ARMY R,D&A

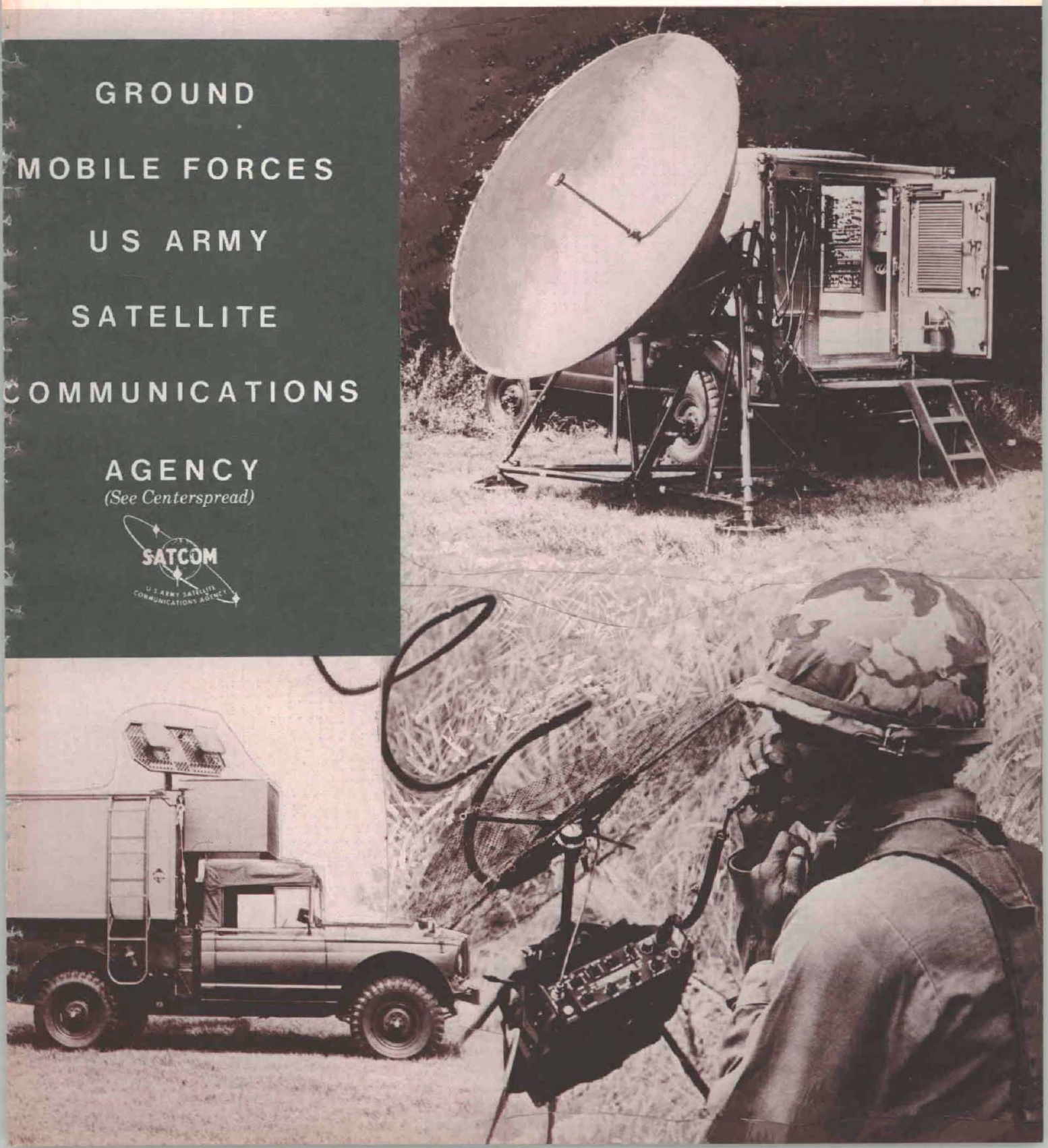
- RESEARCH
- DEVELOPMENT
- ACQUISITION

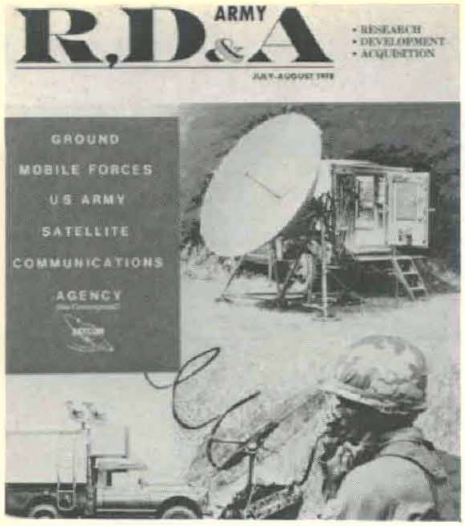
JULY-AUGUST 1978

GROUND MOBILE FORCES US ARMY SATELLITE COMMUNICATIONS AGENCY

(See Centerspread)

SATCOM
U.S. ARMY SATELLITE COMMUNICATIONS AGENCY





ABOUT THE COVER:

Typical of new multipoint and/or point-to-point terminals being produced to satisfy critical command and control multichannel transmission requirements of the Ground Mobile Forces are the AN/TSC-85(V)2 (top), the AN/TSC-91/92 mobile UHF satellite communications terminal (bottom left), and the AN/PSC-1 Manpack Transceiver, which gives the soldier a capability to communicate via satellite with a similarly equipped user as far as 9000 miles away. Back cover shows 2-inch cast bronze medallion that will be presented to 75 Army scientists/engineers in recognition of their achievements that have advanced capabilities of the Army.

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FEATURES

DEPARTMENTS

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Atlanta V Conferees Discuss Materiel Acquisition Concerns

The annual spring conference between DARCOM's top management and presidential and senior level executives of industry was held in Atlanta, GA, 25-26 May, 1978. The 1978 conference, called "Atlanta V," had as its theme "Systems Acquisition Perspectives." Over 260 top executives from industry participated along with some 50 senior officials from the Department of the Army and DARCOM.

Cosponsored by the American Defense Preparedness Association and the National Security Industrial Association, the conference, held at the Hyatt Regency Hotel in Atlanta, was the fifth consecutive meeting between key officials of the Army Secretariat industry and DARCOM's senior management, designed to improve communication between the two vital elements of the nation's defense effort.

Attendees were outspoken in their belief of the considerable value of this and previous meetings, in the opportunities provided for frank and informal high level exchange of views on policy matters, trends and directions, and problem areas.

The conference was called to order on Thursday, 25 May, by Mr. John D. Blanchard, Assistant Deputy for Materiel Development, HQ DARCOM, who introduced Mr. Phil Alexander of the staff of Mayor Maynard Jackson of Atlanta. Mr. Alexander welcomed the participants on behalf of the mayor and the city.

GEN John R. Guthrie, DARCOM commander, gave the opening remarks stressing his concern that there be a mutual exchange of information, that all participants feel free to ask questions and discuss areas of concern. By way of background, the DARCOM commander noted his belief that his command was the most complex and least understood command in the U.S. Army. A full understanding was essential, the General felt, if DARCOM was to be able to carry out fully its vital and irreplaceable role.

The reorganization of DARCOM, begun in 1974, is still going on, said Guthrie, but it was one of his main objectives to bring stability and balance to the new structure. It was, in his opinion, a tribute to the high quality of the people in DARCOM that work continued without adverse impact during the periods of greatest turbulence. What was needed now, said the General, was time to consolidate and "debug" the new organization into a smoothly operating command.

A major concern, the DARCOM commander expressed, was that of the process of transitioning a program from the development side of DARCOM to the readiness side. He encouraged industry to provide him with their ideas on the many aspects of this process.

GEN Guthrie pointed out that DARCOM had recently acquired two additional missions—that of being the single manager for conventional ammunition for all of the Military Services, and the second, that of being executive agent for Army international security assistance. The latter program, he stressed, has undergone a considerable change, shifting from primarily a grant-aid type operation to primarily sales logistic support and parts supply and distribution.

LTG Robert J. Baer, Deputy Commanding General for Materiel Development, in his remarks praised the value of past Atlanta conferences as a mechanism to enhance the personal exchange of information between high level members of industry and DARCOM's senior managers. Since becoming the Deputy for Materiel Development, Baer noted that he believed he now was able to see things with a broader view, and that he was impressed with industry's "can-do" attitude, its proficiency and dedication.

GEN Frederick J. Kroesen
U.S. Army Forces Commander
Atlanta V Luncheon Speaker

The Soviet challenge of attaining military superiority over the West, said General Baer, shows no sign of stopping. To offset this challenge, the Free World must rely on technology, increasing its technical base efforts, in order to get advanced systems into the hands of troops. But there must be a constancy of effort, he continued; a yo-yo approach to fund fully, then reduce, then boost the effort once again, will not produce the desired results.

Additionally, he continued, there must be a greater effort of selectivity in determining the direction of the technical base efforts. In that connection, he urged industry to engage in in- house research and development; such efforts can often provide a company with a "leg-up" position. For guidance on the Army's future needs in the technical base area, the classified Science and Technology Objectives Guide (STOG), is available to security cleared industry through the Defense Documentation Center.

The recent OMB Circular A-109 dealing with Major Systems Acquisition, Baer noted, forces a concentration on the front end of the acquisition cycle, as well as providing for frequent re-evaluation of the threat. The circular stresses the need to review alternative ways of attaining the solution to a materiel need, to include evaluating foreign systems. The General sees a new development as the last resort, after determining that

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LTG Robert J. Baer
DARCOM
DCG for Materiel Development

MG Tom H. Brain
DARCOM
Director for Security Assistance

Mr. John D. Blanchard
DARCOM
Assistant Deputy for Materiel Development

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(Continued from page 1)

product improvement and alternative approaches cannot provide an acceptable solution.

General Baer then talked of some problem areas that he felt needed the cooperative efforts of both the military and industry. The length of time involved in developing a system needs shortening. Better planning on the part of both, said Baer, can contribute to the shortening of development time. Lack of candor or realism in dealings with one another was a second problem area, the General mentioned, and the third was to find ways to encourage greater investment by contractors in capital assets that will result in cost savings to the Army.

The timely topic of "DARCOM Rationalization, Standardization, Interoperability (RSI) Efforts—Some Guidelines," was addressed by Mr. John D. Blanchard. The speaker noted that last summer DARCOM had undertaken an extensive study to identify the principal inhibitors of RSI—grouping them into those which would have to be dealt with by higher authority and those for which DARCOM could develop guidelines. The study concluded that none of the inhibitors is insurmountable.

The effort is a continuing one, said Blanchard, noting "we have a long way to go before we can say we have a body of meaningful 'know hows' incorporated" into the study.

Mr. Blanchard stressed that his comments about RSI were given from the point of view of Army acquisition of foreign technology, weapons, and equipment—"the less used lane of the 2-way street . . . Europe to the U.S."

All data accumulated to date, he continued, provide convincing evidence in support of three basic observations. First, it is difficult to disentangle the impacts of RSI from domestic issues and policies, and from an international aspect, of such things as balance of payments and as an instrument of foreign policy. Second, that DARCOM is committed to full participation in the RSI effort, and third, that there are areas where "external initiatives" will be required.

There are four areas or categories, Blanchard stated, into which RSI inhibitors may be grouped: environmental, statutory constraints, organizational and management impediments.

Under the first of these, he continued, "there are fundamental differences within the [NATO] alliance on national objectives, that create both real and artificial barriers. . . ." In addressing the second, Mr. Blanchard noted that there is a need for clarification and consolidation of the laws, regulations, policies, and procedures of the United States to facilitate RSI objectives.

As for organizational considerations, he remarked that RSI acquisition matters are not exempt from normal staffing patterns. Additionally, it was found that there is a growing RSI community in the Department of Defense, State, Treasury, and extending downwards through their structures. This points up, he said, the need for a concise treatment of the specific roles and responsibilities of each. Noting with concern this growth of separately manned organizations, the DARCOM speaker remarked that "RSI must be made an essential and integral part of our daily way of doing business."

As for the fourth inhibitor, that of management requirements, it is clear, said Blanchard, that RSI will require additional management resources—to include the operating levels.

Also a product of the DARCOM study was a framework for integrating the "how" guidance that has been developed to date. Grouped as the second volume of the study, this package will be the working tool for people carrying out day to day tasks on RSI. The third volume of the study is a comprehensive appendix containing a lexicon of RSI terms and a complete reference to OSD and Army RSI directives and policy statements.

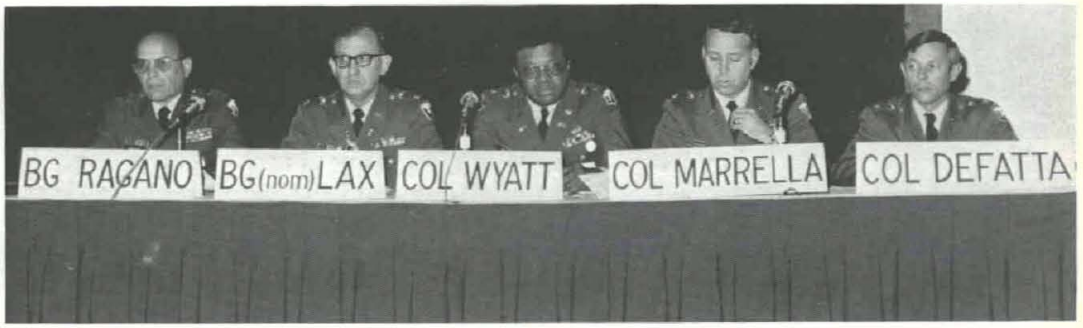
Mr. Blanchard concluded his presentation by stressing that GEN Guthrie's guidance to "spread the RSI virus" throughout DARCOM is being energetically carried out.

MG Tom H. Brain, DARCOM director for Security Assistance, provided an overview of the policies governing international Security Assistance and a review of how the Army is implementing these policies.

The General reviewed President Carter's policy statement of 19 May 1977, that placed restraints on the sales of U.S. military arms and equipment to foreign countries other than NATO partners, Australia, New Zealand and Japan. The goal for Fiscal Year 1978, under the President's policy, said Brain, is to reduce the dollar volume to less than the amount attained in Fiscal Year 1977. The policy is designed "to impose disciplines and restraints on [U.S.] arms transfer activities abroad and at the same time to make available those arms and other equipments and services needed by our Allies and close friends to meet

"DARCOM Development & Readiness—Some Perspectives" Panel. Moderator, Hon. Robert L. Johnson, former ASA (R&D) and now president of McDonnell Douglas Astronautics Co. Panel (from left): MG Robert J. Lunn, director of Development and Engineering; BG Ernest A. Vuley Jr., director of Materiel Management; MG (nominee) Jere W. Sharpe, director of Procurement and Production; MG Louis Rachmeler, commander, Army Missile Materiel Readiness Command.

"International Cooperative Programs From a Real World Perspective" Panel. Moderator, Hon. Malcolm R. Currie, former DDR&E and now vice president and group executive, Missile Systems Group, Hughes Aircraft Co. DARCOM Panel of Program Managers (from left); BG Frank P. Ragano (Roland); BG Joseph O. Lax (Viper); COL James E. Wyatt (SINCGARS); COL Leonard S. Marrella (DIVAD); COL Vincent DeFatta (Stinger).



their legitimate defense needs."

Five basic controls are being employed, said Brain. These are: (1) the U.S. will not be the first to introduce into a region newly developed weapons that would create a significantly new or higher combat capability; (2) the U.S. will not sell or permit coproduction of weapons until they are operationally deployed with U.S. forces; (3) the U.S. will not permit development of advanced weapons solely for export; (4) there will be no coproduction by other countries of significant weapons, equipment, or major components; and finally, (5) U.S. diplomatic and military officials will not be permitted to promote the sale of arms.

Actions taken in the procedural area to implement the President's objectives, the General continued, include limiting overseas representatives directly involved in foreign military sales, the advice on arms transfer matters required of the Arms Export Control Board to the Secretary of State, revisions to procurement regulations that eliminate incentives for foreign military sales, tighten control of bailments and U.S. Government property in actions that could be interpreted as directed toward foreign military sales, amendment of State Department regulations requiring U.S. Government approval before U.S. contractors may enter too deeply into proposals for such sales, the requirement for foreign governments to now use diplomatic channels in forwarding requests of $7 million or more for purchase of significant combat equipment, and finally, attain the President's dollar goal of some $600 million less sales in 1978 than in 1977.

As commander of DARCOM's U.S. Army Security Assistance Center, the General said he had over 600 people involved in managing the Army's security assistance program. His agency, he said, functions as a catalyst, setting things in motion and being responsible that these actions remain on course.

The magnitude of the Army's Security Assistance Program is great, according to General Brain. He cited over 7,000 open foreign military sales cases at this time, with 84 different countries and NATO organizations. In Fiscal Year 1977, he said, the Army had slightly over $3 billion on new sales which essentially maintained the previous year's level, though less than the two prior years.

The General saw an increase, however, in future requests for supply support and services. While the number of export licenses requested has decreased since the President's policy announcement, the dollar value has increased significantly, and Brain expected these trends to continue, especially the requirement for follow-on support for equipment sold in prior years.

General Brain stated that he believed arms sales will continue to play a very substantial role in support of U.S. foreign policy and national security objectives, and to that end he made available to the audience a listing of the new points of contact and their telephone numbers of State Department, Department of Defense, and Department of the Army individuals who could assist industry in foreign military sales matters.

GEN Frederick J. Kroesen, commander of U.S. Army Forces Command, was the luncheon speaker on the opening day, and the General's address stressed the need for the U.S. soldier to be able to use and maintain the equipment that is placed in his hands.

The General pointed out that if today's Army had to go to war tomorrow, it would be using equipment that represents 25-30-year-old technology. There would be some exceptions such as the TOW, Redeye, and some of the night vision devices, but by and large, said General Kroesen, there hasn't been too much change in the past two decades.

But even so, the Army is becoming an equipment-intensive organization, he continued, with almost three major items of equipment for every four soldiers. However, the Army differs from the other services in that its systems assist the soldier, who continues to be the dominant force in land warfare. Kroesen noted that as capabilities grow so does sophistication, generally leading to more complex equipment. And the soldier, said Kroesen, can absorb just so much complexity.

Speaking of the Volunteer Army, the General felt today's force was as good as any the U.S. had ever fielded. He said he believes today's soldier is better trained and better prepared, and more confident in his ability because we have recognized and responded to a threat which demands a higher state of readiness than we have ever maintained before.

But, Kroesen stressed, there is still a need to "soldier-proof" every new item of equipment and to make it simple in operation, maintenance and repair. He cautioned that the future 18-year-old will be no different than past and present 18-year-olds, with all the capabilities and distractions characteristic of that age group. We can

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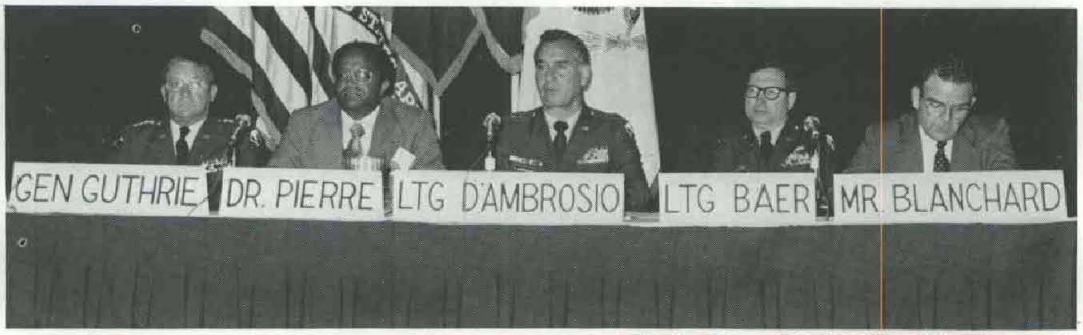
"Some Sharpening of Perspectives" Panel. Moderator, Hon. Barry J. Shillito, former ASD(I&L) and now vice president of Teledyne, Inc. Panel members include DARCOM Commander GEN John R. Guthrie, ASA(RDA) Percy A. Pierre, DARCOM Deputy Commander for Materiel Readiness LTC Eugene J. D'Ambrosio, Deputy Commander for Materiel Development LTG Robert J. Baer, and DARCOM Assistant Deputy for Materiel Development Mr. John D. Blanchard.



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count on today's solider, and tomorrow's, to do what has to be done to win a war, Kroesen said, but we will make his job much easier if we keep in mind that the tools we give him must be designed to help him win it and not win it for him.

"Today's Search for the Materiel/Systems of Tomorrow's Army" was the theme of the presentation by LTC Patrick J. Kelly, currently a student at the Army War College, and a member of DARCOM's military scientific community.

Colonel Kelly began by pointing out that 80 percent of the Army's technical base effort was under the auspices of DARCOM, and that 25 percent of DARCOM's RDTE funds were in support of expanding the technology base. This support was also being directed more profitably by the Science and Technology Objectives Guide, previously mentioned by LTG Baer.

Areas where technological thrusts were being undertaken fell into eight broad categories, said Kelly. These were (1) conventional weapons/munitions, (2) electronics, (3) aviation, (4) tank/automotive, (5) missiles, (6) chemical warfare/chemical biological defense, (7) individual soldier support, and (8) combat support.

Under conventional weapons, the colonel pointed out, advances were sought in things like anti-armor munitions, defensive materials to defeat armor penetrating weapons, liquid gun propellants, fuzing, and in smoke and obscurants. In the electronics area, new capabilities are needed in spoofing and jamming, in intelligence, surveillance and target acquisition, and in increased survivability of equipment, and in signal processing and data distribution.

Aviation thrusts, said Kelly, include advances in aeronautic components, aircraft weaponry, and propulsion. In the tank/automotive fields, engine design, track design, and improved survivability were among the areas where technology advances were needed.

Missile thrusts, Kelly continued, included terminal homing advances, improvements in simulation and software, as well as ways to decrease costs.

CW/CB defense, said the colonel, needed better detection equipment and alarms, along with medical defenses against chemical agents.

To better provide for the individual soldier, the colonel continued, advances were needed in foods and food services, in new clothing and individual equipment. And finally, under combat support, improvements were needed in barrier and counter-barrier systems, in energy and environmental systems, and counter- surveillance systems.

The balance of the first day was devoted to panel discussions that drew considerable audience participation. The first panel, moderated by the Hon. Robert L. Johnson, former Assistant Secretary of the Army for Research and Development and now President of McDonnell Douglas Astronautics Co., had as its topic "DARCOM Development and Readiness—Some Perspectives." Panel members included MG Robert J. Lunn, director of Development and Engineering, DARCOM; MG Jere W. Sharpe, director of Procurement and Production, DARCOM; BG Ernest A. Vuley Jr., director of Materiel Management, DARCOM; and MG Louis Rachmeler, commander of Army Missile Materiel Readiness Command, DARCOM.

The second panel was moderated by the Hon. Malcolm R. Currie, former director, Defense Research and Engineering and now Vice President and Group Executive, Missile Systems Group, Hughes Aircraft Co. Its theme was "International Cooperative Programs From a Real World Perspective."

The panel was composed of five of the DARCOM's program managers whose programs had international implications. The members were: BG Frank P. Ragano (Roland), BG Joseph O. Lax (Viper), COL James E. Wyatt (SINCGARS), COL Leonard S. Marrella (DIVAD), and COL Vincent DeFatta (Stinger).

The final session of the first day was listed as "Industry's Finest Hour." At this time GEN Guthrie presented awards to ten industrial firms whose contributions to DARCOM's missions were deemed outstanding. (See page 5 for details of awards.)

The Friday, 26 May, session was again a response-provoking panel moderated by the Hon. Barry J. Shillito, former Assistant Secretary of Defense for Installations and Logistics and now Vice President of Teledyne, Inc. The panel members included the Hon. Percy A. Pierre, Assistant Secretary of the Army (RDA), GEN Guthrie, LTG Baer, LTG D'Ambrosio, and Mr. Blanchard. The panel theme was "Some Sharpening of Perspectives."

As was the case in the previous day's panel sessions, there was widespread response from the the floor in the form of questions directed at the

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DARCOM Recognizes 10 Industrial Firms for 1977 Support Efforts

In a ceremony during the Atlanta V DARCOM-Industry Conference on 25 May 1978, GEN John R. Guthrie, U.S. Army Materiel Development and Readiness Command (DARCOM) commander, signaled out 10 industrial firms for special recognition of outstanding achievement in support of DARCOM for 1977. Each company received an engraved plaque and the personal congratulations from GEN Guthrie. The companies recognized and their citations were:

AAI Corp. is cited for its outstanding effort in establishing concept feasibility for the (lightweight) high survivability test vehicle.

AAI developed unique and innovative approaches for the lightweight vehicle concept. The company accomplished this under extreme pressures of a compressed schedule, minimum design parameters, and late program changes. The results showed a detailed and thorough analysis of various configurations, thus contributing to the competitive excellence of the Army's acquisition programs.

American Metal Services, Inc. is cited for its outstanding support to the U.S. Army as a subcontractor supplying new materials to one of the Army's prime contractors. American Metal Services has continued to be a reliable supplier offering competitive prices while meeting difficult delivery schedules. In addition, the company has compiled a raw material catalog for buyers that is in use throughout the industry. This performance and initiative reflects the professionalism and dedication of the American Metal Services, Inc. team.

BEI Electronics, Inc. is cited for its outstanding support to the U.S. Army in the production and delivery of Pershing digital shaft angle encoders and 2.75-inch rocket motors.

BEI Electronics, Inc., a small business concern, is a subcontractor who has repeatedly demonstrated corporate credibility in the conduct of its business. At its expense, BEI has recalled encoders to correct a possible reliability problem, and extended warranties to cover other potential product difficulties.

In addition, with production quantities of 2.75-inch rocket motors fluctuating from 500,000 per month to 20,000 per month, BEI found unique production control techniques to maintain efficient operations in order to meet unpredictable program changes.

