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DoD Instruction Establishes STI Functional Area Managers

Authority, responsibilities and relationships between the Scientific and Technical Information Program, the Technical Logistics Data and Information Program, and the Standardization Program are prescribed in Department of Defense Instruction 5010.13.

Issued in January to all DoD agencies concerned, the Instruction establishes positive and powerful lines of control in six major functional areas. Overall coordination responsibility is vested in Brig Gen Allan T. Stanwix-Hay of the United States Army.

Installed in July 1964 as Director of Technical Data and Standardization Policy at DoD level, General Stanwix-Hay is named in the Instruction as chairman of the Working Group of the Council on Technical Data and Standardization Policy. He also heads one of the six groups in the functional areas.

An organizational chart shows "Working Relationships in the Management of DoD Technical Data and Standardization Programs." Command line responsibility in four of the six functional areas is assigned to Assistant Secretary of Defense (Installations and Logistics) Paul R. Ignatius. (See chart on page 36.)

Similarly, the remaining two areas of command line responsibility are assigned to Deputy Director of Defense Research and Engineering Dr. Eugene G. Fubini. His assistant is Deputy Director of Defense Research

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COSATI Group Studies National Requirements

The Federal Council of Science and Technology's Committee on Scientific and Technical Information (COSATI), through its Task Group on National System(s), probed problems of improving utilization of scientific information at a Jan. 14-16 meeting.

The special session of the Task Group, hosted by the Army Ballistic Research Laboratories at Aberdeen Proving Ground, Md., was an intensive discussion that started early and finished late each day. Lt Gen William J. Ely, chairman of COSATI and Deputy Director of Defense Research and Engineering (Administration and Management), presided.

Participants included representatives from the White House Office of Science and Technology, Department of Defense, National Aeronautics and Space Administration, U.S. Atomic Energy Commission, National Science Foundation, U.S. Department of Agriculture, and the Department of Health, Education, and Welfare.

The Task Group on National System(s) consideration of plans to de-

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Cassidy Designated Chief of Engineers

Maj Gen William F. Cassidy

Maj Gen William F. Cassidy is designated to take over July 1 as Chief of Engineers (CofEngrs), succeeding Lt Gen W. K. Wilson, Jr.,

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Army Leaders to Brief Industry on Long-Range Needs

A distinguished team of Army officials, headed by Assistant Secretary of the Army (Installations and Logistics) Daniel M. Luevano, will discuss future Army needs with industry, small business and labor at five regional unclassified briefings in March and April.

This team will represent the Army in a series of DoD briefings sponsored by the National Security Industrial Association (NSIA) and supported by the Department of Defense. Dates are: Mar. 3-4, Los Angeles; Mar. 16-17, New York City; Mar. 31-Apr. 1, Chicago; Apr. 14-15, Dallas; Apr. 28-29, Washington, D.C.

The Army team headed by Mr. Luevano will feature General Frank S. Besson, Jr., commanding general, U.S. Army Materiel Command, plus four of his major commanders: Maj Gen Frank W. Moorman, CG, U.S. Army Electronics Command; Maj Gen John G. Zierdt, CG, U.S. Army Missile Command; Maj Gen William W. Lapsley, CG, U.S. Army Mobility Command; and Brig Gen Roland B. Anderson, CG, U.S. Army Weapons Command.

The officials will discuss Army Advanced Planning Requirements, to include the Army's mission and respon-

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Featured in This Issue...

Army R&D Newsmagazine

Vol. 6, No. 2 February 1965

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Purpose: To improve informal communication among all segments of the Army scientific community and other Government R&D agencies; to further understanding of Army R&D progress, problem areas and program planning; to stimulate more closely integrated and coordinated effort among the widely dispersed and diffused Army R&D activities; to maintain a closer link from top management through all levels to scientists, engineers and technicians at the bench level; to express views of leaders, as pertinent to their responsibilities, and to keep personnel informed on matters germane to their welfare and pride of service.

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COSATI Group Studies National Requirements

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velop technologies and methodologies for the establishment of a national framework for collecting, analyzing, processing and utilizing scientific information and technical data assumes added significance in view of a recent report to the 89th Congress.

In that report, the House Select Committee on Government Research, chaired by Rep. Carl Elliott, recommended coordinated effort in attacking scientific and technical information problems with a "concentration of responsibility and authority."

The Committee suggested that COSATI be assigned responsibility for this overall exercise of power, and that the White House Office of Science and Technology "implement decisions based on COSATI recommendations, the former being closer to the seat of Executive authority."

Continued meetings of the Task Group on National System(s) are scheduled during coming months, directed toward the goal of a final report this summer. That report will submit findings and recommendations to the Federal Council for Science and Technology, under the chairmanship of Dr. Donald F. Hornig, Special Assistant to the President for Science and Technology.

Recommendations and findings of the Task Group will cover not only the national systems scientific and technical information requirements of the Federal Government, but also will include suggestions relative to the industrial, academic and general scientific professional community.

Deadline on Army R&D Awards

Plans for the annual Army R&D Achievement Awards for 1965, to be presented in June, are being firmed up by the Office, Chief of Research and Development (OCRD). Nominations should be submitted in accordance with AR 672-304 for review by awards committee prior to Mar. 31.

Chemical R&D Labs Announce New Deputy Commander

Lt Col Erwin P. Loeffler has been named deputy commander of the U.S. Army Edgewood Arsenal (Md.) Chemical Research and Development Laboratories.

From 1960 until recently, Col Loeffler served as security officer and chief of the administrative staff of the Laboratories.

A veteran of more than a quarter-century of military service, Col Loeffler began his Army career as an enlisted man in Troop K, 105th Cavalry, Wisconsin National Guard and in 1944 received a direct commission as a second lieutenant.

A native of Germany, he served as intelligence officer and prisoner-of-war interrogator for the 101st and 17th Airborne Divisions in Europe and as a strategic/historical interrogator, with Seventh Army, Germany.

Lt Col Erwin P. Loeffler

Among his numerous other assignments have been those of intelligence officer with U.S. Constabulary (Cavalry) and German border police units, Eighth Army intelligence liaison officer with the Fifth Air Force in Korea, intelligence officer with the Southern European Task Force in Italy, instructor in several U.S. Army schools in the United States, and training officer for the 525th Military Intelligence Group at Fort Bragg.

Col Loeffler prepared several special interrogation reports for the U:S. Forces in Europe following World War II. These included: "Death of Hitler," "Hitler Youth," "Battle of the Ardennes," and "Subversive Organizations in Germany." He also made major contributions toward the preparation of a World War II War Department manual on "The German Military Forces."

A holder of the Bronze Star Medal, Col Loeffler also has earned the Army Commendation Medal with two Oak Leaf Clusters, and United States and Republic of Korea Presidential Citations. He also has the Belgian Fourragere and Netherlands Order (Orange Lanyard) of Queen Wilhelmina. In addition, he has earned the Combat Infantry Badge, Parachute Badge and nine campaign and service medals.

Immediately prior to his new assignment at the CRDL, Col Loeffler attended a special warfare and counter insurgency course at the John F. Kennedy Special Warfare Center, Ft. Bragg, N.C.

Maj Gen Cassidy Designated Chief of Engineers

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when he retires from active service.

President Johnson also nominated General Cassidy for 3-star rank, effective when he assumes his new duties.

A graduate of the U.S. Military Academy, General Cassidy, 56, has served in the dual role as commanding general of the U.S. Army Engineer Center and commandmant of the U.S. Army Engineer School, Fort Belvoir, Va., since Mar. 1, 1963. General Wilson, 58, has been Chief of Engineers since May 1961.

From April 1962 to March 1963, General Cassidy was deputy chief of Engineers for Construction, Office, Chief of Engineers (OCE). Prior to that, he was director of Civil Works (September 1959-April 1962), with direct supervision over planning, construction and operation of flood control, navigation, hydroelectric power, and other water resources development throughout the United States. In 1958 and 1959, he served as senior logistics adviser to the Republic of Korea Army.

From 1954 to 1958, he was division engineer of the South Pacific Division, responsible for construction of major missile installations, air bases and buildings for the Army and Air Force, as well as dams, levees and other works pertaining to navigation and flood control in California, Nevada, Utah, Arizona and Hawaii.

In World War II, General Cassidy commanded engineer troops specializing in the construction of airfields in the Mediterranean area, for which he was awarded the Legion of Merit. He then became chief of the War Plans Division, OCE.

At the war's end, he was assigned as assistant division engineer, Lower Missisippi Valley, and after three years of service was ordered to Japan at the outbreak of the Korean War.

His decorations include the Presidential Citation (Republic of Korea) as well as the United Nations Service Medal, Bronze Star Medal and Legion of Merit with Oak Leaf Cluster.

GENERAL WILSON will have completed 36 years of active service in the Corps of Engineers when he retires. A native of Fort Barrancas, Fla., and a son of the late Maj Gen Walter K. Wilson, he was graduated from the Military Academy in 1929.

During World War II, he served with the Amphibious Corps, Atlantic Fleet, the Engineer Training Center and the 79th Engineer Combat Regiment, which he activated. After graduating from the Army and Navy Staff College in 1943, he served as deputy engineer-in-chief, South East Asia Command, at New Delhi, India, and Kandy, Ceylon.

In September 1945, he became commanding general, Advance Section, U.S. Forces, India-Burma Theater, and chief of staff of the Chinese Army in India. Later, he commanded all ground forces remaining in the theater.

In April 1953, he was ordered to Morocco as division engineer, Mediterranean Division, with responsibility for construction for the Army and Air Force in North Africa from Morocco to Eritrea, and in Saudia Arabia. In 1955, he took command of the 18th Engineer Brigade, Fort Leonard Wood, Mo.

He became assistant chief of Engineers for Military Construction in May 1956, and deputy chief of Engineers for Construction in November. In August 1960, he became commanding general of the Army Engineer Center and Fort Belvoir and commandant of the Engineer School. He was appointed Chief of Engineers with 3-Star rank in May 1961.

Lt Gen W. K. Wilson, Jr.

General Wilson's decorations include the Legion of Merit with Oak Leaf Cluster, the Soldier's Medal, the Army Commendation Ribbon and the French Legion of Honor.

A former national president of the Society of American Military Engineers, he is a member of the American Society of Civil Engineers and the National Society of Professional Engineers, and is a registered professional engineer in Alabama.

Army Leaders to Brief Industry on Long-Range Needs

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sibilities as they relate to material requirements; materiel and research and development requirements in the areas of missiles, other weapons, electronics, transportation, ammunition, repair parts and maintenance; and the responsibility and opportunities offered business, both large and small.

Heading the team of Defense officials participating will be Dr. Harold Brown, Director of Defense Research and Engineering; Paul R. Ignatius, Assistant Secretary of Defense (Installations and Logistics); and Charles J. Hitch, Assistant Secretary of Defense (Comptroller).

Subjects to be covered at the briefings are as follows: Major Objectives of the DoD and Programs Designed to Implement Them; Changing Patterns in Defense Spending and Resulting Problems and Opportunities; Five-Year Force Structure and Financial Program; Technological Challenge of the Next Ten Years; Management Trends in Defense Development and Production; Defense Cost Reduction Program; Defense Supply Agency-Procurement Trends and Future Industry Relationships; Army Advanced Planning Requirements; Navy Advanced Planning Requirements; and Air Force Advanced Planning Requirements.

Panel discussions are scheduled at each location.

The American Federation of Labor-Congress of Industrial Organizations will provide a guest speaker at each briefing, as follows:

Los Angeles—C. J. Haggerty, president, Building and Construction Trades Department; New York City—Leonard Woodcock, vice president, United Automobile Workers; Chicago—Joseph A. Beirne, president, Communications Workers; Dallas—A. J. Hayes, president, International Association of Machinists; and Washington, D.C.—to be announced.

The Director of the Department of Defense Small Business and Economic Utilization Office and representatives of the Military Departments and Defense Supply Agency will be present at the briefings to provide counseling services on contract policies and procedures of their organizations.

Current Invitations-for-Bids and Requests-for-Proposals of the Army, Navy, Air Force and Defense Supply Agency will be available for consideration, as well as listings of possible future buys of services and supplies by their respective agencies.

In conjunction with the briefings, the Department of Defense and NSIA will cosponsor a Defense Contractor Cost Reduction Exhibit at each location to illustrate the effectiveness of industry's cost reduction ideas and achievements. Fifty-five major Defense contractors will participate.

Arrangements are being handled by the NSIA. Copies of the master program are being distributed by NSIA.

DoD Instruction Establishes STI Functional Area Managers

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and Engineering (Administration and Management) Lt Gen William J. Ely, who also is chairman of the Committee on Scientific and Technical Information (COSATI) of the Federal Council of Science and Technology. (See chart on page 36.)

The Instruction states: "To attain more effective management of the total program, to facilitate the flow of information, and to create formal channels of coordination, responsibilities will be assigned for segments of the program along functional lines.

"These responsibilities supplement those now residing in the Office of the Secretary of Defense organizational entities for project authority and control. Thus, the manager of a functional area will consider all projects within that functional area irrespective of the administrative assignments of responsibility for budgetary purposes."

Mr. Ignatius and Dr. Fubini are cochairmen of the Council on Technical Data and Standardization Policy, composed of assistant secretaries of the Military Departments for research and development and for installations and logistics, as well as the Director of the Defense Supply Agency.

The Council has authority for final review and approval of all substantive actions affecting DoD technical data and standardization programs. In contrast to their former restricted role as coordinators for the Council, the functional area managers now exercise broad operational authority and control in their areas.

In addition to General Stanwix-Hay for *Technical Data and Standardization Policy*, the functional area managers are: *Data Systems*, Walter M. Carlson, Director of Defense Technical Information, Office of the Director of Defense Research and Engineering (ODDR&E); *Maintenance*, George E. Fouch, Deputy Assistant Secretary of Defense (I&L) for Equipment, Maintenance and Readiness; *Procurement Policy*, Graeme C. Bannerman, DASD (I&L) for Procurement; *Supply Management*, DASD (I&L) for Supply and Services; *Engineering*, James W. Roach, Assistant Director for Engineering Management, ODDR&E.

Emphasized in DoD Instruction 5010.13 is that one of its basic purposes is to bridge the interface between the Scientific and Technical Information Program and the Logistics Data Information Program at all levels.

To achieve this objective, the Instruction requires that all DoD components engaged in development design, testing, procurement, use, maintenance or disposal of military items, equipments, or systems, will designate individuals to coordinate and review technical data and standardization projects at the proper organizational level in each functional area.

The senior person assigned by each of the Military Departments and the Defense Supply Agency in each of the functional areas, the Instruction states, will serve as the point of contact with the Office of the Secretary of Defense functional manager in his area. Names of designees are to be forwarded to the Director of Defense Research and Engineering within 30 days of receipt of the Instruction.

"Adequate management of the technical data and standardization program," it is explained, "requires visibility at the Office of Secretary of Defense level. Because of the relatively low cost of technical data and standardization projects compared to other military projects, most technical data standardization projects are below the threshhold requiring OSD review.

"To provide the required visibility, all technical data and standardization projects will be reported to the responsible OSD office within 30 days after initiation."

The Working Group of the Council on Technical Data and Standardization Policy includes the managers of OSD-level offices assigned functional responsibilities involving the Technical Data and Standardization Program. The Group will provide functional management responsibilities assigned to organizational elements represented on the Group.

Under provisions of the Instruction, each of the functional managers will have specific duties to perform as a member of the Council's Working Group, as outlined in considerable detail. The duties will be performed in

ARO-D Hosts Army Scientific Advisory Panel Meet

Assistant Secretary of the Navy for R&D Robert W. Morse was among top-ranking R&D leaders who attended the Feb. 11-12 Army Scientific Advisory Panel (ASAP) meeting at the U.S. Army Research Office-Durham (ARO-D), Durham, N.C.

Mr. Morse was a guest speaker Feb. 11, along with Deputy Under Secretary of the Army (Personnel Management) Roy K. Davenport, who spoke on "Marginal Manpower—An Area for Research."

Assistant Secretary of the Army (R&D) Willis M. Hawkins, Chief of Research and Development Lt Gen William W. Dick, Jr., Army Materiel Command leader General Frank S. Besson, Jr., Lt Gen Dwight E. Beach, CG of the Combat Developments Command, and Director of Army Research Brig Gen Walter E. Lotz participated in the program.

Mr. Hawkins reported on the "Organization of the ASAP and Future Activities."

Col Nils M. Bengston, ARO-D commanding officer, gave the address of welcome and Dr. Hermann Robl, deputy chief scientist at ARO-D and session chairman, presented an "Introduction to ARO-D Programs." Col Walter M. Vann, deputy chairman of Project TECSTAR (Technical Structure of Army), reported progress.

Other discussion areas included low-speed aeronautics, ceramics for structural use, high-speed and temperature processes, mathematical analysis of nonlinear systems, Lasers and communicating research results.

Morrough P. O'Brien, Dean Emeritus, University of California College of Engineering, made the summary remarks of the meeting.

Lt Col Kenneth R. Bull, Office of the Chief of Research and Development (OCRD), is executive secretary of the ASAP. Lt Col Karl Borcheller is assistant executive secretary.

The ASAP meets three times a year, each time at a different major Army R&D field installation or headquarters to observe facilities and study programs in progress or projected for the future. Its purpose is to advise the Secretary of the Army, the Chief of Staff, the Assistant Secretary of the Army (R&D), and the Chief of Research and Development on scientific and technological matters of concern to the Army.

Redstone Physicists Give Papers

Two research physicists from the U.S. Army Missile Command, Redstone Arsenal, Ala., presented technical papers at the recent meeting of the American Physical Society in New York City. Romas A. Shatas spoke on "Phonon-Induced Infrared Absorption Spectrum in Irradiated Magnesium Oxide," Dr. John D. Stettler presented a paper titled "A Second-Quantized Hamiltonian for Electron-Phonon Systems."

behalf of the Council and under the guidance and approval of the Council.

Within 90 days of receipt of the Instruction, the Military Departments and the Defense Supply Agency are required to send copies of instructions or regulations which implement DoD Instruction 5010.13 to the Director of Defense Research and Engineering and to the Assistant Secretary of Defense (I&L).

"To the maximum extent possible," it is explained, "the responsibility for technical data and standardization projects coordination and review will follow normal organizational channels. The formation of boards or committees to provide management of technical data standardization activities is to be discouraged."

Functions of the DoD Council on Technical Data and Standardization Policy are outlined as:

- Analyze the principal projects and initiate or terminate projects.
- Recommend manpower and financial requirements in accordance with procedures prescribed by the Assistant Secretary of Defense (Manpower) and the Assistant Secretary of Defense (Comptroller).
- Recommend organizational structure changes.
- Formulate policies for promulgation through DoD directions and instructions and revision to the Armed Services Procurement Regulation.

Individual members of the Council's Working Group are assigned:

- *Project Inventory and Analysis.* Ensure the reporting and periodic updating of all projects within their respective functional areas to the DoD Central Project Inventory Library to maintain a current project listing; also, provide to the Library the project categories and sequence of listing, as well as the project interrelationships within the functional area.
- *Project Review.* Review reports submitted by DoD components on projects underway or projects initiated to determine their relationship to overall DoD objectives and programs. Assign specific DoD components the responsibility for conducting studies, appraising alternatives or preparing projects which may be needed to fulfill overall DoD objectives in a functional area. Recommend to the Working Group of the Council the termination of any projects which are unnecessary or economically unsound as part of the program in a functional area.
- *Organization.* Establish and maintain an effective liaison arrangement for project review and overall program management with the senior contact personnel assigned to a functional area. Recommend to the Working Group organizational changes in DoD components which may be required to meet objectives in a functional area.
- *Resources.* In conjunction with the DoD components affected, prepare analyses of manpower and funds allocated to projects in a functional area or required to conduct proposed projects. Recommend to the Working Group for submission to the Secretary of Defense future allocations of manpower and funds in accordance with approved DoD procedures.
- *Policy Formulation.* Maintain a continuing review of the impact of existing DoD policies upon the effective management of technical data and standardization activities in-house and in contractor locations. Assess desirability of changes in policy to correct known deficiencies, to achieve cost reduction, or to improve efficiency of development, design, procurement, installation, supply, operation, or maintenance. Recommend to the Working Group of the Council any appropriate additions or deletions to existing policies or, as necessary, promulgation of new policies.

By Dr. Ralph G. H. Siu

One of the most popular features that has enlivened the *Army Research and Development Newsmagazine* for the past four years is ended. Dr. Ralph G. H. Siu, scientific director of the Research Division, U.S. Army Materiel Command, and chairman of The Army Research Council (TARC), announced a decision to terminate his T-Thoughts column in a Dec. 29 "Memorandum to Recipients of T-Thoughts," as follows:

"As the old saying goes: the danger of wit is to go beyond the mark.

"Rather than approach the threshhold of importunity too treacherously, your humble purveyor of T-Thoughts —if indeed wit they be—is now, with your understanding indulgence, bringing the mailing series to a close. Your very generous reactions to them in the past have brightened his life considerably. Hopefully, the T-Thoughts have brightened yours just a little bit."

