fortunate in TRADOC (Training and Doctrine Command) in reenforcing our operations research capabilities."

GEN DePUY then launched into a discussion of the role of operations research and systems analysis relative to helping the U.S. Army to "win the first battle of the next war." He stressed that advances in lethality of weapons systems, the high attrition rate of modern warfare, may prove a decisive factor in making the winner of the first major battle the ultimate victor.

Most of GEN DePuy's address was in support of the showing of vugraphs depicting U.S. and Soviet systems and comparisons of capabilities based on intelligence estimates, war gaming studies, first-hit lethality of some of the newer weapons, and the upsurge in importance of camouflage and smoke screens as an outgrowth of Lessons Learned in the Mid-East War.

The requirements for victory on any future major battlefield, he said, place tremendous importance on continued progress in the "real-world applications" of advanced methodology in operations research and systems analysis.

Under Secretary of the Army Norman R. Augustine touched briefly at the beginning of his address on the cost-effectiveness results of the U.S. Army operations research and systems analysis activities. ORSA personnel, he said, "may have as much to do with helping to win the next war as any group I can think of. . . . I believe that good ORSA . . . can be of enormous value."

Linked to his address was a movie showing effectiveness of various ground, sea and aerial weapons systems, and a comparison of some major weapons systems and over-all combat capabilities of the United States and the Soviet Union.

Secretary Augustine discussed at length the part that effective ORSA studies may have in helping decision-makers determine how to equip the United States Army. He focused on the complexity of trying to determine what weapons may become obsolete for future battles and what will be required by way of replacements to provide adequate power for combat success.

Two of the vugraphs he showed illustrated "The Necessity for Choice," depicting what might be bought and operated on $500 million a year over a 10-year basis, and the variance in decisions on composition of land warfare forces by eight European nations. The charts are a part of the summary of his address which appears on page 22.

(Continued on page 20)

Miller Appointed Assistant Secretary of Army (R&D)

Edward A. Miller was sworn in Nov. 17 as Assistant Secretary of the Army for Research and Development, succeeding Norman R. Augustine who served from September 1973 to May 1975. Dr. K. C. Emerson, deputy for science and technology, served during the interim as acting ASA (R&D).

Miller assumes his new title following an association since 1973 with the ITEK Corp., Lexington, MA, as president of the Optical Systems Division. During 1970-73 he was corporate vice president and general manager, Space and Electronics Systems Division, Fairchild Industries in Germantown, MD, until promoted to senior vice president, Fairchild Space and Electronics Co.

From 1968 to 1970 he was general manager, Space and Re-entry Systems Division, Philco-Ford Corp. During 15 years with the General Electric Corp. he was manager, High Energy Fuel Engine Development Program, GE Flight Propulsion Division, Cincinnati, OH, 1956-58; manager ICBM Experimental Re-entry Vehicle Programs and manager, MK3 ICBM Re-entry Vehicle R&D Program for Atlas Missile, GE Missile and Space Division, Philadelphia, PA, 1958-60; manager, Recoverable Satellite Programs, Missile and Space Division, Valley Forge, PA., 1960-64; and general manager, Manned Orbiting Laboratory, 1964-68.

Active duty with the U.S. Army, 1944-46 and 1950-53, included 26 months in the Southwest Pacific and an R&D assignment at Fort Eustis, VA.

Graduated with a 1950 BS degree in engineering from the University of Maryland, he also has LLB and Juris Doctor degrees from the Salmon P. Chase College of Law, Cincinnati, OH.

Miller is a registered professional engineer in Ohio; a member of Phi Alpha Delta law fraternity; an associate Fellow of the American Institute of Aeronautics and Astronautics; and from 1970 to 73 was director, National Capital Chapter, Armed Forces Communications and Electronics Association.

Edward A. Miller

Army Leaders Stress Role of ORSA in Decisions

(Continued from page 19)

BANQUET SPEAKER BG S. L. A. Marshall (USA, Ret.), noted military historian and author of many books based on experiences and observations during his long Army career, selected as his topic "Research by Hindsight."

Those who know the general well expected that the presentation would sparkle with his famed salty wit. He fully lived up to his reputation, and was rewarded with a standing ovation. The speech carried a cover sheet titled SLAM-O-GRAM, based on S. L. A. Marshall, and it fitted that caption.

PANEL SESSIONS. Sharing the focal point of attention for audience participation in questions and answers, following technical presentations, were two panel discussions and nine workshops.

Deputy Under Secretary of the Army (Operations Research) Dr. Wilbur B. Payne, Army Materiel Systems Analysis Activity Director Dr. Joseph Sperrazza, Abraham Golub, technical adviser to the Deputy Chief of Staff for Operations and Plans, HQ Department of the Army, and David C. Hardison, adviser for Research, Development, and Acquisition, Office of the DCSRDA, formed one panel.

Discussion during this session dealt with subject material submitted in selected special presentations, as follows:

Influence of Red Teams on ASARC (Army Systems Acquisition and Review Council) Decisions, Richard J. Trainor, director, Systems Review and Analysis Office, Office of the Deputy Chief of Staff for Research, Development and Acquisition, HQ DA; Resource Allocation in Defence—A Scientific View, Prof. Ronald Shepard, Royal Military College of Science, UK; and

R&D Decision Space Analysis, LTC Miles B. March and Leonard S. Freeman, U.S. Army Concepts Analysis Agency, Bethesda, MD; Development of a Program for Quality Assurance, William A. Bayse and LTC J. F. Henry, also of ACAA; Army Planning Factors Management, Ellwood C. Hurford, scientific adviser, U.S. Army Logistics Center.

Members of the latter panel were Dr. Seth Bonder, president, Vector Research Inc. and a former University of Michigan faculty member; Dr. Marion Bryson, scientific adviser, U.S. Army Combat Experimentation Command, Fort Ord, CA, and a prominent figure at all 14 of the Army Operations Research Conferences;

Dr. Edgar M. Johnson, Army Training and Doctrine Command Systems Analysis Activity, White Sands (NM) Missile Range; Roger F. Willis, chief, Methodology and Quality Assurance Office, Combat Operations and Analysis Directorate, U.S. Army Combined Arms Combat Developments Activity.

CONCURRENT WORKING GROUPS. Topics discussed at these sessions will be listed later along with the titles of presentations and authors. The chairmen were: COL John R. Witherall, director, Force Concepts and Design Directorate, U.S. Army Concepts Analysis Agency (ACAA); W. Allan Chavet, acting chief, Cost Analysis Division, Office of the Comptroller, Army Materiel Command; BG Ernest A. Vuley Jr., deputy commander, Army Logistics Center;

Dr. Ivan R. Hershner Jr., assistant director for Research Programs, Directorate of Army Research, Office of the Deputy Chief of Staff for Research, Development, and Acquisition, HQ DA; John W. Kramer, assistant director, Systems Effectiveness and Joint Service Activities, Army Materiel Systems Analysis Activity (AMSAA); Dr. Marion Bryson (title listed earlier); Richard J. Trainor; Hunter M. Woodall Jr.; and Oscar M. Wells, adviser for Studies and Analysis, ODCS, Combat Developments, TRADOC.

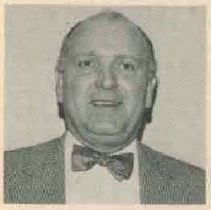
Group A: Force Structure Analyses.

J. R. Witherall

Strategic Management Uunder Detente, LTC George W. Handy, ACAA; Army Total Force Structure Logistics Support Force Structure, T. S. Hurley and LTC T. W. Arnold, ACAA; Current Force Capability Assessment, LTC John A. Croft, ACAA; New Technique for Measuring and Analyzing Army Force Readiness, F. Gordon Barry, ACAA;

Force Stratification System (FSS) Model, LTC Theodore J. Molthen, TRADOC Systems Analysis Activity; Design and Evaluation of Combat Battalions, Roger Willis, Army Combined Arms Center; An Analysis of Field Artillery Unit Configurations Employing Cannon Launched Guided Projectiles (CLGP), Dr. Samuel H. Parry, Naval Postgraduate School, and CPT Stephen J. Pryplesh, Army Field Artillery School; Cost-Slice Methodology for the Development of Conceptualized Forces, COL Robert E. Robinson, ACAA.

Group B: Resources



W. Allan Chavet

Multiple Bid Evaluation Model, David Fermaglich, Army Electronics Command (ECOM); Application of JCAP Multiple Bid Evaluation Model of the Procurement of Ammunition Components, Blair W. Hussey, (JCAP), Army Armament Command; A Systems Force Cost Model (ASYSTFORCOST), Duryea duBaun Gray, ACAA; A Method for Comparison of New Main Battle Tanks by Equal Cost, Equal Effectiveness, and Equal Quality Procedures, Larry P. Waggoner, AMSAA;

Risk Analysis Methodology for Engineering Development Contracts, Nixon W. Powell, Army Missile Command (MICOM); Costing Tilt Rotor Aircraft, Daniel J. Shedlowski, ACAA; Cost of Confidence, Dr. Ted Gifford, Office of the Project Manager for REMBASS, ECOM; Cost Benefit Analysis of Pollution Control Measures, Enos H. Campbell, AMSAA;

Minimizing Commercial Telephone Cost, Dr. John Luzaruk, Army Communications Command; RAMED—The Management Information Systems with a Human Touch, LTC Dennis Rice and Stephen Mandell, Office of the PM for Munitions Production Base Modernization and Expansion; On the Development of a Laboratory Selection Process, Dr. John D. Hwang and Prof. C. Richard Shumway, HQ U.S. Army Air Mobility Research and Development Laboratory.

Group C: Logistics

BG E. A. Vuley

Development of a Combat Damage Assessment Model, LTCs Thomas T. Moxley and Donald S. Zutter, CPTs James H. Laux and James A. McDonald, Army Ordnance Center and School (AOCS); Evaluation of Maintenance Support Concepts for the Army in the Field, J. D. Wood, R. R. Groover, MAJ A. B. Hutton and CPT E. R. Quatrevaux, AOCS; Simulation Modeling in Support of the Maintenance Standards Study, MAJ John L. McHale III, MAJ Joseph Raffiani and Billy R. Williams, Army Logistics Center;

Military Airlift Employment—An Unfinished Operations Research Task, William O'Connor Jr., AMSAA; AMC Depot Maintenance Performance Evaluation, John B. Massa, Army Items Data Agency; The Feasibility of Eliminating Depot Maintenance in U.S. Army Europe (USAREUR), Dr. John Sjoberg, Logistics Evaluation Agency;

Use of Availability Simulations to Determine Sparing and Maintenance Philosophy, Howard I. Shulman and Louis J. Laeger, Army Training and Doctrine and Systems Analysis Activity; Analytical Menu Model for Quantification of Labor and Equipment Requirements in Food Service Facilities, LTC Avalon Dungan and Dr. Robert V. Decareau, Army Troop Support Agency, and Natick Development Center;

AMC Establishes International Logistics Command

Establishment of a U.S. Army International Logistics Command (USAILCOM), headed by MG Joseph Fix III, has been announced by Secretary of the Army Martin R. Hoffmann as a combination of elements of HQ U.S. Army Materiel Command with the International Logistics Center, Cumberland Army Depot, PA.

MG Fix will continue to function as director, International Logistics at HQ AMC, Alexandria, VA, in addition to taking command of USAILCOM. The purpose is to consolidate within one organization the activities and monitorship of the Army's multibillion dollar international logistics program.

The office of the commander of USAILCOM and director of International Logistics will remain at HQ AMC because management responsibilities are focused in the Washington area. The main body of USAILCOM will be at New Cumberland.

This arrangement will facilitate interaction between the new command, HQ AMC, foreign embassies, security assistance staffs within the Department of the Army, and other elements of the Department of Defense having security roles.

The Washington Field Office organizational structure calls for a total military and civilian staff of about 188 persons. Established as the Army Materiel Command's eighth major command, USAIL COM is programmed for an eventual staff of 675.

The phased relocation to New Cumberland of operating elements currently assigned to the International Logistics Directorate at HQ AMC (about 85 positions) is to be completed by June 30, 1977.

Other AMC major commands are concurrently upgrading international logistics elements to directorate level and structuring staffs to accommodate USAILCOM. A Mid-East desk officer at USAIL COM will have a counterpart at each of the other major subordinate commands to make possible improved vertical management of the logistics program.

MG Joseph Fix III

Reliability Improvement Warranty: An Experimental Logistics Support Center, Ronald A. Mlinarchik, P. E., ECOM; Equipment Loader and Asset Scheduler for Transportation in CONUS (Elastic), Dr. Joe W. Knickmeyer and MAJ William A. Jones, Military Traffic Management Command; A Method of Forecasting Army Aircraft Peacetime Losses, Frank W. Ross and Alan LeMay, Army Aviation Systems Command.

I. R. Hershner

Group D: Mathematics of ORSA

Mathematical Models of Military Operations—Model Development for Realistic Problems, Roger F. Willis, Combined Arms Center; U.S. A. Concepts Analysis Agency's Factor Analysis System: A Multivariate Statistical Analytical Tool, Dr. Daniel A. Nussbaum, ACAA; Approximately Optimum Confidence Bounds for System Reliability Based on Component Test Data, Dr. Nancy R. Mann, Rocketdyne, International Rockwell Corp., and Dr. Frank E. Grubbs, Army Ballistics Research Laboratories;

A Study of Direct Search Techniques in the Interior Point Penalty Function Formulation of Constrained Nonlinear Optimization Problems, David V. Strimling, Army Armor Center; Validation of Engineering Simulation Models Using Bayes' Formula for Conditoional Probabilities, Roland H. Rigdon, General Thomas J. Rodman Lab;

Reliability Growth Procedures When Actual Failure Times Are Unknown, Dr. Larry H. Crow, AMSAA; New Methods for Ill-Conditioned Optimization Problems, Dr. Paul T. Boggs, Army Research Office; On a Characterization of Bayes' Decision, Dr. James T. Wong, Army Air Mobility R&D Laboratory and Ames Research Center; A Characterization of Stability in Linear Programing, Stephen M. Robinson, Mathematics Research Center and Computer Sciences, U. of Wisconsin.

Group E: Weapon System Effectiveness

J. W. Kramer

American Armor Experience in World War II, CPT Gordon T. Griffin, 622d MobDes Det (ODCSRDA); The Determination of the Tactical Effectiveness Index for Electronic Countermeasures, COL John R. Ross, USAR MobDes, HQ ECOM; Indirect Fire on Moving Vehicular Targets by Direction Finding, Kenneth J. Dean, Army Mobility Equipment R&D Center (MERDC); Barrier Effectiveness Under Covering Fire, John A. Christians, Kenneth J. Dean, MERDC;

Automated Terrain Simulation, Thomas L. Smith and Mark R. Weldon, MICOM; Air Defense Concept Analysis, Stanley Goodman, Frankford Arsenal; An Optimal Armor, Ralph E. Shear, A. W. Arbuckle and Dr. V. B. Kucher, Army Ballistic Research Laboratories; An Expected Values Model for Simulating Sustained Helicopter Combat Operations, Wyoming B. Paris, AMSSA, and James H. Young, Falcon R&D Co.;

Effectiveness Analysis of Advanced Cannon Launched Guided Projectiles Concepts, Jeffrey D. Hanne, General Thomas J. Rodman Laboratory (GTJRL); Preliminary Analysis of Tank Agility in Terms of Battlefield Survivability, Miss Teresa A. Bridgford, Richard E. Herber and Francis X. Brandi, GTJRL; The Application of System Performance Modeling Techniques to Evaluate Precision Helicopter Gun Pointing Concepts, Thomas D. Hutchings, GTJRL; An Illumination Effectiveness Model with an Application to Mortar Fuzing, Dr. Martin Messinger and Leonard Oleniczak, Picatinny Arsenal.

Marion Bryson

Group F: Testing and Field Exercises.

Environmental Effects on Ordnance Materiel Studied, Unsheltered, Studied, Unsheltered, Outdoors, Milton Resnick, Picatinny Arsenal; Field Measurement of Real-Time Attrition, MAJ Robert A. Miller and Jimmy W. Dudark, HQ Modern Army Selected Systems Test Evaluation and Review (MASSTER); Firing Test of Anti-Aircraft Guns Against Maneuvering Targets, Roland H. Rigdon and William F. Fulkerson,

Field Experiments as Simulations: The CDEC Suppression Program, MAJ H. W. Nieubuer and MAJ M. Tratensek, Army Combat Developments Experimentation Command; Comparison of the Carmonette Model with the TETAM Field Experiment, K. D. Thorp, ACAA; Field Testing of the Tactical Effectiveness of Minefields in the Anti-Armor Weapons System, Dr. Martin Levy, Army Engineer School;

Operational Reliability Test Planning and Assessment, Wilson Ford and CPT Richard Adkins, Army Operational Test and Evaluation Agency (OTEA); An Application of Simuplation Networking Techniques to Risk Analysis in Operational Test Design, MAJ Elwyn L. Brown, Office, Joint Chiefs of Staff, and Dr. Douglas C. Montgomery, Georgia Institute of Technology;

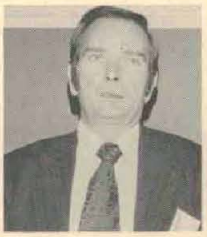
A Success Story—The Trinity of Design, Testing, and Analysis in Determining Operational Effectiveness, Langhorne P. Withers, OTEA; Status-of-the-Art Data Acquisition Techniques, Leonard S. Goldsmith, Picatinny Arsenal; Study of Man-Weapon Reaction Forces Applicable to the Fabrication of a Standard Rifle Firing Fixture, Thomas D. Hutchins and Albert E. Rahe, GTJRL.

Group G: Materiel Acquisition Process.

B. J. Trainor

An Approach for Preliminary Appraisals, CPT John R. Bondanella and 1LT James R. Aldrich, Army Training and Doctrine Command; A Critique of the Role of Design-to-Cost in the Materiel Acquisition Process, Miss Linda Kimball and Miss Audrey Mitchell, AMSAA; Impact of USAOTEA in Materiel Acquisition Process, Walt W. Hollis, U.S. Army Operational Test and Evaluation Agency; Preference Ordering of R&D Technology Base Programs, MAJ Richard W. Porter, ACAA;

XM1 Tank Main Armament Alternatimes—Technical Risk and Cost/Schedule Analysis, Robert C. Banash and James B. Beeson, ARMCOM; Evaluation of Computerized Layout Algorithms for Use in Design of Control Panel Layouts, Dr. Leslie G. Callahan Jr., Georgia Institute of Technology, and CPT Samuel D. Wyman III, U.S. Military Academy; Materiel Acquisition Risks Associated with Foreign Military Sales, Roger L. Finnestead, Army Aviation Systems Command; Decision Risk Analysis of TNT Prove-Out, Norman H. Trier and Thomas H. Mazza, ARMCOM.



H. M. Woodall

Group H: Selected Topics I.

A First-Cut Method for Evaluating Improvement in Tank Performance Due to Design Change, CPT Chauncey F. McKearn, Army Combat Experimentation Command, and Dr. Samuel H. Parry, Naval Post Graduate School; Tradeoffs Between Mobility/Agility and Armor, Richard E. Tuck, P.S. General Accounting Office; Applications of DIVWAG on a Simulation Mode, Jerry W. Frantz and George E. Stiles, GTJRL; Vulnerability Analysis of Theater Transport System (VATTS), T. A. Sanders, LTC R. P. Skowronek, LTC C. E. Hess, ACAA; with the XM19 29mm Weapon, Richard W. Dikant, Frankford Arsenal; Simulation Model of the AN/TSQ-73 Computer System (An Application Program/Operating System/Hardware Interface (APOSHI) Model, CPT Edward A. Gallo and Patrick J. Ward, Army Test and Eavluation Command;

Artillery Neutralization Requirements, MAJ Allan D. Graham, ACAA; Individual Suppression as Induced by Direct Fire Solid Projectile Weapons: Its Effect and Duration, Albert C. Aiken (deceased), Ms Wanda L. Phillips and David V. Strimling, Army Armor School; A Cursory Evaluation of te Effectivness of the United Kingdom Smoke Grenade System for Tank Defense, George J. Stiles, AMSAA; Status of Electromagnetic Hazard Tests of Weapons, Abraham Grinock, Picatinny Arsenal; Improved Hawk Survivability Study, Robert J. Redwinski, AMSAA.

Group I: Selected Topics II.

O. M. Wells

Landscape Quantification for Materiel Systems Analysis, Dr. Robert L. Anstey, Framingham State College, MA; Modeling of Suppression in the ASARS Battle Model, MAJ John M. Riddell, Army Infantry School; A Concept for Modeling Command and Control Performance, Charles Todd, Jerry Lyman, Benjamin Morgan and Dr. G. L. Neal, TRADOC Systems Analysis.

Quantitative Evaluation of Training Effectiveness, Virgil A. Henson, MASSTER; A Proposed Application of Performance Descriptor Tree Methodology to Planning Training System Effectiveness Evaluation, Dr. Gilbert L. Neal, TRADOC SAA; Cost and Operational Effectiveness Analysis Computerized Training System, CPT Benjamin Whitehouse, TRADOC Training Support Activity; Officer Dual Specialty Allocation System, ACAA; General Purpose Combat Model Graphical Processor for High-Resolution Models, G. T. Hawkins, ACAA.

Forty-five additional technical papers were submitted to the AORS XIV Program Committee but could not be presented within the time available. These papers will be included in the symposium proceedings.

Dr. Carlson Named Air Mobility R&D Lab Director

Selection of Dr. Richard M. Carlson as director, U.S. Army Air Mobility Research and Development Laboratory (AMRDL) at NASA-Ames Research Center, Moffett Field, CA, was announced Nov. 20. Dr. Carlson has served as acting director since Paul F. Yaggy retired in September 1974. AMRDL provides the research capability of the U.S. Army Aviation Systems Command, St. Louis, MO.

A 27-year veteran in research, development, design and evaluation of helicopters, Dr. Carlson joined the laboratory as chief of the Advanced Systems Research Office in January 1972, following an assignment as division engineer for Rotary Wing Advanced Design, Lockheed California Co. He has authored numerous publications in this field.

Dr. Carlson was the 1974 winner of the American Helicopter Society's Annual Honorary Fellowship Award "for distinguished and meritorious service in advancing rotary wing aeronautics." He was recently awarded the Decoration for Meritorious Civilian Service, the Army's second highest award for civilian employes, in recognition of aviation R&D "exceptional performance as chief, AMRDL Advanced Systems Research Office."

Dr. Richard M. Carlson

Dr. Carlson has been a lecturer in aeronautical engineering at Stanford University since 1958 conducting courses in VTOL aerodynamics and aeroelastic problems and VTOL configuration design. He has served as Federal Aviation Administration engineering representative (structural) since 1952.

Graduated with BS and MS degrees in aeronautical engineering from the University of Washington in 1945 and 1948, he received his PhD in engineering mechanics from Stanford University in 1960. He is a Fellow of the Royal Aeronautical Society, an Honorary Fellow of the American Helicopter Society and an Associate Fellow of the Institute of Aeronautics and Astronautics. In addition, he is the first foreign member of the Swedish Society of Aeronautics and Astronautics, a member of Sigma Xi and a registered mechanical engineer in the State of California.

AORS LEADING PARTICIPANTS (from left) GEN John R. Deane Jr. and GEN William E. DePuy, opening day speakers; Dr. Joseph Sperrazza, cosponsor; MG Erwin M. Graham Jr., welcoming address; BG S. L. A. Marshall (USA, Ret.), banquet speaker; Dr. Seth Bonner, Prof. Ronald Shepard, featured speakers; and Keith A. Myers, AORS XIV chairman.

Data for Critical Decisions . . .

Operations Research and the Next War

Under Secretary of the Army Norman R. Augustine's address to attendees at the 14th annual Army Operations Research Symposium kept him standing at the podium for more than half an hour on a heavily bandaged ankle that was obviously giving him considerable pain. He fractured a small bone and tore a ligament in his right ankle while playing tennis with Secretary of the Army Martin R. Hoffmann. An unclassified summary of the address follows.

Norman R. Augustine
Under Secretary of the Army

I welcome this opportunity today to provide a few observations on the role of your craft, "systems analysis," because I believe that the disciplined use of your slide rules and equations may be a major factor in deciding who wins the next war. That is, of course, a very strong statement—deserving scrutiny.