Dayron Corp. is cited for its outstanding service to the U.S. Army in developing production capacity for 3 million fuzes per month. This capacity developed at Dayron's expense, has created a healthy competitive environment within the fuze industry which offers cost and schedule advantages to the Army. Dayron has contributed immensely to the Army's fuze production base and is recognized for its support.

Metal Masters, Inc., with some 26 employes, participated in the first competitive breakout for the shells for the guidance package and warhead for the Improved Hawk Missile system.

Metal Masters, under a firm fixed price contract, and with substantial private investment in tooling, has consistently delivered a quality product on time. Metal Masters, Inc., is cited for its outstanding support to the U.S. Army in improving our production capability for this critical weapons system.

Motorola Corp., Government Electronics Division, is cited for its technical excellence in the development of electronic counter-countermeasure equipment for the side-looking airborne radar. This equipment marks the first time that counter jamming equipment has been effectively operated from an airborne platform, and is seen as a major breakthrough in protecting airborne radar from electronic countermeasures. This performance reflects the profes-

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DARCOM Commander GEN John R. Guthrie presents achievement plaques to: Top (l. to r.)— Messrs. Marvin Kahn for AAI Corp.; Thomas King, American Metal Services; W. L. Reismont, BEI Electronics, Inc.; and L. C. Grammer, Dayron Corp. Bottom—Mrs. Lois McKay, Metal Masters, Inc.; and Messrs. George W. Gerung, Motorola Corp., Government Electronics Division; Frank J. Zulcaitis, National Presto Industries, Inc.; Lynn Hanan, Pacific Car and Foundry Co.; Rollin Osgood, Southern Research Institute; Jack Davis, Xerox Corp., Electro-Optic Division.

DARCOM Recognizes 10 Industrial Firms

(Continued from page 5)

sionalism and dedication of the Government Electronics Division at Motorola.

National Presto Industries, Inc. is cited for its outstanding support to the U.S. Army through the successful modernization of its munition production facilities. This is the first modernization of its type to be implemented in the private sector and it has saved over $15 million through judicious application of equipment rehabilitation. This achievement was the result of the dedicated management and enthusiastic employes of National Presto. National Presto has contributed immensely to a successful munition production base modernization and expansion program.

Pacific Car and Foundry Co. is cited for its outstanding effort in establishing concept feasibility for the (lightweight) high survivability test vehicle.

Pacific Car and Foundry developed unique and innovative approaches for the lightweight vehicle concept. The company accomplished this under the extreme pressures of a compressed schedule, minimum design parameters, and late program changes. The results showed a detailed and thorough analysis of various configurations, thus contributing to the competitive excellence of the Army's acquisition programs.

Southern Research Institute is cited for the development of chemical agent warning and detection equipment. Southern Research Institute has made significant technical contributions to the state-of-the-art in chemical agent alarms including development of the original spontaneous electrolysis alarm. SRI has remained at the forefront of alarm equipment design and application which has contributed immensely to the Army's demilitarization program.

Electro-Optical Systems Division, Xerox Corp. is cited for its outstanding support to the U.S. Army in the multiple integrated laser engagement system. Xerox Electro-Optical Systems is developing an innovative training device in an emerging technology for less than the estimated cost. In addition, through Xerox efforts, The Surgeon General has revised eye safety standards for lasers making them more realistic. This effort in lasers and eye safety reflects credit on the management and staff at Xerox Electro-Optical Systems.

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panel members and the moderator.

The conference ended with a strong wrap-up summation by GEN Guthrie. He told the audience that their concerns and their advice would be heeded, and that he would continue to strive for a better understanding by industry of DARCOM's organization, role, and missions. Meetings such as these, the General continued, provide senior officials from each community the opportunity to become acquainted with each other and to exchange views in a relaxed atmosphere.

Noting the integrity of the military-industrial team, GEN Guthrie stated he was in no way prepared to be defensive about that partnership—it was "too important and too fundamental to the security of the nation."

The General recalled to the audience the caution of GEN Kroesen concerning the relationship of the soldier and his equipment, a caution that should be kept in mind as future systems evolve.

GEN Guthrie ended his summary by stressing again his goal of ending any existing adversary relationships in DARCOM's contacts with other Army commands, and with industry. DARCOM, he said, was just one member of the Army team, but it was *the* member of the Army-Industry team.

High-Level Speakers Address 3d Annual MARED Seminar

High-level support for continued development of competent executive personnel within the U.S. Army Materiel Development and Readiness Command was evidenced at the 3d annual Materiel Acquisition and Readiness Executive Development Seminar in San Antonio, TX.

A total of 103 recent MARED selectees—representing numerous career disciplines—participated in the seminar workshop sessions. They were provided with Individual Development Plans, heard distinguished speakers review DARCOM's present and future management picture, and were treated to a tour of the Army Fuel and Lubricants Laboratory.

Keynote speaker MG Robert Bergquist, DARCOM deputy commander for Resource Management, relayed DARCOM Commander GEN John R. Guthrie's strong endorsement for the MARED program, and extended congratulations to the new selectees.

DARCOM Director of Readiness MG Emil Konopnicki presented an address on "Management Philosophy That Works." This philosophy, he said, is based on respect for the dignity of others, on teamwork, and on a daily self-critique.

Additional guidelines for managers were discussed in another "hardhitting" speech by MG Oren DeHaven, Department of the Army assistant deputy chief of staff for Logistics. He urged his audience to be aggressive, fight the "yes- man" syndrome, and seek out honest opinions.

"The Army Position on Executive Development" was the topic of Mr. Joseph Bennett, deputy assistant Secretary of the Army for Civilian Personnel Policy and Equal Employment Opportunity. About 8,000 people Army-wide are now enrolled in some type of executive development programs, he noted.

Mr. John D. Blanchard, DARCOM assistant deputy for Materiel Development, and Mr. James Maclin, assistant deputy for Materiel Readiness, offered a lively discussion on "Management as a Profession."

Maclin indicated that DARCOM is far ahead of other federal agencies in the development of management-oriented executive training plans. He also stressed that the ability to motivate people is the vital spark for an effective manager.

Blanchard called on the MARED selectees to learn to depend on their specialists in order to keep their own focus on the larger picture. He also emphasized that the basic mission of DARCOM is to provide equipment for the soldier.

Former Army Chief of Research and Development LTG Austin Betts (USA, Ret.) reviewed the status of current energy research programs. Focusing on alternatives to fossile fuels, he cautioned against permitting the "pernicious interventionist" to limit future energy options.

Other featured speakers included Mr. Carlos Lively from the Office of the Chief of Legislative Liaison, Department of the Army and MG Tom H. Brain, commander of the U.S. Army Security Assistance Center and DARCOM director of Security Assistance.

A climactic part of the MARED selectees tour of the Army Fuel and Lubricants Laboratory was a briefing on new efforts to develop a self-extinguishing fuel which may eliminate dangerous and costly tank and vehicle explosions.

Annual R&D Achievement Awards Recognize 75 Army Scientists/Engineers

Army R&D Achievement Awards, consisting of a 2-inch cast bronze medallion and a wall plaque, will be presented to 75 Army scientists/engineers, to recognize their scientific achievements that have advanced capabilities of the Army and contributed to the national welfare during the past year.

Winners of the 18th annual awards for accomplishments during 1977 include 61 personnel attached to activities of the U.S. Army Materiel Development and Readiness Command, 10 to the Office of the Surgeon General, and 4 to the Office of the Chief of Engineers.

High-ranking Army R&D leaders will present the individually engraved plaques and medallions to the winners, during the next few months, at the activities where the selectees are employed. Award winners and brief excerpts of their nominations/citations, as well as the major command, subcommand and/or installation at which they are employed, are as follows.

U.S. ARMY MATERIEL DEVELOPMENT & READINESS COMMAND (DARCOM).

Army Materials & Mechanics Research Center (AMMRC), Watertown, MA. The team of *Drs. Robert E. Sacher, Gary L. Hagnauer* and *James F. Sprouse* developed methods and techniques that will impact significantly on the Army's selection process for fiberglass reinforced epoxy resin systems.

They will receive the Army R&D Achievement Award for their work, which represents a breakthrough in the area of quality control and quality assurance for Army programs such as Black Hawk, CH47, Cobra, or any others using fiberglass epoxy systems in critical applications where strength, light weight, and corrosion resistance are important, as for example, in rotor blades and fuselages.

All three research chemists are employed in the Polymer and Chemistry Division of the Organic Materials Laboratory of AMMRC.

Human Engineering Laboratory (HEL), Aberdeen Proving Ground, MD. *Mr. John A. Stephens* will receive the award for his contribution to the Integrated Helicopter Control Program.

A summary of achievements states that "His technical and supervisory leadership led to a major technological breakthrough in the design, fabrication and flight test of a one-handed control for helicopters. Many of the advantages and benefits derived from a control of this type are the enhancement of survivability in a combat environment and freedom for the pilot to perform other tasks such as communications, navigation and subsystem control.

"It also could be exploited in a long-range objective of helicopter cockpit simplification and in achieving a cost-effective, single-pilot IFR capability."

U.S. Army Armament R&D Command (ARRADCOM) HQ, Dover, NJ. A 12-man team will receive the Army R&D Achievement Award for successful completion of the engineering development program and type classification of the 155mm Projectile, AT, M718/741 (RAAM) Systems.

According to the citation, this effort resulted in the world's first artillery delivered antitank mine, which will provide the Army with a capability that will add a new dimension to mine warfare.

"For the first time, rapid emplacement of remote minefields can be accomplished day or night, under all weather conditions, in minutes. Moreover, highly effective and reliable, it extends the use of mines to an offensive role and offers improved effectiveness in the conventional defensive role."

Members of this team are *Messrs. Frank Diorio, John W. Grogan, Robert J. Miller, Herbert A. Grant, J. Tracy Ireland, Bert J. Zlotucha, William A. Clear, Ferdinand Dukic* and *Norman Regber*, all of the Large Caliber Weapons Systems Laboratory; *Mr. George E. Lutz* of the Product Assurance Directorate; *Mr. Edward F. Cousineau Jr.*, and *Mr. James R. Tworkouski*, Office of the PM for Selected Ammunition.

Ballistic Research Laboratory (BRL), ARRADCOM, Aberdeen Proving Ground, MD. Two team awards and three individual awards will be presented for significant R&D achievements at BRL.

Cited for teamwork in formulating and demonstrating concepts for revolutionary improvements in the design of shaped-charge warheads are *Dr. Andrew M. Dietrich, Mr. Robert L. Jameson, Dr. Fred I. Grace, Dr. Clifford L. Aseltine* of BRL, and *Mr. James Pearson* of the Large Caliber Weapons Systems Laboratory at Dover, NJ.

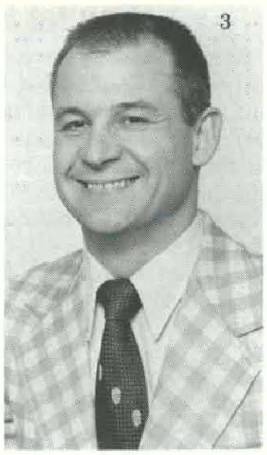
"Their work may be regarded as a scientific breakthrough which makes possible the design of weapons systems which will be an adequate response to a number of anticipated threats of major military consequence."

Drs. Donald Eccleshall and *Judith K. Temperley* will be honored for their innovative concepts for multistage high-power electron acceleration.

The citation states: "The new configurations, which are based on the use of transmission lines to store and transfer electrical energy, have advantages over existing concepts in providing a more constant electron beam energy, being lighter and more compact, or yielding a higher acceleration gradient and higher efficiency for transfer of the stored energy to the elec-

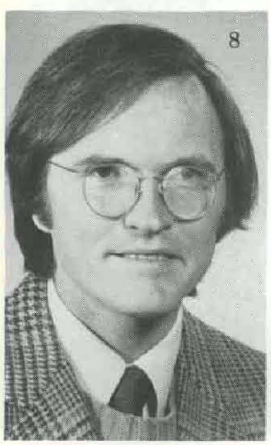
(Continued on page 9)

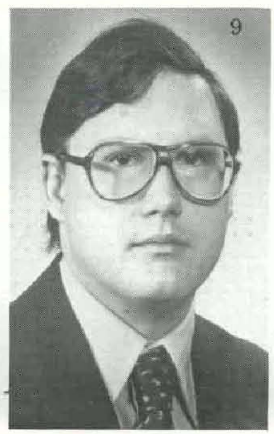
R&D ACHIEVEMENT AWARD WINNERS. U.S. Army Armament R&D Command (ARRADCOM), HQ Dover, NJ—(1) Seated (l. to r.) are Norman Regber, Frank Diorio, Herbert Grant, Ferdinand Dukic. Standing are George Lutz, Robert Miller, John Grogan, William Clear and Bert Zlotucha. Other members of this team (not shown on photo) are J. Tracy Ireland, Edward Cousineau and James Tworkouski. Ballistic Research Laboratory, ARRADCOM, Aberdeen Proving Ground, MD—(2) Drs. Judith K. Temperley and Donald Eccleshall.

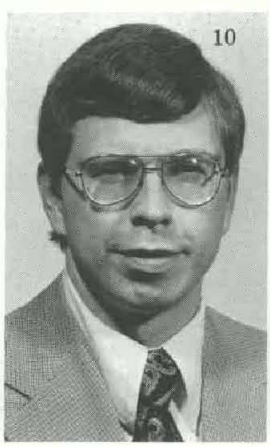


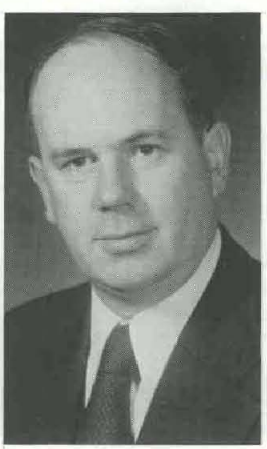
R&D Achievement Award Winners

Ballistic Research Laboratory, ARRADCOM, Aberdeen Proving Ground (APG), MD—(1) Front row (l. to r.): Fred Grace and Andrew Dietrich. Back row: Clifford Aseltine, Robert Jameson and James Pearson. (2) Harold J. Breaux (3) Dr. J. Terrence Klopcic (4) Dr. Edward Schmidt. Human Engineering Laboratory, DARCOM, APG, MD—(5) John Stephens. Chemical Systems Laboratory, ARRADCOM, APG, MD—(6) Robert Turner, Robert Merbler, Lester Strauch and Robert Gamson. Army Materials & Mechanics Research Center, DARCOM, Watertown, MA—(7) Dr. Robert Sacher, Gary Hagnauer and James Sprouse. U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS—(8) Dr. Donald Resio (9) Charles Vincent. U.S. Army Engineer Topographic Laboratories, Fort Belvoir, VA—(10) James Jancaitis. U.S. Army Tank-Automotive R&D Command, Warren, MI—(11) Donald Sarna. Standoff Target Acquisition System, ERADCOM, Fort Monmouth, NJ—(12) William Kenneally.









Army R&D Achievement Awards Recognize 75

(Continued from page 7)

tron beam.

"This achievement establishes a basis for subsequent technology developments which can significantly enhance the Army's capabilities in the area of compact, lightweight pulsed-power energy transfer systems."

Mr. Harold J. Breaux is recognized for significant accomplishments in the area of modeling high-energy laser propagation and effects phenomena leading to the development of standardized Army methodology for Systems Propagation Codes and Laser Vulnerability Modeling.

Dr. J. Terrence Klopcic will receive an R&D Achievement Award in recognition of pioneering research and display of outstanding ingenuity in the development of a methodology for quantitatively assessing the vulnerability of targets to high-energy laser radiation.

According to the citation, "His effort has significantly advanced the state-of-the-art in this area and has produced laser vulnerability data that preserves all the unique characteristics that are peculiar to possible laser weapons.

"The successful completion of this has provided a powerful tool that is producing the essential vulnerability data that is necessary to answer critical questions concerning the development of laser weapons."

Dr. Edward M. Schmidt was selected for technical competence and responsible leadership in producing valuable and timely research results in projectile launch dynamics and the muzzle blast environment of weapons.

"His research on the blast mechanism

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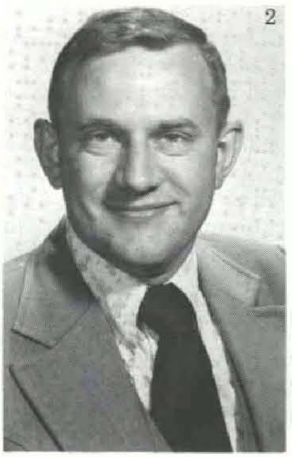
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U.S. Army Electronics R&D Command (ERADCOM), Adelphi, MD—(1) Front row (l. to r.): John Creedon, Sol Schneider and Joseph McGowan. Back row: Anthony Buffa, George Hrivnak, Stephen Levy and John Carter. William Wright, also a member of this team, is not shown. U.S. Army Mobility Equipment R&D Command (MERADCOM), Fort Belvoir, VA—(2) Dr. Richard Young (3) Dr. David Heberlein. Atmospheric Sciences Laboratory, ERADCOM, White Sands Missile Range, NM—(4) Dr. Richard Gomez. U.S. Army Missile R&D Command (MIRADCOM), Redstone Arsenal, AL—(5) Joe S. Hunter (6) Seated (l. to r.): John Leonard, Gene Widenhofer, Robert Yates. Standing: Robert Alongi, Charles Northrop, Charles Lewis (7) Kenneth Letson (8) Lewis Minor (9) John Schaeffel.


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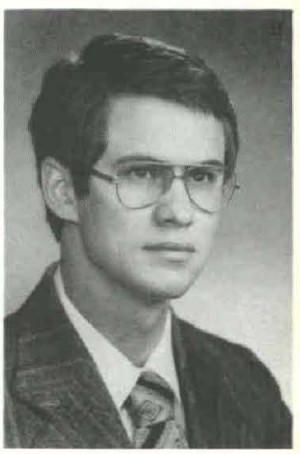
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Army R&D Achievement Awards Recognize 75

(Continued from page 9)

has led to revisions of interior ballistic models, and to the development of a particular form of suppressor. These findings also are presently being considered for aircraft weapon systems improvement."

Chemical Systems Laboratory (CSL), ARRADCOM, APG, MD. *Messrs. Robert M. Gamson, Robert L. Merbler, Lester D. Strauch Jr.,* and *Robert B. Turner* were selected to receive the Army R&D Achievement Award for their outstanding and creative efforts, individually and collectively, in the development of the M256 Chemical Agent Detector Kit.

This item, which has been type classified, represents a major advance over any other existing detector kit. All necessary reagents are contained in each plastic card, and the conventional use of pumps and dropper bottles has been eliminated, resulting in a simplified method of detecting and identifying chemical agents.

U.S. Army Missile R&D Command (MIRADCOM), Redstone Arsenal, AL. One team and four individual awards will be shared among 10 personnel employed at MIRADCOM.

A 6-man team will receive the R&D Achievement Award for their efforts in providing the Army with the ability to rapidly construct, validate and utilize simulations of complex guided missile systems, including the execution of difficult experiments involving instrumentation and data reduction problems.

Cited for efforts that have produced a Laser Designator Weapon System Simulation (LDWSS), which has proven to be an invaluable tool in the development of Copperhead, Hellfire, Tactical Airborne Designation System, and Ground Laser Designators are:

Mr. John P. Leonard, Dr. Robert E. Yates, Mr. Gene Widenhofer, Mr. Charles L. Lewis and *Mr. Robert E. Alongi,* all of the Technology Laboratory, and *Mr. Charles L. Northrop,* Engineering Lab.

An individual award will go to *Mr. Joe S. Hunter,* Technology Lab, for improvement of inertial instrument design and performance. His citation states, in part:

"The dedication and technical competence demonstrated by Hunter has played a significant role toward the objectives of establishing a technology base for new inertial component and system hardware and improving upon existing hardware with the goal of optimizing performance, size, weight and reliability versus cost; and demonstrating feasibility and performance through laboratory experiments."

The second individual award will go to *Mr. Kenneth N. Letson*, Technology Lab, for novel research investigations concerning the aerothermal and rain erosion effects on radome structures for use on hypersonic, thermally guided missiles.

"Through judicious sled testing of small-scale radomes with and without rain and empirically theoretical correlations obtained therefrom, he has been able to predict inflight performance of ceramic and reinforced plastic radomes subjected to aerodynamic heating and rain encounters.

"His efforts have resulted in determining the external configuration of the Pershing II radome and in the fabrication of an alternate, nonfragile radome for advanced full-scale testing."

Dr. Lewis G. Minor, Technology Lab, was selected for his innovative and exemplary achievements in image processing for missile guidance applications.

"He designed, constructed and programed an experimental electrooptical tracker that proved the concept that a high-speed microprocessor could be used to implement radically different real-time tracking techniques by changing only the stored program.

"By eliminating the need for a different hardware configuration for each type of tracker, significant cost reductions and performance improvements can be expected."

Mr. John A. Schaeffel, Technology Lab, will receive an award for his work in developing an automatic data reduction system that reads and processes interferograms of structural displacements in seconds as opposed to hours required for manual data reduction.

"An automatic system such as this integrates the computer into the various forms of experimental stress analysis and enables the engineer to reduce large amounts of test data in a short period of time by using the computer to do the routine work."

U.S. Army Electronics R&D Command (ERADCOM), Adelphi, MD. Electronics Technology & Devices Laboratory, Fort Monmouth, NJ. An 8-man team, all with the ETDL, will receive awards in recognition of a major contribution to the development of high-peak and average-pulse power technology.

"The advanced technology has been demonstrated in the Brassboard Modula-

R&D ACHIEVEMENT AWARD WINNERS. Signals Warfare Laboratory (SWL), ERADCOM, Vint Hill Farms Station, Warrenton, VA—(1) Left to right; Robert Sommer, Larry Lunsford, SSG David Stewart, John Dizer II, Colby Hinton, Michael Murphy and Calvin Eanes. Night Vision & Electro-Optics Laboratories, ERADCOM, Fort Belvoir, VA—(2) Walter Mannherz. U.S. Army Corps of Engineers Cold Regions Research and Engineering Laboratory, Hanover, NH—(3) Wayne Tobiasson. Office of the Surgeon General (OTSG). U.S. Army Medical Research Institute of Infectious Diseases, Fort Detrick, MD—(4) Dr. Robert Wannemacher Jr. Other OTSG R&D Achievement Award winners for which photos were not available at press time are: Letterman Army Institute of Research, Presidio of San Francisco, CA—Dr. Edwin S. Beatrice, David I. Randolph, Harry Zwick, and Messrs. David J. Lund and Bruce E. Stuck, CPT Stephen T. Kelley, LTC (Dr.) Thomas A. Bensinger, LTC (Dr.) Carl C. Peck and LTC (Dr.) Thomas F. Zuck.

tor which is now being used by the Missile R&D Command's contractor to perform critical experiments on the Cold Flow Electric Laser Device. This development has reduced the size and weight of multimegawatt modulators to one-tenth that of conventional modulators."

Cited for this contribution, which makes possible the fielding of mobile, directed energy systems for tactical applications are *Messrs. Anthony J. Buffa, John L. Carter, John E. Creedon, George Hrivnak, Stephen Levy, Joseph W. McGowan, Sol Schneider, William Wright.*

Standoff Target Acquisition System (SOTAS) Project Manager's Office, ERADCOM, Fort Monmouth, NJ. *Mr. William J. Kenneally,* deputy project manager for SOTAS, was selected for outstanding technical competence and managerial skills in the operational application of airborne MTI radar systems.

His citation states, "His skills in developing a program strategy for the U.S. Army has resulted in successful deployments of the SOTAS to Korea and Germany. His forceful leadership has resulted in the Army and DOD establishing the SOTAS program as a major weapon system program with the recognition that under his leadership it has been a successful program which will significantly increase the effectiveness of the U.S. Army fighting forces."

Atmospheric Sciences Laboratory (ASL), ERADCOM, White Sands Missile Range, NM. *Dr. Richard B. Gomez* will be honored for his role in developing a Smoke Obscuration Model that makes it possible to predict the effectiveness of electro-optics weapon systems in tactical environments.

"The application of this model will have a considerable impact on determining the optimal electro-optical system to deploy on the battlefield depending on atmospheric conditions. The results from this model will also have an important input in the design of future systems."

Night Vision & Electro-Optics Laboratories, ERADCOM, Adelphi, MD. *Mr. Walter A. Mannherz* was nominated and selected for technical leadership in the Common IR Module Program designed to identify component elements common to all systems and to execute development of standardized modular versions of each component.

The summary of achievement states: "He directed the innovative engineering effort which not only incorporates the common modules, but configures the assembly of these modules into a basic infrared receiver which is interchangeable between end item equipments. . . .

"The result of the engineering leadership provided by Mannherz materially advanced the development of thermal imagers, not only for this manportable class of systems, but since this program is the forerunner of other system applications utilizing the common modules, all future programs for tank and aircraft applications will benefit as well."

Signals Warfare Laboratory (SWL), ERADCOM, Vint Hill Farms Station, Warrenton, VA. *Messrs. John T. Dizer III, Calvin T. Eanes, Colby H. Hinton, Larry E. Lunsford, Michael D. Murphy, Robert H. Sommer* and *SSG David A. Stewart* will be commended for contributions to the Army's tactical and the nation's strategic SIGINT systems.

In less than five months, the group members, representing diverse disciplines, worked as a cohesive team and conceptualized, designed, fabricated and field tested a state-of-the-art device that represents a major breakthrough in a critical area of SIGINT processing and analysis.

U.S. Army Mobility Equipment R&D Command (MERADCOM), Fort Belvoir, VA. Individual awards will be presented to *Dr. David C. Heberlein,* Countermine Laboratory, and *Dr. Richard K. Young,* Counter Intrusion Lab., MERADCOM.

Heberlein will be honored for "outstanding contributions rendered in the perception and initiation of several innovative research efforts and the keen insight and exceptional experimental skills employed to rapidly and vigorously advance the embryonic technologies to their current states which reflect their considerable promise for greatly enhancing the Army's countermine capabilities.