Many thousands of readers have been pleasantly stimulated by T-Thoughts and the editorial staff joins with them in expressing regret that Dr. Siu has decided not to risk "going beyond the mark" in his observations.

Certainly, one who is a part of the "great bureaucracy" comes under the constant downpouring of words verbal and written—words to be dealt with, words to be remembered, words one would like to forget, words making up thoughts of great content, of small content and often of no content.

Words, in fact, are the coin in which we deal and it is a rare event when there appears on the scene one who is a master at recognizing the art of fabricating the brilliant anecdote pertinent to R&D problems and weaving the delicate thread of witty wisdom. Such a one is R. G. H. Siu who, in his collected T-Thoughts, has packed more meaning per "square root" into his selections over the past several years than any other single compiler of recent note.

Innocent nursery rhymes conceal the sharp edge of censure; an ancient table of water division portrays the gradual encroachment of unwarranted power; a parable of the new rooster teaches how easy it is to lose one's head when up against a professional; gentle twitting of the pompous and the important goes hand-in-hand with strong support of the humble and the harrassed; Parkinsonism is illustrated in its many subtle forms; the new is shown as a rediscovery of the old; and the face of wisdom remains cheerful and smiling.

These and many more circumstances and situations were served up in T-Thoughts, making them a constant source of delight to readers. Dr. Siu's decision is in keeping with a modesty his many friends and associates know and respect. Many of them will contradict his thinking that he might be in danger of "going beyond the mark."

On behalf of our readers, may we hope, Dr. Siu, that you will some day resume your column in the Newsmagazine, and may we join with them in "Thanks to you for the pleasure and stimulus your T-Thoughts have provided."

The Value of Modern Methods in Chemical Information Handling

By Dr. George P. Hager *

The following article is a resume of a talk presented at the recent meeting on U.S. Army Chemical Information and Data Studies at Walter Reed Army Institute of Research.

Chemical information, the results of the chemical research and development in which vast investments are made, can be handled by traditional methods and by modern methods.

At present, chemical information is being handled primarily, if not exclusively, by traditional methods. The *modern* methods that should now *supplement* the traditional procedures for the benefit of the scientific community-at-large are actually operating effectively only for isolated groups of chemists and other users of chemical information with limited mission orientations.

Many of the systems for handling chemical information by modern methods for specific groups of users have been included in a "Survey of Chemical Notation Systems" (Publications No. 1150, National Academy of Sciences—National Research Council, 1964).

Most of the modern systems that were surveyed were established for the benefit of groups of scientists employed by industrial concerns. Perhaps industry's incentive to realize maximum dividends from the resources invested in research and development is particularly compelling.

In any case, industrial concerns, together with several Federal agencies, have pioneered in providing modern services as indispensable supplements to the traditional information services available to their research and development personnel.

Management's intense desire to maximize the dividends from research and development investments has been the principal impetus in the establishment of a modern system. User demands for more modern services, once a modest modern system has been established and has demonstrated its utility, have reinforced and justified management's attitude toward the modern handling of information. When the management's "push" and the users' "pull" are ultimately coupled, the success of the modern system is guaranteed.

During the building process, very large backlogs of accumulated information must be incorporated into the system before the critical mass that will make the system operational has been attained.

In this critical stage, the attitudes of both management and user must be determined by a reasonable degree of faith or, at least, friendly understanding of the magnitude of the preliminary tasks.

It is during this period also, that the information specialist must constantly keep management and user aware of the ends that justify the means that are so much in evidence prior to the inauguration of the system as a research and development instrument. All parties concerned must from time-to-time step back from the trees in order to contemplate anew the forest.

Management, especially, will require reassurance about the "operations research" aspect of the modern system. Scientific information and data are purchased at a great price in connection with some specific project or mission.

If, subsequently the information bits and data can be expeditiously combined and permuted without constraints imposed by the specific project for which they were generated, and if they can thus be brought into coincidence with information bits and data from other unrelated projects in connection with some future problem, past research and development investments can yield new dividends.

The versatility of the modern system, especially the infallible and uninhibited recall capacity of the computer, simulate and magnify the creative genius of the human brain in the association of seemingly unrelated facts for insight into new problems and their solutions. The modern system can, in this way, facilitate and increase greatly the production of new dividends from old investments in R&D.

Management, especially, will also be impressed with the capacity of a modern system to reduce unintentional duplication of research and development. Some idea of the magni-

DIRECTOR OF ARMY TECHNICAL INFORMATION and chief of the Scientific and Technical Information Division, U.S. Army Research Office, Col Dale L. Vincent, and Col George H. Pierre, CO, Frankford Arsenal, view operation of the Army Chemical Typewriter (ACT) during demonstration at the Arsenal. Chemist Helen L. Merwoy is the operator. The ACT can put intricate chemical data, including structural diagrams of compounds, into digital form for storage and retrieval by computers. It can be operated in conjunction with FADAC (Field Artillery Digital Automatic Computer). The combined devices will permit rapid retrieval of information, wherever it may be, and thus greatly reduce research time. One goal is to minimize duplication of effort by Federal agencies. By 1966, it is hoped to have a number of ACT-computer systems at each of the Army chemistry laboratories. Ultimately, Federal Government technical agencies will be linked by the system, it is envisioned.

* Dr. Hager is Dean of College of Pharmacy, University of Minnesota, and chairman of Committee on Modern Methods of Handling Chemical Information of the National Academy of Sciences in Washington, D.C.

tude of the needless investment in research and development that can only produce facts that have already been well established can be acquired from an article by John Martyn, "Unintentional Duplication of Research" (New Scientist, No. 377, Feb. 6, 1964, p. 338).

As a modern system of handling information forestalls investment in research for *re*-generation of established facts, it enables greatly improved management of research by concentrating existing resources on the unknown factors of a problem. To the extent that the modern system can be used to reduce unintentional duplication of work, and to the extent that it is so-used, research productivity can be increased.

Research productivity can be increased and unintentional duplication of research can be reduced by use of modern methods for analyzing the information bank.

Furthermore, management and user alike will be impressed by any demonstration of the synthesis of new information, or, even more important, of new concepts by manipulation of the information bank by modern methods.

The happy accidents through which prepared observers have made new and useful discoveries, the creative insights that come about through association of apparently unrelated bits of information, can be facilitated greatly by the use of a modern system when it is employed with a free play of serendipity.

The handling of information by traditional methods has always been used in synthesis of new concepts. This virtue of information handling is greatly increased when modern methods are employed.

The user of the modern system must be convinced that the system is, indeed a *new* tool—that it will not supplant the traditional information tools and services that he will continue to need and to use especially for purposes of "browsing" and current awareness.

Furthermore, the traditional information tools will continue to serve him with greatest efficiency whenever his query involves a *simple manipulation* of a relatively *small volume* of information. For example, "What is the average daily dose of reserpine?"

On the other hand, the user should be convinced that the information bank can be handled by modern methods to accomplish objectives that cannot be accomplished by traditional methods or that could be thus accomplished only by a hopelessly inefficient and time-consuming procedure.

In general, the modern method will be most useful in retrospective searching of the information bank in connection with a new project for which the user has had no previous specific preparation or experience.

In retrospective searching, modern methods can provide information in response to a query that is comprehensive (chronologically and multidisciplinary) —information that is precisely selected in accordance with the query and, therefore, truly relevant to the problem. Furthermore, the modern methods provide much greater freedom of access to the pertinent information and permits much greater sophistication in the users' questions.

For example, a query that could be probed readily by a modern method but only with great difficulty by traditional use of information: "What is the average daily dose of reserpine in a normally obese woman in the third trimester of pregnancy who is suffering from hypertension of renal origin and predisposed towards paralysis agitans?"

If the initial search produced negative results, the least important condition, perhaps "normally obese," could be sacrificed and the search repeated. By such an orderly procedure, the condition can be cut back, until a positive response is obtained. In this way, the truly unknown aspects of the problem are identified and the laboratory effort can commence at the proper stage.

The user of chemical information will be particularly interested in the manipulation of information about composition or molecular structures. Molecular structures provide excellent access to chemical information, including the conceptual information that is associated with compounds.

The user regularly employs traditional information tools and their indexes to structures in search for answers to his queries. When he is interested only in specific compounds, the traditional tools will continue to be more or less satisfactory, even though searches of this type can be expedited by modern methods.

When the user is concerned with groups of compounds that have certain structural features in common, even though they differ greatly as regards the associated structural features (generic searches), modern methods are almost indispensable.

For example, "Since epinephrine is a broncho-dilator useful in treatment of asthma, and since its use is mitigated somewhat by its side effects on the heart, what compounds related to epinephrine structurally should be synthesized, or otherwise obtained, for testing as broncho-dilators for treatment of asthma?"

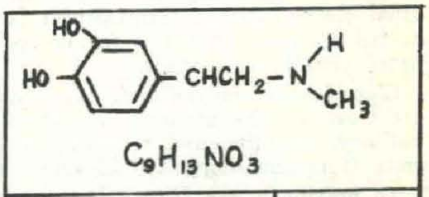
In using the most comprehensive traditional index to structures, *Chemical Abstracts*, the researcher would have relatively very limited access to epinephrine and its congeners.

Perhaps he would be able to locate epinephrine in five or six different places and the chance of locating many or any of the congeners in the same places would be quite remote.

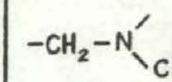
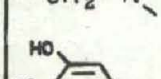
Modern methods could provide virtually unlimited access to epinephrine and all of its congeners. Even a somewhat primitive method for handling structures by modern methods would greatly increase the user's accessibility to the information required. For example, the encipherment of epinephrine's structure by a fragmentation code is shown in Table I.

As indicated in the Table, seven descriptors (codes) were used for epinephrine's structure. These can be combined 126 different ways (2^n-2) and each combination would be an

(Continued on page 25)



$C_9H_{13}NO_3$

Constituent Group	Group No.
	F5D1
	F611
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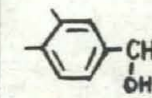
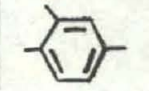
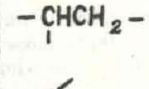
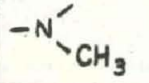
	H8G1
	NY81
	0191
	00A1

TABLE I. A TYPICAL ENCODING OF A MOLECULAR STRUCTURE

DoD Policy Seeks to Ease STI Flow to Non-Defense Activities

Policies directed toward correct classification of information in terms of current security needs, as defined in a new Department of Defense Instruction, ultimately are expected to facilitate flow of scientific and technical information into non-Defense activities.

DoD Instruction 5210.47, signed by Assistant Secretary of Defense (Manpower) Norman S. Paul, delineates policy, standards, criteria and procedures which govern security classification of DoD information. It also will provide the basis for classification activities in Defense industry.

In one package the Instruction sets forth, for the first time, the grounds or reasons for classification, one or more of which must be involved in any particular case of correct classification. It also contains the basic mechanics for carrying out these decisions. Authority to make original classification determinations is curtailed and restricted to the designated classifying officials.

Classification is the first step in the Government's attempt to protect military, scientific and technical secrets from unauthorized disclosure.

To provide in the Instruction comprehensive guidance for all DoD personnel who may be called upon to make classification determinations, all existing rules and regulations were reviewed, analyzed and recast, and many new features were added.

Approximately 90 percent of all classifications are derivative, being based on some existing classification. To assure accuracy of these decisions, the Instruction requires derivative classifiers to know precisely what requires security protection.

Paragraphs of documents must be noted to show their individual classifications or other detailed guidance supplied covering the documents. Responsibility for making derivative classifications is fixed and a system for timely review of these classifications is prescribed.

The Intruction emphasizes the necessity for detailed classification guidance for all programs and projects. It stresses clear, concise identification of exactly what requires security classification. Physical things such as hardware, equipment and the like are to be classified only to the extent necessary to protect from unauthorized disclosure information contained in or revealed by the physical object.

Overall, the Instruction is intended to provide the means for safeguarding sensitive information while at the same time reducing to a minimum the amount of documentation and material which is classified. To assure that its provisions are being correctly applied to eliminate overclassification and misclassification, the program will be monitored at all levels.

Future additions to the Instruction are planned. These will provide for systematic reviews of existing classifications and for reports that will provide data for evaluation of the program.

NASA Transfers Syncom II and III Operations to DoD

Transfer of the operation of Syncom II and Syncom III communications satellites to the Department of Defense from the National Aeronautics and Space Administration (NASA) began Jan. 1 and is expected to be completed by Mar. 31.

The civilian space agency completed its experimental research and development program with the two synchronous satellites and the DoD will operate the satellites for the remainder of their useful lives.

The DoD has furnished the communications ground stations used to relay transmission by the two Syncoms for the past two years. Telemetry and command stations and range and range-rate equipment operated by NASA for its Sycom program also will be transferred to DoD.

The DoD, however, will provide NASA with certain telemetry and ranging data of scientific and engineering interest. Syncom II was launched from Cape Kennedy July 26, 1963, and Syncom III was launched from Cape Kennedy Aug. 19, 1964. Both are orbiting at altitudes of about 22,300 miles.

The satellites are referred to as synchronous because their orbital periods around the earth are equal to the time it takes the earth to complete one rotation about its axis.

The official transfer of control was arranged by an exchange of letters between NASA Associate Administrator Dr. Robert C. Seamans, Jr., and Dr. Eugene G. Fubini, Assistant Secretary of Defense and Deputy Director, Defense Research & Engineering.

U.S. ARMY SATCOM (Satellite Communications) Agency commander, Brig Gen J. Wilson Johnston explains closed-circuit TV information display equipment in the SATCOM Test Operations Center to Col George Sammet, Jr. (seated) and Lt Col James J. Cobb (left) during their recent orientation visit to the Fort Monmouth (N.J.) SATCOM Agency. Col Sammet and Lt Col Cobb were recently assigned to Army space activities in the Office of the Chief of Research and Development (OCRD) as deputy director of OCRD Space Directorate and Nike X-Space Division chief, respectively. At right is Lt Cmdr E. Irvin Lissy, USN, head of the SATCOM Agency System Operation Division, who briefed the visitors on the Test Center and on Project SYNCOM.

5 Officers, 1 Civilian Assigned to OCRD Staff

Five military officers and one civilian were recently assigned to the Office of the Chief of Research and Development (OCRD).

Lt Col Norman L. Durocher was assigned by OCRD as the Army representative to the newly formed Joint Meteorological Satellite Program Office in the Headquarters of the U.S. Air Force, designated overall managing agency of the Department of Defense-wide program.

Backed by B.A. (1946), B.S. (1960) and M.S. (1961) degrees from the University of Washington, he served from August to November 1964 as chief, Electronics Section, Evaluation Branch, Program Control Division, Headquarters, U.S. Army Materiel Command, Washington, D.C.

For the preceeding 12 months he served as assistant signal officer with the Headquarters of the I Corps in Korea. From June 1962 to July 1963, he was executive officer, U.S. Army Electronics R&D Activity, Fort Huachuca, Ariz.

Col Durocher was chief of the Meteorology Department, U.S. Army Electronics Proving Ground, also at Fort Huachuca, from 1960-62, after two years as a meteorologist there. He has served as an aerology officer at U.S. Naval facilities (1951-56) and as a civilian meteorologist with the U.S. Weather Bureau, Juneau, Alaska (1947-50). He holds the Army Commendation Medal.

LT COL HAROLD C. FRIEND reported as assistant chief of the Physics and Engineering Branch, Physical Sciences Division, U.S. Army Research Office.

Previous assignments include: chief, Engineering Branch, Hq., Third U.S. Army, Fort McPherson, Ga., 1962-64, signal officer, Fourth U.S. Army Missile Command, Korea, 1961-62; assistant professor, Electrical Engineering Department, U.S. Military Academy, 1958-60.

A 1946 graduate of the U.S. Military Academy, he also holds an M.S. degree in electrical engineering from Massachusetts Institute of Technology and is a graduate of the Command and General Staff College.

While assigned to Hq., Third Army, Col Friend worked on the reorganization of the Signal Section, which became the Communications Electronics Division, and strengthened the plans and operations function.

Lt Col N. L. Durocher | Maj W. H. Goodwin | Maj H. L. Dukes

MAJ HARRY L. DUKES, JR., was assigned to the General Materiel Branch, OCRD Combat Materiel Division after a year as assistant G-1, Fort Lee, Va. He served three years as chief, Analysis Section, U.S. Army Quartermaster Technical Intelligence Detachment, U.S. Army Europe, and is a former chief of the Uniform Quality Control Office, U.S. Army Laboratories, Natick, Mass.

A graduate of the Command and General Staff College, Maj Duke holds a B.S. in textile manufacturing from Clemson College (1952), and an M.S. in textiles, Georgia Institute of Technology (1957). His decorations include the Army Commendation Ribbon with First Oak Leaf Cluster.

MAJ WILLIAM H. GOODWIN reported to the Space Office as a staff officer in the Range Branch. A 1949 graduate of the U.S. Military Academy, he spent three years in Germany as a battery officer and two years as an ROTC instructor at Purdue University, Lafayette, Ind. The next two years he spent at the University of Southern California, where he received an M.S. degree in mechanical engineering in 1958.

From 1958-61 he was a project officer with the Missile Division, U.S. Army Artillery Board, Fort Bliss, Tex. After a year at the Defense Language Institute, West Coast Branch, Monterey, Calif., studying Thai, he spent two years as an artillery school adviser to the Republic of Thailand before his current assignment.

Maj Goodwin is a graduate of the Command and General Staff College and holds the Army Commendation Ribbon.

CAPT JOSEPH E. BROWN was assigned to the Chemistry and Materials Branch, Physical Sciences Division, U.S. Army Research Office.

Previously he served with S-3, 218th Chemical Battalion at Fort McClellan, Ala., 1960-62, as a unit chemical officer, receiving a Certificate of Achievement in 1961. Earlier, he served as a platoon leader and executive officer, E Co., 2nd Airborne Battle Group, 187th Infantry, 101st Airborne Division, Fort Campbell, Ky., 1959-60.

He holds a B.S. degree in chemistry from Georgia Institute of Technology (1958) and an M.S. in physics from Iowa State University (1964).

RAYMOND L. COLLINS reported as a management analyst in the Management Analysis Branch, Review and Analysis Office, OCRD. For the past four years, he has been employed with the Office, Deputy Chief of Staff, Comptroller, U.S. Army Engineer Center, Fort Belvoir, Va., as an administrative assistant and management analyst.

He attended the University of North Carolina (1954-55) and the University of Maryland (1959-60) while serving in the Army. His decorations include the Bronze Star, Army Commendation Medal, Purple Heart and service ribbons earned in the European Theater in World War II and the Korean War.

55 Selected Officers Take Management School Course

Col Hubert L. Nolan, deputy chief, Physical Sciences Division, U.S. Army Research Office, was among 55 specially selected officers and civilians from the U.S. Army and other Government agencies who graduated recently from the U.S. Army Management School.

The school, especially important for commanders, deputy commanders and other principal staff officers serving in senior managerial positions, presents executive level courses dealing with the development of doctrine, organization procedures and techniques relating to the performance of managerial functions of Army installations and activities.

CRDL Research Chemist Completes SA Fellowship

Dr. Edward J. Poziomek, a research chemist at the U.S. Army Chemical Research and Development Laboratories (CRDL), Edgewood (Md.) Arsenal, recently became the third CRDL employee to complete a Secretary of the Army Research and Study Fellowship.

Results of his research, performed at the State University of New York from October 1962 to January 1964 on "Establishment of Theoretical Principles on Which to Design Organic Detection Reactions for Air Pollution Control," were recently filed with the Secretary of the Army Executive and Professional Development Committee.

Other CRDL personnel who completed Secretary of the Army Research and Study Fellowships are E. H. Engquist, director of Defensive Systems, who studied at the University of Michigan (1958), and Frank Shanty, chief of the Detection Division, Directorate of Defense Systems, who attended the University of Pittsburgh School of Public Health (1960).

Col Willmann, CRDL commander, described Dr. Poziomek's work under the fellowship as "outstanding on the basis of scientific merit, important to the chemical detection research program of the Laboratories, and of high value to the Department of the Army and the Federal Government as a whole."

The research was one basis for Dr. Poziomek's candidacy for Maryland's Outstanding Young Scientist of 1964 award. Dr. Poziomek now heads the

Dr. Edward J. Poziomek

Organic Research Section of the Directorate of Defensive Systems.

As a result of experience gained by Dr. Poziomek during his fellowship studies, various new aspects of chemical research are being investigated at the Laboratories. Also, he is currently instructing other Laboratories personnel in various new scientific techniques to aid them in their research and development activities.

He has written two articles on his fellowship research project for the *Journal of the American Chemical Society*. A third article is currently being processed for publication.

While working under the fellowship, Dr. Poziomek also demonstrated his administrative ability. During a major portion of the work, his research adviser—Dr. Edward M. Kosower—was in Europe and Israel on a lecture and study tour, and the Edgewood Arsenal scientist was responsible for the administration of Dr. Kosower's research group.

In a letter to S. Carlisle Botts, executive secretary of the Secretary of the Army's Executive and Professional Development Committee, Dr. Kosower described the young scientist as ". . . one of the best administrators I have ever seen. . . . He is very fair and considerate in his dealings with people, but never fails to remember what his duties and responsibilites are."

