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Medical Service Creates Research Unit-Presidio

Establishment of the U.S. Army Medical Research Unit-Presidio, San Francisco, Calif., with the objective of preventing and reducing military disability caused by selected diseases and injuries, was announced in mid-October.

Commanded by Col Joseph Goldstein, the new unit will be directly responsible to Brig Gen Colin F. Vorder Bruegge, CG of the U.S. Army Medical Research and Development Command, Washington, D.C.

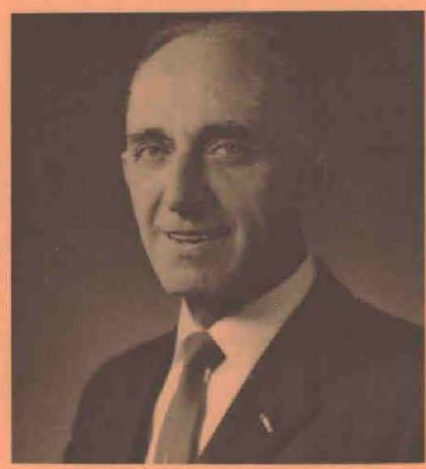
The support agreement and the plan for collaborative relationship between the Presidio unit and Letterman General Hospital was signed by Maj Gen Charles H. Gingles, CG of Letterman, and Col Goldstein, chief of the Nuclear Energy Division at HQ Medical R&D Command until named to head the new research unit.

Professional caliber of the staff of the Presidio unit is indicated by the fact that 42 investigators and phy-

(Continued on page 3)

Besson Strengthens Role of AMC Deputy

Further strengthening of the authority of Dr. Jay Tol Thomas as his Deputy for Research and Laboratories is directed in a recent memorandum by General Frank S. Besson, Jr., commanding general, U.S. Army Materiel Command.



Maj Gen L. E. Simon (USA, Ret.), *Recipient of Samuel S. Wilks Award.* *For story, see page 2.*

In January 1966, Dr. Thomas left Northrop Space Laboratories, where he was Chief Scientist and Director of Research, to accept the newly created position of AMC Director of Research and Laboratories.

General Besson detailed specifically the authority and responsibilities of Dr. Thomas in a June 23 memorandum to AMC directors and chiefs of separate staff offices, project managers at HQ AMC, and commanders of major subordinate commodity commands and the nine central laboratories.

Most important, the memorandum elevated Dr. Thomas to Deputy for Research and Laboratories, with responsibility for direct and complete line authority over the central laboratories. He also is charged with assuring the technical quality "of that portion of the AMC research and development program that is performed in-house at the commodity command laboratories."

More recently, General Besson further clarified the functions of the Deputy for Research and Laboratories as differentiated from those of the Director of Developments Brig

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Record Firing Climaxes Project HARP Canadian Briefing

Loading and firing of a record, earth-shaking charge of 1,180 pounds of propellant in a 16-inch atmospheric-probe gun climaxed an Oct. 6 Project HARP briefing for high-level U.S. Government officials.

The demonstration was staged at McGill University's Highwater Test Facility in Quebec Province, Canada. HARP (High Altitude Research Project), originally a McGill University-U.S. Army concept in 1959, has evolved as a joint U.S. Army-Canadian Department of Defense venture.

Objective of the briefing was to provide information on the progress, accomplishments and techniques developed by HARP, which seeks to exploit the inherent accuracy, reliability and economy of gun-fired projectiles for atmospheric research.

During the past six years, research probes with 5-, 7- and 16-inch extended-barrel smooth-bore guns located at various sites in the U.S., Barbados (West Indies) and Canada have reached ever deeper into the upper atmosphere.

Representatives of the U.S. Army, Navy, Air Force, National Aeronautics and Space Administration, and the Defense Atomic Support Agency attended the briefing. Heading the Army delegation were Director of Army Research Col Robert E. Kimball, and Dr. Jay Tol Thomas, Army Materiel Command Deputy for Research and Laboratories.

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5 Rockefeller Awards Go To Agencies Outside DoD

Rockefeller Public Service Award winners for 1966 are representative of five Federal Government agencies other than the Department of Defense. The five awards, each carrying a $10,000 cash grant, are for outstanding achievement in Government service.

Announced Oct. 17 by President Robert F. Goheen of Princeton University, award winners and categories of service for selection are:

John M. Leddy, Assistant Secretary of State for European Affairs—for foreign affairs or international operations; Millard Cass, Deputy Under Secretary of Labor—for administration; David D. Thomas, Deputy Administrator of the Federal Aviation Agency—for general welfare or national resources; John R. Bland-

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OTHER GOVERNMENT AGENCIES' requirements should be submitted directly to the Army Research Office, OCRD, Department of the Army, Washington, D.C. 20310, ATTN: Scientific and Technical Information Division.

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Wilks Award Features Design of Experiments Meet

Self-styled as "primarily a professional soldier and only secondarily a statistician," Maj Gen Leslie E. Simon (USA, Ret.) is the recipient of the American Statistical Association's highest honor for 1966, the Samuel S. Wilks Award.

Presentation of the award was a highlight of the 12th Conference on the "Design of Experiments in Army Research, Development and Testing," Oct. 19, at National Bureau of Standards headquarters, Gaithersburg, Md.

Sponsored by Army Chief of Research and Development Lt Gen Austin W. Betts and the Army Mathematics Steering Committee (AMSC), the meeting was hosted by the Army Harry Diamond Laboratories, Washington, D.C., and the National Bureau of Standards. Dr. Ivan R. Hershner, Jr., Army Research Office, is AMSC chairman.

The conference was broken down into 10 technical sessions interspersed with clinical and general sessions.

General Simon was cited for his "pioneering contributions to Quality Control, Sampling Inspection, Reliability, and Army Design of Experiments, and for his timely promotion of statistical activities which have benefited not only the Army but our Government and country as well."

Previous recipients of the award are Prof. John W. Tukey, Princeton University, and Dr. Frank E. Grubbs, Army Ballistics Research Laboratory, Aberdeen (Md.) Proving Ground. Dr. Grubbs served as chairman of the 1966 Wilks Award committee.

Upon retirement in 1956 after 32 years of distinguished Army service in ballistics research and development and quality control, General Simon became director of research and development and later vice president of the Carborundum Co. In 1949 he received the first Shewart Medal of the American Society for Quality Control. Among his military awards are the Legion of Merit and Distinguished Service Medal.

General Simon has served in many national and international advisory capacities, including the Aerodynamics Committee of the National Advisory Committee on Aeronautics; Division of Mathematics, National Research Council; Scientific Advisory Committee, Army Ballistics Research Laboratory; Defense Science Board.

In 1959, he was U.S. delegate, Tripartite Armament, Explosive and Propellants Research Conference in Canada and in 1958 was a member of the Congressional Appropriations Committee on Reliability of Guided Missiles.

At the 10th Conference on Design of Experiments in 1964, General Simon was credited with originating the idea of the Wilks Award when he presented a paper, "The Stimulus of S. S. Wilks to Army Statistics." Wilks, a Princeton statistician and professor who died in March 1964, was eulogized at the conference as "Statesman of Statistics."

The Samuel S. Wilks Award, presented annually, consists of a medal and cash honorarium from a fund established by one of his former associates, Philip G. Rust, now retired. Criteria were established by the American Statistical Association.

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

In addition to Dr. Grubbs, members of the 1966 ASA Wilks Award Committe were Prof. Robert E. Bechhofer, Cornell University; Dr. Francis G. Dressel, Duke University and the Army Research Office-Durham, N.C.; Dr. Churchill Eisenhart, National Bureau of Standards; Prof. Oscar Kempthorne, Iowa State University; and Dr. Alexander M. Mood, U.S. Office of Education.

Betts Assumes Added Role As Nike–X System Manager

Nike–X System Manager is an additional duty that Chief of Research and Development Lt Gen A. W. Betts assumed late in October, when it was announced that a U.S. Army Nike–X System Office is being established.

The Nike–X Project Office at Redstone (Ala.) Arsenal, Headquarters of the Army Missile Command, will continue as an element assigned to the Army Materiel Command. However, it will receive operational instructions directly from the new Systems Office in the Washington, D.C., area.

The Systems Office will absorb the functions and personnel of the existing Materiel Command cadre and various ad hoc groups. The staff will be augmented by a brigadier general and a technical director to strengthen the controls over planning and management.

Lt Gen Betts was awarded the first Oak Leaf Cluster to the Legion of Merit by Army Chief of Staff Harold K. Johnson in February 1965 in recognition of his outstanding service as special assistant to the Chief of Research and Development on a Nike–X Threat Analysis Study.

Philbin Assigned Deputy CG Of 4th Armored Division as Sheppard Fills AMC Vacancy

Brig Gen Tobias R. Philbin, Jr., ended eight months service as deputy to Dr. Jay Tol Thomas, Army Materiel Command Deputy for Research and Laboratories, when he was assigned last month as assistant commander, 4th Armored Division in Germany.

Col Harvey E. Sheppard, chief of the AMC Life Sciences Division, is "doubling in brass" as the acting successor to General Philbin, who was AMC Deputy Director for Research and Development (Plans) for a year preceding assignment to Dr. Thomas' staff.

General Philbin served in World War II with the 43rd and 95th Divisions. While commanding the 1st Battalion, 379th Infantry, he was awarded the Distinguished Service Cross for heroism at Metz and later received Great Britain's highest combat decoration for a foreigner, the Distinguished Service Order.

Among his other decorations are the Silver Star, two Bronze Stars, two Purple Hearts, Combat Infantryman Badge and Army Commendation Medal with Cluster. He served in the Korean War as senior adviser to the First Republic of Korea Army, and assistant military attache in Moscow.

General Philbin was graduated from Georgetown University in 1955 with a master's degree in international relations, and in 1962–63 was the Army Fellow at the Center for International Affairs at Harvard University. He is also a graduate of the U.S. Army Command and General Staff College and of the Imperial Defense College in England.

COL SHEPPARD was chief of the Research Division in the Materiel Command R&D Directorate prior to assignment to Dr. Thomas' staff. He has held R&D assignments in the Chemical Corps R&D Command, in the Office of the Chief of Research and Development, Department of the Army, and in the Office of the Director of Defense Research and Engineering.

Preceding assignment to AMC, he was commander of the 81st Chemical Group at Fort Bragg, N.C., and Rocky Mountain Arsenal, Denver, Colo.

Following graduation from Virginia Polytechnic Institute, he served as G–2 of the Mars Task Force in Burma during World War II. He is a graduate of the Army Chemical and Infantry Schools, Command and General Staff College and the Army War College.

Col Sheppard has been enrolled in the Army R&D Officers Specialist Career Program since its inception. He is a member of the American Association for the Advancement of Science, the American Institute of Management and the American Ordnance Association. Known as an author and consultant on Virginia postal history, he has won a number of awards in national and international stamp exhibitions.

Brig Gen T. R. Philbin, Jr.

Col H. E. Sheppard

5 Rockefeller Awards Go To Agencies Outside DoD

(Continued from page 1)

ford, chief counsel, House Committee on Armed Services—for law, legislation or regulation; Dr. Edward F. Knipling, Director of the Entomology Research Division, Research Service, Department of Agriculture.

Dr. Knipling was recognized as a "trail blazer" in the developing technology of insect control by sterilization of males, a field in which Army scientists, particularly at the Natick Laboratories, have been making notable progress. Dr. Knipling has been employed in the Department of Agriculture since 1930.

Initiated in 1960 by John D. Rockefeller III to recognize distinguished service of those he has termed "the unsung heroes" of public life, the awards are administered by Princeton University. Thirty-seven awards have been made.

Recipients of the 1966 awards, each representative of 25 to 36 years of Federal service, will be honored Dec. 7 at a banquet at the Washington Hilton in the Nation's capital.

Medical Service Creates Research Unit-Presidio

(Continued from page 1)

sicians include seven medical doctors, five with PhD degrees, four masters of science, three doctors of dental surgery and one doctor of veterinary medicine.

Assigned fields of investigation include clinical aspects of surgery, medicine, physiology, biochemistry, microbiology and radiobiology.

The Flexible Programs Division is organized in three areas of effort. Dr. Marion Sulzberger, internationally renowned specialist and technical director of research at the Medical R&D Command in Washington until reassigned to Letterman General Hospital in September 1964, heads the dermatologic research. Surgical research is under Lt Col John A. Morris, Jr., and Lt Col Martin Steiner is chief of maxillofacial sciences.

Col Goldstein also heads a new Department of Research in Letterman which will have as one of its functions the encouragement, coordination and support of clinical research by the house staff and junior physicians of the hospital staff.

Support will include advisory services in designing and evaluating research studies, aid in preparing reports, providing equipment and facilities, and assistance in arranging research seminars and the presentation of technical papers.

Efforts of the research unit will complement the hospital's clinical activities and educational programs. Hopefully the arrangement will provide a model for similar activities in other Army teaching hospitals.

One of the special projects will be a study to find a "typical best type" research unit which can be used as a model. Actually, Col Goldstein explained, it will be "research of research units to find a single most workable model."

DIAC Reviews Programs, Problems, Viet Nam Needs

Defense programs, general economic problems and Southeast Asia combat requirements dominated discussions at the 14th meeting of the Defense Industry Advisory Council (DIAC), Oct. 14–15, in Washington, D.C.

Chaired by Deputy Secretary of Defense Cyrus R. Vance, the DIAC was led in general Defense posture study by Secretary of the Navy Paul H. Nitze, Secretary of the Air Force Dr. Harold Brown and Under Secretary of the Army David E. McGiffert.

Established in 1962 as a forum for discussions by Department of Defense principals, the DIAC has 22 non-governmental members, including many top industrial leaders.

Alternate to Mr. Vance is Paul R. Ignatius, Asistant Secretary of Defense (Installations and Logistics). The industry vice chairman is Dr. Ruben F. Mettler, Thompson-Ramo-Wooldridge Systems Group, Redondo Beach, Calif.

Leaders in discussions of economic problems, including Defense procurement and contract lead-time considerations, were Secretary Brown, Assistant Secretary of the Air Force (I&L) Robert A. Brooks, Mr. Ignatius, and James Duesenberry of the Council of Economic Advisers.

Assistant to the Chairman of the Joint Chiefs of Staff, Lt Gen George S. Brown (USAF), recently returned from Viet Nam, spearheaded the council's discussion of Southeast Asia. The Deputy Director of Defense Research and Engineering (Southeast Asia Matters), Leonard Sullivan, talked on research and development for that area.

Thomas D. Morris, Assistant Secretary of Defense (Manpower) spoke on the revised standards for draftees.

Several reports were made to the Council, including a general report on DIAC subgroups by Clyde Bothmer, DIAC executive secretary; Military Export Committee (Research and Development Recoupment), Leonard A. Alne, Deputy to the Deputy Assistant Secretary of Defense (International Logistics Negotiations) Henry J. Kuss, Jr.; final reports on Contractor's Weighted Average Share (CWAS), Deputy Assistant Secretary of Defense (Procurement) John M. Malloy; and Contractor Independent Technical Effort (CITE), James W. Roach, Assistant DDRE (Engineering Management).

Barry J. Shillito, president of Logistics Management Institute, Washington, D.C., gave a report on "Profit Study." Mr. Ignatius reported on "Release of Weights Used in Proposed Evaluation" and Mr. Charles on "Total Package."

Besson Strengthens Role of Dr. Thomas as Deputy

(Continued from page 1)

Gen Kenneth H. Bayer, for research, development, test and evaluation operations. Essentially, General Bayer continues operational responsibilities assigned to him when he headed the Directorate of Research and Development.

Dr. Thomas will represent General Besson in direct communication with the Assistant Secretary of the Army (R&D) Dr. Russell D. O'Neal and with Chief of Research and Development Lt Gen A. W. Betts on all matters pertaining to the in-house research programs conducted by the Army Materiel Command.

General Besson has assigned to Dr. Thomas directive control in the planning and execution of technical programs, establishment of laboratory personnel policies, selection of key individuals, fiscal resource allocation, determination of facility requirements, and evaluation of operational effectiveness.

AMC Central Laboratories under the control of Dr. Thomas are the Ballistic Research Laboratories, Human Engineering Laboratories, and the Coating and Chemical Laboratory, all at Aberdeen Proving Ground, Md.; Nuclear Defense Laboratory, Edgewood Arsenal, Md.; Harry Diamond Laboratories, Washington, D.C.;

Also, Army Materials Research Agency, Watertown, Mass.; Cold Regions Research and Engineering Laboratory, Hanover, N.H.; Natick Laboratories, Natick, Mass.; and the Army Aeronautical Research Laboratory, Moffett Field, Calif.

In mid-October the organizational structure of Dr. Thomas' relatively small staff was approved by Secretary of the Army Stanley R. Resor. It provides for five divisions:

Physical Sciences A, headed by Norman L. Klein, former chief, Chemistry and Materials Branch, Research Division; Life Sciences, with Col Harvey E. Sheppard as chief; and Earth Sciences, under the leadership of Dr. Geoffrey E. H. Ballard. Physical Sciences B, and Applied Sciences were not staffed as the Newsmagazine went to press. A general officer will serve as deputy to Dr. Thomas and Col John T. French is executive officer.

EXHIBITED at the recent annual meeting of the Association of the U.S. Army in Washington, D.C., is this 16-ton, cross-country, tilt-bed tractor-trailer, which can self-load or unload the versatile Containerized Express (CONEX). It was designed and built by the U.S. Army Engineer R&D Labs, Fort Belvoir, Va., and the contractor (Barnes and Reinicke, Chicago) in 110 days. Three containers can be loaded in 12 minutes and transported at 30 m.p.h. The driver can simultaneously unload by releasing ties, tilting the bed and driving off.

NRC Appoints David to Staff

Dr. Henry David, social scientist and historian with the National Science Foundation since 1964, has been named executive secretary of the National Research Council's Division of Behavioral Sciences effective Dec. 1. He succeeds Peter B. Hammond, who resigned.

4 Army Researchers Attending Karman NATO Institute

Four U.S. Army research and development employees enrolled recently for nine months of postgraduate study and research at The von Karman Institute, a NATO-sponsored training center at Rhode-Saint-Genese, Belgium.

Selection was based on achievements and potential for career advancement through training as reported by their nominating agencies.

The students are Joseph M. Kirshner, Harry Diamond Laboratories (HDL), Washington, D.C.; Gilbert G. Morehouse, Aeronautical Research Laboratory (ARL), Moffett Field, Calif.; Joe C. Walters, Missile Command (MICOM), Redstone (Ala.) Arsenal; and Donald P. Neverton, Aviation Materiel Laboratories (AVLABS), Fort Eustis, Va.

The von Karman Institute was incorporated in 1956 as an international scientific organization to contribute to the dissemination of knowledge in fluid mechanics and applied aerodynamics.

Some 20 postgraduate students from 10 NATO countries are selected each year to attend the Institute's Training Center for Experimental Aerodynamics. To earn a diploma, each student must complete an individual research project in addition to at least 240 hours of selected courses.

KIRSHNER, a research physicist at HDL, is principal author and coordinator of the recently published first textbook on *Fluid Amplifiers*, and is author or coauthor of 10 professional papers. A GS–15 employee, he has worked at HDL since 1953. He has a BS degree from the University of Delaware and an MS in physics from the University of Maryland, where he has completed most of the requirements for a doctoral degree.

MOREHOUSE is a GS–13 engineer at the ARL and a veteran of 20 years as an officer in the U.S. Air Force. Most of his work has been in the aeronautical disciplines and as an assistant professor of aerospace engineering at the U.S. Air Force Academy. He received a BS degree from the University of Nevada and an MS in aeronautical engineering from the California Institute of Technology, Pasadena.

WALTERS is a GS–13 aerospace engineer in the Structures and Mechanics Laboratory at MICOM. He works primarily in missile dynamics problems, has BS and MS degrees in civil engineering from the University of Oklahoma, and is taking postgraduate courses at the University of Alabama's Huntsville extension.

From 1956 to 1962, Walters was with the Allison Division of General Motors in work concerning aircraft, engines and missiles. He is the author of several technical reports on systems analysis and is a registered engineer in the State of Indiana.

NEVERTON, a GS–13 aerospace engineer (materials and structures) at AVLABS since 1963, was for five years previously a design engineer for the Sikorsky Aircraft Division of United Aircraft. He has a BS degree in aeronautical engineering from Tri-State College, Angola, Ind., and a master's degree in mechanical engineering from Columbia Univ.

ASA Scientist Wins Association of Old Crows Electronic Award

Exceptional achievements in electronics during a 26-year Civil Service career earned James Gall, senior scientist with the U.S. Army Security Agency, the Association of Old Crows Award at the annual convention.

Formed in 1963 in Washington, D.C., the Association of Old Crows is now composed of more than 2,200 members in 15 chapters. Its purpose is to advance the state-of-the-art in electronic warfare, to document and preserve EW history, to promote the exchange of EW ideas and information, and recognize the efforts of those who make major contributions.

Rear Adm Samuel D. Brown spoke at the banquet at which the Old Crows Award was presented to Gall in recognition of his work as a "moving force in many major developments in electronic intelligence and countermeasures, in classified areas which cannot be detailed here."

The citation acclaims Gall for pioneering in development of mobile and airborne systems which advanced operational concepts for field armies. "In one instance," it states, "he is credited with accomplishing almost single-handed a 30-month project in a period of 9 months. This monumental engineering achievement . . . opened the door to an operational concept which today enhances the ability of the tactical forces to successfully conduct land warfare."

Mr. and Mrs. Gall

McNamara Swears In Dr. Walske As Head of AEC Liaison Group

Dr. Carl Walske, a theoretical physicist at the Los Alamos (N. Mex.) Scientific Laboratory, was sworn in Oct. 3 by Defense Secretary Robert S. McNamara as chairman of the Military Liaison Committee to the Atomic Energy Commission.

Dr. Walske, who has a BS degree from the University of Washington and a PhD in theoretical physics from Cornell University, succeeds William J. Howard, who left the Department of Defense in June to join the Sandia Corp.

Formerly deputy research director at Atomics International and senior scientific representative of the U.S. Atomic Energy Commission at the Conference on Suspension of Nuclear Tests, Dr. Walske also has served as scientific representative of the U.S. Atomic Energy Commission in the United Kingdom and Ireland. He was a theoretical physicist with the Rand Corp., and scientific attache on the U.S. Mission to NATO and to the Organization for Economic Cooperation and Development.

Dr. Walske is a member of the American Physical Society and the American Nuclear Society.

LMC Teaching R&D Management

A course in total life cycle management of Army materiel is being taught in a 2-week quarterly course at the Army Management Center, Fort Lee, Va. More than 100 professional and technical employees have graduated since the R&D Management Orientation Course began in February 1966.

SCIENTIFIC CALENDAR

1966 Vehicular Communications Technical Conference, sponsored by IEEE, Montreal, Quebec, Canada, Dec. 1–2.

Meeting of the American Institute of Chemical Engineers, Detroit, Mich., Dec. 4–8.

International Antennas and Propagation Symposium, sponsored by IEEE, Palo Alto, Calif., Dec. 5–7.

Meeting on Electrical and Magnetic Ceramics, London, England, Dec. 5–7.

Meeting of the Marine Technology Society, San Diego, Calif., Dec. 5–8.

2nd Annual Conference on Operating Metallurgy, Philadelphia, Pa., Dec. 5–9.

15th Annual Wire and Cable Symposium, sponsored by AMC, Atlantic City, N.J., Dec. 7–9.

Fall URSI–IEEE Meeting, Stanford, Calif., Dec. 7–9.

Industrial Sequencing Symposium, sponsored by ONR, Hoboken, N.J., Dec. 8–9.

International Conference on Fluid Logic and Amplification, Cranfield, England, Dec. 14–16.

Annual Meeting of the American Association for the Advancement of Science, Washington, D.C., 26–31.

