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Regulation Establishes Career Management Plan For Scientists, Engineers

An Army Civilian Career Program for Scientists and Engineers became a prescribed management responsibility with the issuance early in June of Civilian Personnel Regulation 950-18.

The regulation provides that a central inventory file of Qualification Records Cards and initial Career Appraisal Forms be completed by field activities and submitted to the Office of the Deputy Chief of Staff for Personnel by Aug. 1, 1965. Mandatory referral requirements specified in the program will become effective Oct. 1.

Possibilities of using the TEL/TIPS (Technical Effort Locator/Technical Interest Profile System), developed as one of the major efforts in the Army Scientific and Technical Information Program, were presented to officials concerned with the new program at a recent briefing at the U.S. Army Research Office.

Established on the basis of information gathered in a year-long on-site survey of the Army's total STI resources, TEL/TIPS is designed to provide complete information on scientific and technical personnel.

Present for the briefing, which was followed several days later by a

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Report Covers Army In-House Labs Survey

Significant improvement in the quality of professional staffing and a substantial reduction in turnover are positive trends among scientists and engineers reflected by findings of a survey at 18 U.S. Army in-house laboratories.

The survey was conducted by the field organization of the Office of Civilian Personnel (OCP), U.S. Army Deputy Chief of Staff for Personnel (DCSPER) from August 1964 through April 1965.

The overall survey coordinator was Edwin Steiner, in charge of the OCP San Francisco field office.

Questionnaires were filled out by 2,427 Army research and development scientists and engineers, and in-depth interviews were conducted with 287 managers and supervisors. The sampling represented about 25 percent of the 10,000 total scientist-engineer R&D work force at Army in-house laboratories. Similar surveys were conducted in 1956 and 1959.

The purpose of the survey was to follow up on problems reported in the earlier studies as regards the effective utilization, direction, and recognition of scientific personnel. The survey also concentrated on such areas as supervision, management, communications, working conditions and facilities, training and development.

Noted among the findings is that 91.8 percent of the professional staff now have a college degree, compared with 85.4 percent in 1956, including

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General Johnson to Address Human Factors Conferees

(See story on page 4)

U.S. Army Chief of Staff General Harold K. Johnson

NSF, NIH, DoD Fund National Chemical Data Effort

Presidential Science Adviser Dr. Donald F. Hornig's announcement this month of a $2,043,600 contract for a 2-year experimental program to develop the basis of a national chemical information system may be traced to an Army-developed concept.

Funded jointly by the National Science Foundation, the National Institutes of Health and the Department of Defense, the contract turns over to the American Chemical Society's Chemical Abstract Service (CAS) the task of developing the program.

Background buildup for this action was initiated by the Department of the Army in a Scientific and Technical Information Program offered to the Director of Defense Research and Engineering in January 1963 for incorporation into the DoD program.

Following DoD approval of the Army program, which included 23 tasks projected by an Ad Hoc Study Group, the Director of Army Technical Information proceeded with development of the Army Chemical Information Data System (CIDS) as the first of a series of systems planned to serve the major scientific disciplines.

The CIDS Program was explained Sept. 17, 1963, at a briefing of 275 industrial leaders conducted by the Scientific and Technical Information Division, U.S. Army Research Office. The possibility of a computer-based registry system for chemical compounds, one of the objectives of the

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Featured in This Issue . . .

Army R&D Newsmagazine

Vol. 6, No. 7 July 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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Resor, Hawkins Address ASAP Meeting

Presentations by Secretary of the Army Stanley R. Resor and Assistant Secretary of the Army (Research and Development) Willis M. Hawkins highlighted the June 17-18 meeting of the Army Scientific Advisory Panel at Fort Bragg, N.C.

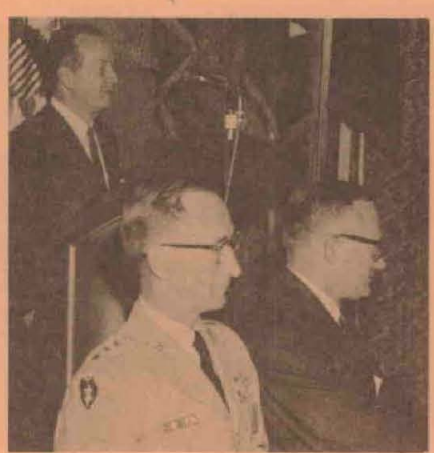
The U.S. Army John F. Kennedy Center for Special Warfare, Fort Bragg, was host for the meeting. Participants were welcomed by Brig Gen Robert R. Linvill, chief of staff, 18th Airborne Corps, representing the CG, Lt Gen Bruce Palmer, and Col William P. Grieves, acting CG.

Secretary Resor stressed the theme of the Army's new concept in air mobility. He discussed in detail the tremendous strides the Army has made in air mobility and the composition and capabilities of the new 1st Calvary (Air Mobility) Division.

Secretary Hawkins reviewed the current spectrum of Army R&D activities in his classified presentation.

Six members of ASAP and 15 consultants new to the Panel were sworn in June 18 by Lt Col Kenneth R. Bull, outgoing executive secretary of ASAP. Maj Donald E. Rosenblum is his successor and Capt Arthur E. Dewey is the new assistant secretary.

The ASAP is presently comprised of 18 appointed members, backed up by 44 consultants in various special fields of research and development. Dr. Finn J. Larsen, vice president for Research, Honeywell, Inc., and former Assistant Secretary of the Army (R&D, is chairman and Dr. Harold M. Agnew, of the Los Alamos Scientific Laboratory, is vice chairman.



CHIEF OF R&D Lt Gen William W. Dick, Jr., and Secretary of the Army Stanley Resor listen to presentation by Assistant Secretary of the Army (R&D) Willis Hawkins (background) during ASAP meeting at Fort Bragg.

ASAP, the senior scientific advisory group for the Department of the Army, meets annually with its consultants. Members of the Panel, chosen from among the Nation's industrial and academic scientific leaders, meet three times a year.

Fort Bragg was selected as the meeting site this year to provide ASAP members and consultants with greater insight into the Army's activities and problems in the area of special warfare.

The program included a briefing on the mission and capabilities of the Center, a description of Special Warfare School courses of instruction, an explanation of the medical aspects of counterinsurgency, a presentation on the U.S. Army Combat Developments Command Special Warfare Agency, and the Gabriel Demonstration of special warfare techniques.

Col Bengtson Becomes CO Of 60th Ordnance Group

Col Nils M. Bengtson was recently assigned to command the 60th Ordnance Group, Fort Lee, Va., after serving since October 1962 as commander of the U.S. Army Research Office, Durham, N.C.

Graduated from the United States Military Academy in 1940, he received an M.S. degree from the Massachusetts Institute of Technology in 1948 and a M.B.A. degree at George Washington University in 1962. Since 1957 he has been enrolled in the Research and Development Officer Specialist Program, Department of the Army. He is a graduate of the Command and General Staff College (1945) and the Industrial College of the Armed Forces (1962).

Col Bengtson was on active duty at Pearl Harbor when the Japanese attacked on Dec. 7, 1941. During the final year of the war he served in Europe with the "Rolling W" Div.

From 1952 to 1955 he was United States Representative for Ordnance in the United Kingdom. Later he was liaison officer for the Army on the Navy Polaris Missile Project, and held key positions at the Army Ballistic Missile Agency and Ordnance Missile Command, Redstone Arsenal, Ala.

The U.S. Army Electronic Proving Ground (USAEPG), Fort Huachuca, Ariz., kicked off its Zero Defects Program July 8. Maj Gen Benjamin H. Pochyla, USAEPG commanding general, called upon all employees to do their share in eliminating mistakes. All personnel were asked to sign Zero Defects pledge cards and were given ZD information pamphlets. Guy C. Bevers is ZD coordinator.

Regulation Establishes Career Management Plan

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round-table discussion in depth involving the same personnel, were Dr. Charles Fotis, special assistant for Civilian Training and Career Development Policy, Office of the Secretary of Defense (Manpower), and R. O. Dale Anderson, chief, Employee Management Division, Office, Deputy Chief of Staff for Personnel, Department of the Army.

Others in attendance included W. R. Bruce, chief of the Career Management Branch under Mr. Anderson; Jack Blackburn, deputy to the Director of Training, Office of Civilian Personnel, DCSPER; and Ed Steiner, San Francisco Field Office of OCP, DCSPER, who recently completed a special study of personnel practices at Army in-house laboratories.

More than 24,000 Army civilian scientists and engineers Army-wide and worldwide will be covered under the career management program. A concept since the reorganization of the Army in 1962, the program has been in development for about two years.

Nine occupational fields already under the career-management plan, all programed since 1959, include personnel, administration, comptroller, safety management, supply management, procurement, education and training, equipment specialist, quality control and inspection.

Four additional career programs being planned are manpower management, librarian, recreation specialist, and information and editorial.

The career program for engineers and scientists differs from other established Army-wide programs in the following respects:

- The career program is administered jointly by the Chief of Engineers and the Commanding General of the U.S. Army Materiel Command as separate functional chiefs with distinct areas of responsibility.
- The Army-wide career program is included under one Civilian Personnel Regulation covering the joint responsibilities of the two functional chiefs.
- The complexity of this career program, resulting from the size and variety of disciplines covered, will require special care in the implementation and operation of the mandatory activities.

The U.S. Army Deputy Chief of Staff for Personnel (DCSPER) has responsibility for providing direction, coordination and continuing evaluation of civilian career management in the Department of the Army. More specific responsibility for overall policy surveillance and guidance rests with the Career Management Branch, Employee Management Div., DCSPER.

The Career Program for Engineers and Scientists involves successive career assignments and career patterns, integrated appraisal, counseling and career planning, tailored training and development, and central registration and referral. The program also provides for recruitment at Federal entrance level of GS-5 and above, depending on a person's education and experience.

Career goals and objectives are established with planning to achieve them in an orderly and systematic manner. The payoff element of the program is the central inventory file and referral system, designed to fill vacancies with the best qualified scientists and engineers available Army-wide.

Inherent in the system is a requirement for greater mobility for an Army scientist or engineer seeking rapid advancement in his field or in the area of scientific administration. He must go where the jobs are, whether East Coast, West Coast or overseas. The scientist or engineer indicates his preferred areas of relocation on his Qualification Record Card.

Figures compiled by the Office of Civilian Personnel show that the mobility rate, or the number of civilian employees willing to relocate for career advancement, has increased from 20 percent to 55 percent since initiation of career programs in 1959.

Four broad career levels have been identified with corresponding training and skill development characteristics prerequisite to further advancement. They are junior level (GS-5 through GS-7), intermediate (GS-9 through GS-11), senior (GS-12 through GS-13) and executive level (GS-14 and above).

The characteristic pattern of growth is flexible and changes as the needs of the Army and interests of the careerist change. A wide variety of training and educational opportunities are delineated at each career level. They range from private university courses to middle management and executive seminars, Secretary of the Army Research and Study (SARS) Fellowships, or attendance at a Service College.

Careerists are given the opportunity for rotational assignments and the assumption of supervisory duties as early as possible to provide them with the depth and quality of experience for higher-level assignments.

Careerists under the Chief of Engineers are categorized into 24 occupational specialities, primarily construction types, ranging from hydraulic engineer to cartographer.

Thirty-seven nonconstruction scientific fields come under the responsibility of the Commanding General of the U.S. Army Materiel Command. They range from operations research to parasitology. General, mechanical, electrical and materials engineers, however, may register with both functional chiefs.

The Career Program insures that career appraisal and development plans are documented and reviewed at higher echelons within and outside the agency to which the employee is assigned.

Inventories will be maintained at local activity, command and headquarters levels. Personnel inventory records will be designed to provide information on the best qualified man for a particular vacancy.

Automation, employing new equipment for speedy processing of personnel information where needed, is basic to the program. Advanced mechanical means will be used for personnel record keeping, career field analysis and for preliminary screening of qualified individuals.

Automation might also be used to reduce substantially the number of qualified individuals to be considered for a vacancy. Professional specialists would then further narrow the list to 10 or fewer. From this register, management officials will be free to make selections based on their best judgment in meeting the mission requirements of an activity.

Maximum dissemination will be made of information on career development ladders, opportunities for special training on-the-job or advanced education courses under various Army programs, specialized reading for self-improvement and various other means of encouraging employees to advance their career growth.

COs, Tech Directors to Hold Annual Meeting in September

The third annual Commanders and Technical Directors Conference will be held in September, but dates and location are still to be decided.

Initiated in 1963 as the successor to the Army Key Scientists meetings, the first Commanders and Technical Directors Conference was held at the U.S. Army Combat Developments Experimentation Center, Fort Ord, Calif., May 1-3; the second was at the U.S. Army Natick (Mass.) Laboratories, Aug. 3-4, 1964.

Report Covers Army In-House Lab Survey

(Continued from page 1)

22.2 percent with an advanced degree, a decline from the 1956 figure of 27.6.

Civilian personnel officials expressed concern that the number of scientists and engineers with advanced degrees has declined and recommended accelerated efforts to recruit and retain these personnel.

Seventy-six percent of the scientists, engineers, and managers interviewed, however, expressed confidence that professional staffs are of higher quality than four or five years ago. In addition, the voluntary resignation rate has declined by nearly two-thirds to 4.5 percent.

Surveyors queried the sample group of employees for an explanation of why they think the Army R&D staffs are of higher quality than in 1959. Nearly twice as many attributed the improvement to professional growth on the job as to the infusion of higher quality personnel into the work force. Only a small percentage believed that advanced education courses after employment were a major factor.

Scientists and engineers interviewed, except for those with higher degrees, indicated that improvement of Federal salary scales since the last survey had made their pay much more nearly comparable to that offered by private industry.

Many of those with Ph. D. degrees said higher pay was available elsewhere but indicated more interest in research opportunity than in pay. Scientists and engineers in general also expressed greater satisfaction with administrative and technical supervision.

The survey showed that the number of performance awards received by Army scientists and engineers increased from 94 in 1956 to 823 in 1964. Suggestions submitted doubled in one year from 1963 to 1964. Suggestions adopted and patents submitted and adopted also increased, the survey showed. The number of scientists and engineers honored by presentation of papers at the Army Science Conferences has steadily increased since these meetings were started following the first R&D survey in 1956.

Sixty-six percent of employees sampled expressed satisfaction with publicity received by their installation for scientific accomplishments as compared with 73 percent in the 1959 survey. Reasons reflected at all 10 installations included in previous surveys are: the glamor of earlier achievements has worn off; missions have changed; clearance of technical articles for publication has become more difficult.

In 1959, civilian personnel at three installations expressed dissatisfaction with military supervisors, but military-civilian relationships were not found to be a problem at any installation in the survey this year. In this regard, civilian supervision of R&D activities has become even more general and has been extended to higher organizational levels since 1959.

The questionnaires revealed broad support of the Career Management Program for Scientists and Engineers now being implemented by OCP, DCSPER. Army-wide competition for positions of GS-14 and higher was favored by 70 percent of the sampling and by 81 percent of the manager-supervisor group. On the question of mobility, 68 percent of those queried recognized mobility as an aid to advancement, and 93 percent considered themselves mobile.

The scientists and engineers queried, however, attached certain conditions to the changing of jobs under the career program: 74 percent of the general sampling and 68 percent of the Ph. D. group (151 of the 2,427 persons in the sampling), would consider moving for a promotion; 67 percent of the sampling and 80 percent of the Ph. D.'s would consider changing jobs for a special work challenge: 61 percent and 58 percent of the Ph. D.'s would weigh a special area or climate as a reason for transfer.

Office of Civilian Personnel officials predicted scientist-engineer acceptance of the Career Management Program when its contents are understood, but noted that orientation is a major need since only 37 percent of the sampling knew that the program is being implemented.

Eighty-four percent of those interviewed are satisfied with training and development opportunities and 87 percent agreed that meaningful use is being made of non-Government training facilities.

The theory that the Ph. D. scientists and engineers are a group with unusual motivation was further substantiated by the question, "What do you like most about your job?" Fifty percent of the Ph. D.'s responded "research opportunities," contrasted with only 14 percent of the general sampling. Thirty-nine percent of the total cited "type of work" (Ph. D.'s 9 percent) and 10 percent cited "opportunity for development" (Ph. D.'s 5 percent).

The Ph. D. group (19 percent) also considered meetings and conferences a more important source of new technical information than the sampling (8 percent). Other sources of technical information cited were: on-the-job activities, sampling 67 percent, Ph. D.'s 63; self-development, 19 and 24 respectively; formal study, 13 and 6 percent.

Another matter of concern to OCP officials which emerged from the survey was that only one-fifth of the sci-

Gen Johnson to Address Human Factors Conferees

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U.S. Army Chief of Staff General Harold K. Johnson has accepted an invitation to present the keynote address at the 11th annual Army Human Factors Research and Development Conference, Oct. 3-6, at Fort Bragg, N.C.

"The U.S. Army—A Force for Stability," the theme of the conference, grew out of a thesis by General Johnson, on which he is expected to elaborate.

Sponsored by the Chief of Research and Development, Lt Gen William W. Dick, Jr., who is planning to participate, the Human Factors R&D Conference is designed to improve interchange of information concerning requirements, accomplishments and future plans in this field.

Joint hosts of the conference are the 18th Airborne Corps and the John F. Kennedy Special Warfare Center, Fort Bragg, whose commanding generals will give addresses of welcome.

Indications are that about 250 psychologists, scientists, engineers and top management personnel representative of the Army, industry and nonprofit research firms will participate. The Quadripartite (ABCA) nations and the U.S. Navy, Air Force and Marine Corps also have been invited to take part.

The Special Warfare Center will review current doctrine concerning special warfare missions and will stage its GABRIEL demonstration of special warfare techniques in a simulated setting.

Other general sessions will review ongoing human factors research and provide an indication of its future direction. Research in human engineering and personnel training and selection as they relate to special warfare operations also will be covered.

entists and engineers surveyed understand the local system for selection of people to attend professional meetings and conferences. OCP officials expressed the need for a firm, clear, written policy on this subject for broader understanding among the R&D personnel and better planning by management.

As in previous surveys in 1956 and 1959, problems were reported in utilization of scientists and engineers at their highest skill levels. Employees indicated that they did a significant amount of administrative or lower grade professional work which could be reassigned. Only 24 percent of the sampling gave a positive answer that management has done as much as it could to correct the situation.

Reasons for this attitude cited by OCP officials include a possible lack of continuing emphasis on former special approaches for scientists and engineers; and newer general programs stressing effective utilization of all employees.

The OCP recommended that the new programs be revised, to assure that they promote the best utilization of scientists and engineers, and that a major orientation effort be made to show R&D managers how to use the new general programs to improve utilization.

The Career Management Program is also expected to help alleviate doubts about management's concern for scientists and engineers.

The majority of the sampling indicated eventual receipt of supplies requested, but nearly half of the questionnaire respondents and 66 percent of the Ph. D. group were unhappy about supply delays. Although definite progress has been reported since the last survey, through such innovations as self-service stores, OCP officials feel that there are great opportunities for continued improvement. It was recommended that further study be made by supply experts.

Improvement also has been made in providing better working facilities, but a 40 percent overall satisfactory rating (as high as 50 percent at five of the 18 in-house laboratories) presented a mandate for further progress. OCP officials recalled a thesis of the Skifter Report (an Army Scientific Advisory Panel ad hoc group study of Army R&D laboratories released in 1963) that the Army cannot do first-class work in second- and third-rate facilities.

Personnel completing the questionnaire indicated satisfaction with improvements in housing facilities at isolated installations and with the activities of local civilian personnel offices.

Training and recruitment programs have been tailored to the needs of R&D activities and the new method of evaluating positions for pay purposes in basic and applied research has met with favor. OCP expressed the view that further tailoring of personnel assistance programs to the needs of R&D groups will be forthcoming.

In summary, nine recommendations by the Office of Civilian Personnel grew out of the results of the in-house laboratories survey:

- Renew efforts to improve utilization of scientists and engineers.
- Increase ability to attract and retain those with advanced degrees.
- Improve working facilities.
- Nominate more scientists and engineers for high level awards.
- Enlist further assistance from supply specialists.
- Revise publicity programs concerning Army scientific accomplishments.
- Increase understanding and confidence in selection procedures for attendance at professional meetings and conferences.
- Encourage greater tailoring of civilian personnel programs to the needs of scientists and engineers.
- Orient scientists and engineers to their new career program.

Col McEvoy Assigned as LWL CO; Col Holmes Detailed to Paris

Col Sterling C. Holmes, commanding officer of the U.S. Army Limited War Laboratory, Aberdeen Proving Ground, Md., until he was relieved June 9 by Col Robert W. McEvoy, has reported to his new assignment in Paris, France.

Col Holmes has been detailed to the U.S. Army Missile Command Project Manager's Office, headquartered at Redstone Arsenal, Ala., with duty station at the NATO Hawk Management Office in Paris.

Col McEvoy formerly served as deputy chief of the Environmental Sciences Division, U.S. Army Research Office, Arlington, Va., and also is a former Harry Diamond Laboratories CO.

Army Accepts First of Five Test Models of MICV

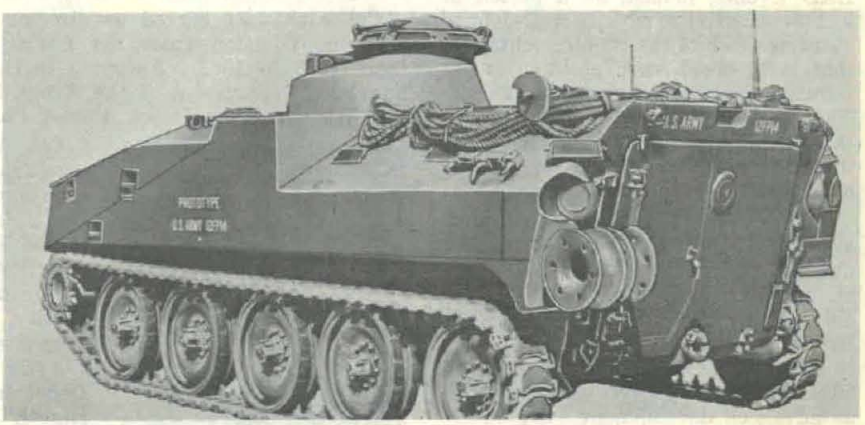
A pilot model of the armored Mechanized Infantry Combat Vehicle (MICV), the first of 5 to be used in testing the concept of an armored Infantry vehicle with increased firepower, speed, range and amphibious capability, was accepted recently by the Army.

Using automotive components already in the Army inventory, the MICV has the same 425 horsepower diesel engine, transmission, and suspension system proven successful in the M107/M110 family of self-propelled artillery.