"Particularly notable were his contributions to and leadership in the development of an improved fuel air explosive, conception and investigation of a means for prematurely actuating magnetically fuzed mines, and determination of shock compression properties of composite materials."

Young was cited for "highly significant contributions under Project Night Fishing, by successfully combining original design concepts with existing automatic data processing technology to produce and field a new Automatic Resistivity Data Collection System and a new Geoanomaly Interactive Data Analysis System.

"This new equipment provides the Army with greatly improved capabilities for detecting and locating underground anomalies such as tunnels, caches and other man-made cavities."

U.S. Army Tank-Automotive R&D Command (TARADCOM), Warren, MI. *Mr. Donald S. Sarna,* Automotive Systems Laboratory, was selected for his "exemplary performance in providing qualitative and effective engineering leadership which advanced materially the development and initial production release of the Simplified Test Equipment for Internal Combustion Engines.

"All of the efforts in this project are targeted at providing a simplified test system readily usable with very little training, capable of being used to accurately diagnose problems with the power package within a military ground vehicle.

"The cost savings associated with this equipment is projected to be $3 million per month after having been fully fielded to the Army units."

OFFICE OF THE SURGEON GENERAL.

Letterman Army Institute of Research (LAIR), Presidio of San Francisco, CA. Research efforts of five members of the Division of Non-Ionizing Radiation have resulted in the application of laboratory biomedical research data to the development of safe laser systems for field use.

Their summary of achievements indicates they were the first to demonstrate the effects of low-level laser radiation upon color vision and the first to show changes in the retinal photoreceptor and in the electrophysiology of the visual centers in the brain after gallium arsenide laser radiation.

"This interdisciplinary group has established a comprehensive laser bioeffects evaluation program which provides timely, much needed data to the U.S. Army Environmental Hygiene Agency, DARCOM, and other laser users."

Team members are *Drs. Edwin S. Beatrice, David I. Randolph, Harry Zwick,* and *Messrs. David J. Lund* and *Bruce E. Stuck.*

An individual award will be presented to *CPT Stephen T. Kelley* of the Animal Resources Division, Department of Comparative Medicine, LAIR, who distinguished himself by defining the characteristics of an economical system for breeding owl monkeys in the laboratory and by demonstrating the success of the system by achieving the highest reproduction rate documented for a captive colony of owl monkeys.

"In developing his management practices," the citation states, "he applied practical judgement, cautious experimentation, and excellent veterinary medicine. He accumulated abundant new data on owl monkey behavior, hematology, skeletal maturation, reproductive physiology, and other aspects of their biology. These contributions are a major technologic advancement and form the basis for future progress in the care and use of these valuable research animals."

Combining leadership and various scientific disciplines, three investigators from the Department of Surgery, LAIR, spearheaded a combined civilian-military research and evaluation effort which culminated in licensure of a preservative solution that safely prolongs the liquid storage of blood from 21 to 35 days.

"This accomplishment," the citation states, "will greatly improve the ability of the military to provide adequate stores of blood in the combat theater and will min-

(Continued on page 12)

Army R&D Achievement Awards Recognize 75

(Continued from page 11)

imize wastage of blood, a precious lifesaving resource.

"Because of this licensure, the civilian community will also benefit by an improved ability to prolong storage of unusual types of blood and to supply blood stores to remote regions."

Award recipients are *LTC (Dr.) Thomas A. Bensinger, LTC (Dr.) Carl C. Peck,* and *LTC (Dr.) Thomas F. Zuck.*

U.S. Army Medical Research Institute of Infectious Diseases (AMRIID), Fort Detrick, Frederick, MD. *Dr. Robert W. Wannemacher Jr.,* assistant chief of the Physical Sciences Division and senior biochemist, AMRIID, was cited for his work in elucidating the mechanisms involved in the alterations of host nitrogen metabolism which occur during infectious diseases.

"His thorough knowledge of intermediary metabolism and research efforts have led to the development of a therapeutic approach of substrate replacement to prevent the wasting of body protein, enhance host defense against the infectious organism, and promote rapid recovery."

U.S. ARMY CORPS OF ENGINEERS.

U.S. Army Engineer Waterways Experiment Station (WES), Vicksburg, MS. A Department of Army R&D Achievement Award will be presented to *Drs. Donald T. Resio* and *Charles L. Vincent* for conducting research leading to significantly improved methods for providing wave climate data for coastal engineering applications.

"They devised new and significantly improved methods for estimating wind fields over lakes and similar water bodies, for calculating directional wave spectra in fetch limited and complex shoreline configured areas, and for application of external statistics analysis to wave hindcast stimulation studies.

"The systematic and sophisticated approach they developed has resulted in a quantum advance in the technology of wave climate estimation and has significantly improved the basis for many engineering calculations."

U.S. Army Cold Regions Research and Engineering Laboratory (CRREL), Hanover, NH. *Mr. Wayne N. Tobiasson,* a research civil engineer at CRREL, has been selected to receive an award for his concept of moving a 3300-ton DEW Line Facility in Greenland sideways off its distorted foundation onto new supports. As stated in his citation, never before had a structure that size been moved under such difficult conditions of site, foundation failure and structural overstress.

"Use of this concept, developed from the research program in icecap flows and forces, to move the facility instead of taking the nomal engineering approach to reconstruct the inclosure resulted in an estimated savings of $1.5 million to the Air Force in their efforts to extend the life of this critical facility."

U.S. Army Engineer Topographic Laboratories (ETL), Fort Belvoir, VA. *Mr. James R. Jancaitis* will receive the award for his personal technical effort in the development of an advanced technique for storing digital terrain data in the form of a polynomial mathematical model of the earth's surface.

According to COL Philip R. Hoge, commander/director of ETL, "this new mathematical modeling technique combined with powerful minicomputer software and hardware could revolutionize the use of terrain data in map making, environmental studies, computer simulations, military planning and construction involving the earth's surface."

YUH-60A Crash Traced to Improper Functioning Stabilator

No major design deficiencies or physiological, facility or weather factors were responsible for the 19 May crash of a YUH-60A prototype Black Hawk utility helicopter, according to a recent announcement by the Department of the Army.

The Army's Collateral Board concluded that the accident—which resulted in the death of three Sikorsky Aircraft crew members when the aircraft crashed into the Housatonic River near Stratford, CT—was caused because the stabilator, a stub-like wing surface at the Black Hawk's tail section, did not function properly.

Improper functioning of the stabilator reportedly resulted because the airspeed sensing devices did not transmit appropriate signals to permit the stabilator to rotate to the proper position. These sensing devices were disconnected for maintenance purposes on the night preceding the flight and were inadvertently not reconnected.

Consequently, the stabilator remained in the full downward position, a proper position for takeoff, but did not automatically rotate upward for forward flight. The deflected stabilator eventually forced the Black Hawk's nose down and into an attitude from which recovery was impossible.

A backup manual system was available to the pilot but for some unexplained reason it was not utilized. This manual system is independent of the airspeed devices and gives the pilot manual control at any time.

A thorough review of all factors related to maintenance and stabilator procedures and aircraft configuration has been accomplished on the remaining two prototypes and will be applied to all production models.

Resumption of prototype flight testing by Sikorsky was authorized by the Army on 26 July.

New Imaging Technique May Aid in Detecting Tumors

A new imaging technique developed for nondestructive testing of missile parts is believed to have great potential for detecting tumors in humans and other medical applications, according to its inventor Mr. Robert L. Brown of the U.S. Army Missile R&D Command.

Brown, a metallurgist, reports that the technique—which uses a fiberoptic plate composed of tiny parallel tubes as a scintillator to convert X-rays into imaging light—offers far better resolution and efficiency for X-rays than is now available.

Nuclear (tracer) medicine, says Brown, can expect three to four times greater resolution over existing systems, while other intensifier systems can expect a substantial reduction of dosage with the same or better resolution. Identical considerations may also apply to industrial areas.

The patented technique employs a fiberoptic disc, coupled with an electronic intensifier, as the face plate on a standard high-gain camera tube, in place of conventional scintillators which are made of solid opaque material.

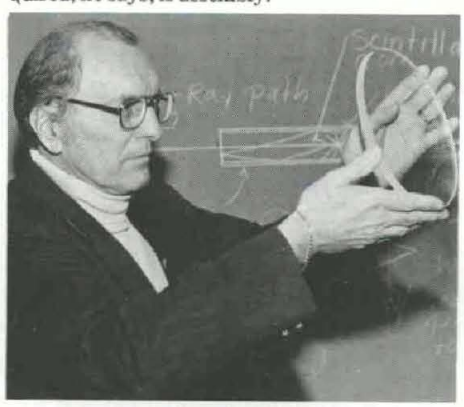
An essential problem in conventional tracer medicine is that the opaque material must be thick to absorb and convert gamma radiation to light. The result is a blurred image in which small objects are often undetected.

Brown reports that 50 times less radiation dosage to doctors, patients and assistants, during real-time X-raying, can be expected with his technique. The technique's resolution also permits 50 times magnification from a direct-viewing microscope.

Relative to nondestructive testing, the new technique will equal or exceed resolution levels of standard industrial X-ray systems, but with far less radiation input or in less time. A 10-fold improvement in speed is also envisioned.

Other advantages include portability and economy. There is no need for expensive radiographic film. Quality pictures are obtained by using an ordinary still camera to photograph the TV screen where the image is displayed.

The Army is now working on plans to develop the new invention for imaging X-ray use. Brown states that it can be constructed from commercially available parts. All that is required, he says, is assembly.



Robert L. Brown

Design Changes Provide Improved Dragon Jump Pack

U.S. Army airborne units have recognized the need for quick employment of antitank weapons to meet a serious armor threat. If an airborne force is committed it will be expected to knock out its share of tanks, and the weapon which will accomplish this is the Dragon missile.

The Materiel Test Directorate's Air Movement and Special Projects Branch, Yuma Proving Ground, AZ, has just completed testing the Dragon Missile Jump Pack, developed by Natick Research and Development Command, MA.

YPG air delivery test officer, CPT John Morris rigged with Dragon Jump Pack.

As a result the airborne trooper can now carry the Dragon in the Jump Pack, and immediately after making ground contact, set up the missile, fire and defeat a tank.

CPT John Morris, test officer at YPG says the test presented many unique problems. First, the Jump Pack had to be proved safe for the jumper. To accomplish this the airborne trooper jumped with a dummy Dragon missile. Then, the missile was dropped from a tower at YPG to check survival on impact.

After the tests, Morris and his men jumped with four "live" missiles. The missiles were then taken to Redstone Arsenal, AL, to be fired. Some of the missiles did not function properly, so Natick R&D Command, with the help of the Missile Materiel Readiness Command's Dragon Project Office and McDonnell-Douglas Corp., changed the design of the Dragon Jump Pack to better protect the Dragon.

Design changes were so extensive Morris began a new series of live jumps and controlled impact tests to qualify the new Jump Pack. This time all the firings at Redstone were successful and the Dragon Jump Pack will soon go into production. Thus, an individual airborne trooper will be able to engage and destroy a tank as soon as he reaches the ground.

Morocco to Receive Modified FAAR Equipment

The U.S. Army Missile Materiel Readiness Command, Redstone Arsenal, AL, has announced that final preparations are underway at Letterkenny (PA) Army Depot for the first shipment of Forward Area Alerting Radar equipment to a foreign country.

Delivery of the FAAR equipment to Morocco is being achieved through cooperative efforts involving the Chaparral/FAAR Project Office, the Army's Missile Materiel Readiness Command, Missile R&D Command, Letterkenny Army Depot, Aberdeen (MD) Proving Ground, and Sanders Associates of Nashua, NH.

The Forward Area Alerting Radar is a Redstone-developed, highly mobile system that detects low-flying aircraft and relays information to Army air defense weapons such as Chaparral, Redeye and the 20mm Vulcan gun.

Morocco is receiving a modified version of the FAAR. It has been removed from its normal carrier—the Gamma Goat—and mounted on two new vehicles, the M-796 General Purpose Trailer and a standard 2½-ton Army truck.

Modifications to the FAAR were required because the Gamma Goat carrier was not available for foreign sale. Responsibilities for providing the modifications were assigned to the Missile R&D Command's Skunk Works—a select group of personnel tasked with finding solutions to specific equipment problems.

The Skunk Works subsequently designed and built the first prototype which was road tested at Aberdeen in 1977. Four kits were then submitted to Letterkenny for converting the Gamma Goat to the new truck/trailer combination.

Sanders Associates conducted tests on the new units at Letterkenny and the depot is now completing the first package for overseas shipment.

Small Unit Support Vehicles (SUSVs) BV202 (left), manufactured by Volvo, and the BV206, under development by Hagglunds & Soner, are being evaluated by the U.S. Army Test & Evaluation Command (TECOM) Cold Regions Test Center (CRTC), Fort Greely, AK. The U.S. Army Tank-Automotive R&D Command (TARADCOM) signed contracts with the Swedish firms, under the auspices of TECOM's International Materiel Evaluation Office, to lease two of each type vehicle for a year, to determine if they meet requirements for use by the U.S. Army Alaska. The Volvo BV202, developed in the mid-60s, is considered the standard North Atlantic Treaty Organization (NATO) over-the-snow vehicle and is in the inventory of several NATO countries' Armed Forces. The Hagglunds & Soner BV206 is in the development cycle with production scheduled for the 1980s. The BV206 was shown in the background of a photo in the May-June issue of this magazine, p. 3, along with a snowmobile during a recent field exercise; the BV202 was not shown in the photo.

Integrated Technical Documentation and Training (ITDT)

A term being heard with increasing frequency about the halls of the Pentagon, DARCOM and TRADOC is Integrated Technical Documentation and Training, a program with a very down-to-earth, realistic, and practical purpose and goal.

Basically, what the whole thing means is that from now on there will be a formal process to make technical manuals and the associated training materials clearly understandable and useable to soldiers who must maintain today's and tomorrow's increasingly complicated materiel and equipment.

The importance to the Army of this deliberate process has been domonstrated by the formal policy statement on the subject signed by GEN John R. Guthrie, commander, DARCOM and GEN Donn A. Starry, commander, TRADOC.

There is still a segment of the population, both in and out of government, that thinks of the Army as being basically a force of soldiers armed with rifles, backed up by seemingly non-complicated things like cannon, tank, trucks, and a few rockets. This image is formed largely from the mass of photographs of WW II, Korea, and Vietnam, showing infantrymen struggling through mud jungles, mountains, and deltas. They are simply unaware that there are in the Army today over 72,900 radios, 41,790 generators, 1,620 radars, 7,170 antitank weapons, 8,970 air defense weapons, 6,400 helicopters, 4,730 cannon and mortars, some 20,900 tracked vehicles, and over 111,400 wheeled vehicles. That works out to .71 systems per man, not including small arms.

Not only are there vastly more systems today, but they are far more complex than yesteryears'. And, as one looks at today's development programs, there will be an ever increasing degree of complexity, simply because of the need for machines and systems to make up manpower deficiencies and increase capabilities. For example, coming into the field in the foreseeable future are the new XM1 tank, the Black Hawk and AH-64 helicopters, Patriot air defense system, and the cannon-fired guided projectile system called Copperhead, just to mention a few. All of these new capabilities are a plus only if they work when they are supposed to. That is where the problem is becoming increasingly irritating.

The Army is having increasing difficulty in matching its available manpower resources, in terms of ability to understand how to maintain, repair, and operate these new systems, against the growing number of systems and their complexity. Today, the Army is reportedly doing slightly better in terms of quality of people entering service than it did at the end of the draft. Fewer Category Four people are being accepted, while more Category Three men and women are being enlisted. A large part of the manpower pool, then is composed of Category Three people, and a considerable portion of this group is the lower half of the Category Three profile.

But that's still not the end. As the saying goes, the plot thickens. For a number of reasons, mismatches result in placing trained soldiers in other than slots for which they were trained and vice versa. For example, a recent study of a sampling of tank repairmen showed that 52 percent of 891 trained on the R8/M551, were mismatched; of 246 trained on the W1/M60A2, 40 percent were mismatched.

The ability to quantify performance capability through the new Skill Qualification Test program has revealed that today's soldiers cannot perform their tasks as well as the system requires for optimum performance. Another test of trouble-shooting revealed that on an average, 35 percent of those items returned as faulty were found to be without fault.

The goal of ITDT then, is to correct some of the weaknesses in the system that give rise to these "disconnects."

For over two and a half years DARCOM and TRADOC have been working on ITDT. The culmination was the policy statement of 31 Jan. 1978, signed by GENs Guthrie and Starry.

Key provisions of the policy statement stress that

- Development, evaluation, and fielding of training support packages is recognized as equally important for fielded weapons and other priority systems when operation and maintenance performance problems otherwise seriously degrade their effectiveness, and that ITDT is an integral part of the Integrated Logistics Support process.

The Army's problem as a result, is that it has a large number of very complex systems that must be competently handled by a group that, according to a recent Army briefing, collectively has an average intelligence capability. As if this was not enough, figures to date reflect that of every 100 personnel who are trained, only 11 to 15 remain beyond the first enlistment.

- Technical manuals will be accurate, understandable to the user, efficient in presentation, and complete in essential—not comprehensive, detail. They will be tailored and matched to the audience that will be doing the work. TRADOC will describe the using audience for DARCOM, who will furnish this information to the contractor.
- While the manuals will provide the procedures, the knowledge and skills required will be developed using the training courses that make up the training component of ITDT. Unlike current maintenance training, the ITDT concept requires accurate, proceduralized manuals and uses these as the basic references for the soldier undergoing training.
- The development of ITDT materials will be based on precisely defined performance requirements. These are acquired by a process called Front-end Analysis, discussed in more detail later in this article. What this really means is a total evaluation of a system's functional and equipment characteristics, the tasks needed to keep it going, the types of MOSs required, identification of tasks which need to be school trained and those that can be learned on the job, and determination of the best ways to attack a given problem in a system.
- The most important step in the development phase of the ITDT process will be the validation and verification of the technical manual and associated training materials. Verification of all documented maintenance procedures will be required to be conducted using a statistically valid sample of using soldiers representative of the target population in the field. The policy says that it is imperative that both DARCOM and TRADOC agencies responsible for the particular ITDT project, supervise the verification closely.
- For systems already in the field, a joint DARCOM/TRADOC General Officer Steering Committee will decide those that will receive postfielding ITDT. The decision will be based on such factors as combat criticality, density of the force, size of the MOS population associated with the system, costs, etc. For systems currently in the development process, there will be a determination, on a case by case basis, of whether there should be a full or partial ITDT implementation, whether there should be a waiver, or whether the system should be treated as a fielded system. Similarly, other special types of systems, will be given a case by case review.
- For these developmental systems for which it has been decided that there will be an ITDT implementation, the ITDT package will be fielded with the system at its IOC date.

Simply put, the policy statement serves as formal notification that the Army is going to attempt to upgrade its maintenance training materials and procedures.

The new approach is intended to provide a complementing package of job performance instructions and job training materials. Each package will be designed so that any soldier, from a novice of modest intelligence to the soldier with the highest aptitudes, will be able to use the materials and perform successfully the required maintenance tasks. The materials will be keyed to the reading level required for the task and for the people assigned to the task, in a variety of easy-to-read easy-to-understand media. Imaginative ap-

proaches as film strips with synchronized audio, tape cassettes, and highly illustrated documents, etc., will be employed as necessary for the task at hand.

With the ITDT approach, training can be provided anywhere at any time. It is not keyed to the traditional classroom and an instructor. Instead it will be applied on the job under a supervised, structured OJT program. Each soldier will receive only the specific task training he needs, as he needs it.

The approach will be to tell the soldier how to make a piece of equipment work and how to do it. The traditional technical manual approach has been to try to tell the soldier how it works. The traditional approach also assumed that certain higher levels of skills and intelligence were present which is not the case.

In the past technical manuals were prepared in isolation from the design of the training program. Conversely, developers of maintenance training programs had little interface with the development of the technical manuals. This will no longer be the case. Before the materials are issued in their final form they will be tested against a good sample of the intended using audience to ensure a product that lives up to the intent.

A critical aspect of the program involves what is called the Front-end Analysis. This entails a series of very time-consuming detailed analysis of these general areas at the very beginning of the process. The first is the analysis of the equipment itself. A systematic procedure is followed to identify all components that will require some type of maintenance action. Included with this will be a listing of components, the characteristics of these components, identifying special tools and test equipment that will be required, and identifying all lubrication references.

The second area is that of functional analysis. Here the system is broken down into its smallest functional entities, with each having a specific input and a recognized output. Coming from this analysis will be the block diagrams, list of parts by functional group, schematic diagrams, functional descriptions, failure symptom tables, and input-output measurement procedures.

The third part is the analysis of the various tasks. This is a systematic breakdown of each task into its component steps, identification of tools, equipment and supplies required and the pre and post task actions required. From this is obtained a listing of job tasks, each described separately. All tasks will be organized by type and by maintenance level in the order in which they must be performed.

MG Robert J. Lunn, director of Development and Engineering, DARCOM, recently told an industry audience "If the phrase (ITDT) is new to you, I assure you it will not be for long." While there are still many aspects of the program, Lunn told them, still to be worked out, the concept is here and considerable funds have been allocated in the FY80 budget for the program. Briefings on ITDT for DARCOM commands/PMs and TRADOC/TSMs are being planned for the near future.

For those desiring further information, the focal point in the Directorate for Development and Engineering, HQ DARCOM is Mr. William Kracov, Autovon 284-8605 or (202) 274-8605.

OPPS—Sorry for the Goof

In the May-June 1978 issue of the Army RDA Magazine, p. 6, (Army Plans Modernization of CH–47 Helicopter Fleet), we incorrectly stated that the CH–47 Modernization Project was assigned to the U.S. Army Troop Support and Aviation Materiel Readiness Command, St. Louis, MO.

That article should have correctly stated that the CH–47 Project Manager's Office is assigned to the U.S. Army Aviation Research and Development Command, which is commanded by MG Story C. Stevens.

Ribbon Bridge Erection Boat Undergoes Development Tests

Phase two development testing of two models of the Ribbon Bridge Erection Boat is reportedly nearing completion by the U.S. Army Aberdeen (MD) Proving Ground's Materiel Testing Directorate.

Following completion of slow water testing of the vessels at Aberdeen and Fort Belvoir, VA, operational and development tests in fast water will be conducted at the Granite City Army Installation, IL, according to senior test director Peter Kaminek.

Both craft are commercial items which are being adapted for military use with the ribbon bridge—a floating modular structure with an integral superstructure and floating supports.

A complete bridge consists of a ramp bay at each bank with additional interior bays to complete the span. Development testing of the bridge was concluded at APG in 1975. The purpose of the boats is to guide and anchor the bridge sections into place.

One of the boats under consideration is a tunnel-drive craft manufactured by Alcoa. The other is a water-jet propulsion boat manufactured by Rotork, a British company.

The Alcoa model is 26 feet long, has a rounded bow and tunnel stern with a modified V-bottom, and an aluminum hull. It has two diesel engines rated at 73 shaft horsepower at 2400 revolutions per minute.

The Rotork boat is water-jet propelled with a flat bottom, square, tapered bow and a fiberglass hull. Powered by two turbo-charged diesels rated at 200 shaft horsepower at 3000 rpm, it is over 27 feet long and 10 feet wide.

Each boat normally carries a 3-man crew comprised of an operator and two assistant operators. A ribbon bridge company has nine boats, each of which is transported individually by truck.

Thus far, tests have been conducted at APG to evaluate such things as maneuverability, speed, turning radius, thrust, endurance, stability, deployment and anchoring capabilities, and assembly and disassembly of a ribbon bridge.

BRITISH Rotork Water-Jet Propulsion Boat

ALCOA Tunnel-Drive Craft

AMMRC Builds Alkali Metal Facility

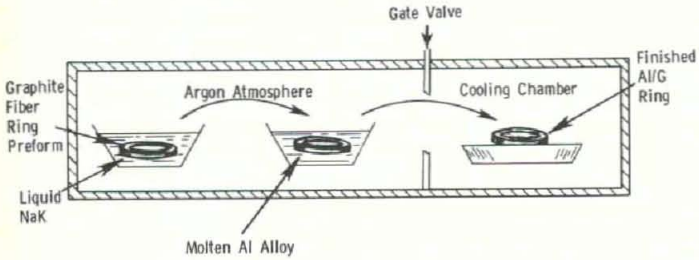


Fig. 1. New process for producing AL/Graphite structures.

A specialized facility has been designed and constructed in the Metals Research Division of the U.S. Army Materials and Mechanics Research Center to handle highly reactive free alkali metals. The facility utilizes these metals in a special process of treating graphite fibers which are subsequently infiltrated with molten light metals such as aluminum to produce light-weight, high-stiffness composites.

This process has the advantage of permitting fabrication of final graphite/aluminum structures by infiltration of woven graphite preforms such as rings, cylinder, and cones (see Fig. 1).

The alkali metals are used in two glove boxes in which inert gas atmospheres are maintained. One box (Figure 2) is used for the actual treatment and infiltration of the graphite fiber tows.

Its gaseous atmosphere consists of commercial argon supplied from a bank of five cylinders which is continuously recirculated and purified in a titanium gettering furnace. A trace oxygen analyzer monitors the oxygen concentration in the glove box.

Concentration of less than 10 ppm oxygen is required to perform successful alkali metal operations. The liquid alkali metal is transferred to the work site by argon gas pressure. After treating and infiltrating the fibers with matrix metal, the finished specimens are removed from the glove box to prevent access of outside air into the working space.

A second glove box will be used as an alkali metal recovery facility. It is being equipped with a vacuum filtration apparatus which draws the contaminated alakli metal through a fine-mesh filter and then collects it in a sealed flask under inert gas.

A hot plate is provided inside the glove box to heat the liquid metal during filtration in order to decompose the contaminating oxides. The filtration process may be repeated as often as desired until the required metal purity is attained.

A commercial oil burner nozzle filter was adapted to this system and has given excellent results. Considerable savings are realized by reclaiming the contaminated alkali metals, due to their high cost and elaborate shipping containers.