Record Firing Climaxes High Altitude Research Program Briefing

(Continued from page 1)

Col Kimball was accompanied by Dr. Richard A. Weiss, Deputy and Scientific Director of Army Research, Dr. Leonard S. Wilson, chief, and Dr. Hoyt Lemons, Environmental Sciences Division, Army Research Office, Office of the Chief of Research and Development.

Technical Director Dr. C. W. Lampson headed a group from the Army Ballistic Research Laboratories, Aberdeen Proving Ground, Md., that included Warren Berning, chief, Ballistic Measurements Laboratory, and Dr. Charles Murphy, chief, Free-Flight Aerodynamics Branch and Army project leader for HARP.

Other U.S. Army Materiel Command attendees included Lt Col Jere W. Sharp, special assistant to the commanding general; Lt Col John S. McClelland and Richard Navarin, Development Directorate; and Richard Epps from the U.S. Army Missile Command.

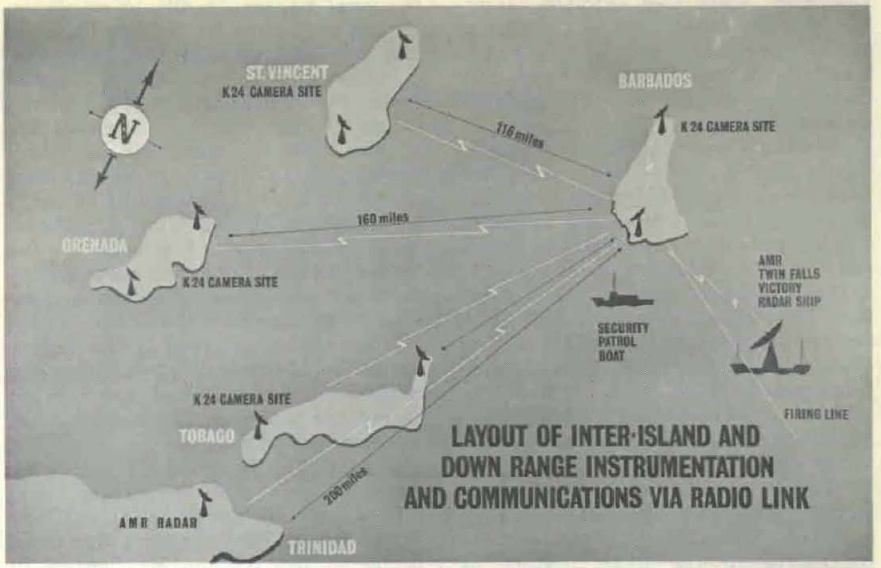
Capt Leslie R. Olsen (USN), CO of the Naval Propellant Plant, Indian Head, Md., and James Edwards represented the Navy; Capt E. V. Von-Gohren, Sixth Weather Wing, the U.S. Air Force; Jack Spurling, NASA Facility, Wallops Island, Va.; and Lt Thomas C. Cagle (USN), the Defense Atomic Support Agency.

Dr. Gerald V. Bull, professor of engineering science at McGill University and originator of the theory that guns could be used to launch scientific vehicles into space, discussed performance of the gun-launched systems as the key speaker at the briefing.

Dr. Murphy outlined HARP facilities, activities and support of the project. McGill University scientists reported on each major aspect of the program.

Accomplishment of research at the vertical firing site at Barbados, where several hundred test firings have been made, were reviewed in detail. The Barbados 16-inch gun site is a fully instrumented facility, with down-range observation stations on the islands of St. Vincent, Grenada, and Tobago.

Specially designed Martlet missiles are acquired and tracked by Barbados Range radars, and at approximately 98,000 feet altitude, they are acquired by the Eastern Test Range radar at Trinidad. Telemetry receiving facilities are at Barbados, Antiqua and aboard the *Twin Falls Victory* ship.



The first 16-inch probe missile was designated the Martlet 2A. Martlet designates the heraldic bird that appears on the McGill coat of arms. First fired in June 1963, this 5-inch diameter, 185-pound vehicle has reached an apogee of 340,000 feet. Advanced versions (Martlet 2C) have carried electronic instrument payloads to an altitude of 475,000 feet.

Trimethyl-aluminum (TMA) was ejected from the base of the vehicle above altitudes of 270,000 feet to form chemiluminescent trails observed by camera tracking stations at Barbados, St. Vincent, St. Lucia, Grenada and Tobago.

Ionospheric wind shears were measured by these observations from altitudes of 280,000 feet to apogee. The data was correlated with ionosonde soundings of the sporadic–E layers. Data collected on wind shear during Barbados research represent the most extensive information available on this phenomena. Results were reported in the October issue of *Journal of Geophysical Research.*

Martlet 2G Missile

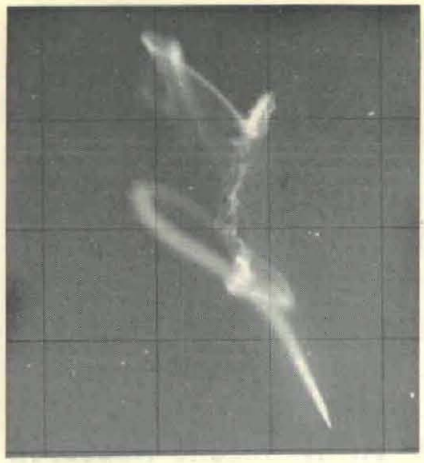
Many other successful Martlet 2C flights have been made with onboard telemetry operating at 250 and 1,750 megacycles. Langmuir probes have been used to measure electron density throughout the D layer and into the lower F layers.

With successful development of operational performance of the early vehicles, attention was turned to payloading and synoptic data gathering. This led to different versions of the 2C and eventual design of the Martlet 2G.

Almost twice the size of the 2C, the Martlet 2G is based on the 5- and 7-inch gun center sabot designs, which take weight off the sabot and add it to the vehicle.

The newest vehicle is the 2G–1. It represents a straightforward development from the vehicles flown in the HARP program over the past three years. The first airframe, machined from a 175mm gun-tube, is being built in the Highwater shops and will be test flown in the near future. For probe work, the rocket payload is designed to attain altitudes of between 1,000 and 2,000 miles with payloads varying in weight from 30 to 70 pounds.

Results of tests with the Martlet 2C and 2G have led to design and initial tests with the Martlet 3E and 3D. The 3E is a 7-inch gun, solid-booster system, encapsulated in a fiberglass case, which has the capa-



NIGHTTIME TMA trail pictured after distortion from ionospheric winds over Barbados, after 16-inch launch.

bility of sending 10 pounds to more than 200 miles altitude.

The first successful 3E tests were made in Canada, using a technique in which the projectile is fired over a frozen lake and recovered intact. X-rays of the rocket grains after recovery showed no damage from launching or recovery loads.

Flip-out stabilizing fins of the 3E are trailed back in the gun, opening and locking in the out position as the vehicle emerges from the barrel.

Designed primarily as a first-stage for the Martlet 4 system, the 3D is intended to carry about 1,500 pounds of solid rocket propellant. It will be launched at velocities between 4,000 and 6,000 feet per second.

After the vehicle leaves the gun, flip-out fins stabilize the assembly while it coasts to an altitude of approximately 40,000 feet, at which time the second-stage ignition occurs. Burn-out of the second-stage occurs between 125,000 and 150,000 feet, with the system velocity in the region of 12,800 feet per second.

HIGHWATER horizontal 16-inch gun (rear view), and downrange area.

After burn-out of the second stage, the remaining vehicle is allowed to glide for approximately 60 to 100 seconds while it is oriented by on-board equipment. A horizon sensor gives the angle with respect to the earth's horizon, and a sun sensor establishes the necessary second angle.

Jets operated by cold nitrogen are used to orient to the desired firing angle through the system of on-board logic and computers.

The Martlet 4 system guidance and control have been designed and tested at low elevations with 6-inch guns, which are controlled to simulate the desired real case. Components have been flight tested numerous times, but further design and development work is necessary to complete an integrated system.

In June 1966, installation of a 16-inch vertical-firing gun was completed at Yuma (Ariz.) Proving Ground and a flight series was fired. The Yuma site extends the base for geographic data gathering and was selected for simultaneous soundings with Barbados. It provides a good desert recovery area and most recovery work is centered about this facility.

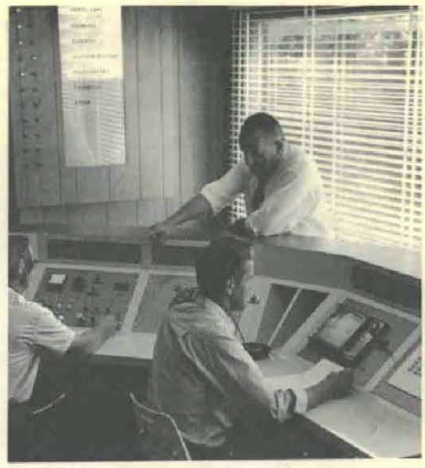
Additional gun-launch probes have been made at Fort Greely, Alaska, with a 6-inch gun; at White Sands (N. Mex.) Missile Range, using 5- and 7-inch guns; and at Wallops Island, Va., using 5- and 7-inch guns.

The HARP program led to an urgent need for adequate horizontal test facilities. In 1965, a new testing facility was established at Highwater and ground area now covers some 10,000 acres in Quebec and Vermont.

Managed by the Space Research Institute of McGill University, the Highwater Laboratory represents the major HARP engineering development testing station. It has 16-inch and 6.3-inch/80-caliber horizontal-firing guns as primary testing tools, and an 18-inch short-caliber gun for ignition and propellant testing.

The laboratory also has a complex of supporting activities, including machine shop, electronic shop, vehicle preparation area, rocket test facilities and launch control area.

The 118-foot-long barrel of the 16-inch HARP gun, it was reported, has led to considerable changes of internal ballistic performance. Development of electronic payloads has progressed to the point where an industrial firm is developing commercially available on-the-shelf transmitter and metasonde packages, and the application of microtechniques and integrated circuitry is underway.



HIGHWATER TEST range manager Robert Stacey, a native of Vermont, directs firing of 16-inch gun. At left is firing panel, at right, TV monitor.

Physicist Aims to Modernize Research Structure in Brazil, U.S. Army Element Discloses

Modernizing the research structure within Brazil is one of the ambitions of Prof. Gerhard Jacob, who at 36 is recognized as one of the leaders in Latin America's new generation of scientists.

The U.S. Army Element of the Defense Research Office, Latin America, reported that Prof. Jacob recently was appointed "Catedrático" in the Chair of Theoretical Physics, Federal University of Rio Grande do Sul. The appointment ranks higher than full professor in the United States, is good for life and was made personally by President Castello Branco.

Presently doing research for the U.S. Army under contract, Prof. Jacob is concerned with better correlation of data for improvements in materials for solid-state devices, in signaling and data-handling techniques, and strengthening of field Army capabilities.

In addition to his research and teaching duties, he seeks to modernize the research structure within Brazil by serving on the Research Council of the University of Rio Grande do Sul and also on the National Research Council of Brazil.

Prof. Jacob was educated at Heidelberg University in Germany, the University of Mexico and the University of Copenhagen.

New Film Portrays Safety in Disease Experiments

"Laboratory Design for Microbiological Safety," an educational film showing how research centers solve problems inherent in the study of infectious diseases, is being released this month.

The 35-minute color movie is centered around research scenes from nine cooperating Government and private laboratories. Although directed to engineers and administrative personnel concerned with safety features in laboratories, it is considered of importance throughout the medical research field.

The film approaches safety problems from the engineering point of view in the design and construction of buildings that house microbiological research work. Methods of containment of microorganisms are discussed in detail.

Researchers of the National Cancer Institute, working on a Special Virus Leukemia Program, originated the idea for the film. Concerned about increased hazards of leukemia research, they formed a Biohazards Control and Containment Working Group to assess risks associated with investigation of pathogenic organisms. This group recognized the need for educational material for contractors and scientists involved.

Dr. Arnold G. Wedum, chief of the Industrial Health and Safety Office at Fort Detrick, Md., and Dr. G. Briggs Phillips, Public Health Service representative to the National Aeronautics and Space Administration, both members of the Working Group, served as technical consultants for the film.

Dr. Phillips coauthored the film script with Durward R. Thayer of the Communicable Disease Center, Atlanta, Ga., and Robert Runkle, National Cancer Institute project officer. Thayer directed the movie and Dr. Wedum narrates the introduction and conclusion.

Laboratories contributing scenes to the film are Fort Detrick; Department of Veterinary Pathology, Ohio State University; U.S. Naval Biological Research Laboratory; School of Aerospace Medicine, Brooks Air Force Base; Taft Sanitary Engineering Center, Public Health Service; Biological Research Laboratories, National Drug Co.; National Animal Disease Laboratories, U.S. Department of Agriculture; Virus Laboratories, California Department of Public Health; and the Medical Research Laboratory, University of Illinois.

The film may be borrowed from the Audio-Visual Branch, Communicable Disease Center, Public Health Service, Atlanta, Ga., 30333. Copies will be available for sale.

Aberdeen Recruiting Civilians To Fill Professional Positions

Scientific and professional civilian personnel are being recruited to fill a wide variety of positions at Aberdeen Proving Ground (APG), Md.

Positions are open in grades ranging from GS–13 to GS–7, including engineers of all types, mathematicians, general and nuclear physicists, chemists and attorneys (general and patent).

APG is on the Chesapeake Bay 30 miles east of Baltimore, Md. One of the Army's largest installations, it covers some 75,000 acres of land and water. Much of the Army's testing of weapons, tactical vehicles and munitions is conducted at APG.

Application should be made on Standard Form 57 to the Secretary, U.S. Civil Service Board, Civilian Personnel Office, Aberdeen Proving Ground, Md. 21005. For further information, telephone area code 301, 278–3594 or 278–3671.

Cholesterol Crystals Serving Army Missile Research

Trim-figured women and overabundance of cholesterol usually do not go together, but Shelba Brown of Redstone (Ala.) Arsenal, Army Missile Command, provides an exception to the norm.

Shelba has more cholesterol than a circus fat lady, yet she tips the scales at only 118 pounds. The explanation is that most of her cholesterol is in crystal form and in bottles.

In the Structures and Mechanics Laboratory of the Research and Development Directorate, Mrs. Brown is performing experiments that could have far-reaching results for Army missile and rocket programs.

Using fins and wings from Army missiles and rockets in her tests, Mrs. Brown hopes to come up with a simple, inexpensive way of detecting structural flaws. The main tools of her research are "liquid crystals," chemical substances containing cholesterol.

Liquid crystals, which share some of the properties of both solids and liquids, were hardly more than laboratory curiosities until a few years ago. Now various technological applications appear on the horizon, centered around the crystals' remarkable ability to register changes in temperature, mechanical stress, electromagnetic radiation and chemical environment by changing their color.

Shelba Brown

Like many other organic chemists, Shelba had hardly heard of liquid crystals until going to work at Redstone Arsenal several months ago. She admits that much of her work has been trial and error; she even had to make some equipment as she went along.

In her work she mixes cholesterol crystals with a liquid solvent, brushes them on one of the wings, and lets the surface dry. Then she heats the metal. As the temperature drops, crystals in the metal change through a rainbow of colors, from violet to blue to green to yellow to red.

If there is a flaw in the wing, that area conducts heat unevenly and produces different patterns of colors from the rest of the wing. Out of the cholesterol liquid crystal experiment may come a simple, economic way of inspecting the airframe of a missile or rocket for defects.

Simple methods of detecting flaws are not available to maintenance soldiers in the field. The X-ray or ultrasonic equipment would be extremely bulky and expensive. Using the liquid crystals method, all that would be needed are the crystals, a solvent, a brush, and heat and light sources.

Similar experiments are being conducted in laboratories across the country, but Shelba is having amazing success with metals three times as thick as others use.

For some unknown reason, she says, other research chemists have been unable to come up with liquid crystals suitable for use on thick metals. She has concocted crystals so sensitive their color changes with 1/300th-degree shifts in temperature, making possible detection of structural flaws.

Test Program 'Tortures' Lance Missile Prototypes

Once known only as "Missile B," the Army's Lance battlefield missile system has come a long way in four years to the R&D stage where prototypes now are being subjected to every torture and environmental test engineers can devise.

Objective: To insure that combat units get a simple-to-operate, rugged and reliable general fire-support weapon system that can perform anywhere in the world and go anywhere soldiers can—by land, air or water.

Since March 1965, Lance has undergone intensive development flight testing at White Sands (N. Mex.) Missile Range. Currently, the system is facing environmental stresses to prove its versatility.

Rugged overland and water tests are being conducted at Aberdeen (Md.) Proving Ground. Ground-support Lance vehicles are pounding over rough roads, climbing steep grades that would trouble a foot soldier, and plowing through bogs that might stop a truck.

Two Lance prototypes, the Self-Propelled Vehicle and the Transporter Loader, are being "launched" into a deep lake at Aberdeen to demonstrate fording ability.

Air-drop tests, initiated in late 1965, are being continued with the improved R&D model at Yuma (Ariz.) Proving Ground. Six huge parachutes are used to ease the impact of 10 tons of equipment on the desert floor.

Arctic test chambers, hangar-like structures at Eglin Air Force Base, Fla., are used in "warm up" tests for later demonstrations of Lance equipment in subzero weather at the Arctic Test Center, Fort Greely, Alaska.

In another phase of the environmental test program, Lance will be subjected to sand, dust, salt spray, humidity, fungus and sun in special chambers at HQ Army Missile Command (MICOM), Redstone Arsenal.

Field tests similar to operating conditions in a tactical situation are conducted at Fort Sill, Okla.

Inputs from the various testing commands will be coordinated by MICOM's Test and Reliability Evaluation Laboratory. Data will be reviewed for determination of any changes to be incorporated into the final design for production.

Lance is being developed to fill the Army need for a highly mobile weapon system that can be transported or driven anywhere. The missile and launcher, mounted on a self-propelled, tracked vehicle, can be dismounted and carried by helicopter or dropped by parachute. On the ground, the unit can be towed by any light vehicle.

Lance is the first Army missile to use prepackaged storable liquid propellants. Its payload can be nuclear or conventional warhead.

LANCE PROJECT manager Col W. E. Mehlinger discusses model of Army's newest battlefield missile with British Army visitor Brigadier Ronald L. Allen, chief inspector, Land Service Ammunition Office, Ministry of Defense.

Col Olenchuk Returns to Fort Detrick as CO

Upon completion of more than two years of duty as a staff officer in the Plans and Policy Directorate, Joint Chiefs of Staff, Col Peter G. Olenchuk assumed command of Fort Detrick, Md., where he was executive officer from 1953 to 1955.

Col Olenchuk succeeded Col Vincent L. Ruwet when he recently retired from the Army after serving as commander at Fort Detrick since April 1964. Graduated with honors from the Command and General Staff College in 1959, Col Olenchuk was assigned to the Life Sciences Division, U.S. Army Research Office, for more than two years.

A year of duty as deputy chief of the Chemical-Biological Division, Office of the Chief of Research and Development, Department of the Army, preceded assignment as a student for the 10-month course at the Industrial College of the Armed Forces, Washington, D.C. He then became chief, Chemical Operations, J–3, Headquarters, U.S. Military Assistance Command, Viet Nam.

During his tour of duty with the Joint Chiefs, Col Olenchuk returned to Viet Nam on a 2-month special mission for the chairman, JCS.

Col Olenchuk enlisted in the Army Corps of Engineers in 1943 after graduating from Lebanon Valley College, Pa., with a BS degree in chemistry. He served during World War II at Fort Belvoir, Va., and in the North Africa and Burma theaters of operation.

In 1945 he was commissioned a second lieutenant in the Chemical Corps at the Army Chemical Center, Md., where he served as troop officer, then as student and instructor at the Chemical Corps School. He graduated with honors in 1949 from the school's advanced course and served on the faculty until 1950.

Col Olenchuk received a master's degree in microbiology from the University of Wisconsin in 1951 and later an MBA degree in management from George Washington University. He holds the Legion of Merit, Air Medal with Oak Leaf Cluster and the Joint Service Commendation Medal.

Col P. G. Olenchuk

Austrian Geodesist Joins GIMRADA as Consultant

Austrian scientist Dr. Karl Rinner, internationally recognized geodesist, has joined the consultant staff of the U.S. Army Engineer Geodesy, Intelligence and Mapping Research and Development Agency.

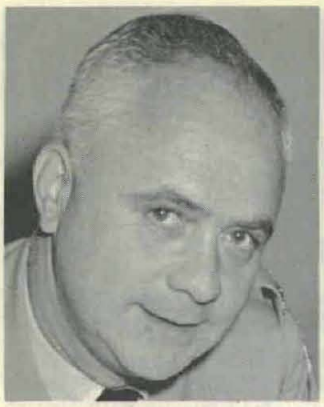
Dr. Rinner will conduct a geodetic science workshop at the Fort Belvoir, Va., installation and provide assistance in planning and developing an effective Army satellite geodesy research program. Special consideration will be devoted to the problem of the error propagation in global geodetic networks.

Dr. Rinner has earned two doctorate degrees, from the Technical University of Berlin and Technical University of Graz, Austria.

He served as director of the German Research Institute in Munich, Germany, and has authored many publications concerning photogrammetry, hydrographic surveying and electronic distance measuring.

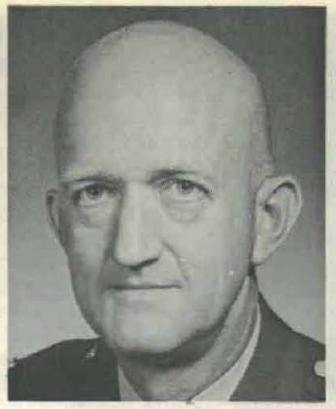
Nobel Prize Winner Gives Exhibit

Dr. Francis Peyton Rous, 87, known as the "grand old man of cancer research" and cowinner of the 1966 Nobel Prize for medicine, recently donated material for an exhibit, "Transplantable Chicken Tumors," to the Armed Forces Institute of Pathology Registry of Noteworthy Research in Pathology, Washington, D.C. Visiting hours are 9:00 a.m. to 5:00 p.m.



Col J. N. Lothrop

Lt Col A. G. Lange, Jr.



Lt Col E. W. Powell

Lt Col E. Rudd

AMC Reports 4 Assignments to Key Staff Positions

Four key assignments announced by the U.S. Army Missile Command include project managers for the Pershing, Sergeant and TOW missiles and a deputy to the deputy commanding general, Land Combat Systems.

Col James N. Lothrop became project manager for the TOW weapon when Lt Col Ballard B. Small retired. Graduated from the U.S. Military Academy, Col Lothrop also has an MS degree in aeronautical engineering from New York University.

Before joining the Redstone Arsenal staff, he studied at the Army War College, Carlisle Barracks, Pa., then completed the Army's Project Manager School at Dayton, Ohio.

During World War II, he served with the 95th Infantry Division, Third Army in Europe, and later with the Eighth Army in Korea. Other major assignments include: HQ, U.S. Army, Europe, Heidelberg, Germany; Armed Forces Special Weapons Project, Sandia, Base, N. Mex.; and the First Guided Missile Battalion, Fort Bliss, Tex.

Among his decorations are the Bronze Star with Cluster and the Army Commendation Medal.

LT COL ED RUDD, who served at Redstone Arsenal, Ala., with the Army Rocket Guided Missile Agency, phased out several years ago, is now project manager of Pershing. He is a 1948 graduate of the U.S. Military Academy with a master's degree from Purdue University and is also a graduate of the Army War College.

He has served in the Office of the Chief of Research and Development, Department of the Army, at Aberdeen Proving Ground, Md., in Europe and at Kwajalein in the Marshall Islands. From 1962-64, he was chief, Zeus Operations Division, Pacific Field Office.