Dr. Poziomek attended the Christian Brother's Academy in Albany, N.Y., and received his bachelor of science degree from Rensselear Polytechnic Institute in 1954. He received his master's in 1960 and a Ph.D. degree in 1962 from the University of Delaware.

He is a member of the American Chemical Society, Sigma Xi (Honorary Scientific Society), Chemical Society of London, and the American Microchemical Society.

New Firebee System Increases Flight, Payload Capabilities

A new ground-launch system for the Army's Firebee target guided missile promises to increase flight time and improve payload capability.

Remote controlled Firebees are used as targets in training Army air defense missile crews. Developed by Ryan Aeronautical Co., under a contract with the U.S. Army Missile Command, Redstone Arsenal, Ala., the new system will enable the Firebee to fly as long as three and one-half hours. It was tested at White Sands Missile Range, N. Mex.

The target will utilize an 11,000-pound thrust JATO bottle, which will burn for four seconds, or twice as long as present JATO units, to increase the Firebee load-carrying capacity. Extended wing tips for greater lift will offset increased payload.

Army Civilian Education Program Aids 142,000 in 1964

More than 142,000 Army personnel enrolled in on-duty or off-duty study programs completed nearly 675,000 courses during FY 1964 under the Army civilian education program.

Almost 141,000 enrolled in the General Education Development (GED) off-duty program, which offers courses extending from grade school through graduate level. Of this number, 717 earned college degrees and 41,430 successfully completed high school proficiency tests.

More than 23,000 students completed 55,000 courses at civilian colleges and universities during off-duty hours. Individuals enrolled under this program receive financial assistance to defray a part of tuition costs.

In addition, nearly 40,000 used off-duty time to take correspondence courses offered by the United States Armed Forces Institute (USAFI), in Madison, Wis. Many of these courses are accepted for degree credits by colleges and universities.

Some 1,500 officers and enlisted men pursued college and graduate level studies in an on-duty, resident-student status during FY 1964. About 550 attended colleges and universities under a Degree Completion Program, which permits one year of study for a bachelor's degree and six months of study for a graduate degree.

Another 958 officers studied for master and doctorate degrees under the Civil Schools Program. This program is designed to prepare selected officers for assignment to positions requiring special training in fields such as science, engineering, administration, journalism, language and psychology.

Today, 75 percent of all U.S. Army enlisted men are high school graduates, compared to only 48 percent 10 years ago. Among the national population, only about 21 percent of men over 25 are high school graduates.

In the officer corps, some 73 percent are college graduates, compared to 49 percent 10 years ago. More than 90 percent of all lieutenants now hold college degrees.

Among the national population, only 10 percent of men over 25 are college graduates. By comparison, some 19 percent of all active Army officers today hold graduate degrees.

Army Regulation 70-45 Prescribes STI Policies, Responsibilities

Responsibilities and policies for the Army Scientific and Technical Information (STINFO) Program are set forth in Army Regulation 70-45, expected off the press this month.

Major objectives of the STINFO Program, as stated in AR 70-45, are:

". . . To improve the flow of technical information into, through and from the Army in order to: 1) Secure economies by reducing research, development, test and evaluation (RDTE) lead time by eliminating unnecessary duplication of effort; 2) improve RDTE program management; 3) support the information needs of scientists, engineers and managers."

The STINFO Program will establish a "coordinated network of generally decentralized information activities operated and administered by major commands and other Department of the Army components."

Program support activities and functions in general include acquiring, evaluating, storing, processing, announcing, retrieving and disseminating technical information and data that are products of, related to, or required for support of RDTE programs and similar activities.

The Regulation delineates program policies and responsibilities for which the Chief of Research and Development has overall staff responsibility.

Department of the Army elements are required to "provide for adequate interchange of technical information among themselves and with their contractors, the other military departments and Federal agencies, and, to the maximum extent consistent with national security, the United States scientific, technical and academic communities in general."

Further, "maximum use will be made of existing technical information facilities." Technical information projects will be supported on the basis of user needs in order to meet RDT&E and related program requirements.

Release of unclassified and classified technical information will be in accordance with existing Army Regulations 380-19, 380-5 and 380-130 and controls of the Army Assistant Chief of Staff for Intelligence.

AR 70-45 lists specific responsibilities of appropriate elements of the Department of the Army in the U.S. and major overseas commands as follows:

- Carry out policy and procedures for the Army Scientific and Technical Information Program and enforce appropriate provisions of the Armed Services Procurement Regulations (ASPR) to support the Department of Defense and Department of the Army technical information projects, task areas, and related functions.
- Develop programs and provide guidance, supervision and support to subordinate organizations and activities consistent with Department of the Army policies and objectives to insure maximum exchange of technical information in support of scientific and technical missions.
- Provide resources, including manpower, funds, materials and information and perform planning, programing, budgeting and other support functions required for operating and managing technical information activities.
- Maintain a current inventory of technical information functions and activities under their control. Maintain planning on a 5-year program basis.
- Designate technical information officers in offices staffed with qualified scientific or technical personnel as at appropriate commands and installations.
- Encourage the publication of monographs and technical papers.
- Review technical information needs and make proposals for initiating revising or terminating technical information projects or activities.
- Consolidate the organization, development and operation of technical information functions and activities so as to provide for the most efficient and economical services.

JMSPO to Manage DoD Meteorological Satellites

The Joint Meteorological Satellite Program Office (JMSPO) was established recently by the Director of Defense Research and Engineering (DDR&E), Dr. Harold Brown, for staff management of Department of Defense activities in this area.

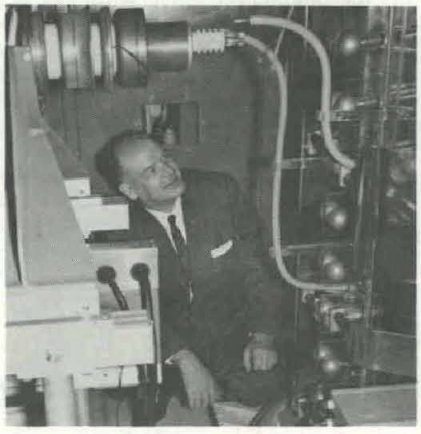
As a joint staff office, composed of Army, Navy and Air Force personnel, the JMSPO will be responsible directly to the DDR&E Office. It has been placed under the general sponsorship of the Air Force for executive management, logistic support and administration.

Directing the new office is Col Peter E. Romo, USAF. The Army member is Lt Col Norman L. Durocher, who was recently assigned to the Office of the Army Chief of Research and Development for duty with the JMSPO.

The JMSPO will have responsibility for the following:

- In cooperation with the U.S. Weather Bureau, continually review the National Aeronautics and Space Administration's Meteorological Satellite Program to define military applications of the national system and arrange Department of Defense (DoD) technical efforts to support the national program.
- Collect and consolidate Military Service and Joint Chiefs of Staff requirements relative to meteorological satellites.
- Provide staff management of any DoD meteorological satellite developmental efforts.
- Provide DoD support and technical assistance to U.S. representatives engaged in international discussion on weather satellites.
- Perform other such tasks and functions relative to weather satellites, as might be directed by DDRE.

Members of the JMSPO are authorized direct access to all elements of the Department of the Army in furtherance of its assigned mission.



CHIEF SCIENTIST of the Army Materiel Command, Dr. Craig M. Crenshaw, views electron injection apparatus of gamma linear accelerator recently acquired by White Sands (N. Mex.) Missile Range. Housed in the Nuclear Effects Laboratory, the accelerator is part of the Army's most integrated nuclear test facility.

Research In Review...

Selection and Classification Research in the Army

By Dr. Samuel King

Dr. Samuel H. King joined the Human Factors and Operations Research Division of the U.S. Army Research Office, Office of the Chief of Research and Development, in September 1961. From 1948 until 1961, he was a research psychologist in the forerunner to what is now the U.S. Army Personnel Research Office, an organization that includes five laboratories.

Dr. Samuel King

In 1955-56 he was chief of the Performance Evaluation and Rating Research Unit, Personnel Branch, Office of the Adjutant General, and then became Research Group Chief of the Branch. His duties included supervising research in helicopter pilot selection, combat allocation procedures, retention standards, error-free performance, image interpretation, and measures to predict differential success of newly commissioned officers.

Graduated (Cum Laude) from Lincoln Memorial University in 1946 with a B.A. degree in psychology, he earned an M.A. degree the following year from the University of New Mexico. He was a Graduate Fellow in industrial psychology at Northwestern University in 1950-51 and received a Ph. D. degree in 1954 from Western Reserve University.

In 1949 he took part in research in Arctic maneuvers for selection of personnel for arduous assignment and in the spring of 1951 was on the officer-civilian psychologist research team that made frontline studies of combat troops in Korea.

Affiliated with the Psychometric Society and the American Psychological Association, he has authored or coauthored numerous publications on personnel research.

Though "selection" of some kind has been used in all armies since biblical times, the United States Army was the first to place emphasis on the scientific basis for the selection and classification of large numbers of men. This began during World War I.

The psychologists who formed the nucleus of the World War I effort were men who had founded the first psychological laboratory to be concerned with problems of industry. In this laboratory at the Carnegie Institute of Technology, they were conducting research to improve the selection and training of life insurance salesmen.

As military and civilians working for The Adjutant General, they were called the "Committee for the Classification of Personnel." Their roll included the most famous U.S. psychologists of the day: Watson, Yerkes, Bingham, Scott, Clothier, Thorndike. The best known tests constructed by the Committee were the Army Alpha and the Army Beta—forerunners of the selection and classification tests used today.

After World War I, military interest in such research remained dormant until World War II caused a rebirth of interest in selection and classification techniques for military populations. The major effort was initiated under The Adjutant General's Office, which was responsible for the construction and validation of all psychological measures used in determining acceptability for induction and selection for training. The Army General Classification Test (AGCT) is probably its best remembered product.

The U.S. Army Personnel Research Office (USAPRO), a Class II installation under the Office of the Chief of Research and Development, is the current name for the research organization begun in early World War II. Though the work performed by USAPRO has become quite diverse in scope, to meet the research requirements of today, its selection and classification research is still an important element and is respected worldwide for its high caliber.

Both the AGCT and its World War I predecessor were "global" tests. While they sampled several areas of ability, they provided only a single overall estimate of ability to learn; that is, the score showed where a man stood in relation to the rest of the manpower pool with respect to job potential in general. For adequate classification, the Army needs to know what each man's outstanding abilities are, and how he compares with others in each of these abilities.

The concept of differential classification, as developed and applied by USAPRO, was a major step forward in scientific personnel research and management. Differential classification capitalizes not only on the differences among individuals but also on the fact that individuals differ in the pattern of their abilities. It involves matching the requirements of different job areas with the capabilities of the man to be assigned. The objective is to allocate enlisted men to training so that the aggregate quality of performance in Army jobs is as high as human resources available at a given time will permit.

The Army Classification Battery (ACB) and the aptitude area system are the instrumentation of differential classification. Scores on the 11 tests of the ACB are used in composites termed aptitude areas. Each composite represents a combination of abilities considered important for satisfactory performance in a number of Army jobs and bears an established relationship to performance in those jobs.

From the viewpoint of classification efficiency, the ideal would be to have nonrelated sets of jobs and each aptitude area highly valid for a given set of jobs but much less so for all other jobs. In practice, however, performance in jobs is usually quite highly correlated, as are scores on predictor measures. The aptitude area score associated with a particular set of jobs is the best predictor now available for that set of jobs.

The aptitude area system has greatly increased the effectiveness of classification. On a typical section of the enlisted input, 90 percent score 90 or above on at least one aptitude area, whereas less than 75 percent of the same group have scores of 90 or higher on a single ability measure. Use of aptitude areas has resulted in substantial gain in the number of men who can be assigned to jobs requiring ability of a 90 level.

When men are assigned to job areas appropriate to their higher aptitude area scores, 80 percent can be ex-

pected to perform acceptably in training and on the job. About 45 percent in typical technical services can be expected to perform at a very high level—better than 7 out of 10 men in the general manpower pool. Corresponding percentage of people expected to perform at these levels in combat areas are 72 percent and 37 percent, respectively.

Prior to the taking of the tests which comprise the Aptitude Areas, a primary decision must be made: Is a person qualified to enter the Army or isn't he? Less parochial—is he qualified to be a member of the Army, Navy, or Air Force?

The Army is the executive agency for the Armed Forces Qualification Test (AFQT), which is administered at all Armed Forces Examining Stations. This test, as prescribed by Congress, requires as a minimum a "passing" score of 65 for entry into any of the three Services. A score of "65" is meaningless, of course, unless anchored in some meaningful way.

In a Standard Score System, it is completely defined: for a specified group of people, a known percentage of these persons score above and below the 65—and the same percentage figures are true for all tests for which the same standard score system is used. In times of expansion or contraction of the Armed Services, it can be predicted how many people would be lost by requiring higher mental standards and how many would likely be gained in lowering standards.

Since late 1953, a prescreening test, highly correlated with AFQT, has been used by local recruiters to determine which men are likely to qualify for service. About 80 percent of those tested are sent on to Recruiting Main Stations where the AFQT is given. Rejection of 20 percent at the earliset screening point saves the Army considerable expense in travel, quartering and processing.

Special selection studies have been conducted in many areas. An early effort—initiated when the Air Corps was still a part of the Army—was devoted to developing valid measures for selecting pilots, bombardiers, and navigators. Since that time, special selection studies, some of a continuing nature, have been conducted for ROTC, OCS, USMA, NCO's, motor vehicle operators, rotary and fixed wing pilots for Army aviation, and technical training of various kinds.

The approaches used are basically the same as in other research: Study the problem, find out what has been done, formulate hypotheses as to what will succeed, construct measures for these hypotheses, try them out experimentally against the best appropriate criterion, determine effective weights and interrelationships, and try out again in an independent sample.

USAPRO has developed over 100 testing instruments which have been used operationally and which more efficiently select and classify candidates for regular and special assignments. In a typical peacetime year, approximately 16 million copies of USAPRO-produced tests are administered to assist in training and job assignments.

Frequently, low relationship obtained between a painstakingly constructed selection procedure and a suitable criterion of performance occurs because of unavoidable factors. For example, if the object is to predict success when multiple criteria, equally weighted and equally difficult are to be used, good prediction can not be obtained if the intercorrelations among the criteria are low. This is also true if the underlying relationship between performance in successive stages of a program is low. Further, attrition from such a program will be high.

For example, this frequently happens when the first phase of a course involves only "leadership," the second "academic subject," the third "psychomotor ability," and persons are eliminated from this program during or at the end of each phase. If the underlying abilities for the three separate phases are relatively orthogonal to each other, the only hope for supplying adequate persons for training is to have a very favorable "selection ratio" — that is, be able to eliminate by the selection procedure a larger percentage of the total number tested of the otherwise qualified applicants; be able to test a lot and select a few.

Questions are sometimes raised as to the comparison of the Army's selection and classification research with that of the other Services, business and industry. The three Services are quite similar in their approaches and recognition of the technical problems involved. Specifics differ among the Services—as do the problems to which the research is directed. All three Services use "actuarial" as opposed to "clinical" prediction.

Actuarial prediction utilizes probabilities and predicts only that a group of individuals with particular scores will form a specific distribution on later performance (or some other variable). Clinical prediction attempts to predict later performance (or some other outcome) in the case of a specific individual (or individually for each member of a group). Actuarial prediction, as used in this sense, is typified by quantification of data, statistical determination of optimum weights, and—usually—assumption of linearity of regression.

Clinical prediction, as used here, refers to a prediction made by a person or persons using "guessed weights." That is, consciously or unconsciously, anyone who makes predictions and who does not use statistically determined weights uses his own approximations as to what is important and what is not. This type prediction is frequently all that is available to many industrial and consulting organizations, since they do not have a large enough sample size to determine multiple regression weights. Aside from usually being more costly per person tested or hired, it is less valid than results obtained from actuarial prediction using larger samples.

Variants of the following procedure are used in clinical prediction: one or more "projective" tests (e.g., Rohrshac, Thematic Apperception Test (TAT) administered, scored, and interpreted by a trained professional; one or two general ability tests; special ability tests, depending on type job; commercially available tests of interest, personality; a complete personal history; interviews by one or two trained interviewers are also administered.

Information from all these sources is then used as the basis for making recommendations to the client company. Most producers of commercial tests try to provide standardization and reliability data—though validity data are usually scarce.

Some very interesting, and sometimes very important, problems and solutions arise as sidelights to the main focus of research. Some of these examples from different areas are covered in the following paragraphs.

"Guessing" at the answers is one. Many tests have warnings to the examinees—something to the effect that "guessing" will be penalized and "do not guess." What is meant is that in tests comprised of multiple choice answers, there is a correction factor for the total test score so that the total corrected score will equal the total number of right responses minus some fraction of the total number of wrong responses.

Under some conditions, the correlation between the total number right

(Continued on page 26)

ACV Capabilities Tested for Army in Polar Regions

Details of an evaluation testing program on the use of air cushion vehicles (ACVs) as a means of transportation in polar regions were disclosed recently.

Conducted by Bell Aerosystems Co. for the U.S. Army Transportation Research Command and the U.S. Army Cold Regions Research and Engineering Laboratory, the month-long tests were made on the Island of Greenland, 700 miles north of the Arctic Circle.

Using the Bell Carabao, a 1½-ton ACV that glides on a cushion of air above a variety of surfaces, a 5-man engineering test team from Bell Aerosystems reported the following major conclusions:

- Operational speeds in excess of 40 m.p.h. can be maintained on the Greenland Icecap. These speeds are about four times faster than any existing polar ground transportation, such as tractor-towed sleds or snow-cats.
- The vehicle traveled over snow drifts and sastrugi (ridges of hard snow) up to three feet in height with no difficulty while maintaining cruising speed.
- The vehicle demonstrated its ability to cross 5-foot-wide crevasses.
- Against a 15-knot wind, the vehicle climbed a 10-percent slope, three miles long at 25 miles per hour.

A highlight of the evaluation program was a 78-mile cross-country run over the snow-packed trail between Camp Tuto, about 14 miles east to Thule Air Force Base, and Camp Century, Greenland's city under the ice where the Army conducts much of its polar research.

The Carabao was transported by a tractor-towed sled train, called a swing, to a point 60 miles from Camp Tuto where the ACV was unloaded to make the remainder of the 138-mile trip to Camp Century under its own power.

CAMP CENTURY commanding officer Maj Billy H. Morris (right) welcomes Bell technical director Walter A. McMurry, who drove Carabao air cushion vehicle on historic 78-mile, cross-country run to Camp Century.

With a 2-man crew and full arctic survival equipment, the Carabao departed Mile 60 at 3:35 p.m. and arrived at Camp Century at 6:00 p.m., taking a total of 2 hours and 25 minutes for the 78-mile trip.

Meanwhile some of the swing's fast M-116 snow tractors left an hour ahead of the Carabao, at 2:30 p.m. and arrived at Camp Century at 2:00 a.m. the next day, or about eight hours after the Carabao.

"We encountered nearly all types of snow surface conditions — from very soft snow to sastrugi, snow drifts and deep ruts made by other vehicles—and surmounted them without difficulty," ACV operator Cliff Olivera said.

According to Walter A. McMurry, Bell's technical director for the Greenland mission, the cross-country run proved the ability of an air cushion vehicle to travel over the icecap trail at high operational speeds.

For the Greenland mission, the machine was modified for cold-weather operation with the addition of a heater for the cabin and installation of heating and de-icing equipment for the engines.

Prior to the Greenland tests, the ACV had demonstrated its ability to operate over deep and shallow waters, swampy areas, water hyacinth beds, reefs, ice-clogged waterways, rough land surfaces and areas of thick sugar cane.

Temperature extremes seem to have little effect on the Carabao's operations. It has operated in southern Florida at temperatures over 90° and in the Arctic at temperatures near 0°.

Named after the tough and versatile water buffalo of the Philippines, the Carabao has the load-carrying and mobility features of a small truck and a boat. It has a top speed of 60 m.p.h.

The vehicle utilizes a multi-cell concept to provide stability, and has three circular plenum cells, equally spaced around the center of the vehicle and fed by a single lift fan.

Power is supplied by two air-cooled aircraft engines. A 150-horsepower engine drives the 6-foot, variable-pitch propeller which provides the thrust and braking action. A 120-horsepower engine drives the fiberglass lift fan.

The Carabao is 18.7 feet long, 16 feet wide and has an overall height of 10 feet. The side extensions of the vehicle fold upward and reduce its width to 9.7 feet to enable it to be towed along narrow roads. Normal operating weight is 1½ tons. An additional 1,000 pounds can be carried with a reduction in performance.

Bell Aerosystems also designed and built the 22½-ton Hydroskimmer for the Navy. A research craft designed to explore military capability and pave the way for larger, ocean-going vessels of this type, the Hydroskimmer (designated SKMR-1 by the Navy) is in the midst of a research and development test program being conducted by Bell on Lake Erie.

CARABAO crosses simulated 4-foot-wide crevasse during recent tests.