I recently heard of a puzzle wherein it was hypothesized that one knotted a string tightly all the way around the earth, at the equator, and then added 40 additional feet to the string, distributing the slack so as to create a *uniform* space along the circumference of the earth.

The question asked was whether you would be able to slip a piece of paper through the space between the string and the earth or whether you could walk through it. The answer was that you could walk under the string anywhere along its length. I found this hard to believe, but have made the calculation, and it is irrefutably true . . . yet all my applicable experiences and instinct rebel against it.

This is where you come in. The 1,250 civilian and military practitioners of your profession in the Army are the bridge between our experiences and lessons of the past, with which we are altogether too comfortable, and the new realities of change due to advancing technology, which may well decide whether we continue to exist after the next war.

If "galloping technology" is an ineffective metaphor, it is only because it is too modest in describing the speed with which scientific advances in weaponry are outstripping our ability to comprehend their implications. Technical growth has provided us options from which we must choose, yet they are so far afield from our experiences that we lack the grounds to make the choice. It is as if Hannibal's Army was suddenly presented with a fleet of helicopters. Having no precedent for their employment, he may well have used them to fan his overloaded elephants as they struggled across the Alps.

Consider but a few of the advances that have occurred between World War II and the present. The infantryman of that era packed a 14.9-pound armament load—his weapon and 72 rounds of ammunition. Today's soldier, carrying several ounces less in total weight, has 200 rounds at his disposal.

The bazooka-firing soldier had to creep within an unhealthy 200 meters of an enemy tank in order to have a reasonable chance of hitting it. A moving tank today is in serious trouble if it gets within 1,000 meters of a Dragon missile gunner. And when it came to providing himself protection from air attack, he had no capability at all—in contrast with today's Redeye missile-carrying soldier.

An artilleryman of the Second World War faced the statistical probability of almost wearing out his gun tube with 833 rounds before striking a moving tank. The Cannon Launched Guided Projectile, now in development, has been routinely hitting turrets at 8 kilometers on the first try.

The list is not endless, but it is lengthening daily. The phenomenal growth of lethality and accuracy has led to attacks on the weaponry "establishment." Shall we place on the battlefield a tank, the cost of which exceeds the lifetime earnings of over 98 percent of the inhabitants of this planet, if it can be destroyed by a $3,500 missile? If a $15-million aircraft can be blown out of the sky by a shoulder-fired rocket, should we build such aircraft? Should surface ships costing hundreds of millions of dollars be bought when they can be sunk by modern homing antiship missiles costing a fraction of that amount? Heavy decisions are involved, especially when the competition for funds is as fierce as it is today.

If, for example, tanks or helicopters are obsolete, let's take them off the battlefield. But if we do, and they are not, the price for our mistake will be paid in more than dollars.

History, including our own, is replete with examples of failure to choose the correct option among those posed by advancing technology. Likewise, penalties have been paid for hanging on to "proven" concepts whose day has gone. The principle of inertia is not confined to physics.

The French, possessing a strong scientific base in mobile, armored warfare in the years preceding World War II, chose to huddle in concrete behind huge guns trained on an avenue of attack 20 years old and, when the Germans changed the rules, lost their nation for four years. The Maginot Line serves as a tombstone for those who tied themselves to the past when planning for the future.

Inventors approached the British in 1816 with a quaint proposal for an "electric telegraph," only to be rebuffed with the explanation that the existence of semaphore made such an invention totally unnecessary.

Closer to home, we Americans have a dangerous tendency to revel in unpreparedness as if it were a national virtue. We like to think of ourselves as a folksy, placid people who drop our plows to mobilize when an agressor strikes, and go on to defeat him.

Unfortunately, in modern warfare mobilization is in most instances obsolete, and the next war may well be decided long before we have our Victory Bonds printed up. In short, developing technology to put on the shelf is a good way to get your shelf captured.

If our nearsightedness in the past has been less costly to us than to other nations, it is because of an accident of geography, an advantage which we no longer possess. An early preview of the end of our ocean barriers occurred in December 1903 when the Wright brothers made one of history's great quantum jumps at Kitty Hawk, NC. We revere this event as indicative of American inventive genius.

What we often ignore is the fact that even after two years of successful flight, including one of over 25 miles, the Army

bureaucracy noted in declining a proposal from the Wrights to deliver an aircraft (without charge until all specs were met): "No further action (is to be taken) until a machine is produced which by actual operation is shown to be able to produce horizontal flight and to carry an operator." Thus did the Bureau of Ordnance and Fortifications dismiss the aviation age two years after it was a reality!

In 1920, three years after the British had won the battle of Cambrai, and captured 7,500 prisoners and 120 guns by the use of tanks, the United States was spending $500 for armor research and development. In 1934 we had a total of 12 tanks that could be counted on, mechanically, to make it into battle. In 1938, when state-of-the-art German Panzers were rolling off the lines, we were spending more on feeding our horses and mules than on tank development.

Lest one get the impression that myopia wears one uniform, I might quote Admiral Clark Woodward, two years before Pearl Harbor: ". . . As far as sinking a ship with a bomb is concerned, it just can't be done."

General George Brett of the Air Corps wrote in a 1941 letter to Dr. Goddard: ". . . the Air Corps does not feel justified in obligating funds for basic jet propulsion research and experimentation."

Dr. Vannevar Bush, Director of the Office of Scientific Research and Development, gave President Truman, in 1945, his appraisal of the impending event at the Alamogordo Test Range: "The bomb will never go off, and I speak as an expert in explosives."

One wonders if we are now speaking as experts and ignoring some outlandish concept that may make all the difference in the world to the outcome of the next war.

Our track record in grasping the implications of new technology has been, by no means, all bad. At the beginning of World War II, we and the Soviets were roughly at parity in nuclear physics. They, however, were skeptical about the possibility of making an atomic bomb, and underestimated its potential military value in the event it was feasible. They all but dropped their atomic energy program in 1941.

We, on the other hand, were pushed and cajoled, by a small corps of visionaries, into putting 600,000 people and billions of dollars into the development of a concept that might not work, but could not be ignored. If we had listened to the counsel of the skeptics, while the Soviets had pushed on in atomic energy, I suspect that today there would not be a free man in Europe, perhaps not anywhere.

If so much advanced militarily applicable technology is available to us, and it is, why not pursue every new capability which emerges from the laboratory? The problem is that state-of-the-art is often restricted by state-of-the-wallet, and we cannot afford to explore fully, much less pursue in earnest, every option that technology offers us. Figure 1 shows what $500 million a year will buy and maintain in general-purpose warfare armaments.

Unfortunately, today, we have little more than intuitive judgment upon which to select a balanced force from such a list—in spite of the fact that one or another of the items generally sticks out like a fur coat on a grocery list to the individual who happens to be exercising that judgment, depending upon his own particular experience.

You Can Buy And Operate For $500M / Year
(10 Year Basis)

QUANTITY	SYSTEM
33792	INFANTRYMEN
1350	155mm SP HOWITZER
1314	XM-1 TANKS
714	AH-1S COBRA / TOW
508	AAH
228	F-15
1.	NUCLEAR CARRIER WITH AIRCRAFT

Fig. 1. The Necessity for Choice

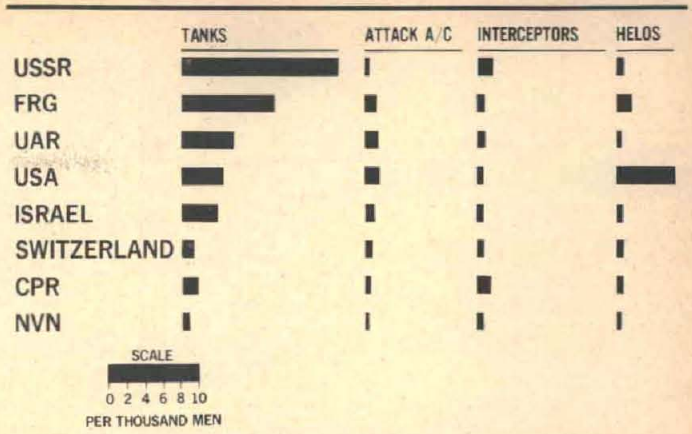


Fig. 2. Composition of Various Land Warfare Forces

Spending constraints for defense, in real dollars, are becoming tighter by the year. If we elect to spread our resources over a wide variety of promising systems, we will possess a broad technological base but an eggshell-thin defense. If we expend all our funds on one "sure-fire" system or family of systems, we are reverting to the Maginot Line mentality and are vulnerable to the other guy's breakthroughs. We need help with the big picture, and Operational Analysts must aid us in deciding on which squares we should put our chips.

Figure 2 shows where several countries have *in fact* placed *their* chips. The disproportionately heavy Soviet tank force reflects an atavistic fixation with armor which dates from the success of the T-34 during World War II.

Critics of our XM-1 program argue the obsolescence of the tank. I do not believe they are correct, but I wish they were. The Soviets now have 40,000 tanks. We have about 9,000. We have, by contrast, invested heavily in helicopters, and I would urge you to inform us if we are going too far in that direction, or not far enough.

Preoccupation with Air Defense, another Soviet characteristic, dates from many unpleasant encounters with the Luftwaffe. A single German pilot destroyed over 500 Soviet armored vehicles. Once again, they are basing their present force structure on the corporate memory of a 30-year-old-war, and may someday repeat history by paying it too much attention.

Our judgment of the priorities we set must also be sure at the outset. Otherwise we lose time and waste incredible amounts of money while programs flounder or die in indecision. Our average Army development program now takes twice as long as it took us to win World War II. Effective operations analysis can insure that we are not beginning such enormous undertakings without reasonable assurance that we are on the right track.

The rate of growth of modern technology is such that 80 to 90 percent of all scientific work performed in history has been done during the careers of men now ready for retirement. The half-life of technology is now on the order of 10 years by most measures, and decreasing. We are being presented with choices which our experience as managers or soldiers do not equip us to handle alone.

I see the function of operations analysis as the clarification of those choices and the development of data which will enable us to choose the correct one. You must tell us things we do not want to hear, and puncture with data the outdated instincts and preconceptions which are so hard to shake. I would emphasize that I do not expect you to replace our judgment; only to sharpen it. (Italics added.)

Operations Analysts devote a good deal of time to asking questions whether one thing or another is cost effective. It is thus only fair to turn the tables and ask whether *Operations Analysts* are cost effective!

Based upon an assessment of the Army's costs for operations research, an increase in over-all Army fighting capability of only two-tenths of one percent would justify this cost—a return that is undoubtedly being far exceeded.

An old Chinese proverb states: "It is very difficult to prophesy, especially about the future!" That, however, is an essential function of operations analysis, and since, for us, the only critical battles will be fought in the future, it is a very important function indeed.

MISSILE MANUFACTURING TECHNOLOGY CONFERENCE

PANEL CHAIRMEN, shown with Deputy Secretary of Defense William P. Clements Jr., AMC Commander GEN John R. Deane Jr., and AMC Director of RD&E BG Harry A. Griffith, are (from left) Joseph Moquin, Elliot Ring, William Shepard (Griffith, Clements, Deane), Justin Margolskee, Drs. William Simecka, Leonard Buchanan, and David Altman.

PURPOSE: Offset inflation costs by U.S. Army-industry teamwork to make technological advances for manufacturing superior-performance military materiel—ruggedly reliable, easy to maintain, operable with brief training, cheaper for the Army, and producible at a reasonable profit for industry.

In the minds of doubters, that may describe, somewhat succinctly, The Impossible Dream. About 255 hard-nosed pragmatic probers for methodology advances who gathered at Hilton Head Island, SC, vigorously attacked the problem at an Army Missile Manufacturing Technology Conference as a challenging, achievable goal.

Among those who reported "encouraging progress" following presentations on problem areas, "cost drivers" with respect to current technology and materials, and spiraling wages, were 178 representatives of industry (60 companies) and 77 from 15 U.S. Government agencies.

Success of the conference, as evidenced by submission of 337 potential MT projects—which Army Materiel Command Deputy Commanding General for Materiel Development LTG George Sammet Jr. termed "equivalent to unsolicited proposals"—set the stage for a series of planned similar conferences in other areas of military materiel. The next ones may be on tracked combat vehicles, and electronics.

Deputy Secretary of Defense William P. Clements Jr. was introduced by GEN John R. Deane Jr., commander of the Army Materiel Command, as the keynote speaker at a luncheon. Secretary Clements gave an address that was resoundingly applauded as a hard-hitting exposition of his views relative to the Department of Defense Manufacturing Technology Program, for which the Army is assigned a major management responsibility. Clement's address is featured in SPEAKING ON . . . which starts on the inside front cover.

LTG Sammet gave the banquet addres, likewise vigorously applauded. The address is carried complete beginning on page 26.

Army Materiel Command Director of Research, Development and Engineering BG Harry A. Griffith was the presiding chairman as well as the director of over-all conference arrangements.

Conference cochairmen were Dr. John L. McDaniel, director of the Army Missile Command Research, Development and Engineering Laboratory, and Dr. Alvin E. Gorum, director, U.S. Army Materials and Mechanics Research Center (AMMRC).

Sponsored by the U.S. Army Materiel Command, the conference was arranged with the joint support of the Missile Command and the Materials and Mechanics Research Center working with major assistance from participating industrial organizations.

BG Griffith called the conference "a new approach on the part of the Army to improve long-range planning for its Manufacturing Technology Program—a top-down analysis of a commodity, in this case missiles, which will result in generation and funding of manufacturing technology projects which provide the greatest return on investment to the Army."

Missile systems considered by conference participants included Pershing, Dragon, ILAW, Stinger, MANPADS, TOW, GSRS, SAM-D, SEAS, Hellfire, 2.75 rocket, CLGP, LRGM, TFGM, TGSM, Laser Designators, Hawk, Chaparral, SHORADS and ATI.

Seven areas of missiles manufacturing technology were selected for identification of "cost drivers" that might serve to exploit the potential for the greatest reduction in costs. Subject areas were: Containers; Test Equipment; Control; Propulsion; Launchers; Structures; and Guidance.

Dr. McDaniel of the Missile Command provided guidance that contributed to selection of seven outstanding industrial leaders to serve as chaimen of panels for each of these areas: *Containers*, Joseph C. Moquin, president, Teledyne Brown Engineering; *Test Equipment*, Dr. William B. Simecka, vice president for Tactical Systems, Northrop Corp.; and

Control, Dr. Leonard F. Buchanan, vice president and general manager, GM Pomona Division, General Dynamics; *Propulsion*, Dr. David Altman, division vice president, United Technology Center; *Launchers*, William L. Shepard, vice president, Advanced Systems, LTV Aerospace; *Structures*, Elliot Ring, chief engineer, Orlando Division, Martin-Marietta Corp.; *Guidance*, Justin Margolskee, vice president and general manager, Operations, Missile Systems Division, Raytheon Co.

Prior to the Conference, the panels convened as necessary to develop MM&T potential projects that could offer the maximum possibility of early exploitation of technology advances for the largest cost reductions. MT projects emphasize such approaches as: Ability to Produce; Relief of Critical Material Shortages; Energy Conservation; Lead-time Reduction; Pollution Abatement; Performance Improvement; System Enhancement; and RAM (Reliability and Maintainability).

This preliminary effort produced seven volumes (each ½ to ¾-inch thick, total about 1,500 pages) to present MM&T Potential Projects (337 total) for consideration at the conference. The volumes, including 59 programed technical presentations, were distributed to conference participants as they registered to provide them a background for the discussion sessions. Identified were major "cost drivers" and developments that could be taken to reduce costs. Estimated funding needs were set at $140 million.

An example of one MM&T project already in progress is that of lowering the cost of diode phase shifters used in phased array radars. SAM-D is being used as a "test-bed" because this missile system has more than 6,000 phase shifters in each phased array radar. Each shifter costs over $100. Techniques have been developed in prototypes that promise reduction of weight of each radar by two-thirds (4,000 down to about 1,500 pounds) and costs of each phase shifter to about $40—a projected saving of over $23 million for shifters for SAM-D alone.

The seven panels were organized to insure that the 59 presentations and the 7-volume set of MM&T projects would provide data for each of the 21 missile systems considered—sufficiently to facilitate computation of the savings and return on investment (ROI) for the projects suggested.

Intensive effort of the panels at the conference further refined the potential developments and assessed probable impact on the 21 current and future missile systems. This was a major undertaking, somewhat analogous to evaluating 337 unsolicited proposals. A minicomputer was used to calculate total return on in-

(*Continued on page 30*)

Scenes at Missile Manufacturing Technology Conference

(1) CONFERENCE SUMMARY is given by Dr. Leonard Buchanan, General Dynamics Corp. (2) INFORMAL CONVERSATION with distaff attendees is held by Wilbur S. Mann, United Technologies Research Center; Natalie, wife of M. Kornizky, AMMRC; Charles Downer, OSD; Deonna and John Meyer, AMC program coordinator; and Nancy, wife of Raymond Farrow, AMMRC. (3) Deputy Secretary of Defense William P. Clements and Mrs. Clements arrive at Hilton Head Island, SC. (4) MG Laddie Stahl (USAR), special assistant to GEN John Deane, addresses conference. (5) SOCIAL HOUR DISCUSSION—From left, Robert Vollmer, AVSCOM; Dr. Alvin E. Gorum, AMMRC; Mrs. John Burke; BG Harry Griffith, AMC; John Burke, AMMRC; and Aaron Tarpinian, AMMRC conference coordinator. (6) COFFEE BREAK brought together (from left) Mart Steward, Office of the Assistant Secretary of the Navy; CPT Theodore Fekula, USN, Naval Electronic Systems Command; John Wyatt, Naval Electronic Systems Command; and Dale Hartman, Hughes Aircraft Co. (7) ATTENDEES included (from left) COL Charles W. Barker, AMC; Horace Lowers, MICOM; Richard Long, AVSCOM; BG Oscar Decker, TACOM; David Morrison, Battelle Columbus Labs.

'A New Way of Doing Business' . . .
Materiel Cost-Cutting Goals of Army-Industry Effort Detailed

U.S. Army Materiel Command Deputy CG for Materiel Development LTG George Sammet Jr. was promoted to 3-star rank less than 48 hours after he presented the banquet address to an innovative Missile Manufacturing Technology Conference at Hilton Head Island, SC. His address follows.

AMC Commander GEN John R. Deane Jr. presents third star to LTG George Sammet.

I am glad to have the opportunity to participate in this first AMC Manufacturing Technology Conference. Hopefully, we will be able to follow with a series of similar meetings which can focus on other areas of manufacturing technology.

Judging from what already has taken place, I am confident that we will have achieved a number of important results by the time the conference ends.

As you know, over the past 18 months we at the Army Materiel Command have been making a strong effort to increase the effectiveness of our communication with industry. The Atlanta Conferences, along with the regional APBIs (Advanced Planning Briefings for Industry), were all part of this effort. So is this Manufacturing Technology Conference.

For better or for worse, the Army and industry are partners in a marriage. In looking at this relationship, I am reminded of George Bernard Shaw's view of marriage. He termed it "an institution which is popular because it combines the maximum of temptation with the maximum of opportunity."

In many ways, the closer relationship we are trying to foster between the Army and industry provides both temptation and opportunity. There is the temptation, as we bare our souls and our problems to each other, to take advantage of the situation.

Letting each other in on our secrets has a sort of seductive appeal. From the Army's point of view, we are after the best possible equipment for our combat forces at the lowest possible cost. From the industry perspective, the bottom line is, and must be, maximizing profits by improved design and manufacturing technology.

But I, as well as many other of the senior leaders of both the Army and industry, am convinced that between these two goals is a fertile middle ground in which both the interest of the Army and of industry overlap. That is the opportunity part of this marriage.

It is my firm belief that by improved communications and by an open, candid discussion of our procedures and our problems, we can move together toward a more effective relationship and a new, more innovative approach in doing business that will benefit both sides.

This statement is made with full recognition that there are those who are very suspicious of a close relationship between the Army and industry. Realized also is that there is tremendous pressure within industry to loosen the dependence on military programs and look for new, more reasonable partners in the civilan sector. But we are dealing here wth something that is of overriding concern to all of us—the national security of the United States.

Gentlemen, with the increasing constraints of funds available to run the Defense establishment, plus the bite of inflation, a slack economy and the accompanying severe pressures on industry, we all have to do a better job at the business of materiel development and production. I am committed to this effort, and that is what this conference is all about.

Tonight I also want to talk to you about some of the organizational changes we are making in AMC to improve our management of the materiel development business. We label it "a new way of doing business."

Results will have a significant effect on the structure of the AMC Headquarters, impacting strongly also on our commodity commands and the evolving development centers and logistics commands. The changes will have a significant influence on the manner in which industry conducts its business with AMC.

Although this is the first AMC Manufacturing Technology Conference, no one should get the idea that the Army is just now waking up to the benefits to be gained from development or application of new manufacturing methods and technology.

The Army at present spends over $60 million annually in this area—far more than the other Services combined. The point is that we are increasing the emphasis on manufacturing technology, to the extent that we expect to more than double this investment during the next several years. But we need to get a good return on that investment.

Every time I talk about technology, I am reminded of a story about a company that had a huge and extremely complex computer. Well, one day this computer went haywire. I don't know exactly what went wrong with it; maybe it stripped a gear or began to print out obscene words or something. Anyway, the thing to do was call a repairman.

The repairman arrived carrying quite an impressive bag of tools. He looked the computer over for just a moment, reached into his tool bag, pulled out a little hammer and gave the machine a slight tap. Well, that did the trick.

A few days later when the bill arrived, the comptroller was astonished. The bill was for $201. Naturally, he called the company and demanded an itemized bill. When the comptroller received the response he found that his company had been charged thusly: Tapping unit with hammer—$1. Knowing where to tap—$200.

You would have to say that this is a good example of getting a lot for a little, and this is essentially what we are trying to do in materiel development. Better exploitation of manufacturing technology should help us reach that goal. But we have to tap the system at the right spots to get a significant payoff.

The efforts we are putting forth in the area of manufacturing methods and technology are, I think, indicative of the evolution that the Army Materiel Command is undergoing.

Probably, I should say is "still" undergoing because, actually, AMC has been undergoing a process of evolution throughout its 13 years of existence. During the last few years, we have begun to speed up that evolutionary process.

That leads me to the second subject I wanted to talk about—some of the more recent changes in AMC. I especially want to discuss the whys and wherefores of the reorganization of AMC Headquarters and try to put it into the perspective of the ensuing concept of how we intend to do business.

The military bears the brunt of many jokes about constant reorganization. But the military organization is a huge organization, and a huge organization is hard to get organized in the first place. Some people seem to think we should never change anything. They are like a story I heard about a farmer who went into a country store one day and heard a dog barking.

He said to the storekeeper, "What in the world is the matter with that dog?" The storekeeper said, "He's sitting on a cocklebur." The farmer said, "Why doesn't he get off it?"

The storekeeper replied, "Because it takes less energy for him to bark and howl than to get off the cocklebur."

You are probably all familiar with the Army Materiel Acquisition Review Committee (AMARC) Study. This was the study group that really took a close look at how we were doing things—and was not altogether pleased with what it found.

You might recall that one of the most significant AMARC recommendations was that we separate the materiel acquisition and logistic functions at major subordinate commands.

This is being done by consolidating AMC laboratories into mission-oriented development centers for RD&E and materiel acquisition; also, by having the logistics support and readiness functions performed in logistic centers.

The development and logistic centers are perhaps the most significant and most visible things to emerge from the AMARC

study. We now have a good start on setting up the centers. What we expect to have after the dust settles will be 8 development centers and 3 to 6 logistics centers. Two development centers, the Mobility Equipment Research and Development Center and the Natick Development Center, are in operation.

Remaining to be created are the Tank Automotive Systems Development Center, the Armament Development Center, the Air Mobility Development Center, the Communications/ADP Development Center, the Harry Diamond Development Center, and the Missile Development Center.

Plans for the establishment of the logistic centers are not yet firm, but it is proposed that they will include the Armament Logistic Center, the St. Louis Logistic Center, the Communications/ADP Logistic Center, the Tank Automotive Logistic Center, and the Missile Logistic Center.