He holds the Army Commendation Medal with two Oak Leaf Clusters.

LT COL ARTHUR G. LANGE, Jr., is the new project manager of the Sergeant ballistic missile system. He has served as project officer of the Sergeant missile at White Sands Missile Range, N. Mex. Overseas tours include the Philippines, Korea, Japan and Europe.

Col Lange holds a bachelor's degree from the University of Maryland and a master's degree from Babson Institute of Business Administration. He also has attended the Command and General Staff College, the Industrial College of the Armed Forces, and the Army Air Defense School.

LT COL ELBERT W. POWELL is the new deputy to Brig Gen Edwin I. Donley, deputy commanding general, Land Combat Sytems. From 1963 until recently he was head of the Pershing Project Manager's Staff Office in Europe.

From 1959 to 1961, he was with the Army Ballistic Missile Agency at Redstone Arsenal. When the Missile Command was formed in 1962, he was named assistant manager of the Honest John Project.

He has a BS degree in biology from Athens (Ala.) College and has completed the regular Army Command and General Staff College course. Since joining the Army in 1942, he has served in Europe, Korea, Japan and Alaska.

Among his awards and decorations are the Bronze Star Medal, Army Commendation Medal with Oak Leaf Cluster, Joint Service Commendation Medal and Belgian Military Cross.

Army Extends JSHS Charter, Advisory Council Terms

Continuation of the charter of the U.S. Army Junior Science and Humanities Symposium (JSHS) Program and extension of appointment of its Advisory Council to serve until June 30, 1968, were announced in October.

Appointed by the Secretary of Defense, the Council was established in 1961 when the JSHS became an Army-wide program. The Council provides continuing evaluation of the program and assists the Assistant Secretary of the Army (R&D) and the Chief of Research and Development in establishing objectives and guidelines. Members serve without reimbursement for their time and travel expenses.

More than 20 regional symposia, involving some 4,000 selected students and teachers each year, culminate in a national symposium for about 150 students, based upon their research reports. Some of the Nation's top-ranking educational and industrial leaders participate.

Chairman, Dr. Ernst Weber, president of the Polytechnic Institute of Brooklyn; J. Harold Browne, national director of exploring, Boy Scouts of America; S. C. Donnelly, assistant works manager, Western Electric Co.; Dr. Ralph Gibson, director, Applied Physics Laboratory, Johns Hopkins University; Dr. Marcus E. Hobbs, professor of chemistry, Duke University; Col George F. Leist (U.S. Army, Ret.), Owens-Illinois Co.; Dean Harry L. Levy, dean of studies, City University of New York; Dr. George R. Seidel, education manager, E. I. DuPont de Nemours and Co.; and Dr. M. H. Trytten, director, Office of Scientific Personnel, National Academy of Sciences.

Government representatives are Director of Army Research Col Robert E. Kimball, Office of the Chief of Research and Development; Col John C. Raaen, Jr., CO, Army Research Office-Durham, N.C. (ARO-D); and Mrs. Grace Boddie, Advisory Council executive secretary, ARO-D.

18 Nations Confer on Military Medicine

Seventeen Latin American nations and the United States joined efforts to integrate and strengthen health services at the recent First Medical Conference of the Armies of the Americas at Fort Amador, Canal Zone.

"Military Medicine, a Cornerstone to National Health" was the theme of the 5-day meeting, sponsored by the U.S. Army Forces Southern Command. General Robert W. Porter, Jr., Commander-in-Chief, U.S. Southern Command, participated in opening ceremonies.

High-ranking representatives of the Office of The Surgeon General and the Medical R&D Command, U.S. Army, and military medical leaders of Latin American republics exchanged ideas and information on advances and current trends in medical research and development.

Maj Gen J. D. Alger, commander of the U.S. Army Forces Southern Command (USARSO), welcomed the conferees. Maj Gen Olivio Vieira of Brazil presented him with a plaque, saying he hoped it "will serve as a frame in the friendly relations among military doctors in the hemisphere."

Commanding General (Brig Gen) Colin F. Vorder Bruegge, U.S. Army Medical R&D Command, presented the opening address. Titled "The U.S. Army Medical Research and Development Effort," the speech was supported by a later showing of a 30-minute film, "The Constant Search," which he introduced.

"Military Medicine — Organization and Function" was discussed by Maj Gen James T. McGibony, U.S. Army Deputy Surgeon General, who stated:

"Military medical services of a free society have an obligation, not only to participate, but to take the lead in this people-to-people effort to build sound bodies, sound minds, sound economies, and mutual good will, which are the foundation of permanent world peace."

Commanding General (Maj Gen) Douglas B. Kendrick of Walter Reed Army Medical Center (WRAMC), Washington, D.C., spoke on "The Role of the Fixed Military Hospital," saying in part:

"The cooperation and mutual understanding by men of science and medicine in the countries making up the two Americas have continued to create a bulwark of strength in the Western Hemisphere."

In general discussion sessions, General Kendrick reviewed advances in the field of whole blood replacement and in the treatment of burns.

Discussion of "Some Persistent Worldwide Medical Problems" included malaria, viral hepatitis, Chagas' Disease, and medical aspects of operations at high altitudes (mountainous terrain).

Col Herschel E. Griffin, chief of the Division of Preventive Medicine, Office of The Surgeon General, U.S. Army, introduced discussion of activities and progress in preventive medicine.

Other leading speakers included Dr. Vincent A. Sutter, whose topic was "The Pan American Health Organization"; Col Robert Bernstein, USARSO chief surgeon and conference director, "Some Current Concepts of Field Medical Support"; Lt Col W. H. Belt, chief, Technical Committee, U.S. Army School of the Americas at Fort Gulick, "Medical Enlisted Training, Formal and On-the-Job"; and Lt Col M. E. Cabezas, surgeon, 8th Special Forces Group (Airborne), Fort Gulick, "Medical Civic Action."

Lt Col B. C. Walton, U.S. Army Medical Research Unit, Panama, moderated a technical session that included papers by Dr. K. M. Johnson, director, Middle America Research Unit, and Dr. Martin D. Young, director, Gorgas Memorial Laboratory in the Canal Zone.

The U.S. Army Medical R&D Command presented a display of some of the latest medical equipment, including a portable field X-ray film processor, hypodermic jet injector for high-speed immunization, a backpack sprayer-duster for sanitizing medical areas, and a portable medical lab.

Delegates represented, in addition to the United States, Argentina, Bolivia, Brazil, Chile, Columbia, Costa Rica, the Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Nicaragua, Panama, Peru, Uruguay and Venezuela. Instantaneous translation in English and Spanish was provided.

Conferees visited the Middle America Research Unit, Gorgas Memorial Hospital and Laboratory, and the Miraflores Locks.

Seminar Considers Progress In Prosthetics, Exoskeletons

Engineers and scientists from Government and industry met Oct. 12-13 at the Army Tank-Automotive Center (ATAC), Warren, Mich., to discuss prosthetic and exoskeletal devices as aids to human motion.

ATAC Chief Scientist Dr. E. N. Petrick arranged the seminar, first of its kind, as "pertinent to long-range Army mobility with a view toward future advanced vehicular concepts." Attendance was limited to 32 recognized specialists in research and design.

Discussions centered on devices made to mimic, replace or amplify the use or functions of human limbs. Such subjects as systems analysis, biomechanics, electromyography, force feedback and servosystems were reviewed. Devices discussed and demonstrated ranged from prosthetic apparatus for humans to mechanisms for "quadruped" cargo trucks.

Speakers included Dr. Petrick; Dr. Fred Leonard, Walter Reed Army Medical Center; Dr. Edward J. Baldes, Army Research Office; Dr. R. Finley, Philco Corp.; Ralph Mosher, General Electric Co.; M. J. Farr, Office of Naval Research; E. G. Johnsen, National Aeronautics and Space Administration;

Also, Dr. E. Murphy, Veterans Administration; A. Levin, Army Engineers Research and Development Laboratories; Prof. M. Minsky and Dr. Ralph Alter, Massachusetts Institute of Technology; Ronald A. Liston and Fred Pradko, ATAC; R. A. Morrison, Space General Corp. (El Monte, Calif.); and William Bradley, Institute of Defense Analysis.

Dr. Killion Promoted to PL–313 as USAEPG Tech Director

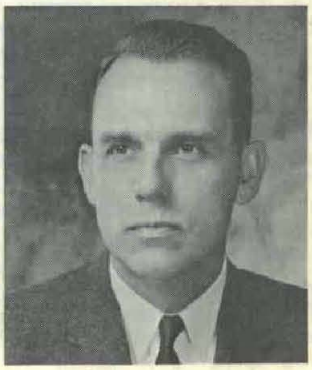
After serving on detail as chief scientist and technical director of the U.S. Army Electronic Proving Ground (USAEPG), Fort Huachuca, Ariz., since May 1965, Dr. Lawrence E. Killion recently was appointed to the post under Public Law 313.

Dr. Killion is responsible for providing direction for USAEPG technical activities and for advising the commanding general regarding R&D programs of national consequence.

Prior to joining USAEPG, Dr. Killion served six years as chief, Nuclear Quality Assurance Agency, Albuquerque Operations Office, Atomic Energy Commission.

Graduated from Baylor University in 1943 with a BA degree in physics and mathematics, he received a master's degree in 1948 and a doctorate (1955) at Washington University, St. Louis, Mo.

Dr. Killion is a member of the Institute of Electrical and Eectronics Engineers, American Physical Society and the American Society for Quality Control.



Dr. L. E. Killion

Army Awards $609 Million in RDT&E, Procurement Contracts

Army contracts for research, development, testing, evaluation and procurement totaled $609,327,735 since last reported in this publication.

Western Electric Co. will be paid $272,684,201 for work on the Nike-X antimissile-missile system, radar operation and maintenance. This includes a $256,581,512 modification for Nike-X RDT&E, a $12,834,296 modification for Nike-X production planning and engineering, and $2,065,000 for Nike Hercules modification kits.

The Ford Motor Co. received contracts totaling $40,599,419 for ¼-ton trucks. Day and Zimmermann, Inc., was awarded a $23,439,183 modification for ammunition components and operation and maintenance activities.

A $22,300,000 contract for CH54A helicopters went to United Aircraft Corp. The U.S. Rubber Co. won a $22,043,735 modification for explosives and maintenance and support services, and Remington Arms Co., Inc., received a $21,382,859 modification for 20mm cartridges and operation and maintenance.

Contracts totaling $19,519,372 went to AVCO Corp. for aircraft engines and bomb components. Two contracts with Raytheon Co. will procure components for a communication system for a 750-pound bomb for $12,580,965.

Contracts and modifications to General Electric Co. will supply aircraft machineguns, ammunition pods, support equipment, repair parts, and special tooling for a total of $14,934,595. Silas Mason Co., Inc., will receive $11,590,393 for 750-pound bombs and maintenance and support services. Sperry Rand Corp. was issued an $11,102,664 contract for M18 mines, 105mm shell metal parts, and maintenance activities.

Hughes Tool Co. received a $1,739,838 modification to a contract for light observation helicopters, related publications, and special tools, and $9,316,747 for the third increment of a contract for OH–6A helicopters.

Contracts totaling $10,350,677 with General Motors Corp. are for arm and housing assemblies for the M–114 carrier command post, 20mm automatic guns, production engineering services in support of and repair parts for the M551 armored reconnaissance airborne assault vehicle, as well as services for reactivation, rehabilitation and procurement of production equipment for the St. Louis Army Ammunition Plant.

Utility airplanes worth $9,789,081 were purchased from Beech Aircraft

Army's 'Gama Goat' Vehicle Undergoing Final Tests

Imaginatively named to denote unusual climbing ability in rough terrain, the "Gama Goat," officially designated the M561 truck, is undergoing final testing preliminary to competitive bidding for production contracts.

The U.S. Army Test and Evaluation Command, Aberdeen Proving Ground, Md., is conducting the tests through its Development and Proof Services. Tests are pertinent to problems of production tooling, fabricating methods and improvement. The U.S. Army Armor and Engineer Board, Fort Knox, Ky., is making evaluation tests of a pre-production prototype.

The 1¼-ton, off-road vehicle was type-classified in June, following 24-hour-a-day, 7-day-a-week testing at sites in several countries. Eight vehicles compiled more than 230,000 test miles over terrain ranging from desert sands and jungle swamp to arctic snowfields.

Research, development and engineering of the vehicle was completed in three years, a remarkably short "lead time," by the U.S. Army Tank-Automotive Center and Ling Temco Vought/Michigan Division in Warren.

Intended for use in forward combat areas where ground-gaining and fire-support are most difficult, the M561 represents a dramatic departure from conventional military truck design.

The 6-wheel, 2-unit vehicle is diesel-powered and carries 10 men, including the driver, or a 2-man crew and 2,500 pounds of payload, with a top speed of 55 m.p.h. With a full load, it can travel more than 490 miles without refueling a 40-gallon fuel tank. Towing an additional load, the Goat can cover 300 miles without refueling.

The unusual design features an articulated joint connecting the two units. This allows the bodies to pitch and roll independently of each other while keeping all six driving wheels on the ground. The vehicle is 226 inches long and 84 inches wide with a low silhouette advantageous in combat situations.

To add to the mobility, the rear wheels are capable of a limited degree of rotation about the tractor-roll axis. As a result, in extremely rough terrain, it is not unusual to have the rear wheels cocked at a 15-degree angle to the wheels of the front unit.

The rear wheels also can be used to help steer in mechanical coordination with the front wheels. This permits a turning radius of 29 feet and improves steering on upgrades. Most other vehicles lose steering action with transfer of weight to the rear wheels.

Adding to the Gama Goat's off-road mobility is the limited-slip differential, which transfers power from a wheel with poor traction to a wheel with good traction. Independent wheel suspension provides optimum distribution of traction and ground-bearing pressure among all six wheels. Ground clearance is 15 inches.

The truck is capable of "swimming" inland waters, carrying its rated payload without special rigging. The welded aluminum bodies provide an inherent flotation. The six wheels will drive the vehicle in water at speeds up to 2½ m.p.h.

In addition to its extremely mobile nature, the M561 can be modified to 18 special uses through conversion kits that were developed concurrently with the vehicle. It can be changed into a weapons platform, mounting recoilless cannon, mortars or machineguns; an ambulance; a communications center; or a carrier for the nuclear-tipped Davy Crockett missile.

"GAMA GOAT" climbs up and over walls and obstructions as high as 18 inches and has a flexibility of 18 special uses. The vehicle can carry a crew of 10.

Corp., and U.S. Time Corp. will supply artillery shell fuzes for $8,908,000.

An increment of $5,941,338 for 10-ton tractor trucks went to Condec Corp. Kentron Hawaii, Ltd., received a $5,188,130 contract for operation and maintenance of technical facilities at the Kwajalein Test Site, Marshall Islands.

Harvey Aluminum, Inc., will receive $3,988,128 for incendiary projectiles and classified ammunition items. Federal Cartridge Co. will supply small arms ammunition and maintenance services for $3,951,860, and General Dynamics Corp. is to provide engineering services for the FY 1965 Redeye weapons system for $3,933,182. A $3,686,036 modification will procure Nike-X R&D facilities from the Bell Telephone Laboratories.

Contracts and modifications totaling $3,567,200 were awarded to Menominee Engineering Corp. for bridge components. United Aircraft Corp. gained a $3,500,000 contract to supply items for the CH–54A (Flying Crane) helicopter. Varo, Inc., received a $3,379,920 modification for periscopes and related components for the M114 armored reconnaissance assault vehicle.

Modifications totaling $3,110,500 went to Bell Aerospace Corp. for UH–1E helicopters and armament systems and training devices for the AH–16 (Cobra) helicopter. Teledyne, Inc., will provide metallic belt links for 20mm cartridges for $3,039,980.

FMC Corp. will provide track assemblies for M113 vehicles for $2,919,398. High explosive projectiles from Defense Metal Products, Inc., will cost $2,919,127 and Ravenna Arsenal, Inc., is to provide supply maintenance and support services at Ravenna Army Ammunition Plant for $2,889,467.

Donavan Construction Co. received a $2,639,375 contract and Zeller Corp. will get $2,372,062 for high explosive projectiles. Diesel engine 12½-ton capacity crane shovels will be purchased from the Koehring Co. for $2,347,130.

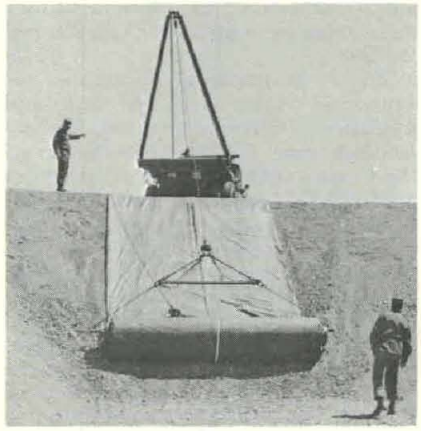
LFE Electronics received a $2,192,820 modification for navigation sets. A $2,070,000 contract with LTV Electro Systems, Inc., will provide services and material for the development of engineering change proposals and modification work orders in the manufacture of kits for aircraft. Standard Products Co. was issued a $2,051,101 contract for track shoes for the M114 armored reconnaissance vehicle.

A modification for $1,899,497 was issued to Atwood Vacuum Machine Co. for 20mm metalic belt links. Standard Container, Inc., received a $1,749,891 modification for ammunition boxes, and Union Carbide Corp. won a $1,721,658 contract for dry batteries for portable radio sets.

Other contracts: $1,600,000 to Wright Chemical Corp. for explosives; $1,572,636 to Hanson Machinery Co. for 5-ton cranes; $1,531,710 to the Motor Wheel Corp. for road wheels for M48 tanks; $1,490,019 to Continental Motors Corp. for crank shaft assemblies for combat trucks; $1,487,986 to Firestone Tire and Rubber Co. for track assemblies for M113 vehicles; and a $1,463,118 modification to Collins Radio Co. for aircraft navigational sets.

The Army also awarded a $1,415,680 definization contract to Emerson Electric Co. for design and development of the XM28 aircraft armament subsystem for AH–1G Huey Cobra helicopters; a $1,357,668 modification to Zenith Radio Corp. for rocket fuzes; a $1,350,000 modification to Aerojet General Corp. for metal parts for 2.75-inch rockets; and $1,329,234 to Eltra Corp. for generators for trucks.

420,000-Gallon Tanks Travel As 14-Foot Rolls of Fabric



Two 420,000-gallon "hasty storage" reservoirs that travel as 14-foot rolls of synthetic rubber-coated nylon cloth recently were shipped to Viet Nam as field "tanks" for petroleum products.

Developed by the Army Engineer Research and Development Laboratories (ERDL), Fort Belvoir, Va., the collapsible fabrication is 184 feet long and 49 feet wide. It can be folded and rolled on a pipe mandrel in a compact package 5 feet in diameter and weighing 5,000 pounds.

Replacing cumbersome steel tanks, the fabric reservoirs are installed in trapezoidal pits excavated by standard earth-moving equipment. Sides of the pit support the treated cloth, providing a depth of 12 feet.

Harwell-Kilgore Corp. received a $1,306,739 contract for smoke canisters for 155mm shells; Page Communications Engineers, Inc., $1,280,000 for a communications system in Southeast Asia; General Instrument Corp., $1,276,327 for bomb components; Stewart-Warner Corp., $1,211,076 for metal parts for ordnance items; and Canadian Commercial Corp., $1,141,500 for metal parts for 2.75-inch rockets.

Atlantic Research Corp. won a $1,134,771 contract for a computer program; Epsco, Inc., $1,022,000 for Mobile Tracking Systems, ground stations, and airborne transmitter/telemetry sets; National Gypsum, $1,009,105 for maintenance and support services at Kansas Army Ammunition Plant; Olin Mathieson Chemical Corp., a $1,007,837 modification for similar services at the Alabama Army Ammunition Plant; and Texas Instruments, Inc., $1,000,000 for classified electronics equipment.

Army Research May Transfer Ship Chartroom to Wheelhouse

Sailors be aware! The U.S. Army may move the shipboard navigator's chartroom to the wheelhouse with an experimental device that projects microfilmed color slides of standard charts for course-plotting at the helm.

The Army Engineer Research and Development Laboratories, Fort Belvoir, Va., are developing prototypes under contract with ITEK Corp. The equipment must withstand extensive sea tests preliminary to permanent installation in the Army's Mark II, 340-foot beach-discharge lighter.

The console-enclosed unit projects a full-scale 36- by 42-inch image of the desired chart onto the underside of a transparent tabletop. Courses may be plotted on the image and easily erased. Vellum can be used as an overlay for a permanent record.

A model of the prototype was displayed early this month at the Military Symposium on Aeronautical Charts and Navigation Displays in Washington, D.C.

New Huey Cobra Testing Begins

First preproduction model of the Huey Cobra (AH–1G), fast Army attack helicopter under development by Bell Helicopter Co., is undergoing flight testing at the Bell facilities near Fort Worth, Tex. The second model is expected to be completed by January 1967. Production models of the first fully integrated weapons helicopter will be delivered next spring; 110 aircraft have been ordered.

Surgical Research Unit at Brooke AMC Specializes on Burns

This is the fourth in a series of articles on research in U.S. Army Medical Service laboratories. The first (June) explained missions of the U.S. Army Institute of Dental Research, Washington, D.C.; the second (September) reviewed the U.S. Army Medical Unit, Fort Detrick, Md. The third (October) reviewed the mission of the U.S. Army Medical Research Laboratory at Fort Knox, Ky., in coping with physical and mental stresses of the U.S. soldier.

Severely burned patients present a formidable challenge to the profession of medicine. Potential impact of a limited or general thermonuclear war makes the challenge even greater because of the anticipated large numbers of patients resulting from such an eventuality.

Civilian disasters have provided some information about the serious emotional and physical trauma associated with the severely burned patient. The Cocoanut Grove fire in Boston, 1942, and the Texas City, Tex., explosion in 1947 demonstrated clearly the inherent problems associated with thermal injury.

Although these disasters can be classified as individual mass casualty situations, the impact on medical personnel and resources and the enormous amount of time required for treatment of the burned patient were clearly established.

These isolated instances have served merely as a proving ground for what could occur on a much larger scale in the event of nuclear war.

The purpose of this article is to describe the mission of the U.S. Army Surgical Research Unit (USASRU), Brooke Army Medical Center, Fort Sam Houston, Tex., in its role of research for better methods of treatment, and daily care of the severely burned patient. This dual mission of research and care makes the unit a unique member of the U.S. Army Medical Research and Development Command.

ORGANIZATION AND MISSION. Simply stated, the USASRU mission is: To investigate problems of mechanical and thermal injury and the complications arising from such trauma; to care for patients with such injuries; to teach and train other physicians in the principles of management of injured patients, and to conduct studies at basic and clinical levels.

Accomplishment of this complex mission requires assemblage of civilian and military research scientists representing disciplines in the medical and scientific fields. A total of 166

Col John A. Moncrief

Commander and Director
Army Surgical Research Unit
Brooke Army Medical Center

military and civilian personnel are organized into two major professional divisions:

- The Clinical Division has primary responsibility for research and development of better methods in the care and treatment of patients.
- The Laboratory Division conducts research studies in the physiological aspects of the thermal injury and furnishes support for the Clinical Division.

These professional divisions are supported by the Administrative and Logistical Divisions and the Medical Audio-Visual Branch. The Office of the Commander and Director provides professional and command guidance for all personnel assigned to the Unit.

HISTORY. The USASRU was established originally in 1943 at Halloran General Hospital, Staten Island, New York, with an assigned mission to conduct studies in traumatic surgery, with specific emphasis on the effects of penicillin in battle wounds. In 1945, the Unit was assigned similar responsibilities in the use of streptomycin. As the antibiotic spectrum increased, studies of additional drugs were conducted.