U.S. Army Selectee for Japan Student Science Fair Chosen for Nationwide TV

A few drops of blood, a microscope, and a lot of hard work that won 18-year-old Nancy Lee Williamson a recent trip to Tokyo, Japan, have now earned her a featured guest spot to appear on nationwide television.

Nancy will appear on the Honeywell "Science All Stars" program on the ABC-TV network, Mar. 28 at 5 p.m. (EST), along with U.S. Ambassador to Japan Edwin O. Reischauer.

The program will show scenes of her 10-day visit as the U.S. Army representative to the Japan Student Science Fair, Nov. 2-8. Miss Williamson was one of six Army selectees among 13 students who shared first-place awards in the 15th (1964) National Science Fair-International (NSF-I) in Baltimore, Md.

Top honor recognition for the Japan trip was based on her exhibit of a project titled ""Immunological and Serological Studies of Plant Lectins as related to Blood Grouping."

Almost simultaneously, she was selected by "Science All Stars" to appear on the nationwide TV series that features a select group of young people who have demonstrated outstanding talent in science or engineering.

Members of the "Science All Stars" program staff accompanied her to Japan to record the event. Miss Williamson, now a freshman at Defiance (Ohio) College, proved such an apt performer that she is scheduled for two appearances on the Honeywell program. One will document her research in blood typing and the other her experiences in Japan.

Dubbed "Operation Cherry Blossom," the trip of Miss Williamson, Navy representative Robert Brock and Air Force representative Kevin J. Glading was cosponsored by the three services and Science Service, Inc., an American nonprofit organization that has administered the NSF-I for 15 years.

Nancy Lee Williamson

AMBASSADOR TO JAPAN Edwin O. Reischauer greets Army representative Nancy Lee Williamson during her visit to Japan Science Fair.

AN ENJOYABLE PART of Nancy's orientation on Japanese customs and family life was her experience as a guest in Masotoshi Saito's home.

The Japan Science Students Awards program was sponsored by the Yomiuri Shimbun, one of Japan's leading newspapers, which also sponsors participation of Japanese students each year in the NSF-I in the United States.

Mrs. Dorothy Schriver, assistant director of Science Service, and Maj John P. Weber, Office of the Chief of Information, Department of the Army, escorted the students on the trip to Japan.

Jack B. Fenn, Scientific and Technical Information Division, U.S. Army Research Office, Office of the Chief of Research and Development, and Dr. Winifred Osner, 5th Air Force, Tokyo, were project officers for on-site arrangements.

Highlights included visits with Japanese families and high school students, tours of Japanese villages, the Imperial Palace grounds and a major industrial camera plant. They attended the Kokusai Theater and visited Yomiuriland, termed the Disneyland of Japan.

Yomiuriland is surrounded by a large monorail system and contains gardens, an aquarium, an underwater theater, the world's largest artificial ski slopes and jump, skating rink and similar features.

Other guests who will appear on the series of programs scheduled between Jan. 10 through Apr. 14 include space scientist Dr. Wernher von Braun, nuclear physicist Dr. Edward Teller, and chief of U.S. Air Force Systems Command General Bernard A. Schriever.

In discussing the "Science All Stars" series, James H. Binger, president of Honeywell Inc., said, "The imagination and pure intellectual achievement of bright young American children seem almost limitless; still, there aren't enough of them. In the field of engineering alone, U.S. Department of Labor statistics indicate a shortage of 250,000 engineers by 1970.

"What we're trying to do is give honor and recognition to some of the truly outstanding young people in the United States. By doing so, we hope to stimulate and encourage thousands of others to seek careers in science or engineering—or at the very least to continue their education as far as their abilities will carry them."

Army Awards $98,517,345 for Iroquois Helicopters

The U.S. Army has awarded a $98,517,345 contract to Bell Helicopter Co. for 720 turbine-powered Iroquois helicopters. The order is for 149 UH-1Bs (9-passenger) and 571 UH-1Ds (14-passenger). The UH-1D last fall claimed 21 world records.

Recent Army contracts totaled $318 million. Western Electric Co. is receiving a $90,664,200 modification to an existing contract for research and development of the Nike-X missile system. Work will be done at various locations throughout the United States. Western Electric also received a $1,379,188 agreement for modification kits for the Hercules missile.

Olin Mathieson Chemical Corp. was awarded two contracts totaling $12,813,000 for 7.62 mm. cartridges.

AVCO Corp. received two contracts totaling $12,238,388, one for $9,631,143 for 155 mm. projectile components, and the other for $2,607,245 for operation, modification and maintenance of missile tracking and instrumentation radars and interfacing equipment.

Chamberlain Corp., Scranton, Pa., was granted two contracts totaling $11,749,946 for 155 mm. and 175 mm. projectile metal parts. Amron Corp., Waukesha, Wis., was issued a $9,849,500 agreement for components for the 155 mm. projectile.

Honeywell, Inc., Hopkins, Minn., received two contracts totaling $8,211,910 for 155 mm. shell components and for research and development of ammunition. Sylvania Electronics Systems, Sylvania Electric Products, Inc., Needham, Mass., was awarded an $8,000,000 second increment of a 2-year buy of classified electronic equipment.

General Motors Corp., Allison Division, was awarded a $6,154,170 contract for transmissions for 155 mm. howitzers, 8-inch howitzers and light armored recovery vehicles.

Day and Zimmerman, Inc., Philadelphia, Pa., received a $5,989,548 agreement for loading, assembling and packing of ammunition and miscellaneous components.

Bell Aero Systems Co., a division of Bell Aerospace Corp., was issued two contracts totaling $5,895,110 for fire control sighting equipment of helicopters and for fabrication and incorporation of improvements into Visual Airborne Target Locator Systems. Bulova Watch Co., Jackson Heights, N.Y., received $5,238,270 for the first increment of a 3-year buy of fuzes for various projectiles.

Firestone Tire and Rubber Co. was awarded a $4,202,064 contract for 173,424 track assembly replacement parts for combat vehicles. Ford Motor Co. will produce 1,043 stake and platform trucks and 230 tractor trucks under two contracts totaling $4,046,578.

International Harvester Co. was awarded two agreements totaling $3,257,495 for 266 trucks of various types and 420 school buses. Sperry Farragut Co., division of Sperry Rand Corp., received a $2,985,000 contract for fuzes.

TEMCO Electronics and Missile Co., division of Ling-Temco-Vought, was issued a $2,900,000 agreement for classified research and development. Mine Safety Appliance Co., Pittsburgh, Pa., will produce protective field masks with filter elements and repair parts for $2,694,369.

Philco Corp., Aeronutronics Division, was issued a $2,685,483 modification for a program study on the Pershing missile system. FMC Corp., New York, N.Y., received a $2,326,566 contract for production of items at the Newport (Ind.) Army Chemical Plant. Technical Operations, Inc., Burlington, Mass., will continue research and scientific studies under a $2,130,000 contract.

Johnson Furnace Co., Bellevue, Ohio, will produce 2,700 1½-ton cargo trailers for $2,064,000. Continental Aviation and Engineering Corp., Detroit, Mich., under a $2,017,137 agreement, will perform production engineering services for engines used in 2½- and 5-ton tactical trucks.

Stewart and Stevenson Services, Houston, Tex., received a $1,856,417 contract for generator sets for the Pershing Missile system. Esso Research and Engineering Co., Linden, N.J., will continue research and development on high performance propellants under a $1,559,100 agreement.

Chrysler Motor Corp. was awarded a $1,367,736 contract for 315 trucks of various types. Scovill Manufacturing Co., Waterbury, Conn., will produce metal parts for bombs for $1,338,621.

General Electric Co. was issued a $1,305,800 contract for armament subsystems for helicopters, repair parts and inspection equipment. Intercontinental Manufacturing Co., Inc., Garland, Tex., will produce first- and second-stage Pershing missile motor cases under a $1,302,134 agreement.

General Steel Tank Co., Inc., Reidsville, N.C., was awarded a $1,226,485 contract for portable fuel supply systems. Raytheon Co. received a $1,165,373 contract for FY 65 inspection, assembly and modification of Hawk items. Thiokol Chemical Corp. was awarded a $1,134,456 contract for signal pellets and rocket motors.

USofA Ignatius Succeeds Morris as ASD (I&L)

Under Secretary of the Army Paul R. Ignatius succeeded Thomas D. Morris December 23 as Assistant Secretary of the Army (Installations and Logistics).

Mr. Ignatius served as Assistant Secretary of the Army (Installations and Logistics) from May 2, 1961, until his appointment as Under Secretary Feb. 28, 1964. Mr. Morris resigned to return to private industry.

Before joining the Defense Department, Mr. Ignatius served as vice president and director of Harbridge House, Inc., a management and consulting firm founded by himself and two other members of the Harvard Business School Staff in 1950.

The firm's work dealt principally with military procurement and Defense contracting and aided research and consulting efforts in the Department of Defense, the Army, Navy and Air Force, the Defense Production Board of Canada and a large segment of defense industry.

In World War II, Mr. Ignatius served in the Navy with the rank of lieutenant aboard an aircraft carrier in the Pacific, and was also stationed in Washington, D.C.

Born in Los Angeles, Calif., in 1920, he is a graduate of the University of Southern California and the Harvard Graduate School of Business Administration. He was an instructor in business administration in the Harvard Business School from 1947-50 and is a member of Phi Beta Kappa.

Assistant SecDef (I&L)
Paul R. Ignatius

UH-1D Iroquois Establishes 11 World Record Claims

The U.S. Army's Bell UH-1D Iroquois established claims to 11 more helicopter world records for speed and altitude over a 28-day period ending December 14.

Making the flights from facilities of the Bell Helicopter Co. at Fort Worth, Tex., were seven pilots from the U.S. Army Aviation Test Activity (USAATA), Edwards Air Force Base, Calif., an element of the U.S. Army Test and Evaluation Command, and one from the U.S. Army Aviation Test Board, Fort Rucker, Ala.

Last fall, the UH-1D claimed 10 world records in speed, distance and time-to-climb categories, bringing the total to 21, more than any other helicopter in the world. One of the 11 records the Iroquois recently claimed was held by Russia.

Lt Col Richard J. Kennedy, CO of the USAATA, established claim to one of the records. The 11 flights, which must be recognized by the Federation Aeronautique Internationale of Paris to be certified for world aircraft records, are as follows:

3-KILOMETER (1.86 miles) SPEED—173.19 m.p.h. flown by Capt D. P. Wray. Class E-1,e. No previous record.

15/25 KILOMETER (9 to 15 miles) SPEED—171.65 m.p.h., flown by Capt D. P. Wray. Class E-1,d. No previous record.

15/25 KILOMETER (9 to 15 miles) SPEED—172.9 m.p.h., flown by Maj L. R. Dennis. Class E-1,e. No previous record.

100-KILOMETER (62.14 miles) SPEED—164.12 m.p.h., flown by Maj J. K. Foster. Class E-1,e. No previous record.

100-KILOMETER (62.14 miles) SPEED—168.98 m.p.h., flown by Maj J. K. Foster. Class E-1,d. Bettered record of 157.714 m.p.h. held by Russia.

500-KILOMETER (310.60 miles) SPEED—170.75 m.p.h., flown by Capt R. A. Chubboy. Class E-1,e. No previous record.

500-KILOMETER (310.69 miles) SPEED—176.8 m.p.h., flown by Maj B. L. Odneal. Class E-1,d. Bettered record of 148.449 m.p.h. held by Bell UH-1.

1,000-KILOMETER (62.37 miles) SPEED—164.07 m.p.h., flown by Maj E. F. Sampson. Class E-1,e. No previous record.

3-KILOMETER (1.86 miles) SPEED—180.14 m.p.h., flown by Capt J. F. Comer. Class E-1,d. Bettered record of 158.037 m.p.h. held by Bell UH-1.

ALTITUDE WITHOUT PAYLOAD —25,418 ft., flown by Lt Col R. J. Kennedy. Class E-1,e. No previous record.

ALTITUDE WITHOUT PAYLOAD —35,150 ft. flown by Maj E. F. Sampson. Class E-1,d. Bettered record of 32,840 ft. set by Kaman H-43B.

The class designations refer to weight of the aircraft. Class E-1,d applies to helicopters 3,858 to 6,614 pounds. Class E-1,e applies to helicopters 6,614 to 9,921 pounds.

Although all of the 11 records were claimed for Model UH-1D, weight adjustments were made in the helicopter to qualify it for the various record contests.

The latest flights give the U.S. claims on 35 of the recognized 61 world helicopter records. Nearest rival to the U.S. is Russia with 17.

The UH-1D, with a 15-place capacity, is the latest in the Army's Iroquois series. The record-claiming UH-1D was powered by a Lycoming YT53L13 engine of 1,400 shaft horsepower (flat rated to 1,100 horsepower).

On nine of the recent flights the UH-1D was equipped with Bell's new Model 540 "door-hinge" rotor, which will be standard on all production Army UH-1B's and the Marine Corps' UH-1E beginning in June 1965.

The rotor is a new concept featuring simplicity of design, lower aerodynamic drag, improved performance and maneuverability and greatly reduced vibration. The new system's rotor blade has a 44-foot diameter and a 27-inch chord or width.

Coordinating the flights were R. S. Stansbury, Bell engineer, and Maj B. L. Odneal, chief, VTOL Division, and service test pilot of the USAATA. Flights were observed by officials of the National Aeronautic Association, U.S. representative group of the Federation Aeronautique Internationale.

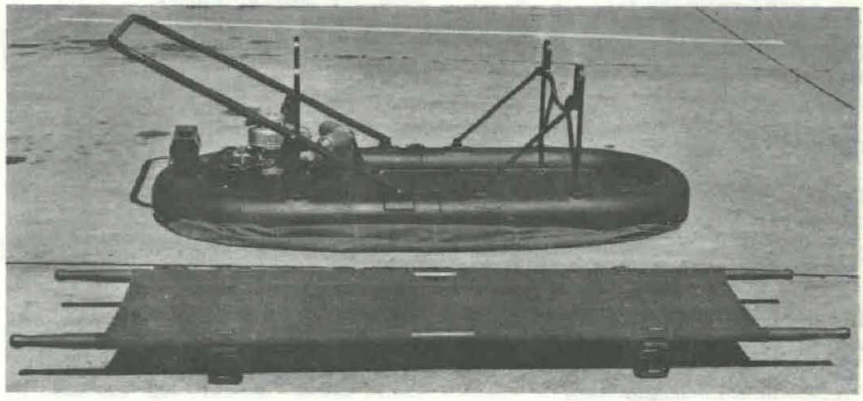
Col Clark Assumes Command Of Kwajalein Site in Pacific

Col Melvin D. Clark, formerly head of the U.S. Army Field Office, Eastern Test Range, became in mid-January the new commanding officer of Kwajalein Test Site in the Pacific.

He succeeded Col Glenn Crane, who returned to the U.S. Army Missile Command, Redstone Arsenal, Ala. Col Curtis Ferrell, a division head at the Missile Command, assumed Col Clark's duties at the Eastern Test Range.

The Kwajalein Test Site is operated by the Nike X Project Office at Redstone Arsenal. Located some 2,000 miles southwest of Hawaii, Kwajalein is near the terminal point for long-range missiles fired down the Pacific Missile Range, the Western counterpart of the Eastern Test Range.

Col Clark is a veteran of 24 years of Army service and holds a master's degree in physics from the University of Rochester. He is a graduate of Coe College, the Air War College, and the Armed Forces Staff College.



AN INITIAL PATENT AWARD for design of Ground Effects litter, developed and constructed at the U.S. Army Transportation Research Command (TRECOM), was awarded recently to Alexander Burns, a mechanical engineer at the Command. Powered by a 3-h.p., 2-cycle lawnmower-type engine that turns a high-volume air supply propeller, the machine can carry 200 pounds over obstacles up to 6 inches in height. The inflatable skirt is perforated to allow the air to escape and build up an air cushion under the litter. While it is possible to adapt it to handling material such as ammunition, etc., the machine was developed primarily as a battlefield litter. Evaluation of the concept will be made for The Surgeon General's Office, Department of the Army.

Zero Defects Program Aims for Army-wide Status in FY '65

Zero Defects—the Defense Department's program to raise quality standards throughout the defense industry—has advanced notably since its conception in 1962 to a series of important implementing actions scheduled for 1965.

Over 300 major industrial firms have initiated or plan to initiate Zero Defects methods. Before the end of the current fiscal year, the Zero Defects Program is expected to achieve command-wide status in the U.S. Army Materiel Command (AMC) and be in various stages of implementation throughout the Department of Defense.

Managing the AMC Zero Defects Program is the Command Director of Quality Assurance, Maj Gen John M. Cone. His office is also preparing a Zero Defects handbook for the Department of Defense and must have a preliminary draft ready by Mar. 31.

The concept of Zero Defects takes exception to the idea that it is only human to err. It challenges the initiative of individuals to shoot for perfection and, most important, to "do the job right the first time."

Since the Zero Defects concept seeks to prevent costly mistakes, malfunctions and rework, it surpasses the Department of Defense Cost Reduction Program in scope of philosophy. The concept harks back to old world craftsmanship and stimulating American pride in workmanship.

Zero Defects began with the Martin Orlando Division of Martin Marietta Corp., early in 1962, in connection with a delivery of Pershing Missile sets for the U.S. Army Missile Command. Martin had agreed to deliver the Pershings ahead of schedule and in perfect working order. In order to meet the obligation, a radical new concept was necessary to do the job right the first time. Martin management came up with the concept of Zero Defects.

Impressed with the new idea, the U.S. Army Missile Command took up ZD and passed it on to the Departmen of the Army.

The Missile Command encouraged selected missile contractors to adopt the program and presented the concept to other U.S. Army Materiel Command activities. Meanwhile, other industrial firms voluntarily established Zero Defects Programs based on the success at Martin Orlando. ZD increased their competitive position by lowering costs and improving quality.

Early in 1964 Thomas D. Morris, then Assistant Secretary of Defense (Installations and Logistics), personally expressed interest in Zero Defects activities and directed his staff to look into the possibility of Defense-wide application.

FRANKFORD ARSENAL CO, Col George H. Pierre poses with Deputy Assistant Secretary of Defense George E. Fouch (center) and Mr. Thomas Lee, President, Northeast Chamber of Commerce, during kick-off of Arsenal's Z D Program.

As a result, Mr. Morris asked the Department of the Army to prepare a DoD program and the Materiel Command Quality Assurance Director was assigned the task.

A brochure was prepared for the Office of the Secretary of Defense on Zero Defects. When the Defense program was launched, it aimed at encouraging Defense contractors voluntarily to adopt Zero Defects programs.

The Materiel Command then requested the Missile Command to help AMC activities establish voluntary in-house Zero Defects programs.

On June 23, 1964, a seminar for the missile industry, sponsored by the AMC and the Missile Command, was held for industry and Government representatives at Redstone Arsenal, Ala. A second AMC seminar followed for the automotive industry at the Detroit Procurement District at Detroit, Mich. About 800 representatives from industry and Government attended the two seminars.

The enthusiastic response to the first two seminars prompted the Office of the Secretary of Defense to sponsor two additional seminars, Nov. 17 at Bethesda, Md., and Dec. 8 at San Diego, Calif. Senior representatives of about 1,300 Defense contractors attended.

General Frank S. Besson, Jr., U.S. Army Materiel Command CG, made the keynote address at the Bethesda seminar. "Zero Defects," he explained, "is a program of inspired motivation aimed toward making members of the military and the industrial complex more quality conscious—dedicated to the goal of preventing defects as opposed to costly detection and rework. . . .

"Zero Defects is not something for only industry to be concerned with; it is a program which lends itself to extensive in-house application."

General Besson recalled the words of Secretary of Defense Robert S. McNamara, "Let's do this job together. Let's set our sights on the goal of each one of us doing our job, each job, right the first time'."

The present AMC guides for ZD program initiation emphasize that such a program should not be stereotyped, or dogmatic, but should be tailored to each arsenal or activity so workers feel they are important as individuals to management.

Other Department of Defense and Army speakers at the Bethesda seminar included: George E. Fouch, Deputy Assistant Secretary of Defense (Equipment Maintenance and Readiness); Lt Gen R. D. Meyer, USA, Director for Logistics, Joint Staff, Joint Chiefs of Staff; Vice Adm J. M. Lyle, Director, Defense Supply Agency; and Kenneth E. Joy, chief, Quality and Reliability Management Office, U.S. Army Missile Command, and director of the DoD Zero Defects Seminar held at the Missile Command last summer.

Mr. Fouch also spoke at the Detroit seminar, along with Brig Gen John A. Goshorn, Director of Procurement, Office of the Assistant Secretary of the Army (Installations and Logistics), and representatives of Detroit industry.

Implementation of Zero Defects programs within the Army Materiel Command is proceeding at a rapid rate. All Army procurement districts have initiated in-house programs, with Boston and Detroit the most advanced.

The first Zero Defects program at a U.S. Army Supply and Maintenance Command depot was launched at Anniston Army Depot, Anniston, Ala., Dec. 7, 1964. Keynote speaker for the occasion was Brig Gen Durward E. Breakfield, Director of Maintenance, U.S. Army Supply and Maintenance Command.