Reorganization of AMC HQ is related directly to this change in our field structure. The present HQ organization is simply not compatible with the development and logistic center concept in the field.

The HQ reorganization began as most reorganizations do—with a study. The major objective was to create a more compact, corporate-type headquarters that could concentrate on the functions of policy formulation, planning, resource allocation, and evaluation, while leaving day-to-day operating functions to the field.

Another objective was to improve the acquisition process by increasing the emphasis on management of the materiel acquisition function and reducing layering. The buzz words of the new AMC are "A new way of doing business," "hard-hitting corporate type headquarters," and "decentralization."

In terms of organization and functions, it means a substantial shakeup at the HQ with many existing functions being decentralized to the field. In terms of personnel, it means a reduction of about 30 percent in strength, with the transfer of 375 spaces to subordinate commands, and the elimination of 314 spaces.

Spaces being eliminated are the so-called "layering" spaces which represent work that is being done both at HQ and the subordinate commands. In the future these functions will be performed solely at subordinate commands.

The new HQ will include two Deputy Commanding Generals where we now have three. Both will have 3-star rank as opposed to the current 2-star Deputy Commanding General for Materiel Acquisition, and Deputy Commanding General for Logistic Systems.

As the Deputy CG for Materiel Development, I will supervise all of the 8 development centers, the 2 remaining corporate labs, the 13 project manager offices which report directly to HQ AMC, the Test and Evaluation Command, all Army research and standardization offices, and the Foreign Science and Technology Center at Charlottesville, VA.

The Deputy CG for Materiel Readiness will supervise all of the logistic centers, 17 depots and storage activities, 9 logistic management activities, 26 logistic assistance officers scattered worldwide, and 5 to 10 project manager offices.

Since most of you here tonight are concerned primarily with the materiel acquisition function, I want to go into some detail about the new structure within the HQ which will manage the materiel development business.

In the current HQ organization, there are a total of 608 spaces specifically concerned with materiel acquisition functions. In the new organization there will be 373 spaces, a reduction of almost 40 percent. Based on numbers alone, it should be obvious that we are going to a new approach in managing our acquisition business.

Under the new organization, I will exercise control over 5 offices pertaining to specialized and highly visible portions of the acquisition process, and 3 directorates covering the major functional area of materiel acquisition.

AMARC and numerous industry people have told us that the Army tends to place too much emphasis on totally new developments—and not enough emphasis on the evolutionary development of equipment. I think they are right, and so do a lot of other people.

Consequently, a new office, the Product Improvement Program, or PIP Office, has been given the mission of managing the entire product improvement program for AMC. This means establishing policy, plans, funding guidance—in short, whatever it takes to change the emphasis that AMARC and industry criticized.

In this way, we can be sure that the PIP function has emphasis and visibility at the corporate headquarters level.

Surprisingly, perhaps, one of the biggest problems we face in the product improvement area is a very practical one. Once an improvement is developed and approved, the kit is sent to the field. Too often, the kits are never installed. Fortunately this is not a problem in the missile and aviation areas, or when the improvements are of an emergency nature.

Over-all, it is nonetheless a problem. The PIP Office will provide us with a visible audit trail so that we can follow up on any PIP development. The level of funding of product improvements is increasing rapidly, and I think you will find that we will do a better job of evolutionary development.

Another new office is related to our purpose in being here today. You have heard from Secretary Clements several ideas to reduce cost and to improve the productivity of Department of Defense contractors.

I am convinced, as is the Secretary, that we can realize considerable savings and achieve a much greater return on investment through the application of new or improved technology, and by broadening the application of improved manufacturing techniques.

We feel so strongly about this that we are establishing within HQ AMC a Manufacturing Technology Office to insure that new or improved manufacturing processes, techniques, materials and equipment are exploited fully in the production, modification and overhaul of Army materiel.

This office will see to it that all end-item programs are subjected to a close scrutiny to ensure that we use the most timely and economical methods of production at each stage in the acquisition cycle—production engineering planning, value engineering, and design to cost. Here again the headquarters emphasis is on planning, policy and evaluation.

We expect big things from this office, and we can't afford to be disappointed. We are facing rising costs and limited sources throughout the acquisition arena. If we are going to keep on moving ahead, which we are determined to do, then we must make manufacturing technology work for us.

This new office is going to help us do just that. Actually we intend to use this conference as a pilot effort for what will amount to a total revamping of our management of manufacturing technology.

We chose missiles as an initial area of study because of the large planned future procurements, about $5 billion through FY 81. We also chose missiles because manufacturing includes high-technology items sensitive to new techniques.

Let me say again that we are expecting big things from this program. Would you believe a 6-to 20-fold return on investment? Think about that for a moment. Apply the figure of 6-fold to a total manufacturing investment of $150 million and you are talking about a cost savings of almost $1 billion.

This does not mean that we will spend less, but we will get more security for the dollar. It means that in times of crisis we will be more responsive and will be able to act from a position of greater strength and readiness. This is really what materiel acquisition is all about.

This may not be related to the evolution of AMC, but I want to make it clear the Army cannot do any of this alone. The new Manufacturing Technology Office cannot do it all. We need industry's help—your help.

Each participant in the conference could help us by acting as a consultant when it comes to improving the way the Army does business. Someone has defined consultant as a person who knows 48 ways to make love but doesn't know any girls.

I don't know if that description fits any of you, but I do know that you know more than one way to build a missile or a missile component. We are depending on you to see that the best methods are applied.

Moving on now, the function of managing the Army's International R&D Program was transferred from Department of the Army to AMC July 1. Our new Office of International R&D is the Army's senior-level action agency in the areas of cooperative R&D and international standardization programs.

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'A New Way of Doing Business' . . .

(*Continued from page 27*)

There is greatly increased interest, as you know, both within the U.S. Defense community and abroad, in expanding the cooperative R&D programs and in increasing the standardization with our Allies. I have been associated with this effort for a number of years, and I am glad to see it come under Army Materiel Command.

Our job now is, with your help, to make these programs more effective. Those of you who have worked with foreign research programs know that success is often frustrating and hard to come by, but the payoffs can be handsome.

Another new organization, the Office of Laboratory and Development Center Management, OLDCM, will be responsible for research programs carried out under the program budgetary elements 6.1 (basic) through 6.3a (advanced development) including technology base responsibility.

OLDCM will run our research programs and provide the institutional overview of labs and development centers. This office has the specific responsibility of determining the adequacy of our research facilities and equipment, and to upgrade our capabilities in both these areas if required.

The Office of Project Management keeps the mission of over-all staff supervision of the Project Manager Program. This includes policy and administrative support of the system.

The office is also responsible for career development of project managers, preparation of PM charters, control of and support for various reports and review studies.

The project management system is one of the most effective management devices we have in the Army. We are getting the cream of the Army's officer corps in this program, and I am pleased to see increasing recognition by the Army of the level of responsibility involved in project management.

For example, in the past year, we have had a number of PMs selected for promotion to general officer rank. This is a breakthrough in our efforts to gain Army-wide recognition for men who are the core of our development process.

The first directorate I want to mention is Development and Engineering, which will replace the old Research, Development and Engineering Directorate. This is headed by BG Harry Griffith, your host at this conference. A few of the functions of this new directorate will be the same as the old. But there are some significant changes.

The entire research function, as mentioned previously, will be transferred to the Office of Laboratory and Development Center Management. But the most significant change is that detailed management of individual development programs will be done solely at the development centers and PM offices.

As an example of the extent to which we are getting out of the business of managing detailed line items, we are cutting 140 spaces once devoted to line item and systems management, and combining three hardware divisions into a systems division.

Over-all, the directorate is being reduced in strength from 290 to 116. Based on this alone, you can see that our orientation will thus be on broad functional areas, not on an individual weapon, tank or plan program. Within this directorate will be offices and divisions covering industrial relations, foreign intelligence, specifications and standardization, the Army space program, and systems evaluation and testing.

The Directorate for Requirements and Procurement will become the Directorate of Procurement and Production. The major changes are the deletion of the commodity management branches and the transfer of the requirements office to the materiel readiness side of the house.

Again, we see here the elimination of the layering so characteristic of the present Army Materiel Command. Procurement management and decisions will take place in the development centers and logistics commands to a far greater extent than under the present organization.

It goes without saying that the primary point of contact for industry on individual procurement programs will be at these lower levels instead of at the headquarters.

As part of our reorganization, we have added visibility and emphasis on ways where we can get a better return for our dollar. Under production and procurement, we have added a director for the industrial base. He will be the Army focal point on preparedness planning, including Industrial Plant Equipment Program, and Production Base Support Program.

The only totally new directorate is for Battlefield Systems Integration (DBSI), headed by MG Ira (Jim) Hunt. This is the "think tank" of our management system, working to insure that battlefield requirements are fully met by the materiel acquisition side of AMC.

The DBSI will assure that current procurements and developments are consistent with current and projected Army operational doctrine; also, that any voids in filling the user's needs are identified and addressed, and that specified requirements exploit fully new advances in technology.

The primary focus on this effort will be on "the big picture," to ensure that the various development programs are fully integrated to maximize combat power of the total system. This represents a major new effort to improve the materiel acquisition program by closer coordination with TRADOC (Training and Doctrine Command).

What I have talked about tonight reflects changes in requirements and resources, the realignment of functions, and the realization that we can do the job a lot more efficiently than we have done it in the past. When we look at AMC now as opposed to 13 years ago, we see the cumulative effect on the evolution of AMC. We have one less major subordinate command, 20 fewer depots, 3 fewer labs, 69 fewer installations and activities, and 65,000 fewer personnel.

You probably are wondering what all this means to you. It means many things—decentralized management, increased contact directly between HQ Department of the Army and the development centers and PM offices. It means more decisions and greater industry involvement at lower levels, and I think it means more effective management of materiel acquisition.

To put it in perspective, it might be interesting to hear the view of one of our newly assigned major subordinate commanders as he looks up at this new headquarters and our new way of doing business. He stated to his command staff:

"A HQ AMC reorganization was announced last week. This reorganization will reduce the HQ from approximately 2,100 to 1,400 people, a reduction of about 700. About 400 spaces will be decentralized to the field and 300 eliminated.

"The reorganization will be implemented over the next 18 months or so. What does this mean to us? Commodity orientation will be eliminated at HQ AMC. There will be no commodity sections, branches or whatever in supply, maintenance, R&D, requirements and procurement, etc., at the HQ level.

"At most, there will be a commodity point of contact. In short, we will carry the ball. More emphasis will be required to tie together other commodity commands and agencies involved in our actions. "More decisions will be made at our level. Very few problems will be passed up the line. We will resolve them here. It is more important than ever that we be accurate in everything we do—because no one will be massaging and purifying our product up the chain.

"There will be more direct queries from the Department of the Army Staff that will necessitate prompt answers and, depending on the subject, letting HQ AMC know after the fact about the subject or problem. More responsiveness will be required in everything we do. You'll see more decentralization from HQ AMC as each week passes. Therefore, prepare yourself and your personnel—mentally and organizationally.

"I think this trend is good! It makes us the Army's real center of excellence and expertise! I encourage you to accept the challenge—and pass it along to your people!"

That is the end of the quote, gentlemen, and that is the end of my talk, except to encourage you also to accept the challenge to provide the excellence in missile technology and missile systems development that you are discussing here.

If all of this is really going to make a difference, it will require the full support and participation of industry. As I remarked at the beginning, the Army and industry are partners in a marriage. It is a relationship that must be worked at if it is to succeed.

I pledge my full support to this effort, and I ask for yours. I appreciate the efforts you have put into this conference.

ECOM-Developed EQUATE Electronic Test System Proves Tri-Service Capabilities

By Charles E. McBurney

EQUATE, denoting Electronic Quality Assurance Test Equipment, developed by U.S. Army Electronics Command and RCA scientists and engineers as a computerized system applicable to many Army requirements, is proving its merit to the satisfaction of the Navy and the Air Force.

Intended initially as a "universal" system to meet a diversity of production acceptance and in-line production test requirements for Army radios and other electronic equipment—in response to continuing complaints from field troops regarding reliability—EQUATE has demonstrated its superior versatility in Navy and Air Force surveys of other testing systems.

The Naval Air Engineering Center (NAEC), Philadelphia, surveyed about 50 testers and test systems before concluding that EQUATE, with its programable stimulus and measurement capability, could check out more types of small, replaceable assemblies (SRAs) than any other system.[1] Contributing to this finding was the fact that EQUATE is a hybrid digital and analog system.

The Naval Avionics Facility at Indianapolis (NAFI) is installing an EQUATE system in its incoming inspection department to check out electronic units, including modules and assemblies procured for the Standard Hardware Program.[2] NAFI is the central inventory control point for this program, which now involves about three million modules. EQUATE will be used to inspect some 40,000 modules annually of about 150 different types.

Similarly, the Air Force and its contractor for the Airborne Warning and Control System (AWACS), Boeing Aerospace, have determined that EQUATE can effect substantial savings in testing the UHF Communications System and Interface Adaptor Unit of AWACS. The checkout budget will range from one to two percent of total cost. Other firms using less sophisticated test systems are reportedly averaging 5 to 10 percent of total cost.[3]

The EQUATE system consists of a NOVA 800 computer, a tape reader and keyboard input, various alternating and direct current voltages, adaptors for connection to the radio under test, several high-frequency signal and measuring chassis, and a cathode ray tube and line printer.[4]

The new concept offered by EQUATE is that the computer can be programed to create the desired input waveforms, apply them to the proper pins on the test unit, sample output waveforms from selected pins or test points, and analyze them mathematically.[5] There is no need for an array of d.c. and a.c. power supplies and signal generating units.

Using digital techniques, the computer generates waveforms based on mathematical formulas. A waveform is synthesized in digital format, then smoothed through low-, medium-, or high-frequency filters before being switched to the test item.

Output is read from the correct pin and switched to the signal processing and computer sections for analysis. Again, analysis is on a mathematical basis—Fast Fourier Transform of a set of 64 sample measurements. Deviations are shown on the cathode ray tube and/or printed out on the line printer.

Frequency Groupings. Three ranges of frequency for the stimulus and measurement (input and output) sections extend the usefulness of the EQUATE system. Low-frequency chassis include d.c. to 10,000 hertz. Radio frequency sections cover 10 kilohertz to 100 megahertz, and the microwave sections go from 100 megahertz to 18 gigahertz.

These X and KU band sections give the tester exceptional range for high-frequency radar, distance-measuring equipment (DME) and other equipment.

Software. An important element in the adaptability of a computer-controlled test system is its program language. It must be versatile enough to permit the programing of complex test procedures and simple enough to permit a test engineer inexperienced in programing to generate instruction software.

EQUATE's programing language is an extension of ATLAS (Abbreviated Test Language for Avionics System), which permits an engineer with little software experience to program with the aid of a reference manual. Characteristics of each input stimulus and output measurement device are detailed in the manual. Standard vocabulary and syntax are used almost exclusively.

EQUATE configuration, above, includes (from left) a line printer, a d.c. power station, computer station, UUT station, r.f. station, and an a.c. power distribution station.

Test engineers at RCA and at Fort Hood, TX, where EQUATE is now being evaluated for field use, had little trouble picking up the language and programing the set for such diverse items as the VRC-12 vehicle transmitter-receiver, PRC-77 small modularized infantry radio, TS-352 field telephone multiplexer or ARC-114, 115, and 116 aircraft radios.[5]

Software for testing this equipment was developed while the EQUATE was used in the Modern Army Selected Systems Test, Evaluation, and Review (MASSTER) program.

During demonstrations of the EQUATE System at the RCA Burlington (MA) plant, capabilities of the tester were observed by representatives of the Army, Air Force and Navy. Results, plus a demonstration at HQ Army Materiel Command in Alexandria, VA, led to high-level interest in the system by other Department of Defense elements.

The Army Security Agency, for example, procured two systems for use in depots for support of secure equipment. The Naval Avionics Facility followed by installing a system for checkout of modules and assemblies for the Standard Hardware Program. Other EQUATE systems may be used aboard ship or alongside flight lines.

In conclusion, ECOM's EQUATE quality acceptance test system, developed at RCA Burlington with Army's manufacturing methods and technology funding, has found added usage in divergent fields. Among these are: checkout system for AWACS; maintenance diagnostic system for advanced Army helicopter avionics; and incoming inspection system for modular electronics and components. How it fares in these roles is now being determined. Versatility has been demonstrated by its acceptability for these widely divergent tasks.

EQUATE was developed and production-engineered on ECOM's Manufacturing Methods and Technology project 2 71 9353, under AMC's MM&T program. The object of the program is to establish manufacturing equipment, techniques and processes to insure efficient production of defense items.

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CHARLES E. McBURNEY has been with U.S. Army Production Equipment Agency (PEQUA) for 10 years, following employment with Gulf and Western Industries. He holds a degree in electronics from Iowa State University and an advanced degree in industrial management from the State University of Iowa. PEQUA is the Army focal point for technical assistance to U.S. Army Materiel Command headquarters on the Manufacturing Methods and Technology Program.

Missile Manufacturing Technology Conference

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vestment for each suggested project.

Special Sessions. One session was concerned with the problem of motivating both the U.S. Government and industry to utilize more efficient manufacturing technology; this was moderated by MG Laddie Stahl, special assistant to the commanding general, Army Materiel Command. Another session on the impact of specifications and standards on materiel costs was chaired by COL Charles Barker, assistant for special projects, Research, Development and Engineering Directorate, Army Materiel Command.

Conference Results. Discussions and deliberations of the seven panels during the conference were concentrated in three days of overtime effort. The results were summarized by Dr. Leonard F. Buchanan, chairman of the Control Panel, who was selected by the other chairmen for this task.

GEN Henry A. Miley Jr., who retired from the Army early this year as commander of the Army Materiel Command, also gave a presentation on his observations at the concluding session. GEN Miley is executive vice president, American Defense Preparedness Association.

Among the results were: Cost Drivers identified for the 21 missile systems that were considered; list of potential manufacturing technology projects generated; feasibility of applying new technology established; determinations made to provide the Army Materiel Command with information essential to improved management of the MM&T program.

Results of MM&T programs will be coordinated with project managers of major weapons and other materiel systems, and with contractors and other U.S. Government agencies. Dissemination of information will be accomplished through conferences and seminars, industry demonstrations, interference with producibility engineering and planning, articles in trade journals and other publications, films and exhibits.

Recommendations. The panel chairmen recommended that:

- Because there are significant potential payoffs, the Army should actively pursue a coordinated program in missile manufacturing technology.
- The Army should increase funding for missile manufacturing technology to be consistent with acquisition (procurement) materiel expenditures.
- Initial concentration should be given to 26 areas with an estimated investment of $26 million.

Background of Conference. The Missile Manufacturing Technology Conference resulted from a February 1975 Secretary of Defense FY 77-81 Planning and Programing Guidance Memorandum, urging each of the Services to increase manufacturing technology emphasis. Increased funding support was urged for the FY 77-81 time frame, and central management by the Army recommended.

Deputy Secretary of Defense Clements issued a directive in April 1975 to the Secretaries of the Services providing guidance for implementation of the MM&T Program expansion, including assurance that, if warranted, Congress would be requested to provide additional funding, BG Harry Griffith then moved rapidly to respond to guidance.

Specified objectives of the Missile Manufacturing Technology Conference were listed as: 1) Identification and analysis of the major cost factors in the production of Army missile systems; 2) definition of potential projects which will provide new or improved manufacturing technology; assess the potential payback these projects would yield if accomplished and implemented.

Missile technology was selected for the introduction of the contemplated series of Army-industry conferences to advance the MM&T Program because of: 1) Large future procurements through FY 81; 2) small funding for missile MM&T development in the past; 3) high technology items sensitive to new manufacturing technology; 4) many new missile systems "coming down the pike"; 5) high visibility in the Department of Defense and Congress (for results showing return on MM&T investment to justify continued program support).

Women Participants Find Challenge in ORSA Careers

(*Continued from page 21*)

Seven women registered as participants in AORS XIV, four coauthored technical papers that were presented, and an eighth member of the fair sex coauthored a paper but did not attend.

Anita A. Ontiveros, a diminutive brunette, 34 years old, mother of twin sons aged 7 and another 11-year-old son, was the most experienced in operations research and analysis with 12 years of service as an Army employe, but attended only as an observer. Her husband was an intermediate school principal in her home town of El Paso, TX, and is now in the Personnel Department.

Mrs. Ontiveros began her ORSA career as a GS-7 Civil Service employe at White Sands (NM) Missile Range and is now a GS-13 grade employe as an operations research systems analyst with the Air Defense School at Fort Bliss, TX.

After 5½ years with the Flight Simulation Laboratory at WSMR, she transferred to the Safeguard Systems Evaluation Agency (TRANSANA), an element of the Training and Doctrine Command for another 5½ years before accepting her present job at Fort Bliss a year ago.

Graduated from the University of Texas in El Paso, she has done graduate work at New Mexico State University and hopes to continue there until she receives her master's degree. What does she think about ORSA as a career?

"Well, I find it stimulating and challenging. I just wish that when I come to conferences like this that I would see more women in attendance. I like my work and I think they would enjoy it."

Among the youngest women at AORS XIV were Audrey Mitchell, 23, and Linda Kimball, 25, coauthors of their first technical paper on operations research. Titled "A Critique of the Role of Design-to-Cost in the Materiel Acquisition Process," the paper was presented by Miss Kimball.

Miss Mitchell was born in Norfolk, VA, graduated from Virginia Polytechnic Institute with a BS degree in physics, and entered Federal Civil Service 14 months ago with the Army Materiel Systems Analysis Activity (AMSAA) at Aberdeen Proving Ground, MD. Enrolled in the Army Management Intern Program (AMIP), she credits her supervisor, Dean Westerman, chief of the Resource Studies Combat Support Division, with stimulating her to coauthor a paper.

Linda Kimball graduated in 1972 from Maryland College with a bechelor's degree in mathematics and English. After teaching school for two years in Joppatowne, MD, she accepted the AMIP opportunity 17 months ago with AMSAA. How does she like her work in ORSA?

"Oh, I enjoy it! It's challenging—more compatible with my capabilities."

Miss Teresa A. Bridgford, 23, entered ORSA as a career field about 18 months ago, shortly after graduating from St. Ambrose College, Davenport, IA, with a BA degree in mathematics. William Rankin, chief of the Simulation Technology Division, Rodman Laboratory, Rock Island (IL) Arsenal, encouraged her to coauthor a paper with Richard E. Heber and Francis X. Brandi.

Miss Bridgford also was enthusiastic about her ORSA work, but commented: "I would like to see more women in ORSA. It's a stimulating field."

Miss Wanda L. Phillips coauthored a paper with Albert C. Aiken (decreased) and David V. Strimling, U.S. Army Armor School, Fort Knox, KY, titled Individual Suppression as Induced by Direct Fire Solid Propellant Weapons.

Dr. Nancy R. Mann, Rocketdyne, International Rockwell Corp., coauthored a paper presented by Dr. Frank E. Grubbs, Aberdeen Proving Ground, MD, one of the Army's pioneers in operations research and systems analysis. Dr. Mann did not attend. Other women attendees were Mrs. Mary J. Russel and Miss Jennifer Tregilgus, both with the Army Logistics Center at Fort Lee.

AMONG WOMEN participants in AORS were (from left) Audrey Mitchell, Mrs. Anita A. Ontiveros, and Linda Kimball.

AMC Commander GEN John R. Deane Jr.

Scenes at Missile Manufacturing Technology Conference

ADPA Executive Vice President GEN Harry A. Miley Jr. (Ret.), former AMC commander, is flanked by J. Frank Dement, Martin Marietta Aerospace; Dale Hartman, Hughes Aircraft; Elliot Ring, Richard Howell, Martin Marietta; Ed Gardner, AMC.

Deputy Secretary of Defense William P. Clements, Mrs. Rita Clements, and BG Harry A. Griffith at conference reception.

From left, Daryll Seymour, Boeing Aerospace Co.; Leonard Buchanan, General Dynamics Corp.; Howard McCoy, General Dynamics Corp.; Joan Howell, wife of Richard A. Howell, Martin Marietta Aerospace; Howard Stewart, General Dynamics Corp.; J. Michael Thomas, General Dynamics Corp.; Leo Siebenaler, Boeing Aerospace Co.