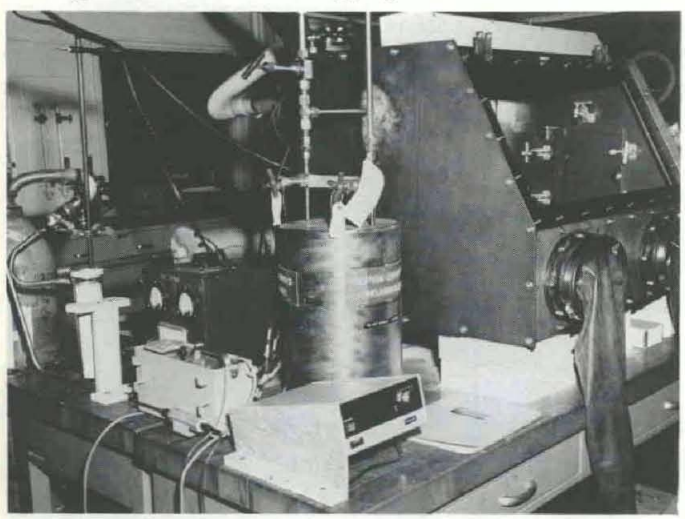


Fig. 2. Front view of alkali treatment glove box, showing alkali metal storage container.

Encouraging results in producing graphite fiber tows infiltrated with 6061 aluminum alloy have already been obtained. The present facility is currently being upgraded with a large capacity commercial gas purification system which will interface with either glove box.

Other plans include continuous feeding of fiber tows to produce coated composite wire, metal infiltration of woven fiber structures, ultrasonic cleaning and agitation and glow discharge cleaning.

The manual manipulation of specimens via the gloves will eventually be replaced by use of mechanical arms and actuators. This will assure more permanent and effective gas-tight integrity of the working spaces, and guard against accidental leaks to insure greater operational safety. Automated operation of simple processing functions is eventually planned. This work is being achieved by Mr. Hans E. Band and Mr. Albert P. Levitt, Metals Research Division, AMMRC.

ETL to Publish Manual on Vegetation Analysis

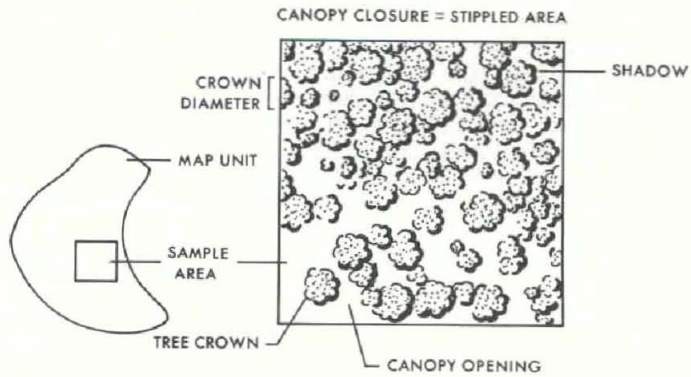


ILLUSTRATION from Terrain Analyst Procedures for Vegetation. Canopy closure is defined as the proportion of each map unit's ground surface covered by tree crowns.

A new procedural guide for vegetation analysis, scheduled for publication by the U.S. Army Engineer Topographic Laboratories, Fort Belvior, VA, will soon be distributed to various topographic field units for testing and evaluation.

Titled *Terrain Analyst Procedures for Vegetation,* the limited edition prototype manual describes an experimental vegetation mapping system developed by ETL's Geographic Sciences Laboratory for worldwide application.

Based on 13 parameters needed to define the vegetation of a given area, the new system requires no rigorous identification of specific flora or in-depth classification of physical characteristics of plants. The system relies primarily on easily photo-measured parameters of vegetation height and general type.

In addition to definitions of parameters such as mean height to top of canopy, percent canopy closure and number of stems per hectare, the new guide provides step-by-step instructions for reducing and recording information.

Given the constraint that little or no ground data collection is feasible, three alternative information sources are treated: military topographic maps, literature and aerial imagery. A vegetation overlay, registered to the 1:50,000 topographic map with supporting data tables can also be produced.

Designed for use with overlays of other terrain subjects, the vegetation overlay may also be used to generate factor complex maps. These maps become manuscripts for special graphics on cross-country movement, fields of fire and intelligence preparation of the battlefield.

Preparation of a cross-country movement map would, for example, begin by combining overlays for vegetation, surface configuration and surface materials into a complex map.

Data elements affecting cross-country movement, i.e., slope, stem spacing, stem diameter and soil strength, would be recorded in the complexed map areas. A computer then translates these elements into vehicle speed predictions for each area.

The ETL's now plan to produce and test 15 procedural guides on such topics as soils, rock types and drainage. They are intended for use in military operations and civil works projects.

The Rifleman's Assault Weapon

By Alfred B. Carpenter

If continued exploratory development proves to be as promising as early results indicate, the Rifleman's Assault Weapon (RAW) may substantially increase the future effectiveness of the individual infantryman in the urban/assault role.

The unique Rifleman's Assault Weapon will provide the gunner with high explosive power in a system which is lighter than Viper (7 pounds), and with a noise level, at release, less than the M16 from which it is launched. It will also be effective at ranges up to 200 meters.

Conceptually, the RAW embodies a very unusual approach to free rocketry. Contrary to most rocket designs, which are long and cylindrical, the RAW is spherical in shape. Inside the sphere is a rocket motor warhead and fuze.

Since the rocket is spherical, it is aerodynamically neutral, i.e., it does not tend to weathervane into the wind when under rocket powered flight. However, to prevent it from tumbling and insure that it maintains the direction of aim, something must be done to keep the thrust axis of the rocket motor in the proper orientation. This is achieved by rapid spinning.

When a body of revolution is spun rapidly enough, it takes on the properties of a gyroscope and one of those properties is rigidity in space. Thus, if the spherical free rocket can be properly oriented in relation to the desired flight path (aimed), then spun up to a rotational velocity which will maintain that orientation, it can be launched and will fly a nearly straight line path until the rocket motor burns out. After burnout, the sphere follows a normal ballistic trajectory.

All of this has been incorporated into the concept now being developed at the U.S. Army Missile Research and Development Command, Redstone, Arsenal, AL.

The Rifleman's Assault Weapon concept was demonstrated in the 1960s, but it has become of interest to the Army since the increasing need for urban weapons has been recognized. A concept demonstration program was conducted by the Navy under Defense Advanced Research Projects Agency sponsorship in 1975 and 1976. This culminated in a 30-round demonstration firing program.

Representatives of the U.S. Army Infantry School observed these tests and were sufficiently interested to ask the then Army Missile Command to continue exploratory development and resolve problems encountered in the DARPA program.

In May 1977, the Army contracted with Brunswick Corp. in Costa Mesa, CA, for an 18-month effort to develop an improved release mechanism, design and test a smokeless motor, conduct wind tunnel tests and derive precision accuracy.

In March 1978, through cooperative effort with the U.S. Army Armament Research and Development Command, funds were provided to initiate warhead design. An experimental system demonstration is now scheduled for late September 1978 at the Missile Research and Development Command.

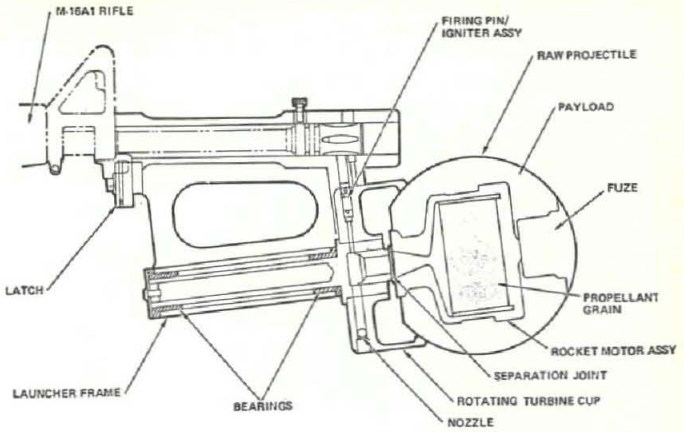
In its present configuration, the RAW is attached to, aimed with, and launched from the standard unmodified M16 rifle. Its total weight is six pounds, of which three pounds are to be high explosive—a payload-to-weight ratio of 50 percent.

By comparison, the only other weapon known to have the low signature of the RAW is the German designed ARMBRUST system. Basically, the ARMBRUST ejects two equal masses from each end of a launch tube. The front mass is the projectile, while the rear mass consists of thousands of plastic wafers which break into harmless confetti in a distance of about 12 meters.

Propellant gases are contained within the launch tube after firing, thus contributing to its low signature. However, with an effective range similar to RAW, the ARMBRUST has a payload-to-weight ratio of only three percent.

A rifleman carrying the six pound RAW could deliver three pounds of explosive to the target. In comparison, the rifleman carrying a 13 pound ARMBRUST, could deliver only 0.375 pounds of explosive, less than 1/8 that of RAW. Due to its minimal backblast, the RAW is capable of being fired from any enclosure, even if it is only large enough to accommodate one man and a rifle. Also, there is no danger zone behind the rifleman as in other rocket powered weapons.

When used in its present configuration, the Rifleman's Assault Weapon is removed from a shipping container and attached to the M16 by simply sliding the launcher frame over the end of the barrel and attaching the spring-loaded latch to the bayonet clip.



For best accuracy, the standard bipod is also attached to the rifle, but it is not required for firing. Next, the rifle is aimed at the target and either a standard ball or blank round of ammunition is fired.

The gas pressure from the ammunition round activates the ignitor which starts the propellant grain burning. Exhaust gases are then channeled through the turbine assembly which contains two peripheral nozzles that cause rapid rotation of the turbine assembly and sphere.

As the assembly increases in rotational velocity, a separation joint is rapidly heated by the exhaust gases. By careful design, this joint separates as the necessary spin rate is achieved.

The spinning projectile is then free to move and is propelled forward by the rocket motor. The entire sequence, from firing the bullet to release of the sphere, is approximately 0.2 seconds.

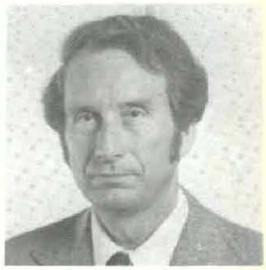
A straight-line flight path is attained by configuring the projectile to incorporate a regressive burning, constant thrust-to-weight ratio rocket motor with the thrust vector inclined so that the vertical component of the thrust exactly balances the gravitational effects throughout the flight. This flat trajectory flight path minimizes range estimation errors, a major contributor to weapon inaccuracies.

Effects of aerodynamic lift and moments are minimized by the aerodynamically neutral configuration. Spin stabilization maintains the initial orientation of the thrust vector and minimizes trajectory deviations to thrust vector misalignments, center-of-gravity offsets and other asymmetries.

RAW is not limited to its present size and rifle launched configuration. In fact, a 15-pound shoulder launched version is being considered. The same concept could also be applied to highly mobile (Jeep mounted) platforms to deliver explosive loads of 50 pounds using a sphere with only a 13-inch diameter.

This might be particularly attractive in heavy wall breaching, clearing rubble, or various demolition missions. With an expected accuracy of 1 to 2 mils, it could be used effectively as a flying satchel charge.

Within the next year, depending on funding, the RAW will be brought to the stage where lethality data can be obtained and compared to other contenders for the urban/assault role. With its light weight, accuracy, low signature and versatility, the Rifleman's Assault Weapon may prove to be one of the weapons of tomorrow's foot soldier.



ALFRED B. CARPENTER has been employed since 1971 as a mechanical engineer in the Advanced Systems Concepts Office at the U.S. Army Missile Research and Development Command, Redstone Arsenal, AL. He joined Redstone Arsenal in 1962 and worked initially on missile test equipment. Following three years service with the U.S. Navy's Civil Engineer Corps, he was employed by the Naval Missile Center, Point Mugu, CA.

His academic credentials include a bachelor's degree in mechanical engineering from General Motors Institute of Technology and a master's degree in public administration from the University of Oklahoma.

Army Receives First SHF Tactical Satellite Communications Terminal

Military communicators will gain a long-needed and sought-after communications capability in August, when the first production model of a small, super-high frequency (SHF) tactical satellite communications terminal is delivered to the Army.

Designated the AN/TSC-85(V)2, the terminal is one member of a new family of multipoint and/or point-to-point terminals being produced to satisfy critical command and control multichannel transmission requirements of the (GMF) Ground Mobile Forces.

GMF are those components of the Army, Marine Corps and Air Force engaged in land combat operations. In a technical sense, GMF satellite communications are synonymous with Tactical Satellite Communications (TACSATCOM). Terminals are characterized by ease of setup for quick reaction, high degree of transportability for a large population of mobile users, and flexibility of communications links during localized, though often shifting, scenes of action.

Both the SHF and ultra-high frequency (UHF) bands are used by the GMF to fulfill satellite communications requirements. Multichannel trunking is carried out at SHF (7250 to 8400 MHz), while single- channel netting makes use of the 225 to 400 MHz UHF band.

While extensive development and production programs of UHF satellite communications terminals have raised the terminal technology to a high level of design, the SHF requirement, until now, has been satisfied primarily by conventional means such as radio relay line-of-sight (LOS), troposcatter and HF sideband radio. Limitations of range, terrain and frequency considerations inherent in these systems restrict the communicator's operational capabilities.

The increasingly crowded conditions on the UHF band, coupled with the need for multichannel and single-channel GMF/-TACSATCOM that was identified in the Army's Integrated Tactical Communications System (INTACS) Study, led to the initiation of a Ground Mobile Forces Satellite Communications (GMFSC) program.

In January of this year, the program was approved by the Army Systems Acquisition Review Council (ASARC), with specific responsibility for its implementation assigned to the U.S. Army Satellite Communications Agency (SATCOMA), Fort Monmouth, NJ. Designed to provide an optimum mix of terrestrial and satellite communications systems, the program encompasses both SHF and UHF terminal acquisitions.

Production of the small, GMF SHF family of ground terminals implements the first phase of this program. In December 1972, the SATCOMA project manager responsible for development, production and initial fielding of ground terminals DOD wide, awarded a contract to RCA's Government Systems Division for development of a new family of tactical and strategic SHF satellite communications terminals. After successfully completing the engineering development phase, RCA was contracted to perform Low-Rate Initial Production (LRIP) in June 1976.

The complete family consists of four types of ground terminals—three tactical (AN/TSC-85(V)2, AN/TSC-93 and AN/-TSC-94) and one strategic type (AN/-TSC-86). All meet the diverse range of environment conditions that our tactical forces encounter.

Working through the Defense Satellite Communications System (DSCS), the terminals will replace selected links now serviced by conventional radio equipment. Planned for use from Army headquarters down to brigade level, or equivalent command echelons, they will significantly increase combat effectiveness through improved command and control.

The user will be provided the high capacity and reliability of a microwave line-of-sight system, over a vastly expanded range, without the need for relay links. System flexibility—the ability to reallocate traffic flow—is thus greatly improved.

Reconfiguration of terminal groupings also can be effected quickly due to common unitized equipment design. Unlike HF systems, the satellite circuits are relatively immune to fading and other propagation problems. Finally, the system does not require prominent terrain for the location of terminals and is designed for setup and teardown by a 4-man crew in approximately 20 minutes.

In addition to the above advantages, fielding of these terminals will create the first nodal (multipoint), internodal, and nonnodal (point-to-point) TACSATCOM network capability. This capability refers to the use of one terminal serving as a nodal or hub station, simultaneously providing full duplex, multichannel links to up to four other widely dispersed terminals, on a single SHF carrier. The communications network eliminates the need for multicarrier operation and the attendant intermodulation problems.

All in all, these terminals will represent, as a minimum, a milestone in operational capability for the tactical user. The following data will briefly describe the design of the SHF terminals, as well as the UHF developments included in the GMFSC program.

Small GMF SHF Terminal Family. The tactical terminals are in three 1¼-ton shelter, truck-mounted configurations, designated the AN/TSC-85(V)2, the AN/TSC-93 and the AN/TSC-94. Outwardly, the three appear identical. The basic difference lies in the areas of subsystem redundancy, baseband multiplex equipment required and multipoint or nodal capability, based upon user applications of the Army, Air Force, and Marine Corps.

All terminals use a 500-watt power amplifier and transmit in the 7.9 to 8.4 GHz band. They receive at 7.25 to 7.75

Fig. 1. AN/TSC-85(V)2 Tactical Terminal

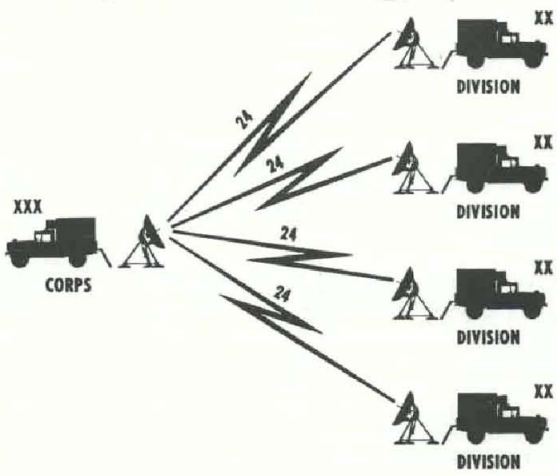


Fig. 2. GMF TACSATCOM Multipoint Concept

GHz. Each is equipped with an automatic 8-foot diameter ground-mounted antenna for random step-scan tracking. Commonality of components and built-in-test equipment reduce logistics and maintenance costs, while maximizing terminal availability.

AN/TSC-85(V)2 is the only terminal capable of serving as the hub of a multipoint network. It also can serve as a nodal destination terminal or in point-to-point operation. In a multipoint trunking network, it is capable of transmitting up to 96 secure or nonsecure voice and orderwire channels of pulse-code-modulated (PCM) digital data via a single SHF carrier, and receiving up to four independent carrier frequencies. It is used in conjunction with a remote or collocated multiplexer van.

A typical 4-level multipoint network operational concept is portrayed in the following illustration.

A nodal terminal at Corps is linked to four nonnodal terminals at Division. The nodal terminal contains a Tactical Satellite Signal Processor (TSSP) that combines four cable data streams (from the collocated mux van) into a single high-data-rate stream (96 channels of PCM or 24 channels for each destination nonodal terminal).

This composite stream is then modulated on a single RF carrier using phase-shift-keying (PSK) modulation and transmitted via satellite links to the nonodal terminals. Each nonodal terminal demodulates the entire data stream and, via a demultiplexer, selects its proper group data.

Each terminal then transmits its respective group data on independent carrier frequencies. These four carriers are received, demodulated and digitally decombined by the nodal terminal and mux van completing the communications links.

The AN/TSC-85(V)2 is redundant in the RF, Digital Modems and TSSP sections.

AN/TSC-93 is a nonnodal or point-to-point terminal capable of transmitting and receiving on a single carrier 6/12/24 channels of voice traffic and orderwire using standard Army PCM equipment. An interleaver provides for substitution of 16/32 kb/s data in each of the voice channels.

An additional capability to interface on a digital basis with an external 16 kb/s secure voice channel or up to 96 channels of secure or nonsecure PCM voice traffic is provided. The terminal is nonredundant in both the RF and baseband sections.

AN/TSC-94 has been configured for U.S. Air Force unique requirements and is tactically transportable by C-130 and C-141 aircraft for intratheater communication. It is similar to the AN/TSC-93 except that it does not contain the TSSP digital decombining equipment.

It is a self-contained, point-to-point terminal capable of transmitting and receiving on a single carrier 6/12 voice channel groupings of 48 kb/s per channel. All equipment subsystems, except the antenna, are redundant. Voice channel capacity was traded off in favor of reliability and "on-board" baseband multiplexing.

Light Transportable Terminal AN/TSC-86, also being produced by RCA, will be used to fulfill the need for SHF single-carrier operation in areas where communications are not readily available and where users require the advantages of higher frequencies and can tolerate reasonably sized antennas.

It will satisfy contingency and quick-restoral requirements of strategic users in the Defense Communications System (DCS). Other applications will be as a replacement for the AN/TSC-54 first generation satellite communications terminal, fielded in 1966 as the first military contingency tactical satellite communications terminal; in diplomatic support, survivable network, special uses and intra-area trunking.

It is capable of single point-to-point operation, using an 8-foot ground-mounted antenna. An alternate 20-foot, high-gain antenna also is provided for multicarrier operation on both the transmit and receive sides with up to four independent carriers.

Using a 1,000-watt power amplifier, the terminal transmits and receives in the same frequency ranges as the tactical terminals. The 2½-ton AN/TSC-86 can employ various modulation/demodulation equipment through the use of different Communication Subsystems (CSS).

Interim Operational Capability. Sufficient quantities of GMF SHF ground terminals will be available in 1979 to constitute an Interim Operational Capability (IOC).

GMF UHF Development. The Ground Mobile Forces Satellite Communications program also includes UHF developments. UHF single-channel netting requirements can be satisfied by two basic terminal configurations, a vehicular-mounted terminal for general purpose

Fig. 3. AN/PSC-1 Manpack Transceiver

command and control communications, and a manpack for long range patrols, special forces and forward observers.

UHF satellite terminal requirements of the GMF will be satisfied through the exploitation of equipments designs already developed through other DOD programs. Currently included in the GMFSC program are the AN/PSC-1 manpack and the AN/MSC-64 vehicular-mounted terminal. The Marisat (Gapsat), AFSAT, FLEETSAT and other follow-on UHF satellites will be used for single-channel netting.

AN/PSC-1 Manpack Transceiver, developed for SATCOMA by Cincinnati-Electronics, is in the final stages of development and currently is undergoing government operational testing. Using only 35 watts of power and a satellite relay, the 25-pound transmitter can establish 2-way voice and digital data satellite communications with a similarly equipped user as far as 9,000 miles away.

It also can operate in the LOS mode, requiring only 2 watts of power. It transmits in the 225-400 MHz range and can receive any one of 15 selectable channels, plus a conference channel, at 10 watts. A special combination of BPSK/QPSK/-CVSD modulation minimizes required transmitter power; consequently, the transceiver can transmit voices to within 2 db of the theoretical signal-to-noise ratios.

Two antennas are provided—a collapsible medium-gain helical antenna that can

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Fig. 4. AN/TSC-91/92 mobile UHF satellite communications terminal has been used to test effectiveness of satellite communications at European bases since 1976. Its big brother, the AN/MSC-64, is part of the Ground Mobile Forces Satellite Communications program.

Selective Scanner . . .

XM1 Displays Cross-Country Capabilities at APG

Cross-country mobility, agility and firepower capabilities of the XM1 tank system were displayed by the U.S. Army Test and Evaluation Command during a demonstration for the press corps at Aberdeen Proving Ground, MD.

Presently in its 20th month of full-scale engineering development, the XM1 ws put through its paces at APG's Main Front Range Complex in competition with the Army's current main tank—the M60A1.

The XM1 literally left the M60 in a cloud of dust during the mobility portion of the demonstration on the 1½-mile test course. It achieved a speed of about 40 mph while the M60 registered only about 18 mph.

Obvious superiority of the XM1 was also evidenced by tabulations which showed that it crossed the finish line in three minutes and one second. The M60 tagged behind with a finish line time of four minutes and 48 seconds. Both tanks satisfactorily negotiated the hump crossing demonstration.

Equipped with 105mm rank guns, both tanks fired two rounds at stationary targets from a range of 2000 meters, then moved downrange and fired five additional rounds. The XM1 also fired on the move from 1,200 meters and repeated the mobility, hump crossing and firing tests.

Both tanks fired armor piercing projectiles which travel 4,850 feet per second. The XM1 also displayed its smoke grenade system which engulfed the tank in a huge cloud of smoke and seemingly provided an adequate protective cover.

Chrysler Corp., prime contractor for the XM1, has fabricated 11 vehicles which the Army will evaluate under all developmental and operational conditions. The first XM1s are scheduled to roll off the production line in February 1980 at Lima, OH.

Prototype qualification test-government or, PQT–G, began in March of this year with the arrival of two prototypes at APG. This testing is expected to end in July 1979 after TECOM crewman and engineers have driven the 11 tanks over 40,000 miles and fired more than 12,000 rounds.

Test Benches May Improve Accuracy of Radar Data

Significant improvements in the accuracy of radar tracking data may be provided by new test equipment developed at the U.S. Army's White Sands (NM) Missile Range.

Termed radar transponder test benches, the equipment measures operating characteristics of radar transponders. When placed in missiles, drones and aircraft, they aid radars in identifying and tracking targets over extended ranges.

Following receipt of a predetermined signal, the transponder transmits its own high power signal which the radar uses as a tracking source point. White Sands procures nearly 300 transponders annually for various military test activities.

Prior to accepting delivery of the transponders, White Sands tests and measures the equipment's operating characteristics. The new test bench aids this testing by simulating radar interrogation and monitoring transponder response.

The delay between radar interrogation and transponder response must be measured precisely to insure the accuracy of the tracking data. The test bench can reportedly provide the measurement of the delay within two billionths of a second.

White Sands' Instrumentation Directorate, utilizing existing residual equipment, fabricated the first three test benches at a total cost of $80,000.

The self-contained, portable system is comprised of power supplies, signal generator, multiple pulse code generator, a digital multimeter, peak power meter, oscilloscope, spectrum analyzer, frequency meter, a computing counter, a keyboard and a printer for recording transponder parameters.

Mr. Dick Wise of the Instrumentation Directorate's Electronics Division is credited with engineering development of the new equipment. Fabrication assistance was provided by Mr. Ed Vidal.

Army Plans Tests of New British 81MM Mortar

A new British 81mm Lightweight Mortar, claimed to have a longer range and a faster rate of fire than the American M29A1 weapon, will undergo extensive testing this fall under a program directed by the U.S. Army Armament R&D Command, Dover, NJ.

The testing, which is designed to evaluate the mortar system's capability to meet U.S. Army standards for an operational weapon, will be conducted at Aberdeen Proving Ground, MD, the Cold Regions Test Center, Fort Greely, AK, and Fort Stewart, GA.