The second Supply and Maintenance Command program was held

Jan. 27, 1965, at Tobyhanna (Pa.) Army Depot. Special guest participant was Lt Gen Jean E. Engler, commanding general, U.S. Army Supply and Maintenance Command. A third Army depot at Toelle, Utah, is developing a program expected to begin early this spring. All 26 Army depots are expected to have Zero Defects programs operating by the end of the current fiscal year.

The U.S. Army Missile Command has served as the focal point for Zero Defects activities and it conducted the first workshop sponsored by a military department at Redstone Arsenal, Aug. 8. A series of eight Zero Defects workshops sponsored by the Army Materiel Command and administered by the Missile Command began at Orlando, Fla., Jan. 28-29, 1965.

A total of 320 administrators from industrial firms with Army contracts and Government facilities will be instructed on how to establish and maintain Zero Defects programs.

Workshops will be held at Orlando, Feb. 11-12 and 25-26, Mar. 4-5 and 18-19, Apr. 1-2 and 15-16, and May 6-7. Classes are limited to 40 participants.

In support of the DoD and AMC Zero Defects efforts, the Missile Command has provided national media as follows:

- Three Zero Defects films for industry and Government units on a loan basis.
- 5,000 copies of a DoD Zero Defects pamphlet, which explains the basic concept and management techniques of a ZD Program.
- 3,000 Zero Defects information kits for hand-out at seminars and by direct mail to interested companies. (Kits are designed to motivate and provide managerial details on program operation techniques.)
- 5,000 Zero Defects pins for Government and contractor personnel.
- Art design of AMC Zero Defects posters.

The Army Missile Command in-house program is scheduled to begin this spring. It will be installation-wide, involving 17,000 Command military and civilian employes.

Maj Gen F. W. Moorman, Commanding General, U.S. Army Electronics Command, emphasized the importance of a ZD program by putting his deputy, Brig Gen Wesley C. Franklin, in charge of acivities to the specific needs of the E-Command.

Several planning sessions were held in January and the program will get under way in the near future. Members of the planning group under General Franklin represent the Directorates of Procurement and Production, Materiel Readiness, Electronics Laboratories, Personnel and Training, and the Offices of Information, Quality Management, Management Science, Data System and the Electronic Support Command.

The U.S. Army Test and Evaluation Command (USATECOM) also is developing a program, although it has no materiel development responsibility and requires a different approach to Zero Defects. The approach will be to encourage personnel to effect substantial improvement in test planning, test reporting and laboratory and field operations.

Brig Gen Roland B. Anderson, CG of the U.S. Army Weapons Command, has directed subordinate installations to develop and implement a Zero Defects techniques. Coordinators and planning committees have been appointed at each WECOM installation. Programs for implementation utilizing media suggested by various Army Materiel Command seminars and workshops have been developed.

About 40,000 people will be involved at the U.S. Army Munitions Command, in keeping with the theme for 1965 of "Quality Counts," in a Command-wide effort endorsed by Maj Gen Floyd A. Hansen, CG.

Extensive programs started Dec. 4 at Frankford Arsenal, Philadelphia, Pa., and Dec. 11 at Picatinny Arsenal, Dover, N.J.

Widespread interest in Zero Defects is reflected in the inquiries received by General Cone from the U.S. Navy, U.S. Air Force, the Defense Supply Agency, the U.S. Army Corps of Engineers, the U.S. Army Deputy Chief of Staff for Logistics and even industrial concerns as far away as Europe and Japan.

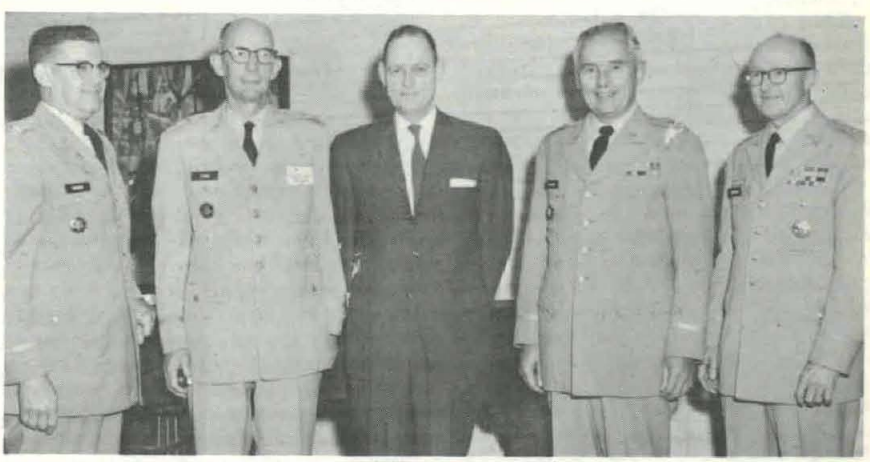
Future plans include further establishment of a formal Army program, publication of an instruction manual, orientation for personnel at AMC Headquarters, and completion of a ZD manual for the Office of the Secretary of Defense. Preparation of an information kit for the Assistant Secretary of the Army (Installations and Logistics) to be furnished to other Army activities for their information, is projected.

AMC also plans to put into operation at the Army Missile Command, Redstone Arsenal, Ala., a Zero Defects Information Center. This will be a clearinghouse for ZD information, education, promotion, the evolution of new techniques and publication of a ZD bulletin.

AMC promoters emphasize that success of the program depends upon voluntary compliance through stimulated enthusiasm. Momentum is picking up throughout the Army and the Department of Defense as individual activities evolve their techniques.

Employees often sign pledge cards and receive pins or other token awards for sustained performance of non-defective work. ZD planners emphasize that a permanent, continuous program is necessary so that workers will not accept Zero Defects as a passing fad.

Kenneth E. Joy, of the Missile Command, stated at the Bethesda seminar that although Zero Defects appears to be radical and new, it is "as old as civilization itself." Based on craftsmanship and individual determination to turn out the best possible product, he termed it "an affirmation of the dignity of man."



DETROIT PROCUREMENT DISTRICT CO, Col Warren E. Besse (left) is shown with (l. to r.) Director of Quality Assurance, U.S. Army Materiel Command, Maj Gen John M. Cone; former Assistant SecDef (I&L) Thomas D. Morris; Director of the Procurement Office, ASA (I&L) Brig Gen John A. Goshorn; and Army Mobility Equipment Center CG, Brig Gen T. B. Simpson.

E-Command Spots Elusive Electronic Circuit Fault

Like the legend of the battle that was lost "for want of a nail," almost indetectable faults can cause failure of vital electronic circuits in missiles, satellites and other military communications and surveillance equipment.

One such cause has been traced to its source by a team of scientific sleuths in the U.S. Army Electronics Command at Fort Monmouth, N.J. They discovered that certain types of transistors can be temporarily disabled by tiny balls of solder that form when the transistor is subjected to an abnormal transient surge of power.

Solder balls can break loose under vibration or other mechanical movement and touch critical areas of the transistor, causing a brief short circuit—sometimes lasting only thousandths of a second—thereby inducing circuit failure.

Not infrequently, guilty transistors may test out perfectly after such a failure, because the ball has moved out of its temporary shorting position.

Though the solder ball problem has been known for several years, and has been a source of great concern to electronic engineers, it usually was blamed on inadequate manufacturing control and inspection.

The team of engineers in the Electronics Components Department of the U.S. Army Electronics Laboratories, a major directorate of the Electronics Command, in addition to clearing the manufacturing process of culpability, pinpointed the real villain —tin—one of the principal solder ingredients.

The team, composed of Edward B. Hakim, Luke K. McSherry and Bernard Reich, painstakingly explored every possible cause of the strange solder ball phenomenon, enlisting the aid of microscopes and high-speed motion pictures for dynamic analysis.

Then they applied electrical power in various manners to high-power silicon alloy-diffused transistors and to high-reliability medium-power silicon alloy transistors (common types, widely used in military designs), always in a way that would produce surges of high peak power.

They discovered that current or voltage modes of stress could cause constriction in current paths that resulted in localized hot spots reaching temperatures as high as 1300° F. Under such conditions, solder balls invariably formed in those transistors that used tin solder as the basic material, and usually started in the emitter area of the transistor.

To confirm the fact that the spontaneous solder ball formation was due to heat, the engineers devised a simple test that applied exterior heat to good transistors. Solder balls also appeared.

It was noted that the balls that were formed remained attached to the transistors, which continued to operate, but that severe mechanical jolts could loosen them, and the balls could then locate themselves on the emitter-base area junction. Since they could move about, they could cause intermittent emitter-base short circuits.

It was determined that there was a third possible source of the heat that might cause formation of solder balls. The first two, application of high transient currents and external heat, were found in laboratory tests. The third possibility was during life testing, or "burning in," performed by the manufacturer at his plant.

In this last the maker could test the transistor and inadvertently form the solder balls which would not be seen in inspection because the transistor was already sealed in its protecting cover. Then in shipment the balls could break away and cause a short when put in operation.

Summarizing their results, the experimenters found:

- Balls can form when local temperatures in excess of 416° F. exist.
- These temperatures are reached either by electrically (surge) induced hot spots or external heating.
- The ball is 99 percent tin, the main ingredient of the emitter and base regions.

SCIENTIFIC TEAM views damaged transistor held above high-speed camera used in deductive work that resulted in discovery of solder trouble, which has been the cause of failures of power transistors used in vital electronic circuits. L. to R. are Edward B. Hakim, Luke K. McSherry, and Bernard Reich from the Electronic Components Department of the U.S. Army Electronic Laboratories.

- Electrical performance of the transistors frequently is not initially affected by formation of the balls.
- The balls remain physically attached to the device at the point of formation until mechanically jolted loose.

The obvious conclusion of the experiments calls for the substitution of other basic contacting materials than tin . . . for example, lead, aluminum, or various alloys that have higher melting temperatures than tin.

New Redstone Division Speeds Up Materiel Delivery

When an Army missile system anywhere in the world goes out of action because of parts failure, a new organization established at the Army Missile Command at Redstone (Ala.) Arsenal can locate the required part and issue a shipping order within an hour or less—day or night.

Known simply as the Stock Control Division of the Directorate of Supply and Maintenance, the organization maintains a master register of every missile part in every depot warehouse in the United States.

The speedy service capability is designed to support urgent, high-priority user requirements. The new Division will have personnel on duty 24 hours a day, 7 days a week.

The Stock Control Division emerged as an operating entity as a result of implementation of the TASAMS (The Army Supply and Maintenance System) concept which centralizes all military property accountability and certain related supply and financial functions. These functions were formerly performed by U.S. Army Depots.

The Stock Control Division was activated Oct, 1, 1964, with Howard G. Odell of Decatur, Ala., assigned as acting chief. The TASAMS concept was fully implemented Feb. 1.

The Division will hold accountability for major items and supporting parts of missile materiel valued at approximately three-quarters of a billion dollars formerly accounted for by six U.S. Army Depots.

CRREL Adds 'Backyard' Facilities for Arctic Research

"Backyard" research facilities have been added to U.S. Army Cold Regions Research and Engineering Laboratory (USA CRREL) capabilities for studies of snow, ice and frozen ground at Hanover, N.H.

In the rear of the 72,000-square foot Laboratory, a 206-foot hole, 36 inches in diameter, has been sunk and cased in steel and cement.

The hole has been filled with water and frozen solid by means of the refrigeration system used to keep the Laboratory's 24 cold rooms at desired temperatures (down to —50° F.) for a wide range of in-house analyses and testing.

The solid shaft of ice will permit laboratory-based developmental tests in USA CRREL's deep ice-core drilling program which is primarily conducted in Greenland and Antarctic.

A tower is being erected over the ice well to accommodate the USA CRREL-developed thermal drill. This unique device melts through deep ice, yet retains in a 10-foot chamber a sizeable core in the essentially undisturbed state in which the ice has lain for centuries.

Tests also are planned for an electro-mechanical drill, a recent development which is designed to permit the thermal drill to pierce rock formation in deep snow and ice.

Under development also in the rear of the Laboratory is a "permafrost patch," a plot of ground some 20 feet in diameter, which will be frozen artifically to a depth of 50 feet. Here, pile-driving tests and other experiments in cold regions construction materials are being made possible as economical, supplementary operations —similar to full-scale operations the Laboratory conducts in the frozen ground of arctic and subarctic areas.

Another of the "backyard" facilities at USA CRREL is an 88-foot mobile extension tower, used in the terrain analysis tests. Equipped with a closed circuit TV system, it is utilized for research in snow, ice, and frozen ground, and for assembly and trial of apparatus and techniques before their use in aerial sensing tasks in remote arctic and polar locations.

CRDL Exhibit Achieves New Recognition

An exhibit prepared by the Directorate of Medical Research, U.S. Army Chemical R&D Laboratories, Edgewood (Md.) Arsenal—judged among the top 10 of 150 displayed at the recent American Medical Association clinical meeting at Miami Beach, Fla. —will be featured in the *Journal of the American Medical Association.*

In addition to appealing for attention of readers in a forthcoming edition of the AMA Journal, the exhibit has won an invitation for display at the AMA's annual meeting in New York City, June 20-24.

The exhibit deals with anticholinesterase material, which has serious effects on the central nervous system and is present in certain commercial pesticides and military chemicals.

In recent years anticholinesterase poisoning from pesticides has been an increasing problem in agricultural areas. Reports indicate at least 150 deaths annually in the United States result from accidental exposure to this type of insecticide poisoning, caused mostly by mishandling.

In addition to ingestion, anticholinesterase materials may enter the body through the eyes, the respiratory tract, or absorption through the skin. The symptoms of exposure vary with the manner in which the poison enters the body, thus making cases of the poisoning more difficult to diagnose. Booklets describing the poison, its effects, and guidlines for diagnosing and treating it were also made available to doctors viewing the exhibit at Miami.

Development of means of diagnosing and treating anticholinesterase poisoning is only one of the many ways in which research conducted at the Army Chemical R&D Laboratories has, in the past few years, resulted in contributions for the betterment of mankind.

The exhibit was prepared under the direction of Dr. Van M. Sim, deputy director of Medical Research at the Laboratories.

Lt Col Darling Takes Over As WRAIR Exec. Officer

Lt Col James O. Darling, formerly executive officer of the U.S. Army Medical Research Team in Viet Nam, is the new executive officer at Walter Reed Army Institute of Research, Washington, D.C.

Since entering military service in 1941, his previous assignments have included: CO, Separate Medical Battalion, Fort Benning, Ga.; 80th Medical Group and Medical Section, Headquarters, Eighth U.S. Army, Korea; chief, Plans and Operations Division, Medical Section, Headquarters, U.S. Army-Europe; chief of the Plans Branch, Brooke Army Medical Center; instructor and department head, Medical Field Service School, Fort Sam Houston, Tex.; and personnel commander, Valley Forge Army Hospital, Valley Forge, Pa.

Col Darling received his B.S. degree in chemistry at John Carroll University, Cleveland, Ohio, and a master's degree in education from the Incarnate Word College, San Antonio, Tex. He is a graduate of the Command and General Staff College.

ERDL Warfare Vision Lab Opens

Limited operations began this month at the new $1.75 million Warfare Vision Laboratory of the U.S. Army Engineer Research and Development Laboratories, Fort Belvoir, Va. Installation of furniture and equipment was being done by Installab, Inc., under a $316,215 contract. The facility is to become fully operational in June.

AMONG TOP 10 EXHIBITS at a recent American Medical Association meeting, the above exhibit dealing with anticholinesterase poisoning will be featured in a forthcoming *Journal of the American Medical Association.*

Col Angel Becomes USAEPG Chief of Staff

Col Nicholas C. Angel became chief of staff at the U.S. Army Electronic Proving Ground (USAEPG), Fort Huachuca, Ariz., and deputy post commander when Col John R. Magnusson retired Dec. 31.

Col Clarence A. Mette, Jr., took over as assistant chief of staff for Plans and Operations, succeeding Col Bob H. Glover, who was named director of the newly organized Test Directorate at USAEPG.

COL ANGEL until recently was chief of the Test Operations at USAEPG for nine months. Before his assignment to Fort Huachuca, he was assistant director for National Military Command Systems Test, Evaluation and Doctrine, Defense Communications Agency, Arlington, Va.

He was commissioned a second lieutenant in the Corps of Engineers in 1936 and, prior to World War II, served in various Civilian Conservation Corps and Corps of Engineers assignments until his wartime service in the European Theater. He was awarded the Bronze Star medal for meritorious service.

In 1946 he attended the Command and General Staff College, Fort Leavenworth, Kans., followed by service as Antilles signal officer at San Juan, P.R. From 1952-55 Col Angel was professor of military science at the Tennessee Polytechnic Institute.

He then served with the Joint Chiefs of Staff in Washington and attended the NATO Defense College in Paris. In 1960, after a period as chief of the Telecommunications Branch at Supreme Headquarters Allied Powers Europe, he was appointed chief of the Materiel Management Branch in the Office of the Chief Signal Officer, Washington, D.C.

COL METTE is a 1937 graduate of the University of California at Los Angeles. During World War II, he commanded the 1st Battalion, 417th Infantry Regiment, 76th Division, in the European Theater.

Following a tour in the Philippines, he attended the Command and General Staff College at Fort Leavenworth, Kans. In 1953, after three years with the AAF Board Three (Infantry Board), Fort Benning, Ga., as rocket and recoilless department chief, he attended the Naval War College, Newport, R.I.

After two years' duty with the Military Assistance Advisory Group in Turkey, he served as the commander of 8th Infantry, Fort Lewis, Wash. From there he attended the Army War College and went on to become a member of the staff and faculty of the Naval War College.

Col Nicholas C. Angel

In 1961 Col Mette was assigned as chief, Plans Division, Eighth U.S. Army in Korea, later serving as commanding officer, Pusan Area Command. From 1962 until his present assignment, he served with the Combat Developments Command, Fort Belvoir, Va.

His decorations include the Silver Star, Bronze Star with Oak Leaf Cluster, Army Commendation Medal and Combat Infantryman's Badge.

Whitley Assigned Deputy Project Manager for TOW

Robert Whitley has been named deputy project manager of the Army's TOW weapon system, the ninth project-managed missile system recently placed under U.S. Army Missile Command control.

Whitley joins project manager Lt Col Ballard B. Small in directing management of the TOW (Tube-launched, Optically-tracked, Wire-guided) missile system.

Formerly chief of the U.S. Army Missile Command Development Division's TOW Branch in the Directorate of Research and Development, Whitley was assigned to Redstone (Ala.) Arsenal in 1951 and has been connected with the TOW program from early development.

Prior to assignment to the TOW Branch, he served with the National Advisory Committee for Aeronautics (now NASA) as a research engineer at Langley Field, Va. He is a graduate of Auburn University with a B.S. degree in aeronautical engineering and served for 15 months with the Army Air Corps in World War II.

The optically tracked TOW is the first U.S.-developed missile automatically guided in flight by commands transmitted by means of a wire link between the gunner and the missile.

The gunner aims a telescopic sight at a target, then launches the missile which follows his line of sight. For moving targets, the gunner tracks the target with his sight, thus generating signals that correct the missile.

To give it greater mobility, TOW is being developed for possible use on a variety of ground vehicles as well as on helicopters, and can be carried by its crew.

Robert Whitley

Oral Regions Pathology Course Scheduled at WRAIR, Mar. 1-5

The Armed Forces Institute of Pathology will host the 12th annual postgraduate course in "Pathology of the Oral Regions," at the Institute in Washington, D.C., Mar. 1-5.

Directed by Capt Henry H. Scofield, DC, USN, chief of the Institute's Dental and Oral Pathology Division, the course will be designed to provide dentists and physicians current information regarding the various aspects of oral disease.

Presented by specialists in oral and general pathology, oral surgery, periodontics and dental and cancer research, the course will feature discussions on developmental disturbances of the head, neck and oral region, inflammatory diseases of the oral mucosa and jaws, the oral manifestations of certain systemic diseases and neoplasms of the oral cavity, jaws and salivary glands.

The course will be supplemented by illustrations of the clinical roentgenographic and microscopic characteristics of those factors. Lectures will be correlated with case presentations and microscopic seminars.

Further information regarding the course may be obtained by writing: The Director, Armed Forces Institute of Pathology, Washington, D.C. 20305.

CSC Schedules Courses for Management Personnel

The Office of Career Development, U.S. Civil Service Commission, has announced a full schedule of seminars and short courses of interest to Army research and development management personnel.

An Institute for Executives in Scientific Programs, scheduled Mar. 1-5, is designed to give scientists in executive and laboratory positions an opportunity to explore important concepts and current critical issues relating to the organization and administration of scientific and related activities of the Federal Government.

Participation will be limited to scientists and engineers and scientific administrators at the GS-15-18 level and military officers of colonel to general. Speakers will be drawn from among leading authorities in universities and industry and Federal administrators.

A seminar in Manpower Utilization will be held Mar. 3-5. Personnel officers, budget officers and administrators with responsibility for manpower management in grades GS-13 and above (or equivalent) are eligible to attend. Concepts to be discussed are: determining manpower requirements; improvement of work design; staffing to accomplish organization missions; motivation and performance; assessment of organizational achievement.

Automatic Data Processing (ADP) for Management Interns will be offered Mar. 8-12, emphasizing management implication of the computer for employees preparing for managerial positions.