Ralph Manfred, Aerojet Solid; Donald Graves, Hercules, Inc.; Mrs. and Richard Sailer, Hercules, Inc.; Tug Wilson, United Technologies Corporation; Donald Loomer, Northrop Corp.

From left, Joseph Ferderber, Hughes Aircraft Co.; William Wiley, Teledyne Ryan Aeronautics; BG Hillmam Dickinson, DCSRDA; Earl White, Honeywell, Inc.; Henry Handler, AMC.

From left, Francis Heiser, Watervliet Arsenal; Dr. Raymond Fenn, Lockheed Missiles and Space Co.; Fred Lee, IBM Corp.; Robert Davidson, Martin Marietta Corp.; Albert Hoffmanner, Battelle Columbus Laboratories; Ron Petersen, Lockheed Co.

PROTOCOL OFFICER Stacey Davenport, MICOM; Virginia, wife of Edward Mackiewicz, TACOM; Kay, wife of William Gain, Boeing Aerospace Co.; Suzanne, wife of Ed Gardner, AMC; Nancy, wife of Robert Vollmer, Aviation Systems Cmd.

Ammunition Systems for Future Tanks

By Earl H. Buchanan

EARL H. BUCHANAN, chief of the Munitions Development Branch, Ammunition Development Division, has been with Picatinny Arsenal for the past 31 years. He is considered an expert for the Army on tank ammunition and has served on several international panels.

In 1968, Buchanan received the Army's second highest award given to a civilian employe, the Army's Meritorious Civilian Service Award, and has received several other Army awards during his career. Buchanan attended North Carolina University and Colgate University under the auspice of the U.S. Navy and served as a WWI Navy pilot.

In the march-April 1975 issue of the *Army Research and Development Newsmagazine*, it was reported that the United States, United Kingdom (UK) and the Federal Republic of Germany (FRG) were conducting a series of tripartite firing trials to evaluate candidate gun-ammunition systems for the next generation of tanks.

Systems under consideration for use on the FRG Leopard 2 tank, the joint FRG/UK future MBT and the U.S. XM1 tank, include the FRG 120mm gun, the UK 110mm gun and the U.S. 105mm gun with improved ammunition.

The trials have been completed, but assessment of the results will not be available for some time. The standard U.S. 105mm tank gun with its new fin-stabilized kinetic energy (KE) cartridge demonstrated its ability to compete with the newer systems.

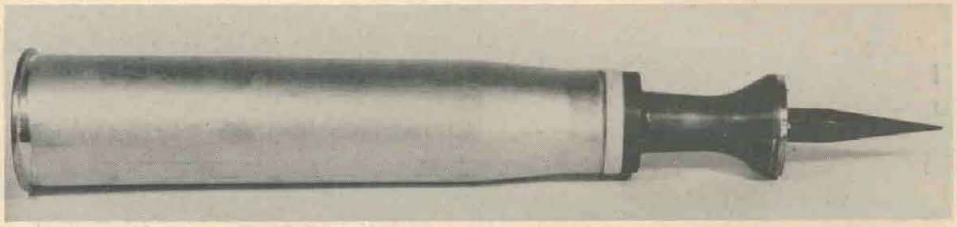
The U.S. candidate, by far the lightest of the three systems, uses the standard M68 gun, which is the main armament for the U.S. M60-series tank. This gun, or its UK equivalent the L7, is used by practically every member of the NATO alliance and numerous other countries of the Free World, including Israel.

The secret to providing this smaller gun system with the necessary precision and penetrating power to meet requirements established by the FRG and UK for their future MBT is the XM735 APFSDS (Armor-Piercing Fin-Stabilized, Discarding Sabot) cartridge.

Designed and developed at Picatinny Arsenal, Dover, NJ, the XM735 is relatively radical in design compared to the conventional armor-piercing spin-stabilized discarding sabot shot (APDS), now standard throughout most of NATO.

The design concept goes back to the 1950s when Picatinny Arsenal researchers, convinced that the long, slender, fin-stabilized projectile was the way to go, were conducting design studies, and manufacturing and firing small quantities of experimental models of this concept.

Over the years, the studies were continued, although the demands for available dollars to meet requirements, such as the Berlin Crisis and Vietnam, did not permit allocation of sufficient money or manpower to bring the concept to an earlier fruition.



XM735A Armor Piercing Fin-Stabilized Discarding Sabot Cartridge

However, when it became necessary to provide a KE-type round for the joint U.S.-FRG MBT-70 effort in the middle 60s, the basic projectile that provided this capability was a fin-stabilized round designated the XM578 APFSDS cartridge. It was the only way this capability could be provided to the 152mm system, which was designed to launch the Shillelagh as the main antiarmor weapon.

Scratched because its degree of sophistication made the cost prohibitive, the MBT-70 was succeeded by the XM1. Parametric studies of main armament systems for the SM1, conducted at Picatinny Arsenal, and based on requirements established at that time, indicated that a gun-ammunition system somewhat smaller than 105mm could satisfy the requirements established for this system.

The tremendous logistic advantage of being able to utilize the worldwide stockpile of existing 105mm guns and ammunition led to the decision to develop a KE cartridge of significantly improved performance, but designed to operate within the envelope of the standard M68 cannon.

The basis for performance predictions was the data generated in firings of the XM578 APFSDS cartridge. Initially, the subprojectile was lifted almost intact from that program, the only difference being the development of a 105mm sabot and the reduction of the fin diameter. This cartridge was designated XM735.

Early firings of the XM735 confirmed these predictions; however, when the U.S. entered the tripartite trials, it became clear that considerable attention would be focused on the ability of the competing systems to achieve the higher levels of penetration that had been agreed to between the UK and the FRG.

Picatinny's research on penetrators, particularly on core material, was used as the basis for some changes designed to achieve the level of penetration required by the UK and the FRG. Success was achieved and, with the XM735E2 demonstrated in tht later trials, the Anglo-German penetration goals were met.

During the trials, the XM735 also conclusively demonstrated its ability to match or exceed the precision of spin-stabilized projectiles. This achievement should lay to rest the long-standing controversy over whether a fin-stabilized round can compete for precision with spin-stabilized projectiles.

The performance of the XM735E2 with its high ratio of length-to-diameter, developed in conjunction with the Chamberlain Corp., and its tungsten alloy core, manufactured by a new and unique process, developed in conjunction with Kennemetal, has demonstrated a remarkable increase in effective range over the standard 105mm M392 APDS cartridge.

However, a new design, offering even greater improvement, was demonstrated during the tripartite trials. This firing was conducted at Aberdeen Proving Ground, MD, and witnessed by officials of the other trials partners and high ranking officials of the U.S.

The new design, designated XM774, uses a highly efficient penetrator material in a further-optimized length-to-diameter configuration. Although still in the early stages of development, results of these trials show a "growth potential" for the 105mm gun that exceeds tripartite goals

M60-Series Tank With 105mm Gun System

by 50 percent in effective range.

With full realization that many factors other than dispersion and penetration enter into final results, it is certain that the impact of XM735 APFSDS cartridge development will be felt for years.

It provides a viable option as the main armament for the U.S. XM1 MBT, at a significant decrease in weight and cost over the other two candidates, and with a family of ammunition stockpiled.

Regardless of the trilateral gun decision, it will be used in existing tanks to provide a significant increase in the potency of the U.S. M60 battle fleet, guaranteeing ability to defeat armor the enemy can field for years to come.

In addition, it provides an inexpensive means of up-gunning that large portion of NATO that utilizes the 105mm gun system to provide significant improvement in its defense posture.

Army Engineer Aids ERDA In 'Boiler Fuel' Program

Dr. Richard Hutchinson, a chemical engineer at Picatinny Arsenal, Dover, NJ, has been selected by HQ Army Materiel Command to assist the Energy Research and Development Administration (ERDA) in designing a plant that converts soft coal to other energy forms.

Dr. Hutchinson was appointed because of his experience in designing high explosive pilot plants at the arsenal. Half his time is now spent in Washington, DC, on the "boiler fuel" program.

"The project is directed toward using high sulfur coal so that it does not pollute the environment," he explained. High sulfur coal is changed to liquid boiler fuel by pulverizing the coal to a fine powder. Then under pressure at 1,000°F, the powdered coal reacts with hydrogen gas and is partially converted to heavy oil and products such as natural gas and propane. By treating the remaining coal at high temperature with oxygen and steam, the hydrogen needed for the conversion process is formed.

One result of Dr. Hutchinson's work is a contract awarded to Coalcon Corp. to build and operate a demonstration plant to convert 2,500 tons a day of high sulfur coal to clean fuels.

Dr. Hutchinson has been recognized by the Department of the Army with an award for outstanding work on high explosives. He received his PhD from Lehigh University. His doctorate dissertation was titled "The Effect of Iron Impurities on Thermal Decomposition of Lead Azide," a research project supported by Picatinny Arsenal under an Army career advancement program.

Kem Departs Office Chief of Staff for OCE Public Affairs

LTC Richard S. Kem, former assistant to the Director of the Army Staff, Office, Chief of Staff, is now public affairs officer, Office of the Army Chief of Engineers, U.S. Army Corps of Engineers.

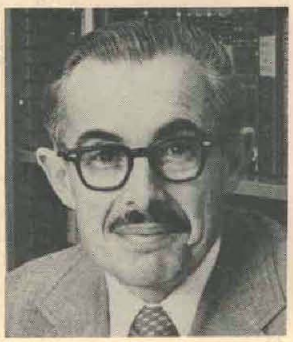
A 1956 graduate of the U.S. Military Academy, LTC Kem has MS degrees in civil engineering from the University of Illinois and in international affairs from George Washington University. He has completed courses at the Army Command and General Staff College, and Naval WC.

Included among his military awards and decorations are the Legion of Merit, Bronze Star Medal, Meritorious Service Award, Air Medal with Oak Leaf Cluster (OLC), and the Army Commendation Medal with OLC.

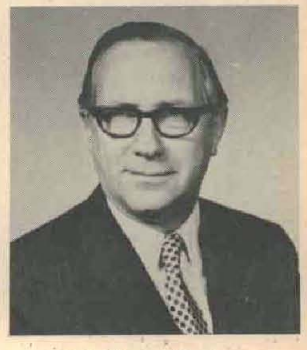
Future Requirements Cited . . .

Natick Development Center Hosts International Food Meet

MG John C. McWhorter



Dr. Marcus Karel



Dr. Jean Mayer

Food and logistics experts representing the United States and eight foreign nations exchanged technical and general information at the recent Third International Meeting on Food for the Armed Forces at the U.S. Army Natick (MA) Development Center.

Keynote speaker MG John C. McWhorter, former commander of the Natick Laboratories (now the NDC) and currently deputy director for Logistics (Strategic Mobility), Office of the Joint Chiefs of Staff, discussed the present service and future planning for military food service in the field and in the garrison.

Looking at future "optimal" requirements for operational rations, he remarked that "field commanders, logistics planners and transporters all agree. They would like a completely nutritious ration that weighs practically nothing, takes up no space, and has an indefinite storage life under all temperature conditions. . . . The increased sophistication of our armies makes these factors more important than ever."

The weight-carrying capacity of the individual soldier has not increased, he siad, but modern technology has added to his burden with various new handheld weapons, body armor and other protective equipment items.

MG McWhorter said he is encouraged by recent Natick developments such as compressed freeze-dried foods, thermally processed foods, the new individual meal-ready-to-eat in flexible packages, and the long-range patrol rations developed for use in Vietnam.

Peacetime garrison food service is the U.S. Army's biggest problem in carrying out its Department of Defense assigned responsibility of providing nutritious and popularly acceptable food for the U.S. Armed Forces, he said—stressing that "since we now have a volunteer force, we must install positive thoughts in our soldiers about the food they will be served and facilities in which they eat.

"Let me, in closing, make a final reflection upon our reasons for being here today. We all recognize, I am sure, that these exchanges on food for our Armed Forces are building blocks in the structure we are erecting to insure our mutual security and world peace.

"Our need to improve our capabilities is unrelenting. One of the most promising areas for progress is that of standardization! Currently, NATO standardization is receiving a lot of attention in the Pentagon. . . ."

Other distinguished U.S. food experts who delivered featured addresses included Dr. Jean Mayer, professor of Nutrition, School of Public Health, Harvard University, and Dr. Marcus Karel, deputy department head and professor of food engineering, Masachusetts Institute of Technology.

Dr. Mayer's banquet address was directed toward the world food crisis and the critical dependency on petroleum products for fertilizer production. He said that underdeveloped countries can not have adequate food supplies unless they receive assistance in farm mechanization and petroleum energy resources.

Dr. Karel stressed that during the next 25 years man must find as many new food sources as he found during his first four million years of existence. This "new era," as he termed it, will be characterized by engineered foods, with the emphasis on high nutritional qualities, sanitation in processing, and major technological advances in understanding chemical interactions in food preparation and packaging.

In addition to experts from all of the U.S. Armed Forces, U.S. conference representation included personnel from Natick DC's Engineering and Food Sciences Laboratories, and Dr. Edward Anderson, special assistant for the Department of Defense Food Program and U.S. coordinator of the conference.

Foreign representation included food experts from Belgium, Canada, Denmark, Germany, United Kingdom, Norway, Sweden and The Netherlands.

Defense Directive Assigns Army as Conventional Ammunition Manager

Department of Defense No. 5160.65, dated Nov. 26, 1975, provides instructions to the Secretaries of the Army, Navy and Air Force for implementation of a program under the Army as the Single Manager for Conventional Ammunition. The transmitting memorandum is signed by Deputy Secretary of Defense William P. Clements.

"This action will improve the management and result in savings and increased efficiency," a DoD announcement stated, explaining that plans for integration of facilities and personnel of the other Military Departments will be worked out over the next several months by the DoD and the Service Secretaries.

Planning for and joint use and modernization of ammunition plants and facilities will begin immediately. This phase will be followed, as soon as the necessary program changes are submitted and approved, by the Army's assumption of centralized management of conventional ammunition.

The established target date for changes in personnel and costs phasing into the regular planning, programing and budgeting cycle is not later than the end of FY 1979 but as "quickly as possible."

Objectives prescribed in the directive include:

- Integrate conventional ammunition logistics functions of the Military Departments to the maximum extent practicable, thereby eliminating unwarranted overlapping and duplication; and
- Achieve the highest possible degree of efficiency and effectiveness in the DoD operations required to provide top quality conventional ammunition to the U.S. forces during peacetime and mobilization.

Conventional ammunition (hereinafter referred to as "ammunition") includes: Small arms, mortar, automatic cannon, artillery and ship gun ammunition; bombs (cluster, fuel air explosive, general purpose and incendiary); unguided projectiles and rockets; chemical ammunition with various fillers (incendiary, riot control, smoke, toxic agents, burster igniters, peptizers, and thickeners for flame fuel.

Included also under the definition are: Flares and pyrotechnics; land mines (ground-to-ground and air-to-ground delivered); demolition materiel; grenades; all items included in the foregoing, such as explosives, propellants, chemical agents, cartridges, propelling charges, projectiles, warheads (with various fillers such as high explosive, illuminating, incendiary, antimateriel and antipersonnel); fuzes, boosters, and safe and arm devices, in bulk, combination, or separately packaged items of issue for complete round assembly.

Specifically excluded in the definition are: Guided missiles; naval mines and torpedoes; nuclear ammunition and included items such as warheads, warhead sections, projectiles, demolition munitions, and training ammunition; cartridge and propellant-actuated devices; chaff and chaff dispensers; and guidance kits for bombs or other ammunition.

The remaining eight pages of the single-line-spaced directive use about half of this space to prescribe the responsibilities of the Secretary of the Army, with the remaining pages spelling out Navy and Air Force requirements.

Among the Army responsibilities is to establish and maintain, in coordination with the Secretaries of the Navy and the Air Force and the director, Defense Supply Agency, where appropriate, a quality assurance program, including first article testing and approval, that conforms to the policies prescribed in DoD Directive 4155.1.

AMC Project Managers Convene . . .

Army Training Device Agency Hosts Annual Meeting

PROJECT MANAGERS try training device during tour of Training Device Agency.

U.S. Army Materiel Command project managers for major weapons and materiel systems held their sixth annual conference Nov. 11-14 as guests of the U.S. Army Training Device Agency, Orlando, FL, with high-ranking Army and industrial leaders as speakers and participants.

Assistant Secretary of the Army (Installations and Logistics) Harold L. Brownman was originally programed only for the banquet address, but he also spoke on behalf of Secretary of the Army Martin R. Hoffmann on the opening day due to a late development change.

Brownman's address conveyed Secretary Hoffmann's acknowledgement of appreciation for the important role of AMC project managers in the materiel acquisition process, along with assurance of support for their efforts. Other luncheon speakers were Dr. James R. Larkin, Washington, DC, representative for TRW Systems, and Thomas G. Pownell, president of Martin-Marietta Aerospace.

AMC Commander GEN John R. Deane Jr. gave the keynote address on "Knowing the User," following opening remarks by AMC Deputy CG for Development LTG George Sammet Jr. GEN Deane also expressed his recognition for outstanding achievements of project managers and stressed the importance of a strong interfacing relationship with the Army Training Device Agency.

Commanded by COL Leszczynski, the ATDA is an element of the Training Device (TRADE) Project headed by COL Leland A. Wilson at Fort Benning, GA.

MG Ira A. Hunt, director of the Directorate of Battlefield Systems Integration, established recently as the newest major element at HQ AMC, gave a briefing on its organization and functions. Francis X. McKenna, AMC General Counsel, discussed "Standards of Conduct."

AMC Director of Maintenance BG William E. Eicher gave a major address the second day on "Project Hand-Off," the recently initiated major effort of the AMC to insure "user satisfaction" with new or improved items of materiel when they are turned over to field units.

COL Dan H. Williamson Jr., PM for M60 Tank Development, and MAJ Ralph

ASA (I&L) Harold L. Browman and Mrs. Sarah (Sally) Clements, assistant deputy, Materiel Acquisition, to the ASA (I&L).

AMC Commander GEN John R. Deane Jr.; MG Ira A. Hunt, AMC; and Dr. James R. Larkin of TRW Systems Inc.

P. Brown, M60 NET team leader, spoke on their highly successful "Hand-Off" of the M60A2 tank in Europe.

MG Elmer R. Ochs, commander, Operations Test and Evaluation Agency, discussed OTEA activities and abilities.

Other leading speakers included AMC Deputy Director for Research, Development and Engineering Dr. Richard L. Haley; HQ AMC Assistant Deputy for Materiel Development John D. Blanchard; BG William J. Hilsman, PM for ARTADS; and COL Franklin A. Hart, Training and Doctrine Command.

Herbert Roback and Thomas S. Hahn, professional staff members of the U.S. House of Representatives Committee on Armed Services, spoke on the congressional interface with project managers.

A high point on the agenda was a tour of the Army Training Device Agency facilities. COL Leland A. Wilson, PM for Training Devices, spoke on the mission capabilities and support provided by his project. Agency staff members followed with briefings on its operations and the broad diversity of training devices currently under development to reduce time and costs of Army training.

Another conference highlight was GEN Deane's presentation of a plaque to Mrs. Sarah (Sally) Clements on behalf of the PMs, to whom she became known as "Den Mother" while she served as assistant chief of the AMC Office of Project Management. She recently became the Army's first GS-16 female employe when promoted to assistant deputy, Materiel Acquisition to the ASA (I&L).

Armament Development Center, Logistics Command Created

Another major recommendation of the Army Materiel Acquisition Review Committee (AMARC) was effected Dec. 2 with announcement of formation of the Armament Development Center, and Armament Logistics Command as components of the Army Materiel Command.

Issued through the Department of Defense, Secretary of the Army Martin R. Hoffmann's announcement explained that the action will consolidate AMC's field armament elements into two distinct organizations. One is charged with responsibility for materiel development, the other for logistics management.

An interim (provisional) Armament DC headquarters is scheduled to become operational between July 1 and Oct. 1, 1976, and will then assume responsibility for managing ADC programs and the budget. Command of subordinate elements is programed for progressive accomplishment over a 4-year period.

Picatinny Arsenal, Dover, NJ, an Army armament and munitions R&D installation since the American war for independence, will be assigned directive responsibility for ADC activities. Both large and small caliber weapons systems laboratories will be located at Picatinny, but the Benet Laboratory, part of the Large Caliber Systems Laboratory, will continue at Watervliet (NY) Arsenal.

Existing activities at Aberdeen Proving Ground/Edgewood Arsenal, MD, will be used form the Ballistics Research and Chemical Systems Laboratories.

Functions of the Rodman Laboratory, Rock Island (IL) Arsenal, are programed for transfer to elements of the new ADC. As announced in November 1974, the closure of Frankford Arsenal, Philadelphia, PA, will continue.

Similarly, Army Armament Command resources at Rock Island Arsenal will provide the basis for formation of the Armament Logistics Command, thereby further consolidating functions of the Army Armament Program. ARMCOM will be disestablished.

Major improvement of Army armament functions is the dominant objective of the realignment but resultant economies will affect 5,755 civilian jobs, including elimination of 3,163 civilian and 43 military spaces. Estimated cost of the realignment is about $86 million, but a saving of $42 million in annual operating costs is anticipated.

The Army announced that resources freed by the realignment will be reallocated to improve combat forces, but that plans do not provide for modifications possible as a result of Congressional action on the FY 76 budget.

All Army career employes are assured of maximum assistance in continuing their careers as U.S. Government employes through transfer with functions or reassignment to other positions in the Department of Army or other agencies.

AMC Cost Saving Suggestions Yield $38 Million

Cost-saving ideas submitted through the Army Incentive Awards Suggestion Program accounted for U.S. Army Materiel Command FY 75 economies totaling $38,004,604—$150,000 every working day or $1.5 million each 2-week pay period.

Civilian employes accounted for more than $36 million and military personnel, comprising roughly 10 percent of AMC's work force, saved about $1.75 million. Moreover, 91 percent of the civilian savings were made by only 11 installations.

Particularly outstanding was Savanna Army Depot in Illinois with 177.7 suggestion submissions for each 1,000 employes, almost doubling its FY 74 percentage and 304.3 percent of the worldwide norm set by the Army. Tooele (UT) Army Depot reached an index of 174 percent and Pueblo AD in Colorado achieved 144.0 percent. Pueblo had the largest submission rate of 412.5 per 1,000 employes and Seneca AD in New York had 374.8 percent based on an Army goal of 225 per 1,000.

Sharpe AD was the AMC leader in the rate of adopted suggestions with 153.1 based on a DA goal of 56 percent. Second was Savanna AD with 106.7 percent. Sacramento (CA) DC was third with 103.5 percent.

Troop Support Command submitted the highest number of suggestions, 317.6 per 1,000 employes—among AMC's seven major subordinate commands—(92.6 of the Army-wide goal) and an adoption rate of 68.2 percent. The Armament Command was second with a submission rate of 246.2 percent and an adoption rate of 67.8 percent.

The Electronics Command paced all AMC commands in dollar benefits to the government through the Suggestion Awards Program with almost $8 million savings reported. The Missile Command was second with about $7.5 million.

Army Materiel Command employes collected about $675,000 in cash awards.

Dr. Payne Tranfers to WSMR as TRASANA Director

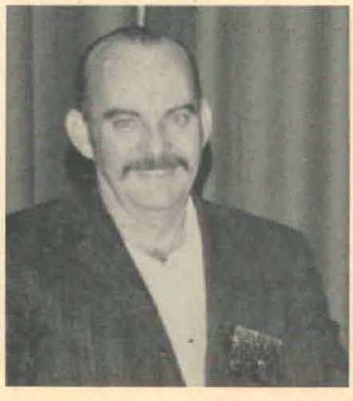
Deputy Under Secretary of the Army for Operations Research Dr. Wilbur B. Payne gave up that title shortly before he arrived Dec. 1 at White Sands Missile Range, NM, as director, U.S. Army Training and Doctrine Command's Systems Analysis Activity.

Dr. Payne, 48, had served since 1968 as DUSA(OR). He succeeded Leon F. Goode, acting director since Oct. 1. Goode was named interim director upon the retirement of COL Milton L. Haskin, TRASANA's last military director.