The British weapon is also being evaluated in conjunction with the Army's Rationalization, Standardization and Interoperability program to achieve standardization of weapons, ammunition and related items used by members of the NATO alliance.

If the tests prove successful, the Army has announced plans to initially procure 300 of the British mortars and 150,000 high-explosive rounds of ammunition during the next fiscal year.

Patriot Hits Multiple Maneuvering Targets

One of the claims in behalf of the Patriot development program was that the system would meet the Army's need for an air defense system capable of multiple target track, multiple maneuvering target engagement, and be able to operate in a heavy electronics countermeasures environment. Recent firings of Patriot have demonstrated all of these.

Three missiles were fired from the same launcher, only seconds apart, against a full sized PQM–102 jet and two Firebee drone targets flying at different ranges and altitudes. None of the single-stage solid propellant missiles carried live warheads, but two of these passed well within killing distance of their intended target. The third missile failed to receive guidance commands and destroyed itself accordingly.

"We had said Patriot could do it. Now we have proved it," said MG Oliver D. Street III, Patriot project manager.

This firing brings to 31 the number of fully guided flights in the Patriot program. Raytheon Co. is the prime contractor, with Martin Marietta the principal subcontractor for the missile cannister and launcher. Thiokol Co. is the subcontractor for the propulsion unit.

WES Reorganization Consolidates Lab Services

Recently announced reorganization of the U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS, will reportedly provide more economical and efficient service to research and development customers.

Transfer from a six laboratory complex to a four laboratory system, effective in April, will, according to WES Commander COL John L. Cannon, improve flexibility to meet future requirements and also eliminate overlapping between various elements.

Civil and military activities regarding the environment have been consolidated under the Environmental Laboratory. Responsibilities include studies of water quality and resource systems, wastewater treatment and management and aquatic plant control.

Missions of the former Weapons Effects and Concrete Laboratories and the Soil Dynamics Division are now incorporated under the Structures Laboratory. Primary areas of effort are static and dynamic loads, improved construction materials and media-structure interaction problems.

The Geotechnical Laboratory will conduct research in soil mechanics, structural foundation design, embankment design and slope stability, earthquake engineering, seepage analysis, airfield pavement design, soil stabilization and dust control.

No substantial changes in the Hydraulics Laboratory are anticipated. Studies will continue relative to fluid in motion through use of mathematical and physical scale models of rivers, harbors, beaches, estuaries and man-made structures.

Sting RAG Recommended for Type Classification

Commander of the U.S. Army Armament R&D Command MG Bennett L. Lewis recently signed a recommendation approving the Sting Ring Airfoil Grenade for type classification as an official U.S. Army weapon system.

Research on the low hazard projectile system, a totally new concept in the field of civil disturbances control, has been underway in the Weapon System Concept Office in the Edgewood area of Aberdeen (MD) Proving Ground since 1972.

Mr. Abe Flatau, chief of ARRADCOM's Weapon Systems Concept Team, is credited with spearheading the Ring Airfoil Grenade. He and associates Mr. Don Olso and Mr. Miles Miller initially developed the system for Army military police use.

In 1974, Messrs. Robert Belden and Walter Arbogast joined the weapon systems concepts organization and served as primary development engineers throughout the remainder of the Sting Ring Airfoil Grenade program.

Sting RAG and its unclassified counterpart Soft RAG are long awaited developments sought by military and civilian authorities as an effective system to control civil disturbances and restrain rioters with a minimum of physical hazard to either side.

U.S., Germany, France to Test Roland Weapons

A shipment of European Roland air defense weapons and support equipment will undergo extensive testing by the United States, Germany and France during the coming months at White Sands (NM) Missile Range.

French and German fire units, mounted on tracked vehicles, missiles and other support equipment, will be examined specifically to demonstrate the compatibility and interchangeability of U.S. and European equipment, components and personnel.

Developed by France and Germany, Roland is a short-range, all-weather air defense system. It is the first major European system selected for production in the U.S. for deployment with the U.S. Army.

Huges and Boeing, under license to Euromissile to transfer European technology to the U.S., are building the U.S. Roland in this country and mounting it on the M-109R tracked vehicle.

The U.S. Roland will differ only slightly from the European version. U.S. missiles and approximately 90 percent of the fire unit replaceable parts (body, turret and electronic equipment) are interchangeable with European counterparts.

Volunteers Plan Memorial to the 'Combat Medic'

Proposed construction of a permanent memorial to honor the "too often forgotten" combat medic has been announced by an unofficial group of active and retired U.S. Army officers and enlisted personnel.

Programed for completion during the 1980-81 time frame at Fort Sam Houston, TX, the memorial statue will be bronzed and approximately 1½-2 times actual life size.

The success of this nonprofit undertaking is dependent upon public encouragement. Additional information may be obtained from: Mr. Richard J. Berchin, chairman, Combat Medic Memorial Fund, P. O. Box 34, Academy of Health Sciences, Fort Sam Houston, TX 78234, or commercial telephone (512) 221-2454/5706.

Army Receives First SHF Tactical Terminal

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be assembled in two minutes for satellite operation, and a whip antenna for LOS.

A hand-held burst digital entry message device (DMED), also developed by Cincinnati-Electronics, is being used as a companion device to demonstrate operational feasibility. The DMED weighs just over 2 pounds, transmits and receives 510 characters, displays 16 alphanumeric message characters, and can fully edit output messages, as well as store input and output data.

Production of the AN/PSC-1 will establish the first manpack satellite communications link between soldiers in battle, on ships or aircraft, and at ground stations.

AN/MSC-64 is a UHF mobile terminal that will be produced in two configurations, the (V)1 Command Post terminal and the (V)2 Force terminal. The Force terminal, in capability, will be the big brother of the AN/TSC-91/92 UHF satellite communications terminals produced for the Army in 1974 for a European Test Bed at selected Special Ammunition Storage (SAS) sites.

The Command terminal is housed in a S-250/G Shelter for transport on a 1¼-ton vehicle. The Force terminal is housed in an S-280/G ter and mounted on a 2½-ton vehicle. The Force terminal is housed in an S-280/G shelter and mounted on a 2½- ton vehicle. The terminals have a 0 dB gain antenna for operation on the move and a 9 dB roof- mounted antenna for stationary operation. Using a 100-watt transmitter, they provide primarily teletype traffic.

Baseline for TACSATCOM. This then is the Ground Mobile Forces Satellite Communications program, except for other SHF/UHF follow-on actions still in the planning stage. With a solidly entrenched history of over three decades of satellite communications experience, SATCOMA has pursued a progression of design and development of ground terminals that has provided UHF tactical and SHF strategic users with an outstanding satellite communications capability. Under direction of COL Charles F. Lindberg, the agency is working to apply the almost unlimited future satellite technology to tactical command and control.

Conferences & Symposia . . .

Army Science Conference Highlights. . .

Awards & Look at Future are Featured

U.S. Army Science Conference main events, 20-22 June, included Under Secretary of the Army Dr. Walter B. LaBerge's banquet address, Assistant Secretary of the Army (RDA) Dr. Percy Pierre's award presentations for 20 of 96 technical papers, Deputy Chief of Staff for RDA LTG Donald R. Keith's keynote challenge, and a panel on "Outlook for the Battlefield of the Future."

Superintendent LTG Andrew W. Goodpaster made the welcoming remarks, as almost all his predecessors have done since the U.S. Military Academy was host to the first biennial ASC in 1957.

Top distinction during presentation of cash honorariums, Certificates of Outstanding Achievement signed by Dr. Pierre and LTG Keith, and silver or bronze medallions for the best papers, was the Dr. Paul A. Siple Memorial Award. This honor rewarded the paper coauthored by Dr. David W. Howgate, Dr. Charles M. Bowden and John J. Ehrlich of the Army Missile R&D Command at Redstone Arsenal, AL.

In addition to the 3-inch silver medallions bearing the facial likeness of the U.S. Army's most distinguished cold regions explorer the trio shared a $1,000 honorarium. A total of $3,600 was made possible by the U.S. Army Incentive Awards Program, which also included one award of $500, three of $350 each, and seven of $150.

Emphasis on the team effort of Army in-house laboratory personnel, involving a combination of interdisciplinary skills, was evidenced by 10 of the 20 award papers bearing the names of three or more coauthors. Five single author and five paid efforts were recognized.

The title of the Siple Award paper is MIRADCOM Program in Swept-Gain Superradiance. The abstract report on this achievement states that the MIRADCOM scientists' work has made possible the prediction of "circumstances under which a volume of gas can radiate coherent pulses of electromagnetic energy having anomalously high intensity (increasing as the square of the density) and anomalously short temporal duration (decreasing as the reciprocal of the density). . . . Thus scaling to other wavelengths is possible, and such a configuration is highly suggestive for construction of an X-ray laser."

ASA (RDA) Dr. Percy Pierre presents Dr. Paul A. Siple Memorial Award to Dr. David W. Howgate for a paper he coauthored with Dr. Charles M. Bowden and John J. Ehrlich of the U.S. Army Missile R&D Command at Redstone Arsenal, AL. The authors shared the ASC top honor and $1,000.

An award of $500 (shared), bronze medallions and Certificates of Outstanding Achievement to Dr. Philip M. Howe and Dr. Robert B. Frey, Ballistic Research of Compartmentalized Ammunition - Causes and Preventive Measures.

The abstract of their paper states in part: "A mechanism for the initiation process was developed and experiments were conducted to provide

ASC $500 winners. Dr. Philip M. Howe accepts award for team effort with Dr. B. Frey. ASC $350 winners include Dr. William H.

Drysdale, accepting for Richard D. Kirkendall and Ms. Louise D. Kokinakis, Theodore F. Ewanizky; and Dr. Ralph F. Goldman.







ASC $150 winners. Top (l. to r.) Dr. Edward Collett; Joseph F. Hannigan; Dr. Norman J. Berg accepting for self and Dr. John N. Lee and Burton J. Udelson; John E. Creedon for self and Anthony J. Buffa, John L. Carter, Steven Levy, Joseph W. McGowan and Sol Schneider. Bottom (l. to r.) Dr. Sammy A. Kiger accepts for self and Dr. Jimmy P. Balsara; Glenn Randers-Pehrson for self and I. Peter Juriaco; Dr. Judith K. Temperley for self and Dr. Donald Eccleshall.

additional support. Based upon the mechanism, techniques were developed which are effective in preventing interround propagation between compartmentalized 105mm HEAT rounds.

"Design guidance has been provided the XM1 (tank) project manager. An effective technique for reducing vulnerability of munitions to fragmentation impact was developed."

Awards of $350 for each of three papers, along with individual bronze medallions and Certificates of Outstanding Achievement, were made to:

- Dr. William H. Drysdale, Richard D. Kirkendall and Ms. Louise D. Kokinakis, all with the Ballistic Research Laboratory at APG, for: Sabot Design for a 105mm APFSDS Kinetic Energy Projectile.
- Theodore F. Ewanizky, Electronics R&D Command, Fort Monmouth, NJ, for: Unstable Resonators for Army Laser Designators.
- Dr. Ralph F. Goldman, Institute of Environmental Medicine, Natick, MA, for: First Battle in the Heat: Physiological Logistics for Success.

Seven awards of $150 each (total $1,050) with bronze medallions and Certificates for Outstanding Achievement recognized a total of 17 authors and coauthors. Individual awards went to Dr. Edward Collett, Electronics R&D Command, Fort Monmouth, NJ, and Joseph F. Hannigan, Engineer Topographic Laboratories, Fort Belvoir, VA.

Collett's paper was titled: A Four-Channel Polarimeter to Measure Nanosecond Laser Pulses. Hannigan's work was on: Direct Electronic Fourier Transforms (DEFT) for Camouflage Signature Measurement (CSM). Other $150 awards are:

- Dr. Norman J. Berg, Dr. John N. Lee and Burton J. Udelson, Harry Diamond Laboratories, Adelphi, MD, for: Real-Time and Memory Correlation via Acousto-Optic Processing.
- John E. Creedon, Anthony J. Buffa, John L. Carter, Steven Levy, Joseph W. McGowan and Sol Schneider, Electronics Technology and Devices Lab., Fort Monmouth, NJ, for: Brassboard Modulator for HELS.
- Dr. Sammy A. Kiger and Dr. Jimmy P. Balsara, Engineer Waterways Experiment Station, Vicksburg, MS, for: Response of Shallow-Buried Structures to Blast Loads.
- Glenn Randers-Pehrson and I. Peter Juriaco (now deceased), Large Caliber Weapons Systems Laboratory, Armament R&D Command, Dover, NJ, for: Computer-Aided Self-Forging Fragment Design.
- Dr. Judith K. Temperley and Dr. Donald Eccleshall, Ballistic Research Laboratory, ARRADCOM, for: Transfer of Energy from Charged Asymmetric Transmission-Line Pairs.

Certificates of Outstanding Achievement honored 8 technical papers with a total of 28 coauthors. Joachim A. Maass received the only individual award for: work at the Communications R&D Command, Fort Monmouth, NJ, on: MESH (Multiple Electronically Synapsing Herirachy).

In this category, Dr. Alton L. Gilbert and Dr. Michael K. Giles, White Sands (NM) Missile Range, received a 2-man team award for: Novel Concepts in Real-Time Optical Tracking. Two 3-man teams were honored:

- LTC Carl R. Alving, Dr. Edgar A. Steck and Dr. William L. Hanson, Walter Reed Army Institute of Research (WRAIR), Washington, DC, and College of Veterinarian Medicine, University of Georgia, Improved Therapy of Leishmaniasis by Encapsulation of Antimonial Drug in Biodegradable Artificial Phospholipid Vesicles (Liposomes).
- MAJ Charles L. Bailey, COL Bruce F. Eldridge and David E. Hayes, WRAIR, The Survival of St. Louis Encephalitis Virus in Overwintering Mosquitoes.

Five researchers, representative of three agencies, pooled professional skills to win an award for: Project MILES—Biomedical Research and Coordination in Safe Field Exercises. They are: LTC Edwin C. Beatrice and David J. Lund, Department of Biomedical Stress, Letterman Army Institute of Research, Presidio of San Francisco, CA; LTC John D. Cours and Paul Wampner, Office, U.S. Army Project Manager for Training Devices, Orlando, FL; and David H. Sliney, U.S. Army Environmental Hygiene Agency, Aberdeen Proving Ground, MD.

Dr. Charles W. Bruce, Dr. Ronald G. Pinnick, Dr. Ralph J. Brewer, Young P. Yee and Gilbert Fernandez, White Sands Missile Range, earned their award for work on: *In Situ* Measurements of Aerosol Absorption With a Resonant CW Laser Spectrophone.

Quiet Radar Theory and Tests was the title of a paper that won an award for Dr. Michael D. Fahey, Dr. George T. O'Reilly, Robert R. Boothe Jr. and William G. Spaulding, Missile R&D Command.

Dr. Lothar L. Salomon, Elliot G. Peterson, Eldon W. Burgess, Walter Gooley Jr. and Frederick L. Carter, all Dugway (UT) Proving Ground scientific and engineering personnel, shared an award for: Characterization of Obscuring Smokes in the Field.

Selection of Award Papers. The 20 ASC award-winning papers were selected by a panel of judges headed by Director of Army Research Dr. Marvin E. Lasser, also the conference presiding chairman. The 96 papers that were presented were chosen from 311 narrative proposals for submission of papers representative of Army in-house laboratory effort.

Other members of the final selection panel were Dean Ralph E. Fadum, School of Engineering, North Carolina State University at Raleigh; former Assistant Secretary of the Army (R&D) Dr. Russell D. O'Neal, a private consultant; Dr. Bruce A. Reese, head of the School of Aeronautics and Astronautics, Purdue University; Dr. Wilson K. Talley, professor, Department of Applied Sciences, University of California, Davis; and Dr. Chris J. D. Zarafonetis, member of the Army Science Board and associated with the Simpson Memorial Institute, University of Michigan.

Opening Ceremonies. The first general session was called to order by

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Certificates of Outstanding Achievement went to (from left) Joachim A. Maass; Dr. Alton L. Gilbert, shown receiving the award for himself and coauthor Dr. Michael K. Giles; LTC Carl R. Alving for self and Dr. Edgar A. Steck and Dr. William L. Hanson; MAJ Charles L. Bailey for self and COL Bruce F. Eldridge and David E. Hayes; LTC Edwin C. Beatrice for self and David J. Lund, LTC John D. Cours, Paul Wampner and David H. Sliney; Dr. Lothar L. Salomon for self and Elliot G. Peterson, Eldon W. Burgess, Walter Gooler Jr., and Frederick L. Carter. Others, not available for pictures, included a 5-man team of Dr. Charles W. Bruce, Dr. Ronald G. Pinnick, Dr. Ralph J. Brewer, Young P. Yee and Gilbert Fernandez; and a 4-man team—Dr. Michael D. Fahey, Dr. George T. O'Reilly, Robert R. Boothe Jr., and William G. Spaulding.

(Continued from page 23)

Assistant Director for Research Programs, Office of the Deputy Chief of Staff for RDA, Dr. I. R. Hershner, also chairman of the ASC Advisory Group.

LTG Goodpaster's welcome speech included a brief summary of the role of the Academy as the pioneering organization in establishing the nation's academic resources to build the engineering profession, along with its more recent rapid expansion across the full spectrum of sciences. Citing examples of academy graduates over the years fostering the growth of science and engineering the General noted that during the fast-moving Space Age, six USMA graduates have been among astronauts who helped to blaze a path from the Earth to the Moon, including COL White, the first man to walk in space, who lost his life in the Apollo I spacecraft fire and is buried at the USMA.

Among the Class of 1978—947 cadets, the largest class in history—are many whose outstanding records as science and engineering students, he said, are expected to lead them to contributions to the nation's R&D achievements.

Dr. Hershner, before calling on Dr. Lasser to take over as presiding chairman and introducing LTG Keith as keynote speaker, acknowledged appreciation to Dr. Gordon Bushey of the Office of Laboratory and Development Command Management, Army Materiel Development and Readiness Command (DARCOM). Dr. Bushey was a key member of the Army Science Conference Advisory Group that arranged the conference.

Dr. Hershner also acknowledge his gratitude for the participation of high-ranking dignitaries of the defense and R&D of the United Kingdom, Canada, Australia, the Federal Republic of Germany and France.

LTG Keith's presentation was, judged by applause, the kind of message ASC participants wanted to hear. It was a hard-hitting review of the U.S. national defense posture vis-a-vis the potential enemy. It explained the challenge confronting the national scientific and engineering community in efforts to maintain technological superiority—in view of the rapid progress by the Soviet Union in a counter all-out effort.

"Measured by any standard," he said, "the Soviet military research and technology program is the largest in the world, exceeding that of the United States by about 75 percent. Compared to the American methods, of doing RDTE, the Soviet style offers pluses and minuses.

"The plus parts arise from their evident commitment to achieving military-technological superiority and a willingness to pirate and plagiarize foreign technology. They concentrate on carefully chosen goals to simplify the search for superiority in selected areas."

LTG Keith talked about some of the more notable Soviet achievements, including a simply designed but still the fastest, highest-flying armed airplane in the world; also, an "ugliest looking device imaginable"—but a helicopter that can carry 200 fully armed troops, which the U.S. lacks.

". . . We would be wise," he said, "to pay some attention to their less complicated approach instead of our traditional reliance upon technical sophistication to solve our problems. We used to have the advantage there, but not anymore. They are now producing technically sophisticated, well-designed combat hardware also."

A recent U.S. Library of Congress report, LTG Keith said, contended that the Soviets are clearly ahead of the U.S. in areas of R&D such as cost and commonality of components, ease of maintenance, rockets and ramjets, air defense missiles, armored fighting vehicles, artillery/rocket launchers, and smokes (combat concealment screens).

Other areas in which the U.S. appears to be losing ground, he said, are radiant and particle-beam-directed energy, obstacle crossing, artillery range, missile accuracy, composite materials, and inertial instrumentation. The U.S. is regarded as still having a clear lead in computers, integrated circuits, target acquisition, countermeasures and counter-countermeasures.

"There is no reason why we should not be ahead in all of these areas," LTG Keith stated. "We can and must maintain big leads on this technology scoreboard—get further ahead where we lead and recover in areas where we have lost ground."

Much of the remainder of LTG Keith's address was devoted to a review of U.S. Army material development priorities, progress and funding.

Among notable successes in the U.S. Army materiel modernization program he cited the XM1 tank, the Patiot air-defense system, and the advanced attack helicopter.

LTG Keith also discussed the intensity and the urgency of the current standardization and interoperability program of systems development to achieve maximum combat effectiveness among NATO nations.

"Where we can really save money and enhance our logistics posture," he explained, "is in the achievement of interoperability of spares, fuel, ammunition, and other high-volume consumables that make armies work. Doing so steps on no one's political or economic toes, and provides terrific dividends."

Turning to the role of the Army in-house laboratory scientists, engineers, directors and high-level decision-makers in structuring weapon systems and materiel geared to the anticipated battlefield of the future, LTG Keith said it is clear that the Army is, and must remain, committed to maintaining a strong capability.

Centers of expertise must be maintained, he said, to provide technical leadership—to keep us *smart* in buying equipment and in interacting with the best know-how available in the private sector. Under current policy guidance, he stressed, the laboratory manager has maximum flexibility to choose research and technology areas, and to adjust his program . . . without being directed by people . . . who have pet programs to push.

Priority objectives are articulated in the Science and Technology Objectives Guide (STOG), he explained, and much of the R&D effort should support high-priority STOG items.

"The STOG represents the Deputy Chief of Staff for Operations and my assessment of future Army needs to guide your efforts. So within the freedom that single project funding provides, the labs should develop programs that satisfy those Army goals. . . ."

LTG Keith said the topics of papers programed for the ASC evidence the high quality of Army in-house laboratory effort. The careful thought in interpreting the results show that you are meeting the challenge to your professionalism, and can function well within the framework.

"Our policy," he stated, "is to foster and defend our scientific research. We want to maintain a sufficient proportion of the technology base program in pursuing long-range ideas and incisive research at the frontiers of science and engineering. That is the only way our researchers can maintain the sharp edge they need to understand their subject to the depths where innovative ideas occur. . . ."

After discussing some of what he considers new and potentially high-payoff scientific areas in which special emphasis is planned, and the importance of continuing full-cycle interface with the users of materiel systems to insure that the end products satisfy their requirements, LTG Keith stated in conclusion:

"I want to express my personal gratitude for your continuing contribution toward solving Army problems and finding new methods and equipment for improved combat capability. . . . With the competence and dedication of a creative work force in-house, and support from industry and the academic community, I look forward to high productivity in the years to come."

Under Secretary of the Army Dr. LaBerge's banquet address, titled *Suppose Edison Came Back to Run This Conference,* was a tribute to the creative and managerial genius of the famed inventor—"comparable in his own field of the likes of Alexander the Great and Napoleon in that his reputation for genius was established at an early age."

Dr. LaBerge emphasized Edison's intense commitment to practicality in his inventions and managerial methods, and his belief that the true value of his devices was a function of their utility. He learned that lesson by his first invention, a vote recorder to be used by legislative chambers to speed up the voting process.

One of his politically astute friends explained the invention's lukewarm reception by pointing out that this attitude was attributable to the fact that the minority faction was interested in delay beneficial to them.

After pointing to numerous examples of how Edison turned his talents to making money at an early age, as efficiently as possible, Dr. LaBerge said: "Had Edison pursued business rather than science, he would undoubtably have joined the ranks of the Goulds, Fisks and Rockefellers. But his overriding compulsion was science."

As the number of his inventions increased rapidly and found applications in business ventures, Edison developed a staff to which he gave wide-ranging responsibilities, but he remained the guiding force.

Asked about the organization of his research facilities in later years, Edison replied, "I am the organization."

The simple, direct approach was his way of research and of management. After watching one of his university mathematicians produce many pages of graphs and formulae to comply with a request to determine the volume of the incandescent light glass bulb, Edison suggested that he fill the bulb with water and measure the amount.

Dr. LaBerge commented that Edison moved often in his early career and that his first concern in his new location was invariably a place (laboratory) for his work, and secondly a place to sleep.

"Edison's approach to his work was almost of a savage intensity. His guideline for the productive use of a day's time was 10 hours of thought, 8 hours of manual labor, and the balance for sleep. It was not unusual for him to work on projects 100 hours a week for weeks on end, and demand the same of his workers."

During World War I, Edison turned his mind to the practical problems of war. His most notable contributions were devices which reduced the dangers posed by submarines. But of far greater relevance than his brief connection with military research, Dr. LaBerge said, was the focus of his work in general.

"That focus was on the practical and the important. So, too, must the Army scientists of today focus on the important and the practical. In that real world of the battlefield, far from the sanctuaries of our laboratories, we are confronted by a multitude of problems.

"Our forces are threatened by an increasingly sophisticated technological environment unlike any we have had to overcome before. The advances of our potential opponents in the fields of armaments, electronic warfare, aviation, munitions—in fact, across the board—have been prodigious in recent years.

"Our traditional boasts of technological superiority are beginning to have a hollow ring. . . . What this means for the Army scientific community is that we must conform to Edison's appoach. We need to focus on important problems.

"Let me give a few examples of the kinds of problems which are crying out for our attention. First, in the area of chemical warfare, we are confronted by the very high probability that a European conflict would include the use of chemical agents. Our potential adversaries have provided for such measures in their training, doctrine and equipment."

Dr. LaBerge said the United States is only now beginning to make some allowances for the prospect of CW in the force structure, but that the obvious need is for a means to reduce the effects of nerve agents. The basic defense, he said, is still the gas mask. "What we are emphasizing is a simple and effective antidote, as well as other measures."

Specialized research projects, each with its specific constituency and its vise-like budget and schedule, Dr. LaBerge noted, "make it difficult for researchers to do what Edison did—to put aside a project for a time in order to pursue an idea which comes out of the blue. I hope that we can somehow recapture that capability."