LABORATORY TECHNICIANS perform clinical bacteriologic support.

The Unit moved in 1946 to Fort Sam Houston and became part of Brooke General Hospital. It functioned as a Surgical Research Unit, using hospital facilities and continuing its research in the field of traumatic surgery. In 1949, a study was introduced in the evaluation of burn therapy which eventually developed into the major research effort of the Unit and earned it a worldwide reputation as the United States Army "Burn Center."

The Unit remained an integral part of Brooke General Hospital until 1953, when it was designated as the 9940 TSU, SGO, Surgical Research Unit, a separate Class II Activity under operational and technical supervision of The Surgeon General.

In January 1957, the Unit was redesignated as the U.S. Army Surgical Research Unit, a Class II Activity, and in 1962 it was placed under the command jurisdiction of the Commanding General, U.S. Army Medical Research and Development Command. The present commander and director is Col John A. Moncrief, MC.

THE BURN WOUND. The physiology of the burn wound is an important part of USASRU investigations of body metabolism, pulmonary function, cardiac output, immunologic response, changes in body chemistry, renal function and related areas. All these studies seek more thorough understanding of effects of the severe burn on the human body. Through a complete knowledge of burn wound physiology, various modes of treatment can be investigated.

Physiology of the burn wound is important in developing any adequate regimen of treatment. The major area of current investigation is control of burn wound infection. After much research in all aspects of the burn wound, infection has evolved as the major problem, causing 86 percent of all deaths.

Experimental animal research is conducted continuously in two major aspects of the burn wound: First, to isolate the organisms that are present in the burn wound; second, to discover a means of preventing the spread of infection after it has been discovered.

Through repeated tests, certain strains of *pseudomonas aeruginosa* have been isolated as the major bacteria present in the infected burn wound. Investigation toward a preventive drug has resulted in the use of P-aminomethylbenze sulfonamide. Used in a cream-like base, of the consistency of butter, it is a sulfa drug derivative. Tests have been con-

ducted in the laboratory with a water soluble hydrochloride and acetate base.

Results in the control of the infectious strains of *pseudomonas* were so successful that the drug is presently being used extensively on human patients. Minimal side effects have resulted and it is presently the drug of choice in the treatment of patients with second- and third-degree burns.

Topical therapy has reduced the mortality rate from burn wound infection by 50 precent overall, with the most significant effect of burns of 50 percent of body surface or less. From this experience, it appears that control of burn wound infection can be anticipated, thus removing one major cause of death in the serverely burned patient.

Physiological changes created by the severe trauma also are involved in burn mortality rates. Much information has been derived from the care and treatment of approximately 1,500 patients during a 15-year period. Research in the laboratory and with actual patients is an endless effort for continued decrease in mortality of the severely burned patient.

BURN TEAMS. The major principle developed through continued research in treatment of the burn wound is to provide definitive care as soon as possible. The longer the postburn period is prior to treatment, the more problems arise in providing an adequate treatment regimen.

To provide quickly the proper treatment, the USASRU has developed the "Burn Team." Consisting of a physician, nurse and enlisted technicians, each team is ready on call to go to pick up a burn patient. Several teams are organized within the Unit to provide full-time coverage, and they travel wherever the U.S. Air Force can fly them. Initial treatment is given at the pickup point and care is continuous until the patient is admitted to the burn ward. A Burn Team Kit has been developed which provides medical supplies and equipment.

Team members have served as ambassadors all over the United States in the demonstration of efficient patient care as representatives of the "U.S. Army Burn Center."

SIGNIFICANT ACHIEVEMENTS. Fluid therapy in the treatment of burns developed at the USASRU is accepted as the standard for initiating therapy.

Notable also is the development and evaluation of an animal burn wound model for conducting research in topical therapy.

Demonstrations of radioisotope techniques have shown that infusions of salt water alone will restore and maintain normal blood volumes after

EQUIPMENT for measuring radioactivity from chromatographic column is used in physiology experiments.

acute blood loss. Thus, requirements for whole blood in combat areas could be reduced as much as 50 percent.

Dextran therapy of acute thrombophlebitis, a clotting of blood in veins, has proved to be highly effective and simple to use. The substance also aids in maintaining the patency of arteries repaired after injury.

Insertion of silastic-teflon cannula in blood vessels of individuals whose kidneys are temporarily nonfunctional, due to injury or disease, has further expanded frequent and long-term use of the artificial kidney, a technique developed at USASRU.

CURRENT PROJECTS. USASRU research is directed toward development of an effective first-aid neutralizer to reduce the severity of white phosphorus burns, usable by the individual soldier or attending medic.

Development of a suitable *pseudomonas* antiserum to use in further combating infection in burns is being continued.

Other efforts include studies of the effect of thermal munitions on combat effectiveness; biophysics of the circulation and problems associated with impaired pulmonary function in the postburn period; and response of the patient to mechanical injury.

The severely burned soldier represents an enormous amount of time lost from duty and requires tremendous expenditures of medical personnel, supplies and equipment. The Army Medical Service conducts a continuous research program in its endeavor to conserve fighting strength, and the Army Surgical Research Unit is performing its portion of this research to provide care and treatment of the highest order.

MICOM Holds Industry 'Fairs'

Biweekly "Procurement Fairs" at the Army Missile Command, Redstone (Ala.) Arsenal, have been declared successful by both the Army and participating industry representatives.

Several hundred responses were received as a result of the first fair Oct. 5 attended by more than 225 representatives of 175 companies.

Industrialists who register for the fairs are provided lists of the Army's current needs for missile repair parts and may examine procurement packages to select those on which they wish to submit bids or proposals.

Deputy Commander Succeeds Pochyla at USAEPG

Col Nicholas C. Angel, a 30-year career officer, has assumed command of the U.S. Army Electronic Proving Ground (USAEPG), Fort Huachuca, Ariz., after serving 15 months as deputy.

Maj Gen Benjamin H. Pochyla retired Sept. 30, ending three years as CG of the Proving Ground and 37 years of military service. His successor was first assigned to Fort Huachuca in 1964 as chief, Test Operations Department, and later became chief of staff for the USAEPG.

From 1960 to 1962, Col Angel served as chief, Materiel Management Branch, Office of the Chief Signal Officer, Washington, D.C., after a tour in Paris at the NATO Defense College and as chief, Telecommunications Branch, SHAPE.

He also has served as assistant to the director of Communications-Electronics, Joint Chiefs of Staff, Washington, D.C., including one year as the U.S. Member, Communications - Electronics, NATO Standing Group.

Col Nicholas C. Angel

Graduated from Yale University in 1936, he attended the Command and General Staff College, Fort Leavenworth, Kans., after the end of World War II. Col Angel began his military career in 1936 with the 1st U.S. Engineers (Combat) and was awarded a Bronze Star for wartime duty in the European Theater. He also holds the Europe-Africa-Middle East and the Asiatic-Pacific campaign medals.

He is a member of the Armed Forces Communications and Electronics Association, the Association of the United States Army, and Yale Engineering Association, the Arizona Society of Professional Engineers, and the National Society of Professional Engineers.

Kudos

LEGION OF MERIT. Col Roland Savilla, commander of the Atlanta (Ga.) Army Depot, received the Army Legion of Merit before he left for Viet Nam to serve as commander of the Depot Complex, Saigon. He was cited for "demonstrated leadership qualities and profound professional competence in a position of great responsibility."

The Legion of Merit was awarded also to Colonel Thomas G. Muller, now chief of Project Team II, Combat Developments Command Experimental Center, Fort Ord, Calif. The award was for meritorious service as chief, Technical Industrial Liaison Office, Office of the Chief of Research and Development (OCRD), Department of the Army.

SFC (E-7) Robert M. Brunson is congratulated by Army Chief of Engineers, Lt Gen William F. Cassidy, while receiving $300 and an honorary certificate for suggesting that four types of nuclear reactor operator badges be issued upon completion of various phases of training. The suggestion award is the largest made to a military man at the Nuclear Power Field Office (NPFO), Fort Belvoir, Va., under the Army Incentive Awards Program. The basic badge will be issued to NPFO graduates. The 2nd Class Operator Badge is for those completing four to five months additional training as operators at a field plant or the SM-1 plant at Fort Belvoir. The 1st Class Operator Badge is silver. Those who qualify as shift supervisors will receive gold badges. Presently, 513 graduates (305 Army and the remainder from the Navy and Air Force) are eligible.

Three OCRD employees were honored recently for participation in the P1127 Tripartite Evaluation Program. Legion of Merit awards recognized Col Thomas E. Haynes, who retired in June from the Standardization Group, United Kingdom, and Lt Col Lowell K. Solt, Air Mobility Division. Lt Col Charles S. Horn, Combat Materiel Division, received the Army Commendation Medal.

COMMENDATION MEDAL. Lt Col Arley C. Richter, commander of the 516th Signal Group, was awarded the second Oak Leaf Cluster to the Army Commendation Medal for exceptionally meritorious performance June 1965 to May 1966. The award recognized him for work as chief of staff and as chief of Plans and Programs, U.S. Army Strategic Communications Command Europe, as well as in his present assignment.

Maj William D. Jones, now assigned to the U.S. Army Mobility Equipment Command's Engineer Research and Development Laboratories, Fort Belvoir, Va., recently received a first Oak Leaf Cluster to the Army Commendation Medal.

The award was for meritorious service and contribution to the Army's multi-million-dollar construction program in Southeast Asia as construction engineer, Staff Engineer Section, 9th Logistical Command, Thailand, October 1965 to July 1966. The citation state, in part:

"Demonstrating sound military judgment and outstanding technical competence, he was instrumental in transforming a broad construction plan into a vital and dynamic program encompassing highways, petroleum facilities, airfields, railroads, military cantonments, and a major port. By his professional ability and dedication to duty, he contributed to a great degree to the successful implementation of over $75 million dollars of construction."

The first Oak Leaf Cluster to the Army Commendation Medal was awarded to Alfonzo Spencer, amputee demonstrator and photographer at the U.S. Army Medical Biochemical Research Laboratory, Walter Reed Army Medical Center, Washington, D.C. An amputee veteran of the Korean War, he retired in May 1966 after 20 years of service.

The citation acclaimed him for meritorious service in testing and evaluating experimental prosthetic devices and running the photographic laboratory. He is beginning his fifteenth year at the Laboratory now as a civilian.

Lt Col William R. Cordova, deputy commander of the Army Engineer Geodesy, Intelligence and Mapping Research and Development Agency, Fort Belvoir, Va., received the Army Commendation Medal for exceptionally meritorious service in support of the U.S. Army Corps of Engineers' geodetic satellite-tracking program.

The citation states that as team chief, Sequential Correlation of Range, from July 1965 to July 1966, he was "responsible for support of geodetic satellite-tracking operations in the Pacific area designed to produce an ultra-precise connection of the Tokyo and North American geodetic datums.

"He welded U.S. and British military, Army civilians, and U.S. and foreign contract personnel into six integrated tracking teams occupying widely separated islands across the Pacific."

BRONZE STAR. Capt Glenson P. Rhodes, Jr., now assigned to Redstone Arsenal, Ala., received a Bronze Star for his work with the Medical Service Corps in Viet Nam. The citation says he "consistently obtained outstanding results. He was quick to grasp the implications of new problems with which he was faced as a result of the ever-changing situations inherent in a counterinsurgency operation and to find ways and means to solve these problems."

AIR MEDAL. For meritorious achievement in piloting a prototype Army CV-7 Buffalo aircraft from Travis Air Force Base, Calif., to Viet Nam last November, Col Raymond E. Johnson received the Air Medal third Oak Leaf Cluster at the Army Test and Evaluation Command, Aberdeen (Md.) Proving Ground.

The record flight was accomplished in 37:30 hours flying time (44:05 hours total elapsed time). On arrival, the aircraft was ready for immediate use in combat support operations. Col Johnson is president of the Army Aviation Test Board, Fort Rucker, Ala.

COMMENDATION CERTIFICATE The following employees of the Office of the Chief of Research and Development received Commendation Certificates for Outstanding Performance: Glenna B. Hester, Nora Lee Comer, Joan C. Padgett, Walter Willis, Betty Kleindienst, Marian L. Batson, Frances R. Belles, Phyllis M. Brown and Lela A. DeTemple.

Other OCRD employees honored with Commendation Certificates were Robert P. Fink, Jean F. Greene, Lawrence E. Jones, Jeanette H. Merritt, Rufus M. Mitchell, Dr. Selig Starr, Dr. R. B. Watson and Dr. R. A. Weiss.

FASEB's Life Sciences Research Director Earns Outstanding Civilian Service Award

Medical research program analysis and counseling provided to the Army by Dr. Wendell H. Griffith, director, Life Sciences Research Office, Federation of American Societies for Experimental Biology (FASEB) since 1962, have earned the Army's Outstanding Civilian Service Award (OCSA).

Director of Army Research Col Robert E. Kimball presented the award on behalf of Chief of Research and Development Lt Gen A. W. Betts at a ceremony, Sept. 28, in the U.S. Army Research Office, Arlington, Va.

Tribute to Dr. Griffith's exceptional abilities and achievements as a scientist, professor of biochemistry and academic leader of national stature, and adviser to numerous agencies, is attested in a long citation.

An even more revealing insight into the extraordinary qualities of Dr. Griffith was a heart-warming expression of professional esteem and personal affection voiced by Col Tyron E. Huber, chief, Life Sciences Division, U.S. Army Research Office.

Col Huber recalled his long association with Dr. Griffith, starting as a student of the eminent biologist and carrying through years of working relationships in Department of Defense R&D activities.

Formerly professor of biochemistry, and chairman, Department of Physiological Chemistry, University of California at Los Angeles, Dr. Griffith has served as director of the FASEB Life Sciences Research Office since it was established as an Army contract agency in July 1962.

Present for the OCSA ceremony were Dr. J. F. A. McManus, executive director of FASEB, and his predecessor in that office until he retired, Dr. Milton O. Lee. Another distinguished attendee was Dr. Stanhope Bayne-Jones (Brig Gen, USA, Ret.), who received the same award in 1965 at a ceremony that drew top leaders of the Departments of State, Defense and Army.

Other dignitaries who turned out to honor Dr. Griffith included Dr. Herbert Pollack, Institute for Defense Analysis, Washington, D.C., and two men closely associated with the award winner in his work with the Army, Dr. Herbert Ley and Col Ralph Bunn.

Dr. Ley was recently appointed director of the Bureau of Medicine, U.S. Food and Drug Administration. Formerly, he and Col Bunn were in the Army Research Office Life Sciences Division.

Dr. Griffith's citation states, in part, that he "provided exceptionally meritorious service to the Secretary of the Army and the Department of the Army staff by his wise counsel and perceptive analyses in the biological and medical sciences during the period of 27 July 1962 to 1 March 1966.

"As organizer and director of a novel advisory service in the Life Sciences, he exercised his leadership in the scientific community to develop unique research methodologies leading to analytical reviews of problems.

"His dedication to the highest standards of scientific excellence, his initiative and imagination in precisely defining new research areas, and his rare perception of research opportunities, provided the basis for dynamic support of Life Sciences research in the Army. . . ."

Many other honors have rewarded Dr. Griffith's long career as a professor, and as a consultant to the Department of Defense. Military service in World Wars I and II earned him the Legion of Merit and the Bronze Star. He served as chief, Nutrition Division, Office of The Surgeon General, European Theater of Operations, with responsioility for nutritional adequacy of rations to troops, hospital patients and prisoners.

DIRECTOR of Army Research Col Robert E. Kimball presents Outstanding Civilian Service Award to Dr. Wendell H. Griffith, director, Life Sciences Research Office, FASEB.

Dr. Griffith was graduated from the University of Illinois in 1923 with a PhD in biochemistry. His 40-year teaching career has included service at St. Louis University, University of Texas (Galveston), and the University of California at Los Angeles. He was a department chairman at the latter two schools and was retired from UCLA as Professor Emeritus in 1963. He is a member of the Faculty Senate, UCLA.

Dr. Griffith was president of the American Institute of Nutrition (1950-51) and has served on numerous boards and committees of the American Medical Association, National Academy of Sciences-National Research Council, National Institutes of Health, Veterans Administration and various other agencies.

Maj Gen Pochyla Gets Awards Upon Ending 37 Years Service

MILITARY AND CIVILIAN HONORS for exceptional service were presented to Maj Gen Benjamin H. Pochyla, CG of the U.S. Army Electronic Proving Ground, Fort Huachuca, Ariz., for the past three years, when he retired Sept. 30 to end 37 years of Army service. Lt Gen James L. Richardson, CG of the Sixth Army, presented him with the Distinguished Service Medal (1st Oak Leaf Cluster) and Arizona Governor Sam Goddard awarded the Governor's Citation in recognition of service to the people of Arizona and the Nation. General Pochyla earned his first DSM as a member of General McArthur's staff in the Southwest Pacific during World War II. Several generals and other ranking dignitaries joined 1,500 marching troops and thousands of additional participants.

DoD Opens Management Program

Management training programs in the fields of research and development, finance, personnel, and other areas are planned under the Defense Management Education and Training Program, DoD Directive 5010.16.

The Assistant Secretary of Defense (Manpower) will administer the program and issue an updated Management Education and Training Catalog. He will also chair a board to establish courses and monitor existing efforts to assure a comprehensive and coordinated program.

Realism in Research Exemplified by Rugged Mountain Trek

Realism in research is exemplified in a report by Dr. Jay Tol Thomas, Deputy for Research and Laboratories, U.S. Army Material Command, on a rugged 15-day heavy back-pack hike to the 14,496-foot level of the Sierra Nevada Mountains.

Business was combined with pleasure on the trip. Dr. Thomas is the type who finds the best relaxation from laboratory or administrative duties in the exhilarating outdoor life. Mountain climbing is his idea of real sport. His primary purpose was to test, first hand, Long Range Patrol Food developed by the U.S. Army Natick (Mass.) Laboratories.

Complete candor is reflected in his report to Brig Gen William M. Mantz, CG of the Natrick Laboratories. Some of his comments regarding certain field rations indicate he believes improvement is in order.

The famed John Muir Trail he traveled is recorded as 211 miles long, and it winds through some of the world's most beautiful scenery, but Dr. Thomas made a couple of side trips that raised his total trek to 242 miles. All of his supplies except water were back-packed.

Excerpts from his trip report follow:

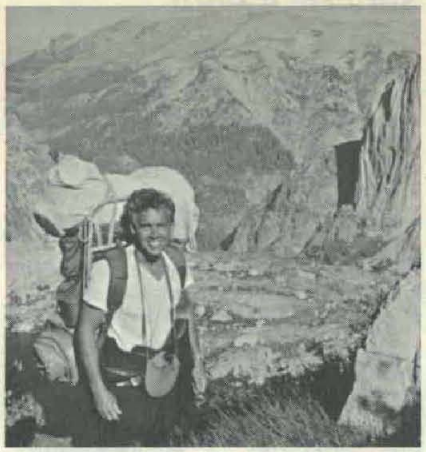
"Finally, I'm sure you realize that it is not distance along the trail that is the challenge, but the number of feet one has to climb in altitude, or up the 'Z axis' as I call it. After leaving Yosemite, the following passes were climbed:

"Cathedral Pass, 10,000'; Donohue Pass, 11,125'; Island Pass, 10,250'; Silver Pass, 10,900'; Selden Pass, 10,870'; Muir Pass, 12,059'; Mather Pass, 12,050'; Pinchot Pass, 12,050'; Glen Pass, 11,900'; Forester Pass 13,200'; and finally Trail Crest Pass at 13,777'. If one plots altitude versus distance along the trail, it is a continuous series of 'saw tooths' gradually increasing in altitude.

"There are two 'holes' below 8,000 feet that one has to pass through. One of these is Red's Meadow, where a pack station is located. As I went into this station, I saw a large color photograph of Mr. McNamara [Secretary of Defense] and a small boy posted on one of the columns located by the door.

"This pack station has the only telephone along the trail, except at Tuolumne Meadows, and after I had been there a few minutes the owner, Mr. Tanner, came up to me and said, 'Are you Dr. Thomas?' After I had answered he gave me a note which stated 'Call your office.'

"The total payload which I started with was 82 pounds (I weighed it with some bathroom scales which I had in the car). This included food, clothes, medicine, stove, two cameras, 40 rolls of film, flashlight with two extra batteries, two Swiss Army knives, down sleeping equipment, air mattress, ground cover and canteen.



JOHN MUIR TRAIL at 14,496-foot peak level of Kaweah Gap forms background for Dr. Jay Tol Thomas, Army Materiel Command Deputy for Research and Laboratories, on 15-day, 242-mile trek through Sierra Nevadas.

"I used a Keltey pack made of nylon on an aluminum frame with a heavy foam-rubber-lined waist strap. I wore Norse net 'drawers' and a cotton T-shirt. Over this I wore a wool Air Force flying suit which I purchased from surplus five years ago. I use this suit because it has six pockets, which eliminates the necessity of stopping to obtain items from the back pack such as film or chapstick.

"Now on to the Natrick food. In an effort to simulate various conditions, I ate the dehydrated portion of the meals three different ways: dry, rehydrated with hot water, and with cold water. To heat the water, I used a Bleuet S-200 stove. With this stove I had boiling water in seven to eight minutes.

"This stove, which uses liquefied petroleum under high pressure in replaceable cartridges, weighs only a few ounces. Two cans of fuel lasted for the entire trip. The flame is smokeless and almost colorless — a whitish blue.

"*Packaging:* The packaging is excellent. There was no split or open bag at any time. In fact the bags are so tough I suggest you could use them for determining the deteriorating strength of the combat soldier with instructions, 'If you can *not* open this bag by hand, return to your company and report to the Medics.'

"*Matches:* These matches are good but the stems are not as strong as I would like. On several occasions they would break as I tried to strike them. Since I used only a few per day I noticed that after carrying a package for two or three days the paper cover splits completely open at the end near the head.

"*Cereal Bar:* This is excellent in my opinion. In my eagerness to get data, I unfortunately gave away some of these bars and did not have any for the last three days. Reaction of others was uniformly the same, 'Where can I buy some?'

"*Coffee:* Instant (Type II). Excellent. At high altitudes, low temperatures and strong winds an optimazation decision has to be made; if a full cup is made, it will probably be cold by the time it is consumed. So I usually made half a cup at a time, which necessitated portioning out just the right amount of coffee. You might consider putting in just a little more coffee in case of spillage, etc.

"*Cocoa:* I tried this several times with hot and cold water. In this form I really don't care for it since it has a rather artificial taste. I used some dry milk with it and it was rather tasty. I gave away about ten sacks of it and the comments varied from poor to fair.

"*Main Dish:* As stated previously, I ate the food hot, cold and dry. In contrast to the instructions, I found that it takes 12 to 15 minutes to rehydrate the food. Of course I ate above 10,000 feet most of the time, so the boiling point of the water was decreased. I prefer to eat it dry rather than rehydrated cold. It tastes rather good dry. (Before pouring in the hot water I stirred the dehydrated food. After the hot water was poured, I put the bag back into the brown bag to minimize thermal loss.) As to each menu:

"*Beef Hash:* This is fair but I suggest that it is mislabeled. It should be mashed potatoes with a beef flavoring. I really had trouble finding any pieces of beef of any size. I think we can do better on the protein allocation.

"*Chili Con Carne:* Delicious, but you fellows forgot the crackers!

"*Spaghetti with Meat Sauce:* Delicious, but no Parmesan cheese!

"*Beef with Rice:* Very good and in this case the size of the beef chunks is adequate. You might consider some dehydrated soy sauce with this.

"*Chicken Stew:* Very good but could use more carrots.

"*Pork with Escalloped Potatoes:* Very good, but someone must have mistyped the label because those were diced not escalloped potatoes.