The MICV will have a top speed of 37 m.p.h. and a maximum range of 400 miles. Firepower includes a cuppola-mounted 20 mm. automatic gun and a 7.62 mm. coaxial light machinegun. Grenade dispensers provide for close-in protection and firing ports in the hull will permit all-around fire by squad members.

The pilot models were designed and fabricated by Pacific Car and Foundry Co. under a $2 million contract awarded by the U.S. Army Materiel Command. The MICV is a project-managed weapon system assigned to the Project Manager for Combat Vehicles, Col Thomas W. Davis, III.

Other weapon systems within the responsibility of the Project Manager for Combat Vehicles are the M109 self-propelled 155 mm. howitzer, M114A1 command and reconnaissance vehicle, and the Interim Vehicle Rapid Fire Weapons System.



MICV (Mechanized Infantry Combat Vehicle) sketch of left rear view shows position of firing ports for riflemen and large rear ramp which enables squad members to embark and disembark rapidly.

Study Report Deals With Department of Defense RXD Policies

"Management Factors Affecting Research and Exploratory Development," is the title of a study report prepared under contract for the Director of Defense Research and Engineering.

Distributed to Defense officials in mid-June, the unclassified study prepared by Arthur D. Little Co. is an extension of a classified in-house laboratory report.

Objective of the study was to "discover circumstances which the Defense Department could manipulate or control which favor the initiation, execution and utilization of research and exploratory development projects."

The Department of Defense, it is explained, is vitally interested in obtaining the greatest possible return from the investment it makes in research and exploratory development. Of the many aspects to the problem, the study explored one, the effect of environment, in an attempt to develop hypotheses which will assist the DoD to increase its effectiveness in the administration of programs.

The study is considered the first step in a broader project to determine successful patterns of research and exploratory development (RXD) in past RXD projects, so that proven techniques and staffing procedures may be applied to present and future RXD programs.

In considering environment, the study included all circumstances which might influence the initiation, execution or utilization of the work. Attention was directed primarily to those factors which might be used constructively as tools in the management of research and exploratory development.

Projects considered were termed RXD Events, defined as a period of technical activity with a well-defined outcome. One of the requirements was that it involved some creative or innovative act; another that it produced an irrevocable or irreversible change in the state of knowledge, in the understanding of what is feasible or how something can be done.

The outcome required for consideration was that the RXD Event influenced the development of a weapon system procured by the DoD for operational use. Eighty-seven such Events were identified and described in the study, including 11 as research, 59 as exploratory development and 17 as advanced development.

The 87 Events took place at 36 different laboratories of the following types: Government laboratory, 3; Government laboratory, university operated, 5; Government laboratory, industry operated, 1; university, 2; industry, 24; research institute, 1.

Most of the research and exploratory development Events were identified in historical studies of six representative weapons systems: Mark 46-0 Acoustic Homing Torpedo; XM-102 105 mm. Howitzer; AGM28 Hound Dog Air-to-Ground Missile; Polaris A-1 Missile; Minuteman Missile; and Sergeant Missile.

The outcome of an RXD Event may have been a progress report, a proposal, a journal article, a patent disclosure or some other document which summarized the information generated in the RXD Event.

It also may have been a verbal presentation, a successful execution of a field test, a consensus in a committee meeting, or some other action not ordinarily conceived of as information-bearing or information-transmitting.

The outstanding quality of the outcome, as determined by the contractor, was that it was the dividing point between the state of knowledge before and after the RXD Event.

The report describes a number of findings resulting from the study. Evidence gathered through analysis of the six weapons systems, for example, disproved the common belief that weapon system development depended on a succession of key events and important technological and scientific breakthroughs. Instead, the surveyors found that successful development resulted from many modest innovations interacting and reinforcing each other.

Further, it was found that RXD is strongly affected by the laboratory director and flourishes in an adaptively organized group. A consensus-collaboration relationship between the group performing the RXD and its sponsor was found in the majority of instances.

One of the important points of utilization of RXD shown by the study is that in most Events, the papers, patents and reports were not important in bringing about the initial utilization. The report expresses the belief that informal communication is as important in effective utilization of exploratory development as it is in the initiation.

The surveys noted that a number of laboratory and management personnel have expressed strong opinion that some exploratory development funds should be made available during weapons systems development.

They contended that if such funds are not provided, an environment is established in which they must choose between neglecting exploratory development which appears to be justified in order to improve the system, or risk proceeding with exploratory development under funding labeled under another category.

If exploratory development advance funds are available, however, improvements can be made in the sec-

Col Alexander Takes Over as USALMC Commandant

Col Joseph Paul Alexander, Jr., has succeeded Col Felix J. Gerace as commandant of the U.S. Army Logistics Management Center (USALMC) at Fort Lee, Va. Col Gerace is now executive to the Assistant Secretary of the Army (I&L) at the Pentagon, Washington, D.C.

Col Alexander served as director of the Center's Logistics Research and Doctrine Division (now the Logistics Research and Doctrine Department) from 1958 to 1961. Assigned to the Office of Personnel Operations, Headquarters, Department of the Army, he left in July 1963 to take command of the Atlanta Army Depot, Forest Park, Ga.

Col. J. P. Alexander, Jr.

Col Alexander graduated from Wofford College, Spartenburg, S.C., in 1938 with a B.S. degree and a commission as a second lieutenant in the U.S. Army. During World War II he served in the European Theater of Operations.

Following a 3-year tour as assistant professor of Military Science and Tactics at Cornell University, he was assigned to the Office of the Quartermaster General until 1953.

After duty as deputy commander at Drew QM Depot in Japan, he was Quartermaster for the Eighth U.S. Army/United Nations Command in Korea. He is a graduate of the QM School, the Command and General Staff College, the Armed Forces Staff College, and National War College.

ond generation of a weapons system which were impossible to correct in the first model.

The study report recommends that the DoD should take the following actions:

- Show substantial interest in and encourage initiation, execution and utilization of modest innovations in management of exploratory development resources and recognize the interrelations of such innovations and military needs.
- Give weight to the reputation of the laboratory director when allocating exploratory development resources; consider training programs for developing those scientists in DoD laboratories who have management potential, as well as attracting as laboratory directors promising young men from circles outside the Government.
- Improve communication of plans, requirements and objectives between DoD top management and in-house laboratory directors.
- Consider means for further encouraging flexibility in the use of exploratory development funds at the local level.
- Insure that initiative for undertaking exploratory work be exercised by people closely associated with those generating the ideas, such as members of the laboratory technical staff and the lab director; commit resources promptly.
- Encourage informal and open communication of needs and progress toward fulfilling goals and adaptiveness in institutions where it supports RXD.
- Stimulate the competition and interplay of ideas and continue support of groups bringing valuable ideas to fruition.
- Encourage organization by tasks or projects, rather than by a stable organization tree, and avoid detailed definitions of scope and method of approach, schedules and organization plans, and other constraints which inhibit free development.
- Simplify RXD administration in order to focus attention on goals that motivate the effort rather than the means of achieving them.

Of the three ways to trigger exploratory development activity, the report points out, the Department of Defense at present systematically exploits only one: allocating resources to look for ideas in order to meet recognized need.

The reprt contends the DoD should also exploit the other two possibilities. First, support should be given to environments which foster creative inspiration, have resources available to exploit new ideas, and which can commit those resources rapidly after exploratory effort and some initial evaluation.

Second, the DoD should spur the advance of weapons technology by better anticipation of its needs and better dissemination of these needs to scientists and engineers with a good command of current technology—those who operate in an environment conducive to creative work and who can command resources to evaluate and execute their ideas.

In any case, the report proposes, the Department of Defense should encourage the conjunction of the three essential elements: need, idea source and commitable resources.

CRDL Employee Gets State Post

Edmund H. Schwanke, chief, Technical Information Division, U.S. Army Chemical Research and Development Laboratories, Edgewood (Md.) Arsenal, was recently appointed a trustee of the Harford County (Md.) Board of Education

Maryland Governor Millard H. Tawes chose Schwanke from among 10 nominees. Associated with the Army's chemical R&D program for 24 years, as a civilian and as a World War II Army Officer, he is listed in American Men of Science and is a past president of the Edgewood Arsenal chapter of the Armed Forces Chemical Association.

Geographical Society Honors Late Dr. Klimm, ASAP Member

A fellowship in geography to honor the late Dr. Lester E. Klimm, the first chairman of the Environmental Subpanel of the Army Scientific Advisory Panel, has been established by Geographical Society of Philadelphia.

Dr. Klimm chaired the ASAP subpanel from 1958 until his death in 1960 and was a member of the faculty of the university for 36 years, during which he achieved recognition as one of the Nation's leading geographers.

The Lester E. Klimm Fellowship in Geography will be awarded annually to an outstanding student doing graduate work in geography at the University of Pennsylvania. The award will carry a stipend of $2,000 when accompanying a university scholarship that grants free tuition.

The first award has been made to Miss Cynthia Levin of Middlesex, England. Interested applicants may write for details regarding the award to Gerald J. Karaska, The Wharton School of Finance and Commerce, University of Pennsylvania, Philadelphia 4, Pa.

Army Contractor Develops Morse Code Translator

A miniaturized Morse code translating device which can be plugged into any Army radio has been developed under contract with the U.S. Army Electronics Command Laboratories, Fort Monmouth, N.J.

The translator, about the size of a pack of cigarettes and weighing less than a pound, converts code dots and dashes into letters and numerals at the rate of 10 to 20 words per minute.

MORSE CODE translator that converts Morse Code into letters and numbers is demonstrated by Sp/4 Richard Hoffman. The translator, shown in the foreground at the right, is designed for use in any Army radio.

A display panel consisting of 17 tiny lamps forms one letter at a time as the coded message is received. An operator untrained in Morse code can receive coded transmissions by copying the letters in the sequence in which they appear.

Because the translator must distinguish between Morse code dots and dashes and determine the spaces between characters, it has been called the world's smallest computer. It is about the size of a pack of cigarettes (2⅞ x 2⅞ x 1¼ inches) and weighs less than a pound.

The device contains 350 diodes, 75 transistor circuits and is powered by a self-contained battery pack. Because of the electrical circuitry the translator has only one moving part—the on and off switch.

A distinct advantage offered by the use of the translator is that transmissions which formerly had to be sent by voice can be sent and received by an operator not trained in Morse code. Coded messages, of lower wave frequencies and less erratic than voice transmissions, can usally cover greater distances and are better able to penetrate jungle foliage.

The translator was designed and built by Regency Electronics, Inc., Indianapolis, Ind., under technical direction of the Electronics Command Laboratories.

Recommendations on Support Services Management Approved

Report recommendations of a special study designed to improve management of military support services, involving about $8 billion annually, were approved June 9 by Secretary of Defense Robert S. McNamara.

Dozens of varied functions from housekeeping services to overhaul of combat vehicles are included in the general area of support services. They are performed worldwide by Department of Defense personnel (57 percent) and contract employees (43 percent).

The study, which began Sept. 11, 1964, covered three basic areas: contract technical personnel services; all other support services; and contractor acquisition of electronic data processing equipment by purchase or lease.

The first recommendations to be implemented involve use of contract technical personnel services. Contract technical personnel are employees of industrial or commercial organizations who assist Defense personnel in the operation, maintenance and training requirements for weapons, equipment and systems.

The study concluded that the objectives of improved military readiness and economy both can be realized by a change in management approach. Specifically, it recommended immediate elimination of contract technical personnel when such use is inconsistent with Civil Service laws and regulations.

The study identified 7,000 man-years of such contractor services being performed at an annual cost of approximately $117 million. To the extent that such personnel become, in practice, a part of the Defense work force under the supervision of Defense personnel, their use is inconsistent with Civil Service laws and regulations which prescribe when Federal positions should be staffed through normal Civil Service procedures for filling Government jobs.

From the standpoint of military readiness, it also is important to insure that Defense personnel become capable of operating and maintaining weapons and equipment deployed with operating forces at the earliest feasible time in the life cycle of the weapons, the study observed.

The Military Departments are preparing detailed plans for the orderly conversion of contractual technical support effort to Department of Defense in-house effort in cases where it is considered necessary or desirable. A substantial portion of the 7,000 man-years of technical personnel services will be converted, beginning in Fiscal Year 1966.

Conversion of technical personnel services will be deemed necessary when they are determined to be inconsistent with Civil Service laws and regulations, and it will be considered desirable when it is technically feasible, improves military readiness and is economical.

This conversion effort will not terminate the essential flow of technical data from Defense users to producers of equipment which is necessary to future product improvement and performance analysis during the early operational phase of newly delivered equipment.

Recommendations of the report do not apply to field service representatives who as contractor employees provide liaison service between companies and Defense users of industrial products.

Secretary McNamara also directed that industry representatives be given an opportunity to review and comment upon applicable Defense directives and regulations prior to their issuance, including continuing monitorship by the Defense Industry Advisory Council.

Plans for implementation of the portions of the study report which relate to support services and electronic data processing equipment have not been firmed up.

The study was directed by a steering group chaired by Paul R. Ignatius, Assistant Secretary of Defense (Installations and Logistics). The group included Solis Horwitz, Assistant Secretary of Defense (Administration); Norman S. Paul, Assistant Secretary of Defense (Manpower); Charles J. Hitch, Assistant Secretary of Defense (Comptroller); Lt Gen William J. Ely, Deputy Director of Defense Research and Engineering (Administration and Management); the Service Assistant Secretaries for Installations and Logistics, and personnel heads of each Service.

Representatives of the Bureau of the Budget and the Civil Service Commission participated in steering group meetings.

The study was conducted by a staff of 30, including clerical help, directed by Robert C. Moot, Acting Deputy Assistant Secretary of Defense for Logistics Services. The staff consisted of military and civilian personnel from the three Military Departments and members traveled all over the United States, visiting 130 installations. The European and Pacific Theaters were included in the study.

When the study was initiated, Secretary McNamara directed the study group to:

"Determine where greater use of contractual support would be a more economical means of performing commercial and industrial type functions which are available on a competitive basis from private enterprise.

"Determine where the use of contract support should be terminated because the cost of such service is in excess of that of performing the service internally, or because the use of contract support may be inconsistent with military readiness objectives, or Civil Service laws and regulations."

Other functional areas of the total $8 billion annual support services budget will be studied progressively under a new program of continuous review of cost-effectiveness. The review, carried on in a 3-year cycle, will utilize cost guidelines developed during the study and is expected to result in more efficient performance.

Army Procures 500,000 Pairs of Natick-Developed Boots

Procurement has been initiated for more than 500,000 pairs of a tropical combat boot developed by the U.S. Army Natick Laboratories and adopted by the Army. The boot also will be used by the U.S. Marine Corps.

Termed "the best boot the Army ever issued" by military personnel returning from Viet Nam, the new footwear involved several years of research, development and extensive field testing prior to adoption. Particularly well received was the traction-type sole providing for greater footing on slippery jungle trails.

SARS Fellowships Open Opportunities in Europe For 3 Army Scientists

Secretary of the Army Research and Study (SARS) Fellowships will enable three Army in-house laboratory scientists, each carefully chosen for notable achievement as well as for future potential service to the Army, to begin this summer a year of study of Europe.

Winners of one of the most coveted awards available in the Federal Civil Service career program for scientists and engineers are Dr. Henry P. Kalmus, Harry Diamond Laboratories, Washington, D.C.; Dr. John G. Kapsalis, U.S. Army Natick (Mass.) Laboratories; and Dr. Frederick Rothwarf, Frankford Arsenal, Philadelphia, Pa.

Dr. Kalmus is chief scientist and associate technical director of the Harry Diamond Laboratories. Backed by 17 years of Government career service, he has received numerous honors, including two gold medals for Exceptional Civilian Service and a Fellowship in the Institute of Radio Engineers.

In 1964, Dr. Kalmus was nominated by the University of Michigan College of Engineering for a Rockefeller Public Service Award, for which he was supported by a number of laboratories and industrial firms. This recognition was based on his more than 40 patents and some 20 technical publications in the fields of electronics and physics.

Creative thinking has been evidenced throughout Dr. Kalmus' career. Coworkers at the Harry Diamond Laboratories, including Technical Director B. M. Horton, Associate Technical Director Dr. Maurice Apstein and Associate Director H. W. Sisco have cited among his notable achievements:

Conception of the well-known "cigarette fuze," many applications of frequency modulation to measurements of speed and distance and to sophisticated fuze circuitry, and the design of a novel method of measuring the acceleration of gravity which earned him a prize from the Gravity Research Foundation, New Boston, New Hampshire.

Elevated to the peak of the Federal scientific career service as a PL-313 employee in 1959, Dr. Kalmus served as an engineer with various radio corporations before joining the Ordnance Electronics Division, National Bureau of Standards in 1948.

Born in Vienna, he was graduated from the Technical University of Vienna and his SARS study schedule calls for research there with Prof. Konig. In Italy he will study and do research at the University of Florence with Profs. Sansone and Conti, while in Germany he will visit laboratories of the Institute of Applied Mechanics, Technical University, Darmstadt, and consult with Prof. Karl Klotter.

Dr. F. Rothwarf

Dr. J. G. Kapsalis

Dr. H. P. Kalmus

One of Dr. Kalmus's major areas of professional interest is the mathematics of nonlinear systems. He will work in this field during his SARS Fellowship with Prof. J. K. Hale of Brown University, Providence, R.I. Most of his research will be centered around the development of inexpensive, rugged and small-size oscillators and amplifiers.

DR. JOHN G. KAPSALIS, chief of the Food Biochemistry Section, Food Division, Natick Laboratories, will spend his SARS Fellowship year studying "Relationships Between Water Vapor Equilibrium and Macroscopic Textural Parameters in Freeze-Dried Meat."

Dr. Kapsalis, at 31, is regarded as one of the brilliant young scientists in the Army career service. He is 28 years the junior of Dr. Kalmus, a fact indicative of the Army philosophy that matured and accomplished scientists may present as promising a potential for future service as much younger men. Dr. Frederick Rothwarf is a SARS Fellowship winner at 35.

Dr. Kapsalis became an Army scientist in 1960 with the Food and Container Institute in Chicago, Ill., after post-doctoral studies at Ohio State University. While serving there as an assistant professor, he pursued his research interest in food science and developed a "Consistometer," an advanced instrument now internationally known in texture research on milk.

Since an important area of Army interest in food research is the development of means of identification, objective measurement and improvement of the textural quality of dehydrated rations, Dr. Kapsalis' SARS Fellowship project has special significance.

The SARS project will deal with the combined basic interrelationships of the moisture sorption isotherm and of the rheological properties of foods. Dr. Kapsalis will study with noted food research scientists at institutions in Sweden, Denmark, Holland, England, Scotland, West Germany and Switzerland.

Winner of a Fulbright Fellowship among a number of academic honors, Dr. Kapsalis received B.S. and M.S. degrees in agriculture and chemistry from the College of Agriculture at Athens, Ala., and a Ph. D. in food science from Texas A&M University. He also did post-doctoral research at Roosevelt University in Chicago as well as at Ohio State University.

DR. ROTHWARF will spend from August 1965 to September 1966 at the University of Paris studying and doing research with Prof. P. G. de-Gennes of the Solid-State Physics Group. Studies will focus on electron-electron interactions in superconducting and normal metals.

Employed at Frankford Arsenal as a physicist since 1956, he has been assigned to the Physics Research Laboratory. For the past several years his principal research activities have been concerned with several aspects of superconductivity. He has had responsibility for establishment of the Low Temperature Physics Laboratory and its research programs.

Predominantly dealing with the physics of metals at low temperatures, Dr. Rothwarf's studies have included transport effects, magnetic behavior and optical properties of various alloy systems.

After studying at the University of Delaware from 1947-49, he transferred to Temple University to earn A.B., A.M. and Ph. D. degrees in physics. From 1960 through 1964 he took postdoctoral courses at the University of Florida, Massachusetts Institute of Technology, University of Pennsylvania and Univ. of California.

President Names Resor As Successor to Ailes; McGiffert Under Secretary

Only three months after he took over from Paul R. Ignatius as Under Secretary of the Army, Stanley R. Resor was nominated by President Johnson to succeed Stephen Ailes when he retired July 1 to return to private law practice.

David E. McGiffert, 39, assistant to the Secretary of Defense (Legislative Affairs) since August 1962, became the new Under Secretary of the Army. Earlier, W. Brewster Kopp, also 39, was sworn into office as Assistant Secretary of the Army for Financial Management.

Characterized in an Associated Press account as "a man of keen analysis and hardy action . . . an acute thinker and a doer" and by his longtime law partner, D. Bret Carlson, as "a prince among men," Resor is a tall, sandy-haired lawyer who practiced in New York for the past 19 years.

Mr. Resor is a graduate of the Grotun School, Yale University, and Yale Law School. He majored in government at Yale, where he received an A.B. degree in 1939 along with a commission as a second lieutenant in the Field Artillery Reserve.

During World War II, he served with the Army from February 1942 to January 1946. In the European Theater of Operations, he participated in the defense of Bastogne during the Battle of the Bulge. He achieved the rank of major and was awarded the Silver Star, Bronze Star, Purple Heart, and his unit received the Distinguished Unit Citation.

Returned to the U.S. in October 1945, Mr. Resor reverted to inactive service in January 1946. In 1955 he became a partner in the New York City law firm of Debevoise, Plimpton, Lyons and Gates, specializing in corporate law. He is a member of the American Bar Association and the Bar of the City of New York.

Mr. McGiffert served as a special assistant to the Assistant to the Secretary of the Defense (Legislative Affairs) for a year before his elevation by Secretary McNamara in August 1962.

Other experience of the new Under Secretary of the Army includes eight years with the Washington, D.C. law firm of Covington and Burling (1953-61), except for a year's absence in 1956 as a lecturer at the University of Wisconsin Law School.

A native of Boston, he graduated from Harvard College with an A.B. degree in 1949, attended Cambridge University in 1950 as a recipient of the Lionel de Jersey award, and received an LL.B. degree in 1953 from the Harvard Law School. Mr. McGiffert served in the U.S. Navy during World War II.

Secretary of the Army
Stanley R. Resor

Under Secretary of the Army
David E. McGiffert

Assistant Secretary of the Army for Financial Management Kopp, a native of Rochester, N. Y., received his A.B. degree in economics in 1946 from Harvard University and an M.B.A. degree from Harvard in 1949.

From 1946-51, he was an investment securities analyst, followed by three years as an industrial financial analyst with the Standard Oil Co. of Ohio and the Continental Can Co., specializing in analysis of operations, budgets, management reporting and financial public relations.