Edison, he said, is credited with having commented that "genius is 2 percent inspiration and 98 percent perspiration." In conclusion, he commented that the conference had provided an opportunity to draw inspiration from the work of colleagues. "Now we must return to our offices and laboratories for that other 98 percent. There is much to be done."

Assistant Deputy Chief of Staff (RDA) MG Philip R. Feir firmly established his forensic talents with Army Science Conference participants in 1976 when he filled a dual role as keynote speaker and toastmaster at the banquet. He scored again this year as toastmaster with humorous quips about the titles of several technical papers (some of which later won high honors), head table guests and other attendees.

PANEL DISCUSSIONS. Nearly three hours of presentations, questions and answers were devoted to the panel discussion on: Outlook for the Battlefield of the Future. This session was chaired by Manfred Gale, adviser for RDA Analysis in the Office of the Deputy Chief of Staff for Research, Development, and Acquisition.

Sharing much of the focus was COL Donald S. Pihl, director, Combat Developments Planning Directorate, Deputy Chief of Staff for Combat Developments, U.S. Army Training and Doctrine Command. His topic was: A User's Approach to the Battlefield of the Future. He also "fielded" a substantial portion of the penetrating questions from the audience.

The lead-off speaker was Dr. Hermann R. Robl, technical director, Army Research Office, Research Triangle Park, NC, who gave his views on: The Scientific Contribution to the Battlefield of the Future.

Director of the Electronics Technology and Devices Laboratory, Army Electronics R&D Command, Dr. C. G. Thorton spoke on: The Role of Technology and Technology Transfer in Anticipation of the Modern Battlefield.

Assistant Director for Technology, Research Directorate, Office of the Deputy Chief of Staff (RDA) Dr. Charles H. Church presented his views on: Systems for the Future Battlefield.

Army Chief Scientist, United Kingdom Ministry of Defense, Len Gray presented: The British Connection With the Modern Battlefield.

Appreciation for a job well done in arranging for the conference and keeping it running smoothly was expressed by Dr. I. R. Hershner as general chairman and as head of the ASC Advisory Group. He expressed gratitude to USMA Superintendent LTG Goodpaster as host, Don Rollins as project officer for the Army Research Office, Mrs. Anne G. Taylor as executive secretary of the Advisory Group, Ms. Doris Ellis of ARO, and Mrs. Willie Mae Fennell, executive secretary Incentive Awards Board.

A special acknowledgement went to MSG Richard L. Wilkinson who headed the USMA staff as project officer—the first enlisted man in ASC history to perform a mission formerly entrusted to majors or LTCs.

KEYNOTE SPEAKER LTG Donald R. Keith, Deputy Chief of Staff for RDA, and ASC participants hold informal discussion during break in proceedings. From left are Dr. Gordon Bushey, COL Anthony P. Simkus, LTG Keith, LTG Andrew J. Goodpaster, Dr. Marvin E. Lasser and Dr. I. R. Hershner.

Under Secretary of the Army Dr. Walter B. LaBerge, ASC banquet speaker, displayed an Edison phonograph during his address "Suppose Edison Came Back to Run This Conference."

Power Sources Symposium Speakers Review R&D Progress

LITHIUM BATTERIES Session speakers included (front row, l. to r.) Frederic Bowers, session chairman, Naval Surface Weapons Center; Thomas M. Watson, Power Conversion Inc.; Anne Thunder, Sogea Batteries Ltd; Donald L. Warburton, session chairman, Naval Surface Weapons Center. Back row, l. to r., Fritz Bauman, Lockheed Missiles & Space Co., Inc.; Pinakin M. Shah, Honeywell Power Sources Center; Harry Taylor, P. R. Mallory & Co., Inc.; Gabriel DiMasi, U.S. Army Electronics Technology and Devices Laboratory. DISCUSSING CONFERENCE agenda (at right) are Doris Yanetta, assistant to conference chairman, ERADCOM, and David Linden, conference chairman.

Research and development progress on high-energy power sources—considered to be of potential importance to future military and civilian requirements—was reported at the 28th Power Sources Symposium, 12-15 June, at Atlantic City, NJ.

One of the largest meetings of its kind in the world, the symposium was sponsored by the U.S. Army Electronics R&D Command in cooperation with other Department of Defense Agencies, the Communications Satellite Laboratories, the National Aeronautics and Space Administration, and the U.S. Department of Energy.

More than 700 registered participants and attendees, representing government, industry and academic institutions from the U.S. and abroad, provided a forum for discussions of high priority topics related to six major categories of batteries and fuel cells of national and international interest.

David Linden, who has been associated with symposium arrangements since 1947, and has served as symposium chairman since 1970, retired as chief, Power Sources Division of the Army Electronics R&D Command in January, served as this conference chairman. He was assisted by Doris Yannetta of ERADCOM.

HIGH TEMPERATURE/HIGH ENERGY BATTERIES. The opening day session was devoted to discussions of electrochemical cells using molten electrolytes or beta alumina solid electrolytes. These are important candidates for use with electric vehicles and electric utility service. Robert K. Steunenberg, Argonne National Laboratory, was chairman of this session and Kurt Klunder, U.S. Department of Energy, served as co-chairman.

Latest developments in the two major high-temperature systems which offer the capability of high energy and power density required for these applications were discussed. A report on the structure of sulfur electrodes in sodium-sulfur cells and a comparison with model predictions was presented by Bruce Dunn of the General Electric Co. He noted that problems with secondary batteries of this type, which operate by discharging and then charging, usually occur when the battery is charging. He presented a theoretical model of the sulfur electrode which may overcome this problem.

Marjorie McClanahan, a former Department of the Army employe now with the Ford Motor Co., discussed their Department of Energy-funded program dealing with development of a one megawatt sodium sulfur battery. The program is now concentrated on cell development, with much of this work emphasizing the container material effects on operating performance. Ford Motor Co. is reportedly encouraged by potential of this system.

Floris Y. Tsang, Dow Chemical Co., described the status of the hollow fiber sodium sulfur cells. Tsang discussed plans to scale-up to a 400 A-hr cell preparatory to building a megawatt test unit by 1982.

Leonard Pearce of the Admiralty Materials Laboratory (Great Britain) described a version of the lithium-aluminum/iron sulfide cell in which the LiCl-KCl electrolyte is immobilized by addition of an inert, solid powder to the molten-salt electrolyte.

Another paper on the lithium/iron sulfide battery was presented by Erwin Adler of the Atomics International Division of Rockwell International. This paper reported on the construction and operation of a 2.3 megawatt-hour load leveling type cell having Li-Si alloy negative electrodes and FeS positive electrodes.

Guy Chauvin, French Atomic Energy Commission, discussed a molten-salt secondary system that utilizes aluminum or sodium as the negative electrode and a metal fluoride as the positive electrode. This system, which is still in the experimental stage, is being considered for stationary energy storage applications.

Chen H. Chi from Energy Development Associates presented a discussion of the zinc/chlorine battery, which has metallic zinc negative electrodes and a gaseous chlorine positive electrode. Dr. Chi described the design and testing of a 50 kWh battery being developed for a four passenger urban/suburban electric vehicle.

LITHIUM PRIMARY BATTERIES. A major session was devoted to the lithium primary battery. These new batteries are of particular interest in both commercial and military applications as they deliver more than two to four times the energy of similar sized conventional batteries and can operate to temperatures as low as −60°C. This 1½ day session chaired by Donald Warburton and Frederic Bowers of the Naval Surface Weapons Center dealt with the electrical characteristics, stability, safety, and chemistry of the lithium/sulfur dioxide, the lithium/thionyl chloride, and lithium/solid cathode primary batteries.

G. J. DiMasi of the U.S. Army Electronics R&D Command and H. Taylor of P. R. Mallory reported on redesigned lithium/SO_2 cells with improved stability. They showed that cells with a reduced lithium to SO_2 ratio and other design features can operate safely over a wide range of operating conditions. CPT Bjorn Tuvnes of the Norwegian Army Materiel Command forwarded a paper which was read at the meeting and summarized the successful field tests of lithium/SO_2 batteries in Norway. He concluded that the field trials showed the lithium/SO_2 battery to be reliable under all environmental conditions with low failure.

A number of papers dealt with the lithium/thionyl chloride battery system which is being considered in applications ranging from a one ampere-hour cell for cardiac pacemakers to a 10,000-20,000 ampere-hour cell for strategic military applications. David Morley of ARCO Medical Products summarized results of tests and 3½ years of experience with 20,000 cells in heart pacers with no reported battery failures. F. Goebel of GTE Sylvania and D. L. Chua of Honeywell reported on their progress on the design of the larger size cells. Extremely high energy densities have been achieved with these cells (in excess of 650 Wh/kg compared to less than 100 Wh/kg with conventional batteries). The lithium anode limited design was also found to be a reliable approach for these cells for performance and safety.

Other lithium battery systems for commercial use and using solid cathode materials, such as manganese dioxide, iron sulfide, copper oxide, were discussed by representatives from the Japanese firms of Sanyo Electric and Hitachi Maxell, SAFT, Eagle-Picher and Honeywell.

PRIMARY BATTERIES. A. A. Benderly and Jeffrey Nelson, both from the U.S. Army's Harry Diamond Laboratories, shared chairmenship responsibilities for this session, which was devoted largely to discussions of thermal batteries. Thermal batteries are under development primarily for non-spin ordnance applications. The military is interested in their use with mortars, rockets and missile programs.

The study and evaluation of various characteristics of the conventional thermal battery calcium-calcium chromate electro-

chemical system was the subject of presentations by Philip Wong and James McCauley of the U.S. Army Materials and Mechanics Research Center, and Samuel Levy of Sandia Laboratories. Wong reported that his study on aged thermal battery components indicates that degradation of the calcium anode is occurring during discharge.

Improved thermal battery concepts based on the lithium-aluminum anode/iron sulfide cathode system were discussed by Praful V. Dand of KDI Score, James DeGruson of Eagle Picher Ind., Inc. and by Donald Bush and D. A. Nissen of Sandia Laboratories. The use of this battery system may provide a five-fold increase in energy per unit volume of unit weight.

John K. Erbacher of the U.S. Air Force Academy's Seiler Research Laboratory and David Ryan of Eureka Co. highlighted work on the low-temperature lithium aluminum/copper chloride electrochemical system for thermal batteries. They noted that a thermal battery operating at low temperatures will eliminate many of the limitations of high temperature operation and have the advantage of faster activation times, longer life, and minimum proximity limitations due to high skin temperatures.

SECONDARY BATTERIES. Gerald Halpert, NASA Goddard Space Flight Center, and James Dunlop, COMSAT Laboratories, chaired this session which included papers on alkaline secondary batteries including nickel-zinc, nickel-iron, silver-zinc, and metal-gas systems.

P. McDermott, Coppin State College, in his paper on failure analysis of cells in an accelerated test program, concluded that failure of cells in this program was related to corrosion of the nickel sinter with corresponding plate expansion and drying out of the separator.

H. N. Seiger, Yardney Electric Corp., in his presentation on considerations of capacity enhancement, found a diagnostic model that predicted that either corrosion or recovery of active material was the prime cause of capacity increase in the nickel cadmium cell.

Performance data for nickel cadmium batteries on the Intelsat IV communications satellite was discussed by James Dunlop. He indicated that nickel cadmium batteries are now becoming the life-limiting subsystem after 5½ to 6 years of operation in orbit.

The Battery Energy Storage Test (BEST) facility, a national test center sponsored by DOE, Electric Power Research Institute and Public Service Electric and Gas to assess and indicate advanced batteries designed for use by the electric utilities was described by A. Pivec of PSE & G Research and Development Division. This facility will provide a means for demonstrating the performance of the new batteries and will enable a smooth transition from laboratory to application.

Four papers were presented on silver-hydrogen and nickel-hydrogen batteries. T. L. Markin, Atomic Research Establishment, described the use of $LaNi_5$ as the negative electrode to prevent build-up of hydrogen pressure during charge. G. L. Holleck, EIC Corp., addressed the promise of exceptionally long cycle life for the Ni/H_2 system, presenting test results up through 2,500 cycles for cells with different cell stack components. H. H. Rogers, Hughes Aircraft Co., described design features of the Hughes 50 ampere-hour nickel hydrogen cell with a new zirconium oxide cloth separator, and A. Charkey, Energy Research Corp., discussed work on silver-hydrogen cells using NASA inorganic-organic type separator material.

Speakers from the Westinghouse Electric Corp. presented several papers on the use of iron as the negative electrode. Freeman Hill and W. A. Bryant reported on the iron-nickel and iron-air batteries, both of which are promising candidates for electric vehicle applications. Edward Buzzelli discussed the iron-silver battery which may be a strong competitor for the silver-zinc battery having potentially better cycle life.

The remaining papers were on silver-zinc batteries. Dr. Angres, Naval Surface Weapons Center, described a new heat and chemically resistant membrane being developed to extend the cycle lifetime for silver-zinc cells. Mr. Albert Himy, Naval Ship Engineering Center, presented results of his program to replace the mercury in alkaline zinc batteries. Performance results exceeded program objectives—binary additives of lead and cadmium gave performance results exceeding mercury. Mr. John Lear from Martin Marietta tested cells that were manufactured in 1967. After 10 years of storage these cells still exhibited reasonable capacity and cycle life.

FUEL CELLS. Chaired by Richard N. Belt of the U.S. Army Mobility Equipment R&D Command, the fuel cells session featured technical papers on systems, analysis, diagnostics and catalyst developments. The fuel cell is a major candidate for handling the peak power requirement for electric utilities. The status of the 4.8 megawatt power plant program was reported on by Leonard Rogers of the Department of Energy's Division of Electric Energy Systems. He described the design, fabrication and plan for installation and test on the Consolidated Edison of New York electric systems.

Development of a one kilowatt tungsten carbide fuel cell power plant with a methanol cracker was the topic of an address by Karl P. Maass, program manager for Fuel Cells and Solar Cells, AEG-Telefunken. Sponsored by the German Federal Ministry of Defense, this work is considered important for potential mobile power plant applications. Maass reported that by 1980 AEG-Telefunken is planning to build three development modules. He stressed that his company prefers using methanol because it does not encounter any storage problems and that its cost is comparable to similar type materials. The tungsten carbide catalyst, he said, has a life span of about 6,000 hours.

Alfred P. Meyer presented results of a 1.5 kilowatt methanol fuel cell parametric analysis, conducted by the Power System Division of United Technologies Corp. for the U.S. Army. The analysis provided comparisons of predicted power plant characteristics with U.S. Army goals and described experimental methanol fuel conditioning work in support of this analysis.

ALTERNATE POWER SOURCES. Chaired by Wayne Bishop, Wright-Patterson Air Force Base, this session included progress reports on systems studies for power source selection and optimization, specific device applications, and development of electrical power system components.

LT David G. Hall, Wright-Patterson Air Force Base, reported on a study to determine Air Force terrestrial power requirements and power generation technologies in order to develop an optimum energy program. The Air Force, said Hall, needs a 99.9 percent availability and reliability regardless of what power source is selected for its requirements. They also need systems requiring minimum maintenance and minimum support training. He concluded that the program can benefit significantly both from an economic savings and increases in force readiness by utilizing new and developing power source technologies.

David V. Noren, TRW, Inc., discussed requirements and comparisons of various stored power sources for use with advanced missile systems which must have long service life and low life cycle cost. Studies of alternative power sources, including engine-generators, fuel cells, flywheels, and batteries, showed that none are completely satisfactory. Noren summed up his remarks by stating that no single power source now exists which will satisfy all energy storage requirements. However, rechargeable nickel-zinc batteries, and with further development, primary lithium/thionyl chloride batteries combined with a secondary battery, do appear as a viable power source for the future.

Joseph Lindmayer, Solarex Corp., authored a paper on "Terrestrial Photovoltaic Design—A New Experience in Systems Thinking." Presented by a coworker, the paper reported that the cost of solar cells have been substantially reduced in recent years as a result of new automated production techniques and other factors. Current costs for these systems are about $11.00 per watt, but it is projected that by 1980 the cost will be reduced to about $4.00 per watt. Silicon solar arrays are now the types most used but others are also gaining acceptance for applications.

Mobile electric power for the Field Army may eventually be provided by general purpose units, according to a report by Dr. A. L. Jokl of the Army Mobility Equipment R&D Command. He specifically discussed a new power conditioner and the 1.5 kilowatt inverter which MERADCOM is working on. Pre-prototype tests look promising, he said.

Proceedings of the 28th Power Sources Symposium will be published by the Electrochemical Society and should be available for distribution in December 1978. The cost is $25.00 per copy. Requests may be submitted to: The Electrochemical Society, P. O. Box 2071, Princeton, NJ 08540. Checks are payable to The Electrochemical Society.

The 29th Power Sources Symposium is scheduled for June 1980. Details will be publicized during 1979.

U.S. Team Places Second at International Math Meet

A team of eight U.S. high school students recently took second place honors in competition from among 18 countries participating in the 20th International Mathematical Olympiad (IMO), held this year in Bucharest, Romania.

Supported by travel funds from the Conferences and Symposia Office, U.S. Army Research Office, Research Triangle Park, NC, the U.S. team maintained its successful record of never finishing below third place since it began participation in the Mathematical Olympiad in 1974.

The annual Olympiad brings together teams of high school students from across the globe for competitive examinations requiring a broad knowledge of the mathematical sciences.

Funds for a 3-week study period, which preceded the IMO competition at the U.S. Naval Academy, were provided this year by the U.S. Navy. The U.S. Military Academy, West Point, NY, will host the study period in 1979.

Among the individual honors taken by U.S. team members at this year's IMO was a first place prize by Mark Kleiman of Staten Island, NY. He was credited with the only perfect score during the 2-day IMO examination.

Individual second place prizes were won by U.S. teammates Ehud Reiter of Rockville, MD, Victor Milenkovic of Glencoe, IL, and Randall Dougherty of Fairfax, VA. Charles Walter, Champaign, IL, David Montana, Yardley, PA, David Bernoff, Fort Washington, PA, and Daniel Bloch, Bellport, NY, were third place winners.

Olympiad Committee Chairman Dr. Samuel L. Greitzer, Rutgers University, and Dr. Murray S. Klamkin, University of Alberta, Edmonton, Alberta, Canada, escorted the U.S. team to Romania and served as team coaches during the 3-week study period at Annapolis.

Included among the 18 nations at this year's Olympiad were Romania (first place team winner); Great Britain (third place); Vietnam (fourth place); and Czechoslovakia (fifth place). This was the first year that no Soviet team participated.

The International Mathematical Olympiad is projected to be held in Great Britain in 1979, Mongolia in 1980, and in the U.S. in 1981.

National JSH Symposium Participants Visit More Than 25 Labs

International Youth Science Fortnight trip winners, flanked by DARCOM Deputy CG for Materiel Development LTG Robert J. Baer (left) and MG Hillman Dickinson and MG John K. Stoner Jr., are Anthony M. Sarra, Emily Chen, Lisbeth R. Gibson, Robb S. Harvey and Ethan Lavan.

Exposure to stimulating speakers and activities that point to career opportunities was demonstrated to about 360 participants in the 16th National Junior Science and Humanities Symposium at Fort Monmouth, NJ.

Sponsored by the U.S. Army Research Office, Research Triangle Park, NC, with ARO Commander COL Anthony P. Simkus presiding at several events, the 17-20 May sessions were hosted by Monmouth College, Princeton University and Fort Monmouth.

Numerous highlights of the action-crammed schedule included lectures and films on construction of what is projected—after development at the Princeton Plasma Physics Laboratory since 1951—as one of the potential solutions to the world's long-range electric power generating problems.

The U.S. Department of Energy has allocated about $111 million this year for construction of a $239 million (estimated cost) Tokamak Fusion Test Reactor (TFTR), programed for operational tests during 1981. A demonstration fusion power reactor is planned by the late 1990s. *(Details regarding the TFTR are given later in this article.)*

CLIMACTIC MOMENT. Distinguished guest speakers earned standing ovations and students showed that they appreciated visits to more than 25 laboratories as well as other featured events. The most exciting moment for virtually all participants, however, came at an elaborately staged banquet in the Fort Monmouth Officers Club when the announcement was made of the names of five students whose presentation of papers on their research projects won them a 29 July through 9 August trip to London, England, to participate in the International Youth Science Fortnight.

U.S. Army Materiel Development and Readiness Command Deputy CG for Materiel Development LTG Robert J. Baer announced the winners. To each of them he presented a Certificate for Excellence bearing his signature and that of COL Simkus as ARO commander, along with memento pen and pencil sets. He also presented wall plaques bearing the ARO crest to be mounted in the trophy rooms of the students' high schools.

Chosen by a panel of Army senior scientist judges, the five winners were picked from 41 presenters—one of five students representing each of 41 regional JSHS selected to attend the national symposium. Nearly 8,000 students participated in the 41 regional symposia.

Winners and titles of their papers are: *Ethan Lavan*, 17, senior, Evanston (IL) H.S., An Error Minimizing Numerical Solution of the Three-Body Problem; *Robb S. Harvey*, 17, senior, Waverley (TN) H.S., A Physiological Study of the Effects of Microwaves on Corn; *Lisbeth R. Gibson*, 18, senior, F. T. Wills H.S., Smyrna, GA, Synthesis and Uses of Crown Ethers; and

Emily Chen, 18, senior, Ames (IA) H.S., A Study of Antigenicity by Lymphocyte Trapping in the Lymph Nodes of Rats; *Anthony M. Sarra*, 18, senior, St. Thomas Aquinas H.S., New Britain, CT, Holographic Recording on Photoplastic Devices: A Re-Usable Recording Medium.

Dr. Edward L. Pizzini, JSHS Program regional director in Iowa and a faculty member, Department of Science Education, University of Iowa, won a trip to London as escort officer for the students. Each of the 41 regional directors had this opportunity and the luck of the draw of a high card from a deck determined the winner.

Loch Ness Monster: Yes, No? MG John K. Stoner Jr., commander of the U.S. Army Communications and Electronics Materiel Readiness Command, commented as toastmaster at the banquet on the "scientific explosion" in the complex methodology and equipment used in recent years in the search for the Loch Ness Monster in Scotland.

In introducing Dr. Rines as guest speaker on this search, MG Stoner commented that Rines had been stationed at Fort Monmouth in 1943 and that he is now renowned as a scientist, inventor (holder of more than 50 patents), lawyer, and in recent years as leader of the search expeditions.

With the increasing cooperation of the scientific community in the United States and England, Dr. Rines said, "We think we are very close to solution of the mystery of the Loch Ness Monster, maybe this summer or

early next year . . . . We have credible science solidly behind us now . . . ."

Many photographic slides taken with the aid of the most sophisticated cameras currently available were used by Dr. Rines to support his belief that some large form of life exists in the deep (more than 1,000 feet), extremely cold and inky black waters of Loch Ness. There remains little if any doubt, he said, that there is a sound basis for more than 350 reported sightings of the "monster," and that science will solve the mystery.

Geology, Climatology and Biology of Mars. Dr. Herb Frey used many pictures from NASA space flights to make this subject highly fascinating. The 32-year-old former instructor, and since 1972 research associate in the University of Maryland astronomy program, also has been a research associate since 1972 in the planetology and geophysics branches of the NASA/Goddard Space Flight Center.

Dr. Frey's growing reputation as an expert and highly fluent speaker on NASA's space program is supported by 25 publications in professional journals as an author or coauthor. Much of his NJSHS address was based on his 1978 publication, Rift Valley of Mars and Earth: Structural Comparisons and Implications, which appeared in Lunar and Planetary Science IX.

Dr. Frey discussed the NASA studies of the comparative crustal evolution and changes that have taken place there as well as on the Earth, Venus and Mercury over periods of millions of years. The plate tectonics involved, he said, have theoretically been traced over billions of years—for example, about four billion years, with respect to the moon surface.

Seasonal changes take place on the surface of Mars in much the same way as on Earth, Dr. Frey said. Today Mars' surface is "incredibly dry" but evidence gleaned from studies of NASA photos shows that water existed there perhaps 500 million years ago or longer.

Earth temperatures currently are decreasing worldwide, Dr. Frey commented, and this is of concern to atmospheric scientists who are aware that a shortening of the growing season in some regions "could lead to food shortages"due to greatly decreased production.

Is there some form of life existent on Mars? In the opinion of Dr. Frey, that "remains to be determined. More important," he said, "is that NASA studies are helping us to learn more about our Earth and the evolutionary changes that are taking place . . . ."

Monmouth College President Dr. Richard J. Stonesifer was host to the opening session following introductory comments by COL Simkus. Dr. Stonesifer's brief welcoming address made reference to the Fort Monmouth area being regarded by World War I President Woodrow Wilson as the Summer White House, and it was there that he died. Monmouth College has a Woodrow Wilson Hall. Dr. Stonesifer also stressed the importance of scientists being deeply interested in the cultural arts of "the Humanities."

Dr. Keith Berry, chairman of the Department of Chemistry at the University of Puget Sound in Washington, spoke on a subject new in the annuals of the NJSH program, Crime, Science and Other Life and Death Matters. Introduced by ARO Commander COL Simkus as an expert who has long studied the part scientists may be called upon to play in testifying in cases where their opinions often influence juries in verdicts, Dr. Berry has served as a consultant to law enforcement officials and also to defense attorneys.

Dr. Berry stressed that scientists are morally obligated as witnesses to testify with complete honesty and without bias. He cited a number of notable cases where abuses occurred due to analytic carelessness and incompetence in establishing critical decision factors.

Dr. Walter S. McAfee presided at the second session and introduced MG Hillman Dickinson for comments on the Electronics R&D Command role in developing Command, Control and Communications (C^3) to meet modern battlefield requirements, including interoperability of components for Army, Navy and Air Force Requirements.

Conferees then were divided into groups for escorted tours through 26 laboratories at Fort Monmouth, with senior scientists giving briefings in each. Buses transported the participants for additional laboratory visits at the U.S. Department of Commerce National Oceanic and Atmospheric Administration's National Marine Service Northeast Fisheries Center at Sandy Hook, NJ. They were briefed on the national research program to protect and to preserve marine life resources against disease and pollution.