"Beef Stew: Delicious—a best seller with good taste.

"Chicken and Rice: This packet made me sick each and every time I ate it. After I experienced this fact, in my 'logical and impartial' rationing system I began reprograming the eating of chicken and rice. This clever piece of logistics resulted in having nothing but chicken and rice for the last three meals.

"Fruit: I carried many sacks of the dehydrated fruit. For my taste (and the small sample of campers that tried it), this is much too sweet—it is sickeningly sweet! I made some up at night and tried it the next morning for breakfast, and it was still too sweet. I ate it dehydrated and it was a little more acceptable. The taste is superb but too much sugar is added.

"Other food that I carried with me included 20 sacks of lemonade mix. Each night I made 1½ quarts of lemonade. The next morning the canteen would be partially filled with ice crystals. So for a few hours each morning I had iced lemonade, which from a morale-building point of view was unsurpassed. Also I carried along 10 sacks of low-fat dehydrated milk and 20 sacks of eggnog flavored 'Instant Breakfast.' I mixed these together and the combination is good.

"Water: The John Muir Trail is never more than a mile from water. Although this was the hottest and driest summer, I had plenty of water. In a normal summer the water temperature varies from about 41° F to 55° F. On the first day, when I climbed up the Z axis 6,100 feet, I drank six quarts of water without any urination.

"Climate: Relative humidity probably never was more than 40 percent, but more like 30 percent ± 10 percent. Daytime temperature was in the range of 60 ± 10° F., which is hot for climbing. Nighttime temperature was at least below freezing, and probably down to a high of about 20° F. upon the passes where I slept most of the time.

"Leaving LeConte Canyon, I was warned by a ranger that 'the pass is socked in with heavy snow," but I kept going. By 5 p.m. I had climbed the 'Golden Staircase' and was at Palisade Lake (10,650') and 'grains' of snow were falling. The Mather Pass about a mile on up the trail was indeed 'socked in.' I ate quickly and put on all my down clothing. I lashed myself (in sleeping bag) to the side of a rock partially protected from the increasing wind.

"In about 15 minutes the blizzard hit, with the winds up to about 60 ± 10 m.p.h., and the snow grains pounding down almost parallel to the horizon. The lake about 40 feet below me had white caps that were two to three feet high.

"After about 90 minutes, the storm passed over and a full moon came out. The temperature remained low but I had a good night's sleep tied with a 'perlon' rope to the side of the cliff. Fortunately, it never rained during the entire trip.

"Psysiological Condition: Other than the reaction to the No. 8 food packet, I had no sickness at all. Each day I had a bowel movement. I don't know where you 'disguised' the medicine, but it really works. I used 'moleskin' on my heels, so no blisters developed there, but some did develop between my toes. Also I had heavy 'fever blisters' on my lips.

"My feet took a beating because of the heavy load. The balls of my feet are still numb but will soon return to normal, I hope. As you know, I run about four miles each day, play squash, and continue to lift bar bells, so physical condition was never a concern of mine. At night I measured my pulse rate (in the sleeping bag) and it was in the low 70s most of the time. Each day I soaked my feet in the cold water as I ate lunch and then applied foot powder and put on dry socks (cotton socks under wool socks).

"Sleep: Each night I was in my sleeping bag by 8 p.m.—it gets dark about 8:30 p.m. at that time of the year and that altitude. I took two 'Tuinal' sleeping tablets, two 'Equinal' tranquilizers, two 'Anacin' tablets. I was asleep in a matter of minutes. I was up at 6 a.m., except on the last day of the trip.

"Conclusions: From this atypical sample, the problem that I feel strongly about is the method available to the combat soldier for preparing hot water. It seems to me the last thing he would wish to do is build a fire of damp wood, probably requiring paper and then a messy metal grill.

CONTRAST of rugged peaks, sky, snow and water reflects the unspoiled beauty of the famed John Muir Trail.

You might look into the Bleuet S-200 stove although it is dangerous. It should not be thrown into fires, must be stored away from a thermal source and it takes off like a rocket if a hole is punched in it.

"You might take a look at your No. 8 menu and the sugar in the dehydrated fruit. And of course let's continue to lighten the load where possible for the combat forces.

"I hope no soldier has to carry into combat as much as I did. Along the trail, I had lots of time to think and I rank-ordered the items required for survival in that high and desolate country. My list was (1) water, (2) shoes, (3) warm clothing, (4) food, (5) maps and a compass.

"According to the many books that I have read about the John Muir Trail, this trip was a first of its kind —and certainly no one has made it in shorter time carrying all of his own supplies. But lest I get too smug about it, let me tell you of a trip made by a hardy soul named Orland Bartholomew. He left Lone Pine on the 25th of December and arrived in Yosemite Valley on the 3rd of April skiing most of the way. He carried a 60-pound pack that he replenished from food and equipment caches that he had stored in 11 places along the trail the previous autumn.

"And finally, you may know that for 24 years the U.S. Army managed the national parks in this area at the request of the Department of Interior. One of the superintendents of the Yosemite Reservation, Lt Col S. B. M. Young, later became Chief of Staff of the United States Army."

ECOM Calls for Tech Papers For Frequency Control Meet

Technical papers for presentation at the 21st Annual Frequency Control Symposium, Apr. 24–26, at Atlantic City, N.J., are being solicited by the sponsoring U.S. Army Electronics Command.

The papers should cover progress in research and development of quartz crystal devices and their application to frequency control and selection, piezoelectric resonators, oscillator and frequency synthesis circuits, fundamental properties of quartz, atomic and molecular resonance devices, and related subjects.

Four reproducible copies of a 500-word summary, together with the author's name, address and telephone number, should be sent to the Director, Electronic Components Laboratory, U.S. Army Electronics Command, Attention: AMSEL–KL–ST (M. F. Timm), Fort Monmouth, N.J.

Deadline for submission of summaries is Dec. 15, 1966.

Design for Simplicity

By Col Arthur W. Ries

It is no small task to keep our weapons design simple. Today's Army materiel is more complex and sophisticated than that of the past, and with new scientific information being continuously made available to improve our materiel, this trend is destined to continue.

New scientific knowledge, with its attendant technological advances, has provided our developers with the means to increase mobility, extend and improve communications, and deliver greater firepower in combat. Concepts of modern warfare demand quick tactical responses to rapidly changing and widely dispersed battlefield situations. Our job of providing superior weapons and vehicles to support this concept has become increasingly more difficult.

In stressing superiority, however, the requirement for simplicity of operation and maintenance can be easily overlooked. Sophisticated equipment requires the soldier-user to undergo intensive technical training and many hours of practice to perfect skills.

Two primary courses of action are open to us in maintaining man-equipment compatability—either raise the skill level of our soldier-user, or design equipment that he can use effectively with present skills. The latter is the preferred method.

Simplified materiel may be defined in many ways by the designer, the developer, producer, or the user. Because materiel is produced for the soldier, who will use and evaluate it, the definition is developed from his viewpoint. Since any definition must be drawn wth proper consideration of the cost to our economy, all nonessential features should be eliminated.

With these considerations in mind, simplified materiel may be defined as: *Materiel capable of optimum mission effectivenes, characterized by ease of operation and maintenance and absence of nonessential features.* This definition does not necessarily imply that there must be less complexity in design, development, or production of materiel. Complex equipment may be, and sometimes is, simple to operate and maintain.

Many of the command-emphasis programs currently used as management tools in the research and development process mention simplicity, although it is not the stated objective of any of them. Most important among those which have an impact on simplification are human factors engineering, standardization, cost reduction, maintenance engineering, configuration management, reliability, value engineering and quality assurance.

Since none of these programs is primarily directed towards simplification and the implementing regulations do not define the term, R&D efforts can easily overlook simplification as a desirable goal. Assuming the proposed definition in an examination of the eight programs just enumerated, three were found that may be used effectively to direct our efforts specifically toward accomplishing simplification by *removing nonessential features*, through Human Factors Engineering, Maintenance Engineering, and Value Engineering.

Human Factors Engineering pertains to the application of scientific principles concerning human, physical, and psychological characteristics to the design of equipment. Work in this area, to be most effective, should be accomplished at the earliest possible stage of materiel design, to increase safety, speed and precision of operation, provide maximum maintenance efficiency, reduce fatigue, and simplify operational requirements. Its most important objective is to provide optimum operability of equipment.

This program is implemented within the U.S. Army Materiel Command (AMC) through the establishment of a Human Factors Engineering element within each commodity command. The Research and Development Directorate of AMC Headquarters has staff responsibility for the program. Command-wide monitorship has been assigned to the Human Engineering Laboratories at Aberdeen Proving Ground, Md.

The AMC Maintenance Engineering Program implements those of the Department of Defense and the Department of the Army. It emphasizes the requirement that every possible means will be utilized to reduce maintenance requirements and improve efficiency from initial development of equipment to its disposal.

The Director of Quality Assurance, AMC, is responsible for staff supervision over the coordinated quality assurance system which encompasses maintainability as a part of the system. The Director of Maintenance of the U.S. Army Supply and Maintenance Command monitors the Maintenance Engineering Program for the AMC.

Value Engineering (*VE*), sometimes referred to as Value Analysis, is applied during design and development of materiel to insure the lowest overall cost while retaining the operational and functional characteristics required by the user.

The use of VE as a simplification tool provides a number of bonuses and the additional benefits gained from its use are free. A study was recently conducted by the American Ordnance Association to determine the effects of VE on some of the other programs. It was found that, in addition to the basic objective of reducing costs, VE improved reliability by 30 percent, maintainability of materiel by 50 percent, and human factors aspects by 19 percent. Other benefits also were documented in the study.

Emphasis on cost reduction must be balanced by consideration of a wider range of simplification aspects achievable through the same program. Additional VE emphasis should be given during the design phase, where cost reduction figures are difficult if not impossible to identify. Expanded use of VE during the whole development VE during the whole development cycle and in connection with a wider span of materiel, will enhance the use of this program as a simplification tool.

Overall staff supervision of VE within AMC is the responsibility of the Director of Quality Assurance. Commodity commands, project managers, and commanders of separate installations and activities implement, conduct, and evaluate their VE activities.

These, then, are three existing programs through which we can most effectively emphasize the necessity for

Col. A. W. Ries

Col Arthur W. Ries, the author of "Design for Simplicity," is deputy president, U.S. Army Materiel Command Board, Aberdeen Proving Ground, Md. His is a former Artillery officer and now is a career logistician. He has served with the Office of the Deputy Chief of Staff for Logistics and as special assistant to the Chief of Transportation.

Col Ries was commanding officer of the first aviation group to be organized in the Army and later commanded the Transportation Depot, Sandhofen, Germany. In 1961 he became Chief of Staff for the U.S. Army Aviation Materiel Command, St. Louis, Mo.

simplification. Some method of evaluating progress also is required. AMC's in-process reviews (IPR), ideal for this purpose, provide convenient milestones in the development cycle where progress towards simplification can be evaluated.

In summary, the simplification of Army materiel is being given particular emphasis in AMC by:

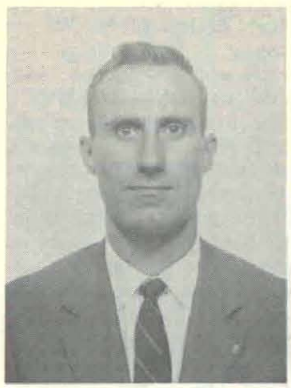
- Using definition cited earlier in this article to provide a tangible goal towards which the simplification effort can be directed;
- Specifying simplification as an additional purpose in the value engineering, and human factors engineering regulations;
- Using in-process reviews to evaluate simplification progress;
- Placing heavy emphasis on simplification early in the R&D cycle and continually evaluating it in process.

The U.S. Army Materiel Command, through these specific actions, is insuring that simplification of materiel is adequately emphasized as a basic goal in providing our fighting men with equipment that is easy to operate and maintain and is free of nonessential features.

Law of the Too-Solid Goof

In any collection of data, the fact most obviously correct, beyond all need of checking, is the mistake. Corollary 1: No one whom you ask for help will seek the mistake either. Corollary 2: Everyone who stops by with unsought advice will see it immediately.

Three Join Professional Staff of Army Research Office



Dr. V. E. Zadnik

Lt Col R. R. Lunger

Lt Col N. C. Sibley

Dr. Valentine E. Zadnik, Lt Col Raymond R. Lunder and Lt Col Nathan C. Sibley are newcomers to the staff of the Army Research Office, Office of the Chief of Research and Development, Department of the Army.

Assigned to the Environmental Sciences Division, Dr. Zadnik has BS, MS and PhD degrees (magna cum laude) in geology from Western Reserve University and the University of Illinois. While at Massachusetts Institute of Technology, he did graduate work in soil mechanics.

From 1960 to 1963, he was employed in the Air Force Systems Division at Los Angeles and was responsible for selection of sites for launching of intercontinental ballistic missiles. He represented the Air Force on a number of technical and advisory panels and committees.

In 1960-61, Dr. Zadnik published reports of his research in several professional journals while employed by the ESSO Research and Engineering Co., Florham Park, N.J.

LT COL LUNGER, engineer adviser to the Saudi Arabian Army in 1965-66, is now staff officer in the Regional and Special Projects Branch, Environmental Sciences Division.

A 1950 graduate of the United States Military Academy, he received an MS degree in civil engineering from Iowa State University in 1958.

From 1961-1963 he was with the New Orleans Engineer District, Baton Rouge, La., after serving with the 24th Infantry Division, Augsburg, Germany. Col Lunger was assigned to the 3rd Engineer Battalion, Munich, Germany in 1959-60 and the 139th Engineer Detachment, USAREUR in 1958–59.

Among his decorations are the Bronze Star, World War II Victory Medal, Combat Infantryman Badge, Korean Service Medal and the Republic of Korea Presidential Unit Citation.

LT COL SIBLEY is a staff officer in the Operations Research Division, His previous assignment was with the Joint U.S. Military Advisory Group, Thailand. From 1960 to 1964 he was an instructor in military science at the University of Virginia, following an assignment in Hawaii.

Col Sibley received a BS degree in physics from Georgetown University in 1950, and has completed the Basic and Advanced Infantry Officers' Courses, the Ranger Course, and the Air Ground Operations Course. He holds the Commendation Ribbon, Combat Infantryman Badge, Silver Star and Purple Heart.

Explosive Device Speeds Trench Digging

Combination of an Army tractor and a prototype device to create repetitive explosions to aid earth-moving work is intended to give the Army a capability of digging a trench 10 feet wide, 5 feet deep and 14 miles long in 8 hours.

A $197,655 contract to design, fabricate, test and deliver the new explosive device by the spring of 1968, was awarded recently to the Southwest Research Institute, San Antonio, Tex.

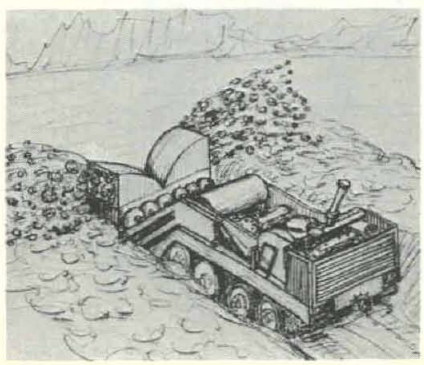
The U.S. Army Mobility Command Engineer Research and Development Laboratories, Fort Belvoir, Va., initiated studies and preliminary investigations for development of the new approach to massive earth moving.

The prototype will be designed to use several explosive cells attached side by side to the front of a tractor. The forward lip of each cell will be pushed forward under the soil to be displaced.

Hydrocarbon fuel and hot, high-pressure air are metered into the combustion chamber and ignited. Force of the explosion is expended through the lip of the cell, breaking the soil above for excavation.

The system, in effect, will somewhat simulate the swimming motion of large sea animals (whale, porpoise, etc.) as the machine moves ahead.

In the artist's sketch below, the new device is shown mounted on the Universal Engineer Tractor (UET), which also was developed by the Engineer R&D Laboratories in their efforts to provide the modern Army with greater mobility.



Military Value of Social Sciences in Insurgent Environment

By Dr. Michael C. Conley

The essential core of insurgent warfare is political, and the counterinsurgent can achieve victory only if he operates skillfully in the political arena. The insurgents' greatest achievement has been their ability to build new institutions and norms for the population and thereby achieve a political control base which overcomes the initial advantages an incumbent government possesses.

Counterinsurgents have generally concentrated on the creation of military forces rather than on programs to offset this insurgent appeal. Such efforts have failed to bring full success because they are tangential to the central challenge.

An analysis of past Communist-dominated insurgencies and of the current experience in South Viet Nam reveals consistent patterns of insurgent behavior. The insurgents' pathway to national power has not been the dramatic seizure of the governmental apparatus, but rather the slow forging of alternative institutions and norms which gradually receive the loyalty of increasing numbers of people.

Government forces are not so much destroyed as they are displaced. The *de jure* authority is superseded by a more vigorous *de facto* control system before any dramatic uprising in the capital concludes the drama. The capture of the physical facilities of the central government comes long after the capture of the loyalties of the populace.

The established government's ostensible material, technological and administrative advantages can be whittled away by insurgents only if they keep two principles firmly in mind:

First, they must sustain the struggle on the socio-political plane where they are strongest and refrain from engaging the government where it has the greater strength.

Second, only after they have achieved a firm base of popular support should they begin to use progressively more varied types of operations against the government and those who identify closely with it.

Even then, they dare not stray at any time from their central political purpose—the capture of the population. Only those types of operations are appropriate at any given time which further this central purpose.

The insurgent objective dictates that they function primarily in the political sphere. Because their field of activities is among the people, their leadership is provided by politicians, not by military commanders. Within this vital sector of operations, the premium is placed upon work with the masses and institution building.

Multiple benefits derive from the insurgents' civil organizational efforts. Psychological and material support is generated which will sustain the movement over extended periods of time. Political force ratios are altered to the advantage of the insurgents as they make significant elements of the population and of the country's resources unavailable to the government.

Natural coloration is created behind which the party apparatus may withdraw from the glare of public attention. An artificial milieu, shut off from external influences, is established in which successive elements of the population can be trained for work in the new totalitarian state which will function upon the consummation of a successful insurgency.

Finally, the insurgent leadership is provided with a quasi-governmental base from which they can engage in international diplomacy and external propaganda activities.

Counterinsurgents, to be successful, must fashion plans in terms of recognized insurgents' objectives and techniques. Only by structuring response to the known threat can counterinsurgents employ resources to best advantage. Such comments may seem obvious, but all too often they are forgotten by counterinsurgents with a technological orientation.

One of the distinctive characteristics of the American has been his inclination to seek resolutions to outstanding domestic problems through the application of technology. This was as much true of Henry Clay's celebrated "American System" of the 1840s, which was designed to draw the disparate segments of the Ohio River Basin together into a single economic unit, as it was of Franklin Delano Roosevelt's Tennessee Valley Authority in the 1930s.

Reliance on technology to the exclusion of other approaches detracts, however, from the counterinsurgent's ability to function effectively in an insurgency. The threat is, to repeat, political. The more a counterinsurgent military force becomes dependent upon its technology to sustain itself in an insurgent environment, the less relevant its operations are to the challenge.

Technology is no substitute for politics; the more the attention of security forces is absorbed by technology, the closer that force is to political bankruptcy and possible military defeat.

Only as counterinsurgent forces work with the people are they responding meaningfully to the challenge that the insurgents generate through their mass organization work. The American soldier must encourage the people to assume an expanding, active role in providing for their own self-defense.

To the extent that the counterinsurgent circumvents the civil population and grasps at technology as an alternative too or substitute for work among the people, he is, in fact, retreating from the real battlefield.

This is not to say that technology is unimportant. Clearly, the measured application of a wide variety of devices may dramatically enhance the counterinsurgent position. But the decision to use or not use a given machine or implement must be political.

Does employment of a device increase the likelihood that the peasant will enter into a lasting compact with the counterinsurgent forces to work for mutually beneficial objectives?

The fact that a device is locally available never of itself justifies its use. Otherwise, strategy becomes a function of technology, and men whose very survival depends upon their ability to think and move politically become politically insensitive.

Again, this is not to suggest that

Dr. Michael C. Conley has been with the Center for Research in Social Systems (CRESS; formerly Special Operations Research Office), The American University, Washington, D.C., since 1964.

During 1961-1964, he served successively as acting director and chief instructor of the Counterinsurgency Department, U.S. Army School in Europe, Oberammergau, Germany. He is the coauthor of Preliminary Survey of Insurgency in Urban Areas, February 1965.

In addition to his duties at CRESS, he teaches a graduate-level 3-credit-hour course in the evolution of Communist insurgency doctrine based upon original source readings.

the soldier in an insurgency situation is less than a professional fighting man or that he may allow his combat proficiencies to decline. Nor is it suggested here that massed attack against a guerrilla who presents an appropriate target is irrelevant.

Rather, the insurgent environment demands of the combatant that he add yet another dimension to his demonstrated capabilities at the combat unit level. Staying power is increasingly a function of politics.

In the long run, only that military force which is capable of sustaining a persistent, active program within the population will be in a position to carry out successfully its more conventional role of fighting the guerrilla. The dynamics of the process do not permit a choice between the one and the other. The military unit must do both well.

The direct correlation between unit fighting ability and popular indigenous involvement is reciving increasing recognition, but this interrelationship is still imperfectly understood.

The technological orientation mentioned earlier has distracted American attention from this problem, but an equally important factor is the lack of adequate literature in the social sciences which would provide a theoretical foundation for the formulation of programs.

Examination of the research and development program presently conducted for the armed forces in the field of counterinsurgency leads to two conclusions:

First, we are the least informed in precisely those aspects of the problem area which have been labeled here as political. Second, in the face of this generally acknowledged ignorance, we continue to assign the lowest priority to those studies which could help to fill in portions of the uncharted regions of human behavior in insurgency situations.

The problem is exacerbated by the fact that our opponent is fully alert to our disinclination to explore this field and is exploiting it against us.

Few themes figure in the torrent of Communist literature dealing with the fighting ability of their American opponents in South Viet Nam with such frequency as that which stresses the American's preoccupation with technical gadgetry and materiel preeminence, and the resultant vulnerabilities that follow from this apolitical orientation.

Stopping up the gap in our doctrinal response to the insurgent obliges us to reorient, consciously, our mission in terms of that rich area of human investigation known as the social sciences. This is the appropriate area for the next great push in the field of research and development.

A similar effort must be made in basic research and training, so as to improve the ability of military personnel to interact meaningfully with the urban and rural civil population in countries confronted with the threat of internal aggression.

Several problem areas deserve attention. The myriad problems the U.S. military advisory program faces in other countries, particularly those relating to how insurgency affects the adviser's role, form a primary field of investigation.

Civic actions should be examined thoroughly in terms of essential doctrines and operational practices. The procedures for the conduct of population analysis in host countries and the issue of how best to utilize information acquired deserve early attention. The applicability of modeling to the study of insurgent environments must be examined, particularly in the light of the potential utility of gaming simulation in teaching.

The general field of terrorism, violence and assassination has yet to receive the attention it deserves, while the complex problems faced in the nation-building process remain poorly understood, particularly with respect to impact of military aid programs.

These are but a few of the areas which have changed the role of the armed forces. Since our opponents have consciously exploited our vulnerabilities in these fields, it is vital that we improve our capabilities here if we are to develop a successful response to the insurgent threat.

STRATCOM Fills 2 Key Posts

Cols Lawrence R. Klar and William C. Neubauer, long-time Signal Corps officers, have been named to key posts with the U.S. Army Strategic Communications Command (STRATCOM).

Col Klar has assumed new duties as the Command's Chief of Staff and Col Neubauer has been appointed CO of STRATCOM's continental U.S. operations. Col Klar, who previously had served as director of the Command's Communications Engineering Department, succeeds Col James G. Moak, STRATCOM's recently retired Chief of Staff.