In 1954 he joined the American Can Co. and was responsible for the introduction of a comprehensive planning and control program in the manufacturing plants known as "Profit Planning."

Four years later he became manager of Financial Analysis, concerned with administration of the financial control system and analysis of all company operations. Appointed corporate manager of Financial Planning and Budgets of American Can in 1962, he was named comptroller of the Glass Division in 1964.

Maj Hylton Earns Doctorate

The degree of doctor of science in pathology was awarded June 8 at Johns Hopkins University, Baltimore, Md., to Maj Alvin R. Hylton, assistant to the director of Biological Research, U.S. Army Biological Laboratories, Fort Detrick, Md.

His doctoral dissertation was on "Extrinsic and Intrinsic Factors Associated with Longevity and Aging in Adult Mosquitoes." Maj Hylton received his B.S. degree in bacteriology from Iowa State University. From August through December, he will attend the Command and General Staff College, after which he will be assigned to the U.S. Army Research Office, Arlington, Va.

Distribution Procedure for R&D Newsmagazine Outlined

ALL REQUIREMENTS for the Newsmagazine must be stated by filling out a Department of the Army Form 12-4. Provided the unit or installation to which the requesting office or individual is assigned has an account established at the U.S. Army AG Publications Center, 2800 Eastern Boulevard, Baltimore, Md. 21220, the DA Form 12-4 should be mailed to that address.

In the event an account must be established, DA Form 12 (May 1, 1964) should be filled out and submitted with the DA Form 12-4. Both of these forms are available in the installation or unit publications stock room and may be obtained upon request to the publications officer. Complete guidance on how to fill out both forms and submit them is provided in DA Pamphlet 310-10, May 1964.

Distribution of the Army R&D Newsmagazine on an individual name basis is restricted to members of the U.S. Army Atomic Energy and Research and Development Officer Specialist Programs, and to members of the U.S. Army Reserve R&D Unit Program. Otherwise, distribution can be made only to the Army installation, office or organizational element to which the requester is assigned.

Changes of address for AE and R&D Office Specialist Program enrollees should be addressed to: ECP, OPD, Office Personnel Operations, Washington, D. C. Reserve R&D Unit members should contact: Special Assistant for Reserve Affairs, OCRD, Department of the Army, Washington, D. C.

Individuals having questions about how to obtain the Newsmagazine regularly should contact their installation or office publications officer. It is his responsibility to insure that an adequate supply is obtained and is promptly and properly distributed upon receipt.

2 Innovations Ease Design Problems for Mine Fuzing Systems

Solutions to multiple problems in design of mine fuzing systems have been facilitated by a Magnetic Latitude Simulator (MLS) and an Automated Magnetic Data Acquisition System (AMDAS).

Scientists at the Army's Harry Diamond Laboratories, Washington, D.C., announced the new system in mid-June. August 1965 is the target date for active use of the MLS equipment now being produced at Aberdeen Proving Ground, Md., under a competitively awarded contract. AMDAS is scheduled for completion in November.

Designers of mine fuzes and mine fuzing systems for use against military vehicles have long been plagued by the time-consuming necessity of manually collecting, plotting, analyzing and transposing into meaningful form massive amounts of magnetic signature data. Thousands of readings had to be taken to construct charts of a "contour map" nature and the element of human error was always present. Only one direction was plotted at a time and data from only one magnetic latitude was being considered.

The first step of the new development is the Magnetic Latitude Simulator, capable of neutralizing the earth's magnetic field and of superimposing any ambient magnetic field that might exist anywhere else on the earth.

The MLS permits measuring of the magnetic characteristics of military vehicles and the field testing of fuzes and fuze systems at any given magnetic latitude, going N, E, S or W.

The equipment has a diameter of 80 feet, with overhead coils approximately 23 feet above ground and underground coils extending to a depth of about 13 feet.

The second step was to develop equipment to be used in conjunction with the MLS so that measurement readings could be taken automatically. That instrumentation is the Automated Magnetic Data Acquisition System (AMDAS), developed by Kenneth Zastrow, electronic scientist, Philip Winter, physicist, and James Richardson, mathematician.

The AMDAS will record on punched paper tape the vast quantity of test data that previously had to be hand recorded. That tape can then be machine-run to provide information about any characteristic of the magnetic signature of any type of military vehicle anywhere on the globe.

HDL designers of the combined systems expect them to be fully operational by the end of 1965.

HumRRO Study Predicts Behavior in Nuclear Warfare

U.S. Army General Staff representatives were briefed recently on likely psychological reactions of military and civilian personnel to nuclear warfare by Dr. Robert Vineberg of Human Resources Research Office.

The analysis was performed by HumRRO as an Army contract agency of George Washington University, Washington, D.C., and as a special project of the Director's Office. It will be published soon as HumRRO Technical Report 65-2.

The purpose was to draw together information that might provide a basis for predicting human behavior in nuclear warfare, with the aim of possible preparation for such warfare and predicting psychological casualties.

Since a nuclear war has not been experienced, Dr. Vineberg used data from other extreme stress situations. They included conventional warfare, personal tragedy situations such as mourning, parents of children with fatal diseases, and patients who face major surgery or terminal illness.

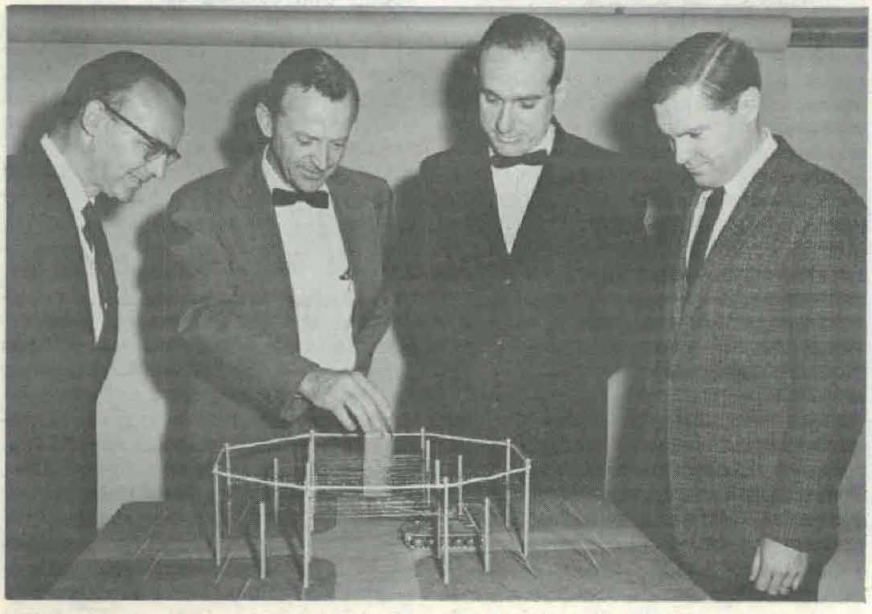
Evidence collected indicates that men are able to tolerate the entire range of stress situations including those of inevitable death. They perform remarkably well, maintain themselves and fight, but are certain to suffer psychological breakdown if combat is severe enough or prolonged indefinitely.

The HumRRO technical report contains certain recommendations for preparing men for nuclear combat based on the knowledge of: a soldier's realistic appraisal of the situation; likely consequences of alternate courses of action; and skills of most use in facing the situation.

Training would include psychological preparedness through simulation and rehearsal of anticipated events; also, the acquisition of skills which most effectively can be used to exert some measure of control over the environment or situation. Such training would be intended to instill confidence.

Dr. Vineberg contends that soldiers probably will be better able to sustain themselves psychologically under stresses of nuclear warfare than civilians because of nuclear survival training, psychological security of the squad or platoon, and because soldiers would generally be able to take some form of direct action against the threat. Since action reduces stress, the HumRRO report explained, it is of positive psychological value.

The Vineberg report, "Human Factors in Tactical Nuclear Combat," also contains a mathematical model for estimating casualty rates of psychological attrition on the battlefield.



MAGNETIC LATITUDE SIMULATOR (scale model) is viewed by Harry Diamond Laboratories developing team (l. to r.) James Richardson, Kenneth Zastrow, Philip Winter and branch chief Tomas Tuccinardi.

Missilemen Evaluating SAM-D Air Defense Concept

SAM-D, a new Army air defense concept aimed at high performance aircraft and certain types of ballistic missiles, is being evaluated by high-ranking materiel experts at the U.S. Army Missile Command, Redstone Arsenal, Ala.

Three contractors have been conducting trade/off system definition studies in support of the SAM-D (Surface - to - Air - Missile - Development) program. Their weapon concepts are intended for eventual replacement of Hawk and Nike Hercules systems now used by the Army.

Backed in their evaluation by laboratories of their respective commands, more than 150 Army missilemen will select a basic missile concept which most nearly meets Army air defense requirements as advanced as the state-of-the-art permits to meet changing battlefield threats.

Recommendations will be forwarded to the Defense Department, requesting initiation of a Project Definition Phase which could lead to subsequent development of the system.

The Army has conducted experiments for the past year on high technical risk items in support of the development objective of a highly mobile surface-to-air missile system that will travel with Army troops on the battlefield and be capable of engaging several targets simultaneously.

Contractors participating in the studies are Hughes Aircraft Co., Radio Corporation of America and the Bell Telephone Laboratories.

The evaluation group includes representatives from appropriate commodity commands of the U.S. Army Materiel Command, the Combat Developments Command (CDC) and consulting firms such as Defense Research Corp., American Research Corp., and Stanford Research Institute.

Col Glenn Crane, special assistant to the deputy commanding general of Air Defense Systems at the Missile Command, is chairman of the evaluation committee. Other members include Charles A. Cockrell, chief of the SAM-D Commodity Office; Harry F. Vincent, technical assessment; William C. Wall, Jr., program estimates; and Robert Orr, cost effectiveness. CDC's Air Defense Agency unit is under Lt Col Wallace N. Fluckey.

U.S. Agrees to Production Of UH-1D in German Plant

The U.S. Army's UH-1D Helicopter, developed in the United States at a cost of about $60 million, will be produced in Germany under an agreement announced June 2 by the U.S. Department of Defense and the German Ministry of Defense.

The production agreement calls for approximately 80 percent of the direct manhours of production to be performed by German industry. The German prime contractor is Dornier Werke. Other participating firms will be Messerschmidt-Heinkel and Siebelwerke and the U.S. companies, Bell Helicopter and AVCO (Lycoming).

The UH-1D can transport 15 persons or up to two tons of cargo under all temperature extremes found in middle Europe. The craft recently established 21 new world records, including speeds of up to 284.5 kilometers per hour, distances up to 2,600 kilometers, climbs to 10,700 meters.

The UH-1 series is now in service in 17 nations around the world.

Defense Documentation Center Charter Revised

The official charter of the Defense Documentation Center (DDC) was revised recently to clarify Department of Defense responsibilities for DDC management and slightly enlarge the area of DDC activities.

Issued by Dr. Harold Brown, Director of Defense Research and Engineering (DDR&E), the revised charter reflects changes which have occurred since DDC was created two years ago from the Armed Services Technical Information Agency.

DoD Instruction 5100.38, issued on Mar. 29, 1965, specifies that policy direction of DDC remains with DDRE&E, where the primary responsibility is delegated to the Director of Technical Information, Walter M. Carlson. Operating control of DDC is assigned to the Defense Supply Agency, to which DDC was transferred on Nov. 1, 1963.

The revised Instruction also directs the DDC Administrator, Dr. Robert B. Stegmaier, Jr., to undertake an active program to acquire technical reports produced in DoD's research and development projects.

The previous charter merely specified that DDC was to receive the reports when submitted. DDC is authorized to provide facilities for storage and retrieval of classified documents requiring special access, whenever it becomes desirable to provide a central service for such reports.

Provision also has been made for eliminating five statements previously used to control distribution of reports submitted to DDC and to substitute the use of six distribution statements authorized in the new DoD Directive 5200.20, issued concurrently with the revised DDC charter.

Army Scientist Gives Paper On Electrodeposits to Steel

Arthur Zavarella, chief of the Materials Research Laboratory, Springfield (Mass.) Armory, presented a technical paper before members of the 52nd Annual Convention of the American Electroplaters' Society July 15 at New York City.

"Adhesion of Chromium and Other Electrodeposits to Steel" described a new rotational technique for spin testing the adhesion of metal coatings to steel in vacuum. It also outlined the Springfield Armory results in qualitative measurements and analysis. The work represents a joint contract effort between the Army and the University of Virginia.

SECOR Unit Contract Let

A $246,884 contract for breadboard and prototype models of a multi-altitude transponder for use in SECOR (Sequential Collation of Range) equipment for geodetic purposes has been awarded by the Army to International Telephone and Telegraph Corp.'s ITT Federal Laboratories, Nutley, N.J.

6 Firms Get Parallel DoD Satellite Development Work

Parallel systems design studies for the Advanced Defense Communications Satellite Project will be made by six firms under contracts awarded June 15 by the Defense Communications Agency. The fixed-price contracts range from about $135,000 to $196,000 each.

The studies, to be completed in about three to four months, will be used as a basis for the design of any advanced operational satellite communications system. The Advanced System is intended to provide for the unique and vital communications needs of the Government in the time period after 1968, when it is expected that the initial research and development satellite communications system will require replacement or augmentation.

The firms selected are the Communications Satellite Corp., Washington, D.C.; General Electric Co., Missile and Space Division, Valley Forge, Pa.; Hughes Aircraft Co., Culver City, Calif.; Philco Corp., Western Development Laboratories Division, Palo Alto, Calif.; Radio Corp. of America, Defense Electronic Products, Camden, N.J.; and Space Technology Laboratory, Redondo Beach, Calif.

Col Batte Assumes Command of Edgewood Arsenal

Col James H. Batte recently assumed command of the U.S. Army Edgewood (Md.) Arsenal, a military complex that embraces Fort Detrick, Md., Rocky Mountain Arsenal, Colo., and Pine Bluff Arsenal in Arkansas.

Deputy commander of Edgewood Arsenal since September 1964, he began his Army career as a second lieutenant with the Chemical Warfare Service in 1935, the same year he received a B.S. degree in chemistry from Davidson College.

Col Batte holds the Silver Star, Legion of Merit, Bronze Star with Oak Leaf Cluster, and the Purple Heart for participation in Normandy, the Ardennes, the Rhineland and Central Europe.

Following World War II he served with the War Department General Staff in Washington, and with Joint Task Force One at Bikini Atoll in the Pacific. After attending the Industrial College of the Armed Forces (ICAF) in Washington, D.C. (1946-47), he was appointed executive aide in the Office of the Secretary of the Army, with concurrent duty as White House aide.

In 1950 he received his master's degree from the Harvard Graduate School of Business Administration. Following a tour as executive officer of the Chemical and Radiological Laboratories at the Army Chemical Center, Md., he was assigned as commanding officer of the Chemical Corps Procurement Agency. His next assignment was in the Office of the Chief Chemical Officer in Washington,

Col James H. Batte

where he served as chief of the Overseas Liaison Branch, and later as comptroller of the Chemical Corps.

In 1955 he was assigned to Hq., U.S. European Command in Paris, as chief of the Supply and Services Branch, J-4 Division. Later he served as instructor at the ICAF.

In 1961 Col Batte became commander of the U.S. Army Chemical Corps Engineering Command, Edgewood Arsenal. Later he was special assistant for Congressional Affairs at Hq., U.S. Army Materiel Command, Washington, D.C., until his return to Edgewood in 1964.

DoD Awards $22.7 Million For Data Process Systems

Contracts totaling $22.7 million have been awarded by the Defense Supply Agency to two major industrial firms to provide, after successful testing, standard automated data processing equipment systems for military logistics.

International Business Machines Corp. will furnish the equipment required for Mechanization of Warehousing and Shipment Processing (MOWASP). Radio Corp. of America will furnish the equipment required for the Standard Automated Material Management Systems (SAMMS).

MOWASP will involve approximately $5.6 million in ADP equipment costs over a 5-year period at seven Defense Supply Agency depots. It is a uniform data system which will provide for mechanization of shipment planning functions, locator records, related warehouse shipments, supply effectiveness reporting and management information.

SAMMS will involve approximately $17.1 million in equipment over a 5-year period at five Defense Supply Agency Centers. This is a uniform system for distribution, requisitioning and supply control, financial management, procurement and production data, cataloging and management information.

Shillelagh to Replace 105 mm. In M-60 Under 2-Year Contract

Adaptation of the Shillelagh missile system to replace the 105 mm. gun in the M-60 tank began recently with award of $1,296,000 of a total $3,580,000 Army cost-plus-incentive-fee engineering and design contract.

Awarded to the Aeronutronic Division of Philco Corp., Newport Beach, Calif., the 2-year contract covers incorporation of Shillelagh subsystem components into the M-60 and the procurement of components and missiles for test and evaluation.

The project-managed Shillelagh armament system consists of a 152 mm. gun/launcher, gun-mount, conventional gun-fired ammunition, the Shillelagh missile and the necessary fire-control elements.

Application of Shillelagh to the M-60 will result in a new turret with a reduced silhouette and improved ballistic protection as well as a major improvement in firepower.

The turrets and guns removed from the M-60 to be retrofitted with the Shillelagh will be installed on M-48 tanks as a replacement for the 9 mm. gun.

BRL Scientist Coordinates DASA Eclipse Experiment

Ionospheric electron density measurement techniques developed by an Army scientist gained further recognition when he served recently as technical coordinator for Defense Atomic Support Agency (DASA) solar eclipse experiments in connection with the International Years of the Quiet Sun.

Warren Berning, chief of the Ballistic Measurements Laboratory, U.S. Army Ballistic Research Laboratories, Aberdeen Proving Ground, Md., was selected by DASA as a recognized expert in his field.

In 1961 he was one of the first winners of the annual Army R&D Achievement Awards, and also was the recipient of the Maryland Section American Rocket Society Award. He has been a BRL employee since 1947.

The DASA experiments, conducted when the moon passed between the sun and the earth on May 30, aimed to determine the atmospheric reaction rate of electrons and ions in the "D" and lower "E" regions. The eclipse was visible at varying times from New Zealand to Peru.

Coordinating agencies for the overall eclipse expedition were the National Science Foundation and the National Academy of Sciences. Participating organizations included the Air Force, Atomic Energy Commission, Navy, National Science Foundation, University of Liege in Belgium, and observatories in France, Italy and the Netherlands.

The experiments sought to determine what happens to the reservoir of electrons and ions of the ionosphere when the supply of ionizing radiation is gradually cut off by the moon. Data collected are expected to yield information on the gross shrinkage in the ionosphere with the absence of the sun's ionizing radiation; also, the changes in the several relatively discrete reflecting layers.

The experiment is an example of DASA's continuing use of simulation or natural phenomena as a means for gathering scientific data. Organizations conducting actual experiments on location were the Illinois Institute of Technology Research, Cornell University, the Stanford Research Institute and the Central Radio Propagation Laboratory of the National Bureau of Standards.

The eclipse provided exceptional conditions for experiments since the sun is now in its "quiet" period, which means a minimal amount of disturbance from the sun's direct rays.

Scientists Meet on Materials Research

More than 100 key scientists engaged in Advanced Research Projects Agency-Interdiscpilinary Laboratories programs in materials science for the military met recently at the U.S. Army Natick (Mass.) Laboratories.

Brig Gen W. W. Vaughan, commanding general of Natick, welcomed the conferees, representing Department of Defense research agencies, laboratories and universities.

Dr. George R. Thomas, associate director of the Clothing and Organic Materials Division, presided over the first session. Featured technical briefings by Natick personnel included: Separation and Identification of Complex Mixtures by Gas Chromatography and Mass Spectrometry, Dr. Charles Merritt; Spectral Techniques and Protein Structure, Dr. Martin J. Kronman; Chain Stiffness in Nylon-1 Polymers, Dr. N. S. Schneider; A Method of Obtaining Ballistic Stress-Strain Information for Fibrous Structures, Roy C. Laible; and Nitroso Elastomers, Dr. Malcolm C. Henry.

Chairman of the session on "Structures" was Joseph I. Bluhm, chief, Applied Mechanics Research Laboratory, U.S. Army Materials Research Agency (AMRA), Watertown, Mass. Presentations included: Electron Distribution in Metals, Dr. Ernest P. Abrahamson, II; Discontinuous Plastic Flow in Low Temperatures, Dr. Eric B. Kula; Solidification Studies, Paul J. Ahearn; Analysis for Conformal Mapping of Two-Dimensional Crack Problems in Fracture Mechanics, Oscar L. Bowie; and Some Problems in Non-linear Theories of Thin Shells, John F. Mescall, all of AMRA.

Bonding Stresses on Microfibers Subject to Transverse Flow of Heat, Dr. M. A. Hussain and Elastic-Plastic Stress Conditions in Composite Pressure Vessels, John Zweig, both of Watervliet (N.Y.) Arsenal.

Dr. Joseph Sperazza, associate technical director, U.S. Army Ballistic Research Laboratories (BRL), Aberdeen Proving Ground, Md., was chairman of the session on "Penetration Mechanics."

Papers were presented on: Flow and Fracture of Metals Under Impact Loading, Dr. Coy M. Glass; Analysis of Soft Media Penetration, Eugene T. Roecker; Transient Response of Targets Subjected to Hypervelocity Impact, John T. Frasier, all of BRL; Projectile and Lightweight Ceramic Composite Armor Interactions, Charles W. Semple, AMRA; and Preliminary Investigation of Mechanical and Optical Response of Polymers to Impact, Dr. Anthony F. Wilde, Natick.

The concluding session on "High Pressure Research" was presided over by Frederick Schmeideshoff, director of research, Watervliet Arsenal. Featured was a paper by Thomas Davidson, of Watervliet, on The Flow and Fracture Characteristics of Metals at High Hydrostatic Pressures.

Directors of ARPA-Interdisciplinary Laboratories are: Mr. Robert H. Cole, chairman of the ARPA Executive Committee, Brown University, Providence, R.I.; Prof. Clyde A. Hutchison, Division of Physical Science, University of Chicago; Dr. Henri Sack, director, Materials Science Center, Cornell University, Ithaca, N.Y.;

Dean Harvey Brooks, Pierce Hall, Harvard University, Cambridge, Mass.; Prof. Robert Maurer, director of Materials Research Laboratories, University of Illinois, Urbana, Ill.; Prof. Ralph Myers, Department of Physics, University of Maryland, College Park, Md.;

Prof. Robert Smith, director, Center for Materials Science and Engineering, Massachusetts Institute of Technology, Cambridge, Mass.; Prof. Lawrence Slifkin, University of North Carolina, Chapel Hill, N.C.; Dr. Malcolm Dole, director, Materials Research Center, Northwestern University, Evanston, Ill.;

Dr. John N. Hobstetter, Director of the Laboratory for Research on the Structure of Matter (LRSM), University of Pennsylvania, Philadelphia; Dr. Hubert M. James, Secretary of the Materials Policy Committee, Purdue University, Lafayette, Ind.; and Dr. Robert A. Huggins, director, Center of Materials Research, Stanford University, Stanford, Calif.