Princeton University Program. Brookdale Community College near Fort Monmouth was host to a breakfast and laboratories tour, with President (Dr.) Donald H. Smith making the welcoming remarks, prior to the bus trip to Princeton University. Dr. Robert Jahn, dean of the Princeton School of Engineering, welcomed the group, speaking briefly on the University's outstanding facilities for engineering students.

Director (Dr.) Irvin Glassman of the Princeton Center for Environmental Studies described high points of the ongoing program, including the search for new sources of energy for 1990-2000 and beyond. The Plasma Physics Laboratory has more than 1,000 employes and in recent years has been funded by about $100 million a year support by the Department of Energy (formerly the Energy R&D Administration).

Tokamak Converter Construction. Following the showing of a film depicting successive development of plasma fusion systems for generation of electric power, including the $239 million Tokamak system expected to be operational for testing in late 1979, Anthony R. DeMeo answered questions as the Plasma Physics Laboratory information officer.

The Tokamak Fusion Test Reactor (TFTR) is the result of about 25 years progressive developmental effort on plasma fusion at Princeton University. It is estimated that the deuterium-tritium fuel must be heated to about 100 million degrees Celsius (more than six times the heat at the center of the sun) for successful generation of electric power. The TFTR is the first device to use this fuel source.

Located on the James Forrestal Campus, three miles from the Princeton main campus, the Plasma Physics Laboratory is expected to be capable of demonstrating practical fusion power by the late 1990s.

Envisioned benefits are described as: • An effectively inexhaustible supply of fuel; no possibility of nuclear runaway; no chemical combustion products; • Materials and byproducts which are not suitable for diversion to the production of nuclear weapons; low amount of radioactive byproducts with significantly shorter half-life relative to fission (normal nuclear) reactors.

Designed to provide experience in solving engineering problems associated with large fusion reactors, the TFTR will have components and techniques as close to present technological capabilities as is practical to ensure test operation by 1981; relevance of the technical approach to future devices is maximized within cost and risk-level constraints; emphasis is on experimental flexibility; since tritium is radioactive, the inventory will be minimized by using a simple and reliable handling system; power densities will approach those required for a fusion power practicable reactor.

CHEMISTRY IS FUN! That was the theme of a presentation that provided, as evidenced by exuberant acclaim, the high point of the 16th NJSHS. Prof. Emeritus Dr. Hubert Alyea titled his address, The Wonders of Chemistry, and his demonstration, as he circulated rapidly between three tables to set off laugh-producing reactions, was punctuated by rapid-fire verbal humor that kept his audience in an uproar of empathy.

Actually, the former Nobel Institute student and National Research Council Fellow at the University of Minnesota and the Kaiser-Wilhelm Institute in Berlin, was demonstrating how many of the greatest discoveries in chemistry came largely by accident. Dr. Alyea obtained his BS degree from Princeton in 1925 and returned to earn his doctorate in 1928. He became a professor there in 1930 and remained at Princeton for his entire career.

Eight Seminar Sessions concluded the program prior to the awards banquet. The distinguished speakers and their subjects were: Alternative Views of Consciousness, Dr. Karl Nice; Medical Studies of Naturally Occurring Toxins, LTC James Vick, Office of the Surgeon General representative to NATO; Jaws—New Surgical Techniques, Dr. Sherwood Wolfson; Entropy and the Self-Regulation of Natural Geologic Systems, Dr. Maynard Miller; Who Is in Charge, or Who Shall Play God?, a discussion of the pros and cons of genetic engineering through DNA techniques by Dr. T. R. Porter; Energy Crisis, Dr. Robert B. Gaither; The Voice-Controlled Motorized Truck, COL John G. Chiarella; Recent Surprises in Genetics—What in the World is a Gene?, Dr. Thomas Klein; Computer Science, Dr. Stuart Carl Schwartz; Alternative Power Sources, Dr. Robert C. Axtmann.

CHEMISTRY IS FUN, presented by Princeton Prof. Emeritus Dr. Hubert Alyea, was a high point of the 16th NJSHS, as he demonstrated how many of the greatest discoveries of chemistry came largely by accident.

ISEF Army Superior Award winners, flanked by DARCOM DCG for Materiel Development LTG Robert J. Baer (left) and ARO Commander COL Anthony P. Simkus, are Charles E. Sauls, Anthony N. Sarra, Carlos Ortiz, Paul J. Hoehner, Peter A. Sandborn, Mary E. Kroening, Perry J. Damiani, Andrew Zupan, Pamela L. Epstein, Craig S. Gawlas and Robert O. Hamburger.

22 ISEF Army Winners Receive Trips, Summer Jobs

Twenty-two high school students were selected by Department of Army judges as Superior and Meritorious Award winners from more than 450 finalists who exhibited science/engineering projects at the 29th International Science and Engineering Fair (ISEF), Anaheim, CA.

Operation Cherry Blossom. Among Army Superior Award winners was *Paul J. Hoehner,* 17, Lutheran H.S. North, Mt. Clemens, MI, who will receive an expense-paid trip to Tokyo, Japan, for the 22d Annual Japan Science Awards Program in January 1979. Paul was selected for his presentation of "Intracardiac Conduction Alterations During Hemorrhagic Shock."

Army alternate for the trip is *Mary Elizabeth Kroening,* 18, Clairemont H.S., San Diego, CA, who was chosen as a superior award winner for her exhibit "CHAOS: Clairemont High Altair Operating System."

The Army has been participating in "Operation Cherry Blossom" since 1963 when it was initiated by the Tri-Services in cooperation with the Japanese newspaper *Yomiuri Shimbun.* The Air Force discontinued sponsoring a student in 1972, and the Navy, since 1977, selects a winner and alternate by a panel of judges independent of the ISEF.

London International Youth Science Fortnight. Army judges selected *Pamela Lynne Epstein,* 15, Merritt Island (FL) H.S., to receive an expense-paid trip to the London International Youth Science Fortnight. Pamela will attend the event this summer, along with five 16th National Junior Science and Humanities Symposium (NJSHS) winners, for her exhibit "An Analysis of Components Affectng Seed Dormancy." *Anthony Nicholas Sarra,* 18, Saint Thomas Aquinas H.S., New Britain, CT, was named alternate for exhibiting "Holographic Recordings on Re-Usable Photoplastic Devices."

The Association of the U.S. Army (AUSA) contributed $100 checks to winners of the Japan and London trips. Superior award winners received Certificates of Achievement, a gold medallion and the choice of an expense-paid trip to, or summer employment at an Army research facility.

LTG Robert J. Baer, deputy commander for Materiel Development, U.S. Army Materiel Development and Readiness Command (DARCOM), presented the awards to Army winners, with the assistance of COL Anthony P. Simkus, U.S. Army Research Office commander.

Army Superior Awards also went to *Robert Owen Hamburger,* 17, Martin Van Buren H.S., Queens Village, NY, for "Localization of Fly Larvae Memory Through Laser Microsurgery"; *Craig Stephen Gawlas,* 18, Waverly (TN) H.S., for "Genetic Control of Tamase Activity in the Submaxillary Gland of the Mouse"; and

Andrew Zupan, 15, Bishop Watterson H.S., Columbus, OH, for "Lyotropic Liquid Crystals and Their Relation to Biological Cell Membranes"; *Perry J. Damiani,* 18, Greendale (WI) H.S., for "The Illaenus-Thaleops Enigma: Determination of a New Species"; *Peter Alan Sandborn,* 18, Fort Collins (CO) H.S., for "Combined Free and Forced Convection"; and

Carlos Ortiz, 15, Luis Llorens Torres H.S., Juana Diaz, PR, for "Extract of *Cordia borinquensis* in Treatment of *Epidermophyton floccosum* Infection"; and *Charles Edwin Sauls,* 16, Tift County H.S., Tifton, GA, for "Diet and the Kairomonal Activity of *H. zea* Frass for *M. croceipes* II."

Army Meritorious Awards, consisting of Certificates of Achievement and silver medallions, went to *David F. Vanable Jr.,* Burrillville Jr.-Sr. H.S., Harrisville, RI, for "The AQ Concept: Valid and Reliable"; *John David Rainbolt,* 18, William Chrisman H.S., Independence, MO, for "*Heliconius cydno* Spermatophores: Chemical Composition and Rate of Incorporation by the Female"; and

Eileen C. Villafane, 17, San Conrado H.S., Ponce, PR, for "Larvicidal Effects of Tropical Plants' Extracts on *Aedes aegypti*"; *Stuart Howard Wolff,* 14, Nimitz Junior H.S., Tulsa, OK, for "Methanol: A Substitute for Gasoline"; *Peter Dau Geiger,* 15 Peachtree H.S., Chamblee, GA, for "Testing Solar Focusing Collectors"; and

Randy C. Elliott, 18, Duncan (OK) Sr. H.S., for "Model Studies of Solar Energy"; *Michael Howard Lev,* 17, Stuyvesant H.S., New York, NY, for "Properties of the Phi-Function"; *Anne Celeste Pfauth,* 18, Marquette H.S., Michigan City, IN, for "Viral Fused L-Cell and Cancer Cell Hybrids: Effects on the Formation, Regression, and Prevention of Leukemia and Lung Cancer"; and

Morgan N. Hardy, 18, Roy (UT) H.S., for "Effects of Pollution on Halobacterium Halobium in the Great Salt Lake"; *Andrew Alan Papp,* 17, Harrison H.S., Farmington Hills, MI, for "Investigation of Electron Microscopy"; and *Nicole VanDerHeyden,* 18, Murray (UT) H.S., for "Genetic Variation of the Lethal Ear-Tuft Trait in Araucana Fowl."

U.S. Army participation in this year's ISEF was arranged by the U.S. Army Research Office (ARO), Research Triangle Park, NC. Mrs. Anne G. Taylor was ARO action Officer; Dr. Gordon L. Bushey, DARCOM, was chairman of the Army Panel of Judges.

LABORATORY PERSONNEL Panel of Judges. Front row (l. to r.): Dr. Richard M. Carlson, Dr. Grant Gerhart, Dr. Ivan R. Hershner Jr., Dr. Gordon L. Bushey. Middle row: Dr. Michael Kaplan, Dr. Don D. Banks, Dr. Neil McCormick, COL Anthony P. Simkus, Dr. Ronald Liston, CPT Lamont W. Law. Back row: Dr. L. R. Shaffer, LTC Carl E. Pedersen Jr., Mr. Edward S. Bender, LTC William E. Houston and Dr. Charles E. Williamson.

RESERVE OFFICER Panel of Judges. Front row (l. to r.): LTC John R. Montgomery, COL Aubrey F. Messing, Dr. Gordon L. Bushey and LTC Carlton L. Jimmo. Middle row: COL Anthony P. Simkus, COL Donald R. Brown, MAJ Henry E. Bass, MAJ States M. McCarter, LTC Gerald H. Elkan, COL Lawrence J. Engel and MAJ James V. Mengenhauser. Back row: MAJ William Peters, MAJ Ronald D. Stricklett, COL Harold Zallen, CPT Edward M. Schmidt and COL Roger L. Pendleton.

Equipment Problems Cited . . .

DARCOM Hosts Special Operations Meeting

Potential solutions to equipment support problems of U.S. Army Special Operations Forces were discussed during an 8 June review conference hosted at HQ U.S. Army Materiel Development and Readiness Command, Alexandria, VA.

Participants included management level representatives from the Organization of the Joint Chiefs of Staff, HQ Department of the Army, HQ DARCOM and DARCOM major subordinate commands, U.S. Army Forces Command, U.S. Army Training and Doctrine Command, and the Army Materiel Systems Analysis Activity.

Special Operations Forces, or SOFs, are generally comprised of elements such as the Special Forces, Ranger Battalions, Psychological Operations, and Civil Affairs Units. How to improve the readiness of these activities is an important concern to the Army and the Armed Forces in general.

U.S. Army Materiel Development and Readiness Command Director of Readiness MG Emil L. Konopnicki opened the meeting by stating that he was sensitive to the various disciplines represented by the conferees.

He candidly stated, however, that many of the problems of special operations forces have been self-created because of the manner in which resources have been handled. Lack of resources is no excuse for problems, he added, because resources have not been lacking.

Relative to equipment requirements of special operations forces, the General said that too much emphasis has been placed on nonstandard items. Said Konopnicki: We must learn to stick with standard items—they are often more durable and, in the long-term, create fewer problems.

He appealed to the conferees to establish better priorities and better organization. "Our organizational structure has broken down and, as professionals, we must take steps to improve it," he said.

An overview of the role of the Special Operations Division in the Organization of the Joint Chiefs of Staff was provided by division chief COL Larry Stearns (USA). He emphasized that special operations and unconventional warfare must be a joint Services effort.

Some significant improvements in unconventional warfare and special operations forces have been achieved as a result of a recently concluded study. We are making progress and we are truly oriented worldwide, said Stearns.

Other briefings from JCS Special Operations Division personnel addressed new forward looking actions including the Joint Strategic Capabilities Plan; potential threats; and the program for mutual enhancement of tactical air/missile forces and unconventional warfare forces (collectively known as Project "Bonus Prize").

LTC Carmen T. Scarpino, U.S. Readiness Command, MacDill Air Force Base, FL, presented a detailed report on Project Bonus Prize, and other high priority efforts directed at improving capabilities of range finders and night vision devices. He stressed the following key points regarding Bonus Prize:

- A tremendous potential exists to improve mutual support between unconventional warfare and tactical air and strategic air and missile forces.
- This potential could be more effectively tapped by developing a systematic or analytic approach.
- Currently, we are using an ad hoc approach to develop new techniques and capabilities for improving mutual support.

MAJ John Seymore, U.S. Army Forces Command, explained, in a report on his command's activities, that unconventional warfare and special operations staffs are becoming increasingly limited. It is very important, he noted, that we make the most of what we have to work with.

He added that reserve component forces play an important role in special operations. Requirements for peculiar type equipment also present a problem, particularly from a maintenance aspect.

Much of this "special equipment," he noted, is often outdated, and very bulky to handle. Also, requesting this equipment through normal supply channels is not an easy task. This is an especially severe problem for field detachments. Psychological operations also have encountered problems in obtaining repair parts.

All of these problems, stressed Seymore, definitely impact on our readiness posture. They impact, to a greater degree, on reserve components than on our active components.

Seymore said that improvements could be achieved by establishing a committee to oversee and tie things together and by creating a structure to look more closely at development and acquisition items.

U.S. Army Training and Doctrine Command problems and ongoing actions to solve those problems was the subject of an address by MAJ John E. Mirus. TRADOC's problems, he noted, are similar to those of FORSCOM.

However, said Mirus, TRADOC is now more aware of some of its problems as a result of recent organizational changes. He added that TRADOC hopes to have a full-time unconventional warfare staff officer in the near future, and he called for improvements in operational doctrine.

Special operations equipment problems encountered by the U.S. Army Institute for Military Assistance (IMA) were summarized in a report by LTC Dahlan Doyen. A unique aspect of the IMA is that it can orchestrate actions involving the development and implementation of unconventional warfare doctrine and materiel.

Doyen devoted a large portion of his address to the many equipment items which his organization evaluates for the Army, the Navy, the Air Force and the Marine Corps. These include batteries, electronics gear, solar chargers, and a varied assortment of communications equipment.

He stated that although IMA's requirements are relatively small, it is difficult to give them the visibility and priority they need to achieve adequate funding. If all of the Services could get together, said Doyen, everyone would benefit in acquiring new items and improving maintenance for low density equipment.

Doyen stated that the problems of the IMA are similar to those mentioned in earlier presentations—funding, maintenance, management. He stressed that intensive management actions are required if improvements in maintenance and logistics (obtaining new items) are to be achieved. More action officers, Doyen said, must also get involved in the logistics equipment problems.

The afternoon session opened with a presentation on "Department of the Army Perspectives and Problems," by BG Neal Creighton, deputy director for Operations and Readiness, Office, Deputy Chief of Staff for Operations and Plans.

One of the key equipment problems facing special operations forces, according to Creighton, is the need for a systems approach and an improved management structure. Special forces, said Creighton, need stronger support at all Army levels because they definitely play a major role in the Army.

He also stressed the importance of Project Bonus Prize in assisting the Services by testing equipment in a joint environment. Shortages and deficiencies in special forces psychological operations, he noted, also impact on readiness.

Mr. Edward C. Nell of the U.S. Army Communications and Electronics Materiel Readiness Command provided a report on problems associated with special operations communications equipment. Age, low density, and lack of demand data were identified as the primary problems.

Nell stated that solutions to problems with the AN/TSC-26 Communications Central and the Radio Set AN/GRC-109 can be dealt with by short-term or long-term solutions. The short-term approach is to overhaul the equipment and the long-term solution is to replace it.

Similar concerns regarding communications equipment were expressed in a highly detailed status report by Mr. John Montgomery, deputy project manager for Army Tactical Communications Systems, U.S. Army Communications R&D Command.

Mr. William Yehle, Marine and Bridge Branch, U.S. Army Mobility Equipment R&D Command, followed with a briefing on the Military Amphibious Reconnaissance System—a small inflatable boat with a silent propulsion system.

In addition to funding problems, Yehle said that MERADCOM has encountered structural design problems with the boat, and weight, size, and Reliability, Availability and Maintainability problems.

Mr. Leonard F. Campbell, Dr. Herbert Hollander and Mr. Paul Smith, all with the U.S. Army Natick (MA) R&D Command, teamed up for a review of some of the equipment items their

(Continued on page 32)

(Continued from page 31)
command is working on to meet requirements of special operations forces.

Campbell spoke on clothing and equipment and problems associated with developing these items. His main problems, said Campbell, are requirements documents and funds. He noted that clothing programs do not get a very high priority when Army requirements are developed.

He also expressed his concern regarding the time required to get an item into the field. The fielding process is too timely and greater emphasis should be placed on chemical protective clothing and oversnow equipment.

Some of the items he displayed included new camouflage garments for jungle warfare, a new tan heavy duty boot, insulated cold weather gear, and improved water resistant (not waterproof) clothing items.

Relative to food research for the individual soldier, Hollander said that Natick's problems are unique because of Natick's involvement in the DOD food program. He was particularly optimistic about the Meal, ready-to-eat individual combat ration; and the long-range patrol food packet.

Items discussed by Smith included the stage parachute system, the ultra-high-speed container airdrop system, rigid wall shelters, and a foreign language printing press. He indicated that his problems also included funds and requirements documents.

Speaking for the U.S. Army Materiel Systems Analysis Activity, COL Albert DeProspero summarized some of the symptoms and problems of the special operations community.

Individual soldier needs have suffered, said DeProspero, because Army R&D has placed so much emphasis on armor, antiarmor combat vehicles, artillery and aircraft communications. The real problems are requirements, credibility and priorities.

DeProspero indicated that a potential solution is to develop dedicated staffing at all decision and coordinating levels in the Army to monitor and expedite requirements. This approach, he said, should also apply to the other Services for joint requirements.

The meeting concluded with a questions and answers discussion session led by COL Edmund A. Thompson, HQ DARCOM point of contact for Special Operations Forces and Actions.

Remote Sensing Technology . . .

International Meeting Draws Over 800 Conferees

America is the world leader in remote sensing technology, according to Dr. Lewis E. Link Jr., chief of the Environmental Research Branch at the Engineer Waterways Experiment Station.

Link recently attended the 12th International Symposium on Remote Sensing of the Environment held in Manila, Philippines. Over 800 representatives from over 50 countries met for a week to present papers and attend lectures and panel discussions on remote sensing. Link presented papers on "Large Scale Demonstration of Aquatic Plant Mapping by Remote Sensing" and "Problems and Concepts in Remote Sensing of Land Use."

Organized and conducted by the Environmental Research Institute of Michigan and the Natural Resource Management Center, Quezon City, Philippines, the meeting was an effort to bring together leaders in remote sensing technology for information transfer.

According to Link, the U.S. is far ahead of everyone else in remote sensing technology. He noted that many international papers at the Manila meeting relied heavily on U.S. technology and often had American coauthors. He suggested also, that the involvement of American corporations and the AID Program in underdeveloped countries has helped significantly to spread U.S. remote sensing technology. Link believes the Japanese, West Germans and French have the most advanced individual technology for environmental and social applications.

"Remote sensing is not a science," he explained, "it's a data collection tool which employs low altitude aerial photography, high altitude photography, satellite, radar, and infrared imagery." It has been applied to mapping of flood plains, detecting tumors in the body, inventory of crops, roof moisture surveys, energy loss in buildings and pipelines, mineral exploration and land use surveys.

Link also mentioned that several applications were evident in the Jackson-Vicksburg area. Remote sensing has been at Ross Barnett reservoir to study aquatic plant infestations to assist in the planning and application of control measures.

There is also a program initiated in the Vicksburg District to evaluate remote sensing to monitor water pollution due to herbicides and pesticides in rainfall runoff entering Eagle Lake through Steele Bayou. These chemicals, although in harmless amounts in the river, could accumulate over a period of time in the closed lake system to toxic levels.

Link explained that a special color infrared film is being evaluated for the water monitoring tests. Clear water absorbs energy and shows up black on film. Suspended sediments reflect solar energy, recorded on film in varying shades of blue. Heavier sedimentation shows up a brighter blue.

Using techniques developed by the Agricultural Research Service in Oxford, MS, the amount of sediments in the water detected by the color infrared film can provide a rough estimate of the amount of pollutants present.

Lab reports on water pollution levels presently take up to two weeks to prepare. By that time pollutants would have already entered the lake. Remote sensing may provide a way to acquire information on water quality enough to close floodgates in time to prevent the flow of polluted water into the lake.

Link has been involved in remote sensing since 1968. He has attended several international meetings on the subject, and rates the Manila meeting as one of the best. "As a result of the symposium, I have received about 20 requests from foreign countries for more information. And there were papers presented that had information useful to us also. It's a good way to promote international relations as well as to advance remote sensing technology."

Aerospace Medical Panel Convenes at Fort Rucker

Approximately 200 representatives from 12 nations contributed to the success of a recent Aerospace Medical Panel meeting of the North Atlantic Treaty Organization's Advisory Group for Aerospace Research and Development.

Hosted by the U.S. Army Aeromedical Research Laboratory and the U.S. Army Aviation Center, Fort Rucker, AL, the conference featured 66 technical papers devoted primarily to medical aspects of helicopter operations.

Dr. Douglas Busby, deputy air surgeon of the Federal Aviation Administration, told the conferees that as pioneers in the new field of helicopter medicine they are being increasingly relied on to provide solutions to problems which will benefit the civilian and military helicopter aviation community.

USAARL Commander COL Stanley C. Knapp stressed that in-

NATO representatives participating in AGARD Aerospace Medical Panel Meeting included (l. to r.) COL K. Jessen, Denmark; MAJ N. H. Haakonson, Canada; MG H. Grunhofer, Germany; Medecin COL J. Bande, Belgium; Air Commodore N. N. C. Cooke, United Kingdom; COL S. C. Knapp, United States; Medecin General G. Perdriel, France; LTC F. Monesi, Italy; COL C. A. Steendyk, Netherlands; Dr. H. T. Andersen, Norway.

COL Stanley C. Knapp
USAARL Commander

Dr. Douglas Busby
FAA Deputy Air Surgeon

creased use of helicopters has created a need for a better understanding of the unique man/helicopter environment if aviation medicine is to render assistance to the NATO nations.

The opening session of the meeting, titled Medical Aspects of Medical Evacuation and Search and Rescue Operations, dealt with helicopter inflight patient monitoring, resuscitation and support, hoist and rescue missions, and special medical equipment requirements.

Session II, Environmental Aspects of Helicopter Operations, addressed the environmental effects and control of hot and cold climate operations, the acute and chronic effect and control of helicopter vibrations, and cockpit toxicology. The third session dealt with crew fatigue and its causes.

Human Factors of Helicopter Design and Operations was the theme of the fourth session, which included discussions of cockpit design, instrument configuration, aircrew workload, performance measurements, combat operations under primitive or cold conditions, and sustained operations in support of ground combat operations.

Two concluding sessions were comprised of papers dealing with Visual and Acoustic Aspects of Helicopter Operations, and Safety Aspects of Helicopter Design and Operations.

The AGARD Conference Proceedings on Operational Helicopter Aviation Medicine are expected to be available for public distribution from the National Technical Information Service in the fall of 1978.

Awards . . .

Patience Personified . . .

Inventor Wins Cash Award After 10-Year Wait

Keith Williams

The age-old adage that "good things come to those that wait" might properly be applied to Mr. Keith Williams of the U.S. Army Rock Island Arsenal.

Ten years ago, Williams invented a device called a muzzle flash suppressor for gatling-type machineguns and, until recently, it appeared that his only reward would be a U.S. patent certificate and the standard $150.00 compensation.

A general engineer with the Army Armament Materiel Readiness Command, Williams was initially given the task of evaluating the muzzle flash suppressor for use on the M134, 7.62mm minigun on the Cobra helicopter.

As he studied the device—which is intended to disperse the gases and particles that collect and ignite in front of high fire rate weapons—he realized that he could design a more efficient, less expensive model.

He eventually came up with a device that could be cast as one piece, rather than the numerous individual parts comprising the suppressor under evaluation. He also designed a special nut and bolt which made his device self-loading and safer.

Williams' suppressor was adopted by the Army for at least five different minigun systems. However, he received no cost savings award because the Army had not purchased any other type of suppressor for the miniguns.

Then, last fall, he learned that the Air Force, which now uses his suppressor for three different systems, had previously used the original, more expensive model. Following a thorough investigation, it was determined that Williams' device was actually $34 per unit cheaper than the first model.

The total savings to the government amounted to $102,113—and Williams was eligible for a cost savings award. He subsequently received a $1,055.00 check for cost savings resulting from the 10-year-old invention.

Gold, Silver Pins Presented . . .

Natick Cites R&D, Administrative Accomplishments

Gold and silver pins recognizing achievements in research, engineering and administrative support were presented recently during annual awards ceremonies at the U.S. Army's Natick (MA) R&D Command.