Paper Cites Research Need on Toxic Algae

Much more extensive research on toxic algae and protective measures is necessary before the sea can fulfill its promise of providing algae as an unlimited food source for the world's rapidly increasing population.

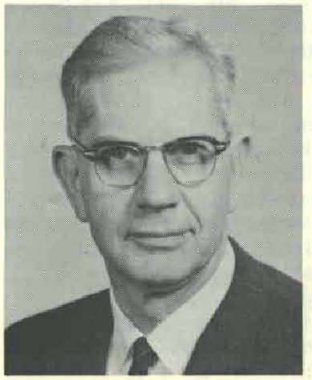
One of the Army's acknowledged authorities in this field of study, Dr. Edward J. Schantz of the Biological Laboratories at Fort Detrick, Md., pointed to this need for expanded research in a technical paper presented at a recent American Chemical Society symposium in New York City.

"Algal Toxins" reported on investigations conducted at Fort Detrick to determine more precisely the nature of algae which cause poisons in clams and mussels, so deadly to man that consumption of one or two may prove fatal, though dosage may be less than a milligram.

Dr. Schantz said the study of toxins produced by algae presents many "important and fascinating problems," since so many species of algae, as well as the marine specimens they infect, are considered potential food sources adequate for requirements of future generations.

Scientists at Fort Detrick have long played an important role in investigating the algae, a simple form of plant life. The problem is that only when all the poisonous varieties can be grown in pure form in the laboratory will scientists be able to explain how man and animals are affected.

In cooperation with researchers at Northwestern University and the University of California, Fort Detrick investigators have purified and characterized the poison from shellfish. The trouble-causing algae has been isolated and cultured for study of its relation to the shellfish.



Dr. Edward J. Schantz

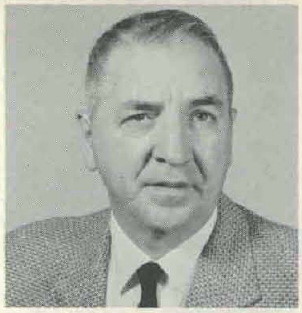
Cases of shellfish poisoning have been reported around the North Sea, the west coast of the United States and Canada, the southern coast of Alaska, and near South Africa and Japan.

Dr. Schantz said one of the major problems presented by toxic algae is the killing of many fish in commercial fish ponds and along the coasts of Florida. Massive mortality, characterized by the color of the water, was first known years ago as the "the red tide."

The report stated that there are also common varieties of algae in fresh-water lakes in southern Canada and northern United States which produce poisons fatal to farm animals.

Nutrient Requirements of Troops in Extreme Environments

By C. Frank Consolazio
Chief, Bioenergetics Division
U.S. Army Medical Research and Nutrition Laboratory
Fitzsimons General Hospital
Denver, Colorado



In any combat situation, under conditions of normal and extreme environments, optimal nutrition is essential in maintaining health and maximal efficiency of the troops. Marginal nutritional deficiencies impair performance, decrease resistance to diseases and slow down rehabilitation from wounds and illness.

Some basic considerations in maintaining top physical efficiency are adequate nutrition, adaptation to and/or control of the environment, and the overall physical and mental condition of the individual.[1]

Optimal nutrition is, in general, related to the quantity and quality of food consumed that is required by the human body to meet the specific needs of the resting and basal metabolic rate, of the building and replacing the body tissues, of the requirements for specified physical activities, of the specific dynamic action of foods, and of the excretory losses.

One can cope with these factors only when he can define the minimal energy requirements and caloric allowances that will prevent the eventual breakdown of men living and working under extreme evironmental conditions. One must remember that a negative balance of only 100 calories daily amounts to a loss of approximately 10.5 pounds a year.

Minimal daily allowances are dependent on many variables including age, sex, environmental temperature, physical activity and body composition. The National Research Council (NRC) minimal daily allowances have now been reduced to 2,900 calories[2] for the man aged 25 years, weighing 70 kg who is living in a temperate environment of 20° C. (68° F.), and who is performing moderate physical activity. These allowances are increased with an increase in body weight and decreased as the age increases (Fig. 1).

Food Intake Factors. The general concept for many years has been that food requirements were inversely proportional to the environmental temperature.[3] This meant that food requirements of men performing moderate physical activities were decreased to 3,000 calories in hot environments of 40° C. (103.8° F.) and increased to 5,000 calories in environments of −20° C. (−4° F.).

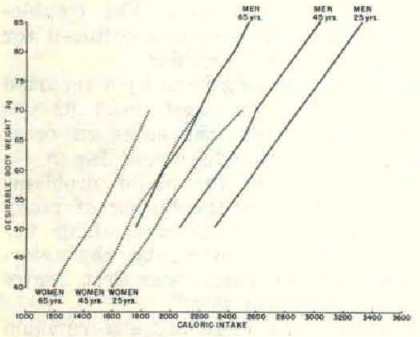


Figure 1. Calorie Allowance in Relation to Age and Body Weights (NRC)

Since these data could not be explained by changes in body weight or by the differences in physical activity, it was the feeling that they were due partially to increased requirements for maintaining body temperature and to increased energy expenditure in carrying heavy cold weather clothing and foot gear.

These requirements[3] had been the subject of controversy for many years, until Welch, et al,[4] published information on the maximal calorie requirements of men living and performing heavy physical activities in an extremely cold environment of −21.8° C. In a 21-day bivouac study it was observed that the daily food requirements averaged 4,200 calories daily, approximately the food requirement observed in men performing heavy physical activities in a temperate environment.

As a result of this study, the present daily calorie allowances for extremely cold environments published by the NRC[2] are practically the same as for temperate climates, except for the two to five percent increase in energy expenditure of carrying or wearing cold weather clothing and heavy foot gear. Under conditions where troops are not adequately clothed, food requirements are increased due to the increase in metabolic rate resulting from shivering.

Studies in extremely cold environments then led to a reevaluation of the food requirements of men living and working in hot environments. In two subsequent studies, it was observed that the food requirement in a hot environment actually increased rather than decreased.[5,6]

Since this was a controversial area, the main points to be evaluated were whether the men in these studies were fully acclimated to the heat and whether the increased requirement was due to insufficient training prior to the beginning of the studies.

In a third study designed to reevaluate these two factors, energy expenditure was measured at three work levels and at three strictly controlled temperatures of 70, 85 and 100° F.[7] This study again demonstrated that the metabolic rate was significantly increased at the higher environmental temperature. The increases averaged 11.8, 13.8 and 10.4 percent for the light, moderate and heavy physical work respectively (Table 1).

TABLE 1
Energy Cost During Rest, Moderate and Heavy Physical Activities Calories/Minute*

	Environmental temperatures			Percentage increase of 100°F. compared with 70°F.)
Activity	70°F.	85°F.	100°F.	
Rest	1.36	1.41	1.52	11.8
Moderate	2.61	2.62	2.95	13.8
Heavy	7.11	7.02	7.85	10.4

* Mean energy expenditure of 7 men during each phase.

The resultant conclusion was that energy metabolism increased in a hot environment and that the increase was due neither to effects of training nor to acclimatization. Suggested also was that the increase in metabolism was the factor responsible for increase in food requirements of men living and working in hot environments.

The recent revision of the calorie allowances published by the NRC[2] suggests that the food requirements be increased rather than decreased for men performing prescribed work at high temperatures.

New allowances are practically unchanged between temperatures of 20-30° C., but are increased in comparison to temperate environments by at least 0.5 percent for each degree increase in temperature between 30-40° C.

In essence, current thinking on the food allowances in a hot environment has changed from a decrease of 9 percent to an increase of 5 percent (an overall increase of 14 percent) compared with temperate climates.

The United States Army's food allowance of 3,600 calories/daily for men performing moderate physical activities in a temperate environment is a slight modification of the NRC's allowance.[1] In addition, the Army also provides for an increase or decrease in the food allowances when the situation arises.

One must always keep in mind that the daily allowances are actually designed to serve as a guide in the planning of an adequate diet for the normal healthy soldier under conditions of growth, heavy physical activity, and under other conditions where increases should be prescribed by the local medical authority. Also, dietary allowances represent the quantity of food actually consumed and not that issued.

Caloric requirements for men performing various levels of physical activity can best be classified in cal./kg. body weight. In a temperate environment, these values range from 32 to 44 calories for light, 45 to 52 for moderate, and 53 to 63 daily for men performing heavy physical activities (Table 2).

TABLE 2
Caloric Requirements in Relation to Environment Calories/kg. Body Weight

Physical activity	Environment			
		Extremely		
	Temperate	Cold	Hot*	Altitude
Light	32–44	35–46	40–54	32–44
Moderate	45–52	47–55	55–61	45–52
Heavy	53–63	56–68	62–75	53–63

* Based on an average increase of 12 percent in the caloric requirements of men working in extremely hot environments.

In a cold environment, these values range from 35 to 46, 47 to 55, and 56 to 68 calories for the same respective groups. In a hot environment, they range from 40 to 54, 55 to 61 and 62 to 75 cal./kg. body weight.

Recent studies by the U.S. Army Medical Research and Nutrition Laboratory (USAMRNL) indicate that the food requirements at altitudes of 11,400 and 14,100 feet are unchanged in comparison to requirements in a temperate environment.[8] However, during the first three to four weeks at altitude, an appreciable loss of appetite is natural.

Food Calorie Distribution. In an extremely cold arctic environment, the Eskimo is accustomed to a meat diet, which may be his only possible diet. Protein intake of the Alaskan Eskimo has been observed to be 25 to 30 percent of the total daily calories.[9] This is considerably higher than the average American intake of 12 to 15 percent and the NRS's daily recommended allowance of one gm./kg. of body weight.[1]

Contrary to popular belief, the Eskimo does not have an extremely high-fat diet. The average observed fat intake was 35 percent of the total calories consumed, slightly lower than the fat intake of other North Americans.

TABLE 3
U.S. Military Personnel Distribution of Calories Consumed in Various Environments

	Percent of total calories consumed		
	Protein	Fat	Carbohydrate
Temperate	12.2	42.4	45.4
Extremely hot	13.0	38.6	48.4
Extremely cold	14.6	36.6	48.8
Altitude (11,500 ft.)	13.1	36.5	50.4
Altitude (14,100 ft.)	12.6	33.4	54.0

Recent USAMRNL information (Table 3) shows that U.S. military personnel consume approximately the same proportion of protein, fat and carbohydrate in all environments. The average is, respectively, 12.2 to 14.6, 33.4 to 42.4, and 45.4 to 54 percent of the total calories consumed.

Food calorie distribution in the diet is a matter of economic status, food habits and preparation. Most Americans are accustomed to a high-fat diet, which may be due to their high economic status. In countries of lower economic levels, one observes high-carbohydrate and low-fat intakes as the general trend. Rice and other grain products are inexpensive, and as a result are the main food items.

Performance. Good physical performance is dependent on many factors. Included are physical condition, technical skill, muscular strength to overcome a given load, motivation to perform to the best of one's ability, limitation of all the inhibiting psychological factors and, above all, optimal nutrition.[1]

A physically fit individual, as compared to the poorly conditioned man, can perform a given grade of light, moderate and exhausting work more efficiently, with less displacement of physiological equilibrium. He can establish steady states at higher levels of work.

If forced, he can displace his physiological equilibrium further for a longer period of time. He has more economical ventilation during work, is able to attain a greater maximal ventilation, has a greater mechanical efficiency as measured in terms of a lower oxygen consumption for a given amount of external work, and is able to attain a greater maximal oxygen consumption.

Moreover, he has the ability to push himself further to a higher lactate level in the blood before exhaustion and has a smaller increase in pulse rate for submaximal work. He has better recuperative powers, in the sense that he can return more rapidly to his normal steady state after an exhausting exercise. Some of the other factors that affect human performance are presented in Table 4.

TABLE 4
Some Areas That Affect Human Performance

Environmental conditions: heat, radiation, convection; cold, windchill; high terrestrial altitude; relative humidity; acclimatization. *Age. Body composition, body fat. Dehydration, water deprivation. Nutrition*: caloric restriction, starvation; salt restriction; vitamin and mineral deficiencies. *Physical conditioning. Motivation*, the ability to continue despite the discomfort of impending exhaustion. *Training.*

Water Requirements. Although the availability of water may not be an immediate problem in a survival situation, it has been shown to be more important than food. Man has been known to survive for 30 days without food,[1] but the survival time without water is very limited.

Gamble[11] has shown that in a temperate environment a normal healthy adult weighing 70 kg., without any fluid intake, loses 1.5 liters of water daily from the lungs, kidneys, skin and bowels. The average total body water of this individual is 45 liters; if he loses 9 liters or roughly 20 percent of his total body water, he is expected to die within 6 days.

Gamble has stated that the absolute minimal daily fluid requirement in a temperate environment is 0.7 liters in the absence of significant phyiscal activity. This is considerably less than the normal daily intake of 2.5 liters or more, varying with the degree of physical activity.

Water requirements are increased with a rise in environmental temperature, due to the increased work load produced by sweating, physical activity and the increased respiratory water loss.

Requirements for water also are influenced greatly by the nutrient composition of a ration. It has been shown that an increased protein intake increases requirements, due to the fact that additional fluid is required to eliminate the nitrogen by-products (especially urea) in the urine. Fat and carbohydrates, which both yield considerable quantities of water on oxidation, decrease the water requirements.

Water balance is essential in maintenance of optimal efficiency. Troops may become voluntarily dehydrated in the field. Johnson[1] and Adolph[12] have shown "that man cannot be trained to restrict fluid intake and that he can never get along without it, no matter how long and often he is exposed to dehydration nor can he reduce his requirements."[1]

Voluntary dehydration or water restriction has been known to cause extreme hardships on soldiers. It is a false assumption that water taken ad libitum "is bad for the soldier, that it reduces physical efficiency, inter-

(Continued on page 26)

Nutrient Needs of Troops in Extreme Environments

(Continued from page 25)

feres with discipline and that it toughens a man."[1] Man must have sufficient fluid for adequate performance. In a hot environment, with water restriction, man quickly becomes incapacitated and exhausted within a few hours.

The "dehydration syndrome" reported by Adolph[12] and others[1] is accompanied by an increased body temperature and pulse rate, restlessness, insomnia and muscular fatigue; all are associated with a decrease in blood volume and impaired circulation. In addition, one observes a loss of appetite, extreme lassitude and unwillingness to work.

Pitts, et al.,[13] in a study where he compared three factors—the use of no water, water fed ad libitum, and water consumed being equivalent to the sweat loss—showed conclusively that water consumption equivalent to the sweat loss produced the best performance. Water ad libitum was the second best situation. No water at all forced the men to collapse much sooner (Fig. 2).

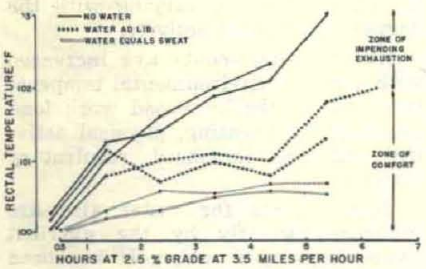


Figure 2. Performance and Water Requirements

Adolph[12] has shown that dehydration, even with moderate physical activity, may disrupt the heat-dissipating mechanism, resulting in an increased body temperature and a decrease in performance. Recent work by Saltin[14] and Consolazio, et al.,[15] has confirmed these conclusions.

A recent field study[15] showed that maximal performance was significantly decreased below control values when a 5 to 10 percent decrease in body weight occurred due to body water loss.

Stevenson[16] made estimates of the survival time of men consuming one pint of water daily at 39° C., and on men who were given five pints of water for total supply at 30° C. (Table 5). One can readily see that the survival time is short.

TABLE 5
Estimated Survival Time, Days

One pint of water/man/day at 39°C.	Days of survival*	Days of ability to work**
No Shade		
Clothes dry	5	2.5
Clothes wet	14	7
Shade		
Clothes wet	20	10
Total water supply 5 Pints of water at 30°C.***		
No Shade		
Clothes dry	5	3
Clothes wet	11	6.5
Shade		
Clothes wet	13.5	8

* Based on 20% body weight loss as the limit of survival.
** Based on 10% body weight loss as the limit of productive work.
*** This is what one can expect if the 5 pints of water are consumed during the first day.

In a desert environment, Adolph and Dill[17] have observed evaporative water losses as high as 1.6 liters hourly. It is no wonder that under these conditions the water requirements are increased three to six times.

Ladell, et al.,[18] reported studies of soldiers in Iraq in World War II living in environments where the maximal daily temperature averaged 115° F. They required approximately 7.5 liters of water daily to maintain water balance. It was recommended that the troops should drink sufficient quantities of water to produce at least 0.9 liters of urine a day, since a low urine excretion was indicative of an early symptom of collapse from a consistent negative water balance.

In a mild desert environment, with a minimal amount of activity, an individual requires about two liters a day. With an increased temperature of 100° F., and with heavy physical activities, a minimum of 12 liters of water a day is required to keep troops functioning properly.

The heat stress imposed by a desert environment is approximately two to three times greater than one finds in the tropics. Molnar[12] observed that in a 24-hour period as was found in a tropical environment.

One cannot be too careful in quoting TB MED[19] which specifically states the following on water requirements:

"(a) These sweat losses must be replaced or rapid decrease in the ability to work, a rise in body temperature and heart rate, deterioration of morale and heat exhaustion will occur. Water loss should be replaced preferably by periodic intake of small amounts of water throughout the daily work period.

"(b) The belief that man can be taught to adjust to decreased water intake in incorrect."

In a cold environment, although the problem of water requirements may not be as critical as in a hot environment, exposure does have a significant diuretic effect on troops. Under cold conditions, the blood volume is decreased. Skin and subcutaneous body tissues become dehydrated, which is a protective measure by the body to prevent the freezing of skin.

A word of caution is in order concerning the great possibilities of voluntary water restriction in a cold environment. In general, there may be a restricted water supply due to the limitation of fuel to melt ice or snow for water consumption.

The procedure for obtaining drinking water from ice is slow and tiresome. Frequently troops in the field would rather become voluntarily dehydrated than spend the time in melting sufficient snow for daily needs.

Water restriction in the cold also could be disastrous due to the increased daily sweating from the wearing of heavy clothing and boots, poor ventilation of the clothing and the respiratory water losses from breathing the dry air. Even in a cold environment, decreased food and water intakes may cause rapid deterioration of troops. Completely impaired military efficiency, physical performance and morale can occur within a few days.[3]

In survival at sea, certain precautions should be taken if at all possible.[16] Prior to abandoning ship, a man should try to drink as much as possible and, assuming short supplies, try to restrict water for a period of 24 hours after leaving the ship, unless he gets very thirsty. Complete fasting usually results in great body water and protein losses which could be disastrous both mentally and physically within 5-10 days.

Under conditions of minimal exertion and negligible seasickness, it has been recommended that 0.5 to 1.0 liters of water a day will prevent dehydration in food-restricted survivors on lifeboats or rafts in a tropical environment.

Consistently reported is that drinking of significant quantities of sea water accelerates the increase of the total diffusing pressure of the human body. An apparent improvement in water balance occurs initially after drinking sea water, but in time the apparent gain in water balance is replaced by an increased urinary excretion. Hervy and McCance[21] recommend strongly against the drinking of sea water even in small quantities, since the evidence indicates that it is extremely harmful.

For survival, it is imperative that troops are reminded constantly of the deleterious effects of water deprivation in man. Thirst is not a reliable

index of water requirements, because an individual's thirst may be satisfied by drinking water long before the sweat losses have been replaced.[12] Adequate hydration is indispensable for maximal efficiency.

Salt Requirements. Salt and water requirements are interrelated closely and are dependent to a considerable extent upon the outdoor environmental temperatures and the physical activity of the individual (heat load and work load).

The NRC Food and Nutrition Board[2] recommends five grams of salt/daily as a liberal allowance in a temperate environment and under conditions of minimal sweating. The allowance can be as high as 10 to 15 grams when the daily fluid intake is below four liters.

Research has shown that an intake of salt between 15 and 20 grams daily is sufficient for most men in a hot environment, although an intake of more than 20 grams is not uncommon under conditions of profuse sweating in a hot environment.

During acclimatization to heat, the salt requirements are greatly increased, due to the high concentrations in sweat. After 6-10 days of acclimatization, the salt requirements are reduced, due to the fact that the concentration of salt in sweat decreases greatly. The daily salt intake must reflect the losses of salt in sweat.

Taylor, et al.,[22] observed that daily salt intake of 15 grams was adequate for men working in extremely dry, hot environments. When the salt intake was decreased to six grams, the men drank much less water, sweated less, but lost twice as much body weight. These individuals had increased body temperatures and pulse rates and poorer cardiovascular adjustments.

Twenty-five percent of the subjects on low salt intakes collapsed. Others showed signs of dehydration, nausea, vomiting, tachycardia, hypotension and vertigo. Only 2.5 percent of the men on the higher salt intakes collapsed. No question exists that the maintenance of salt and water balance even after acclimatization to extreme heat is essential for maintenance of a reasonable level of performance.

The best system of salt supplementation is by its addition to food as a first choice and to water as a second choice. The quantity added to water should not exceed one part in 1,000, a one-tenth percent solution.[1]

A few words of caution are in order on detrimental effects of a high salt intake, especially when the water supply is limited or the troops are not losing excessive salt due to sweating.

Baker, et al.,[23] have investigated thoroughly the effects of high salt intake on water requirements. Findings show that a military ration containing 22 grams of salt a day requires a fluid intake of 4.69 liters for a 155-pound sedentary man living in a warm environment.

This calculation was based on the assumption that the smallest quantity of water required to prevent overloading with salt is that amount which is sufficient to dilute the salt ingested to the same level as sodium and chloride normally occur in the water of blood plasma.[23]

One can readily see that excessive salt intakes (from survival or other rations) under conditions where the water supply is limited should be avoided, since it does increase the water requirements and could also cause intestinal disturbances.

One should always keep in mind the detrimental effects of salt deficiency in men working in a hot environment. A total salt deficiency results in diuresis, since the body is not able to retain water under these conditions. In addition, it is common to observe a decrease in physical performance, an increase in body temperature, an increase in pulse rate, deterioration in morale of the troops and finally heat exhaustion.[22]

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Top Leaders Take Part In Human Factors Meet

Participants in the Twelfth Annual U.S. Army Human Factors Research and Development Conference at the U.S. Army Infantry School, Fort Benning, Ga., Oct. 2–5, heard high-level speakers stress the increasing application of human factors scientific effort to military requirements.

Chief of Research and Development Lt Gen A. W. Betts, Army Chief Scientist Dr. Marvin Lasser and Brig Gen Frank Meszar, U.S. Continental Army Command Assistant Deputy Chief of Staff for Individual Training, gave featured addresses before the 165 conferees.

General Betts said that human factors and operations research, one of the newer areas of Army scientific effort, is reaching maturity as an art that serves a vital military need. Department of Defense officials must be kept aware of the importance of continuing and accentuating activities in this field, he contended.

The keynote address was made by Brig Gen Meszar as successor to Lt Gen Ferdinand T. Unger, recently assigned as High Commissioner of the Rhuykyuan Islands. Dr. Lasser was the banquet speaker.

Five topical sessions featured various aspects of "Social Interface Between U.S. Troops and Local Peoples," "Training for Modern Combat Operations," "Problems and Approaches to the Measurement of Troop Performance," "Human Factors in Night Operations," and "Information Processing in Advanced Computerized Surveillance Systems."