TOP PLANNERS of Advanced Research Projects Agency (ARPA)—Interdisciplinary Laboratories meet at the Natick Labs included (l. to r.) Dr. Earl T. Hayes, Office, Director of Defense Research and Engineering; Dr. George R. Thomas, Natick Laboratories; Dr. E. L. Salkovitz, ARPA.

3 AMC Members to Attend Comptrollership School

Three civilian employees of the U.S. Army Materiel Command (AMC) were selected recently to attend the 1965-66 Army Comptrollership School at Syracuse University, Syracuse, N.Y.

Chosen to attend the 13-month course are Charles E. Becker, Jr., AMC Headquarters, Washington, D.C.; Harold T. Persson, U.S. Army Transportation Research Command, U.S. Army Mobility Command, Fort Eustis, Va.; and Howard W. South, U.S. Army Missile Command, Huntsville, Ala.

They will receive a total of 56 semester credit hours and are eligible to earn a master's degree in business administration.

The school is considered an exceptional opportunity for highly qualified career employees to engage in a formal course on comptrollership at the graduate level. Only those individuals who have clearly demonstrated their potential for progressive growth and increasingly responsible service to the Army are selected.

Skills and knowledge acquired through participation in programs such as this are intended to enable Army civilian personnel to increase their proficiency in current assignments and prepare them to assume more demanding positions at their respective installations.

As chief of Program Coordination and Evaluation Section, Program Control Division, Becker is responsible for monitoring and evaluating the 5-year programs of AMC subordinate commanders and administration of the Hq. AMC Program and Budget Advisory Committee.

Persson is the U.S. Army Mobility Command's financial manager (comptroller) at the U.S. Army Transportation Research Command (TRECOM). He manages and administers TRECOM's financial resources consisting of more than $60 million annually in R&D funds.

Assigned to the U.S. Army Missile Command as comptroller and director of programs, South's duties involve all aspects of financial and program management at Huntsville.

DoD Leaders Confer With Industry on Scientific Information

Many of the top Department of Defense officials concerned with improving utilization of scientific and technical information convened with the National Security Industrial Association at Los Angeles, May 26-27.

Stated objectives included:

- To provide for top management executives from the Department of Defense and industry a forum for mutual discussions of unresolved and potential problems with respect to scientific and technical data.
- To inform industry management of the efforts underway on the part of the Department of Defense to solve existing problems.
- To indicate to key management personnel of the DoD and industry the need for dynamic leadership and active participation in data problems.
- To present various and optional solutions to the existing problems of both the DoD and industry.

DoD representation was headed by Dr. Eugene G. Fubini, Assistant Secretary of Defense (Deputy Director, Defense Research and Engineering), backed up by Paul R. Ignatius, Assistant Secretary of Defense (Installations and Logistics) and Lt Gen William J. Ely, Deputy Director for Administration and Management, DDR&E.

General Frank S. Besson, Jr., CG of the U.S.Army Missile Command, and General Bernard W. Schriever, CG of the Air Force Systems Command joined in a panel with Rear Admiral Allen M. Shinn, Chief of the Bureau of Naval Weapons, in expressing their views on scientific and technical information problems.

Other DoD leaders primarily responsible for improving STI methodology to use existing information effective, in the interest of avoiding undue duplication and overlapping of R&D activities, included: Brig Gen A. T. Stanwix-Hay, U.S. Army, Director of Technical Data and Standardization Policy, Office of the Assistant Secretary of Defense (I&L), and Walter M. Carlson, Defense Director of Technical Information, DDR&E.

Assistant Director for Engineering Management (DDR&E) James W. Roach made the introductory presentation of the over-all DoD problem, following the keynote address by Thomas D. Morris, former Assistant Secretary of Defense (I&L). Mr. Morris, who resigned late in 1964 to return to his partnership in Cresap, McCormick and Paget, emphasized the need of obtaining adequate test data to meet industry and Government requirements at least cost.

"Rights in Data" was the subject of an address by John M. Malloy, Deputy Secretary (Procurement, OAS (I&L).) Col Ole C. Griffith, deputy director, Technical Data and Standardization Policy, U.S. Air Force, spoke on "Criteria for Acquisition."

Industry's interest in achieving more value from existing and currently generated scientific and technical information, thereby eliminating research for knowledge already available, was outlined in an address of welcome by Gerald J. Lynch, president of the National Security Industrial Association (NSIA) and of the Menasco Manufacturing Co.

Other NSIA speakers included: Dr. E. T. Ferraro, vice president, Operations Systems Division, General Precision Aerospace; Dr. Carl Cohen, general manager, Advanced Product Operation, General Electric Co.; C. K. Bauer, manager, Scientific and Technical Information Dept., Lockheed Georgia Co.;

John Paup, vice president, Space and Information Systems Division, North American Aviation, Inc.; Denham S. Scott, assistant to the president, The Garrett Corp.; Robert B. Chaman, III, vice president, Aircraft Armaments, Inc.; and A. L. Bain, patent counsel, General Precision Equipment Corp.

Leading participants included A. Tyler Port, Deputy Assistant Secretary of the Army (I&L) Logistics, Deputy Chief of Research and Development Maj Gen Austin W. Betts and Army Director of Technical Informatin Col Dale L. Vincent. Commanding generals or their representatives from each of the subcommands of the Army Materiel Command and its staff agency leaders concerned with STI activities were in attendance.

Medal of Honor Recipient Publicizes Zero Defects

Capt Roger H. C. Donlon, the first American serviceman to win the Congressional Medal of Honor in Viet Nam, recently visited the U.S. Army Missile Command, Redstone Arsenal, Ala. ,to appear in a motion picture on Zero Defects.

Also appearing in the 30-minute film being made for the U.S. Army Materiel Command are Maj Gen John G. Zierdt, CG of the Missile Command, and S/Sgt Thomas L. Gregg, senior combat medic with the team Capt Donlon commanded in Viet Nam.

Zero Defects is the Department of Defense program to raise personal performance standards by challenging people to do their jobs right the first time. Capt Donlon has been making speeches on Zero Defects at various defense installations for the past 11 months. He presently is stationed at the John F. Kennedy Center for Special Warfare at Fort Bragg, N.C.

Capt Donlon and the 11 men in his Special Forces team were caught in a predawn surprise attack by the Viet Cong on July 6, 1964. The first shell destroyed the communications hut. One of the men grabbed a radio by his bed and had only 30 or 40 seconds to get out a message for reinforcements.

Capt Donlon claims that he is alive today because the communications set was free of defects. In the film, he shows the radio to General Zierdt and the two discuss how Special Forces and other American fighting troops depend upon the people who make their equipment.

Capt Donlon earned his Congressional Medal of Honor, the country's highest military decoration, during five hours of intense fighting before reinforcements arrived. He was wounded four times but still directed defense operations.

TWO OF 2,200 Congressional Medal of Honor winners, Paul Bolden, who received the honor during World War II, and Capt Roger H. C. Donlon, first Medal of Honor winner in Viet Nam, discuss zero-defect-produced communications set used to radio for reinforcements during Viet Cong guerrilla attack on 12-man Special Forces Team at Nam Dong.

$11 Million RADA System Contract Let

The easy operation of a dial telephone combined with the mobility of the vehicular radio in battlefield communications is the developmental objective of an $11,063,752 Army contract.

The multi-phase advanced development contract for what is known as a Random Access Discrete Address (RADA) system, was granted recently by the U.S. Army Electronics Command, Fort Monmouth, N.J., to Martin Co.'s Orlando (Fla.) division.

RADA is an Army Materiel Command Project-Managed item and will be under the direction of Col David R. Guy, RADA-Tactical Automatic Switching Project manager at Fort Monmouth.

The initial phase of the contract, which will be started immediately, is to demonstrate the techniques to be used in a RADA system. Later phases, to be entered after the Army approves the techniques, call for feasibility demonstrations and fabrication of feasibility models of the basic equipment to be used in RADA.

RADA is envisioned as being able to handle voice, teletype, facsimile, and data transmission and reception within an Army combat division without the use of heavy, fixed switching centers or the time-consuming and dangerous laying of wire in battle.

All of the capabilities of wired dial telephone systems, and even more, are planned as integral to RADA. It would provide for priority service among selected subscribers, conference calls, and area warning.

Further, RADA would provide complete privacy of the communication between sender and receiver. It is designed to be easily portable and adaptable to all military vehicles. RADA would operate on vehicular battery power, internal battery power or commercial power, whichever is most readily available.

RADA is a radio system in which simultaneous transmissions can occur within a common frequency band without mutual interference because it can be directed exclusively to the intended receiver. It uses pulse position modulation within its assigned frequency band.

The subscriber set has the features of a portable touch-tone telephone. This equipment automatically selects an available frequency within the allotted band and broadcasts the address of the called party.

If connection cannot be made because of range or propagation phenomena, the user set automatically shifts to another frequency band and calls a repeater unit to extend the search for the called party. The process can be repeated through several repeaters until the search has covered the entire division area. Computer techniques enable this process to be carried out in a matter of seconds.

The design for ease of operation, portability and adaptive channel acquisition of RADA is expected to provide a quantum jump in communications capabilities of military units in the tactical environment.

Army Tropic Test Center Completes 'Jungle Vision III'

"Jungle Vision III," a tropical forest target detection project, was completed recently by the U.S. Army Tropic Test Center in the Fort Sherman area, Panama Canal Zone.

The tests were conducted as part of the Center's Army In-House Laboratories Independent Research Program. Effects of dry season changes in the evergreen rainforest on detection of personnel will be compared with those of a similar study made at the end of the wet season.

Dressed in the Army standard field uniform, Tropic Test Center members acted as targets while 4th Battalion, 10th Infantry soldiers performed as observers. Both wet and dry season tests took place on the same sites, but different observers were used.

All observers were prechecked to insure that each had normal vision; thus any difference in ease of target detection (if such variances appear after analysis of data) cannot be attributed to vision factors.

The jungle vision project is a series of 11 studies planned to obtain visual thresholds for various targets in two major types of tropical vegetation—evergreen rainforests and semideciduous forests.

Data will be used as control information for tropical testing of a series of magnification, ranging and sighting devices; a new test technique applicable to evaluation of visual performance aids in the field; and a data bank for future requirements as yet unspecified.

Project officers are Dr. Delaney A. Dobbins, behavioral scientists, Marvin Gast, physical environment scientist, and Charles M. Kindick, human factors technician—all of the U.S. Army Tropic Test Center.

U.S. ARMY Tropic Test Center soldiers simulate roles of experimenter and observer at Jungle Vision III test site, Fort Sherman, Canal Zone.

Logistics Panels Examine Communication Problems

A Logistic Research Conference sponsored by the Department of Defense to improve communications and interchange of information was held May 26-28 at Airlie House, Warrenton, Va.

Dr. Nathan Brodsky, director of Research and Special Projects, Office of the Assistant Secretary of Defense (Installations and Logistics), chaired the steering committee that planned the conference.

The Logistics Management Institute and the U.S. Army Logistics Management Center, Fort Lee, Va., assisted in management of the sessions. Proceedings will be available from the U.S. Government Printing Office, Washington, D.C.

Nine nationally known logistics specialists headed the following panels: Dr. Hugh M. Cole, Research Analysis Corp.—Logistics Planning Elements; Harry M. Tayloe, Logistics Management Institute—Procurement Practices;

Dr. Irving Siegel, Research Analysis Corp.—Government-Industry Development and Production; Dr. Dorothy Gilford, Office of Naval Research—Practical Inventory Theory; Dr. William Brinckloe, University of Pittsburgh—Maintenance and Repair Concepts;

Dr. Charles B. Tompkins, University of California at Los Angeles—Logistics Information Systems; Dr. W. W. Cooper, Carnegie Institute of Technology—Cost Effectiveness Models and Evaluation; Dr. David S. Stoller, RAND Corp.—Measurement of Logistics Performance-Effectiveness; Dr. Murray Geisler, RAND Corp.—Logistics Simulation.

Army Announces Recent Contract Awards Totaling $180.9 Million

Research, development and production contracts totaling $180.9 million have been awarded by the U.S. Army in recent weeks.

The largest award was to Kaiser Jeep Corp., Toledo, Ohio, consisting of three contracts totaling $55,897,417. Kaiser will produce 111 5-ton wrecker trucks for $2,323,353 and 693 utility trucks for $1,195,979, in addition to a $52,378,085 initial increment to a 3-year contract for various types of 5-ton trucks.

Continental Motors Corp., Muskegon, Mich., received a $13,490,382 first increment of a 3-year buy for multifuel engines. Hercules Powder Co., Wilmington, Del., was awarded a $10,917,962 modification for loading, assembling and packing propellants and explosives, and NIKE boosters.

HRB Singer, Inc., State College, Pa., will get $9,387,226 for infrared surveillance systems and associated support equipment for use with the OV/1C Mohawk aircraft. Day and Zimmerman, Inc., Philadelphia, Pa., received a $7,920,984 modification for loading, assembling and packing ordnance items.

Harvey Aluminum Sales, Inc., Torrance, Calif., was awarded a $6,484,220 contract for classified items and American Electronic Laboratories, Inc., Colmar, Pa., $4,520,000 for electronic equipment.

Model Engineering and Manufacturing Corp., Courter Products Division, Boyne City, Mich., won a $4,323,350 contract for radio sets and radio receiver-transmitters. Collins Radio Corp., Dallas, Tex., received a $4,229,666 supplement to an Army contract to provide an intercom system for NASA (funded by NASA) at Merrit Island, Fla.

FMC Corp., Ordnance Division, San Jose, Calif., won a $4,200,124 modification of a multi-year buy for Armored Personnel Carriers (M113A1) and Mortar Carriers (M125A1). Bogue Electric Manufacturing Co., Paterson, N.J., will produce 976 generator sets for $3,902,400.

Raytheon Co., Burlington, Mass., was awarded a $3,842,246 for air transportable radio communications equipment (AN/TSC-38) and General Dynamics Corp., Pomona, Calif., $3,685,661 for work on the Mauler weapon system.

Hughes Aircraft Co. and Hughes Tool Co., Aircraft Division, Culver City, Calif., will receive $2,122,779 as the first increment of a 3-year buy of light observation helicopters, with supporting information and equipment, and $1,102,226 for R&D on the TOW missile system.

Bowen-McLaughlin-York, Inc., York, Pa., contracts consist of a $1,915,650 supplement to an existing contract for self-propelled, 175 mm. guns, self-propelled 8-inch howitzers and recovery vehicles and $1,049,760 for 486 ½-ton trucks.

General Electric Co., Defense Electronics Division, Syracuse, N.Y., received a $2,912,000 contract for design and development of a portable chemical agent alarm. Albion Malleable Iron Co., Albion, Mich., won a modification of $2,553,826 to an existing contract for 2.75-inch rocket components.

Manson Laboratories Division, Hallicrafters Corp., Wilton, Conn., gained a $2,539,668 contract for 200 radio sets (AN/GRC-26) and 120 radio transmitters (T368/URT), and the Weatherhead Co., Cleveland, Ohio, $2,512,756 for 105 mm. projectiles.

SGM Corp., Kleinschmidt Division, Deerfield, Ill., will get $2,439,600 for teletypewriter sets and ancillary items, and Electrospace Corp., Glen Cove, N.Y., will produce 739 radio sets (AN-GRC-10) and six dynamotor power supply units (DY-94/GRC-10) for $2,153,284.

Caterpillar Tractor Co., Peoria, Ill., was granted a $2,065,569 modification for tractors with bulldozer, scarifier and scraper controls. Southwest Truck Body Co., St. Louis, Mo., was issued a $2,026,402 contract for 6-ton semitrailer shop vans. Aircraft Radio Corp., Boonton, N.J., was issued a $1,924,439 contract for radio receiver sets and components. Aircraft Armaments, Inc., Cockeysville, Md., was allowed $1,886,000 to continue R&D of the special-purpose individual weapons system.

Other contracts are: H. O. Boehme, Inc., Westbury, Long Island, N.Y., $1,799,215 for lightweight, transportable page printer teletypewriting sets with ancillary items; Allied-Webb, Southgate, Calif., $1,713,880 Army contract for modification of Pad 3 for Titan III X at Vandenberg AFB, Calif.; Bulova Watch Co., Inc., Flushing, N.Y., $1,508,800 for rocket ammunition fuzes;

Minnesota Mining and Manufacturing Co., $1,500,000 for classified electronics equipment; General Motors Corp., a $1,480,000 for breech actuator assemblies for the gun/launcher on the General Sheridan, X551, vehicle;

Eagle Engineering Corp., Louisville, Ky., $1,394,828 for 2,102 generator sets. Chrysler Corp. Defense Engineering, Centerline, Mich., $1,270,952 to continue production engineering services related to the M-60 series tank; Canadian Commercial Corp., Ottawa, Ont., $1,099,740 for 793 gasoline-driven generator sets; International Harvester, $1,098,210 for 160 commercial-type dump trucks;

Ford Motor Co., $1,065,000 for production and inspection engineering services for M151, ¼-ton, utility trucks; Firestone Tire and Rubber Co., $1,018,774 for shoe assemblies for the M113 Personnel Carrier; Otis Elevator Co., $1,012,336 for radio sets;

Sentinel Electronics, Inc., Philadelphia, Pa., $1,004,505 for radio sets; Teletype Corp., Skokie, Ill., $1,000,000 for classified electronic equipment; Space-General Corp., El Monte, Calif., $1,000,000 for advanced development of a detection device for biological research.

Scientific Calendar

9th Latin American Chemical Congress, San Juan, Puerto Rico, Aug. 1-8.

4th International Conference on Physics of Electronics and Atomic Collisions, sponsored by ARO-D, ONR, AFOSR and National Research Council of Canada, Quebec, Canada, Aug. 3-7.

Heat Transfer Conference and Exhibit, sponsored by ASCE, Los Angeles, Aug. 8-11.

20th Calorimetry Conference, sponsored by Institute of Atomic Research and Iowa State University, Ames, Iowa, Aug. 11-13.

Annual Convention of the American Institute of Biological Sciences, Urbana, Ill., Aug. 15-20.

Liquid Crystal Conference, sponsored by Kent State University, Kent, Ohio, Aug. 16-20.

Fall Meeting of the American Society for Pharmacology and Experimental Therapeutics, Philadelphia, Pa., Aug. 16-20.

Energetics Conference, sponsored by ASME, Rochester, N.Y., Aug. 18-20.

Subcommittee 29 on Microchemical Apparatus of Committee E-1, sponsored by American Microchemical Society, University Park, Pa., Aug. 22.

International Symposium on Microchemical Techniques, sponsored by American Microchemical Society, University Park, Pa., Aug. 22-27.

1965 Cryogenic Engineering Conference, Houston, Tex., Aug. 23-25.

Meeting of the Institute of Electrical and Electronics Engineers, San Francisco, Calif., Aug. 24-27.

23rd Annual Meeting of the Electron Microscopy Society of America, N.Y.C., Aug. 24-28.

Annual Denver Research Institute, X-Ray Conference, Denver, Colo., Aug. 25-27.

17th Annual Meeting of the American Association of Clinical Chemists, Chicago, Ill., Aug. 29-Sept. 2.

Antennas and Propagation International Symposium, sponsored by IEEE, Washington, D.C., Aug. 30-Sept. 1.

5th Rare-Earth Research Conference, sponsored by AFOSR and Iowa State University, Ames, Iowa, Aug. 30-Sept. 1.

Western Conference of Applied Mechanics, sponsored by ASME, Los Angeles, Calif., Aug. 30-Sept. 1.

4th National Meeting of Society for Applied Spectroscopy, Denver, Colo., Aug. 30-Sept. 3.

2nd International Symposium on Organometallic Chemistry, sponsored by ARO-D, University of Wisconsin and NSF, Madison, Wis., Aug. 30-Sept. 4.

7th International Congress of the International Association for Quarternary Research Symposia, sponsored by Organizing Committee for INQUA and NAS, Boulder, Colo., Aug. 30-Sept. 5.

12th National Conference of the Armed Forces Management Association, Washington, D.C., Aug. 31-Sept. 2.

Bionics May Open Up Frontiers of Engineering Sciences

By Dr. Edward J. Baldes

Research in Review...

HISTORICAL BACKGROUND. Since time immemorial, living organisms have undergone evolution continuously in their struggle for existence and in adapting to varied external environments. As a result, today many viable systems are unique in their reliability and efficiency, while their intricate constitution and microminiature scale excel the present-day technical advice.

Even in this era of technological advances, much can still be learned from nature. Many scientists are attempting to unravel the phenomena presently associated with living matter and apply the new knowledge to expand the frontiers of engineering science.

As far back as Greek mythology, there was the concept of flying machines designed after birds. Daedulus and his son, Icarus, were said to have fashioned bird-like wings of feathers and wax. In the 16th century, Leonardo da Vinci planned an ornithopter, hoping that man might fly like birds. Only after it was decided that human muscles were incapable of furnishing sufficient power to lift man's weight off the ground did he abandon the project.

Other inventors decided that copying directly wings like birds' was not fruitful in the approach to manned flight. Although today machines fly higher, faster and farther than components of flesh, bone and feathers, much is still not understood about the flights of birds. Further studies should yield much information on the aerodynamics of flight, especially the transition from unstable to stable flight and vice versa.

Turning back the pages of history some three and a half centuries, we may single out Borelli (1608-1679), an illustrious member of the famous Italian Society of Accademia de Cimento, who was instrumental in promoting the principle that the living organism was a machine subject to immutable and inescapable physical laws.

Borelli's interest included circulation, respiration, and especially bodily movements. His book on the "Movement of Animals" (1679) was 24 years in preparation. Not only was he interested in the motion of human beings, the flight of birds, swimming of fish, but also in creeping and crawling insects. Surely he would qualify as a great pioneer in the field of biophysical enquiry.

Dr. Edward J. Baldes

Dr. Edward J. Baldes joined the staff of the Life Sciences Division, U.S. Army Research Office in January 1963. He was formerly associated with the Mayo Clinic, Rochester, Minn., where he served as director of the Physical and Biophysical Research Division (1948-58) and as senior consultant with the Biophysics Section.

The noted biophysicist has been a professor of biophysics at the Mayo Foundation for Medical Education and Research, University of Minnesota Graduate School, and served as vice chairman of the Mayo Aeromedical Unit. He also served as a consultant to the USAF Aeromedical Laboratory, Wright-Patterson AFB (1942-49).