Employee Motivation, a Seminar for Personnel Officers is offered Mar. 11-12, to supervisors and managers GS-12-15. The intent is to examine some of the basic factors of human behavior for the purpose of evaluating supervisory practices in the light of fundamental employee needs and aspirations.

An ADP Systems Analysis Seminar will be held Mar. 17 to May 5, one day a week. The objective is to acquaint Federal employees, GS-9 and above, anticipating involvement in ADP systems development, with the concepts and techniques which are most useful to the successful employment of automatic data processing.

A Seminar in Organizational Theory for Personnel Officers is scheduled Apr. 8-9 for supervisors and managers in grades GS-12 through 15. Nomination deadline is Mar. 19. The course is designed to explore traditional and current organizational theories in the light of recent behavioral studies concerning employee needs and motivations.

Other Management Science Programs scheduled from March through June (nomination deadline in parentheses) are as follows:

Executive Seminar in the Behavioral Sciences, Mar. 24-26 (3/1); Senior Seminar in the Management Sciences, Apr. 5-9 (3/12); Advanced Seminar in ADP and Financial Management, Apr. 26-29 (4/2); Field Work Program in Systems Analysis (meets once a week), May 12-June 30 (4/16); Executive Seminar in Management Information Systems, May 13-14 (4/19); ADP Orientation, May 17-21 (4/30); Scientific and Technical Applications of ADP: A Survey, June 7-11 (5/14).

Further information on the various programs may be obtained from agency training directors or the Office of Career Development, U.S. Civil Service Commission, Washington, D.C. 20415.

Nation's Capital Rates First In Scientific Personnel Ratio

Among comparable areas in the United States, the Nation's capital city now ranks first in scientific personnel per 1,000 population and is recognized as a scientific-technological center of international importance.

Statistics announced by Hugh P. Donaghue, chairman of the Science Bureau of the Washington Board of Trade and president of Datatrol, Inc., reflect Washington, D.C.'s, rapid growth in recent years as a scientific center.

According to the findings of the study, the metropolitan area of Washington currently encompasses 369 scientific-technological organizations. They employ more than 85,000 persons, of whom over 25,000 are scientists and engineers.

The growth of scientific activity in the Washington area is indicated by 337 private organizations now in existence, as compared to 144 in 1961, 70 in 1955, 43 in 1950 and 16 in 1940.

War Games Council Accents Logistics at 4th Symposium

The East Coast War Games Council will center attention on logistic gaming at its fourth symposium, Mar. 25-26, in facilities of the Research Analysis Corporation (RAC), McLean, Va.

Attendance will be by invitation. Martin W. Brossman of RAC may be contacted regarding invitations and applications to present technical papers.

Kenneth W. Fisher, a member of the Council's steering committee and chief of the Control Section, War Games Branch, at the Army Ballistic Research Laboratories, said papers dealing with achievements in war gaming are desired, particularly those bearing on logistics. Presentations will be limited to 15 minutes, plus 15 minutes for discussion.

The East Coast War Games Council is an informal organization of individuals actively interested in war gaming. Its steering committee consists of representatives of the U.S. Army Ballistic Research Laboratories, Aberdeen Proving Ground, Md., the Martin Marietta Corp., Operations Research, Inc., Technical Operations, Inc., and the Research Analysis Corp.

India to Use Textbook Coauthored by Army Scientist

Five thousand copies of the new 1965 edition of a pharmacology textbook coauthored by a distinguished U.S. Army Research Office (USARO) scientist have been purchased for use in medical schools in India.

Authors of the text, *The Pharmacologic Principles of Medical Practice*, are Dr. C. Jelleff Carr, chief, Scientific Analysis Branch, Life Sciences Division, USARO, and Dr. John C. Krantz, Jr., professor of pharmacology, School of Medicine, University of Maryland.

Dr. Carr is a former professor of pharmacology at Maryland. Dr. Krantz also is a member of the General Committee of Revision of the *United States Pharmacopeia*.

The latest edition, the sixth, is a 994-page volume published this month. The first edition appeared in 1949, and has been widely used in U.S., Canadian and British schools of medicine, pharmacy, veterinary medicine, dentistry and nursing. Foreign language editions appeared in Spanish in 1956 and Portuguese in 1959. Publisher of the work is the Williams and Wilkins Co.

A number of specialists in various areas served as consultants in the preparation of the text material. One was Lt Col Warren C. Morse, of the U.S. Army Medical Research and Nutrition Laboratory, Denver, Colo., in the field of tuberculosis chemotherapy.

Army Suggestion Program Saves $5 Million in Three Months

Sharp-eyed U.S. Army civilian and military personnel saved the Government nearly $5 million during the first quarter of Fiscal Year 1965 through the Army Suggestion Program.

The savings resulted from adoption by the Army of more than 5,000 of the roughly 20,000 suggestions submitted during the quarter. In FY 1964, savings of $19,150,310 were realized by adoption of about 25,000 suggestions.

During the first quarter of FY 65, civilian employees submitted 14,788 suggestions to improve efficiency or reduce costs; 4,181 of these were adopted. Benefits realized totaled over $3.5 million. During the same period, military personnel made 3,028 suggestions, of which 569 were adopted, saving $1,126,814.

Foreign nationals employed by the Army also contributed ideas which saved the U.S. Government money. Of their 2,017 suggestions, 519 were adopted to cut costs by $150,501.

To emphasize the program and encourage maximum benefits from the Army Suggestion Plan, the Army has undertaken a special suggestion campaign ending June 30 under the theme, "A Better Product and Service at Reduced Cost."

During FY 64, the highest Suggestion Award in the entire Federal Government, $2,160, went to Army employee Jules G. Capone, Ammunition Inspection Engineering Branch, Quality Assurance Division, Picatinny Arsenal, Dover, N.J.

The Secretary of the Army commended Mr. Capone for his suggestion, which saved the Army $330,042.79 in first-year tangible dollar benefits. He proposed that the T336-E10 fuze heads be dusted internally with a dry graphite or moly powder prior to storage or assembly in the completed round, and that the graphite or moly powder be applied through the brushing slots in the base plate with a hand syringe or low-pressure air.

The effectiveness of 60 mm. and 81 mm. high explosive mortar shells used for training with live ammunition is increased by this process.

Other top Army Suggestion awards in order of dollars saved during FY 64 were as follows:

- Francis A. Zello, The Adjutant General's Office, Washington, D.C., received $1,425, for suggesting improved procedures and economy in mail transmission which resulted in savings of $372,036 during the first four months of adoption.

- Merl Meek, radar equipment installer and repairer lead foreman, and Richard Kettering, radar equipment installer and repairer, Pueblo Army Depot, Pueblo, Colo., $1,436, suggestion for systematic methods and procedures for major reconditioning of XM2 self-aligning static tubes for the Nike Hercules system, resulting in average 1-year savings of $385,521.68 and FY 1964 savings of $660,000.

- Malcolm G. Anding, research hydraulic engineer, U.S. Army Engineer District, Vicksburg, Miss., $1,420, for suggested use of Bascule Gates on navigation passes at locks and dams, saving $366,000 in construction of the Jonesville Lock and Dam.

- Aloysius H. Scherzer, production controller, and Max B. Pearson, aircraft welder, U.S. Army Supply and Maintenance Command, Corpus Christi, Tex., $1,000 plus additional cash award based on new savings, suggested repair procedures for T-53 exhaust diffusers which enable those previously condemned to be returned to serviceable condition, saving $327,417 for first year after adoption.

- Capt James H. Brill, chief, Nike Hercules Section, Nike Systems Project, White Sands Missile Range, N. Mex., Army Commendation Medal. Capt Brill initiated a study on his own time on the value of the Nike Hercules Missile Service Life Test Program. His findings indicated that the data produced would be more meaningful if gathered from firings of missiles stored in actual tactical conditions.

This approach eliminated the necessity for specific missiles to be held in storage at White Sands Missile Range, the requirement for testing and handling equipment, and personnel to monitor the program. The Nike Hercules Service Life Test Program at White Sands Missile Range was ended, saving $288,000 annually.

Watervliet Capability Serves Missile Command

Because Watervliet (N.Y.) Arsenal is the only U.S. Army installation with a special sheer-spinning machine, Watervliet technicians were recently called upon by the U.S. Army Missile Command to fashion a nose cone for an experimental reentry vehicle.

WATERVLIET ARSENAL machinist Ronald Greenough (left) and specialist Arthur Hess check sheer-spinning machine used to convert saucer-shaped pre-form of molybdenum into nose cone for re-entry vehicle.

The nose cone had to be shaped from a flat sheet of molybdenum. Molybdenum is a metal element of the chromium group and resembles iron in color (white), malleability, difficult fusibility and capacity to form steel-like alloys with carbon.

Watervliet was requested to fashion the nose cone because molybdenum cannot be machined into the desired shape by conventional machinery. Molybdenum is used because it has great strength at extremely high temperatures, such as the nose cone is subjected to when re-entering the earth's atmosphere.

The spinning process, directed by Charles H. Rose, an industrial engineering technician at Watervliet, has been employed to fabricate containers for the U.S. Navy's Tartar missile and to manufacture thin-walled gun tubes.

Heated to 1,000°F, molybdenum is placed over a mandrel in the spinning machine. As the mandrel spins the sheet of molybdenum, two rollers apply pressure up to 35 tons, elongating the plate into a saucer-shaped preform. The preformed plate is then removed, machined and replaced on the mandrel for additional shaping by heating, spinning and application of extreme pressure.

The Value of Modern Methods in Chemical Information Handling

(Continued from page 7)

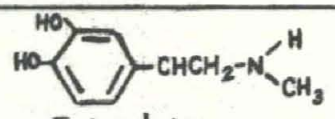
access to epinephrine and all compounds in the file possessing the structural profile represented by the combination.

Actually many other profiles can be selected for searching structures encoded in this way. All three logical conditions ("and," "but not," "or") can be used in programing the seven descriptors (only the "and" condition is implied in the 126 combinations mentioned above). Furthermore, each digit of each 4-digit number can be manipulated in this way in preparing the search program.

In effect, the person preparing the query on the basis of his intuition about the structure-activity relationships, can control to some degree: (a) the structural feature in which any deviation would be permitted; (b) the nature of the deviation in that structural feature; and (c) the extent of the deviation in the structural feature.

In other words, the searcher can vary the relevance of the structures to be retrieved in a controlled manner from those structures that are very closely related to the prototype (epinephrine) to those structures that are very remotely related.

In Table II, a very precise program and a somewhat imprecise program are shown for epinephrine and its congeners. In Table III, the structures retrieved using the two programs are given.



Epinephrine
(prototype for the search)

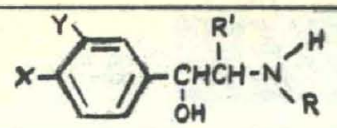
Program I

Dihydric phenol....H752
Secondary carbinol...H8G1
Secondary amine....F5D1
Primary carbinamine..F611
9 carbon atoms.....09

Program II

Phenol.....H75
Carbinol.....H8
Secondary amine....F5D1
9 to 12 carbon atoms...09to12

TABLE II. PROGRAMS OF SEARCHES USING EPINEPHRINE AS PROTOTYPE



	X	Y	R	R'	Stereoisomerism
I	HO-	HO-	CH_3-	H-	dl-epinephrine
	"	"	"	H-	l-epinephrine
	"	"	"	H-	d-epinephrine
II	HO-	HO-	i-C_3H_7-	H-	dl-isoproterenol
	"	"	"	H-	d-isoproterenol
	"	"	"	H-	l-isoproterenol
	"	"	"	CH_3-	
	H-	"	CH_3-	H-	l-phenylerphrine
	HO-	H-	"	H-	l-synephrene
	"	H-	"	H-	d-synephrene
	H-	HO-	C_2H_5-	H-	dl-effortil
	HO-	H-	i-C_3H_7-	H-	
	"	H-	"	H-	

TABLE III. COMPOUNDS RETRIEVED USING EPINEPHRINE AS PROTOTYPE

The example, based on a simple fragmentation code, illustrates the much greater versatility of a modern method in comparison to a traditional method. In a sense, the searcher is able to generate a highly sophisticated index to the information he requires and to do this a posteriori at the time of his search.

It should be stressed that the example involved a primitive modern method and *combinations* of structural features. Methods are now available which employ unique and unambiguous notations of structures. They can be employed for *permutations* as well as combinations of structural features and are, in general, far more versatile than a method based on a fragmentation code. In dealing with structures, permutations of information are especially important because they enable control to a considerable extent of isomerism.

As management and user become increasingly aware of the value of modern methods in chemical information handling, the resources required for the establishment of modern systems will be made available. The emphasis will shift from "How much will a modern system cost?" to "How much will a modern system save?"

MILSTRAP to Establish Automated Stock Records

Military Standard Transaction Reporting and Accounting Procedures (MILSTRAP) are scheduled for implementation for use by the Military Departments and the Defense Supply Agency by July 1, 1965.

The Defense Supply Agency will administer the system, which represents further progress in use of standard data systems in military logistics operations.

It provides standard data elements and codes for the maintenance of stock records and for transmission in punch-card form of information relating to receipt, storage, adjustment, counting and issue of military supplies. A manual describing the system in detail was distributed recently to supply activities.

The MILSTRAP system is a companion to Military Standard Requisitioning and Issue Procedures (MILSTRIP). It uses many of the standard data and one of the punched card forms already established by MILSTRIP.

MILSTRIP was developed by a committee composed of representatives from each of the Military Departments and the Defense Supply Agency. Procedures will be used for transactions within the supply activities of the Military Services and for certain transfers of materiel.

Research In Review...

(Continued from page 13)

and the total corrected score is so high as to justify forgetting about the corrected score. Too, under some conditions, the instructions may be unfair to the person who takes such instructions seriously when compared with a person who does not. For frequently, if a person can eliminate one alternative as definitely being wrong, it pays him to guess even if he has no idea about the other alternatives.

"Restriction in range" is jargon which means the sample being tested, or being evaluated on some criterion, is not representative of the complete range in abilities or performance of the samples for which the tests or criterion are meant to apply. This restriction may be either "implicit" (selected on a highly correlated variable) or "explicit" (selected on the test or criterion used.

Validity coefficients computed on such samples can give a completely erroneous impression as to the relative importance of various predictor tests being evaluated or to the degree of relationship of a particular test and the criterion being used. Correction formulae for different types of restriction in range are available. When and when not to use a particular formula is sometimes debatable.

In operation testing programs, "malingering" and other related problems of falsification are important and challenging. Interesting approaches to the solution of these problems have been devised in some areas. An inductee into the Army who scores low enough on the screening test to eliminate him from serving his country may be in for a rude shock if he really is bright enough to be accepted.

The motivational problems are much harder to solve, either by administrative decree or by testing procedures, though both can help. However, they are usually easy to understand. They are frequently confounded by many different factors. Attrition from longer courses may be due in part to the "undesirability" of the geographical location where the course is held. It has been found that engaged men have done more poorly than other single men or married men. Reenlistment is a function of skill or ability level and economic conditions. Disciplinary troubles relate to age, trouble prior to enlistment, whether or not a high school graduate, as well as to "personality" factors. (Studies in industry have shown that turn-over is high among people who have to travel longer to get to work.)

One problem little understood even among some technical and professional personnel concerns the problem of applying judgmental weights or the difference between "actual" and "apparent" weights. A hypothetical example is given: A school teacher with a small class administers two tests during the course. She decides that Test A should be weighted five times as heavily as Test B and that the final rank order of finish for the course will be the sum of the two weighted grades. The possible range of scores for each test is from 0 to 100. The results are:

Student	Test A	Test A (x5)	Test B (x1)	Final Rank Order
Jim	100	500	70	570
Jack	99	495	76	571
Tom	98	490	82	572
Paul	97	485	88	573
Carl	96	480	94	574
Art	95	475	100	575

In this illustration, the final rank order of finish is exactly the same as the rank order for Test B and is exactly the reverse of the order found in Test A—which was "weighted" five times as heavily as Test B. Test A might as well not have been given as far as it affected the outcome. The problem of weighting becomes more complex when several variables are being used and not only their distributions but also inter-correlations should be calculated.

Edmondson Named Shillelagh System Deputy

Earl R. Edmondson, former chief of the Shillelagh Engineering Division, has been named deputy to Shillelagh project manager Lt Col Robert M. Pearce, U.S. Army Missile Command, Redstone Arsenal, Ala.

A veteran of 10 years service at Redstone Arsenal, Edmondson has been connected with the Shillelagh program since 1960. When the weapon system was transferred from the Missile Command to the Army Weapons Command at Rock Island, Ill., in 1963, Edmondson and his engineering staff continued their work at Redstone. Management of the program was returned to the Missile Command late in 1964.

Shillelagh is a lightweight, surface-to-surface guided missile designed as the main armament for armored combat vehicles. A direct fire missile which is launched from a combination gun-launcher, it is effective not only against tanks but field fortifications as well. It provides high accuracy against moving or stationary targets and can fire either missiles or conventional ammunition.

Earl R. Edmondson

The first application of the weapon will be on the General Sheridan, a light armored reconnaissance airborne assault vehicle.

Edmondson was assigned to Redstone Arsenal in 1954 as a project engineer on rocket development programs and, just prior to 1960, was project engineer on the XA72 rocket grenade development program. Previously he was employed by an Atomic Energy Commission contractor at the National Reactor Testing Station in Idaho Falls, Idaho.

A graduate of the University of Arkansas with a B.S. degree in chemical engineering, Edmondson served with General Patton's Third Army in Europe during World War II, twice receiving the Purple Heart.

Executive Seminar, Mar. 24-26

An executive seminar designed to provide Government managers (GS-15 or equivalent) with information about management implications of the behavioral sciences will be held by the Office of Career Development Mar. 24-26, at the Civil Service Commission Building in Washington, D.C.

Aberdeen Proving Ground Munitions Men Maintain Enviable Safety Record

Eighty-seven men in gleaming white coveralls working with piston-like precision have one of the most dangerous jobs at Aberdeen Proving Ground, Md., and a most enviable safety record.

They are munitions assemblers working in shifts around the clock, in rooms as starkly clean as surgical wards, in the ammunition processing section of Development and Proof Services.

Their white coveralls, hats and gloves are flame-resistant and their shoes are electrically conductive. Adhering strictly to the safety code established for them, in five years, they have established a safety record marred by not even one lost-time accident.

Supervisor Otis W. Bass, conditioned by 35 years of service in the field of explosives, commented: "We have to remain aware of safety every moment. Each man working here has what amounts to a compulsive dedication to the preservation of human life and property."

Matches and cigarette lighters are taboo in the ammunition area and are collected as the men report for duty. They are returned only when owners are homeward bound. An electric lighter in a socket on the wall of an isolated chamber is used during smoke breaks.

The ammunition processing section's five main plants and several auxiliary buildings at the Proving Ground operate to conform with munitions standards set by Headquarters, U.S. Army Materiel Command.

Munitions shipments come by truck, train or air from other Army arsenals and industrial firms. Packed in sealed containers which have undergone rigid inspection at their departure points, in accordance with the Interstate Commerce Commission safety code, the shipments are put through a precise operational cycle.

William R. Craig (left) and Raymond Burk, ammunition workers at Aberdeen Proving Ground, Md., assemble tracers to 90 mm. projectiles.

Other than the clicking of the ammunition cases being moved and assembled, there is no sound—not even a human voice—for the munitions workers believe that silence is a true adjunct to safety.

The munitions constitute every conceivable application of explosives for military use. They are disassembled, fitted into simulated gun mounts, modified, reassembled and ultimately field-tested under any type of combat environment.

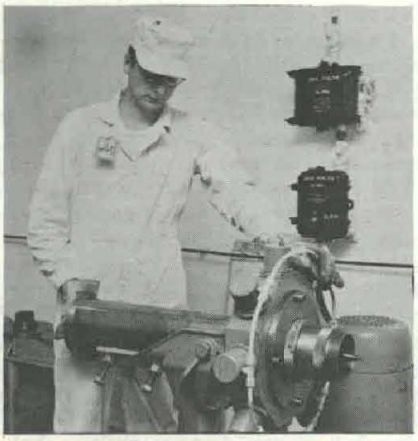
Ammunition items are subjected to simulated battle conditions typifying sand and desert, storm, salt vapor rising from sea water areas and solar radiation heat, before firing on the ranges. They are tried out in environmental situations during which shock, vibration or jarring during shipment from a dockside or an airfield would lessen their effectiveness prior to use.

Once these tests are completed, another team conducts outdoor range trials during which the ammunition is fired by gun crews and engineers to determine accuracy and terminal effect as measured by a crew of recovery and demolition experts. Should even a fuze fail to function, it is removed and disassembled to discover the location of the malfunction.

Here is where the munitions shipment undergoes its most demanding analysis, for the Ballistics Acceptance Test provides the last word for the Munitions Command at Picatinny Arsenal, which is responsible for the design and procurement of munitions allocated to the six Continental U.S. Armies.

Should any explosive fail to meet even the most infinitesimal requirement, engineers present at the range firings at Aberdeen can confirm the flaw with the clarity of an X-ray photo. If need be, the entire shipment or a separate item will be returned to the developer's drawing board to correct deficiencies before the test cycle is reinitiated.