General officers present included Maj Gen Robert H. York, CG of the U.S. Army Infantry Center, Fort Benning; Maj Gen R. G. Fergusson, CG, U.S. Army Training Center, Infantry, Fort Ord, Calif.; Maj Gen T. H. Lipscomb, CG, U.S. Army Training Center, Fort Leonard Wood, Mo.; Maj Gen Ellis W. Williamson (then Assistant Commandant, U.S. Army Infantry School, Fort Benning, and since reassigned to U.S. Army Training Center, Fort Polk, La.);

Also, Brig Gen Robert M. Williams, Deputy CG, U.S. Army Training Center School, Fort Gordon, Ga.; Brig Gen Wallace L. Clement, Director of Personnel Studies and Research, Deputy Chief of Staff for Personnel, Department of the Army; and Brig Gen Michael Paulick, CG, U.S. Army Training Center, Fort Campbell, Ky.

Operational Planners Work 'In Reverse' to Gain R&D Objectives

By Col George H. Russell

Chief, Plans Division, OCRD

An operational planner, when exposed to research and development planning for the first time, soon recognizes that the procedures involved are the same as those he previously used in planning operations— that operational planning involves selection of a suitable objective and then development of the most effective means for getting there with the resources available.

Equally well understood is that an operation is planned "backward," but written "forward," that the planner begins with the final objective, and then selects successive intermediate objectives back to the starting point.

The concept for reaching those objectives is developed and a plan is written to cover operations sequentially, from the starting point through the intermediate objectives, to the final objective. Extensive and complex operations usually involve a family of plans, each making a specific contribution toward reaching the final objective. Similar considerations apply to research and development planning.

The ultimate objective of Army research and development is to furnish weapons, equipment and techniques for the Army which are qualitatively superior to those of any potential enemy, in any environment, under all conditions of war.

The current combat development R&D cycle covers about 25 years from the initiation of ideas stage to complete execution. The planning, research and materiel development that go into this cycle are based primarily on a Joint Staff/Army family of plans and the Army Concept Programs. Each plan and each portion of the Concept Programs contributes toward achieving portions of the overall objective.

The purpose of this article is to outline the procedures, documents and pertinent terminology involved in the Army research and development planning. Programing and budgeting are extremely important sequential and integrated components of the R&D effort but will not be covered. The Army family of plans will be used as a starting point.

BASE/ASP/AFDP. The three Army plans which have principal influence on the R&D effort are the Basic Army Strategic Estimate (BASE), the Army Strategic Plan (ASP) and the Army Force Development Plan (AFDP).

All of these plans are projected 20 years into the future, but each emphasizes different requirements of that period. None of the three is an R&D plan as such. Rather, BASE, ASP and the AFDP analyze national objectives, threats and military force requirements for a stated period of time. They contain specific chapters or annexes which guide R&D work to meet requirements of the military forces.

The BASE projects a worldwide strategic appraisal and a strategic concept to meet anticipated threats under all conditions. It considers national objectives and policies, intelligence estimates and joint planning, and, in the projection of the strategic concept, the technological possibilities.

The ASP, which emphasizes the mid-range period (2–10 years), is directed toward the determination and statement of realistic Army objectives and forces, plus the deployments necessary for execution of the strategic concepts outlined in the BASE. It also states desired Army operational capabilities that furnish guidance to research and development.

The AFDP is the principal Army instrument for planning changes to the Five-Year Defense Program. It addresses resources available or required to include money, facilities and personnel. One of the purposes of the AFDP is to insure that materiel from the R&D program is integrated into the Army most effectively. It also identifies materiel on which R&D efforts should be concentrated in order to equip the Army as planned during a particular year.

JLRSS/JSOP. Influencing the R&D effort are the Joint Long-Range Strategic Study (JLRSS) and the Joint Strategic Objectives Plan (JSOP). The JLRSS contains a forecast of the nature of possible conflict 10 to 15 years in the future and considers anticipated scientific and technological developments likely to affect warfare in that time period. It also contains forecasts developed by the services to cover anticipated technological capabilities.

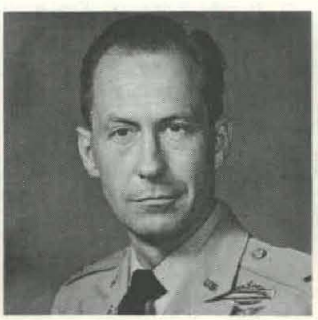
The JSOP, a mid-range plan projected two to eight years in the future, contains a detailed R&D annex. The annex outlines the major service objectives on which priority R&D work and resources should be expended and identifies critical problem areas which require investigation.

LRTF/ARP. Two other key Army documents (not a part of the Army family of plans, but in the planning cycle) are the Long-Range Technological Forecast (LRTF) and the Army Research Plan (ARP). The LRTF is intended to present knowledge, capabilities and examples of materiel which science and technology could be expected to produce over specified time periods up to 20 years when supported by orderly programs of research and development.

The ARP is intended to provide guidance for the detailed formulation of the Army's research programs by assigning relative levels of recognition to scientific and technological areas of interest to the Army. It must support the desired operational capabilities which are derived from the Army Concept Program.

Throughout the R&D planning process, the planner must be aware of the close interrelationship of the Joint Staff/Army family of plans, the LRTF, and the ARP, and recognize that revisions of one plan provide input for the next generation of the others.

CONCEPT PROGRAM. The U.S. Army Combat Developments Command (CDC) has a key role in the R&D planning system. CDC has the mission to formulate current doctrine for the Army in the field, to determine the type of forces and materiel needed



Col George H. Russell

Col George H. Russell, chief of the Plans Division, Office, Chief of Research and Development since March, 1965, has had extensive troop and staff duty. His last command was with the 16th Infantry in Europe. The author is a combat infantryman, a qualified Army aviator, and a parachutist. He is a graduate of Western Washington College (BA), George Washington University (MA), The Infantry School, Naval War College and Army War College. His decorations include the Silver Star with three Oak Leaf Clusters, Bronze Star with three Oak Leaf Clusters, Air Medal, Army Commendation Medal and Purple Heart with Oak Leaf Cluster.

in the future and how these forces and materiel should be employed.

To assist in accomplishing this mission, CDC is developing a series of Army Concept Programs. Each complete program includes a concept study, a statement of the probable threat, supporting doctrinal studies, and all derivative combat development actions necessary for modeling the Army of the future for a five-year period, beginning 20 years in the future.

When the concept program becomes fully operational, concepts will have been prepared and approved for each five years extending 20 years in the future. Concept studies for Army 70 and Army 75 have been approved and the Army 85 Concept Study should be approved this summer. The studies are identified by the Army concept program of which they are a part; i.e., Army 75 concept study is the study for the Army concept program, the implementation period for 1970–75.

The concept studies provide the capabilities required for the Army to meet its worldwide commitments during a particular time frame. They are responsive to the Theater Army/Army Group/national level.

The Doctrinal Studies, approved 10 years prior to beginning of the 5-year implementation period, provide the link between broad guidance included in the concept study and the detailed methods of operation developed by follow-on derivative studies. They cover the combat, combat support, and combat service support aspects of Army operations at the division, corps and field army level.

Derivative Studies, approved 5 years prior to the beginning of the 5-year implementation period, provide an expansion of the doctrinal studies and are branch or functionally oriented. In addition to developing small unit operations (brigade and lower), the Derivative Studies provide requirements for specific organizations and are the basis for TOEs.

An explanation of how material requirements develop from these studies will be discussed later.

OCO. A relatively new term to R&D planning is Operational Capability Objective (OCO). The OCO is a Department of the Army-approved description (quantitative to the extent practicable) of an operational capability desired for achievment primarily in the long-range time frame (10-20 years in the future).

The constraints of probable technological capabilities will be considered in preparing OCOs. Describing materiel capabilities in broad terms, OCOs are expected to impact most on research and exploratory development, including the Army Research Plan.

OCOs are based on a specific Army Concept Study and are prepared by USACDC in conjunction with the Army developing agencies, primarily the U.S. Army Materiel Command.

The first set of OCOs, due for Department of the Army approval in September 1966, will be based on Army 85, and will be recorded in the Combat Development Objectives Guide (CDOG). It is expected that research related to the OCOs will lead to more rapid development of the familiar statements of requirements: QMDO*, QMR* and SDR*.

QMDO PLAN/ADO. Other relatively new documents impacting on R&D planning are QMDO Plans and Advanced Development Objectives (ADO). The QMDO Plan is a developing agency statement describing selected technical approaches to be investigated in solving a QMDO, estimated costs, technical barriers, probabilities of overcoming technical barriers, and estimates of time required for each possible solution.

This plan fits into the R&D process by providing direction for the research and exploratory work required to support the QMDO. Results of the QMDO Plan effort can lead directly to a QMR and engineering development, or to an ADO for advanced development.

The ADO consists of a Qualitative Materiel Approach (QMA) by the developing agency, stating the technically feasible solutions to a QMDO, and an evaluation by USACDC accepting the approaches and recommending cancellation of the QMDO if applicable.

Department of the Army-approved Advanced Development Objectives serve as a basis to justify to the Office of the Secretary of Defense (OSD) the inclusion of a program covered by the ADO in the budget.

PLANNING PROCEDURE. Using the background discussion above, a hypothetical route will be followed across the chart at Figure 1. Although for discussion a fixed path is described, in practice the procedure is highly flexible to permit taking advantage of changing circumstances such as technological breakthroughs and revised priorities.

Requirements can be placed in the cycle, time permitting, or be deleted from it as needed. Such considerations as budgeting and priorities have a very substantial effect on the time involved from the conception of an idea until the issue of the item to the troops in the field.

The chart shows the interrelationships between R&D planning and documents previously described. These are arranged on the chart in their approximate relationship to the R&D cycle, with the left of the chart representing the long-range planning effort. The cycle progresses to the right in time until the final year of the concept program.

It is apparent that technical possibilities and Army requirements become better defined as they move toward the implementation period. It should be kept in mind that a constant dialogue between the several levels of the Combat Developments Command and the developing agencies (primar-

(Continued on page 30)

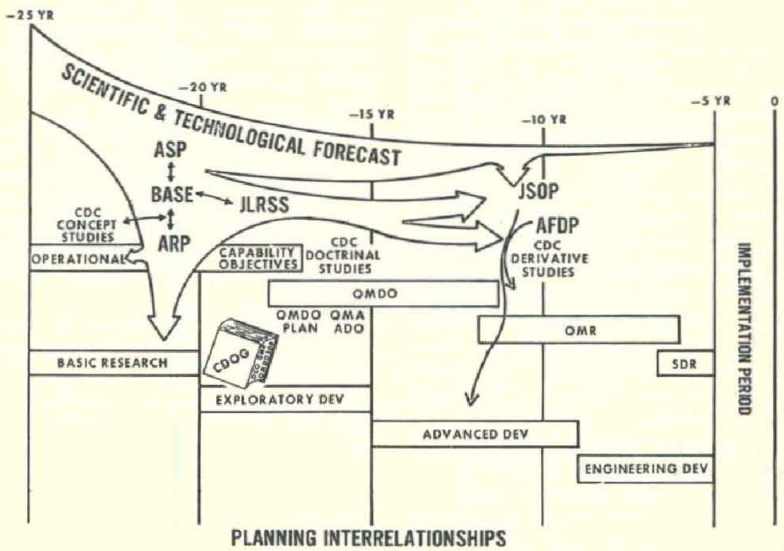


Figure 1. Planning Interrelationships

Army Operational Planners Work 'In Reverse'

(Continued from page 29)

ily Army Materiel Command) is essential, as concepts are the responsibility of CDC and the developer provides the technical possibilities.

The actual initiation of an R&D cycle is a "chicken and egg" matter, but for this discussion the Army Concept Study will be used as the starting point. Using the present national policies, joint and Army documents, and the latest technological information, the CDC develops a concept for Army operations beginning 15 years in the future.

(Preparation of the concept study actually begins 25 years in advance, is five years in preparation and staffing, and is approved 15 years prior to the beginning of the 5-year implementation period).

Operational Capability Objectives are prepared concurrently with, and based on, the Concept Study. OCOs furnish guidance for research and early exploratory development and provide a relevant base of technical information. As possibilities become more defined, QMDOs are formulated.

The developing agency then prepares the QMDO Plan which covers the approaches to be explored in solving the QMDO. Research responsive to a QMDO Plan indicates whether an objective appears feasible and the best technical approach to follow.

During the same period, the CDC Doctrinal Studies are prepared. As a result of these studies, technological advancements and QMDO research, certain QMRs are developed to prescribe specific characteristics for new materiel.

The CDC Derivative Studies establish the requirement for most of the functional and branch-oriented QMRs, and finally, the SDRs, which require about two years for development. The last five years in the cycle are used to organize, equip, and train the Army structured by that particular concept program.

The interrelationships between combat developments and research and development are readily apparent. There must be a constant feedback from one to the other. R&D planning in the long-range period is oriented on acquisition of knowledge, while in the mid-range period it is directed toward development of materiel.

The long-range planning is especially difficult. Throughout the cycle there must be a maximum amount of free thought by and coordination between the Army staff and developing agencies as the options open to each become more restricted as the cycle progresses.

The planner must keep in mind that all R&D efforts are directed toward satisfying the Army's operational requirements and must recognize that there will be continuing adjustments to plans as conditions change. Above all, he must establish imaginative goals and definitive R&D actions which will keep the future Army modern.

*QMDO — The Qualitative Materiel Development Objective (QMDO) states a military need for the development of new materiel, the feasibility of specific definition of which cannot be defined.

*QMR—The Qualitative Materiel Requirement (QMR) is a definitive statement of an Army military need for a new item, system or assemblage, the development of which is believed feasible.

*SDR—The Small Development Requirement (SDR) is a definitive statement of an Army need for an item of equipment of low cost and simplicity which can be developed in a relatively short period of time.

Dr. Longacre Takes Sabbatical To Work on Project at ECOM

An Army Scientific Advisory Panel member since 1957, Dr. Andrew Longacre, professor of engineering science at Syracuse University, is working during a year of sabbatical leave as a visiting professor at the U.S. Army Electronics Command, Fort Monmouth, N.J.

Dr. Longacre is a renowned radar scientist and inventor, known particularly for his work in side-looking radar (SLAR). As a visiting professor, he is associated in his research with Dr. Robert S. Wiseman, director, ECOM Combat Surveillance, Night Vision and Target Acquisition Laboratories, and Victor L. Friedrich, deputy director.

A long-time member and former chairman of the ECOM Scientific Advisory Group, Dr. Longacre will continue to serve with this assembly of top-level electronic scientists and executives in providing advice to the commanding general.

Spider Silk Helps Chemists Study Droplets

Spider silk less than one-hundred-thousandth of an inch in diameter is helping Army scientists to determine useful properties of many liquid chemicals and is finding wider application in medical research.

To study physical properties of some chemical agents, scientists at Edgewood Arsenal, Md., must separate single droplets from mists and hold these droplets still for observation. One method is to catch a droplet on a thread. The droplet clings to the thread, which can be suspended under a microscope for examination. The liquid behaves almost as if it were drifting freely in the air.

When smaller droplets are needed, thinner fibers must be used to trap them. Until the technique was developed, the smallest fiber available for such work was a strand of silver or gold about four microns (sixteen one-hundred-thousandths of an inch) thick.

When researcher Robert D. Kracke and his colleagues began looking for still thinner fiber, they found that 0.2 micron-thick silk thread — just half as thick as the smallest wave length of visible light—is available from a tiny spider commonly found in the United States.

Before leaving a resting place, this spider fastens a strand of silk to a support. It lowers itself by this strand, which is gradually spun from the spider's body. Unlike spider web strands, this strand of silk is not sticky, researchers have discovered.

COLLECTING SPIDER SILK requires art as well as science. In a method devised at Edgewood Arsenal, a spider is picked up on a wooden dowel, then jogged into dropping from this support. Its silk is wound around the dowel as it is spun. Above, Robert D. Kracke studies a droplet of mist that has been captured on a mount made of a spider thread stretched across a small glass ring and glued at each end of the mount. The droplet-carrying mounts can be handled conveniently for testing atomization behavior, evaporation rate, and other properties of liquid chemicals.

Role of Systems Analysis in Army Combat Developments

By Clive G. Whittenbury

SUMMARY OF ARTICLE. The increase in combat effectiveness brought about through combat developments must be purchased at realistic cost. Combat performance costs us resources and these resources are limited. Before combat developments proceed toward operational status, they must pass tests for relevancy, effectiveness and economy.

Data needed to make program decisions in a rational way may be organized by the discipline of systems analysis. This discipline is one of many methods that are useful in the planning, programing and actual prosecution of combat developments. It directs attention to a particularly important problem: the technological base for combat developments.

This article discusses some of the practical issues in the rationale and use of systems analysis. (Views expressed in this article are those of the author. They do not necessarily represent the official view of the Research Analysis Corp. nor of the U.S. Army.)

The complexity of combat developments has been aggravated in recent years by the increasing demand for combat capability throughout the levels of intensity of the land power missions of the Army and by the expanding choices for weapons systems brought about by the progress of technology.

The continued achievement of quality in combat developments has become a severe challenge in the face of strides in technology and the rapid obsolescence of weapons systems. The time allowed for program considerations and decisions between "Today's Vision" and "Tomorrow's Victory" has been shortened.

Help has been provided in making these decisions through the growth of an important body of knowledge and practice in the systematic analysis of weapons systems and their operations. It includes operational analysis, operations research, systems engineering, cost-effectiveness analysis and systems analysis.

Although none of these terms has an acceptably unique definition in the minds of all users, they are all related through consideration of the requirements for a system and analysis of advantages and disadvantages of different ways of meeting requirements.

Each term emphasizes different aspects of the problem. Whereas operations analysis usually considers improvement in the use of an existing weapons system, systems analysis defines the need for and evaluates a future weapon system.

In this article, the role of the discipline of systems analysis in combat developments will be discussed briefly.

The purpose of combat developments is to increase the combat effectiveness of the Army in the field as rapidly as possible at realistic cost through the orderly development and integration into the Army of new or improved doctrine, materiel and organization. One of its tasks, therefore, is the careful evaluation of the worth of a combat system before its development and its future will be underwritten.

The worth of a system is determined through its performance. Performance requires technology and organization, and both cost money to buy and operate. Before the combat effectiveness of the Army can be increased by purchase and use of the system, its cost and the time to develop it must be justified to both the Department of the Army and to the Office of the Secretary of Defense.

Justification includes a description of the need for the system, a rationale for its choice over other possibilities which address the same need or its priority over other systems which address different military needs but compete for the same dollar.

Rational decisions to develop and use particular weapons and tactics have been made throughout the history of warfare without the benefit of formal studies to support these decisions. The detailed justification now demanded for programs is more than just another complication in an already difficult and complex enough combat developments process.

After the simple questions have been asked, the actual process of documenting the justification of programs demonstrates how genuinely difficult it is to explain *why* we want to do something as opposed to describing *what* it is we want to do.

Although it may not always be possible to present the rationale for the nature and characteristics of a specific ground combat system, in a form as simple as for those dominated by complex and massive systems engineering (such as the ICBM and ABM), there are many good reasons for supporting well-ordered decisions through systems analysis. It provides no magic elixir, but helps to order and display the fabric of combat developments process.

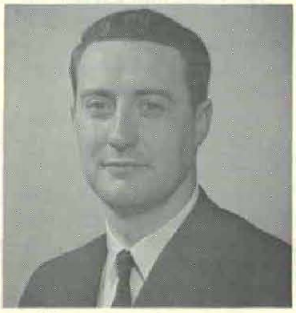
What is special about contemporary conflict that has made the process of decision-making so visible, important and apparently everybody's business?

(Continued on page 32)

Clive G. Whittenbury is head of the department of Science and Engineering at the Research Analysis Corp. (RAC). This department practices neither science nor engineering as ends in themselves but only as a basis for studies of technology in military operations, and in the formulation of concepts for future new systems. One of the disciplines in use is systems analysis.

The author of this article has a PhD in aeronautical engineering from the University of Illinois and a BS degree in honours physics from the University of Manchester, England. He was chief of systems analysis in the missile division of the Douglas Aircraft Co. until 1964, when he joined RAC.

Dr. Whittenbury has contributed to and directed studies at RAC and Douglas in tactical aerial reconnaissance and surveillance, ballistic missile penetration and antiballistic missile systems, and has contributed research in hypersonic rarefied gas dynamics and the dynamics of very-high-energy weapons. He has contributed specifically to the Nike Zeus, Sprint, Skybolt and Saturn programs.



Clive G. Whittenbury

Role of Systems Analysis in Combat Developments

(Continued from page 31)

One reason is the compressed time scale between occurrence of a new form of conflict and the decisions to develop and use new weapons and tactics for combat. Another factor is the wide dissemination of information on combat which invites everyone to make suggestions on how to improve our capabilities.

Among other reasons is the need for large expenditures to be supported by a taxpayer who can pass judgment on decisions and on his representatives according to their positions on decisions; also, the complexity and cost of developments and devices used in combat.

In combat developments, problems have become critical, therefore, in three major areas:

- The shortened time to operational use from the initial concept for a weapon.
- The flexibility required within a particular organization to adapt new ideas and techniques for conflict.
- The importance of effectiveness in the choice of systems to ensure a satisfactory return on the tax dollar.

If we understood the combat needs, the possibilities of satisfying them, and could weigh the pros and cons before committing resources and men, we might have a discipline which could cut down on the undesirable consequences of trial and error in combat developments.

Our limited national resources then could be used more efficiently in achieving our objectives as a nation. We would be freed of our heavy reliance on ingenious but unpredictable inventors and innovators in weaponry and warfare. This discipline might be summarized as: the systematic comparison of different new ways of doing a job in order to allow a rational choice to be made between the different methods involved.

This discipline has become known as systems analysis in the planning for, and the carrying out of the development of contemporary weapons systems. Four simple questions summarize the main components of a systems analysis—Need: What is it we want to do? Alternatives: What are the different ways of doing it? Evaluation: How well do these ways perform? Choice: How do we choose one of these ways?

Systems analysis emphasizes what should be done, rather than how to do it in specific engineering terms. The alternative systems should be described in terms of the functional ways of doing the things that technology allows.

Military judgment in the analysis is really the process of invention, in which new concepts and doctrines are invented to use new devices (sometimes we need to know what we *can* do before the know what we *want* to do) and in which new devices must be conceptualized to match a new function required in a new military tactic.

Although systems analysis considers future systems, it provides a discipline which is useful in management through the complete R&D life of the system: technology can outrace its application but it can also be overestimated, showing the need for a continuous review of the "informed choices" from systems analysis.

In the evaluation, we are concerned with both system performance analysis and cost-effectiveness analysis. A functionally described alternative may be evaluated first in terms of the overall performance (how well does the principal subsystem work?) as contributed to by all the bits and pieces that stick together in series and parallel to make the system work.

From the performance analysis of the system it may be possible to derive the effectiveness of the system in accomplishing the combat mission, considering the specific operational circumstances and environment in which the system is used. Together with the always difficult estimation of costs of the alternatives, one is then in a position to consider which one to build and buy.

The rationale of systems developments can be evolved through the Army Concept Program of the Combat Developments Command. The research and development community has important responsibilities in seeing that technology is used effectively in the formulation of concepts and doctrine in this program.

A key feature of systems analysis is the relation of a need to the methods for satisfying it—particularly through technology. In this sense, systems analysis may be referred to as organized invention.

An inventor fabricates something useful, after ingenious thinking or experiment, through technology. He has determined a real need, satisfied it with an invention and the user (someone else) buys it because he has the need.

The competent military man who is involved in combat developments is also an inventor. He also perceives a need and uses ingenious thinking and experiment to suggest a solution. However, he is his own customer and he must use somebody else's money to buy the capability he needs. This money is divided among many competing needs by the Office of the Secretary of Defense (OSD).

Funding the military invention is therefore not an easy process. The encouragement from OSD to develop a system rationale prior to major budget decisions should ensure improved and early contributions to the Army Concept Program, and the military inventor could still contribute effectively to the making of nonarbitrary decisions.