Dr. Payne has been responsible for policy guidance and for monitoring operations research activities throughout the Army and has also maintained liaison for the Army with these activities in the Defense Department and the other Military Departments.

A 1951 graduate from Tulane University with a BS degree in physics, he received his MS and PhD in physics from Louisiana State University (1953 and 1955).

From 1955 to 1958, Dr. Payne was an operations analyst with the Washington, DC, Operations Research Office of Johns Hopkins University. Following three years as associate professor of physics at Virginia Polytechnic Institute, he was with Research Analysis Corp., McLean, VA.



From 1962 to 1964, he was an analyst for the Assistant Secretary of Defense (Comptroller) and then transferred to the Department of the Army as special assistant for Operations Research, serving later as chief of the Operations Research Office.

Dr. Payne has been awarded the Department of Defense Medal for Distinguished Civilian Service and three different times has been the recipient of the Department of the Army Medal for Exceptional Civilian Service. Born in Pittsburgh, PA, he enlisted in the Army in 1943 at the age of 17. He served in Italy during World War II.

Joint Services Rocket Soundings Probe Atmospheric Disturbance Effects

Nineteen upper-air (twilight D-region) research missiles were launched during a 12-hour period early in December at White Sands (NM) Missile Range in a cooperative test involving the Army, Navy, Air Force and four universities.

Project scientist Thomas D. Conley, Air Force Cambridge Laboratories, said the test was designed to investigate the D and E regions of the atmosphere as a joint cooperative venture between AFCRL and the WSMR Atmospheric Science Laboratory of the U.S. Army Electronics Command.

Instruments and sensors carried by each of the missiles measured the characteristics of the atmosphere with a view to ascertain the mechanisms associated with the enhancement and decay of hydroxyl (CH) emissions. The purpose is to determine the significant degrading influences on military communications, radar and infrared regions.

Rockets were used for the sounding because the D and E altitude regions are inaccessible for measurements by aircraft, balloons or satellites.

Dr. Conley explained: "The Department of Defense is interested in resolving current difficulties in predicting radio frequency and infrared blackout under disturbed conditions. Naturally occurring twilights and auroras create disturbances of these regions which can be studied, thus leading to a general understanding of resulting ionospheric chemistry."

Additional participants in the test included the WSMR Naval Ordnance Test Facility, Utah State University, the University of Texas at El Paso, Oklahoma State University, and New Mexico State University. Tests were conducted at altitudes of 70 and 110 kilometers. Ground observations also were made, using spectrometer and radiometer techniques.

AMC 5-Year Program . . .

$14 Million Provided for Antipollution R&D

Elimination or minimizing of pollutants in munitions manufacturing processes is receiving top priority in a $14 million research and development program to make the U.S. Army Materiel Command's 78 military installations pollution-free or within U.S. Environmental Protection Agency standards.

The 5-year program, which involves 35 pollution abatement and environmental control projects (including air, water, solid waste and hazardous materials), is being planned and directed at Edgewood (MD) Arsenal. Work is under the guidance of Allen E. Hilsmeier, technical projects coordinator in the Office of the Technical Director.

The U.S. Army Natick (MA) Development Center (NDC) is programed to receive about $4.5 million over the next five years for three solid-waste management and recovery investigations and two studies in treatment of explosive wastes.

Edgewood Arsenal, part of the Armament Command (ARMCOM), will get about $3.5 million for instrumentation to support all areas of pollution abatement and environmental control. This includes preparation of environmental impact assessment statements for controversial R&D projects and preliminary studies for eliminating munitions plant pollutants.

The U.S. Army Mobility Equipment Research and Development Center (MERDC), Fort Belvoir, VA, is budgeted for $2.9 million for eight projects involving air, water and solid-waste studies.

Picatinny Arsenal Dover, NJ, is scheduled to receive about $2.5 million over five years for eight water and solid waste munitions R&D projects. Fort Monmouth, NJ, HQ U.S. Army Electronics Command, is programed for about $400,000 to investigate environmental pollution problems.

Frankford (PA) Arsenal will get $200,000 for liquid-crystal tests on brass cartridge cases and studies on the reclamation of cyanide waste.

As AMC's lead laboratory for pollution abatement and environmental control technology, Edgewood Arsenal is charged with providing new direction to environmental programs and establishing priorities and milestones, Hilsmeier said, adding:

"One of our first actions was to ask each AMC command and laboratory to identify specific environmental requirements where research and development was needed to meet the specifications of the Federal Water Pollution Control Act, the Clean Air Act, the Resource Recovery Act as amended by the National Solid Waste Disposal Act, and the National Environmental Policy Act."

Hilsmeier explained that the survey was "rather complex" because of the diversity of AMC activities and the scope of pollution problems. AMC installations are involved with all aspects of Army aviation, electronics and missiles; nuclear, conventional and chemical armament; tanks, mechanized artillery, trucks and all forms of transportation including troop support; and testing and evaluation.

Survey results were evaluated by Edgewood Arsenal's 12-man technical advisory board, with representation from the major AMC centers of research, development and engineering. Recommendations were made on the basis of need for R&D effort, uniqueness and magnitude of problem areas to AMC, elimination of problems rather than reducing impact on the environment, other agencies' current or anticipated involvement, and the reduction of energy requirements.

Findings of the board were the basis for the 5-year environmental research and development program now under way.

Hilsmeier said that the top-priority projects are those involving munition wastes, explaining: "These problems are considered the most serious in magnitude among those within the wide range of pollutants of concern to the Army Materiel Command. The Armament Command produces most of the explosive materials used by the Army, Navy and Air Force."

Elimination of solid wastes was given second priority. The goal is to reduce the volume and weight of solid wastes generated through the AMC complex, or to eliminate them altogether by converting them into useful products. Far-reaching results are anticipated as a result of R&D pilot and prototype plant operations in progress and planned for the enzymatic conversion of cellulose to glucose at Natick Development Center.

The third priority involves ways and means of collecting sewage from Army watercraft and treating it ashore since legislation prohibits disposal overboard. Another area of concern is an effective means of collecting and treating human wastes from troops in the field.

Work on fuels and lubricants is the fourth area of priority. Much of the technology that the private sector and the Environmental Protection Agency (EPA) are developing for vehicles is applicable to Army needs. Army research is limited to projects involving emissions from special fuels.

"Edgewood Arsenal maintains close coordination with the Corps of Engineers and the Army Surgeon General," Hilsmeier said. "This involves periodic technical meetings as well as the exchange of program data sheets."

Coordination and cooperation also are accomplished with the Navy and Air Force through Department of Defense Environmental Quality Cotnferences, and the Joint Army-Navy-Air Force and NASA Environmental Protection Committee on Propulsion Activities.

Other government agencies also are queried regularly for any spinoff from their studies that may apply to Army problems. With regard to other U.S. Government agencies, Hilsmeier explained that coordination is completed by screening 12 data bands for information pertinent to AMC's mission.

Transfer of technology for pollution abatement and environmental control technology is accomplished in several ways. Primarily, each research and technology summary sheet identifies ongoing work that has current or potential application to civilian agencies.

The Armament Command also maintains a semiannual technology transfer report for review. All reports generated are sent to the Defense Documentation Center (DDC), Cameron Station, VA, where they are available to several thousand registrants. Unclassified reports are published by the National Technical Information Service (NTIS), U.S. Department of Commerce, where they are sold to the general public.

"The entire environmental R&D effort is evaluated annually to determine if all 35 individual projects continue to coincide with federal and Army objectives," Hilsmeier explained. "We obtain and update technical, fiscal and schedule milestones. Priorities will be reevaluated and, if necessary, shifted."

He estimates that most U.S. Army R&D efforts should be completed by FY79. Concepts will then be evaluated and the optimum techniques or abatement systems will be selected by FY80 for pilot studies. At that time, each commodity center will be responsible for follow-up efforts to meet the hopeful objective of zero pollution discharge by 1985.

Hilsmeier noted that several Army R&D projects will continue beyond FY80. They include packaging reduction, protection of materials from fungi deterioration, environmental impact assessments and reports, fuel-emission relationships, and state-of-the-art surveys of accomplishments in the private sector as well as within the Army.

"This," he explained, "is because end-products, as well as their production methods and means of disposal, will continually be changing and will require further environmental studies."

220 Attend R&D Associates Meeting at NDC

"Technology, Feeding Systems and the Challenge of the Future" was the theme of the fall meeting of the Research and Development Associates at the Natick Development Center, MA, attended by about 220 representatives of industry, U.S. Armed Forces and other agencies.

Among the attendees were 10 representatives of eight foreign countries who had just participated in the Third International Meeting on Food for the Armed Forces, also held at the NDC.

The 2-day meeting was organized into four sessions. Subject areas and moderators were: Problems in Disaster Feeding, Charles Hinman, Quaker Oats Co., past chairman of the board of R&D Associates; Food Service Development Needs, Robert J. Byrne, chief of Operations Research Systems Analysis Office, Natick Development Center (NDC); New Developments in Food Service Systems, Dr. Edward E. Anderson, special assistant, Department of Defense Food Program, NDC; Flexible Packaging of Food and Military Specifications, Dr. John B. Mann, director of Research for Heublein Inc. and VP for Activities, R&D Associates.

Addresses or technical presentations were made by about 40 participants including featured talks by LTG James M. Gavin (USA, Ret.), the U.S. Army's first Chief of R&D in 1955 and currently chairman of the board of Arthur D. Little Inc.; James H. Sullivan, president of R&D Associates and director of R&D, McCormick and Co., Incl; and COL Rufus E. Lester Jr., commander of the Natick Development Center.

PARTICIPANTS at R&D Associates meeting (from left) Dr. Edward E. Anderson, special assistant, DoD Food Program, NDC; LTG James M. Gavin (USA, Ret.), chairman of the board, Arthur D. Little, Inc.; COL Rufus E. Lester Jr., NDC commander; COL Merton Singer (USA, Ret.), executive secretary, R&D Associates.

LTG Vaughan 'Fully Supports' AMC FWPC Goals

Organization of a U.S. Army Materiel Command Federal Women's Program Committee to promote a program of equal opportunity for women in higher-level jobs, along with other objectives, was recognized by AMC Deputy Commander LTG W. W. Vaughan when he spoke at its recent first meeting.

Assurance that the FWPC at HQ AMC will have full support was given by LTG Vaughan in discussing implementation of the national FWP objectives provided by President Ford and the Congress. Other speakers were George Jones, HQ AMC Equal Employment Opportunity Program officer, and Mrs. Ernestine Mangana, HQ AMC coordinator for the FWP.

As explained at the meeting, the committee will "offer suggestions and formulate goals for the FWP, help in selection and recognition of outstanding women, and serve to identify and resolve those problems which preclude women from fully participating in the EEO setting."

Secretary of the committee is Edith A. Brauer, I&S (AMCIS-P). Other members and symbols of their offices are: Brenda K. Anderson, elected at large; Rosemary Hosse, AMCGC; Lorraine Armstrong, AMCRD-R; Estelle E. Rothwell, AMCCE-E; Florence U. Jones, AMCCP-MI; Patricia J. Parks, AMCHO; Amy H. Gill, AMCSU-A; Teresa C. Kish, AMCMA-E; Mary Utterback, AMCPT-R; Dorothy B. Stokes, AMCLM-D; Mary E. Mooney, AMCSS-I; Ella P. Hance, AMCIN-CI; Ingjerd O. Omdahl, AMCAM-L; and Barbara E. Lee, AMCMS-IS.

Dr. Bramley's Ire Provoked

Dr. Jenny Bramley has rightfully expressed indignation about an item in our July-August edition that stated Marilyn Levy had become the first woman in U.S. Army Electronics Command history to achieve GS-15 grade.

Misinterpretation of a slightly ambiguous phrase in the ECOM news release about Miss Levy's promotion, stating that she was the only woman in ECOM holding GS-15 status caused the error.

Dr. Bramley achieved GS-15 status in 1967 as an internationally known physicist and electronics engineer in the ECOM Night Vision Laboratory, Fort Belvoir, VA.

Until demoted by a RIF (Reduction in Force) in 1972, Dr. Bramley was ECOM's only GS-15 female technical employe. Her complaint of sex discrimination is pending in federal court. Author of more than 50 published technical papers, she has been granted 13 U.S. patents and has others pending.

Roland Meets Test Objectives In Intercept of Drone at WSMR

All test objectives were met is the report on the firing of the Roland missile system to intercept a jet drone Nov. 18 at White Sands (NM) Missile Range, in the first of several live firings planned in this country for the French-German developed weapon.

The U.S. Army has selected the Roland to meet requirements for an all-weather, short-range air defense missile system. A German crew manned the Nov. 18 firing and American crews will take over in other tests.

"The cooperative test program," reported COL Henry F. Magill, Roland project manager for the U.S. Army missile Command, "is giving our soldiers an early look at Roland, already in production for the French and German armies.

"We are getting operational and performance data through hands-on experience. That way we can surface any problems that might arise early in the transfer of technology and incorporate changes into the U.S. system."

The U.S. Roland system will be mounted on an American vehicle and will be built by the Boeing and the Hughes aircraft companies. Each Roland fire unit will carry 10 missiles—two ready for instant fire. Reloading is automatic.

Designed to protect battlefield troops and equipment and rear area emplacements against low-level air attack, the Roland system consists of two missile launchers, a search radar and a tracking radar mounted on a turret atop a single vehicle or placed in a fixed in installation. Fire control is computerized, with consoles and associated displays for the commander and the gunner.

BMDSC Man Selected for MIT Sloan School

Charles D. Smith Jr., U.S. Army Ballistic Missile Defense Systems Command, Huntsville, AL, was recently named one of 54 personnel to attend the Alfred P. Sloan School of Management at the Massachusetts Institute of Technology.

Graduated from the University of Alabama with a BS degree in electrical engineering, Smith has done graduate work at Drexel Institute of Technology and the University of Alabama. He is backed by 11 years experience in ballistic missile defense and has served with the Nike-X Project Office and two years at Kwajalein Missile Range.

EPA Documents Pesticide Lab Services

The U.S. Environmental Protection Agency (EPA) has announced publication of a free pamphlet describing its Pesticide Laboratory services which are available to federal, state and local government agencies.

Titled "Pesticide Examination Services," the 12-page document lists biological and chemical test capabilities of EPA laboratories and field operations in Beltsville, MD; Corvallis, OR; and Bay St. Louis, MS. Copies are available from EPA's Information Center (PM215), Washington, DC 20460, or any EPA regional office.

SPEAKING ON . . . *(from inside front cover)*

effective, high-quality defense systems and to reduce lead times. Projects sponsored by this program are primarily funded with procurement funds and are production oriented. They are designed to bridge the gap between R&D feasibility and full-scale production. This transition problem between R&D and production is especially difficult to solve.

Benefits of the manufacturing technology program are threefold. They reduce costs, cut lead times for current production, and reduce United States dependence on foreign sources for critical raw materials.

The manufacturing technology program has the potential not only to solve many defense production problems, but also has a great potential payoff in the civilian sector by increasing manufacturing productivity.

For example, numerically controlled machine tools were developed under sponsorship of the MT program. Their commercial use has revolutionalized some manufacturing processes and has significantly increased productivity in certain industries. Increased productivity accompanied by technological innovation is the key to prosperity without inflation, and to an economy better able to compete in the world marketplace.

Today, manufacturing represents the largest single segment of our gross national product—30 percent. If through our actions we increase the productivity of this large segment of our GNP, the impact on our economy as a whole will be very significant.

Although the U.S. is still the world leader in providing services and in total manufacturing output, the rate at which our productivity is growing is last among the 20 leading industrial nations of the world. We must accelerate our productivity growth.

One important factor which is limiting full realization of our manufacturing potential is the application of current state-of-the-art technology. Technology sharing is one of my major concerns and is a vital element of industrial health. Industries must not only know their own problems and innovate themselves; they must be willing and able to tap applicable technology wherever it happens.

The "not invented here" syndrome chokes the spirit of technological innovation; it is an attitude which all of us must work to change. One of the great secrets of Japan's successes in "high technology" is its willingness to adopt other technologies and build upon them. The Japanese sent teams around the world to find technology appropriate to their use. Once a desirable procedure was uncovered, they licensed it and often beat originators in applying it.

In contrast, the United States spends billions of dollars in research and development, but we are not applying enough of this new technology to the solution of today's manufacturing problems. We must do better. Action has to be taken to insure more dividends from Government-sponsored research, development and technology programs.

Technology must be communicated, not duplicated! With limited budgets, we cannot afford to "reinvent the wheel." That is one of the reasons why the results and accomplishments of the Department of Defense manufacturing technology program must have wide dissemination.

We plan to have more industry critiques upon completion of projects, and also institute more exchanges through conferences such as this.

I recently spoke with a corporate executive who said he was giving technology transfer major emphasis in all his divisions. In fact, his division managers' aggressiveness and ingenuity in using "outside developed" technology and ideas are major factors in his evaluation of their performance. That's the attitude I am looking for and we need more of it!

All of this discussion relates to the "health" of our defense industrial base. You have heard comments regarding the "erosion of the defense industrial base." There are many contributing factors, such as material shortages, increases in production lead times, growing obsolescence of our industrial facilities, and inadequate availability of capital for modernization of our producton facilities.

There is evidence that certain sectors of our defense industrial base do not have the capability or, in some instances, the desire to respond to surge defense requirements. Reduced force levels, which I mentioned earlier, make it more important than ever for us to have a modern, efficient industrial base capable of rapid response to surge defense requirements.

It is a common misconception that military forces alone are a deterrent to war. I am sure today's perceptive citizen appreciates that a nation's industrial capability to respond rapidly to an emergency also exerts a strong deterrence to aggression.

The United States is lagging behind other industrial nations in expanding and modernizing its industrial base. The number of relatively new machines, less than 10 years old, is only 33 percent of total machine tools in place—the lowest level since before World War II. We must take action to reverse this trend.

Another area that needs attention is the greater application of net-shape manufacturing processes. In other words, "put metal where it is needed in the first place." Further developments and use of such processes as high-energy forging, iso-thermal forging, precision casting and diffusion bonding will make significant improvements in some of our present methods.

I recently witnessed a procedure where a conventional forging was reduced from 350 pounds to 36 pounds through the use of iso-thermal forging techniques. Considering the high cost and scarcity of many of the metals used today, we cannot afford to have 80 to 90 percent of the "on dock" forgings end up as worthless chips.

The machinability data center has analyzed information showing that approximately $60 billion a year is spent in labor and overhead costs for operating metal-cutting machine tools in the United States. There is high potential for cost reduction in metal removal. We should produce net shapes which require less machining, with necessary machining done in the most efficient way possible.

There have been many new developments in machine tools, such as numerical control, and direct numerical control. These advances offer great opportunities for improving productivity over conventional machines. In addition, retrofits of existing numerically controlled machines through the application of adaptive control techniques are being examined. Some relatively inexpensive retrofits have resulted in productivity increases between 30 and 50 percent. Hopefully, improvements will continue to be incorporated as new machines and retrofits evolve.

With this in mind. we must make certain that this nation does not give away all that we have gained from our manufacturing technology advancements. I am talking about the increasingly high levels of technology export. This drain has national security implications and also could have a far-reaching impact on the economic health of the nation and our future balance of payments.

The transition from demonstrated technical feasibility in the laboratory to useable manufacturing technology in the assembly line is a long and expensive process. It appears that some people in the United States do not fully appreciate the value of this technical know-how. However, you can be sure the communist bloc countries and other nations of the world do, and they are aggressively seeking new American manufacturing technology.

The communist nations, in particular, are using every means available to secure not only sophisticated machines but even complete manufacturing plants with all the production know-how to go with it. In many instances, the items they seek are of strategic value and could be used to manufacture sophisticated military hardware.

In addition, the technology could be utilized to manufacture goods capable of competing with our own high-technology products, both in domestic and international markets. We should move cautiously in exporting our technology because of these very serious implications. We must be careful not to export the "goose that lays the golden eggs."

In conclusion, there seems to be no lack of people who

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are predicting dire things for the future of the world. A common theory is that there are 10 stages to the cycle of each civilization, beginning and ending with bondage.

This cycle, although rooted in past civilizations, may apply to the future of our country. Assuming that all mortal creations have a beginning and an end, and assuming the validity of the scale in the first place, where is the United States now? Some so-called experts believe that this country is well into its decline. I do not believe it!

America has only "scratched the surface" in its quest for a better way of life. Through the stimulation of greater investment in new technologies, manufacturing methods, raw materials and modern machines, productivity will increase and our ability to compete will improve. This, in turn, will lead to an expansion of the economy and a corresponding decrease in unemployment. We at the Department of Defense realize that this will not occur through wishful thinking. The government is anxious to explore every practical and equitable way of moving our productivity ahead.

Federal support will probably be necessary, but industry itself must take the lead. I believe we will see more instances of government and industry cooperating as "partners" to solve the many manufacturing challenges facing us. Conferences such as this are a step in the right direction.

The Army's sponsorship of this session is one tangible result of their program. In addition, the Army's program is to fund and implement many of the projects which result from your work here this week.

Let me again stress the words "cooperation and partnership." Neither the Defense Department nor the Army manufacturing technology office can or will do it all. We will fund, encourage and stimulate, but the burden for follow-through action rests squarely on industry!

I have every confidence you will produce tangible and useful results. I commend you for your efforts to reduce costs and increase productivity. I look forward to a review of your findings and recommendations. Have a good meeting!

'Laboratory of the Year' . . .

WRAIR Achievements Cited by ASA (R&D) Award

Walter Reed Army Institute of Research, long renowned internationally for pioneering medical achievements that have benefitted millions of people in many countries, is the 1975 U.S. Army "Laboratory of the Year" award winner.

A Special Award for Accomplishment —recognizing the greatest improvement during the annual period covered by the program of awards initiated in 1974 by then Assistant Secretary of the Army (R&D) Norman R. Augustine—will be presented to the U.S. Army Mobility R&D Center, Fort Belvoir, VA.

Awards for Excellence were presented at the Army Materiel Command to its Ballistic Research Laboratories at Aberdeen Proving Ground, MD; Human Engineering Laboratories also at APG; Night Vision Laboratories, Fort Belvoir, VA, winner of the 1974 Army Laboratory of the Year award; and the Missile Command Laboratories at Redstone Arsenal, AL.

Other Awards for Excellence went to the Army Research Institute for the Behavioral and Social Sciences (Office of the Deputy Chief of Staff for Personnel); Construction Engineering Research Laboratory (Office of the Chief of Engineers); and the U.S. Army Research Institute of Environmental Medicine of the U.S. Army Medical R&D Command.

The purpose of the awards program is threefold:

- To create a means of routinely critiquing and ranking each Army In-House Laboratory.
- To provide a consecutive atmosphere in which the assessment can be accomplished so that a beneficial effect can be realized in terms of continually upgrading the Army's scientific and technical capability.
- To recognize quality performance.

Criteria for evaluation of the "best" laboratory include the degree to which each laboratory realizes its full potential impact in enhancing operational forces capabilities. A high-level ad hoc committee selects award winners.

Dr. Richard A. Montgomery, vice chairman of the Army Scientific Advisory Panel was chairman of this year's committee which included Donald J. Looft, deputy director, Defense Advanced Research Projects Agency; COL Donald I. Carter, military assistant to the Deputy Director, Defense Research and Engineering (Research and Advanced Technology); and

Dr. John Martin, Deputy Assistant Secretary of the Air Force (R&D); Dr. Herbert Ley, Army Scientific Advisory Panel consultant; and James Probus, director of Navy Laboratories.

Selection of WRAIR as Laboratory of the Year was based on an impressively varied program of medical research and development activities and a number of significant achievements. Considered particularly notable by the committee was introduction of a Meningococcal Vaccine Type "A" which has been authorized for military use by the Office of the Surgeon General.

A commercial firm has received U.S. Food and Drug Administration approval for manufacture and sale of the vaccine, using methodology and microorganism strains developed at WRAIR.

Additionally, WRAIR was cited for development of two new antimalarial treatment drugs considered superior to existing drugs and deemed a major achievement for "rapid definitive treatment of military personnel in the field."