Thus the extensive test phase at Aberdeen Proving Ground insures that soldiers of the U.S. Army are given the best possible ammunition.



Eugene R. Schnetzka secures a cartridge case to a projectile to determine the strength of the bullet pull. His coveralls are fireproof.

Scientific Calendar

9th Annual Meeting of the Biophysical Society, San Francisco, Calif., Feb. 24-26.

American Physical Society Meeting, Norman, Okla., Feb. 26-27.

Gas Turbine Conference and Show, sponsored by the American Society of Mechanical Engineers, Washington, D.C., Feb. 28-Mar. 4.

Unmanned Spacecraft Meeting, sponsored by the American Institute of Aeronautics and Astronautics, Los Angeles, Calif., Mar. 1-4.

21st Annual Technical Conference of the Society of Plastics, Boston, Mass., Mar. 1-5.

16th Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy, Pittsburgh, Pa., Mar. 1-5.

5th International Symposium on High Speed Testing, sponsored by the Plastic Technical Equipment Corp., Boston, Mass., Mar. 8-9.

IIC Building Exposition and Conference, sponsored by Clapp and Poliak, Inc., Detroit, Mich., Mar. 8-11.

Mobile Water Resources Engineering Conference, sponsored by the American Society of Civil Engineers and the American Society of Mechanical Engineers, Mobile, Ala., Mar. 8-12.

National Conference on Particle Accelerators, sponsored by IEEE, Washington, D.C., Mar. 10-12.

Symposium on Safety Aspects in Engineering, Milwaukee, Wis., Mar. 11.

Aviation and Space Conference, sponsored by the American Society of Mechanical Engineers, Los Angeles, Calif., Mar. 14-18.

Annual Conference and Corrosion Show, sponsored by the National Assn. of Corrosion Engineers, St. Louis, Mo., Mar. 15-20.

American Society for Testing and Materials Committee D-27 Meeting on Electrical Insulating, Williamsburg, Va., Mar. 17-19.

Institute of Electrical and Electronics Engineers International Convention, N.Y.C., Mar. 22-25.

Spring National Convention of the Society for Nondestructive Testing, Los Angeles, Calif., Mar. 22-26.

Symposium on Thermophysical Properties, sponsored by the American Society of Mechanical Engineers, Lafayette, Ind., Mar. 22-26.

International Anesthesia Research Society Meeting, Washington, D.C., Mar. 28-Apr. 1.

American Society of Tool and Manufacturing Engineers Annual Engineering Conference, Cleveland, Ohio, Mar. 29-Apr. 2.

1965 Army Operations Research Symposium, sponsored by ARO-D, Huntsville, Ala., Mar. 30-Apr. 1.

International Symposium on Chemiluminescence, Durham, N.C., Mar. 31-Apr. 2.

Human Factors Engineering Dates Back to Primitive Period

By Col James L. Burke

Col James L. Burke is chief of the Test Programs and Evaluations Department, U.S. Army Electronic Proving Ground, Fort Huachuca, Ariz. His varied military background has included two assignments with the Office of the Chief Signal Officer, Washington, D.C.; signal officer with Allied Land Forces, Denmark; laboratory processing officer, Fort Monmouth, N.J.; signal officer in the Pacific Theater during and after World War II. His Army training includes Command and General Staff College, Armed Forces Staff College, Army Flight Training School, Army Rotary Wing Training School, and Advanced Signal School.

Col James L. Burke

The cave man who took a club and enlarged the entrance to his cave so that he could walk in rather than crawl in was applying human factors engineering.

When engineers at the Test Plans and Evaluation Department at the U.S. Army Electronic Proving Ground, Fort Huachuca, Ariz., report that the dials on a new radio navigation set are too small to be read accurately, they, too, are applying human factors engineering.

Over the centuries, whatever man has invented or appropriated from nature he has improved and refined—mostly from the standpoint of human factors engineering.

Compare, for example, the first typewriter with today's electric model: today electricity does most of the mechanical work, thus saving the secretary's energy.

Or compare the first automobile with this year's model. We tend to forget that the first one had to be cranked by hand, that it was hot in summer and cold in winter, and that keeping it running—not to mention steering it—was a job that required both hands and feet and constant attention.

Long periods of refinement and improvement have usually followed each invention because no thought was given to human factors engineering in the beginning. True, most inventions were so badly needed by mankind, they were welcome no matter how crude they were. For man could always adapt himself to the new machine or tool; later, when there was time, the machine or tool could be adapted to man.

Today, long periods of trial-and-error given to improvements and refinements are wasteful. This is especially true in communications and electronics equipment, where lack of human factors engineering in the beginning can spoil the usefulness of a new radar, radio, or telephone.

Past tests have turned up such deficiencies as: a lid that would not open wide enough to permit replacement of defective parts; a span between controls that required the over-size reach of a gorilla; knobs on a miniaturized component so close together they were difficult to grasp; a cable connector that would not connect except under extreme force, and cramped space behind panels where circuits had to be checked.

Most design engineers do their best to consider the factors which will adapt their product to the human being. Experience gained so far shows that, compared to a machine, an operator can best detect small amounts of light or sound, recognize patterns of light or sound, handle changes in procedures, remember large amounts of information and apply bits of it when needed, reason from cause to effect, and from effect to cause, exercise judgment.

On the other hand, experience teaches the design engineer not to ask the human to handle too many jobs at once, work accurately for long periods of time, perform heavy work requiring great strength, perform exacting work under difficult conditions or emotional strain.

In short, the operator should not be asked to do something which a machine can do better and machines should not be complicated by functions best left to the operator. Despite these guides, the design engineer may produce a new piece of equipment which inadvertently plays against the weaknesses of the operator: controls may work contrary to the natural movement of the human arm, hand or leg; visual indicators may be mounted so that the operator cannot easily see scales, indices, pointers or numbers; heavy components may lack handles for easy lifting; and work areas may be too cramped for efficiency or long hours of operation.

A final step in research and development, therefore, is human factors testing and evaluation. At the U.S. Army Electronic Proving Ground, as new items of equipment are tested both mechanically and electrically, we find any deficiencies in this additional area.

We are responsible for reporting not only whether equipment does what it was designed to do, but whether it is properly designed for its human operator. We must decide whether the operator is hindered, overtaxed or misplaced.

The trouble is these deficiencies are not easily detectable and finding them cannot be left up to chance observation or informal opinion of operators used to test the same equipment mechanically and electrically. Instead, human factors testing should be conducted under simulated operational conditions where all external factors, such as lighting, temperatures, humidity, vibration, and noise, can be varied to run the gamut of all possible operating conditions.

Often, however, especially when the equipment is large, testing must be done in the field and data collected under available conditions with the hope that enough variation will occur to make the results conclusive. Data may be collected either from trained observers, questionnaires and interviews from operators, or analysis of time-study motion pictures.

The importance of human factors testing and evaluation is growing. For today we are confronted not just with new machines, but with man-machine systems, where the operator contributes as much to the reliability of the system as does the machine.

The points in the system where man and machine come in contact are very critical and a proper evaluation of these points of contact is necessary if the system is to be properly evaluated.

Past experience is not a sufficient guide for testing such systems. More and more, reliance will have to be placed on empirical methods, that is, careful simulation techniques to eliminate guess-work, human bias and unconscious adaptation.

$22 Billion R&D Expenditures Predicted for 1965

A record $22 billion will be spent on research and development in the United States in 1965, economists at Battelle Memorial Institute, Columbus, Ohio, have predicted.

Dr. George W. James, Joseph W. Duncan and Ralph L. Craig pointed out that 1965 will mark the fourth consecutive year annual increases in research and development funds have been greater than $1.5 billion. Research and development expenditures for 1964 are expected to approximate $20.5 billion.

The estimated 1965 national R&D expenditure, the economists noted, represents only a seven to eight percent increase over the 1964 total. This compares with an estimated 11 percent increase in 1964 over the 1963 total. A seven percent increase would be the lowest annual percentage increase during the 11-year period for which statistics are reliable.

The Battelle forecasters estimated that in 1965 research and development expenditures will break down as follows: Federal Government, $15.8 billion; industry, about $5.8 billion; and academic and nonprofit institutions, $0.5 billion. The latter figure is unchanged from 1964.

Federal Government expenditures are expected to increase by about $1.1 billion. Industry is expected to increase its R&D spending by $300 million over 1964. Over $14 billion of research will be performed by industry using funds from both Government and industry sources.

Reviewing research and development trends, the economists pointed out that over the past decade research performed by the Federal Government's in-house facilities has dropped from about 17 percent to an estimated 13.5 percent of total R&D expenditures.

The share of total Federal research performed by industry increased only slightly, while the share performed by academic and nonprofit institutions increased from 10.7 percent to 13.5 percent.

As a source of R&D funds, however, the Federal Government has increased its dominance, boosting its percentage over the past 10 years from under 55 percent to over 65 percent.

Reasons given by the economists for the reduced percentage increase estimated for 1965 R&D expenditures include an apparent ceiling placed on expenditures by the National Aeronautics and Space Administration and a leveling off of total Department of Defense expenditures.

16 Army Employees Join DoD Project Shakedown

Sixteen civilian Army Missile Command employees this month joined 42 Navy and Air Force employees at Norton Air Force Base in San Bernardino, Calif., to participate in Department of Defense "Project Shakedown."

A tri-service undertaking, Project Shakedown is designed to reduce the number of items in the Federal supply system through disclosure of duplication and identification of items that are interchangeable between the three branches of service.

Selected by the Department of Defense as the host activity for the 2-year project, Redstone (Ala.) Arsenal will review and analyze each item in the supply class of guided missile repair, checkout and specialized equipment.

The Army's part of the project is coordinated through the Shakedown Control Office of the Missile Command's Supply and Maintenance Directorate. W. C. Rasnake is office chief.

The 16 employees, all of the Directorate of Supply and Maintenance, are: Edgar L. Zeone, Alvin V. Camp, Glenn A. Stephens, Carlos E. Matthews, Harry Hardin, Carl D. Sullivan, Milton P. Crawford, Donald W. Morris, Kenneth E. Cantrell, John L. Gray, Pul K. Thompson, Eschol A. Hendrix, James W. Neely, Gary Lee Turner, Thomas W. Millward, Jr., and Bobby Canup.

Col Simpson Reports as Sheridan Project Manager

Col Paul A. Simpson recently reported to Headquarters, U.S. Army Weapons Command, Rock Island (Ill.) Arsenal, as Sheridan weapon system project manager.

Directed under the U.S. Army Materiel Command (AMC) system of project managers, the Sheridan system includes the highly mobile, air-transportable, 16-ton General Sheridan armored reconnaissance vehicle, ammunition and all supporting equipment.

Armed with the Shillelagh weapon system, including a guided missile and conventional ammunition, it is suitable for antitank and Infantry support roles.

The General Sheridan possesses a high degree of cross-country mobility, a swimming capability, and a cruising range to permit independent operations at extended distances. It can be employed at night and under conditions of limited visibility.

Immediately before his present assignment, Col Simpson served as director of Maintenance Operations at U.S. Missile Command Headquarters, Redstone Arsenal, Ala.

Holding a B.A. degree in economics (1937) and a master's degree in business administration (1939) from the University of Michigan, he entered the U.S. Army in 1941. He served in the European Theater during World War II.

In 1949 he was assigned to the Studebaker Corp., South Bend, Ind., where he spent a year studying management and production methods. From June 1950 to July 1953, he was assigned to the Office of the Chief of Ordnance in Washington, D.C. Subsequently, he became the senior Ordnance adviser to the Turkish Army and was responsible for the introduction of M-47 medium tanks.

Col Simpson was selected as a member of the first faculty to establish the Army Supply Management Course at Fort Lee, Va., in September 1954. Assigned later to the Ordnance Tank-Automotive Command in Detroit, Mich., he served as executive officer, Industrial Division.

He was the principal project officer during the Berlin build-up in 1961 for the prepositioning of complete division sets of equipment in Europe to reduce the deployment items of divisions to Europe. He also was responsible for U.S. Army-Europe's participation in disaster relief operations in Iran, Morocco, Italy and Yugoslavia.

Col Paul A. Simpson

Kudos

The Meritorious Civilian Service Award, the U.S. Army's second highest civilian honor, was presented recently to James L. Helfinch and Edward R. Thilo, physicists at Frankford Arsenal, Philadelphia, Pa.

Maj Gen Floyd A. Hansen, commanding general of the U.S. Army Munitions Command, presented the awards. The Munitions Command is the Arsenal's parent organization.

Director of the Physics Research Laboratories, Thilo was cited for his "outstanding achievements over a period of years." He began work at the Arsenal in 1941.

Helfinch, 39, was cited for research achievements in the Laser field. He also was one of 19 national winners of the Army Research and Development Achievement Award in 1963.

Dr. Riley D. Housewright, scientific director of the U.S. Army Biological Laboratories, Fort Detrick, Md., recently received his second Meritorious Civilian Service Award (first in July 1962).

Col Vincent L. Ruwet, CO, made the presentation. The citation reads, in part: "His outstanding leadership and scientific abilities contributed substantially to the national defense and to the general public welfare."

Kenneth E. Joy, chief of the Quality and Reliability Office, U.S. Army Missile Command, is a recent winner of the Meritorious Civilian Service Award. During his 25 years of service with the Office of the Chief of Ordnance in Washington, D.C., he received the Outstanding Civilian Meritorious Service decoration in 1945 and the Exceptional Civilian Service decoration from the Secretary of the Army in 1959.

The Missile Command's Senior Executive award went to John A. Muller, assistant director of the Procurement and Production Directorate. The Junior Executive award recognized Gregory J. Long, chief of the Program Management Office, Lance Project Office.

Brig Gen Charles W. Eifler, deputy CG for Land Combat Systems at the Missile Command, shared a patent award for an invention developed in 1961. Lt Col John R. Halisky (USA-Ret.) worked with him to develop a system analysis and diagnostic training device to enable students to analyze electrical, pneumatic, hydraulic and other systems at the U.S. Army Ordnance Guided Missile School at Redstone Arsenal. General Eifler, then a colonel, was commandant of the school.

William P. Murphy, director of the Army Missile Patent Center at Redstone (Ala.) Arsenal, said that he knows of only one other Army general officer who has had an invention patented.

Col Lloyd L. Rall, director of the U.S. Army Engineer Geodesy, Intelligence and Mapping Research and Development Agency (GIMRADA), Fort Belvoir, Va., recently received the Legion of Merit.

A Presidential award authorized by an act of Congress, the Legion of Merit, was presented to Col Rall by Lt Gen W. K. Wilson, Jr., U.S. Army Chief of Engineers for "exceptionally meritorious conduct in the performance of outstanding services."

Col Rall has been director of GIMRADA since July 1964, after serving as deputy director for Topography in the Office of the Chief of Engineers.

Two officers serving in the Operations Branch, Operations and Analysis Division, U.S. Army Limited War Laboratory, Aberdeen Proving Ground, Md., were decorated in January for service as military advisers in Viet Nam last year.

Lt Col Jack F. Matteson received the Bronze Star for outstanding meritorious service in ground support operations and Maj David H. Hayes was awarded the Distinguished Flying Cross for heroism in helicopter support operations.

Earlier in his tour of duty, Maj Hayes earned the Air Medal with 12 Oak Leaf Clusters as well as the first Oak Leaf Cluster to the Army Commendation Medal.

A U.S. Army Research and Development Reservist, Lt Col Melvin C. Koch, was awarded the Army Commendation Medal for meritorious service as assistant adjutant, executive officer and administrative officer to the 2396th Research and Development Unit, XX U.S. Army Corps, Fort Hayes, Ohio, from Apr. 29, 1952 to July 31, 1964. During this period, the citation reads, in part: "Lt Col Koch consistently displayed outstanding initiative and professional competence."

M/Sgt Kenneth N. Jones, senior U.S. Army enlisted man assigned to the tri-service, Tri-Partite P1127 Evaluation Squadron, U.S. Army Standardization Group, London, England, receives Army Commendation Medal from Brig Gen William T. Ryder, U.S. Army Deputy Chief of Research and Development in recent ceremonies. Sergeant Jones received the award from the U.S. Army Transportation School, Fort Eustis, Va., for outstanding service as an instructor from June 1963 to October 1964.

PRESIDENTIAL CITATION is presented by Maj Gen Chester W. Clark, CG, U.S. Army Japan, on behalf of President Johnson and the Secretary of the Army, to Frank J. Spinar, supervisory technologist at the U.S. Army Procurement Agency, Yokohama, Japan. In conjunction with the 10th anniversary of the Federal Employees' Incentive Awards Program, Spinar received the award for his suggestion that shoe laces for jungle shoes be reduced in length from 60 to 50 inches, resulting in savings estimated at $87,684 for FY 64 and 65.

Chemical Engineering Play Key Role in Research, Development at Natick

Military rations, clothing, shelters and a variety of specialized supplies —areas of research and development in which the U.S. Army Natick (Mass.) Laboratories hold prime responsibility for the American military forces—all show some degree of participation by chemical engineers.

Chemical engineers, for example, are large-scale shareholders in the food research program, including packing and packaging, conducted for the Armed Forces at Natick.

In all of these areas, the chemical engineer is a working partner of the biochemist, nutritionist, microbiologist, mechanical engineer, sanitary engineer, container technologist, and many other scientists.

Two fields of food research at Natick are closely identified with the chemical engineer—food preservation by irradiation, using a cobalt-60 source or a linear electron accelerator, and by various dehydration or drying techniques.

Variations in modes of dehydration which have a future potential include such innovations as the "puffing gun" method, which reduces food to a highly concentrated form. A second technique reduces foods to a smaller volume than previously achieved, yet allows them to be quickly rehydrated.

Chemical engineers combine their skills with those of other engineering personnel in the development of equipment, processes and systems in the culture and preparations of unconventional foods for astronauts and space travelers.

The focus currently is on algae, a green plant commonly found in streams, ponds and lakes. The plant is recognized as a good source of protein, minerals and vitamins. The chemical engineer in this project is prominent in the development of a photosynthesis system for the culture of algae. Involved is the application of heat transfer principles utilizing 20 times the illumination of sunlight at mid-day without destroying the material.

Programs closely associated with food products involve an assortment of containers, barrier materials, liners and flexible packaging materials.

Projects range from the design of a flexible package containing fresh sliced peaches, which a soldier can carry in a pocket, to unit load containers which are compatible with the door and cargo space clearance of box cars, vehicles, ships and aircraft used in transport of supplies.

Design and evaluation of shipping containers require knowledge of the environment to which they are exposed. Army-developed instruments make it possible to measure the height from which containers may be dropped, as well as the frequency of fall during shipment or handling.

The instruments also record humidity and temperature conditions, together with the pressures to which stacked loads are subjected. Environmental data are recorded on magnetic tape. A program is now underway for the development of a data processing system to apply the collected information to design and testing activities.

Chemical engineers also team with textile technologists and chemists in material research. An example may be found in body armor design, where an assortment of textiles, ceramics, glass, metals and other materials are investigated for protective characteristics.

A similar group works on development of improved fibers, water- and oil-repellent treatments, fire-retardant compounds and functional finishes — all to improve military clothing that must provide maximum comfort and functionability under conditions ranging from the tropics to the polar regions.

Brig Gen Georges F. Doriot (USA, Ret.), left, is briefed on latest Army developments in clothing, food and equipment by Brig Gen W. W. Vaughan, CG, U.S. Army Natick (Mass.) Laboratories during a recent visit. General Doriot founded the Quartermaster R&D Program which equipped Army troops with rations, clothing and general supplies during World War II and resulted in establishment of the Natick Labs. He is now a professor, Harvard Graduate School of Business Administration.

A continuing study involving both heat transfer techniques and materials research, and in which chemists and mechanical engineers have pooled their skills, seeks the development of an experimental "thermalibrium" suit. This is a head-to-foot clothing system in which the environment is controlled by an integral air-conditioning unit.

At Natick, chemical engineers have an opportunity for replacing natural materials with plastics, thus securing advantages of higher-weight-strength ratio, more resistance to breakage, chemicals, deterioration and better low-temperature qualities.

Chemical engineers have assisted plastics technologists at Natick in product development, including a plastic canteen weighing only a few ounces, serving trays, 5-gallon water containers to replace metal "jerricans," a plastic machete sheath, hardware for load-carrying equipment, an expendable lightweight insulated food container, and even a fireman's helmet.

Another achievement is a range of sizes of expendable plastic shelters constructed by simply spraying foamed chemicals over an air-supported form which is removed for reuse after the foam has hardened.

Still another experimental shelter construction idea under study, in collaboration with Canadian scientists, begins with a "sandwich" filled with a chemical mixture which foams after being ignited. This sheet would eventually be made in a thin, flexible tent-roll material and prefabricated into the desired shelter shape ready for foaming.

The evaluation of soaps and detergents and the development of better ways to remove soil from textile materials are among other tasks for chemical engineers.

Activities of chemical engineers at the Natick Laboratories are woven into the overall military research and development pattern. With other engineers and scientists, they are consulted often for the solution of problems which arise in the design of equipment, or in producing, processing or "characterizing" a product.