The research and development community wants its contributions to improvements in combat effectiveness to emerge quickly and successfully. To accomplish this job, good management tools must be used. Procedures selected from systems analysis provide good tools which can be introduced straightforwardly.

A central theme is to express technology in the user's framework—not simply to provide a shopping list of inventions, black boxes and promises of performance specifications. The user must know how technology satisfies his need and what is new about it.

The user orientation of descriptions of technology should string a continuous thread through the research and development program and the Army Concept Program from the Operational Capability Objective to the Qualitative Materiel Requirement.

Systems analysis has been introduced here as a logical, simple and desirable procedure for making decisions. Its shortcomings reflect man's difficulty in understanding what he really wants to do before he does it. Misrepresentations and misuse of the discipline tarnish its potential benefits. Such dangers are summarized below.

Although systems analysis is a useful discipline, it will not always be done well. Criticisms of cost-effectiveness center on a reduced role of military judgment and on heavy attention to computers. There is nothing inherent to systems analysis that says "neglect military judgment and use computers extensively," although flaws in the analysis may result in just such action.

For instance, there is always a temptation when looking at a complex operation to spare the really hard work, patience and time that must go into describing the operation by a good simple model and displace it with a computer simulation as complex as the original operation.

Another criticism of systems analysis and its use in approving or disapproving programs lies in the suppression or inhibitions of new ideas for weapons systems. There is much justification for this critism, since the actual innovation for the Army occurs when the products of advanced development are incorporated in an operational system.

This opportunity can be stifled by improper use of cost-effectiveness in decision-making. To prove, on paper, the operational utility of a new device or a new system before having a chance to understand its use through actual experience is a very tall order to fill. Nevertheless if the cost of prototypes is too high, this must be done.

The Army has managed its job of developing and using combat systems admirably in the past without formalizing its use of systems analysis. Further steps toward excellence may be taken in making the use of the discipline widespread. It will improve communication of Army needs to those in OSD who make the final decisions, and who currently use formats derived from systems analysis.

Systems analysis organizes and disciplines the design of the future Army; it ensures that the analysis is exhaustive in the system context and does not take only the one track of the lone military inventor. It gives to those of us who are not creative geniuses guidance toward systematic invention.

The discipline provides the talented civilian an opportunity to contribute constructively to the early stages of combat development, by providing him with a systematic method for interpreting his technical skills into the viewpoint of the military user.

The quality of products from the concepts, doctrine and materiel foundry of combat developments depends first upon the ingenuity and joint toil of the research and development community and the Combat Developments Command. In turn, upon these products depends the success of Western Civilization in the resolution or deterrence of overt conflict. Their quality can be enhanced by the disciplined way of viewing a problem of choice afforded by systems analysis.

In addition to those systems analysts in the military, there are many enthusiastic and talented civilians practicing military research who can add strength to this work from an independent and many-disciplined vantage point. Competent systems analysis affords them the privilege of contributing and ensures that the contribution they make is efficient, relevant and helpful.

Metrology Center Honors Memory of Maj Gen Cone

"His Standards Are the Base on Which We Build" is inscribed on the bronze plaque in the lobby of the new $1.6 million John M. Cone Metrology Center, Redstone (Ala.) Arsenal.

Dedicated recently, the Center at Army Missile Command HQ offers the Nation's largest and most completely equipped laboratories for precise calibration and measurement of guided missile equipment. A professional staff of 150 serves requirements of other Government agencies as well as the Army's missile development.

The Center honors the memory of Maj Gen John M. Cone, the White Sands (N. Mex.) Missile Range commander who died in March 1966 when he suffered a heart attack after stopping his card to aid a man trapped in an overturned auto on the desert.

Prior to the dedication ceremonies, Lt Gen William B. Bunker, Deputy CG of the Army Materiel Command, presented to Mrs. Cone the Distinguished Service Medal awarded posthumously to General Cone for exceptional military service, and the Soldier's Medal for heroism in efforts to rescue the auto victim.

Functions performed in the Center's complex of four laboratories, with a total of 39,000 square feet of floor space, are peculiarly exacting. Some sections have air conditioning designed to maintain a constant temperature of 70 degrees F. within .05.

Vibration control also is believed unique. A section of almost 5,000 square feet has a 4-foot-thick concrete floor to isolate instrumentation from the slightest vibration. (A completely detailed description of the Center was carried in the December-January 1966 edition, page 54, of the *Army R&D Newsmagazine.*)

MRS. JOHN M. CONE and son Lt John M. Cone, Jr., admire bas-relief of the late Maj Gen Cone during dedication ceremonies of Metrology Center building named for him at Redstone Arsenal, Ala. At the extreme right is Maj Gen John G. Zierdt, CG, of the U.S. Army Missile Command.

Maj Gen John G. Zierdt, CG of the Missile Command, presiding at the dedicatory ceremonies, praised General Cone's contributions to the Army metrology program to insure quality and reliability of military weapons.

Dignitaries present for the dedication included Lt Gen August Schomberg, former CG at Redstone Arsenal and now commandant of the Armed Forces Industrial College; Maj Gen Leland G. Cagwin, CG of the Army Test and Evaluation Command; Maj Gen Horace H. Walker, Division Engineer, Army Corps of Engineers; Brig Gen Horace Davisson, CG of White Sands Missile Range; and Brig Gen Thurston T. Paul, director, Plans and Programs, Office of Research and Development, Department of the Army.

HumRRO Executive Elected To Head APA Military Unit

Associate Director Dr. William A. McClelland of the Human Resources Research Office (HumRRO) has been named president-elect of the American Psychological Association (APA) Division of Military Psychology.

The Division of Military Psychology is one of the special-interest units of the 25,000-member APA. Dr. McClelland will assume duties at the 1967 APA convention next fall.

Holder of an AB degree from Brown University (1941) and MA and PhD degrees from the University of Minnesota (1946, 1948), Dr. McClelland has been affiliated with HumRRO since 1955. He joined the contract agency of George Washington University, Washington, D.C., as director of Research, Training Methods Division.

From 1951 to 1955 he was a supervisory experimental and physiological psychologist for the U.S. Air Force. He has been an instructor at both Brown University and the University of Minnesota.

Dr. McClelland has been active in APA affairs at the national level, serving as commissioner to the Scientific Manpower Commission (1961-64), as a member of the Education and Training Board (1944-66) and Committee on Public Affairs (1966).

Peru Offers Ideal Conditions for Altitude Stress Research

By Dr. F. W. Morthland

U.S. Army Element, Defense Research Office for Latin America

Peru, a land of many contrasts, is exceedingly valuable to the research program of the United States Army. Here where people live out their lives at altitudes up to 14,000 feet—altitudes where we lowlanders gasp at the least exertion like fish out of water—one can study the effects of altitude stresses on man and animals that are of particular interest to the Army.

Peru provides a combination of factors well nigh unique in the Free World. There are the extensive plains of the Cerro country. There is a stable population acclimated to life at these altitudes. There is a network of modern hospitals to provide controllable experimental environments. Lastly, there are groups of modern scientists in relatively nearby universities who have been studying the many factors of altitude effects.

The Cerro is composed of rolling plains like the eastern slopes of the Rocky Mountains. Average elevations are 11,000 to 14,000 feet above sea level. The region is grassy and well watered by the summer rains—December to April. It extends many miles along the eastern slopes of the Andes.

The eastern edges are penetrated by deep valleys which drop steeply for 2,000 to 4,000 feet and then lead off to the Amazon Basin. To the west lie the jagged peaks and ridges of the Andes, which drop abruptly to the coastal plain. Here and there are peaks coated with snow, but generally there is only bleak forbidding rock, a geologist's paradise of hues and strata.

In December 1965 the opportunity arose to visit the high laboratory sites of the universities in Lima. We set out in a vehicle built for rough roads. In the party were Dr. Federico Moncloa, professor of physiology, Institute for the Investigation of Altitude, Peruvian University Cayetano Heredia; Dr. Jose Ramos, hematologist, Institute of Andean Biology, National University of San Marcos; and Don Carlos, our excellent driver.

The road is barely two lanes wide and is unguarded, with interesting drops alongside of 2,000 to 3,000 feet. Trucks pass along the route at high rates of speed. The drivers are generally young boys with little concept of the limitations of man or machine, an impression reinforced by the sight of two major accidents enroute to La Oroya, a distance of 118 miles.

Our first stop was at Morococha, one of the mining towns of the Cerro de Pasco Mining Co. Here at 14,671 feet live, work and play some 11,000 to 12,000 people, principally Quechua Indians. The company employs some 300 men in the mine and its smelter.

We took a slow tour of the laboratory, which pleasantly surprised me. I was not prepared for the equipment available for extensive scientific study. This laboratory belongs to the University of San Marcos and is equipped to perform quite complete physiological experiments on men. They have treadmills, breathing apparatus, etc. to test endurance under load.

Present research projects are in the fields of physiology, hematology, and some biochemical studies on hormones. A United States Air Force war surplus high-altitude chamber can house six men and is capable of creating conditions similar to those at 100,000 feet. Dormitory space is available for 20 volunteers and staff members who come up from sea level to study changes during adaptation to the stresses of altitude.

Researchers have some animal facilities and are currently studying rats, guinea pigs, rabbits and chickens. It was here that I first saw the large model guinea pig. This animal is a native of Peru and is said to be delicious when used in stews. Those that we saw were 8-10 inches long and we were told some reach 18 inches.

Our next objective was La Oroya, a city of 50,000 inhabitants located at 12,100 feet and 116 miles from Lima. It is the headquarters of the Cerro de Pasco Mining Corp., organized by Americans and Peruvians to exploit lead, zinc and copper deposits in the central region of Peru.

La Oroya houses Chulec Hospital, the headquarters of the Cerro de Pasco Medical Service. There is a triple hospital system in these regions, generally located in the mining cities. There is a network of hospitals and clinics owned and operated by the company. There is a network of Social Security Service Hospitals directed by the National Health Service. Finally, there are a few charity hospitals.

The company medical service is excellent. It provides complete care for on-the-job illness or accidents of the employees, total care for their families, and total care for supervisory and foreign employees. It reaches its apex at Chulec, which is equipped for all care and surgery except advanced neurosurgery.

Among company employee families basic health is very good. The Medical Service carries out an extensive and complete vaccination program, including BCG vaccine against tuberculosis. The Social Security plan is supported by employee members.

The available services are fair to

Dr. Ewing Visits Research Office in Brazil

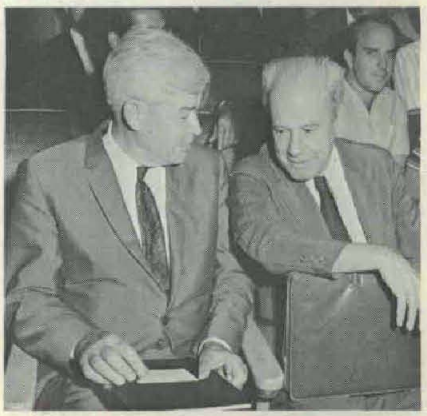
World-renowned scientist Dr. W. Maurice Ewing visited the U.S. Army Element, Defense Research Office Latin America, in Rio de Janeiro, Brazil, during a recent South American trip to consult with scientific leaders and to lecture before the Brazilian Academy of Sciences.

Director of the Lamont Geological Observatory at Columbia University, Dr. Ewing is one of the Nation's most honored scientists, with a long list of medals from major professional societies and seven honorary degrees from universities attesting his major contributions to science.

The visit was arranged by the Office of Naval Research through the Defense Research Office Latin America (DROLA). Col Arvey C. Sanders, commander of the U.S. Element, hosted a meeting of Dr. Ewing with U.S. Army, Navy and Air Force representatives and Brazilian scientists.

Purpose of the meeting was to improve cooperative efforts to accomplish research objectives in Latin America. The presence of a man of Dr. Ewing's professional stature stimulated discussion of mutually profitable projects. Dr. Ewing is known for more than 200 articles and books in his field.

Among the Brazilian scientific leaders with whom Dr. Ewing conferred were Aristides Avezedo Pacheco Leao, acting president of the Brazilian National Academy of Sciences, and Prof. Antonio M. Couceiro, chairman, Brazilian National Research Council.



Dr. W. Maurice Ewing (left) and Dr. Lelio I. Gama, director, Brazil National Observatory and member of the Brazil National Research Council.

good and include minor surgery. Long-term convalescence cases or major surgery cases are transferred to central hospitals in Lima. The charity hospitals provide care to the rest of the people.

At Chulec a very good and active cardiopulmonary section is performing up-to-date treatment and research on problems of the circulatory system. They perform all types of heart surgery, mostly for congenital defects of children of the miners, averaging four or five such operations per month. For some as yet unknown reason, the young of man and animals born at high altitude have a higher rate of congenital defects than at sea level.

Dr. Cuba-Caparo, Director of the Institute of Pathology at San Marcos University has a resident student at Chulec who is gathering routine pathology data from autopsies and surgery. This resident goes down to Lima once a month taking his collected materials and notes for discussion and evaluation of the Institute.

The other section that I visited was the Trauma Service, including its clinical wards. Here Dr. Polo is doing marvelous work in treating people who have suffered injury in accidents in the mines or smelters. Also there are several children who have been badly burned, a major hazard for the Indian children.

Most of the houses have small kerosene heaters which the children tip over in their play. The result is often an extensive second- or third-degree burn. These wounds and burns heal rapidly with very little infection.

In burns, in particular, skin grafts are claimed to "take more rapidly than they would at sea level. One poor 10-year-old girl developed chicken pox shortly after arrival in the hospital. Her skin grafts also had pox, but showed no signs of rejection as might have been expected.

The theory for this rapid healing is that, in adaptation to altitude, the body develops a humoral substance which causes an enhancement of cell replacement or multiplication activity —certainly red cell production is accelerated. When tissue is destroyed, the regenerative and protective functions are more active than in a body without this elevated humoral activity.

We wondered what kind of a hotel would appear at Tarma, our next stop 34 miles away, since every aspect indicated a native town of adobe. We visualized something primitive with a "path" in place of bath. But we turned a corner at the edge of the city proper and coasted through iron gates into the grounds of a luxury hotel, the Hotel Turista.

Tarma was the birthplace of a man who became President of Peru—Odria. It was he who constructed this hotel as well as a large regional hospital at Tarma. Tarma has little attraction for tourists except, perhaps, honeymooners. The day we arrived 5 of the 55 rooms were occupied—four by our party. But we were provided with full service.

The following day, after a 44-mile drive that required three hours, including time to change a tire, we climbed into the bordering ranges to the city of Cerro de Pasco (14,200 feet), another copper mining city similar to Morococha. The population of about 50,000 is again predominantly Quechua Indians, and their main support comes from the mines.

Hospital and medical coverage follows the pattern described earlier with all three types represented: Company, Social Security, Charity. The Instituto de Investigaciones de la Altura of the Universidad Peruana Cayetano Heredia in Lima has established its laboratories here in the Social Security Hospital.

For example, at Cerro de Pasco the only eligible employee members are the miners, so there is an unused maternity ward. This has been granted to the Institute and serves well for laboratory and dormitory space. Equipped for physiology studies on man and animals, the laboratory only does preliminary preparation for specimens for study in Lima. Basic clinical chemistry is performed in the hospital laboratories.

Dr. Moncloa says that one must do all calculations and delicate manipulations at sea level, anyway, since altitude robs man of the ability to do accurate mental work. Cerro de Pasco can be reached by train, which travels on a predictable schedule. This permits the movement of groups of volunteers from sea level in accord with a plan and permits taking samples en route at preselected times and altitudes.

Sunday we returned to La Oroya where we visited Chulec Hospital once more. Then up to Morococha to pick up a graduate student and samples of blood packed in dry ice. We found that in two days we had gained a great deal in our ability to move about. But it was still pleasant to sit drinking warm coffee.

Climbing up to the pass, we crossed it in a mixture of snow, rain and hail, with thunder and lightning thrown in for spectacular effects. Here the road is under construction and was muddy and slick. But Don Carlos pulled us through safely. Down the other side we went, following the Rimac River. In some places the engineers had dug tunnels through cliffs where there was no place for a road. But the tunnels are for the river; the road usurps the river bed!

Finally, we came out in the plain around Lima, where the air felt like warm soup. The bath at the hotel was most welcome. But we missed the cold, thin air of the Cerro!

Schomburg Heads Study Group

Lt Gen August Schomburg, commandant of the Industrial College of the Armed Forces since April 1964, heads a study group to review the desirability of broadening college participation in management education and related activities within the Department of Defense.

The review was directed recently by the Joint Chiefs of Staff.

Viet Nam Returnee Heads USAEPG Test Directorate

Col Chester A. Hall, Jr., became director, U.S. Army Electronic Proving Ground (USAEPG) Test Directorate when he returned recently from Viet Nam, succeeding Col Willis E. Kooken upon his assignment as special assistant to the USAEPG commander.

From 1963 to 1965, Col Hall was chief, USAEPG Communication-Electronics Agency Concepts Division, a Combat Developments Command element.

Col C. A. Hall, Jr.

Graduated with a bachelor's degree in mathematics and electronics from Tulsa University in 1940, he was a high school teacher in Eudora, Ark., for two years before he entered the Army as a private. He was commissioned in April 1943.

Col Hall is a graduate from the Signal Officers Career Course at Fort Monmouth, N.J., the Command and General Staff College, Fort Leavenworth, Kans., and the Armed Forces Staff Colleges, Norfolk, Va.

His decorations include the Legion of Merit with Oak Leaf Cluster, Bronze Star, Army Commendation Medal with three Clusters, Army Occupation Medal with Asian and European clasps, the Europe-African-Middle East Medal with Arrowhead and five campaign stars, the Korean Service Medal with two stars and two Viet Nam campaign medals.

HDL Engineer Develops Laser Radar Techniques

Laser beam radar techniques with possible applications for active optical fuzing and intrusion detection are being developed at the Harry Diamond Laboratories (HDL), Washington, D.C.

The work reportedly represents a technology not yet exploited in military device design. Possible uses also may include area surveillance through limited-range radar and short-range altitude measurement.

William Soper, electronics engineer in the HDL Systems Research Laboratory, has assembled a variety of these portable devices, each consisting of a transmitter, high-speed receiver and oscilloscope or other indicating instrument. Room temperature gallium arsenide units required cryogenic cooling for laser operation.

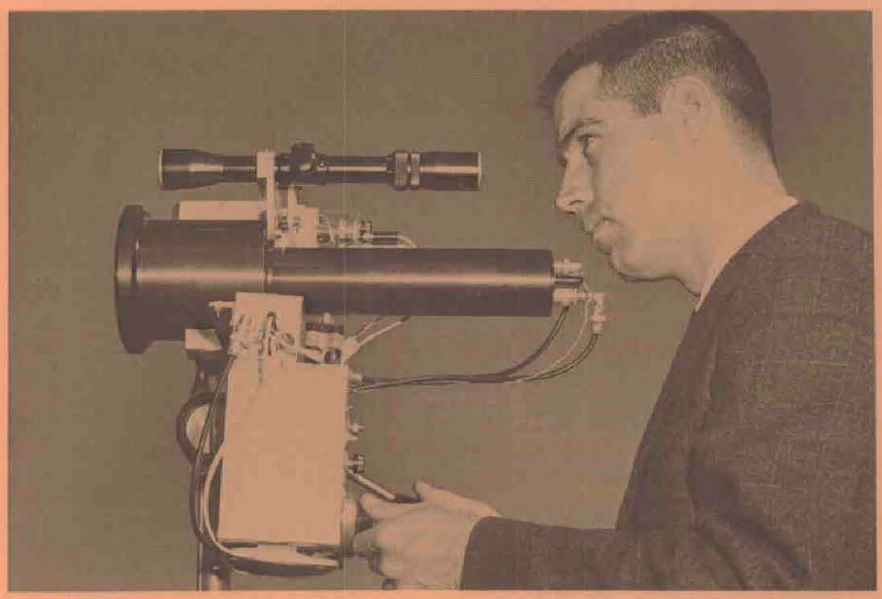
In operation, a narrow beam is directed to a target and reflected back to the receiver, where a photomultiplier or silicon photocell detects the returned signal. An oscilloscope display may be used for ordinary range indications when triggered externally by the outgoing laser signal. Soper plans to equip the device with counter rotating wedges or other beam deflection devices on the transmitter and a scanning photomultiplier for true scan coverage of a selected area.

The systems vary in size and range capability. With one model, 10 nanosecond light pulses of one watt peak power were transmitted at 1,000 pulses per second to targets 350 feet away and received with a 4½ inch objective lens.

Soper has experimented with units employing receiving apertures ranging in size from 1½ inches to 20 inches in diameter. The 20-inch diameter Cassegrain system has demonstrated a high signal-to-noise ratio in picking up signals from a 10 percent reflecting target 400 feet away in daylight.

Another system works on a 12-volt battery. Power consumtion is under 6 watts. A dc-dc converter supplies 400 volts to the laser modulator and 1,200 volts to the photomultiplier. The readout is given by a neon bulb rather than an oscilloscope. Calibrated scales allow varying the width of the range gate and delay so that an interval of space can be examined for targets.

CASSEGRAIN SYSTEM with 20-inch diameter receiver picks up signals from distance of 400 feet in daylight.

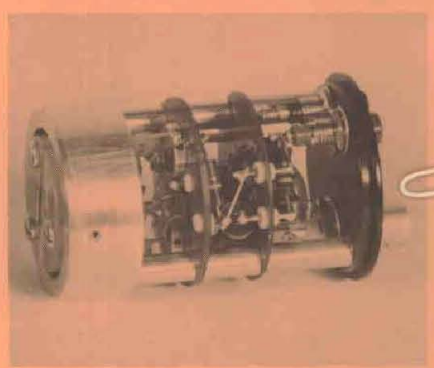


HDL ENGINEER William Soper sights targets at ranges of interest and sets circuitry so the laser transmitter-receiver can function as an intrusion detector.

As an intrusion detector, for example, one knob could be set for 175 feet and the other for 200 feet. If anything appeared between these distances, the light would go on.

Laser using systems of this type have some advantages over radio waves in fuzing. For simple systems of both, these include resistance to countermeasures, range accuracy, and independence of target material. Laser beams can detect human beings very readily, for example, whereas the usual radar cannot. Radio systems, however, are less susceptible than the optical system to the deleterious effects of heavy fog or dust.

Soper is now defining the characteristics of what can be built—whether the devices can do a given job, and if not, what must be done so they will. His preliminary work with the devices is described in a technical report, TM–66–13, available from the Defense Documentation Center.



LASER WITH MODULATOR uses avalanche transistor which triggers two parallel silicon control rectifiers to give 40-ampere peak, 20-nano-second-wide pulses at up to 5KHz repetition rate. These current pulses are applied to the laser diode which is mounted on the left and is accurately positionable by the three screws.

Second-Stage Zeus Motor Fired

Full-duration test firing of the second-stage motor for the U.S. Army's improved Zeus antimissile missile was successfully conducted for the first time recently at Redstone Arsenal, Ala.

The motor is a major component of the new long-range interceptor missile being developed for the Nike–X missile defense system. The improved Zeus is a longer and heavier version of the missile which has successfully intercepted both target nose cones boosted by intercontinental ballistic missiles and a satellite in orbit about the earth.

Dr. Wilson Promoted at ARPA

Dr. Cody W. Wilson has been advanced from deputy director to director of the Behavioral Sciences Office, Advanced Research Projects Agency (ARPA), succeeding Dr. Lee W. Huff when he joined the Agency for International Development.

Dr. Wilson was an associate professor at the University of Texas before entering Federal service with ARPA in 1965. He has a BA degree in mathematics from the University of Arkansas (1950), a master's degree in psychology from the University of Denver (1953) and a PhD degree in social psychology, Harvard University (1961).