Other WRAIR accomplishments cited by the ad hoc committee in their selection report include:

- *Characterization of Virus Antigens.* WRAIR studies of the composition and structure of the dengue virus produced by key data for vaccine development.
- *Hepatitis Viruses in the Military.* Epidemiologic studies demonstrated the co-occurrence of drug abuse and hepatitis in military personnel. WRAIR was credited with establishing more firmly the requirement for a hepatitis vaccine.
- *Microbial Genetics.* Studies of diarrhea-producing bacteria demonstrated the feasibility of developing an immunizing agent. One such organism, a hybrid of *E. coli* and *Shigella*, is now a candidate vaccine agent.
- *Trypanosomiasis.* A vaccine was developed from irradiated trypanosomes which protects cattle from naturally transmitted infections in East Africa. This is considered a major step toward development of a human vaccine for sleeping sickness.
- *Surgery.* The feasibility of stockpiling "donor" freeze-dried veins for vessel replacement was established.

Ad hoc committee selection of MERDC for a special award as the "Most Improved Laboratory" was based in part on FY 75 progress in meeting Army requirements as one of the first development centers established by the Army Materiel Acquisition Review Committee.

MERDC was commended for "self-imposed improvements accomplished in many aspects of laboratory operations including restructuring; RDT&E program overhead reduction; elimination of marginal technology studies; and development of new data base management systems.

The citation further credits MERDC with taking the lead in defining the role of development centers. A "significant contribution" was in-depth analysis and definition of the highly complex interface between DCs and logistics centers.

Listed among key FY 75 MERDC innovations were: definition of a camouflage master plan; establishment of a camouflage action line to provide response within 72 hours to telephone requests for assistance; and creation of a Camouflage Advisory Panel.

MERDC was credited also with "outstanding support to important Army customers such as the High Energy Laser System Project Office and the SAM-D Project Office"; also, for pioneering the Commercial Construction Equipment Program. Results permit the Army to expeditiously procure and field commercial equipment incorporating latest state-of-the-art technology. This concept is believed to have broad potential for improving the Army's materiel acquisition process.

AUSA Annual Meeting Speakers Focus on Changing Status of Army

Major speeches and panel discussions at the 21st annual meeting of the Association of the United States Army (AUSA) in Washington, DC, Oct. 20–22, focused on the present and future status of the Army.

Ambassador and former Secretary of the Army (1968–73) Stanley R. Resor was honored with the George Catlett Marshall Medal at the climactic memorial dinner. He has served since 1973 as U.S. Representative to the Mutual and Balanced Force Reduction Talks in Vienna, Austria.

The AUSA highest award is made to an individual for "selfless and outstanding service to the United States of America." Ambassador Resor was cited for his military service and his current role involving "complex and sensitive negotiations which are critical to the future of all nations."

Recipients of the Marshall Medal have included Secretary of State Henry A. Kissinger, entertainer Bob Hope, former Secretary of State Dean Rusk, former Ambassador Henry Cabot Lodge and Presidents Truman and Eisenhower.

Secretary of the Army Martin R. Hoffman emphasized as the keynote speaker that challenges of the future must be responded to today, and that the Army is moving toward four primary objectives. They are development of a total active force, sustaining as well as institutionalizing the all-volunteer force, raising the combat readiness of the soldier, and enlisting increased public support.

Addressing the subject of "detente," he said that the Soviets have made clear their interpretation—"that there would be no lessening of competition between the two economic and political systems."

Secretary Hoffmann said that in case of war, the U.S. may have no time for mobilization, and the threat would have to be met with existent forces—that the Soviets are constantly improving their military capabilities and that the U.S. must keep pace.

Army Chief of Staff GEN Fred C. Weyand, luncheon speaker, discussed the numerous challenges facing the nation, the Army's combat readiness objectives, and current programs to achieve them. He expressed deep concern about continuing growth of Soviet might, stating:

"In the past we have taken some comfort in the large quantitative advantage that we possessed. But the Soviet weapons have now been tested against ours and we know that the qualitative advantage has been drastically altered to our disadvantage."

Referring to the need for combat flexibility, he said: "We must be prepared to fight around the clock, 24 hours a day, in any weather. . . . Readiness is developed and then reinforced by tough, demanding, realistic training. . . . Superior equipment cannot make up for lack of knowledge or the will to win."

Under Secretary of the Army Norman R. Augustine, speaking at the corporate members reception and luncheon, also stressed that the volunteer Army's principal goal should be readiness for any emergency. The program's success, he said, has produced a "higher quality Army."

AUSA President James W. Woodruff commented in the annual "President's Report" that a larger and stronger membership may be the key to counter increased pressures to reduce defense spending. He suggested that the AUSA expand its membership from 84,000 to more than 100,000.

Commander of the U.S. Army Materiel Command (AMC) GEN John R. Deane Jr. was the featured speaker at the sustaining members luncheon. He spoke on the current philosophy of AMC embodied in the principle of "a new way of doing business' to develop and acquire new or improved weapon systems and other materiel. He also outlined the rationale behind the current AMC reorganization.

Other featured speakers included GEN William E. DePuy, commander, Training and Doctrine Command; GEN Bernard W. Rogers, commander, Forces Command; and LTG Harold G. Moore, Army deputy chief of staff for personnel.

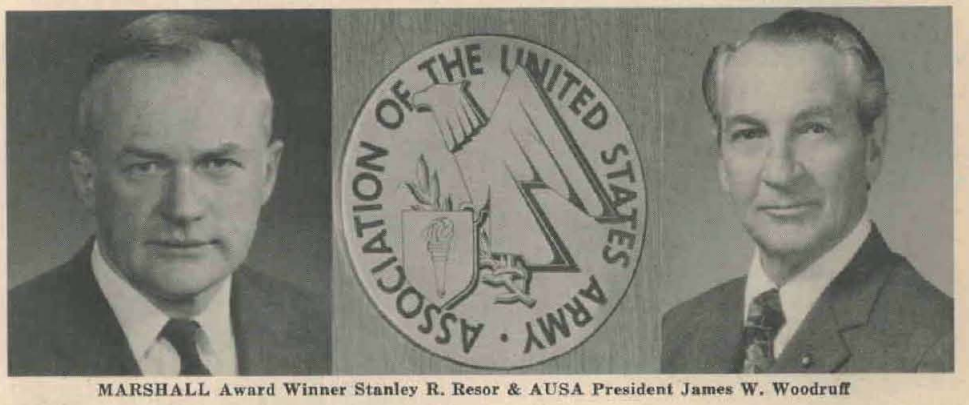
Army and industrial exhibits covered about 70,000 square feet of floor space and overflowed outdoors for the first time in recent years, comprising one of the most impressive displays of weaponry and support systems development in AUSA history—as befitting the Army's proud 200-year role for the nation's Bicentennial Year observance activities.

GEN William E. DePuy
TRADOC Commander

GEN Fred C. Weyand
Army Chief of Staff

GEN Bernard W. Rogers
FORSCOM Commander

GEN John R. Deane Jr.
AMC Commander



MARSHALL Award Winner Stanley R. Resor & AUSA President James W. Woodruff

Secretary of Army Martin R. Hoffmann
AUSA Keynote Speaker

Damage Tolerant Design Handbook

Fracture-toughness data on new and established high-stress and other alloys are presented in a 1100-page second supplement to the *Damage Tolerant Design Handbook*, published recently by the Metals and Ceramics Information Center at Battelle's Columbus Laboratories.

The original handbook, first released in December 1972, together with the first and second supplements, completes the MCIC fracture-mechanics package for designing highly stressed structures.

Copies of the supplement are available at $75 for users within the U.S. and $77.50 for users in other countries. Write to Harold J. Hucek at the Metals and Ceramics Information Center, Battelle's Columbus Laboratories, 505 King Avenue, Columbus, OH 43201 or call him at (614) 424-6424, Ext. 1109.

Annual Listing of Army R&D Newsmagazine Highlight Articles

The following is a headline listing of those articles published in the Army Research and Development Newsmagazine *during the past year which are believed to be of broadest interest to our readers.*

NOVEMBER-DECEMBER 1974

Army Research Institute—Developing Agency for Behavioral & Social Sciences.

Speaking On: Cost/Schedule Control Systems Criteria—Practicable Army-Industry Approach to Acquisition Management.

Army Research Office Plans Relocation to Research Triangle Park.

Army Unveils Nonlethal RAG Projectile.

Armed Services Consider 'Aerocrane' Concept.

Watervliet Duplication Technique May Have Potential Applications in Nondestructive Testing.

Communications-Electronics Materiel: Electronics Command Maintains Rapid Pace in Technology.

Army Corps of Engineers Studies Land Treatment of Wastewaters.

Environmental Quality Conference Reviews DoD Mission Requirements, R&D Programs.

ASA (R&D) Initiates Awards Program: Concept Requires Annual Evaluation of Labs. In-House

Army Sponsors Technical Information Analysis Centers Review.

20th Annual Association of the U.S. Army Meeting Toasts Army's Past, Considers Issues.

NLABS, R&D Associates Discuss Food Research.

AMC Productibility Symposium Emphasizes Improved Visibility, Design, Production.

Air Environmental Monitoring: An International Concern.

Assessing Soviet Progress in Small Arms Research and Development.

New Technology for Radar Pulse Compression.

JANUARY-FEBRUARY 1975

WES—'Mecca' for Variety of Research, Development, Engineering.

Edgewood Arsenal CAD–E Center Eases Materiel Design.

DoD Announces Frankford Arsenal Closing, AMC Depot System Realignment.

Atlanta II Conference Cites Initiatives for Improved Army-Industry Effort.

13th Annual ORSA Symposium Stresses Methodology Progress, Value of Operations Research.

HDL Verifies Safeguard Hardness to Electromagnetic Pulses.

AMC R&D Liaison Office Improves Infantry Support Through Soldier Response.

White Sands Missile Range Tests New Artillery Meteorological System.

Electronics Command Unveils Improved Photo Processing Method.

NVL Recognized by First Annual Laboratory of Year Award.

AMMRC Utilizes Ultra-High-Speed Photography for Ballistics Evaluation of Armor Materials.

MERDC Demonstrates Fuel Air Explosive Mine Neutralization Capabilities. Oil Study Reveals Potential Savings of $2 Million.

AMC Briefing Expansion Includes Medical Department, Corps of Engineers, Army Research Institute for the Behavioral and Social Sciences.

Army Research Office Biannual Review Meeting Considers Operations Research, Systems Analysis.

Innovations Mark DoD Manufacturing Technology Advisory Group Meet.

Fracture Characteristics of Boron Fiber-Reinforced Aluminum Detected by Acoustic Emission.

MARCH-APRIL

Speaking On: Pride in Army R&D Achievements for all America.

U.S. Military Posture Statements Justify Views on Budget Proposals.

MICOM Adds $40 Million Advanced Simulation Facility to Enhance Missile Testing Capabilities.

Army Revises Heavy Lift Helicopter Program, Sets Competitive Prototype Tests.

Seven New Deputies Assigned in ASA (R&D) Realignment.

Studies on Army Materiel Acquisition Review Committee Recommendations Provide Action Basis.

Construction Engineering Research Laboratory Tests Vulnerability to Shock Effects.

President OKs Upgrading Army Chief of RDA to Deputy Chief of Staff for RDA.

GEN Deane Takes Control of U.S. Army Materiel Command.

Army Evaluating Artillery Locating Radar Competitive Designs.

AMC Prepares Plan for Joint Tests of Advanced Medium STOL Aircraft Prototypes.

Pitman-Dunn Laboratory Develops Hydrocarbon-Based Hydraulic Fluid.

USAAMRDL Stresses Importance of Future Aircraft Propulsion.

AMMRC Pilot Plant Aids Electroslag Steel Research.

Atlanta II Seminar Focuses on Army-Industry Teamwork.

AMC DMA's Responsibilities Expanded to Include Laboratories.

Harry Diamond Laboratory Executive Changes Mark Command Group Shift to New Complex.

Advanced Ballistic Missile Defense: Solid-Propelled Motor Technology Progress Reported.

NATO Joint Field Trial on Air Defense Site Camouflage.

Fuze of the Future? Electro-Optical Initiator.

Army Testing Jojoba Oil for Lubricant Use.

International Science and Engineering Fair Military Winners See Japan Student Science Awards, Nobel Prize Ceremonies.

Army Materiel Command Briefs Industry on Criteria for the New Breed of Project Managers.

MAY-JUNE

DDR&E Dr. Currie Discusses Budget: Maintaining Technological Initiative.

MERDC Change Imposes Broadly Diversified Materiel Mission.

Natick Laboratories Redesignated Development Center, Assigned Additional Responsibilities.

Electronics Command Realigns Communications/Automatic Data Processing Laboratory.

Computer-Operated Electronic Systems Compare Simulated Armored Cavalry Capabilities.

U.S. Army/University of Miami Research Team Conclude Skin Disease Study in South America.

Army Materiel Command/Training and Doctrine Command Assessing Contingency Operations Container Handling.

U.S. Army Tank Automotive Command Demonstrates Tracked/Wheeled Tactical Test Vehicle.

Microwave Energy Aids Chemicals Purification Efforts at Aberdeen Proving Ground.

Electronics Command Assesses SAM–D Electronic Warfare Capabilities.

TECOM Aims at RDT&E Savings in Commercial Truck Purchase.

Army OKs Production of Missile Minder Systems.

Army Materiel Command/Industry Meeting Stresses Improved Independent Research and Development Cooperation.

Mechanized Infantry Combat Vehicle Prototypes Undergo Tank Automotive Command Tests.

Achievements Cited at 11th U.S. Army Communications Command Anniversary Observance.

Military Standard 1290 Climaxes 15 Years of Aircraft Crash Safety Research.

Edgewood Arsenal Portable Alarm System Detects Potentially Hazardous Chemicals.

Soviet Computer-Aided Design of Microelectronics.

Small Business Advisory Office Plays Key Role in ECOM Contracts.

Advanced Research Projects Agency Investment Yields Electrons From Cold Emitters.

Maximum Performance Takeoffs of Heavily Loaded Helicopters.

Logistics Center's Role in Scenario-Oriented Recurring Evaluation System.

Research and Development Specialty Opportunities Challenging in Officer Personnel Management.

JULY-AUGUST

Secretary of Defense Speaks on Service for National Welfare: Fixing of Priority Values for a Free Society.

15th Annual Army R&D Achievement Awards Honor 52 In-House Lab Scientists, Engineers.

Harry Diamond Development Center Alternatives Weighed.

SISMS: An Expanded Acquisition Management System.

Army Mobility Equipment R&D Center Announces Type Classification of Desert Modular Camouflage Screen.

MASSTER Testing Potential Replacements for M–151A Trucks.

MERDC Contracts $2.4 Million for Amphibian Vehicle Lighters.

MERDC Installing New Facility Which May Advance 'Built-In' Camouflage Design.

U.S., People's Republic of China Expand Scientific Information Exchanges.

Norman R. Augustine Takes Over as Army Under Secretary.

GEN Deane Letter Stresses Responsiveness to Aim of 'User Satisfaction.'

Infrared Thermography Aids Protective Clothing Research.

Army Materiel Command Laboratory Chiefs Hear R&D Leaders Discuss Changing Operational Procedures.

Edgewood Arsenal, Natick Development Center Team Up on Body Armor Developments.

Promotions Accent Career Opportunities for Army Materiel Command Project Managers.

MASSTER Studies Blend of Night Vision, Combat Lighting Devices.

Contract Orders Aircraft Vulnerability Reductions.

New Missile Command Test Facility Prompts Speculation.

Memorandum of Understanding Finalizes Selection of F–16 Combat Aircraft.

Army Materiel Command Bicentennial Exhibit Van Slated for Nationwide Tour.

Contract Let for Helicopter Hydraulic Advances.

Controversial Discovery: White Sands Missile Range Research Conflicts With Neutron Spectrum Concepts.

1976 Army Science Conference: 500 to 600 Responses Expected to Papers Call.

Army Scientific Advisory Panel Air Defense Review Draws High-Level DoD, Army R&D Leaders.

Natick Development Center Sponsors New England Society for Industrial Microbiology Conference.

Army Judges Select 22 International Science and Engineering Fair Winners for Trips, Jobs.

Famed Nuclear Scientist Dr. Edward Teller Details Energy Crisis Views at 13th National Junior Science and Humanities Symposium.

U.S. Army Engineer Topographic Laboratories Study Environmental Tests.

Foreign Developments in Hydrogen Technology —FSTC Feature Article.

Office of the Deputy Chief of Research, Development and Acquisition Lists Supergrade Changes.

1974 Pace Awards Honor 2 Department of Army Employes for Individual Achievement.

8 Department of Army Civilian Employees Selected for 1975–76 Senior Service Colleges.

U.S. Army Test and Evaluation Command Gets Computerized Radar.

Apollo-Soyuz Space Link Up: 27 Natick Development Center Preserved Foods Will Be Used on Historic Flight.

U.S. Army Missile Command Establishes Technical Industrial Liaison Office.

SEPTEMBER-OCTOBER

USAISR Technology Transfer Impacts in Worldwide Benefits.

Speaking On: Operation Dustoff—Army Medevac Civilian Spin-Off Benefits.

Army Materiel Command Headquarters Reorganization Goals Explained.

AMC Studies Lead to Product Improvement Program Office.

Army Engineer Topographic Laboratories Memorialize First Technical Adviser.

Aberdeen Proving Ground Completes Tests on 4 Hand-Held Stabilized Viewing Devices.

Coastal Engineering Research Laboratory Dedicated.

Development Centers Status: 3 Set Up, 5 in Staffing.

AMC Establishes Battlefield Systems Integration Directorate.

Missile Command Sets Up Software/Hardware Computer Center.

Army Tactical Communications System Project Manager Emphasizes 'User Satisfaction' Criteria.

MASSTER Studies New Military Tent, Van Shelters.

MASSTER Views Commercial, Automated Test System for Maintenance of Equipment.

Defense Nuclear Agency Funds Joint Nuclear Simulation Tests.

ARMCOM Reports Progress on Multishot Area-Fire Grenade Launcher.

New Regulation Details Disposal of Dredged Material as Corps of Engineers Responsibility.

Mobility Equipment Research and Development Center Reports Reorganization Proceeding on Schedule.

Picatinny Arsenal Terms Frisbee Flinger Mine Dispenser Tests 'Successful.'

Edgewood Arsenal Plans 5-Year $48 Million Protective Screening Effort.

Army Reservists Participate in Research and Development Update '75 Seminar.

Construction Engineering Research Laboratories Consider Solar Energy Potential for Heating, Cooling Army Buildings.

Don't Downgrade Dung: EPA Study Points to Potential as Ethylene Source.

MASSTER Tests 2 New Helicopter-Delivered Countermine Systems.

Manned Tarket Tanks Feature Article.

ODCSRDA International R&D Functions Moved to AMC Consolidated Office.

An Improved Solid Propellant for Army Missiles.

EPA Allocates $1.9 Million for Noise Pollution Studies.

40mm Prototype Powder Gun Provides Improved Projectile Velocity.

Management of Power Plant Waste Heat in Cold Regions.

U.S. Army Logistics Center Realigns Training Board, Evaluation and Test Directorate.

Improved Fatigue Testing Keyed to Aircraft Rotor Blade Materials Progress.

DHL Tests Multioption 60mm Mortar Fuze.

Foreign Interest Shown at Natick DC in Meet on Waste Conversion System.

Natick Development Center Hosts Armed Forces Conference on Food Processing, Packaging.

SARS Fellowships Give 3 Army Scientists Year of Foreign Study.

MERDC Commander's Awards: 4 of 33 Achievement Nominees Will Be Cited.

Hoffmann Succeeds Callaway as Army Secretary.

Advancing the State of the Art in Test Instrumentation.

Conferences & Symposia . . .

Wilks Award Presented . . .

Design of Experiments Meet Cites Prof. Solomon

Activities at the 21st Design of Experiments Conference in Army Research, Development and Testing, Oct. 22-24, climaxed with presentation of the American Statistical Association's Samuel S. Wilks Memorial Award to Prof. Herbert Solomon.

Herbert Solomon (right) accepts Wilks Award from R. Frankel, ASA.

Approximately 150 of the nation's leading military, academic and industrial mathematicians and statisticians joined in honoring Prof. Solomon, Stanford University faculty member, who served as conference chairman.

One of the criteria for the Wilks award is that the statistical achievement of the recipient must foster cooperative scientific effort which benefits the Army, Department of Defense, the U.S. Government and the nation.

Known internationally for his work in statistical theory and practice, Prof. Solomon was cited specifically for "steady and helpful influence on the applications of statistics in the service of this nation and contributions to . . . statistical methodology."

His achievements include significant contributions to military target hit probability and coverage problems, modeling of group behavior, surveillance sampling plans, test item selection and, most recently, statistical applications to law.

During his career in education and government service, Solomon has served at Columbia University; as an operation analyst with the U.S. Air Force; head of the Statistics Branch, Office of Naval Research; and principal investigator for government contracts involving Stanford and Columbia Universities.

Graduated with a BS degree from City College of New York in 1940, Solomon has a 1941 MS degree from Columbia University and a 1950 PhD from Stanford University. Prior to joining Stanford in 1959, he was a Columbia statistics professor.

A Fellow of the American Statistical Association and the Institute of Mathematical Statistics (IMS), he has served as IMS president and president, Operations Research Society, Western Section.

Joseph Cameron, National Bureau of Standards (NBS), chaired the awards selection committee. Other members were Dr. Fred Frishman, Internal Revenue Service (former U.S. Army Research Office employe); Dr. Badrig M. Kurkjian, U.S. Army Materiel Command; Dr. William R. Pabst, retired Department of the Navy employe; and

Dr. Joan Rosenblatt, NBS; Prof. Jerome Cornfield, George Washington University; and previous Wilks award winners Prof. George E. P. Box of the University of Wisconsin, Prof. H. O. Hartley of Texas A&M University, MG Leslie E. Simon (USA, Ret.), and Cuthbert Daniel, consultant.

The Armed Forces Institute of Pathology (AFIP), Walter Reed Army Medical Center, Washington, DC, was host to the conference, sponsored annually by the Army Mathematics Steering Committee (AMSC) on behalf of the Deputy Chief of Staff for Research, Development, and Acquisition.

Chairman of this year's program committee was Dr. Frank E. Grubbs, the initial Wilks award winner in 1964 and chief operations research analyst, U.S. Army Ballistic Research Laboratory, Aberdeen (MD) Proving Ground.

Dr. Walter D. Foster, chairman on local arangements, AFIP, was honored with a Certificate for Achievement. Chairman of the AMSC's Probability and Statistics Subcommittee for the past 12 years, Dr. Foster was praised for his key role in organizing the Design of Experiments Conferences.

He was cited specifically for "continuously and vigorously crusading for the application of sound statistical principles and methodology" to Army R&D problems.

Invited speakers and their topics were: Prof. Frederick Mosteller, Harvard University, Success in Social and Medical Experimentation; Prof. Edmund A. Gehan, University of Texas, Nonrandomized Clinical Trials; Prof. Paul Meier, University of Chicago, Randomized Clinical Trials; Prof. Seymour Geisser, University of Minnesota, Predictive Sample Reuse; and Prof. Edmond A. Murphy, The Johns Hopkins University, Normality and Disease.

Major clinical session topics included: Investigations of Interface Between 5.56mm Bullets and Rifling Configurations; Empirical Comparison of Criterion-Referenced Measurement Models; Pressure Impulse Methodology; Application of Life Testing Techniques to Detection Data; Test Design Considerations in Camouflage of the M60A1 Tank; Unknown Signal Detector in a Multiple Object Situation; and Outlier Detection Procedures in Trajectory Data Reduction.