Dr. Baldes holds a B.A. degree in physics from the University of Saskatchewan (1918) and M.A. and Ph. D. degrees in physics, Harvard University (1920 and 1924). He also earned a Ph. D. in physiology from University College, London, England (1936).

For his design of special centrifugal devices which contributed to the safety of American aviators in World War II, he was awarded the War Department Commendation for Exceptional Civilian Service (1945) and the Presidential Citation (1948). Other honors include the French Legion of Honor (1951) and an LL.D. from the University of Saskatchewan (1955).

The author of more than 150 scientific papers in the fields of biophysics, physiology and aviation medicine, Dr. Baldes is an active member of numerous boards, councils, panels and scientific societies.

BIOPHYSICS VERSUS BIONICS. In order to study the organized complexity of living systems, Biophysics has emerged—a term used to denote the application of several disciplines, including biology, chemistry mathematics, mechanics and physics. Three major divisions are presently recognized by the biophysicist, namely, structure, function and organization.

Studies in structure have been the most productive to date, with outstanding accomplishment in molecular biology, chemical genetics and elaboration of the ultrastructure of collagen, virus and muscle.

In function, noteworthy contributions have been made in studies of nerve excitation and conduction, muscle contraction, hormone secretion and bioreceptor mechanisms. The effort expended in organization has been somewhat less intensified and more exacting interdisciplinary training is necessary.

In 1960, a meeting was sponsored by the United States Air Force in which the problems associated with the complex organization of living organisms were emphasized and the name Bionics was given to the symposium.

Studies today under the heading, Bionics, include the exploitation of self-organizing and self-adaptive systems of living matter, with emphasis directed to the solution of engineering problems, the understanding of patterns of perception and recognition, the manner of information storage and retrieval; also, the capability of biosensors, including those in the animal world, to see, hear, taste, smell and touch with extension beyond the range of human perception.

Further, an important concept in Bionics pertains to the role of biological transducers. Borrowed from the engineering sciences this term is defined as devices which "lead across" or transform energy from one form into another, such as acoustical energy into varying electrical current.

Biological transducers are thus considered to be the biological counterparts of the transducers of the physical sciences. They comprise the units and components in living organisms

which act as energy transfer elements functioning in communication and information processes.

For example, biological transducers include those of the sensory type such as rods and cones of the retina, vestibular and cochlear receptors of the ear, as well as thermal, olfactory, gustatory, chemical, electrical and mechanical receptors.

Extending the list still further, we should mention transducers of the proprioceptive organs wherein stimulation within body tissues originate, those humorally mediated, and the synaptic and intermediary units involved in processing and storage of biological data.

Some scientists consider Bionics as a special branch of technical cybernetics. Here we have the application of information gained from biological processes of the nervous system and brain to the solution of mechanical-electrical communication systems.

The study of systems is thus approached through the organization and characteristics of the living organism. This has lead to the development of electric analogs and networks that can be combined into self-organizing information processing devices which may be programed by external conditions.

Much research lies ahead in unraveling the mechanism of the brain of even simple animals, the storage and retrieval of information, especially the functional processes in cells and entire organisms.

ARMY'S INTEREST IN BIONICS. "What is the Army's interest in Bionics?" is a question not so easily answered. How, for example, can research and exploratory development lead to the solution of problems that will enable the Army to perform its mission more efficiently and effectively?

The ultimate answer requires that the soldier, at all times, be maintained in excellent health and physical condition so that his performance can be optimal. He must be provided with innumerable aids and devices, the best that science can develop, to assist him in carrying out his assigned duty, whether on the ground or in the air.

Today, the Army is greatly concerned with problems related to guerrilla warfare. Can Bionics solve some of these issues? How can a mobile unit be pinpointed quickly and accurately? What can be done to increase surveillance capability and ambush detection by discernment and identification of faint sounds and vibrations?

How can the range of vision be extended day and night, as well as our olfactory and gustatory sensibilities? Can voice communication be improved with increased military security? Can better counterinsurgent tactics be developed?

Research toward all these goals seeks less complex equipment, more compact and more reliable in spite of adverse weather conditions. This could provide increased mobility and safety in a battlefield environment—afford a better integration of military operations, in the air and on ground.

MAN AND HIS JOINTS. One of the marvels of nature, but little appreciated, is the freedom of movement of living joints. Here we have surfaces of articular cartilage lubricated more efficiently by synovial fluid than in any engineering bearing. Frictional forces are unusually low and the viscosity of the synovial fluid may vary a thousand-fold, depending on the rate of shear.

For example, the knee of a dead animal may be exercised at physiological speeds over a period of 24 hours without visible deterioration of the articular surfaces. As a matter of fact, electron microscopy indicates that the articular cartilage in man is remarkably static and that no attrition to the surface is observable even after 10 years of active life. Dr. Lipson of the Rheumatism Unit of the University of Vermont has an Army contract to investigate physical factors pertaining to the knee joint of man.

What could be more important to the well-being and efficient performance of the soldier than a comprehensive knowledge of the basic facts describing how joints move? This information should also be of inestimable value in diseased and deformed conditions. As a study in Bionics, there is also the possibility of furthering the engineering knowledge regarding friction and lubrication factors in the surface of bearings.

Studies of the external movement of joints previously supported by an Army contract resulted in the development of the electrogoniometer. This electrical device, produced by Dr. Karpovitch of Springfield College, may permit the study of joint action during any conceivable maneuver of the human body. Further studies on the mechanics of the locomotor and supporting system are indicated, including the influence of environmental factors on various tissues.

The human hand and arm are endowed with exceptional mobility. The history of the design of manipulative devices is chiefly that of man's attempt to duplicate the capability of his own hands. Movement is produced by motor activity of the muscles forming levers with the skeleton. Each contracting muscle is able to exert a mechanical effect due to its fixed attachment to the bone lever. Coordination of a large number of muscles and joints of the hand-arm complex is required in the performance of accurate movements.

Hence, it would seem that the creation of an analog of the human hand-arm complex would be formidable. However, much progress has been made to date in the utilization of bioelectric potentials from flexor and extensor muscle groups as input signals to operate prosthetic devices. With increased knowledge of electromyographic potentials, perhaps from implanted electrodes, improved prosthesetics will be developed.

The U.S. Army Medical Biomechanical Research Laboratory at the Walter Reed Army Institute of Research annex, Forest Glen, Md., is presently engaged in harnessing muscle potentials to control prosthetic devices.

ANIMAL ELECTRICITY. Bioelectricity dates back to the discoveries of Galvani, who, in 1786, demonstrated electricity in frog muscles. Many varieties of animal tissues, such as muscle and nerve, generate electric potentials. Most familiar are the heart potentials measured in millivolts on the surface of the body and the brain potentials measured in microvolts.

The electric organs of fish are useful in their defense and offense. Fish which produce small electric currents are able to localize objects by special biosensors because of the distortion of the electric field in the surrounding water. Other fish with special electric organs are able to produce potentials of 500 volts, often with high current discharges.

Living systems, by oxidation, convert chemical energy into electric potentials and currents during the process of metabolism. This process is greatly accelerated by the catalytic action of organic molecules of high molecular weight, the enzymes. It is interesting to note that some of these bioelectro-chemical cells operate optimally at room temperature where the enzymes display maximum activity.

For example, fuel electrode couples of acetate/acetaldehyde at the anode and an oxygen cathode with the enzyme xanthine oxidase yield a poten-

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Research In Review...

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tial of 1.4 volts. Studies of the mechanisms of bioelectric chemical cells and their interaction in the living organism are an important phase of Bionics.

One of the most challenging concepts today concerns the phenomena of electro-magnetic communication between living organisms. The eye is a very highly developed organ which in man is sensitive to radiations known as the visible spectrum. We are all familiar with the flashing light of the firefly, but there are indications that some insects communicate with their own species by radiations beyond the perception of man.

Long-distance attraction—over five miles—between certain varieties of butterfly is still unexplained. Removal of the antennae of the male is said to prevent his return to the female, so the assumption has been made that these organs acted as a natural micro antenna.

Considerable evidence indicates that moths of opposite sex may also communicate over large distances. The pit viper and other snakes are known to have infrared sensory areas capable of responding to heated objects.

Most debatable today is the possibility of extrasensory perception between certain human beings. Perhaps further research in Bionics will reveal new communication channels in the living world.

BIOLOGIC NAVIGATION. One of the critical areas for present-day investigation pertains to navigation on the ground or in the air, by day or night. It has been known for years that birds have unusual powers of navigation, especially carrier pigeons, as well as migratory birds.

Some believe this involves the interaction of the magnetic field of the earth with a special organ in the eye of the bird sensitive to geomagnetic forces. If this organ, known as the pecten, acts like a magnetic compass in carrying signals to the brain of the bird, it is an outstanding example of microminiaturization.

In this connection, mention might be made that turtles may also navigate in the ocean by geomagnetic biosensors. Of interest also is the migration of fish. Hatched in a fresh water stream, the young salmon follows the current to the ocean, where it may remain several years before returning to spawn in the stream where it was hatched. This mode of navigation is attributed to chemical sensitivity and highly developed olfactory or gustatory organs whereby the fish can identify characteristics of the stream which it formerly inhabited.

The bat possesses one of the most interesting examples of bioreceptors. By the emission of short pulses of ultrasonic energy and the perception of echoes, identification can be made of food or the nature of obstacles. This mechanism is so refined that discrimination is possible from the sound detection and ranging of other nearby bats. Endowed with poor vision, the bat relies almost exclusively on echo location for navigation.

Similarly, the dolphin can emit several types of sound extending to frequencies of 140 kilocycles. With its highly developed receiving biosensor, the dolphin can communicate under water, and by pulsed energy is able to navigate and search for food by echo location. And so we may continue to ennumerate special phenomenology of life that surrounds us.

With increasing knowledge of the interactions of chemical, electrical, mechanical and physical phenomena in living processes, we must be ever mindful of the application to the field of human physiology. Advances here will be made possible by the introduction of a wide variety of devices and technics to record and interpret the many facets of vital processes both in health and disease.

The impact on clinical medicine will be great and the new dynamic methods will permit more accurate and rapid diagnosis of human ills. Emphasis must still be placed on the necessity of continued effort to accumulate basic knowledge.

Concerning future studies of the detailed structure of living organisms and the importance of unraveling intricate biological mechanisms, let us recall the thesis exponded several years ago by the famous biophysicist and Nobel Laureate, A. V. Hill; namely, "that no limit will be found at which the application of physical methods and ideas will be forced to stop in the investigation of living processes."

NSF, NIH, DoD Fund National Chemical Data Effort

(Continued from page 1)

CAS contract, was demonstrated with the Army Chemical Typewriter (ACT), developed by a team at Walter Reed Army Institute of Research.

WRAIR was host to a CIDS Program review and briefing Nov. 18-21, 1964, which was attended by 108 representatives of 24 Army organizations and 24 industrial, academic, Department of Defense and other Federal agencies. The purpose was to consider an exploratory development project time-phased to build the basis for a decision on an operational network by 1967.

As designated by the Office of Science and Technology (OST), headed by Dr. Hornig, the National Science Foundation will manage the CAS contract. One of the leaders will be Paul Olejar, who recently transferred to the NSF after serving since November 1963 as chief of the Research and Analysis Branch, Scientific and Technical Information Division, U.S. Army Research Office.

In cooperation with the NSF, the National Institutes of Health and the Department of Defense, the OST formed a Task Group to examine Federal interests and needs, and to make recommendations for the development of a computer-based, high-speed chemical information system.

The Task Group, to provide for use of the most competent assistance available, established an interagency Technical Coordinating Group to plan and develop the technical information program. This is a pioneering effort in Federal interagency coordination and cooperation in the technical information systems field.

Other scientific societies and non-Government organizations will be involved to ensure that the system developed will be responsive to all needs.

CAS scientists estimate that about 400,000 chemical references will be fed into the system during each year of the contract. About 75,000 references per year will be to chemicals completely new to science. Another 325,000 will involve new information about known chemicals.

The computer "filing" system will be based on the chemical structure of each compound being considered. Information will include a unique registry number for each compound, a drawing of the chemical structure, its molecular formula, any names (systematic, trivial, or trade names) as well as any laboratory codes assigned. Bibliographic references will show the journal in which it first appeared and chemical abstracts in which the chemical may be found.

HumRRO Publishes Results of Tasks NICORD and SAMOFF

The Human Resources Research Office (HumRRO), a U.S. Army contract agency of the George Washington University, Washington, D.C., recently published results of two research tasks and added two more to the FY 1965 Work Program.

Task NICORD has resulted in a 22-week experimental course of instruction for the Nike Track Radar Repairman (MOS 253). As described in HumRRO Research Report 15, it has produced more proficient repairmen in 40 percent less time than the Army's standard 37-week course.

The objective of the task, launched with the support and cooperation of the U.S. Army Ordnance Guided Missile School, was to reduce the amount of training and job experience needed for an electronics maintenance man to attain full field proficiency.

Training was based on four analyses — system, task, knowledge of skills, and determination of training objectives—and differed substantially from content of the standard course.

Emphasis was placed on practical maintenance procedures, specific symptom-cause relationships, adjustment and repair skills and troubleshooting logic.

Reduced emphasis was placed on complex theory of circuit operation, which was found to have little application to the maintenance work performed by the track radar repairman.

Task SAMOFF involved analysis of the training requirements and procedures for surface-to-air missile battery officers. A 7-step procedure for deriving valid training objectives for junior officers was spelled out in detail, with illustrative examples, in a manual recently published by HumRRO and written by Dr. Harry Ammerman, of HumRRO Division No. 5 (Air Defense), Fort Bliss, Tex.

The problem involved the unusual degree of competency required of the junior officer in the modern Army in light of advances in weaponry, technology and doctrine. Researchers attempted to develop training procedures for these officers which would focus on critical duties and activities, rather than to expect maximum proficiency in all skills.

Projects added to HumRRO's work program with the concurrence of the Chief of Research and Development, Lt Gen William W. Dick, Jr., are Tasks INGO and STINTRAC.

HumRRO Division No. 5 researchers will clarify in Task INGO the different methods, terms and criteria associated with determining training objectives related to behavior patterns in actual performance situations.

Task STINTRAC is concerned with developing training and career management programs for key personnel in the Army's Scientific and Technical Information (STI) Program. It will be conducted by Division No. 1 (System Operations), Alexandria, Va., also the location of HumRRO headquarters.

The INGO research team headed by Dr. Harry Ammerman is surveying actual and proposed methods for establishing training objectives for the Army. The task involves analysis of these methods to clarify differences and to find out which methods are most appropriate for specific training situations.

The researchers are surveying practical instructional needs and situations, concentrating largely on Army Service Schools, and they will relate these findings to available methods for deriving training objectives based on expected performance requirements.

This rationale, together with results of the surveys, will be incorporated into a guidebook for use by Army instructors, department heads and school management personnel.

In Task STINTRAC, researchers have been asked by the Army to investigate and devise solutions for any problems that may arise from the establishment of the Department of the Army Scientific and Technical Information (STI) Program. The requirement is for advanced information handling techniques to retrieve, process, store and disseminate information. If successful, the Army network is expected to serve as the model for a network for the Department of Defense.

Because many new job positions will be created to operate a network —jobs for which there is no currently existing parallel—there is already the problem of determining what must be done to prepare persons to fill them. Task STINTRAC has three general objectives:

- To identify and describe the training requirements for all Army STI network major job positions.
- To ensure that appropriate training programs exist, or are developed, for all major users of the STI Network.
- To conduct or supervise the conduct of all training programs developed specifically for network personnel or STI users.

The first year of this effort will be devoted to exploring what needs to be done to implement a Department of the Army STI Training and Career Management Program. Work is under the direction of Dr. C. Dennis Fink of HumRRO Division No. 1.

This phase is expected to produce information which can be used to provide:

- A general description of the training requirements and performance standards for key STI Network personnel and STI Network users.
- A description of the major civilian and Government training facilities that are available for training STI Network personnel.
- A plan describing the R&D activities needed to implement the Army STI Training and Career Management Project.

Senior Army Aviator Appointed USAAML Deputy CO

Lt Col John W. Elliott took over as deputy commanding officer, U.S. Army Aviation Materiel Laboratories (USAAML), Fort Eustis, Va., when Lt Col Robert Calahan left for a special assignment in the Pacific.

A senior Army aviator qualified for helicopter and fixed-wing aircraft, Col Elliott was assigned to USAAML from a tour as deputy chief of staff, Army Aviation Materiel Command, St. Louis, Mo.

Other recent assignments include commanding officer with the 71st Transportation Battalion in Korea; liaison duty with the Air Research and Development Command, Wright-Patterson Air Force Base, Ohio; and chief of the Maintenance and Supply Branch, Aviation Division, Hq., Eighth U.S. Army.

Holder of a B.F.A. degree from Oklahoma State University, the colonel also served at the University as an instructor from 1946-61, attended the Senior Officers Army Aviation Logistics Course, Command and General Staff College, Associate Transportation Officers Career Course, and various fixed and rotorcraft courses.

Lt Col J. W. Elliott

Picatinny Arsenal Using Novel Weapons Research Techniques

Research focused on extending the range of conventional weapons at Picatinny Arsenal, Dover, N.J., has led development test engineers to use novel experimental techniques.

Special test stands resulting from the project are providing the capability for static test firing of solid-propellant booster and sustainer-type rocket motors under simulated gun-launched spin conditions.

The current emphasis on boosted artillery projectiles (BAP) turned attention to techniques of putting the motors through severe simulated firing conditions, including high rates of spin comparable to those achieved by gun-launched projectiles.

One of the significant findings of the tests came in the marked effect high spin rates had on the burning characteristics of the propellant grain. The peculiarities defied the application of standard static rocket data.

Prior correlations with flight test data disclosed that in most instances the standard non-spin static testing firing is inadequate in that it does not yield the required performance data for rockets designed to function under high-spin conditions.

Test stands now in use at the Arsenal can accommodate a variety of rocket motors up to 155 mm. in diameter. Successful tests have been run on 40, 105, 107, 115 and 155 mm. spin projects, with burning times up to 100 seconds and trust levels of 1,000 pounds.

Two basically different design principles are utilized on the test stands. An electric motor, belt-pulley drive arrangement is used for the large diameter motors stand. A drive shaft imparts spin to a chamber mounted in a "floating" bearing housing arrangement. A heavy wall test motor is used in the chamber.

The basic test operation consists of spinning the desired item up to a predetermined rate, firing the rocket motor while maintaining a constant spin rate, and measuring the principal parameters of thrust and pressure versus time.

In some instances, the rocket motor components are loaded directly into the main chamber which simulates the motor body configuration for a particular item. Electrical firing is accomplished through a slip ring assembly and the entire mounting is restrained in all directions except that of the main thrust axis, thereby enabling direct-force transmission to an electro-mechanical transducer.

Different spin rates can be obtained simply by varying pulley combinations. In-place calibration techniques are employed to insure proper stand performance for generating reliable test data.

A second stand uses this same design principle, except that for internal motor pressure measurements it incorporates a strain-gauged element of a Picatinny-manufactured high-frequency pressure transducer. The gauge element is flush-mounted in the test body and the output is fed to a recorder by means of a slip ring assembly.

The 40 mm. projectiles are tested on a specifically designed gas turbine power-driven stand which has attained spin rates in excess of 30,000 r.p.m.'s with no detrimental effects. The basic stand functions and operations are similar to the larger caliber thrust stand—with the exception of the driving mechanism which is controlled by gas pressure regulation.

All stands are capable of accommodating test rounds which are preconditioned at extreme temperature environments (−65° F. and +160° F.) for the purpose of evaluating propellant performance under adverse conditions.

The simplicity of design and low operating cost contribute greatly to the success of the "spinners," test engineers report. In most cases, results have indicated a substantial change in burning characteristics in spin versus non-spin test firings.

The ballistic information obtained from these spin test stands is serving as a valuable aid to the design engineer. It provides him with engineering information which allows him to optimize propellant grain design for boosted artillery projectiles applications prior to conducting actual flight performance tests.

Operation of the three experimental stands at Picatinny is under the direction of Ralph Vecchio, chief of the Propulsion Test Unit, and Frank Femia, test engineer, Technical Services Laboratory, Ammunition Engineering Directorate.

PROPULSION TEST unit chief Ralph Vecchio adjusts gauge of a spin test stand developed at Picatinny Arsenal for 105-155mm. rockets.

AMRA Develops Automatic Shell Inspection Drive

Fully automated, ultrasonic inspection of 81 mm. cast mortar shells is accomplished by a new instrument developed by John W. Orner and Norman E. Rice, U.S. Army Materials Research Agency, Watertown, Mass.

Developed with U.S. Army Munitions Command funding, the instrument was evaluated recently at Frankford Arsenal. It is expected to be placed at the Albion Malleable Iron Co. for an initial shakedown run on a production line.

Designed to be as nearly foolproof as possible, the device has only one control accessible to the operator, an on-off switch. As far as is compatible with performance requirements, electronic circuitry has been simplified and modular construction has been used, thus simplifying maintenance. Information read out is in the form of a "go, no-go" signal that controls the materials handling system.

The instrument checks itself before each scanning operation; should any part of the circuitry prove to be defective, it will automatically shut down the entire inspection machine.

Plans are currently under way to incorporate a self-standardizing feature also so it will automatically maintain its present refection level, in accordance with specified standards.

The instrument reportedly takes a significant step towards the concept of fully automated inspection in which the acceptance decision is taken out of the hands of the human operator, and accomplished electronically by comparison against a predetermined standard.

Col M. O. Becker

Maj W. S. Vargovick

Capt A. E. Dewey

Three Officers Report for New Assignments in OCRD

Col Marshall O. Becker, new commander of the U.S. Army Personnel Research Office in Washington, D.C., served from 1963 until recently as chief, Concepts Division, Combat Services Support Group, Fort Lee, Va.

Before his assignment to the U.S. Army Combat Developments Command installation at Fort Lee, Col Becker was assigned to the Office of the Joint Chiefs of Staff from 1960 to 1962 in Washington, D.C., followed by a year as commander of the 1st Battle Group, 5th Cavalry Division in Korea.

From 1958 to 1960 he was assigned to the Classification and Standards Division Office of the Deputy Chief of Staff for Personnel, Department of the Army. In the Office of the Joint Chiefs of Staff he was an action officer on reorganization of the Joint Staff and the establishment of the Office of Special Assistant for Counterinsurgency and Special Warfare.