The Technical Director's Gold Pin for Research was presented to Dr. Frederick M. Robbins, Mr. Samuel H. Cohen, Mr. John E. Walker and Mr. Ronald A. Segars, all employed in Natick's Food Sciences Laboratory.

They were cited specifically for experiments which demonstrated potential benefits of proteolytic enzymes from animal spleen in tenderizing and fabricating meat items and for establishing a technology base for foods and biomedical purposes.

Dr. David C. Sternberg, also of the Food Science Laboratory, received the Technical Director's Silver Pin for Research. He was cited for devising a method for increasing cellulase production by increasing the cellulose level with Ph control in a Trichoderma reesei culture; and for research of B-glucosidase in cellulose saccharification.

Mr. John L. Secrist, Mr. Walter J. Fitzmaurice and Mr. Robert L. Scott, all assigned to the Food Engineering Laboratory, received the Technical Director's Gold Pin for Engineering and the 1977 COL Rohland A. Isker Award from the R&D Associates for Military Food and Packaging Systems, Inc.

They were recognized for development of a new process for improving the texture of less costly cuts of veal, pork, beef and lamb. The process, termed flake cutting, is used to duplicate the texture of more expensive muscle meat items, all at a potential cost savings of 40 to 50 percent.

The Technical Director's Silver Pin for Engineering was shared by Dr. Carolyn D. Bensel, Clothing Equipment and Materials Engineering Laboratory, and Mr. Thaddeus S. Bonczyk of the Food Engineering Laboratory.

Bensel was recognized for innovative human factors research on combat clothing and life support equipment systems. Bonczyk was cited for conceiving, designing and implementing a field kitchen and a sanitation system for future use by the U.S. Marine Corps.

CPT Ronald D. Acuff and CPT Kirk A. Weber were selected as co-winners of the Commander's Annual Military Award for Research, Development, Testing and Evaluation.

Acuff, an R&D coordinator in the Clothing, Equipment and Materials Engineering Laboratory, developed a comprehensive Department of Defense technical plan on chemical protective ensembles. The plan will reportedly enhance survivability of combat personnel.

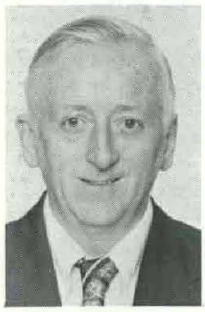
Weber won recognition for nutritional research on military food prototypes and for determining protein qualities of various foods using rapid, easy-to-follow techniques.

Mr. William J. Baxter, chief, Supply and Storage Office, was awarded the Commander's Gold Pin for Leadership in Administration. He was cited for management of Natick's supply system, the Army Stock Fund Program and for supply support.

The CO's Silver Pin for Administrative Leadership was won by Mr. Dennis Gordon, chief, Quality Assurance Management Section, for his direction of Natick's Product Assessment Program.

Gold Pins for Installation Support were also presented to Mr. William M. Stall for accomplishments in the Supply and Storage Office, Mr. Harvey Picconi for mechanical work, Mr. Elias Whitman for technical information services, and Mr. Victor A. DeMilia for design and fabrication of specialized packages.

Gallivan Honored by Testing and Materials Society



James P. Gallivan

Mr. James P. Gallivan, a materials engineer at the U.S. Army Materials and Mechanics Research Center, Watertown, MA, has been named a Fellow and selected to receive an Award of Merit from the American Society for Testing and Materials.

Cited for outstanding contributions to the advancement of voluntary standardization, Gallivan is considered a pioneer in the program of replacing government standards and specifications with nongovernment documents for commercially available materials.

He is a senior member of AMMRC's Specifications and Technical Data Branch, Engineering Standardization Division, and has more than 20 years of experience in the standardization field. Gallivan also heads the metals portion of the materials program assigned to AMMRC under the Defense Standardization Program.

He holds graduate and undergraduate degrees from Boston College, is a member of the Society of Automotive Engineers, and is active on several committees of the American Society for Testing and Materials.

AVRADCOM Major Receives Doctor of Science Degree

MAJ Daniel P. Schrage, a member of the Systems Development and Qualification Division, U.S. Army Aviation R&D Command, recently received his doctor of science degree from Washington University, St. Louis, MO.

In his assignment with AVRADCOM, Schrage has been responsible for engineering support in the areas of aerodynamics, performance stability and control, and aerolastic stability of new Army rotary wing developments and airworthiness qualification of new and modified Army aircraft.

Schrage's doctoral thesis is entitled "Effect of Structural Parameters on Flap-Lag Forced Response of a Rotor Blade in Forward Flight." The thesis reports on research conducted to obtain a better understanding of the structural coupling parameters that contribute to rotor blade response and stability in forward flight. The new methodology established by Schrage's research will reportedly be a valuable tool for rotary wing design engineers.

MAJ Daniel P. Schrage

Earlier, Schrage obtained a master's degree in business administration from Webster College, St. Louis, MO. He is also a graduate of Georgia Tech where he received a master's degree in aerospace engineering, and is a graduate of the United States Military Academy.

Herman Elected as President of Nutrition Society

COL Robert H. Herman, chief, Department of Medicine, Letterman Army Institute of Research, has been elected president of the American Society for Clinical Nutrition.

Prior to his election to this office, COL Herman served for five years as editor-in-chief of the American Journal of Clinical Nutrition, and has been regarded as a leader in the field of nutrition.

He is a Fellow of the American College of Physicians, a Diplomate of the American Board of Nutrition, a Fellow of the Royal Society of Health (England), and holds a class "A" prefix awarded by the Surgeon General for outstanding military physicians. In addition, COL Herman is listed in *American Men of Science, Leaders in American Science,* and *Who's Who in the West.* He is credited with over 130 scientific publications.

COL Herman joined the Army in 1953 after graduating from the University of Illinois Medical School. Following graduate study at the University of Pennsylvania, he worked as an investigator at Walter Reed Army Institute of Research until 1965, when he became chief of the Metabolic Division at the Army Medical Research and Nutrition Laboratory in Denver, CO. He was appointed chief, Department of Medicine when the unit moved to San Francisco in 1974, to become part of the Letterman Army Institute of Research. COL Herman will succeed Dr. Jules Hirsch of the Rockefeller Institute, NY, as president of the society.

Personnel Actions . . .

President Appoints New VCofSA, FORSCOM CG

GEN Frederick J. Kroesen

LTG Robert M. Shoemaker

Presidential approval of GEN Frederick J. Kroesen, former commander of the U.S. Army Forces Command (FORSCOM), as the new Army Vice Chief of Staff, and appointment to 4-star rank and assignment as FORSCOM commander of LTG Robert M. Shoemaker, has been announced by Secretary of Defense Harold Brown.

Commissioned through the U.S. Army Infantry Officer Candidate School in 1944, Kroesen holds bachelor's and master's degrees in international affairs from George Washington University, and has completed the Army Command and General Staff College, Armed Forces Staff College, and the Army War College.

Prior to assuming command of FORSCOM in 1976, he had served assignments as commander of VII Corps and deputy commander V Corps in Germany; commander, 1st Regional Assistance Command, Vietnam; and commander, 82d Airborne Division, Fort Bragg, NC.

Kroesen was also the last commander of the 23d Infantry Division (Americal) in Vietnam during 1971, following tours in the Office, Assistant Chief of Staff, Force Development, Washington, DC, as director of Manpower and Forces and as chief, Information and Data Systems.

He is a recipient of the Distinguished Service Medal, Silver Star with Oak Leaf Cluster (OLC), Legion of Merit with two OLC, Distinguished Flying Cross, Bronze Star Medal with "V" device and two OLC, Air Medal with 29 OLC, Army Commendation Medal with two OLC, and the Purple Heart with OLC.

Shoemaker assumes his new title as FORSCOM commander following service since 1977 as FORSCOM deputy commander. He is a 1946 graduate of the U.S. Military Academy, and has completed requirements at the Army Command and General Staff College, Army War College, and the Army Infantry School.

During 1970-75, he served consecutive assignments at Fort Hood, TX, as deputy commander and chief of staff, III Corps; deputy commander, MASSTER (redesignated TCATA-TRADOC Combined Arms Test Activity); and commander, 1st Cavalry Division, Airmobile (TRICAP).

Other assignments have included assistant division commander and chief of staff, 1st Cavalry Division (Airmobile), Vietnam; and assistant and later chief, Plans and Programs Division, Office of the Director of Army Aviation, Office, Assistant Chief of Staff for Force Development.

Shoemaker's military honors include the Distinguished Service Medal, Silver Star with OLC, Legion of Merit, Distinguished Flying Cross, Bronze Star Medal, Air Medal, Army Commendation Medal with OLC, and Combat Infantryman Badge (2d award).

Burnell Selected as Deputy Chief of Engineers

MG Bates C. Burnell

MG Bates C. Burnell has been named as U.S. Army deputy chief of Engineers, Office, Chief of Engineers, following service since 1977 as assistant deputy chief of staff for Logistics (Army Security Assistance), Office, Chief of Staff for Logistics.

Graduated from the U.S. Military Academy, Burnell holds an MS degree in civil engineering from the Massachusetts Institute of Technology. He has completed the Command and General Staff College, the National War College and the Engineer School basic and advanced courses.

During 1975-77, Burnell served as director of Military Construction, Office, Chief of Engineers, Washington, DC, following a tour of duty as commander of the U.S. Army Ballistic Missile Defense Systems Command, Huntsville, AL.

Other key assignments have included commander, U.S. Army Safeguard Systems Command and deputy Safeguard manager, Safeguard Systems Command, Huntsville, AL; division engineer, U.S. Army Engineer Division, Huntsville, AL; and deputy division engineer, Army Engineer Division, Huntsville, AL.

Burnell has more than 32 years of active military service and is a recipient of the Legion of Merit with two Oak Leaf Clusters (OLC), the Bronze Star Medal with two OLC, the Air Medal and the Army Commendation Medal.

Hauser Succeeds Maus as ARI Commander

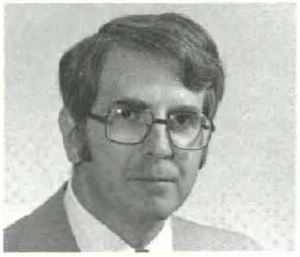
Col William L. Hauser has succeeded COL William C. Maus as commander of the U.S. Army Research Institute for the Behavioral and Social Sciences. COL Hauser comes to this assignment from membership on the Review of Education and Training for Officers (RETO) Study Group.

COL Hauser recently served in Germany as deputy commander and chief of staff of the Seventh Army Training Command and earlier as commander of the 3d Infantry Division Artillery. Before going to Europe, he was chief of the Enlisted Personnel Management System (EPMS) Task Force while assigned to the U.S. Army Military Personnel Center.

COL Hauser holds a master's degree in history from the University of Southern California and has done other graduate work at the University of Singapore and the University of Michigan. As a research associate at Johns Hopkins University in 1972, he published a book entitled *America's Army in Crises*.

Walker Takes Over as DARCOM Deputy Comptroller

Mr. Arthur T. Walker, former deputy for Resource Analysis in the Office, Assistant Secretary of the Army (Installations, Logistics and Financial Management), has assumed new responsibilities as deputy comptroller, HQ U.S. Army Materiel Development and Readiness Command.



Arthur T. Walker

Graduated with a bachelor's degree in commerce from Loras College in 1958, Walker also holds a master's degree in business administration (comptrollership) from Syracuse University and has completed course requirements at the Industrial College of the Armed Forces.

He began his federal civilian career as a management intern with the U.S. Army Ordnance Corps, followed by an assignment as an ammunition storage specialist at the Blue Grass Army Depot.

Walker has also served as chief of the Sub House Office for the U.S. Army Europe, in the Office of the Director of the Army Budget, and in the Budget Office of the Army Materiel Development and Readiness Command.

DARCOM Names Hochheimer as Acting PDS Director

Mr. L. Wm. Hochheimer has been appointed acting director of the Plans, Doctrine and Systems Directorate, HQ U.S. Army Material Development and Readiness Command, following the reassignment of Mr. Robert C. Hawlk to the Office, Deputy Chief of Staff for Logistics, Department of the Army.

L. Wm. Hochheimer

Formerly assigned as DARCOM deputy director of Plans, Doctrine and Systems, Hochheimer served earlier in the Requirements and Procurement Directorate; under the deputy commander for Materiel Acquisition; and as chief of Procurement Policy, Directorate for Procurement and Production, HQ Army Materiel Command.

Other career assignments have included chief of Procurement Operations, HQ Continental Army Command; chief, Procurement Inspections Branch, Logistics Inspector General Field Office, Oakland, CA; and contract negotiator and contract officer, Japan Procurement Agency, Yokohama, Japan.

Hochheimer holds a BA degree in finance and law from the University of Southern California, an MSBA degree from George Washington University, and he is a graduate of the Industrial College of the Armed Forces.

Reader's Guide...

New Pamphlet Explains DARCOM Organizations

Missions, organizational elements, and services of the U.S. Army Materiel Development and Readiness Command are explained in a new 32-page booklet, titled *This is DARCOM* (DARCOM Pamphlet 360-1).

Available from HQ DARCOM Public Affairs Office, Alexandria, VA, the document is intended for use as a quick reference source in identifying DARCOM's 16 major subordinate commands and their locations and functions.

This publication also contains discussions of DARCOM schools, laboratories, other installations and activities, program/project/product management system, and the DARCOM reserve component support function.

DARCOM is responsible for life cycle materiel functions formerly performed by six of the Army's seven technical services (Ordnance, Signal, Quartermaster, Engineer, Transportation, and Chemical)—including R&D, test and evaluation, procurement and production, storage and distribution, inventory management, maintenance and disposal.

DARCOM monitors an annual expenditure of approximately $13 billion and directly employs about 9,900 military and 107,400 civilian personnel. Inventories of about $12 billion (CONUS depots), $5 billion (on order from procurement), and $17 billion (ammunition and other major items in the hands of troops or overseas depots) are managed by DARCOM.

WES Publishes Report on Prefabricated Structures

Precast Concrete Elements for Structures in Selected Theaters of Operations, Technical Report C-78-1 is the title of a new publication prepared by the U.S. Army Waterways Experiment Station, Vicksburg, MS.

The report reviews the current state-of-the-art of design, fabrication, and erection techniques of various prefabricated elements for concrete structures. Specific discussion topics include precast concrete highway bridges, logging bridges, piles, culverts, and pipes.

Also presented, are designs for two precast concrete military bridges capable of supporting military Heavy Equipment Transporters. These bridges can be easily transported to the construction site by existing military equipment.

Copies of this publication may be obtained from: Department of Commerce, National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22151. Additional information relative to costs may also be obtained, upon request, from NTIS.

People in Perspective . . .

Cost Effectiveness Questioned . . .

Scientist Examines Realities of Solar Energy Use

ATMOSPHERIC SCIENTIST Dr. Oskar M. Essenwanger makes a point about solar energy while viewing an exhibit at the Alabama Space and Rocket Center in Huntsville, AL.

Do you believe that you can save great sums of money by installing a solar energy system in your home? Do you believe that the benefits of solar energy far outweigh conventional systems? If your response to one or both of the preceding questions is yes, you haven't heard of Dr. Oskar M. Essenwanger!

Who is Dr. Oskar M. Essenwanger? Dr. Essenwanger is an atmospheric scientist at the U.S. Army Missile Research and Development Command, Redstone Arsenal, AL. Incidentally, he is also an adjunct professor of environment at the University of Alabama.

However, his most recent claim to fame—and the one which should interest you the most—is his storehouse of facts concerning the realities of solar energy.

According to Essenwanger, if you installed a solar heating system in your home the money you saved on utility bills would not begin to offset what you paid to install the heating system today. The cost would still far exceed any potential savings even if you used a backup conventional gas or electric heating system.

In a recently presented technical paper, he argues that knowledge of regional climatic conditions is necessary to design a good solar heating system. "These conditions determine the size of the system's collector and storage areas," he says.

Essenwanger emphasizes that as long as engineers are not given the climatic conditions to design for, they cannot come up with an efficient solar energy system.

He has collected hourly climatological data for the Huntsville, AL, area for the past two winters. Using this data, Essenwanger has determined that a solar system in the Huntsville area would require a 27-day storage capacity.

This large storage requirement, says Essenwanger, makes solar heating in Huntsville very impractical. In fact, such a system would require a tankful of water the size of a basement and would cost about ten to fifteen thousand dollars.

Even if solar energy systems were installed in many homes along with conventional gas or electric heating systems, all would run out of solar energy at the same time, thus generating a peak load on the utilities. It would be similar to a hot day in New York when everyone puts on their air conditioner.

Although research on collecting climatological data is now beginning, it still takes from five to ten years to get sufficient information on which to base a solar heating design.

According to Essenwanger, most solar heating system designs are based on mean values of solar radiation, or in other words, on the amount of sunshine available on an average winter day. An efficient design, he says, cannot be based on mean values.

Recently the nation observed "Sun Day" to draw attention to the potential of solar energy. It rained in many parts of the U.S. on that particular day. Says Essenwanger: "Solar Energy enthusiasts should have learned a lesson from this. People can declare a Sun Day, but only nature can give us a sunny day!"

Army R&D — 15 Years Ago

The Army R&D Newsmagazine reported on . . .

Army Plans Ultramodern Night Vision Laboratory

Sanitation standards far surpassing those of a Swiss watch factory will prevail in "clean rooms" of the U.S. Army ultramodern night vision research facility to be constructed at Fort Belvoir, VA, within the next 18 months. Bids on the $1.75 million building are to be opened this month.

Super cleanliness is essential to rigidly controlled conditions for experiments on three types of night viewing systems under development by the U.S. Army Mobility Command Engineer Research and Development Laboratories. These are infrared, image intensification and battlefield illumination.

Clean or "white" rooms, occupying only a portion of the dust-free design building, are separated into four categories of progressively higher sanitation requirements. The purpose is to avoid contamination of materials used in solid-state research—crystalline, luminescent and photosensitive.

Sanitation standards also will call for extensive use of stainless steel or porcelain enamel partitions and solid glass ceilings through which light will filter from the plenum chambers.

AMC Changes Industrial Information Program

Substantial improvements in the U.S. Army Materiel Command scientific and technical information program are being made by consolidation and coordination of related programs for keeping industry informed about research and development requirements.

Five programs established by the Technical Services and the Office of the Chief of Research and Development have been consolidated into three areas of effort.

Uniform policy has been applied to combine the U.S. Army R&D Problems Guide, the Qualitative Developments Requirements Information, and the Army Study Requirements into a single program. The revised approach is patterned along the lines of the Qualitative Developments Requirements Program established in 1958 by the Ordnance Corps.

Army Plans Career Program for Scientists

Revised scheduling, occasioned by the major reshuffling of personnel in the 1962 general reorganization of the Army, has deferred until the close of FY 1964 the full-scale operation of the "Civilian Career Program for Scientists and Engineers."

Intended to apply to employes in grades GS-5 up through the top level, the program will cover a wide range of professional skills, including all the major engineering fields, the Life Sciences, Physical Sciences, Environmental Sciences—and even landscape architects.

Administrators of the program have emphasized that the present plan is the culmination of prolonged and extensive studies, and that it has been developed in conjunction with a steering committee of top-level scientists, engineers and personnel specialists.

Laser Rangefinder Passes Field Tests at Fort Sill

Successful testing of a lightweight (35-pound) battery-powered laser rangefinder developed by Frankford Arsenal, Philadelphia, PA, was conducted recently at Fort Sill, OK, the U.S. Army Munitions Command has announced.

Concurrently, the rangefinder was demonstrated to LTG John P. Daley, leader of the Combat Developments Command, along with representatives of the Artillery School and the Artillery Combat Development Agency.

Army Orders Test Models of S-64 'Flying Crane'

Concept testing models of the Sikorsky S-64, the largest helicopter ever developed in the U.S., have been ordered by the U.S. Army.

Officially termed "Skycrane," the craft has a bubble cockpit in front and a high backbone. The customary cabin has been eliminated from the design to allow the helicopter to carry the widest variety of loads.

Subsequent to the order for six aircraft, at a total cost of about $13,500,000, the Army tested a leased model. Army officials said results were highly satisfactory. In September the leased model again will be used for testing over a 2-month period.

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DARCOM Commander Endorses Usefulness of Value Engineering Approach

Commander of the U.S. Army Materiel Development and Readiness Command GEN John R. Guthrie was a recent luncheon speaker at the 1978 Society of American Value Engineers International Conference in Indianapolis, IN. His audience was comprised largely of members of the Value Engineering Society and industrial contractors. Indianapolis, home of the famed "500" Race, provided appropriate surroundings for this year's theme—"Racing for Value 1978."

Guthrie began his presentation by stating that cost reduction has to be and must be one of the Army's top materiel priorities, and that value engineering is a very important part of that effort.

DARCOM's FY 1978 budget, he noted, exceeds $13 billion, representing some 60 percent of the total Army budget, not including personnel costs. Of this $13 billion, $5.1 billion is for the Direct Army Procurement program.

The General said that his comment emphasizes value engineering early in the acquisition process. When work is conducted in-house, this policy is translated into dollar savings at subordinate commands, depots and project management offices. Studies identify high cost items, systems and operations.

Army contractors, he added, are also encouraged to identify cost drivers in their programs by using the value engineering incentive or program requirements clause in their contracts. This permits them to also share in savings from approved change proposals.

Guthrie noted that DARCOM's policy is to include in all budget estimates and operating budgets that dollars required to pay for in-house value engineering proposals, contractor change proposals, testing and other costs associated with value engineering.

Another important element in DARCOM's value engineering effort, cited by the General, is DARCOM's Value Engineering Program Manager (Mr. Henry S. Mlodozeniec). One of his functions is to assign goals relative to the number of in-house value engineering proposals, contractor proposals and a dollar savings and cost avoidance goal.

Ten project managers were brought into the value engineering program in 1977. These projects include the Patriot missile, the Black Hawk helicopter, the Advanced Attack helicopter and the Munitions Production Base Modernization effort. All have been assigned value engineering goals for 1978.

"Value Engineering is a discipline which applies team work and a systematic analysis of function to remove unnecessary cost from products and practices . . ."—Anonymous

The General noted also that the Army Management Engineering Training Agency, one of DARCOM's schools, now offers several courses in value engineering for managers and procurement personnel.

FY 1976, he said, was the first year in which an attempt was made to measure the command's return on investment in value engineering. Results indicated first year savings of $102 million and cost avoidance at an estimated cost of $7.2 million for a return on investment of 14 to 1.

In FY 1977, $18.2 million was invested which produced first year savings and cost avoidance of $132 million. Although return on investment dropped to 7.5 to 1, Guthrie stated that a more realistic picture of performance was provided.

The $132 million represents 212 percent of the goal. It resulted from almost 1,500 in-house proposals and more than 500 contractor change proposals. Contractor proposals was the only area where performance fell short of expectations.

Guthrie stressed that the FY 1977 dollar savings were the result of applying the value engineering methodology throughout DARCOM operations and to specific systems, such as Dragon, the M60 tank and the TOW antitank missile.

Some specific examples, cited by the General, where value engineering efforts have proven highly beneficial to DARCOM include:

- Hercules Inc., a contractor, submitted a proposal to change packaging specifications for the shipment of M24 solid cannon propellant. The Armament Materiel Readiness Command evaluated the proposal, accepted it and realized FY 1977 savings of $132,000.
- Watervliet Arsenal undertook a study regarding production of oburator spindle pads which are used with the breech mechanisms of the 8-inch howitzer and the 175mm gun. The oburator pads were made of silicone asbestos and required a 14-step production process at a cost of $199.

Watervliet's value engineering study proposed that the pad be made of solid neoprene requiring only a 3-step process and costing $63. The proposal was adopted and the acquisition cost of these items was reduced by $155,000 in FY 1977.

- Preservation requirements for the M60 tank provided another opportunity for applying value engineering. A study revealed that preservative fuels and lubricants could be used to permit these vehicles to be driven on and off flat cars during their transport. About $1.4 million was saved in FY 1977 as a result of this study.

Guthrie noted that "the U.S. Army continues to emphasize that value engineering can be applied to anything, anywhere, as long as the basic functions are performed without reducing essential requirements for performance, reliability, maintainability, standardization and interoperability, safety and quality."

The General stated that value engineering has even been applied by the Army in the area of food. For example, the Natick R&D Command has developed a "flake cut" process of making veal cutlets from entire carcasses. It is estimated to save the Armed Forces $2,750,000 annually.

The DOD, he noted, has also recognized that big dividends in overall lower life cycle costs can be achieved by applying value engineering methodology early in the development cycle. As a result, the Armed Services Procurement Regulations have been modified to require an incentive clause in engineering development contracts of $100,000 and above.

In addressing the Army's standardization and interoperability efforts, Guthrie used the example of the U.S. Roland short-range all weather air defense system. He stated that we must retain interchangeability of selected hardware between U.S. and European versions, referring specifically to field replaceable subassemblies.

It will be a challenge, he said, to apply value engineering to these subassemblies, have it accepted by our French and German associates, and maintain interchangeability.

Concern for maintaining interoperability is part of the broader dilemma of reconciling the need to reduce costs through value engineering or to product improve our systems, while retaining tight control over configuration management.

This consideration, explained Guthrie, can be a source of problems for domestically produced systems but can become even more critical when standardization and interoperability are concerned.

It is important, he continued, to remember that there are differences in configuration management philosophy between the U.S. and the Europeans. A DARCOM Configuration Control Board is responsible for maintaining the integrity of the technical data package.

However, noted the General, on the international level there is no central configuration management authority. Said Guthrie: If we are to reap the benefits of value engineering and maintain standardization and interoperability, this challenge must be overcome.

Furthermore, stressed Guthrie, we must insure that our partners understand, participate in, and benefit fully from value engineering proposals, and reassure them that they remain in control of the design which they developed.

The DARCOM commander concluded his remarks by stating his belief that there is tremendous untapped potential in the contract value engineering program.

(See page 7)