Technical sessions were themed on: Design of Experiments Dealing with Man-Machine Interface in Current Communications Systems; Planning for the Measurement of Flight Trajectory; Robustness of the Expotential Distribution; and

NonRandomized Factorial Designs Characterized by Trend Elimination and a Minimum Number of Factor Level Changes; A Method of Estimating Error Variance in a Non-Replicated Experiment by Partitioning an Interaction Term Into Non-Additivity and Error; Planning Quantal Response Tests for Ordnance Devices: The Two-Point Strategy and Analysis; and

Applications of the Monte Carlo Technique to Determine Statistical Stress and Strain Response Around Cut-Outs in Composites; Techniques for Statistically Determining Flight Suitability of An Artillery Projectile; and

Random Interval Reliability; Confidence Intervals for a Sum of Renewal Processes With Application in Reliability; Structural Variance Estimation; Applying Simulation of Physiological Systems to the Design of Experiments: Examples of Endocrine and Respiratory Functions; and

A Design for the Detection of Synergy in Drug Mixtures; A New Sampling Rule for Sequential Binomial Clinical Trials; Various Methodological Approaches to Peer Evaluations; Objective Analysis of Camouflage Via Image Interpreters; NATO Joint Field Trial On Air Defense Site Camouflage; A Simple Method for Determining the Unrestricted Average Outgoing Quality Limit of a Continuous Sampling Plan; Semi Markov Chains Applied to Markov Chain Functionals Partially Dependent on Random Retrograde Time Shifts; Progressively Censored Sampling in Log-Normal Distribution.

ECOM Calls for Frequency Control Papers

A call for papers proposed for presentation at the 30th Annual Frequency Control Symposium, June 2-4, 1976, at Atlantic City, NJ, has been issued by the U.S. Army Electronics Command.

Devoted primarily to discussions of frequency control and precision timekeeping, the symposium is normally attended by more than 600 representatives from industry, universities and government laboratories throughout the Free World.

Authors are invited to submit papers dealing with recent progress in research, development and applications in fundamental properties of natural and synthetic quartz crystals, theory and design of piezoelectric resonators, and resonator processing techniques.

Papers also may report research and development progress on filters, quartz crystal oscillators and frequency control circuitry, atomic and molecular frequency standards, laser frequency standards, frequency and time coordination and distribution, radio and systems applications of frequency control devices, and specifications and measurements.

Deadline for submission of summaries is Jan. 23, 1976. Twenty copies of a summary in sufficient detail for adequate evaluation (at least 500 words), together with the author's name, address and phone number should be sent to the Commander, U.S. Army Electronics Command, ATTN: AMSEL-TL-MF (Dr. J. R. Vig), Fort Monmouth, NJ 07703.

Authors will be notified of acceptance of papers by Mar. 1, 1976. Accepted papers will be published in the proceedings of the 30th Annual Frequency Control Symposium. Complete manuscripts are required by June 4, 1976.

Symposium Focuses on Environmental Factors

Precisely how do environmental conditions such as temperature, weather and impact areas relate to fuzing effectiveness and performance of an artillery shell on the battlefield?

More than 200 government and nongovernment participants considered this question at an Oct. 7-9 Fuze/Munitions Environment Characterization Symposium II at Picatinny Arsenal, Dover, N.J. The meeting was sponsored by the U.S. Armament Command (ARMCOM), headquartered at Rock Island Arsenal.

Willard Benson, chief of the ARMCOM Systems Development Division and the director of the symposium, presented the keynote address. Fred Saxe, chief of the Picatinny Arsenal Fuze Development and Engineering Division, was general chairman. Victor Linder, PA deputy director, Ammunition Development and Engineering Directorate, gave the welcome.

The meeting provided a forum for exchange of ideas among those who design and test munitions hardware. Six papers were presented by PA personnel, including: Experimental Stress Analysis of Projectiles, Gary Bubb and Carl Larson; Collision Mechanics for Point Contact Fuzing, Bernard Schulman (in collaboration with Frank Lasher of AVCO Corp. and R. F. Parisse of Effects Technology, Inc.); and

The Dynamic Effects in the Fuze/Warhead of the Stinger Missile During Target Penetration, Marvin Hauptman with J. F. Shelley of Trenton State (NJ) College; Applications of the Finite Element Method to Projectiles During Target Impact, Anthony Tese in collaboration with J. F. Shelley, Radar Instrumentation for Ballistic Testing of Artillery Projectile Fuze Systems, Peter Roumes; Flight Technology Overview, Alfred Loeb.

Symposium Reviews Cable/Wire Flammability

Flammability characteristics of cable material and methods of assuring improved fire resistance were among topics emphasized at the 24th International Wire and Cable Symposium.

Sponsored by the U.S. Army Electronics Command and cochaired by Elmer F. Godwin and Milton Tenzer, both with the ECOM Electronics Technology and Devices Laboratory, the Nov. 18-20 conference featured 51 technical papers. Sixteen papers were authored by foreign scientists.

The banquet speaker was Lee Oberst, vice president, New York Region, New York Telephone Co., who addressed representatives of about 300 U.S. industrial firms, 15 U.S. Government agencies and 21 foreign countries.

Emphasis on cable material flammability was occasioned by the catastrophic fire in a telephone company building in New York City early this year. "The Miracle of 2d Avenue," based on this fire, was shown to illustrate the tremendous job of replacing telephone lines and interconnecting cables.

ECOM Hosts NATO Meteorological Conference

Demonstrations and discussions on standardization of meteorological equipment and techniques featured a recent 4-day North Atlantic Treaty Organization (NATO) conference at HQ U.S. Army Electronics Command, Fort Monmouth, NJ.

Forty Army Armaments Group delegates from Germany, the United Kingdom and the United States participated in an exhibition of meteorological devices and hydrogen generators. The U.S. showed upper air meteorological data sounding systems.

Two of the 20 U.S. delegates were from ECOM—Fred Horning of the Atmospheric Sciences Laboratory (ASL), assisted by Marvin Lowenthal.

MAJ Wilfried Lemaire of Belgium was chairman of the meeting. Other session chairmen included G. Clapp, United Kingdom; LTC A. Stomp, Netherlands; Dr. W. Bloedorn, Germany; CPT J. Cazenare, France; and Cliff Stead, Canada. Group CPT Kenneth Bryant, Supreme Headquarters Allied Powers Europe (SHAPE), was among the observers.

MICOM Meet Considers High Energy Lasers

High energy lasers state-of-the-art, problems related to ongoing programs, and continuance of long-range planning were considered by some of the foremost laser experts from industry, academia and the Army at a recent 2-day symposium at HQ U.S. Army Missile Command.

About 30 of the some 50 participants spoke on their work and the goals of current laser programs during four sessions and group discussions. Stressed was a commitment by the Army to sustain a high energy laser basic research effort.

COL Robert W. Gruen, assistant director, Technology Applications, Army Missile Research, Development and Engineering Laboratory at HQ MICOM, was the banquet speaker. His subject was high energy laser research objectives. Dr. Thomas Barr, acting director in the same directorate, which sponsored the symposium, made welcoming remarks.

Awards . . .

EXCEPTIONAL CIVILIAN SERVICE. *Inez G. Fluke* and *Robert J. Rhodes*, Picatinny Arsenal, Dover, NJ, recently received the Decoration for Exceptional Civilian Service (DECS), the Army's highest award for civilian employes. They were cited for bravery in aiding an injured employe during an explosion in an assembly plant.

Leroy D. Tilton and *Richard F. Bell*, U.S. Army Electronics Command, Fort Monmouth, NJ, received the DECS for rescue of two men trapped in a chemical neutralizing tank.

Richard H. Ruhland, comptroller, U.S. Army Tank-Automotive Command, Warren, MI, earned the DECS for "innovative applications of new concepts which brought about significant savings in financial assets, material, and manpower."

MERITORIOUS CIVILIAN SERVICE. *John D. Blanchard*, assistant deputy for Materiel Acquisition, HQ U.S. Army Materiel Command (AMC), was a recent recipient of the Meritorious Civilian Service Award (MCSA), the Army's second highest award for civilian employes.

Blanchard was cited for significant contributions toward improving the Army's materiel acquisition process—specifically for initiation and development of a program which enhanced Army/industry relationships.

Seymour J. Lorber, director of Quality Assurance at HQ AMC, received the MCSA for increasing the efficiency and effectiveness of Army product assurance operations.

Harry L. Reed Jr., chief, Concepts Analysis Laboratory, U.S. Army Ballistic Research Laboratories, was presented the MCSA for outstanding scientific accomplishments in weapon systems engineering concepts analysis.

Dr. Mary H. Mandels, research microbiologist, U.S. Army Natick Development Center, received the MCSA for research in enzyme technology used in the design and engineering of equipment for the enzymatic conversion of cellulosic wastes into useful products. The process is being used in an experimental prototype plant and has aroused international interest.

Watervliet Team Wins $5,000 Incentive Award

Development of new simulated test procedures for assessing the fatigue life of gun tubes has earned a $5,000 Incentive Award for 12 personnel at the Army's Watervliet NY Arsenal.

Expected to result in first year savings of $20,328,700, the procedures reportedly will aid in reducing required developmental test time and increasing reliability of fielded weapons. Dr. Thomas E. Davidson, chief of the Materials Engineering Division, directed the effort.

Sharing in the R&D award were Bruce B. Brown and Albert N. Reiner, mechanical engineers; Donald C. Winters, electronic engineer; George E. Sogoian and Joseph E. Wido, mechanical engineering technicians; John J. Zalinka, electronic technician; and Abraham Rubin, Steven J. Bell, John F. Williams, Bruno Grestini, James F. Kelly, physical sciences technicians.

Chemical Technique Earns CERL Research Award

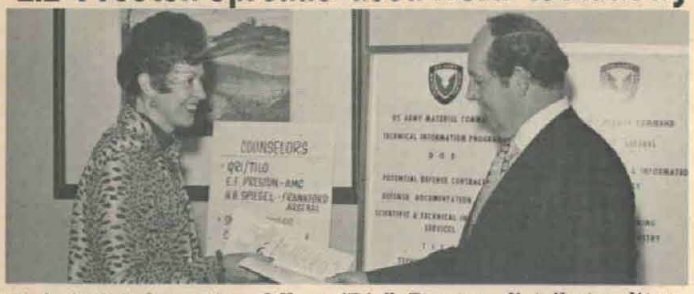
Development of a chemical system which determines water and cement content of fresh concrete, and predicts its strength prior to being laid, has earned the U.S. Army's Construction Engineering Research Laboratory "Researcher of the Year" Award for Paul Howdyshell.

Army adoption of the new system, which has attracted nationwide interest, reportedly could effect savings of millions of dollars annually in civilian and military construction costs.

COMMENDATION to Edgewood (MD) Arsenal employes for a record-breaking $9.2 million contribution to the Army's cost reduction program for FY 75 is presented to Arsenal Commander COL Kenneth L. Stahl (right). MG John C. Raaen, commander of the U.S. Army Armament Command until his recent reassignment as deputy commander for the Defense Supply Agency, praised arsenal personnel for a 336 percent accomplishment of the assigned $2.7 million goal.

Career Programs . . .

'Liz' Preston Spreads 'Good Word' to Industry



Technical Information Officer "Liz" Preston distributes literature to Hughes Aircraft Co. representative George Elliott.

Upward Mobility is a U.S. Army program for career advancement that has opened opportunity's doors to Mrs. Elizabeth F. (Liz) Preston, the only woman speaker among some 800 participants in the Missile Command's recent Advanced Planning Briefings for Industry (APBI).

Assigned to the HQ U.S. Army Materiel Command Technical Industrial Liaison Office as a technical information officer (program assistant), she spoke on "Opportunities for Industry" and is scheduled to make future APBI presentations.

Mrs. Preston's objective is to "spread the good word" to industry on how to go about obtaining information that may be helpful in procuring contracts for materiel research, development, test and engineering programs.

Nine Technical Industrial Liaison Offices (TILOs) have been established by the Army Materiel Command throughout the country on a regional basis to transfer information to industrial contractors or potential contractors. R&D current and long-range information is displayed on microfilm viewers, and some "hardcopy" documents are available upon request.

One of Mrs. Preston's duties is to help inform industry on all types of information available at the AMC TILOs and the procedures to obtain it. Her telephone number at HQ AMC in Alexandria, VA, is 274-9816. Similar information is provided by each of the other eight AMC TILOs, as follows:

U.S. Army Armaments Command (ARCOM), ATTN: AMSAR-RDP, Rock Island, IL, 61201—Tel. 309-794-4511/4098. U.S. Army Tank-Automotive Command (TACOM), ATTN: AMSTA-REA, Warren, MI, 48090—Tel. 313-573-1258. U.S. Army Aviation Systems Command (AVSCOM), ATTN: AMSAV-ERR, P.O. Box 209, St. Louis, MO, 63166—Tel. 314-268-3821/3822. Office of Navy Research, ATTN: TILO, 1030 East Green Street, Pasadena, CA, 91106—Tel. 213-795-5971, TILO Extension.

U.S. Army Missile Command (MICOM), ATTN: AMSMI-RFE, Redstone Arsenal, AL, 35809—Tel. 205-876-3733. U.S. Army Troop Support Command (TROSCOM), ATTN: AMSTS-KT, St. Louis, MO, 63120—Tel. 314-263-3965. U.S. Army Electronics Command (ECOM), ATTN: AMSEL-RD-S, Fort Monmouth, NJ, 07703—Tel. 201-535-2240. U.S. Army Training Device Agency, ATTN: AMCPM-TND-N2A, Orlando, FL, 32813—Tel. 305-646-5761/5771.

Mrs. Preston enrolled in the Army Upward Mobility Program when her husband retired from U.S. Federal Civil Service employment in 1973. Until then she traveled with him to various assignments in the U.S. and in foreign lands.

What does she think about the program? "Well, first of all, I like what I am doing. I enjoy the work. The college courses I took with the University of Maryland overseas program have helped me. I also completed various correspondence courses, and recently completed an R&D Management Course at Fort Lee, VA. I intend to keep on taking job-related college courses."

What does she think about Civil Service career opportunities with the Army? "During the past two years, particularly, I have observed much greater acceptance of women in career fields traditionally held by men. I am pleased with the way I have been treated."

Edgewood Employe Earns R&D Executive Training

Sustained demonstrated potential for managerial responsibility during 12 years of continuing notable scientific achievements has earned Nick Montanarelli, an Edgewood (MD) Arsenal research psychologist, selection for six months of R&D executive training.

Employed at Edgewood since 1963, Montanarelli is the 16th arsenal civilian chosen for this training since the program was initiated in 1971. He will spend three months on various R&D assignments at Edgewood and a similar period at HQ U.S. Army Materiel Command, Alexandria, VA.

Assigned to Edgewood's Biomedical Laboratory, he is credited with contributing to the concept development of using dogs to detect concealed explosives, such as in minefields, and a weapons detector which has been adopted as an aid to prevent commercial airline hijackings.

Instrumental also in development of lightweight body armor now used by the U.S. Secret Service, Montanarelli has coauthored more than 40 technical publications. He has served as an adviser to the Federal Bureau of Investigation, Law Enforcement Assistance Administration, and State Department.

Prior to his selection as an executive trainee, he served as an official representative of the U.S. Department of Justice at the North Atlantic Treaty Organization Advanced Study Institute on the transfer of information on industrial technology.

Graduated with a BA degree in psychology from the University of Maryland in 1971, he has received two sustained superior performance awards, four suggestion awards, 20 letters of commendation and a Certificate of Achievement.

Nick Montanarelli

Career Intern Succeeds by 'Doing Her Own Thing'

Upward Mobility came into being as a U.S. Army career development program several years after 96-pound, 5'3" Sherryl Snodgrass, a black woman intent on "doing her own thing" in career ladding climbing, made it her way of life.

Employed as a GS-11, a personnel management specialist at the U.S. Army Test and Evaluation Command, Aberdeen Proving Ground, MD, Ms Snodgrass expects to receive her GS-12 rating before her 26th birthday. Since graduating as valedictorian from Scottsboro Alabama high school in 1966, her compass has consistently pointed upward.

Scholarships helped her attend Alabama Agricultural and Mechanical University where she received a 1970 BS degree in secondary education. She was a dean's list student, earning the President's Cup twice for straight "A" semester averages.

Following graduation, she entered the U.S. Army Materiel Command's career intern program and attended graduate courses evenings at Alabama A&M. She received her master's in urban planning "to avoid getting locked into a single field."

During her senior year, Ms Snodgrass was elected student council president—an honor achieved only once prior by a female at Alabama A&M. She is listed in *Who's Who in American Colleges and Universities*, and is a member of Alpha Kappa Mu national honor society.

Assigned to TECOM since 1974, she relocated early this summer to the Personnel Support Agency, HQ U.S. Army Materiel Command. Ms Snodgrass hopes to work eventually with juveniles in economically deprived areas. During the interim she has her sights set on a law degree.

Included among her leisure pursuits are writing poetry, traveling and public speaking. Ms Snodgrass was named "Citizen of the Year" in 1973 by a Huntsville Alabama radio station for her work with a public service news program.

Personnel Management Specialist Sherryl Snodgrass conducts an interview at HQ TECOM, Aberdeen Proving Ground, MD.

People in Perspective . . .

Handler Contributes to Materiel Acquisition

Current emphasis on the military materiel acquisition process to achieve large-scale reductions in cost, through strengthened teamwork of the U.S. Army, industrial contractors and cooperative technical and professional societies, has put Henry Handler in the limelight—again, it must be added.

Recognized for outstanding achievement by a long list of high honors, Handler carries the title of technical relations adviser for the U.S. Army Materiel Command. He has filled this position since the AMC was created as a merger of the Technical Services in the 1962 Army-wide reorganization.

Handler's responsibilities include continual liaison with industry and with about 30 technical and professional societies representative of the scientific and engineering professions of particular interest to the AMC. Currently, he engages in a day-to-day relationship with 13 of these societies and less frequent liaison with others.

An article on page 27 of the September-October 1974 edition of the *Army Research and Development Newsmagazine* directed attention to importance of utilizing the professional affiliations of members of these societies to improve the communications link between the industrial community and the Army—to stimulate cost-cutting cooperative efforts.

Considered in this context, Handler's role with respect to Army scientific and technical conferences and symposia assumes its rightful status of importance to achieve objectives of materiel acquisition economy—that is, high-quality materiel at the lowest practicable cost.

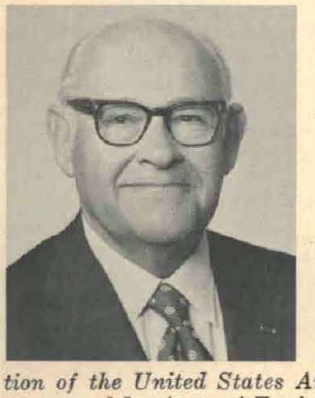
Handler's long affiliation with defense-oriented national organizations and professional societies is conducive to stimulating their support in handling administrative details of technical conferences, symposia and briefings to promote Army-industry cooperations. Included are AMC's series of Advanced Planning Briefings for Industry (APBIs).

Attesting to the results of this liaison are the recent highly successful Atlanta I and II conferences held in Atlanta, GA, and similar regional meetings throughout the U.S.

AMC personnel thus are enabled to concentrate on technical aspects and leave the meeting arrangements to professional associations. This liaison also serves as an effective sounding board between AMC and American industry for exchange of technical information related to military R&D and the acquisition process which is available to all AMC facilities.

Other responsibilities of Handler include maintaining, with AMC-wide support, active rosters of AMC technical liaison personnel with many professional associations to assure that properly qualified individuals are available to work with the technical committees for technical assistance, guidance and advice.

All inquiries or requests for assistance should be addressed to him by telephoning 202/274-9630 (Autovon 284-9630) or by writing to: Commander, U.S. Army Materiel Command, AMCSA-H, 5001 Eisenhower Ave., Alexandria, VA 22333.



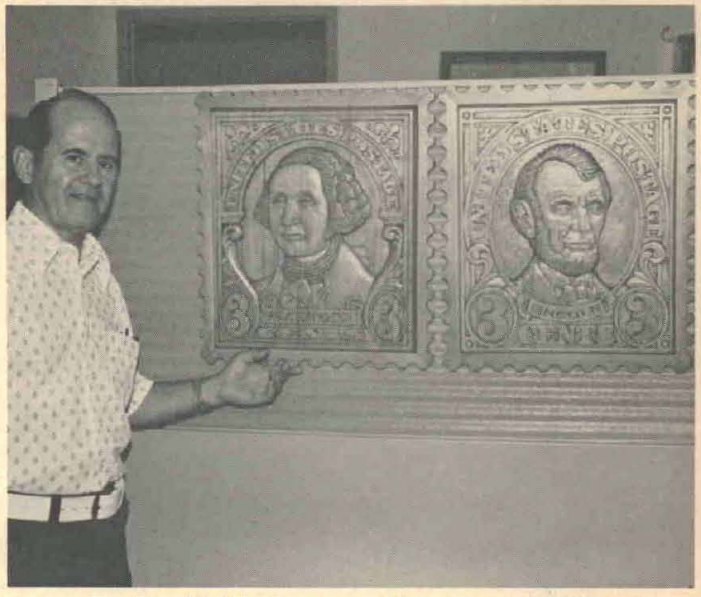
HENRY HANDLER graduated from Stevens Institute of Technology in 1935 with a degree in mechanical engineering and during the next four years continued studies at Rutgers University Graduate School. He completed 17 years as an Army Reserve officer and obtained the rank of lieutenant colonel.

Among his professional affiliations are memberships in the Society of Manufacturing Engineers, American Defense Preparedness Association, Association of the United States Army, Society of Automotive Engineers, and Institute of Environmental Sciences in which he was recently elected a Fellow.

His impressively long list of honors includes the Decoration for Meritorious Civilian Service in 1967 (repeated in 1968). He is listed in American Men of Science; Leaders in American Science; Community Leaders of America; *and* Dictionary of International Biographies.

Bicentennial Stimulates Art . . .

Large Wood Carving Replicas Based on Stamps



Jim Roncker displays carved 3-cent stamp replicas.

Enthusiasm for America's Bicentennial celebration has resulted in a most attractive addition to the home of Jim Roncker, a visual information specialist with the Ballistic Defense Systems Command, Huntsville, AL.

Aside from his talents for drawing, painting and illustrating, Roncker is an accomplished wood carver. Based on the design of two 3-cent stamps from his son's stamp collection, he has fashioned oversized wooden stamp replicas bearing the heads of George Washington and Abraham Lincoln.

Getting slabs of soft pine 18 inches wide was Roncker's biggest problem. Most sawmills just don't cut wood in that size, so he had to scout around several neighboring counties to find what he needed. "Once I found the wood, the rest was fun," he said.

Rockner completed the George Washington stamp in three weeks of spare time work. The Lincoln model was much easier since he now had an outline and a method to guide him. Both stamps are detailed to perfection, including the perforated edges.

Roncker is planning to mount his new creations on either side of an American Eagle carving which now hangs over his fireplace. He and his wife hopes to make this "Early American" motiff a permanent fixture for their den.

SP4 Becomes First Lady Tank Driver in U.S.

When a massive 52-ton tank with a 5′ 3½″ woman driver rolls around at HQ U.S. Army Tank-Automotive Command, Warren, MI, brawny men do a fast "double take" of the action, incredulously.

Distinction has come to SP4 Debra Houghton, Denver, CO, as the first female tank driver in the United States—within the Army or elsewhere. Along the route to that fleeting prominence, however, Debi had to give up her goal when she enlisted last December, that of going into the Army Medical Corps, due to a lack of vacancies.

After completing basic training at Fort McClelland, AL, she was selected, on the basis of her mechanics and electronics test results, to attend a tank turret mechanics course. Competing in a class of 13 as the only woman, Debi was surpassed by only one of the males.

Certified also as a tank inspector specialist, with a current assignment of inspecting and road-testing M60A1 tanks before they are accepted by the Army, Debi experiences only one problem with her duties. She uses a 60-inch booster seat to give her the same view as drivers of larger stature.

Personnel Actions...

Powers Assumes Duties as TECOM Commander

MG Patrick W. Powers

MG Patrick W. Powers, former commander of the U.S. Army Readiness Region Two, Fort Dix, NJ, is the new commander of the U.S. Army Test and Evaluation Command, Aberdeen (MD) Proving Ground.

Graduated from the U.S. Military Academy in 1945, MG Powers holds a master's degree in engineering from the University of Southern California where he majored in guided missiles and aerodynamics. He also graduated from the Army Command and General Staff College and the Naval War College.

Among his command and staff assignments are: instructor, Aero Propulsion and Tactics, Fort Bliss, TX: staff officer, Missile and Space Division, Office, Chief of R&D, HQ DA (now the Office of the Deputy Chief of Staff for Research, Development, and Acquisition); and director, Pershing II Special Task Force, OACS for Force Development, HQ DA.