Col Becker is a graduate of the U.S. Army Command and General Staff College, 1954, and the U.S. Army War College, 1958. He earned his B.A. degree in political science from the University of Washington, 1940, and an M.A. in personnel management from the University of Minnesota, 1954.

MAJ WILLIAM S. VARGOVICK was assigned recently as a staff officer in the Medical and Biological Sciences Branch, Life Sciences Division, Army Research Office. He served as research and development coordinator, Office of the Chief Chemical Officer, 1959-62, prior to a tour as Assistant Military Attache with the American Embassy, Vientiane, Laos, 1963-64.

His other duties have included project officer, U.S. Army Chemical Research and Development Laboratories, Edgewood Arsenal, 1955-58, and forward observer and battery executive officer with the 7th Division in Korea 1950-51.

Graduated from the U.S. Military Academy in 1949, Maj Vargovick received an M.S.E. degree in mechanical engineering from Purdue University in 1955. This year he graduated from the Command and General Staff College.

CAPT ARTHUR E. DEWEY, following his recent completion of the Command and General Staff College course, was named Assistant Secretary, Army Scientific Advisory Panel, Office of the Chief of Research and Development.

Among his past assignments are CO of 169th Engineer Bn., Fort Stewart, Ga., 1963-64, Battalion Operations Officer of the 169th (1964), and Assistant Project Officer for the Army Concept Team in Saigon, Viet Nam, 1963.

Capt Dewey received his M.S.E. degree in civil engineering from Princeton University in 1961. He has authored several articles on Army aviation and counterinsurgency which have appeared in *Army Aviation Digest* and *Army Magazine*.

Engineer R&D Labs Schedule 8th Reserve Officers Seminar

The Eighth Annual R&D Seminar for Reserve Officers at the U.S. Army Materiel Command's Engineer Research and Development Laboratories (USAERDL), Fort Belvoir, Va., is scheduled July 18-30.

The Seminar is designed to acquaint Reserve officers with the latest R&D activities of the Laboratories, as well as future plans and some of the problems that are being encountered.

Lecture sessions will be held in the U.S. Army Management School on Post. Visits will be made to various laboratories as well as to other military R&D establishments in the Washington, D.C., area.

Members of USAERDL Mobilization Designation Detachment No. 39 will again serve as staff members for the seminar. Lt Col Adolph H. Humphreys, CG of the Detachment and, as a civilian, chief of the USAERDL Combat Research Division, will be the seminar director.

Other members of his seminar staff will include Lt Col Herbert W. Maas, Jr., deputy director; Lt Col Raymond F. Dennis, executive officer; Maj Clarence W. Kitchens, operations officer, and 1st Lt Eugene J. Rodrick, functions officer.

Reserve officers interested in attending should write to Lt Col Humphreys, Combat Research Division, USAERDL, Fort Belvoir, Va.

Col Scofield Manages Special Tactical Radio Project

Life-cycle management responsibility for eight new Selected Tactical Radios designed for specific Army requirements is now assigned to Col J. H. Scofield, Jr., one of 33 Army Materiel Command project managers.

Formerly in charge of the AN/VRC-12 and the AN/PRC-25 radios, now being procured in quantity, he has a new title as Selected Tactical Radios project manager and an office at Fort Monmouth, N.J., to maintain close liaison with the Army Electronics Command Laboratories, under the U.S. Army Materiel Command.

Additional responsibilities assigned to him include a group of high-frequency single sideband radio communications equipment — the AN/GRC-106, -108, -122 and -142 and the AN/VSC-2 and -3.

The AN/VRC-12 vehicular radio and AN/PRC-25 manpack radio were demonstrated recently by the U.S. Army Tropic Test Center at Fort Clayton, Canal Zone, and selected for environmental testing and evaluation in the tropics. Other components to be tested are a remote control unit and a hand set.

Expected to take one year, the overall project will include four months of actual exercise usage, followed by an operational evaluation. The other eight months will involve static storage in a nonhumidified area.

The operational portion of the testing is planned to begin this month, with support of U.S. Army Forces Southern Command troops who will use the equipment and report on performance, capabilities, reliability, and handling ease. Later tests will determine the resistance of the components to withstand corrosion, fungi and other environmental elements of the humid topics.

McNamara Stimulates DoD Value Engineering Program

Creation of 265 Value Engineering positions signals a significant expansion of the Department of Defense program to eliminate unnecessary qualitative features in millions of parts and items procured by the DoD.

The expanded Value Engineering Program was approved June 2 by Secretary of Defense Robert S. McNamara, who said:

"Experience has shown that one of the most obvious and continuous sources of savings in Defense procurement lies in constantly challenging design specifications to make certain that we are buying what we need, but only what we need. Changes in specifications resulting from our program of Value Engineering—often referred to as the elimination of goldplating—produced savings totaling more than $250 million in fiscal year 1964 alone. The savings for the current fiscal year will be greater.

"In February of this year, each of the Military Departments and the Defense Supply Agency was requested to submit a plan indicating where Value Engineering personnel could most productively be assigned, and what savings could be achieved by them. At that time, a Value Engineering Evaluation Group was also established to evaluate those plans and submit recommendations to me.

"The Evaluation Group has now completed its study. It has recommended that 265 specialists in Value Engineering—247 are civilian and 118 military—be added to the Military Departments and the Defense Supply Agency and that one additional Value Engineering specialist be employed by the Office of the Secretary of Defense. I have approved these recommendations. The Evaluation Group estimates that this augmentation of personnel will achieve a minimum of $500 million in Value Engineering savings by fiscal year 1967."

The Value Engineering Evaluation Group mentioned by the Secretary is composed of the Materiel Secretaries of the Military Departments, the Assistant Secretary of Defense (Deputy Director, Defense Research and Engineering), and the Director, Defense Supply Agency, chaired by the Assistant Secretary of Defense (Installation and Logistics).

The VE Evaluation Group will continue to meet periodically to provide overall direction to the recruitment, training and assignment of personnel and to monitor the results achieved from this personnel augmentation.

CRDL Scientist Wins Grant for Research in Holland

An Army chemist who recently completed a year of study under a Secretary of the Army Research and Study Fellowship has received a research grant to pursue his interests at the University of Leiden in Holland.

Dr. Edward J. Poziomek, one of the gifted young scientists at the U.S. Army Chemical R&D Laboratories, Edgewood (Md.) Arsenal, received the grant from the United States Educational Foundation in The Netherlands under the Fulbright Cultural and Educational Exchange Program of the U.S. Department of State.

The grant will enable him to work in the field of photochemistry under the guidance of Prof. E. Havingo, a world-renowned expert. He will begin his studies at the University in September and return to the Laboratories in June 1966.

Dr. Poziomek entered the Army in 1956 as an enlisted man in the Chemotherapy Branch of the Army Laboratories. After his discharge in 1958, he returned as a civilian research chemist in the Kits and Laboratories Branch. By attending night classes at the University of Delaware, he earned a master's degree in 1960 and a Ph. D. in 1961.

His work under the Secretary of the Army Fellowship at the State University of New York has been described as "outstanding on the basis of scientific merit, important to the chemical detection program of the Laboratories, and of high value to the Department of the Army and the Federal Government as a whole."

Dr. Poziomek has authored approximately 30 scientific publications and has won 15 patent awards. Early this year he was a nominee for the Maryland Young Scientist of the Year Award.

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

Dr. Edward J. Poziomek (right) receives notification of Fulbright Scholarship from Dr. S. D. Silver, technical director, Army Chemical Research and Development Laboratories.

DoD Establishes Course In Systems Analysis Field

To meet a critical manpower shortage, the Department of Defense has established a one-year course to train military officers and selected civilians in systems analysis.

Leading to a master's degree, the course will convene Aug. 1 and will consist of three academic semesters. Personnel will be trained in techniques of planning, programming and financial management.

The course will be conducted by the Institute for Defense Analyses in cooperation with the University of Maryland, which will be the degree-granting institution. It will include economics, mathematics, statistics, mathematical operations research and strategic studies and analysis of Defense policy decisions.

In the final phase, students will study politico-military situations and review Defense Department studies.

Qualified military officers and civilians now are being screened by the various services. Minimum qualifications include a baccalaureate degree from an accredited institution, demonstrated proficiency in mathematics (credits in differential and integral calculus) and overall qualifications for a first-year course in mathematical statistics.

Graduates will be assigned to the Joint Staff, the staffs of the Military Departments, and the Office of the Secretary of Defense in branches that are particularly concerned with systems analysis and force-level plans.

Conceived by Assistant Secretary of Defense Charles J. Hitch, the course was implemented by the Chief of Naval Personnel. Funding, planning and programing responsibilities are assigned to Secretary of the Navy.

Missile Command Deputy Promoted

Brig Gen Clarence C. Harvey, Jr., deputy commanding general for Air Defense Systems, U.S. Army Missile Command, received his first star from Maj Gen John G. Zierdt, Missile Command CG, in recent promotion ceremonies at Redstone Arsenal.

CDC Selects Brig Gen Lilly to Head CCIS Group

The U.S. Army Combat Developments Command (USACDC) recently announced the assignment of Brig Gen Roger M. Lilly to head its Command Control Information Systems (CCIS) Group at Fort Belvoir, Va.

General Lilly will be responsible for establishing broad objectives and requirements for the development and integration of automatic data processing systems to process information for combat operations at all echelons.

A veteran of 26 years of Army service, he began his career as a Battery officer with the 12th Field Artillery, 2nd Infantry Division, Fort Sam Houston, Tex., after graduating from the U.S. Military Academy.

During World War II, from late 1942 until the end of hostilities in 1945, he commanded the 399th Armored Field Artillery Battalion, 8th Armored Division. His next command was the 919th Field Artillery Battalion, 94th Infantry Division, U.S. Forces European Theater.

Upon returning from Europe in late 1947 he began a tour of duty with the General Staff, U.S. Army, Washington, D.C., serving as assistant to the chief, Research and Development Group, Logistics Division, 1947-49, and as staff officer, Plans Branch, Research and Development Division, Office of the Assistant Chief of Staff G4, 1949-50. He is enrolled in the Research and Development Officer Specialist Program.

Brig Gen Roger M. Lilly

Subsequent to earning an M.S. degree in mechanical engineering from the University of Michigan, 1950-52, General Lilly was assigned to the Field Artillery Service Test Division, Army Field Forces Board No. 1, Fort Bragg, N.C., serving as test officer, 1952-53, chief of the Materiel Branch, Office of the Chief, 1953-54, and director, 1954.

Late in 1954 General Lilly was assigned to Fort Sill, Okla., as director of the Field Artillery Service Test Division and deputy president, Board No. 1, Office of the Chief, Army Field Forces. He was named director, Field Artillery Material, 1954-55.

Within the past 10 years General Lilly's assignments have been: commander, Joint Task Group 7.2 (Army), Joint Task Force Seven, Eniwetok Atoll, Marshall Islands; deputy director, 1956-58, and director, 1958-59, the Department of Combat Developments, The Artillery and Guided Missile School, Fort Sill, Okla.; commander, 212th Artillery Group, U.S. Army Europe, 1960-61; and deputy Artillery commander, Headquarters, Seventh Army, U.S. Army Europe, 1961-63.

His most recent assignments include: deputy chief of staff, Atomic Weapons Training, Field Command, Defense Atomic Support Agency, Sandia Base, Albuquerque, N. Mex., 1963-64; deputy commander, Field Command, Defense Atomic Support Agency and commanding officer, U.S. Army Element, Field Command, DASA (concurrent), also at Sandia Base, 1964; and commanding general, I Corps (Group) Artillery, 1965-65.

3256th Army R&D Unit Hears Talk on Laser Uses

Giant communications networks and a new weapon in the war on cancer were among applications of the Laser beam described by Dr. J. D. Tebo, of the Bell Telephone Laboratories, at a recent meeting of the 3256th U.S. Army R&D Unit, Raleigh, N.C.

Dr. Tebo, head of the Technical Relations Department at the Bell Labs, stated that theoretically a Laser beam could handle all the radio and cable communications now in use. Looking far into the future, he envisioned one beam handling simultaneously millions of conversations.

The 3256 Unit serves the so-called Research Triangle area of North Carolina. Membership includes a large number of scientific people associated with research institutes and private laboratories in the region, as well as many faculty members of Duke University, the University of North Carolina and North Carolina State University.

Col Allen P. Blade, unit commanding officer, presented a letter of commendation during the meeting to Maj William C. Hackler, associate professor of mineral industries at North Carolina State and a long-time member of the unit, who resigned membership.

Dr. J. D. Tebo, Bell Laboratories scientist, chats with Col Allen P. Blade, CO of the 3256th U.S. Army R&D Reserve Unit (center) and Col Edgar R. Brooks, deputy CO, at recent meetings of the Unit in Raleigh, N.C.

Agreement Decides Design Of New Main Battle Tank

The U.S. Department of Defense and the German Military Ministry of Defense have agreed on a single design concept for the Main Battle Tank under the MBT-70 joint development program.

The design reportedly meets the objectives of a major improvement in tank fire power, mobility and protection. Selection of major components has been made, with Renk Daimler/Benz and Frieske and Hoepfner, German firms, participating in the development program with the U.S., Continental Aviation Corp., National Waterlift Co. and Philco Corp.

The need for common logistics and interchangeability of major components in combat is so great, the two nations decided, that it would be necessary to adopt standard fasteners for the interface of major components.

In view of the importance of this problem, and without attempting to resolve the wider application of standard measurement systems, it was agreed that the tank would be dimensioned in both metric and inch scales, that the thread fastener system of the developing country would be used for each component, and that the International Standardization Organization metric thread fastener standard would be utilized at the interface of major components.

In light of the excellent progress reported, the two ministries are developing presentations on the tank concept and future developments-production timing for those NATO countries interested in the MBT-70.

Army Interest in Chemiluminescence Explained

By Dr. Robert J. Heaston

The following article was prepared by Dr. Heaston at the request of the editor following his recent participation in an International Symposium on Chemiluminescence sponsored by the Office of Naval Research and the Advanced Research Projects Agency.

Dr. Robert J. Heaston

Dr. Robert J. Heaston, of the Chemistry and Materials Branch, Physical Sciences Division, U.S. Army Research Office, Arlington, Va., prepared this article after attending the recent International Symposium ond Chemiluminescence at the U.S. Army Research Office, Durham, N.C. (ARO-D).

The symposium was cosponsored by the Advanced Research Projects Agency, Office of Naval Research and ARO-D.

Approximately 100 persons attended from Chile, Brazil, Japan, Germany, England, the Netherlands, Canada and the United States. U.S. participants included representatives from Army in-house laboratories, the Navy, Air Force, National Bureau of Standards, Atomic Energy Commission, National Institutes of Health, National Science Foundation, National Aeronautics and Space Administration, industrial firms and universities.

Dr. Heaston joined the U.S. Army Research Office Headquarters staff, Arlington, Va., in March 1964. He is responsible for staff programing and coordination of Army-wide research programs on propellants, explosives, pyrotechnics, fuels, lubricants, organic materials and protective clothing.

Previously he was an aerospace engineer (propulsion and power) with the Advanced Research Projects Agency (1961-64) and senior project engineer for technical administration of Air Force programs on synthesis and combustion evaluation of special fuels (1955-58). His M.S. and Ph. D. degrees are in chemical engineering.

Any light with a negligible amount of accompanying heat is spoken of as luminescence or a "cold light." It is to be contrasted with incandescence, where the heat production is large and the light is directly associated with the high temperature.

A number of different processes will produce luminscence. The mechanism behind each process gives a specific name to each form of luminescence observed. Thus, there are chemiluminescence, crystalloluminescence, electroluminscence, radioluminescence, and triboluminescence.

Each of these names indicate, respectively, luminescence occurring in a chemical reaction, from crystallization, from electrical excitation, as a result of previous exposure to different kinds of radiation, or from rubbing materials together.

Radioluminescence can be further described in terms of fluorescence and phosphorescence. Fluorescence is the emission of light while a material is being irradiated. If the light continues to emit after radiation, then phosphorescence occurs.

Due to general custom, phosphorescence has come to be applied to specific substances. This term has been used to describe the glow of phosphors and the luminescence of the firefly, the sea, dead fish, flesh and some kinds of wood.

Bioluminescence or photogenesis represents the more technical terms to classify luminescence due to living organisms. The cause of this light has been attributed to the slow oxidation of substances produced by the organism.

Chemiluminescence is the sustained emission of light by a chemical reaction which occurs below 1000°F. The phenomenon of chemiluminescence was discovered 300 years ago. Nevertheless, the field is relatively unexplored because of the complexity of the chemiluminescent process, the sophisticated techniques needed to make meaningful measurements, and relatively recent interest in applications involving chemiluminescence.

In recent years chemiluminescence has developed quickly into a multidisciplinary technology. The following aspects are involved:

- The *physical* aspect is considered to be unusual because the phenomenon of chemiluminescence occurs in aqueous solutions under ordinary conditions.
- The *biochemical* aspect enters into at least 40 different orders of animals, plants, and marine life.
- *Organic* chemistry has revealed a number of substances that can emit easily visible luminescence. However, the relationship between light intensity and the structure of organic matter needs further study.
- No chemiluminscent reaction has been observed that did not involve *inorganic* contributors. In particular oxygen, peroxides, and metal catalysts have been noted as playing a significant role.

In addition to these aspects, chemiluminescence can be classified under the Defense Research Sciences in the areas of Environmental, Life, Physical and Engineering Sciences.

Environmental Sciences. The existence of a high-altitude atmospheric night glow or afterglow has been attributed to chemiluminescence caused by the recombination of oxygen. This phenomenon, known as recombination luminescence, is a fundamental process involving relatively simple gaseous atoms and molecules.

Recent studies have shown that electronically excited molecules or atoms of oxygen can contribute to chemiluminescence. Some typical reactions (where M is the so-called third-body quenching agent) that have been studied as possible intermediate mechanisms for afterglow have been:

$$O + O + M = O_2 \text{ (excited)} + M$$
$$O + O_2 + M = O_3 + M$$
$$O_3 + O = 2O_2$$
$$O_3 + O_3 = O_2 + O_2 + O$$

Various other reactions with the same combinations of oxygen atoms and molecules, and ozone, but with other excited states have also been investigated. There is some controversy as to how a third-body can participate in a low-pressure recombination reaction, with or without radiative emission. One of the most studied reaction schemes has been

$$O + NO = NO_2 + \text{light emissions,}$$
or
$$O + NO + M = NO_2 + M$$
$$O + NO_2 = NO + O_2$$

High-altitude rocket release of nitric oxide has given some spectacular emission clouds. Other reactions which have been studied are:

$$SO + O_3 = SO_2 + O_2$$
$$NO + O_3 = NO_2 + O_2$$

The effects of various quenching agents or third-body materials have been studied extensively in a number of reactions. Measurements have been made on the effects of helium, argon, nitrogen, carbon dioxide, methane, water vapor, etc. Their influence requires further study.

Life Sciences. Chemiluminescence or bioluminescence has been observed in many species of living matter. Because chemiluminescence has been ob-

served in so many biological systems, it is useful to consider this effect. These reactions indicate an energetic turnover which must be much higher than the amounts of energy (15 Kcal mole $^{-1}$) observed in biological reactions and which might be able to excite electrons of proteins, nucleic acids and other essential molecules of living matter.

Chemiluminescence has been used as a tool in studies on aging, evaluation of preparations of mitochondria from rat liver and beef heart, reactions containing hemin and other blood components, mechanism of activity by the thyroid hormone, thyroxine, and studies on selected enzymes and marine animals.

The detection, intensity measurement and spectrographic interpretation of chemiluminescence from bioluminescent reactions is similar to other studies. However, the application of this information to the mechanism of the biological material is probably more complex than other studies involving chemiluminescence.

Nevertheless, the application of chemiluminescence as an analytical technique to biological studies is frequently time-saving and sometimes the only possible approach. It is also probable that generation of products of a reaction in an excited electronic state would be a very useful way to make available the energy of a biochemical reaction. Such excited products could be used in controlled reactions or could be made to transfer the excitation energy to an appropriate receiver.

Physical Sciences. The major scientific interest in chemiluminescence is in the physical sciences area. Because of the need for better chemiluminescent materials, a wide range of chemical reactions has been examined for light-emitting qualities.

In order to direct the search for new reactions of potential interest, it is necessary to develop criteria as to what chemical ingredients or what physical mechanisms might be common to chemiluminescent reactions. Some observations obtained to date are summarized in the following.

Chemiluminescence should be considered as a rather general phenomenon. It appears to be found in any exothermic reaction provided use is made of a sufficiently sensitive detector.

A requirement that chemiluminescent reactions must provide sufficient chemical energy to account for the energy of the light quanta emitted has long been recognized. This places a substantial energy demand on chemiluminescent processes in that, for example, a reaction capable of emitting blue light to 400 millimicrons must provide at least 71.5 Kcal mole $^{-1}$ of chemical energy, including activation energy.

An amazingly large fraction of chemiluminescent reactions involve oxygen, either directly or in the form of peroxides. Most of the efficient chemiluminescent reactions involve organic compounds in solution, and the three best compounds are luminol (5 aminophthalazinedione), lophine (2, 4, 5—triphenylimidazole), and lucigenin (dimethylbiacridylium nitrate). Nevertheless, the quantum yields (amount of free reaction energy converted into light vibrations) for these compounds are less than 5 percent under optimum conditions.

It is known that during the reaction between luminol and hydrogen peroxide bright luminescence arises. However, if the solutions of the components are purified of traces of heavy metals no chemiluminescence is noted on mixing the components.

Some of the metals that have been tested as complex ions are copper, iron, erbium, vanadium, cobalt, manganese, nickel, zinc and others. A great deal of study has gone into trying to interpret the mechanism of this effect. The chromium ion is conspicuous by its absence from the list of metals tested.

In general, those compounds producing a high-intensity chemiluminescence begin to emit quickly when the proper ingredients are brought together. Relatively short, constant-level emissions occur before a sharp decay begins. Low-intensity chemiliuminescent reactions display the opposite effect. The intensity rises over a longer period, plateaus, and decays at lower rates. One particular value of this observation is that chemiluminescence is apparently proportional to the reaction rate.

Although a very large number of chemiluminescent reactions are known, few are efficient in light production. As a consequence, for both military and commercial applications of chemiluminescent reactions and in the elucidation of the molecular mechanism of chemiluminescence and bioluminescence, it is extremely important to know the quantum yield. A quantum yield of five percent appears to be a desirable threshold level for application.

The measurement of the quantum yield in an experiment requires the determination of the chemical stoichiometry, the emission spectrum of the light reaction, the absolute spectral photon sensitivity of the photo-tube used, and the physical geometry of the over-all experimental system.