WMSR Using Novel Integrated Testing Techniques to Prove Nike X

By Capt James H. Brill

A new concept of materiel development received a significant test during the Nike Zeus antimissile missile system research development test and evaluation program at White Sands Missile Range, N. Mex.

Numerous articles have been published regarding the ability of the Nike Zeus system which has now been replaced in development by the more advanced Nike X system to provide a defense against the ICBM threat. However, the fact that a comparatively new method of Army materiel testing was used for the Zeus missile system has gone virtually unmentioned—and by many, unnoticed.

The new concept is termed integrated testing and it involves engineering and service tests blended to an optimum degree, normally at one location. A fully coordinated integrated program also includes the contractor's engineer design tests, permitting utilization of the facilities and personnel of the contractor, developer and user agencies. Studies and equipment tests of interest to the contractor and engineer/service tests agencies (as was the case with Nike Zeus testing) are thus expeditiously and efficiently accomplished.

Under this system, responsibility for engineer design tests rests with the contractor, with the evaluating agency for the Army's independent evaluation of the R&D effort, and with the using agency for the service tests to assure compatibility of the system and requirements of troops.

All three agencies utilize results of the same tests to extract the data necessary for performance of their individual responsibilities.

In some instances, test objectives and results may not satisfy all requirements of one or more testing agencies, and may necessitate some independent testing by the Army. Proper coordination and thorough planning, however, can minimize if not eliminate this need.

In the Nike Zeus Program, integration of engineering and service tests during contractor engineer design tests precluded the necessity for costly and time-consuming duplication of effort. The result was prompt analysis and evaluation of the test findings for Army use in reaching its decisions affecting such areas as funding, design changes and production.

Integrated engineer/service (E/S) test teams were composed of Ordnance and Artillery personnel, representing the developing agency and using agency, respectively. A small E/S test team is still active at the Kwajalein Atoll test facility in the Pacific Ocean.

The E/S teams have worked side by side with and supported the contractor in the performance and monitoring of the Zeus test program. The Army teams were organized into two broad categories—observer and operator. The observer groups were supervised by and reported directly to their military chiefs on assigned areas of responsibility for work and tests performed by the contractor. This information and other data formed the basis for the Army's independent evaluation of the overall Nike Zeus system.

The operator groups worked under the supervision of the contractor and performed tasks assigned by contractor supervisory personnel. Military control of these operator personnel was, of course, maintained by the Army.

All officers and enlisted men assigned to E/S test teams are competent engineer or technicians with several years of experience in the missile field, and have attended the contractor-conducted or Army Air Defense School Zeus training courses in advanced electronic techniques utilized in the development and testing of the Zeus system.

Many of the officers and men who participated in the Nike Zeus R&D program will be assigned to the Nike X test program. Some of them also have worked on the earlier generations of Nike systems—Nike Ajax and Nike Hercules.

The integrated test concept was highly successful in meeting a significant challenge in the testing of the Nike Zeus system. In view of this success and the Army's objective of completing all engineering and service tests within one year, it appears that this method will become the rule rather than the exception in Army testing—especially in the testing of complex and costly missile systems.

Capt James H. Brill has served as aide-de-camp to Maj Gen J. F. Thorlin, commanding general, White Sands (N. Mex.) Missile Range, since June 1963 and earlier was antitank project officer, Systems Test Division, at the Range.

A 1956 graduate of Syracuse University, he has attended the Field Artillery Officers Course, Fort Sill, Okla., and the Nike Ajax and Nike Hercules maintenance officers' courses at Fort Bliss, Tex. From 1958 to 1960 he was an ARADCOM missile officer.

In 1961 he transferred to the Ordnance Corps and was assigned to White Sands, where his assignments have included Zeus Project operations officer, chief, Nike Hercules Section, and ARPAT project officer.

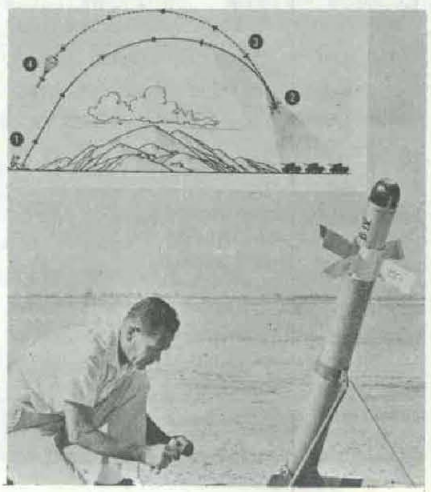
'Ping-Pong' Ballistic Missile Passes Flight Test

A new missile dubbed Ping-Pong, which can zoom over enemy positions, take photographs and return the reconnaissance information to U.S. troops, has been successfully flight tested by Lockheed Aircraft Corp. for the Army Electronics Command.

Ping-Pong is believed to be the Free World's first round-trip ballistic missile. The projectile and supporting equipment are lightweight and small. Because of its simplicity and the fact that it can be recovered and reused, Ping-Pong can be mass-produced at relatively low cost, Lockheed officials said.

Operation is simple. All the soldier does is aim it, launch it and wait for it to return. Rockets attached to each end of the missile supply propulsion for the trip over the area of interest and return. Except for a pair of brief rocket-firing sounds, it operates silently.

Lockheed is conducting follow-up studies of the camera-carrying missile for the Electronics Command.



Materials Researchers at AMRA Study Problems in Premature Fractures

By Robert J. Morissey

U.S. Army Materials Research Agency
Watertown, Massachusetts

Robert J. Morrissey joined the U.S. Army Materials Research Agency in the Materials Engineering Division in June 1962. Assigned to the Theoretical and Applied Mechanics Branch as a mechanical engineer (Applied Mechanics), he has been primarily involved in studies of the behavior of materials. His present assignments include crack-growth studies in fracture mechanics and investigations of tensile fracture mechanisms in high-strength material.

He graduated with a B.S. degree from Northeastern University (1962). His prior experience, designing mechanical devices and testing prototype paper mill machinery, was obtained under the Northeastern University Cooperative Plan by assignments to private industry.

R. J. Morrissey

Current requirements in design have focused the attention of materials researchers on the premature-fracture problem.

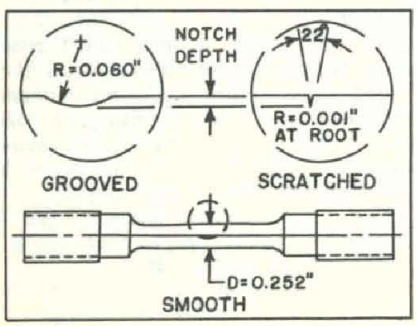
This problem has been greatly intensified by the use of metals having increasingly higher strength-to-weight ratios (generally at the expense of material toughness) coupled with the call for lower safety factors in the design of Army materiel.

Under these conditions, a surface discontinuity such as a scratch can have the disastrous effect of significantly lowering the overall strength level. Thus, in order to preclude catastrophic failure of critical components of materiel, rigid acceptance criteria are placed on manufactured parts.

A configuration of uranium alloy recently redesigned at the U.S. Army Materiels Research Agency was so critically stressed, in view of the low toughness of the material, that an investigation was undertaken: (1) to demonstrate the sensitivity of the alloy to sharp notches (or scratches), and (2) to examine the possibility of modifying the scratch contour with a grooved profile cutter, thereby changing the "sharp crack" into a generous-radius groove.

It was hoped that by this procedure the strength of a scratched component could be restored to its unscratched strength level, and that consequently a lower rejection rate of manufactured components could be achieved.

A series of smooth, scratched and grooved tensile specimens were machined from the bodies of several shells and tested dynamically at room temperature, –20° F., and –65° F. The introduction of a circumferential notch (scratch or groove) into a tensile specimen (see lower part of diagram) of the uranium alloy either slightly increased (in accordance with notch strengthening effects)* or decreased the overall strength level depending on the geometry and depth of notch and temperature.



The test results revealed that scratches (see upper right of diagram) of depths in excess of 0.004-inch lead to a serious degradation, at low temperatures, of the dynamic ultimate strength.

A change in form of this scratch to a 0.060-inch radius groove (see upper left of diagram) restores the ultimate strength to a satisfactory level even when the resulting groove has a depth as much as 0.008 inch.

It should be noted that a real crack would have a root radius much smaller than the 0.001 inch of the "scratched" specimen and could be expected to have a somewhat more severe effect.

This scratch modification technique may be applicable to many other low-toughness materials.

*P II-38, WAL Monograph, Fracture of Structural Metals, June 1962, Watertown Arsenal Laboratories.

Picatinny Reports $22.8 Million VE Savings for FY 1964

The Value Engineering Program at Picatinny Arsenal, Dover, N.J., had validated FY 1964 savings of $22.8 million against a target goal of $6.4, the Arsenal recently reported. The FY 65 goal is set at $8.4 million.

Picatinny Arsenal has adopted the policy that Value Engineering/Cost Reduction should be an adjunct to everyone's operation, whether they are engaged in development, industrial engineering, procurement, manufacturing, inspection, management or other areas.

As a result, personnel in these areas are being trained in Value Engineering methodology. Since Picatinny Arsenal is the prime research and engineering center for Army munitions, this "cost consciousness" of items, materiel, manufacturing processes and packaging has been labeled of prime importance.

In the design development phase, engineers are continually utilizing standard components, shelf items and simplifying designs to maintain maximum reliability and safety.

In the engineering phase, attention is continuously given to the use of economical materials, simplifying manufacturing techniques, automation of manufacturing processes, broadening supply bases and elimination of proprietary items.

In addition, an extensive program was undertaken by the Arsenal to motivate contractors to participate actively in this program. Assistance was given the U.S. Army Munitions Command in establishing training programs and furnishing speakers for various seminars, symposia, and Ordnance Association meetings.

Some of the most significant innovations at Picatinny during FY 64, the validated savings and how savings were accomplished are:

- Cartridge case, 105 mm., M148, $1,804,110 material change, brass to steel.
- Super propellant charge, XM119, 155 mm., $4,618,985, increased range by developing new prop charge.
- Classified components, $4,480,-823, eliminated parts, revised manufacturing and assembly processes, changed materials and redimensioned components.
- Gun erosion, 90 mm., M41 and 105 mm. M68 Tube, $7,927,997, increased gun tube life by application of additives.

Army Training Device Simulates Realism of Radar-Missile Defense System

By Eugene F. Moretta

Project Engineer, AAW Weapons System Trainers Branch U.S. Naval Training Device Center

A trainer known as Device 3G36 that incorporates the latest in synthetic signal techniques has been developed to meet requirements of the Army Participation Group, U.S. Naval Training Device Center, Port Washington, N.Y.

Designed to simulate all signals and effects that normally are associated with missile action against an enemy aircraft, the device will be used to train members of the control crew of the Hawk missile system battery.

The quality and realism of the signals generated and introduced into the Hawk/Radar Missile Fire Control System provide the trainee with an environment that accurately depicts actual operating conditions. The trainer was developed by Belock Instrument Corp.

Housed in an air-conditioned shelter that can be transported by helicopter, the equipment can be used in a classroom environment or at the site of an operational Hawk battery.

In commencing a training problem, a flow of data signals is generated from a simulated advance information source such as the Ballistic Missile Early Warning System, or the MSG-4 Air Defense System. The targets appear on the pulse acquisition radar scope amid various types and degrees of synthetic jamming, deception, noise and clutter.

The target is challenged as friend or foe. During the long-range approach, the operator applies various type of anti-jamming techniques and radar controls in an effort to keep the target visible. When within range, the target is designated to a tracking radar and its associated missile launchers.

The tracking operator accepts his target search and locks-on in an environment of electronic countermeasures. Synthetic intelligence and antenna control signals are fed into the tracking radars to solve the fire control problem. Signals representing the status of each missile also appear at the fire control console in the Battery Control Center.

When the fire control problem is solved, the launcher is aimed and a synthetic missile is fired. At time of burst, the synthetic target video starts to deteriorate. After 15 seconds, all effects are completed, the target disappears, and the device is ready for another training run.

Six maneuverable missiles capable of speeds and ceilings substantially in excess of present winged capabilities can be presented as targets. Any of the targets can be associated with any one of the jamming channels. In addition, s i m u l a t e d ground-based standoff positions are provided from which synethetic jamming may be produced.

A scoring unit, remotely actuated by the instructor in the Battery Control Center, records the time lapse between "designate" and "burst" operations.

To provide training in correction procedures, simulated firing of a number of missiles in sequence from each battery section can be effected, and "duds" or "misfires" may be introduced.

A "probability of kill unit" provides the means by which the established percentage of hit-or-miss probability can be applied to each missile firing. In the event of "missile destruct," the unit can prevent burst effects from functioning.

The simulator is capable of functioning with the operational equipment in three modes. In Mode 1, the simulator acts only as a connection box and has no effect on the signals

CRREL Researchers Collect, Analyze Cosmic Dust

Most researchers, like housewives, go to great pains to get rid of dust and protect their experiments from it, but a research geologist at the U.S. Army Cold Regions Research and Engineering Laboratory (CRREL), Hanover, N.H., painstakingly collects it.

The dust that Chester C. Langway, Jr., collects is a special kind—extra terrestrial, the kind that rains down upon the earth at the rate of about a million tons a year.

"Cosmic dust particles," he said, "are very difficult to distinguish from the furniture-top variety without the aid of special analytical equipment, and even then it is often difficult to tell."

Chester C. Langway, Jr., views "cosmic dust" at U.S. Army Cold Regions Research and Engineering Laboratory (CRREL), Hanover, N.H. The particles, largest of which is only one millimeter in diameter (insert), were obtained from ice cores recovered from deep in the Greenland Icecap drilling program by CRREL.

Until recent years, it was believed that meteorits were the only tangible source of knowledge of the universe beyond the earth. Strong evidence has developed that keys to knowledge of the universe will be found also in the cosmic dust constantly bombarding the globe.

The fallout of the tiny particles from space is fairly well distributed over the globe. Even though this is a consolation to the housewife at her cleaning chores, collection of samples is complicated for Langway and other researchers in the field.

To avoid terrestrial contamination, Langway has been gathering dust samples in Greenland. He obtains the particles by melting and microfiltering samples of subsurface snow layers and from specimens taken from far below the surface of the icecap in CRREL's deep ice core drilling program.

During the summer of 1964, he has been filtering the entire daily water supply at Camp Century, an under-ice research center some 138 miles out on the icecap. Filtering about 10,000 gallons a day has proved a comparative bonanza in yielding particles for isotope studies.

CRREL research has documented composition of dust from outer space, and evidence shows that the particles are droplets from meteors, meteorites and comets.

An important aspect of these studies is investigation of the space density of the particles. Further research may provide answers to asteroidal or lunar erosion phenomena, the breakup of comets, and the mysterious zodiacal dust cloud that rings the earth.

passing through. In this mode the missile battery system can be operated without degradation or delay. At the same time, the simulator can be independently energized, operated or tested without creating interference.

In Mode 2, the simulator adds only its synthetic targets to the operational PPI display. In Mode 3, the simulator generates all signals and the PPI display is completely synthetic. The latter is the mode usually employed for training.

The simulator, complete with the respective switching modes, can be interconnected with the Hawk Missile/Radar System operational gear in approximately one hour. The interconnection involves 18 cables, 10 of which are data cables identical and interchangeable with each other and which can be indiscriminately connected at their outer ends.

However, a test plug and light are required to locate the correct receptacle for the inner ends of the cables. This is accomplished by designating combinations of two wires in each cable keyed to an indicating light network at the entrance panel of the device. This identification system prevents erroneous connections and speeds up the interconnection process. In case of an alert, the device may be electrically disconnected from the operational equipment in a fraction of a second.

The simulator is completely transistorized and modularized, and test points are provided in each modularized sub-assembly for meter or scope analysis. In addition, sufficient organizational level test gear is incorporated into the shelter, which, when used in conjunction with the operational equipment, provides complete overall test capability for the device.

The simulator is equipped with its own PPI scope. During the NORMAL Mode, the operator may simultaneously view the total video display being generated by the device along with the actual video display that appears on the operational PPI. When MTI operation is selected, the clutter on the simulator is eliminated.

When in Target Video Position, all other video is eliminated except the targets. This flexibility permits the operator to check the position of his targets, and the intensity, quality and effectiveness of the various other signals in the course of the problem.

Target simulation is accomplished in a straightforward manner using resolvers, integration and position servos, tachometers, potentiometers.

Input data provides rates and X, Y, Z positions for each target, which are attenuated for range and size. A pulse trigger is supplied by the operational radar or can be generated by the simulator. A phantastron circuit provides the range delay to develop the target echo. The azimuth position of the antenna (or simulated antenna) is compared with target azimuth.

The voltage of coincidence, or near coincidence, is used to control a tube which gates the video signals. The duration of this control determines the beam width. Attenuation is provided for beam power and scintillation effects are introduced.

Various forms of jamming are provided to simulate the operational environment. The jamming is introduced at a level where it provides maximum training for the radar operator and fully exercises the equipment capabilities. Each jamming unit is constructed in modular form so that different types of jamming may be substituted.

The jamming signals are modulated by an antenna pattern before they are mixed with target video. The pattern defines the location and strength of side lobes. If the jamming is strong enough and near enough to the receiver, it will appear in the side lobes of most radars in use today.

A graph of the antenna gain characteristic throughout 360° in azimuth provides the basis for the construction of an antenna pattern modulator. A tapped carbon potentiometer is used to develop an electrical analog of the antenna gain characteristics.

Antenna azimuth is compared to target azimuth in an electrical differential and the resultant difference controls a servo which positions the antenna pattern potentiometer shaft. An antenna pattern modulator is provided for each target and each standoff jammer.

The jamming equipment in this device is the most sophisticated that has been developed to date for a particular application. The types of jamming have been carefully selected and are designed to meet the most stringent military requirements.

Power of the radiating sources can be regulated to conform to the strength of known jammers. When the radar operator de-tunes to escape the jamming, the action is detected, and after an appropriate delay the jamming returns to plague the operator. Other special techniques are used to confuse the operator by providing false intelligence to the radars.

Clutter is developed by using a slide of a typical clutter pattern. A modified vidicon camera, having a PPI type scan and synchronized with the PPI sweep, picks up the clutter display and injects it into the video circuitry.

Window chaff is similarly developed. However, instead of a slide, a memory tube is used on which target video is painted. A modified vidicon camera, synchronized with the PPI sweep, picks up the window display and injects it into the video circuitry. Corridor sowing may be simulated by moving the target across the PPI during a continuous drop period. Decay of the window can be brought about by gradually decreasing the intensity of the memory display.

The ability of the device to create any degree of environment for fire control operators is unparalleled. It will provide this environment regardless of weather, hour of day, complexity of training or tactical situation desired. Training can proceed without the necessity of targets of opportunity.

Perhaps one of the most unique and valuable advantages of the 3G36 Trainer will be its ability to provide electronic countermeasures training in overseas areas. The internal method of generation of these signals guarantees that there will be no interference with commercial broadcasts, aircraft controls, or military radars.

Radar operators can practice antijamming techniques virtually in the shadow of the enemy's radar equipment, and never compromise the character or effect of our own highly classified jamming capabilities, or run risk of being accused of a hostile act.

Training statistics, based on as few as two weeks of training on the 3G36 Device, show that students become considerably more proficient in their operational tasks, reduce their reaction times, and significantly increase their knowledge of crew drill.

Hawk Launcher and Missiles

Working Relationships in the Management of DoD Technical Data and Standardization Programs

(For Story, see page 1)

ASD I&L)

DDDR&E

Paul R. Ignatius

Technical Data and Standardization Policy Council

Working Group of the Council

Dr. Eugene G. Fubini

DDDR&E (A&M)

Director of Technical Data & Standardization Policy

Lt Gen Wm. J. Ely

Command line

Coordination line

Dir. Tech Data & Stdzn Policy	Dep Asst Sec Equipt Main & Bad	Dep Asst Sec Procurement	Dept Asst Sec Sup & Svs	Director Tech Info	Asst Dir Eng Mgt
					
Brig Gen A. T. Stanwix-Hay	George E. Fouch	Graeme C. Bannerman	Paul H. Riley	Walter M. Carlson	James W. Roach
Objective Planning Data Acquisition Policy Training in Tech Data Management Technical Manuals Standardization Data Utilization Policy Specification Management (M200 including Specs and Standards: Coord. Procedures, Rev. and Updating, Simplification, Spec and Indexing, etc.)	Quality Control (Specifications and Standards) Reliability Aspects of Specifications Standards of Productivity (Technical Data)	Data Procurement Policy Rights, Methods and Procedures of Data Procurement Under ASPR	Cataloging Item Entry Control Item Reduction (Supply Simplification) Supply Management Provisioning	Data Systems Planning Data Storage and Retrieval Data Exchange Data Communications Data Element Standardization Data Input Procedures Technical Information Offices Information Analysis Centers R&D on Data and Information Systems	Technical Content (Specifications, Drawings, etc.) Design Standards (Design Criteria, Engineering Practices, Environmental Criteria, Preferred Parts Lists, Design Guides, etc.) General Specifications for Design Test Standards Waivers and Deviation