Known for numerous articles on guided missiles and other military subjects published in professional journals, MG Powers is also the author of *A Guide to National Defense*, a book used by the National War College.

MG Powers is a recipient of the Legion of Merit with three Oak Leaf Clusters (OLC), Distinguished Flying Cross, Bronze Star Medal, Air Medal, Joint CM, and ACM (2 OLC).

Turnmeyer Installed as MICOM Commander

MG George E. Turnmeyer was installed as commander of the U.S. Army Missile Command, Huntsville, AL, following reassignment of MG Vincent H. Ellis whom he served as deputy.

MG George E. Turnmeyer

MG Turnmeyer has a BS degree in military science from the University of Maryland and an MBA degree in industrial management from Babson College. He is also a graduate of the Army Command and General Staff College, Armed Forces Staff College, and the Industrial College of the Armed Forces.

A veteran of 31 years of active military service, he has served in recent assignments as Lance project manager; commander, U.S. Army Materiel Command, Europe; and joint staff officer and coordinator, Pacific Branch, Operations Division, Joint Chiefs of Staff.

Included among his military awards and decorations are the Legion of Merit, Meritorious Service Medal and Army Commendation Medal with two Oak Leaf Clusters.

Clark, Lyon Picked for Reserve Policy Board

Three-year appointments of MG Arthur W. Clark, U.S. Air Force Reserve, and RAdm Richard Lyon, U.S. Naval Reserve, to the Reserve Forces Policy Board have been announced.

MG Clark is now serving as mobilization assistant to the commander, HQ Command, USAF. Key assignments have included adviser to the Assistant Chief of Staff/Intelligence, USAF, and member, HQ Command Air Reserve Policy Council.

Included among his academic credentials are a bachelor's degree from the University of North Carolina and a master's from the University of Southern California, both in geology.

RAdm Lyon is commander of the Fleet Command Staff, U.S. Naval Reserve Center, Long Beach, CA. He began his military career as an enlisted man in 1942.

Promoted to RAdm in 1974, he has a bachelor's degree in engineering from Yale University and a master's degree in business administration from Stanford University.

Jones Takes Over BMD Systems Command

BG John G. Jones

BG John G. Jones, who recently served as military assistant in the Office of the Deputy Secretary of Defense, is the new commander of the U.S. Army Ballistic Missile Defense Systems Command, Huntsville, AL.

Graduated from the U.S. Military Academy, BG Jones has master's degrees from the University of Southern California and George Washington University, and is a graduate from the Armed Forces Industrial College.

Key assignments during recent years have included assistant for Combat Materiel in the Office of the Assistant Secretary of the Army for Research and Development, and chief of Programs, Plans and Operations for the Army's Main Battle Tank.

BG Jones has received the Legion of Merit with three Oak Leaf Clusters, Bronze Star Medal, Meritorious Service Medal, Joint Service Commendation Medal, and the ACM.

Hilsman Succeeds Crawford as ARTADS PM

BG William J. Hilsman

BG William J. Hilsman, former commander of the 1st Signal Group, Fort Lewis, WA, has succeeded Albert B. Crawford Jr. as project manager, Army Tactical Data Systems (ARTADS), Fort Monmouth, NJ.

A graduate of the U.S. Military Academy, BG Hilsman has a master's degree in computer systems engineering from Northeastern University. He has attended the Army Command and General Staff College, and the Armed Forces Industrial College.

Included among his previous assignments are the U.S. Army Infantry Center, Fort Benning, GA; commander, 144th Signal Battalion, 4th Armored Division, U.S. Army Europe (USAREUR); executive, 121st Signal Bn, 1st Infantry Div, Vietnam.

BG Hilsman is a recipient of the Legion of Merit with two Oak Leaf Clusters (OLC), Bronze Star Medal with two OLC, Meritorious Service Medal, and Army Commendation Medal.

Cuthbertson Named AMC International R&D Chief

COL R. J. Cuthbertson

COL Robert J. Cuthbertson is the new chief of AMC's Office of International Research and Development following service since July 2 as executive officer, Research, Development and Engineering Directorate, HQ U.S. Army Materiel Command.

LTC Walter J. Wosicki, who had served as acting chief of the IR&D Office since July, succeeded COL Cuthbertson when he was reassigned shortly before promotion to colonel.

Graduated from the University of New Hampshire in 1955 with a BA degree in history, COL Cuthbertson has an MS degree in public administration from Pennsylvania State University. He is a graduate of the Command and General Staff College, and Army War College.

Listed among his previous assignments are team chief, Programs Branch, Programs and Budget Division, Office, Deputy Chief of Staff for Research, Development, and Acquisition (DCSRDA), Department of the Army, and battalion commander, 426th Supply and Service Battalion, 101st Airborne Division, Air Mobile, Republic of Vietnam.

COL Cuthbertson is a recipient of the Legion of Merit with Oak Leaf Cluster (OLC), Meritorious Service Medal, Air Medal, and Army Commendation Medal with three OLC.

LTC Wosicki is a 1959 graduate of the U.S. Military Academy and has a master's degree in aerospace management from the University of Southern California. He has completed the Army Command and General Staff College courses.

LTC W. J. Wosicki

Assignments with DCSRDA since 1971 have included executive officer, Material Plans and Programs Directorate; staff officer, Management Division; staff officer, Management and Test Division; and Materiel Needs Branch, Plans Division.

LTC Wosicki wears the Distinguished Flying Cross with two Oak Leaf Clusters (OLC), Bronze Star Medal with three OLC, Meritorious Service Medal, Air Medal with 24 OLC, and Army Commendation Medal with "V" device.

Friedersdorff Assumes Duties as REMBASS PM

COL Louis Friedersdorff, a recent graduate of the U.S. Naval War College, Newport, RI, has succeeded COL Robert J. Cottey as project manager for Remotely Monitored Battlefield Sensor Systems (REMBASS), Fort Monmouth, NJ.

COL Louis Friedersdorff

COL Friedersdorff served with the Office of the Chief of Research and Development, HQ Department of the Army (1972–74), as an instructor in electrical engineering and physics at the U.S. Military Academy (1958–61), with the United States Mission in Saudi Arabia, and with combat forces in Vietnam and Germany.

A 1953 graduate of the USMA, he has a master's degree in electrical engineering from Purdue University. He completed the Army Command and General Staff College course at Fort Leavenworth, KS, and the Basic Officers course and Career course at the Artillery School, Fort Sill, OK.

His military awards and decorations include the Legion of Merit, Distinguished Flying Cross, Soldiers Medal, Bronze Star Medal, Meritorious Service Medal with Oak Leaf Cluster (OLC), Air Medal with "V" device and 12 OLC, anl the Army Commendation Medal with OLC.

ACC Chooses Rizor as USAATCA Commander

Commander of the U.S. Army Air Traffic Control Activity (USAATCA) and chief of the Air Traffic Control Office, U.S. Army Communications Command, Fort Huachuca, AZ, are titles assumed recently by COL George A. Rizor Jr.

COL George A. Rizor Jr.

Graduated in 1951 from Oregon State University with a BS degree in industrial management and a Reserve Officers' Training Corps commission, COL Rizor has servel since 1974 as USAATCA deputy commander. In 1968 he received his Master Army Aviator's rating.

Previous assignments at Fort Huachuca have included executive officer, Company B, 16th Battalion; air observer pilot; and avionics plans officer, Aviation Department, U.S. Army Electronic Proving Ground.

Johnson Directs ECOM Product Assurance

COL Alfred H. Johnson III recently succeeded COL Jesse Wang as director of Product Assurance, U.S. Army Electronics Command, Fort Monmouth.

COL A. H. Johnson III

COL Johnson served formerly as executive officer and military assistant to the director for Telecommunications and Command and Control Systems, Office of the Secretary of Defense. He has also served major assignments in Vietnam, Korea, Germany and France.

A graduate from Howard University and the Army Command and General Staff College, he has completed the Advanced Management Program at the University of California, Berkeley. His military honors include the Legion of Merit with Oak Leaf Cluster (OLC), Bronze Star Medal with OLC, Meritorious Service Medal, Air Medal, and the Army Commendation Medal with OLC.

Mayo Assigned as TECOM Test Commander

COL Walter L. Mayo Jr., former commander of the U.S. Army Field Artillery Missile Group Nine, Fort Sill, OK, has assumed new duties as commander for Testing, U.S. Army Test and Evaluation Command (TECOM), Aberdeen (MD) Proving Ground.

COL W. L. Mayo Jr.

Graduated in 1950 from Boston College, COL Mayo served initially with the 1st Cavalry Division in Korea, and later spent 34 months in a prisoner-of-war camp. He has served duty tours as deputy assistant commandant for combat development at the Field Artillery School, assistant professor of military tactics at Boston College, and assistant to the Secretary of Defense for Atomic Energy.

Vitetta Assumes DCA-Pacific Command Duties

COL Eugene J. Vitetta, former deputy chief of staff, U.S. Army Communications Command (USACC), Fort Huachuca, AZ, is now commander of the Defense Communications Agency-Pacific, HQ Wheeler Air Force Base, HI.

A veteran of more than 23 years of Army service, COL Vitetta has a BS degree in electrical engineering. He has completed courses at the Army Command and General Staff College, Industrial College of the Armed Forces, and the British Staff College.

Included among his previous assignments are commander, 11th Signal Group, USACC; commander, 86th Signal Battalion, 1st Signal Brigade, Vietnam; and administrative officer, Office, Chief of Research and Development, HQ DA.

COL Vitetta is a recipient of the Legion of Merit, Bronze Star Medal with two Oak Leaf Clusters (OLC), Meritorious Service Medal with two OLC, Air Medal, Joint Service Commendation Medal, and Army Commendation Medal with OLC.

Canby Assumes Moncrief Hospital Command

COL (Dr.) John P. Canby, former commander of the Post Medical Department Activity, Fort Huachuca, AZ, is the new commander of Moncrief Army Hospital, Fort Jackson, SC.

A veteran of 21 years of Army Service, COL Canby earned his medical degree from Vanderbilt University in 1954. He served his internship at Letterman General Hospital, CA, and his residency at Brooke Army Medical Center, Fort Sam Houston, TX.

Author of more than 40 medical articles, he has served at Walter Reed Army Medical Center in Washington, DC, Fort Ord, CA, Australia, India, and Fort Benning, GA. His awards include the Legion of Merit and Army Commendation Medal.

Personnel Actions . . .

(Continued from page 47)

Rehman Directs ECOM Materiel Management

COL Donald I. Rehman

Director of Materiel Management at the U.S. Army Electronics Command is the new title of COL Donald I. Rehman, following six months service as chief of Production Engineering in ECOM's Research, Development & Engineering Directorate.

COL Rehman was commissioned in the U.S. Army following graduation from Officers Candidate School in 1952. He holds a BS degree in military science from the University of Nebraska at Omaha and an MS degree in logistics management from the Air Force Institute of Technology.

Certified as a Department of the Army logistician in 1973 and in 1975 as a professional logistician by the Society of Logistics Engineers, COL Rehman has received the Legion of Merit, Bronze Star Medal, and the Meritorious Service Medal.

Richardson Becomes BMDSC Deputy Commander

Charles E. Richardson

Deputy commander, U.S. Army Ballistic Missile Defense Systems Command (BMDSC), Huntsville, AL, is the title assumed recently by Charles E. Richardson, following service since 1965 as chief engineer of organizations that evolved into the BMDSC.

Richardson served in 1952 as an engineer with the Nike Ajax program, followed by an assignment in 1956 as Nike Hercules project manager, Industrial Division, Army Rocket and Guided Missile Agency (ARGMA).

In 1958 he was assigned to the Nike Zeus Project Office, R&D Division, ARGMA and in 1962 became chief, Test and Range Operations Division, Nike-X Project Office.

Richardson's academic credentials included a 1949 BS degree in electrical engineering from Auburn University and completion of executive training at the Graduate School of Business Administration, Harvard University, in 1965. He attended Georgia Tech for a year before entry into U.S. Navy service.

Chick Takes Control as AMMRC Commander

LTC Edward E. Chick

LTC Edward E. Chick, the new commander/deputy director of the U.S. Army Materials and Mechanics Research Center, Watertown, MA, recently returned from duty since 1972 as chief of the Materials Branch, U.S. Army R&D Group, Europe.

A graduate of the Army Command and General Staff College, LTC Chick has BS and MS degrees in metallurgical engineering from Lehigh University. He has completed the Ordnance Basic and Career courses.

During 1971–72, LTC Chick served in the Science and Technology Division, Office of the Chief of R&D, following duty as a staff officer, Physics and Engineering Sciences Division, U.S. Army Research Office.

Other assignments include the 4th Ordnance Battalion, Korea, and 9th Infantry Division, Vietnam. He is a recipient of the Bronze Star Medal, Meritorious Service Medal with Oak Leaf Cluster, and the Army Commendation Medal.

Army R&D — 15 Years Ago

The Army R&D Newsmagazine reported on . . .

R&D Functional Realignment Progressing

Plans for functional realignment and expansion of capabilities of the Army research and development program are progressing. Secretary of the Army Wilber M. Brucker has reviewed findings and recommendations of the Roderick Board and outlined 26 desired changes.

'Theme of the Month' Endorsement

Secretary of the Army Wilber M. Brucker, in the page 1 "Theme of the Month," acclaims establishment of the *Army R&D Newsmagazine* stating that it "augers well for achievement of closer communication among the many agencies which are striving to apply the latest scientific and technological developments to the defense and progress of the nation."

Director of Research and Development Richard S. Morse terms creation of the *Army R&D Newsmagazine* "the result of a long-considered analysis of the problem of maintaining more effective communication within the Army R&D establishment and other government agencies."

Chief of Research and Development LTG Arthur G. Trudeau states his desire that the Newsmagazine "will be able to furnish, through the complete cooperation of all agencies and individuals concerned, the kind of information that will build pride of service, stimulate unity of purpose, and eliminate wasteful rivalry. Its aim will be to improve understanding of problems related to our mission and to foster teamwork in planning, integrating and coordinating our program. It will reflect the Army's desire to blend its program with all of the nation's other R&D activities, insofar as is practicable, in solving problems of building military strength expeditiously."

Actions Direct Improvements in R&D, AE Fields

Directed toward widening the career vistas of officers in the Army R&D and Atomic Energy Programs, a new position of Assistant for R&D Officer Career Planning and Education has been established. A worldwide survey of Army positions in R&D has been initiated.

Redstone Arsenal Establishes R&D Division

MG August Schomburg, commander, U.S. Army Ordnance Command, has announced formation of a Research and Development Division within the Army Ballistic Missile Agency, Redstone Arsenal, AL. Plans call for a staff of 1,000 and an estimated budget of $216 million.

Missile and rocket systems assigned to the new division include Redstone, Jupiter, Pershing, Nike Zeus Target, Honest John, Littlejohn, Corporal, Sergeant, Missile A, Missile B, Light Anti-Tank Weapon (LAW) and special weapons.

Research Aims at Cutting VTOL Surface Erosion

Under contract from the U.S. Army Transportation Research Command, a study has been initiated to determine the various effects on earth surfaces and water from Vertical Takeoff and Landing aircraft. The U.S. Army Waterways Experiment Station is assisting in field tests.

New Solar Cell Hailed as Important Advances

A new type of solar cell developed by the U.S. Army Signal Corps R&D Laboratories is acclaimed the most important advance in this research area since the first solar cell was produced by Bell Laboratories and announced in a scientific paper in 1954.

ARTS Lists Status of 2,900 Tasks

Status of nearly 2,900 Army research tasks conducted in-house, by contracts or by grants to nonprofit institutions is reported in the new Army Research Task Summary (ARTS). Now being distributed to Department of Defense and other U.S. Government agencies concerned, the summary, for the first time, reports on tasks in progress at the close of a Fiscal Year, June 30, 1960.

SEQUENCE of explosion designed to determine target response from a low-yield, subsurface nuclear detonation of an earth-penetrating warhead during Project ESSEX experimentation.

Nuclear Effects Knowledge . . .

Advances in DNA/CE Project ESSEX

Project ESSEX (Effects of Subsurface Explosions), sponsored jointly by the Defense Nuclear Agency and the U.S. Army Corps of Engineers as a 5-year research effort in using simulation techniques for buried low-yield nuclear cratering detonations, reached a high point in a recent experiment.

Conducted by personnel of the U.S. Army Engineer Waterways Experiment Station (WES), Vicksburg, MS, the demonstration of results of high explosives (10 tons of TNT equivalent) was staged October 30 at Fort Polk, LA, Military Reservation. The test was monitored by Defense Nuclear Agency engineers.

Differing from eight previous Project ESSEX detonations, which were concerned primarily with basic cratering effects of a simulated underground nuclear explosion—as a means of denying enemy access to an area—the experiment was designed to determine target response from a low-yield, subsurface nuclear detonation typical of an earth-penetrating warhead (EPW).

Accordingly, 11 surface and underground structural models were fielded varying in type, size and strength, both "hardened" and nonhardened, to study effects.

Targets included 1/3 scale earth-mounded aircraft shelters (precast reinforced concrete); steel girder 1/3.7 scale bridge components (piers on steel H piles, abutments and spans); buried reinforced concrete rectangular (3C) and barrel-arch (3A) command posts; and one POL storage and distribution facility (built-up steel and concrete storage tank with 1/3.7 scale pipeline and booster pumping station).

Specified objectives included: Determine damage mechanisms for typical targets from EPWs; determine in-structure motion; provide data for structural response code verification. Additional objectives included: Determine effects of geology, stemming configuration, and depth of burst on crater (obstacle) size and shape; ejecta deposition patterns, ground shock and airblast.

Design of the "shot," a mixture of 87 percent nitromethane, 10 percent sand and 3 percent guar gum, was identical to that used for the eight previous Project ESSEX experiments—except that sand particles were not coated with iridium to serve in simulated fallout dispersion pattern identification.

Placement of the charge was based on a study of geologic profiles developed from site borings conducted by WES, previous tests, and certain weapons systems characteristics. The charge design was developed by Systems Science and Software, La Jolla, CA.

Personnel of the Waterways Experiment Station and Weidlinger Associates determined location of the structures relative to ground zero by a pretest study involving analytic prediction of potential regions of damage. Structures and surrounding back fill were instrumented to measure 248 channels of data about detonation effects and structure response.

Vibration tests were conducted prior to and after the detonation to determine influence of the surrounding soil on the dynamic characteristics (modes, shapes, frequencies) of the underground and surface structures (bridge span, buried reinforced precast concrete arched building, rectangular buildings and aircraft shelter).

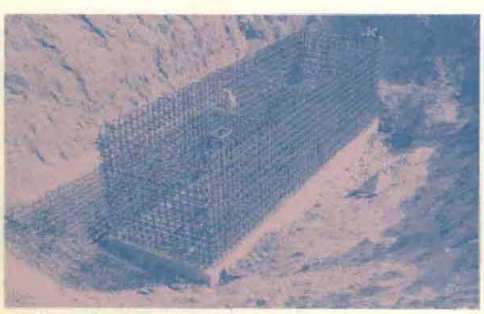
Detonation physics objectives were defined as: To confirm full detonation of the explosive, verify the detonation velocity for gelled nitromethane used in the equation-of-state, and to study relations of the shock wave in the stemming column near the open access hole and the vent flow in the hole.

Cratering kinetics determinations included vent gas temperatures, study of early time mound growth, study of base surge and cloud formation and earth movement.

The eight previous Project ESSEX high-explosive detonations were directed to such determinations as: How large a crater would be created by varying the depth and stemming configuration for a charge of nitromethane? How much air blast? How much ejecta (quantity of rock and dirt blasted out to form the crater)? How was the pattern of simulated fallout dispersion varied by differing charge configurations? What were the particle velocities and accelerations?

Also: How much shock was transmitted through the ground? How effective were the craters as barriers to tanks, trucks, armored personnel carriers, and other tactical vehicles? How long a time and what equipment would be required to fill in the crater to restore mobility across it?

LT JAMES R. WILLIAMS, Civil Engineer Corps, U.S. Navy, has been stationed with the Defense Nuclear Agency in Washington, DC, since June 1973. Educated as a structural engineer, he has been primarily concerned with the assessment of physical vulnerabilities for military significant targets. Most of his responsibilities have involved naval ships and facilities, but association as project officer for Project ESSEX and other programs has required frequent contact with Army, Air Force and other Department of Defense organizations. Upon graduation from the Naval Academy, LT Williams served as a company commander for a Seabee battalion in Vietnam and returned for graduate study at the Georgia Institute of Technology.

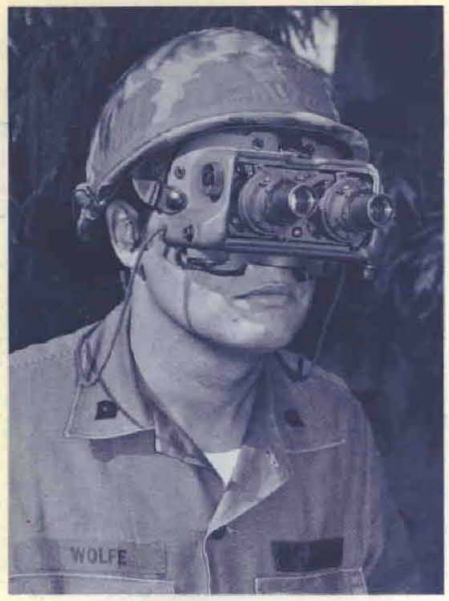


Rectangular Structure

Buried Arch Structure

SIDELIGHTS: One of the discoveries in Project ESSEX is that nitromethane when exploded underground is about twice as effective for cratering as a nuclear warhead—that is, a 500-ton buried, high explosive blast has effects approximately equivalent to the effects from a 1,000-ton nuclear weapon. This is due to the slower release of high explosive energy and the correspondingly more complete absorption of the energy into the ground. About half the power of a buried nuclear charge would be dissipated by rapid venting into the air.

Craters at Fort Polk caused by the project have been appreciated by cattlemen and sportsmen. The vertical crater lips have been graded and defiles created so cattle can water when the craters are filled. The resulting stock ponds attract wildlife and stocking the waters with fish will attract outdoorsmen.



AN/PVS-5 GOGGLES

RANGE/DISTANCE – 400M
F.O.V./CHAMP – 10°
MAG./GROSSISSEMENT – 4x
WT./POIDS – 2.6KG

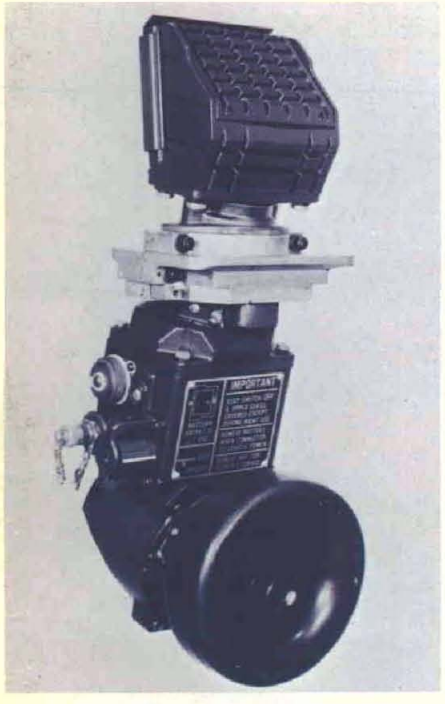
AN/PVS-2

RANGE/DISTANCE-1000M
F.O.V./CHAMP-7°
MAG/GROSSISSEMENT-7x
WT./POIDS-7.3KG

AN/TVS-2

RANGE/DISTANCE – 400M
F.O.V./CHAMP – 15°
MAG./GROSSISSEMENT – 3.8x
WT./POIDS – 1.6KG

AN/PVS-4



AN/VVS-2 VIEWER

RANGE/DISTANCE-1000M
F.O.V./CHAMP-9°
MAG./GROSSISSEMENT-6.5x
WT./POIDS-3.4KG

AN/TVS-5

AN/VSS-4 (XE) SEARCHLIGHT ON M60AIE3

TI TOW NIGHT SIGHT