Another interesting facet of chemiluminescence which was recently concluded is that no light emission from solutions has ever been observed in the presence of acid.

Engineering Sciences. Although it may not be legitimate to classify this part of the discussion as Engineering Sciences, it is still true that one of the major values of chemiluminescence would be its wide application as a material(s) with practical uses.

The major contributor to the relatively recent intense interest in chemiluminescence has been the Naval Ordnance Test Station (NOTS). Project TIARA was initiated by NOTS in 1961 and supported by the Advanced Research Projects Agency (ARPA) from 1961 to 1964. The goal of this project was to obtain chemiluminescent materials suitable for use in remote area conflict.

It was soon realized that there are many potential military applications for chemiluminescent materials. Some of these applications include air-sea rescue, wakes of ships, landing strips, perimeter defense, intrument markers and target identification.

The major base for initiation of Project TIARA was tetrakis (dimethylamino) ethylene, TMAE (called "tammy"), which exhibits interesting chemiluminescent properties on exposure to air.

At ordinary temperatures, TMAE is a stable liquid. When exposed to air or molecular oxygen at ambient temperatures, the oxidation is accompanied by the emission of light in the visible region. Chemiluminescence continues through the oxidation process.

There has been much speculation as to the exact nature of the active species that is responsible for the luminescence phenomenon. It has been suggested that oxygen causes TMAE to cleave at the double bond to form either a free radical or ion-radical, and it is one of these fragments that gives rise to chemiluminescence.

In an attempt to deduce the chemiuluminescence reactions of TMAE, it has been observed that the vapor phase oxidation of TMAE exhibits three reaction zones. There is a slow oxidation zone, a cold-flame zone, and an explosive zone, all of which are a function of oxygen pressure, initial temperature, and induction time.

It has also been observed that protonic materials increased the intensity of chemiluminescence. This characteristic has been observed in solutions of TMAE with various other constituents. In controlled experiments, oxygen is bubbled through a mixture of

(Continued on page 28)

Congress Report Weighs National Data Center

Findings and recommendations of an Ad Hoc Subcommittee on a National Research and Data Processing and Information Retrieval Center, chaired by Congressman Roman C. Pucinski, are presented in a recently issued report.

The report to the Eighty-Eighth Congress, Second Session, on H.R. 1946 contains the viewpoints of many of the Nation's leading academic, industrial and Government leaders in the scientific and technical information field.

H.R. 1946, renumbered H.R. 664 in the Eighty-Ninth Congress, is described as "a bill to amend Title IX of the National Defense Education Act of 1958 to provide for a science information data processing center to be located at one place in Chicago, Ill."

The hearings covered by the report, Part 4 of the overall report on the Pucinski Committee study, were held Apr. 27-28 and Aug. 13, 1964. Further hearings on the bill are planned this fall. In his instruction to the opening session, Rep. Pucinski stated:

"Before we proceed with the first witness I would like the record to clear up one misconception that I think some of the people who have been discussing this legislation have unfortunately been engaged in, and that is that the legislation before this committee proposes a center which in effect would be a clearinghouse or a nerve center for a national system.

"Many people have inquired whether it was the intention of H.R. 1946 to try to group under one roof and one central location all of the existing research data processing facilities. We have previously made the record clear and we are merely reemphasizing again today that H.R. 1946 does not envision bringing under one roof all of the scientific research data processing and retrieval facilities.

"It would be, in my judgment, a tremendous waste of money and resources, and absolutely unworkable, to try to create a joint information center when we have in this country a whole constellation of excellent facilities in our universities, both private and public research establishments, that assemble, process, and abstract scientific research. . . ."

The concept of H.R. 1946, Rep. Pucinski explained, is that a national system would be established that would function as a nerve or flow center for maintenance of a "running inventory on what is being done, where, by whom, and what is already available in the respective disciplines so that . . . the scientific community will be able then to impose its own discipline against waste and duplication."

Contained in the report on the hearings are many "Quotable quotes" by recognized experts in the scientific and technical information field regarding the need for a national information center to control the flow of information through decentralized facilities already in existence.

From the viewpoint of the Pucinski Ad Hoc Subcommittee, one of the strong statements in support of such a national facility and system was made by Norman H. Taylor, special assistant to the president of Control Data Corp., Minneapolis, Minn.:

"Dr. Jerome Weisner [former Presidential science adviser], I believe, has stated that when both sides have filled their arsenals with more weapons than either can use, indeed the ability to handle information becomes itself a balance of power.

"The knowledge of our research base, the ability to avoid duplication of effort, and the use of results of

Chemiluminescence

(Continued from page 27)

TMAE, nonpolar organic solvents such as dioxane, and small amounts of alcohols. In these tests methyl alcohol appears to give the highest intensity although alcohols up to 1-octanol and beyond have been successful. A number of mechanisms have been postulated for the reaction of TMAE with oxygen but no specific approach has been generally accepted.

Conclusions: Luminescence, or light emission from relatively cool systems, is a general phenomenon. Until recently, different areas of interest in luminescence have developed independently. These areas are now being united. Bioluminescence and chemiluminescence are presently the major topics of interest.

The main problem facing investigators of bioluminescence is to determine how relatively nonenergetic life processes can generate the highenergy levels required for light emission.

The objectives of the efforts being conducted on chemiluminescence involve evaluation of known light-emitting systems to determine the mechanism and searching for new chemiluminescent systems. By determining the mechanism for the conversion of chemical energy to electronic exictation energy, it is possible that requirements for a specific chemical system might be predicted.

The search for better chemiluminescent systems is aimed toward obtaining longer lifetimes, higher efficiencies, and better handling properties. The quantitative magnitude of these characteristics, including light-intensity levels, are dependent upon end use. However, a quantum yield of 5 percent or greater is apparently a suitable target for efficiencies for most applications.

Chemiluminescence also is related to pnenomena of interest such as: (a) photochromic (color changing) processes depend upon related quantum mechanical behavior; (b) light intensification techniques used for absolute intensity measurements have some relationship to approaches to night vision; and (c) materials displaying chemiluminescence might be of use in Laser pumping systems.

Proposed ASVIP Goes Out for Letter Ballot Approval

A Proposed American Standard Vocabulary for Information Processing (ASVIP) was processed by the American Standards Association Sectional Committee X3 at a meeting in New York City, June 10, and is now out for approval by letter ballot.

Compiled by the ASA Sectional Committee X3.5, under the chairmanship of Martin H. Weik, chief of the Systems Branch, Scientific and Technical Information Division, U.S. Army Research Office, the ASVIP contains definitions of some 700 computer, data processing, and communications terms in alphabetical order.

As a general vocabulary on information processing, some of the terms and their definitions are already in approved and proposed American Standards. The first edition, intended to support the needs of the other ASA X3.n subcommittees on a limited scale, was compiled after consulting more than 45 existing vocabularies.

The next edition of the ASVIP will extend this support. The format permits the easy insertion of new terms and their definitions. All terms are either defined or refer to a defined term. Synonyms and deprecated terms are referred to the preferred term. A separate entry is made for words that are common to several multiple-word terms, as an aid for cross reference purposes.

The Office of the Special Assistant for Army Information and Data Systems (SA/AIDS) of the Office, Chief of Staff has developed an official Army position favoring adoption of the ASVIP as an American Standard.

one group to enhance progress of another are certainly a part of such a statement. . . ."

The report points out that more than 100,000 technical journals are pouring out scientific literature, and that failure to disseminate and use this information effectively "results in wasteful duplication of research estimated to be up to 50 percent of our current $15 billion effort in research and development."

Recommendations in the report call for an increase in the budget for the Office of Science Information Service, and for initiation of steps to establish a national data processing and information retrieval system. Regarding the latter, the report says:

"Because the concept of the coordinated national information system portends an undertaking similar in scope to the Manhattan Project, the Office of Science Information Service must take initial steps necessary for implementing a national data processing and information retrieval system at the earliest possible time.

"Such steps should take into account not only the valuable facts and ideas presented during the hearings before this committee, but also include past and present histories of the effectiveness of national information systems throughout the world."

Included in the report are the statements made by noted authorities in the scientific and technical information field during the hearings, supported by supplemental material submitted to the committee by various academic institutions and corporations working on the national system.

Among those who made presentations to the committee are: Dr. Robert M. Fano, Massachusetts Institute of Technology; Dr. Harry Letlaw, Bunker-Ramo Corp.; Fielding G. Lucas and L. W. Armstrong, Minneapolis Honeywell; Dr. James G. Miller, University of Michigan; Dr. Derek J. de Solla Price, Yale U.;

Dr. Richard C. Raymond, General Electric Co.; Dr. Morris Rubinoff, University of Pennsylvania; J. W. Sweetser, Martin-Marietta Co.; Norman H. Taylor, Control Data Corp.; and Dr. Werner von Braun, the distinguished director of the George C. Marshall Space Flight Center.

AMC Safety Digest Recognized

The Army Materiel Command Safety Digest was one of four publications to win the National Safety Council Award of Merit for "exceptional service in the promotion of safety during 1964" in a recent competition among 80 industry and Government publications.

Fred M. Bishoff is AMC safety director and Albert F. Abraham is Safety Digest editor.

ECOM Completes Major Functional Realignments

Functional realignments within the U.S. Army Electronics Command in progress for more than a year were completed this past month with the separation of research and development activities into 7 major elements.

Maj Gen Frank Moorman, ECOM commanding general, said the restructuring process has placed six new laboratories and an advanced research establishment directly under the CG's control.

The Combat Surveillance-Target Acquisition Lab and the Avionics (Army aircraft electronics) Lab were established earlier this year. Other new elements are the Electronic Components Lab, Combat Communications and Automatic Data Processing Lab, Electronics Warfare Lab, Atmospheric Science Lab, and the Institute for Exploratory Research.

The six Laboratories, the Institute and a Research and Development Directorate will encompass the research and development functions of the Command's present Electronics Laboratories, which have carried out broad multi-faceted programs in electronics and related fields.

Among its responsibilities, the R&D Directorate will provide engineering support, shop and administrative services, and perform overall functions not assigned to the individual Laboratories and the Institute.

The huge Hexagon, where the work of the present Electronics Laboratories has been focused, will become to an even greater extent the central point for research and development. General Moorman and his top Command group moved there from the main post this past month.

General Moorman stated that the changes are designed to reduce further an "administrative superstructure." Among the expected results are that technical personnel and administrators will be able to function more efficiently in their respective areas. Further changes are pending.

General Moorman also announced appointment of Dr. Robert S. Wiseman to head the Combat Surveillance-Target Acquisition Laboratory, with promotion to PL-313 status.

Dr. Wiseman served formerly as chief of the Warfare Vision Division at the U.S. Army Engineer Research and Development Laboratories at Fort Belvoir, Va. He was selected recently as one of 24 winners of the 1965 R&D Achievements Awards.

The Combat - Surveillance - Target Acquisition Laboratory was the first of the R&D elements formed by General Moorman to concentrate on well-defined technical areas of major importance that have been encompassed within the Electronics Laboratories.

Col Milner Relieves Col Kerkering as CO of ERDL

After nearly five years service as commander of the U.S. Army Engineer Research and Development Laboratories, Fort Belvoir, Va., Col J. H. Kerkering was relieved on June 15 by Col Frank Milner.

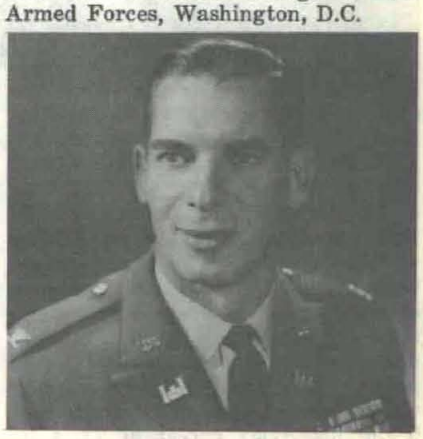
Col Milner, 49, served his first Regular Army tour of duty at ERDL from 1938 to 1940 and returned as director of the Combat Developments Group of the Engineer School at Fort Belvoir from 1956 to 1959.

When the Japanese attacked Pearl Harbor, Col Milner was stationed there. Later he commanded the 841st Engineer Aviation Battalion in the Southwest Pacific and 1178th Engineer Construction Group, Philippines.

Until two years ago, when he became chief of the Technical Liaison Office, Chief of Engineers, he was deputy chief of staff for Logistics and Administration with the Allied Land Forces Southern Europe (NATO), with duty station at Verona, Italy.

Experience as a registered professional engineer in Illinois is among Col Milner's qualifications for his new duties of directing about 1,500 civilian and military personnel in some 20 fields of military engineering requirements at the Laboratories.

Graduated from Purdue University in 1938 with a B.S. degree in civil engineering, he earned an MSCE degree from the University of California in 1941. He has attended the Command and General Staff College, Fort Leavenworth, Kans., the Armed Forces Staff College at Norfolk, Va., and the Industrial College of the Armed Forces, Washington, D.C.



Col Frank Milner

Kudos

The Secretary of Defense Meritorious Civilian Service Medal was presented recently by Secretary of Defense Robert S. McNamara to Henry J. Kuss, Jr., Deputy Assistant Secretary of Defense (International Security Affairs) for International Logistics Negotiations.

Appointed to his present job Feb. 7, 1964 Mr. Kuss has held major positions in the Office of the Secretary of Defense since 1961. The accompanying citation stated in part:

"His imaginative leadership combined with unparalleled ability as an international negotiator has assisted in a unique fashion to develop the military export sales program and other significant international logistics efforts. In the short span of three years he has shaped a major program of international logistics negotiations that has enhanced the Free World defense posture and immeasurably benefited the United States."

The Legion of Merit was presented to Col Henry J. Cronin for "exceptionally meritorious service" while serving as chief of the Combat Materiel Division Office of the Chief of Research and Development. Chief of R&D Lt Gen William W. Dick, Jr., made the presentation.

Col Cronin, who has served in the position since September 1963, was cited for having "ably directed and skillfully coordinated 100 major research and development projects . . . and his sound guidance for more than 500 subtasks in such wide and diverse areas as nonatomic firepower, ground mobility and combat support equipment."

Notable actions singled out in the citation were: the U.S.-Federal Republic of Germany (FRG) Main Battle Tank Program and the Main Armament of the tank; the U.S.-FRG Armored Infantry Fighting Vehicle Program; and studies leading to the development of a follow-on Combat Vehical Weapons System.

Col Cronin served as chief, Operations Division, S-3, Eighth U.S. Army, Korea before his present assignment. A 1939 civil engineering graduate of the Virginia Military Institute, he also has completed the Army War College and the Command and General Staff College.

CHIEF OF R&D Lt Gen William W. Dick, Jr., congratulates Col Henry J. Cronin, chief, Combat Materiel Division, Office, Chief of R&D after presenting to him the Legion of Merit.

Dr. Robert W. Weigle, chief scientist at the U.S. Army Materiel Command's Watervliet (N.Y.) Arsenal, was a recent recipient of the Army Meritorious Civilian Service Award.

Presented by the Arsenal commanding officer, Col Keith T. O'Keefe, the award recognized Dr. Weigle's technical and executive ability in developing a new thread form for use in the breech assembly of the Shillelagh gun-launcher for the Sheridan vehicle. His work has resulted in an

Dr. Earl E. Lackey (center), 87-year-old physical geographer at the U.S. Army Natick (Mass.) Labs, receives a citation and $300 award from Brig Gen W. W. Vaughan, CG. Looking on is Dr. Peveril Meigs, director, Earth Sciences Division. Dr. Lackey was honored for developing advanced techniques in predicting weather variable throughout the world by compiling records of global weather stations into a single "general purpose monograph" that could be applied to a wide range of elements. Dr. Lackey began his Army career at 72, after retiring from academic life.

Col Kaufman Wins Citation for Prescribed Action Link

The Legion of Merit, awarded in peacetime for completing a special requirement or extremely difficult duty "which is performed in unprecedented and clearly exceptional manner," was presented recently to Col Lee S. Kaufman.

Based on Col Kaufman's direction of a top-priority DoD requirement to develop a Prescribed Action Link (a device to prevent unauthorized use of nuclear weapons), the award was presented by Maj Gen F. A. Hansen, CG, U.S. Army Munitions Command.

Formerly deputy commander of Picatinny Arsenal, Col Kaufman was reassigned recently as director of Materiel Readiness, U.S. Army Munitions Command. He was nominated for the medal by Col H. H. Wishart, Picatinny commanding officer.

The citation reads in part: "Col Kaufman distinguished himself by exceptionally meritorious service from 1962 to 1965. . . . The Prescribed Action Link immeasurably reduces the chance of an unintentional detonation of a nuclear weapon. His qualities of exceptional technical skills were of crucial importance in the absence of formal requirements. His experience in Ordnance and his initiative and imaginative methods were the foundation in resolving unprecedented situations. . . .

"His work was not only an extraordinary accomplishment in carrying out the mission of the Department of the Army and an eloquent testimonial to his own abilities, but also materially enhanced the prestige of the United States and helped to assure the continuity of American alliances and the peace and security of the world."

LEGION OF MERIT is presented to Col Lee S. Kaufman by Maj Gen F. A. Hansen, CG, Army Munitions Command, as Mrs. Kaufman observes.

estimated initial cost avoidance to the Government of $825,000.

Previously he had received a Presidential Citation for his direction of a program which developed new techniques for simulated test firing of conventional weapons, the use of which produced savings of $245,375 in 155 mm. howitzer testing.

Dr. M. Geneva Gray, a physiologist, and Miss Maxine Spengler, women's clothing designer, at the U.S. Army Natick (Mass.) Laboratories, also recently received Meritorious Civilian Service Awards.

Dr. Gray was honored for establishing and maintaining a technical intelligence facility which has greatly expanded the research and development capabilities of the Natick Labs. In addition, she serves as toxoligocical safety officer and consultant in toxicology to the chief of the dispensary.

A graduate of Boston University, with advanced studies to her credit at Boston University, Radcliffe College, Massachusetts Institute of Technology, and Harvard Medical School, she was associated with Arthur D. Little, Inc. for 15 years prior to joining Natick in 1957.

Miss Spengler, cited for exceptional performance as a clothing designer, joined Natick in 1954 after serving with the Office of the Quartermaster General in New York and Philadelphia. She has been in charge of designing the new Army green uniform for women and also created the design for the uniform worn by female employees of the Postal Service. She is a graduate of Smith College.

Col Arvey Sanders, now assigned

MERITORIOUS Civilian Service Awards were presented recently to Army Natick (Mass.) Laboratories employees Dr. M. Geneva Gray (left), physiologist, and Maxine Spengler, U.S. Army women's clothing designer.

to the Walter Reed Army Institute of Research, Washington, D.C., received a distinct honor immediately prior to his recent departure from Japan as commanding officer, U.S. Army Research and Development Group-Far East.

Col Sanders is the fourth foreigner and the first not a doctor of medicine who has been elected an honorary member of the very select and highly respected Kitasato Institute of Japan.

In a congratulatory letter to Col Sanders, Chief of Research and Development Lt Gen William W. Dick, Jr., stated: "I wish to congratulate you upon being selected for this honor in recognition of your demonstrated scientific competence and outstanding professional contributions to the Institute.

"It is indeed gratifying that while representing this office in Japan, you have gained such high esteem of the Japanese medical scientists, reflecting credit upon yourself and the United States Army."

Lt Col Louis G. Klinker, assigned to the Advanced Research Projects Agency's R&D Field Unit in Viet Nam, was recently awarded the Oak Leaf Cluster to the Army Commendation for "exceptionally meritorious service" while serving consecutively as general staff action officer and chief, Chemistry and Materials Branch, Physical Sciences Division, U.S. Army Research Office, Arlington, Va.

The citation singled out his "outstanding performance" in reorganizing the Army Materials Advisory Committee into the Materials Advisory Group and forming technical working groups for program analysis and research planning of the Army materials program.

Dr. Alexander Hammer was recently named a Fellow of the American Society of Mechanical Engineers (ASME). The director of research in the Support Research Branch, Research and Engineering Division, at Springfield (Mass.) Armory was selected for "outstanding contributions" to the engineering profession.

To receive consideration for the grade of Fellow in the ASME a nominee "must be an outstanding engineer with acknowledged engineering attainment and leadership qualities" and must have 25 years of engineering practice or teaching and 13 years of ASME membership.

Dr. Hammer was awarded a Certificate of Merit by the ASME Council in 1963, following service as secretary of the New England Region from 1959 through 1962.

Picatinny JSH Symposium Draws Over 300 Students, Instructors

A tour of Picatinny Arsenal's Dover, N.J., research and engineering facilities was a highlight of the 5th annual North Jersey Junior Science and Humanities Symposium at Fairleigh Dickinson University, Madison, N.J., June 3-5.

More than 300 high school students, faculty members and observers attended the symposium to hear presentation of 15 original research papers by selected high school seniors. The Picatinny tour included the plastics, chemistry and quality engineering laboratories, the linear accelerator and a static rocket test.

Cosponsors of the symposium were the Arsenal and the U.S. Army Research Office-Durham (N.C.). L. H. Eriksen, Picatinny's director of research, was one of the cochairmen and Willard Benson, Arsenal mathematician, was a featured speaker.

Army Missile Command CG Maj Gen John G. Zierdt recently presented second annual Missile Command Scientific and Engineering awards to (l. to r.) David J. Salonier, Helmut Dudel and Dr. Oskar Essenwanger. Salonier's effort was in the area of guidance and control of guided missiles. Dudel and Essenwanger were cited for effective inclusion of atmospheric environmental conditions into fuzing parameters in design of guided missile systems.

Harry Diamond Labs Backed by Proud Record of R&D Advances

Research results and inventions that have had a profound impact upon the combat capability of the Army, the other Military Departments and in many ways the economic progress of the Nation are the proud record of the Harry Diamond Laboratories.

Formerly known as the Diamond Ordnance Fuze Laboratories, an offshoot development of research activities started in World War II by the U.S. National Bureau of Standards, the HDL are in Washington, D.C.

"An unusual organization with a unique assortment of skills and facilities with long experience in research and a history of meeting the exacting requirements of the Army, the DoD and other Government agencies"—that is the definition of HDL given by Lt Col M. S. Hochmuth, commanding officer.

Until 1940, the National Bureau of Standards had the appearance of a quiet university campus—ivy-covered buildings that housed scholars, researchers and practical engineers. Then World War II and the National Defense Research Committee established at the NBS the nucleus of a group to study feasibility of proximity fuzing.

Harry Diamond, considered an inventive genius and an outstanding Federal administrator, was selected to head a program that, from the beginning, required maximum effort and speed. The result was rapid expansion of the staff and facilities.

In January 1943, the VT fuzes were first used in combat. The War Department described them as "second in importance to the atomic bomb" in bringing about victory.

After the end of World War II, NBS continued working in the field with sponsorship from all the Military Services. By agreement between the Secretaries of Army and Commerce in September 1953, the portion of NBS doing fuze and related work was transferred to the Army. Activated as a Class II R&D installation under the Chief of Ordnance, it was named the Diamond Ordnance Fuze Laboratories, in honor of the late Harry Diamond.

The mission then provided for the R&D of fuzes and related items, consulting and liaison services fabrication of models and prototypes and performance of developmental testing.

In 1955 the installation was charged with the industrial engineering beyond design release to the completion of a mass producible item, of

DIAMOND ORDNANCE RADIATION FACILITY Triga Pulse Reactor is used at HDL for research in neutron and gamma radiation effects on electrical and electronic components, systems and circuits.

Lt Col Milton S. Hochmuth
Harry Diamond Labs Commander

improving manufacturing processes, and of solving problems encountered therein—a procurement package.

The seven Technical Services of the Army were assimilated into new command as a result of a major reorganization in August 1962. DOFL was assigned directly under the new U.S. Army Materiel Command and three months later became the Harry Diamond Laboratories, to reflect the broadened mission of the installation.

HDL programs today range from fuzes to heart pumps, from microminiaturization to complete radar installations, from basic research in solids to quality control in production. Each phase of activity provides an important contribution to national defense as well as the industrial and scientific community at large.

Of the current HDL staff of 1,350 employees, approximately 35 percent are scientists and engineers in chemistry, chemical engineering, mathematics, physics, mechanical engineering, electrical and electronic engineering, etc. About 25 percent are technicians, augmented by 8 percent of highly skilled wage board instrumentmakers, machinists, etc.

The mission of HDL may be categorized generally as:

- Perform basic and applied research in (but not restricted to) the fields of radiating or influence fuzing, (electrical, electronic, delay or fluid), and selected command fuzing for target detection, signature analysis, and the target intercept phase of terminal guidance.
- Perform weapon systems synthesis and analysis to determine characteristics that will affect fuze design to achieve optimum weapon effects.
- Perform basic and applied research, in support of fuzing functions, designed to achieve maximum immunity to adverse influences, including counter-countermeasures, nuclear environment, battlefield conditions, and high-altitude and space environment.
- Perform basic and applied research, in support of assigned missions, or as directed by the Director of Research and Development, AMC, on instrumentation, measurement and simulation; on materials, components, and subsystems, including electronic timers for weapons; and on selected advanced energy transformation and control systems.
- Conduct basic research in the physical sciences, as directed by the

AMC director, Research and Development.

• Perform basic and applied research on fluid amplification and control and development of pure-fluid devices and systems.

• In support of other AMC elements having project management or commodity management responsibility for specific systems or items, or as assigned by the Director of Research and Development, AMC, perform development (including industrial and maintenance engineering and related prototype productions) of: Proximity fuzes, radiating or influence field; Time fuzes, electrical, electronic, delay or fluid; and selected command fuzes.

PHILOSOPHY OF MANAGEMENT. The prime objective is to provide solutions to the scientific and technical tasks which are assigned to HDL by the Army and other agencies of the Government.

HDL depends on the knowledge and skills that have evolved over the years amongst its closely knit staff. Each individual has a wide opportunity to contribute to the task at hand and to shape his environment so that he can optimize both his contributions and self-satisfaction.

A continuing effort is made to encourage free and open discussion among all who are concerned with a given project. Creativity, initiative and the ability to bring ideas to a successful conclusion are qualities that are rewarded.

Free interchange of technical information is an important facet of HDL's program. In this way, R&D progress is recorded and made available to the scientific community. Through the conduct of and/or attendance at symposia, HDL's staff and other scientists keep abreast of current events. Almost 1,300 reports have been published by the laboratories, and 260 patents, along with many Notices of Allowability, have been granted to HDL.

Employees are encouraged to submit articles to scientific journals and present papers at conventions and professional society meetings. Technical exhibits depicting new systems, devices, and techniques developed at HDL are shown at professional meetings, trade shows, and on other appropriate occasions.

FUZES. Proximity fuzes are developed at HDL for use in bombs, mortars, land mines, rockets and missiles. They initiate detonation by sensing one or more of the following target characteristics: presence, distance, direction and speed. Detonation can occur at a predetermined distance from the target, greatly increasing weapon effectiveness.

Applicable areas of pure and applied science are utilized at HDL to respond to the broad spectrum of miltary need. Facilities are equipped to process fuzing systems from original conception, through R&D, limited production, and testing to the preparation of a proceurement package.

Among the more important HDL contributions to major U.S. defense systems are these fuzes: Puff, Cigarette, Loki, Signature, Firefly, Coral, Cobra, Copperhead, Serif, Delta, Tank Killer Land Fuze, Universal Artillery Fuze, Deacon I and II, Long-Delay Bomb Fuze, and Universal Electric Bomb Fuze.

Fuzes have been designed and developed specifically for the following missiles and rockets: Terrier, Bomarc, Corporal, Little John, Lance, Area Toxic Rocket, Jupiter, Honest-John, Redstone, LaCrosse, Mauler, Crockett, and Seargeant.

Billy M. Horton
HDL technical director

MEDICAL ENGINEERING. In cooperation with the Walter Reed Army Institute of Research, the HDL are developing a group of life support equipment for sick and wounded soldiers. These include heart pump, a volume-cycled respirator, a pressure-cycled respirator, and external cardiac compressor, and a membrane oxygenator.

While these are being developed especially for the soldier, they are equally responsive to civilian needs. The longer range schedule includes the development of an artificial heart replacement for the irreparably sick human heart. This is being developed in cooperation with the National Heart Institute.

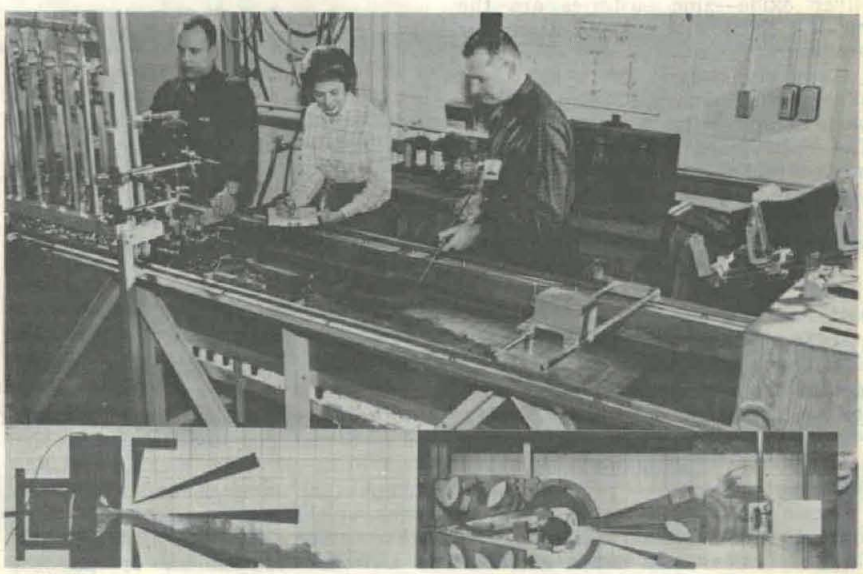
All HDL life-support equipment uses fluid amplifiers in some aspect of pneumatic control. Examples are:

1. The Army artificial heart pump has good functional capability and flexibility, both as an experimental research tool and as a general use, extracorporeal, pulsatile pump. It is capable of being synchronized with the heart's electrical action potential and can be used to augment failing hearts and circulations.

Because a fluid amplifier is used to control the gases squeezing the ventricle, the design eliminates electronics, and minimizes moving parts, weight, size and production costs.

2. The Army Emergency Respirator operates entirely without moving parts yet can perform complex resuscitative functions. A fluid amplifier is attached to a face mask. A

(Continued on page 34)



WATER TABLE provides scientists at HDL with information on the flow of water under varying conditions. Resultant test data has proven invaluable in the new system of fluid amplification developed at the Laboratories.

HDL Backed by Proud Record of R&D Advances

(Continued from page 33)

feedback line in the respirator senses the gas pressures within the face mask and causes the respirator to cycle between a predetermined range of positive and negative pressures. The device can breathe with or for the patient.

3. The Army External Cardiac Compressor is designed to perform closed-chest cardiac massage in emergency situations involving cardiac arrest. It is controlled by a bistable fluid amplifier. Because the maximum stroke of the ram is independent of the power driving the ram, it is impossible to cause accidental chest deflections greater than the present ram excursion.

4. The Army Volume-cycled Respirator uses a fluid amplifier to drive a piston-bellows arrangement. When the piston moves upward air is forced out of the bellows into the patient's lungs. As the piston moves down, the patient is allowed to exhale through a breathing valve, and the bellows fills with fresh breathing gas. When breathing for the patient, it is designed to deliver a fixed volume of gas per cycle and can be used to breathe with or for the patient.

POWER SUPPLIES. Development of reserve electrical power supplies for ammunition and missile fuzing has been pioneered at the HDL. An extensive research, development and engineering program is currently supported. Off-the-shelf and easily packaged items such as thermal batteries, self-heating silver oxide—zinc batteries and reserve, all-temperature silver oxide—zinc batteries are the result of HDL internal and contractor programs.

Assembly stations for a miniature silver oxide—zinc battery are only a part of the battery assembly area. The 700-square foot area has humidity controlled at all times so it is never allowed to exceed five percent, even with a crew of six to eight persons working an 8-hour day.

Electronic equipment is used to optimize electrochemical systems for batteries and fuel cells. Stationary state and relaxation techniques are used to study electrode reactions. Measurements of polarization, capacitance, surface area, diffusion rates, etc., give fundamental information necessary in designing test cells and full-scale batteries.

Possibly the most important development in fuze components is the thermal battery, which has excellent shelf life and reliable performance at extreme temperatures (–65°F to +160°F).

MATERIALS RESEARCH. The requirement that fuzes and related equipment withstand shock and vibration is frequently met by encapsulation of the electronics in plastics or other dielectric materials.

HDL research and development are particularly concerned with compact electronic systems expected to operate for short periods of time, be stored for long periods of time, and withstand high shock levels and temperature extremes. The Laboratories claim a degree of competence in dielectrics research unique in the Army.

Because dielectric properties of the potting material can seriously influence performance of the electronic system by introducing capacitance or power-loss effects, a continuing search is conducted for potting materials with low dielectric constants and losses, low shrinkage, low viscosity, toughness at low temperature, and a variety of other properties.

Hoyt W. Sisco
HDL associate director

HDL research is conducted in the polymerization of new resins and a facility is maintained for the dielectric evaluation of experimental as well as commercial materials. Techniques are evolved for the applications of such materials to end-items. Dielectric properties of a resin are determined over a broad range of frequency and temperature.

FLUID AMPLIFICATION. Since its birth at HDL only a few years ago, the technique of fluid amplification has become one of the most promising of the installation's interests. Streams of fluid (liquid gas) deflect other streams, making possible computation devices and servo-systems which function under conditions where other systems cannot perform.

Extreme ruggedness is possible because the devices operate without moving parts. Components consist simply of solid structures into which passages have been drilled, machined, or etched. There is little to wear out, nothing to be jammed. The units can operate at almost any temperature, as long as the solid remains a solid, and the fluid remains a fluid. Pneumatic devices have been built at HDL having no moving parts, and capable of amplification, memory, logic function, and both analog and digital computations.

A water table is maintained at HDL for test purposes. It allows the scientist to visualize the flow of a fluid through a simulated amplifier prior to construction. Reaction jets from a 1000 psi source are readily controlled by admitting or excluding atmosphere from the control ports. This fluid control is digital in operation.

HDL has designed and tested a fluid oscillator with a frequency sensitive to temperature. This device has the potential of measuring temperatures as high as materials will survive (and maintain shape), and will have particular application to turbine engines.

A fluid Pulse Modulation System has been developed in which analog signals proportional to error are introduced into the control of a digital oscillator to control the amount of time that the gas stream spends on each side. The simulated missile is controlled in pitch by using a position gyro to sense position error, and a pulse duration modulation system to correct the error.

LASERS. Both fundamental and applied laser research is conducted at HDL on solid-state and gas lasers. Applied research groups are investigating techniques, principles and systems that can be of military use. This includes the design and construction of special Laser devices and other related components to achieve, or to detect and measure specified 1p performance characteristics.

HDL ENGINEERS work on diverse objectives related by reliance on physicalelectronics techniques and processes, such as gas-breakdown phenomena, vacuum and electronic tube technology.

The fundamental materials research program is an integrated effort in which the optical properties of selected materials are studied, both experimentally and theoretically.

Results provide the basis for varying some parameters and repeating the preparation-and-study process until the desired understanding is achieved. Thus each function group within the fundamental effort supports and is supported by each of the other two functions.

SHORT-PULSE RADAR. Missile fuzing, man-portable radar, and allied military and space systems generate critical requirements for precision range measurement with rugged miniature equipment. In the middle and late 1950's, significant progress was made at HDL in the field of short-pulse radar at 10 KMC.

Continuing research has produced systems for military devices as well as civilian purposes: short-pulse magnetron systems for Army surface-target missiles; fuze systems for two Navy and three Air Force air-target missiles; Light-weight, high-resolution triode systems for two modern Army weapons; Air Force miss distance indicator; Modulator in use by 3 manufacturers of microwave tubes, reflectrometers, cross-section measurement equipment for reentry studies and other instruments; FAA altimeter, Pershing altimeter, and related devices.

PHYSICAL ELECTRONICS. A continuing responsibility at HDL is the research and development of gaseous electronic devices. Projects have diverse objectives, but are related by their reliance on basic physical electronics techniques and processes, such as gas-breakdown phenomena, vacuum technology, and electron tube design and technology.

HDL's award-winning microminiature lamp was designed for compatibility with transistor circuits and has a wide variety of uses. This concept is now used by industry to produce lamps for visible indication of circuit conditions, and instant reading of meter pointer position. Subsequently, HDL developed lamps for various military applications such as small, high-intensity light for flare replacement, and a lamp for position alignment in optical pick-off systems.

LUNAR PENETROMETER AND HADOPAD. HDL's electronic progress is evident in its space science activities. Prior to lunar landings, the load-bearing characteristics of the surface must be determined. Funded by NASA Langley Research Center, the HDL are developing an omni-directional accelerometer for this purpose. The Lunar Penetrometer will be dropped to the surface from a hovering vehicle. Upon impact, valuable information will be transmitted to the vehicle and relayed to Earth for collection.

A low-cost reusable High Altitude Delayed Opening Parachute Actating Device is another HDL development. The actuator is a distance measuring pulse radar which releases the main parachute at two selectable heights.

The complete assembly is packaged into an aluminum "suitcase" 5½ by 12 by 18 inches. Utilizing conventional military components and commercially available hardware and materials it can be mass produced esily by modern methods.

MICROWAVE COMPONENTS. In the development of microwave components for use in radar guided missile systems electronic fuzes and countermeasure applications the HDL ranks among U.S. leaders. An extensive theoretical and development effort has been conducted on many types of antennas, RF circuits and solid-state devices. Many designs currently used by industry are the outgrowth of early HDL work.

MICROELECTRONICS. Microelectranics has been the handmaiden of proximity fuze development from the very beginning of this work during World War II. Small discrete components were developed at first to fit the limited volume available to fuze designers. When these were found to be too large, HDL and its contractors led in the early development of the photographic techniques used in etched wiring and silk-screen fabrication of circuits and components.

Because photographic methods offered promise of inexpensive semiconductor device fabrication, HDL expended considerable R&D effort. In 1957 a photo-engraving process for transistor fabrication was developed which has become the workhorse of modern semiconductor technology.

R&D of thin films, including chemical deposition, lend versatility of HDL potential in the solution of difficult electronic packaging and specialized device problems. A completely equipped solid-state physics laboratory permits fabrication of semiconductor devices and integrated circuits.

HDL studies indicate that modern technology permits the construction of proximity fuzes for applications previously prohibited by cost. For example, development fuzes for a round have already been field tested. The quantity fuze cost is estimated at $5, and will be even less with integrated circuitry of the future.

INDUSTRIAL ENGINEERING. Activities in Industrial Engineering can be divided into three major areas: support to the research and development projects; planning, initiating and directing production effort; and participation in stockpile quality evaluation and maintenance.

Whenever equipment developed by HDL is required for stockpile and field use, a set of documents must be prepared to furnish all the basic data necessary for the Government to define what is wanted and the criteria for acceptance. This Technical Data Package includes performance requirements, drawings, specifications, inspection equipment requirements, and quality assurance procedures.

TECHNICAL SUPPORT SERVICES. The Mechanical Services Branch provides a corps of highly skilled personnel with long experience in supporting engineers and scientists by fabricating prototype models and special laboratory devices. Activity includes machining, welding, pattern-making, plastic molding and electroplating. A special group designs and develops mechanical devices and provides advice on both prototype and production manufacture.

In the Model Shop, experienced technicians fabricate, modify, assemble and test electronic and electromechanical devices, microelectronic assemblies and printed circuits. This facility allows laboratory engineers and technicians to devote their time to creative efforts by relieving them of repetitive and time-consuming assembly tasks.

HDL TEST AREA. The HDL Test Area is located at Blossom Point, Md., about 50 miles south of Washington. Bounded on the east and south by the Potomac River and on the west by the Najemoy Creek, it is a land area of about 2,000 acres.

The primary activity is the performance of tests conducted by the various segments of HDL, such as, fuze-function tests, recovery tests, environmental tests, and other field operations connected with development of proximity and other types of fuzes for rockets, artillery and mortar shells, and missiles.

RADIATION FACILITY. The Diamond Ordnance Radiation Facility is located on a 5-acre tract at Forest Glen, Md., where various radiation effects associated with a nuclear explosion can be accurately studied with complete safety under controlled laboratory conditions.

The reactor, called the DORF TRIGA, was specially adapted to HDL research requirements. It is used as a principal research tool in the study of effects of neutron and gamma radiation on electrical and electronic components, systems, and circuits in use or being developed.

Engineer R&D Labs Pick 3 Winners of Achievement Medals

COMMANDING OFFICER'S MEDALS WINNERS in science, technology and leadership pose with dignitaries at the conclusion of 8th annual awards ceremonies at the U.S. Army Engineer R&D Laboratories, Fort Belvair, Va. From left, they are Brig Gen Thomas B. Simpson, CG, U.S. Army Mobility Equipment Center, St. Louis, Mo.; the Honorable Joel T. Broyhill, representative from Virginia's 10th Congressional District; Col J. H. Kerkering, past CO of the Labs; Dr. George W. Howard, technical director of the Labs; Donald B. Dinger, scientific achievement winner; Donald G. Hubbard, leadership winner; Richard J. Gainey, technological winner; Dr. Colin M. Hudson, technical director, Development Division, U.S. Army Materiel Command; and Dr. Harold C. Weber, chief scientific adviser, Office of the Chief of Research and Development.

ERDL's 1965 winners of the Commanding Officer's Medals for Scientific, Technological and Leadership Achievements are Donald B. Dinger, Richard J. Gainey and Donald G. Hubbard.

Selected from 13 nominees designated by the various departments and staff offices at the U.S. Army Engineer Research and Development Laboratories, Fort Belvoir, Va., the winners were honored recently at the Eighth Annual Awards Ceremony. Congressman Joel Broyhill was guest speaker.

Among participating dignitaries were Brig Gen Thomas C. Simpson, CG, U.S. Army Mobility Equipment Center, St. Louis, Mo., Dr. Harold C. Weber, chief scientific adviser, Office of the Chief of Research and Development, and Dr. Colin M. Hudson, technical director of the Development Division, U. S. Army Materiel Command.

Each of the 13 nominees was presented a Certificate of Achievement and a cash award of $50. The Scientific Achievement Medal presented to Dinger recognized his theoretical, analytical and experimental studies on the nature of electric and magnetic fields.

Technique for predicting vulnerability of strategic Army installations and materials to such effects and design criteria for attenuating the effects also were developed by Dinger.

GAINEY, a general engineer, was the recipient of the Technological Achievement Medal for "heretofore unattainable gains" in the water purification state-of-the-art that make possible, mobile, lightweight distillation equipment with a greatly increased water processing capacity. He conceived the idea of aluminum distillation equipment, then designed, developed and treated it so successfully that it is now type classified.

HUBBARD, the Leadership Medal recipient, is a supervisory mechanical engineer. The award was for direction of the modernization and expansion of the Power Plant Laboratory, concurrently with accomplishment of the heavy test program on gas turbines, industrial enginees and accessories conducted by that laboratory.

The Scientific Medal was presented to Dinger by Dr. Weber. Col J. H. Kerkering, ERDL commander, presented the Leadership award to Hubbard. Dr. George W. Howard, ERDL technical director, made the award of the Technology Medal to Gainey.

Dinger holds a B.S. degree in electrical engineering from the University of Rhode Island, a master's from George Washington University, and has been associated with the Laboratories since 1958.

Gainey attended Manhattan College and has been employed at the Laboratories since 1941. An employee of the Sanitary Sciences Division, he was nominated for the award by the Military Department.

A graduate of the University of Miami with a B.S. degree in mechanical engineering, Hubbard joined the Laboratories in 1958 and is employed in the Engine Division of the Mechanical Department.

(For other nominees and achievements that earned them nominations for the awards, see May issue of the *Newsmagazine*, p. 28.)

ARPA Spending $20 Million for Kwajalein Radar

A new experimental radar will be designed, fabricated and installed on Roi Namur Island in the Kwajalein Atoll for the Advanced Research Projects Agency of the Department of Defense.

Funding for the project will approximate $20,000,000, exclusive of military construction funds. Of this amount, Sylvania Electric Products, Inc., will receive initial funding of approximately $12,000,000 for fabrication of hardware. Some portion of these funds will be utilized for subcontracting of the design and fabrication of certain components.

Designated Project ALTAIR (ARPA) Long-Range Tracking and Instrumentation Radar), the experimental radar will be used in conjunction with already operating instrumentation in the area.

It is anticipated that the project will further increase the capability of Project PRESS to conduct studies of the physics of vehicles re-entering the earth's atmosphere.

ARPA officials said ALTAIR will be more sensitive and will operate at different frequencies than radars now in use in ARPA's ballistic missile defense research program.

The project will be monitored for ARPA by the U.S. Army Missile Command, Redstone Arsenal, Ala. The Lincoln Laboratory of Massachusetts Institute of Technology, technical director of Project PRESS, will act as ARPA's technical consultant.