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INFORMATION REPORT ON  
RESEARCH, DEVELOPMENT, TEST, AND EVALUATION ORGANIZATIONS  
IN THE  
DEPARTMENT OF DEFENSE



UNITED STATES GENERAL ACCOUNTING OFFICE  
DEFENSE DIVISION

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INFORMATION REPORT ON  
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INTRODUCTION

This report is intended as a resource document for use by personnel of the General Accounting Office in planning and executing work assignments. It identifies the major organizations within the Department of Defense which conduct or sponsor research, development, test, and evaluation programs or projects; the areas of their interests and efforts; and the locations of their major laboratories, development centers and test ranges or proving grounds. Evaluation or testing of controls established for the management of programs and projects was not covered in this survey. The scope of our survey is discussed on pages 41 and 42.

The responsibilities and activities of the Departments and their major organizations in the complex field of research, development, test, and evaluation are best described in regulations, instructions, brochures, and other documents which they furnished to us. Consequently, this report is to a large extent a compilation of information extracted directly from such documents and from publications of other Government organizations--the National Science Foundation and the General Services Administration. Officials of the Office of the Director of Defense

Research and Engineering and of Headquarters of the Military Departments have reviewed the portions of this report pertaining to their organizations to ensure that the information presented is current and accurate.

## BACKGROUND

To implement its primary mission of providing for the security of the United States, the Department of Defense supports a research, development, test, and evaluation program whose size is reflected in the fact that it obligates approximately 50 percent of all Federal research and development funds. Most of this program is conducted or sponsored by the three military Departments within the Department of Defense--the Army, Navy, and Air Force. Almost two-thirds of the funds are obligated for work by domestic industry, one-fourth for work by Department of Defense installations, and the balance for work by colleges, universities, and other nonprofit organizations, a small amount going to foreign countries.

In his proposed budget for Fiscal Year 1968, the President included more than \$7.5 billion for research, development, test, and evaluation by the Department of Defense, summarized by activities as follows (in millions of dollars):

	<u>Total</u>	<u>Army</u>	<u>Navy</u>	<u>Air Force</u>	<u>DOD Agencies</u>
Military sciences	\$ 615.2	\$ 165.4	\$ 192.1	\$ 156.6	\$101.1
Aircraft and related equipment	1,145.1	115.7	279.5	739.7	10.2
Missiles and related equipment	2,498.6	706.2	785.3	889.6	117.5
Military Astronautics and related equipment	1,119.2	11.1	16.3	1,088.8	3.0
Ships, small craft and related equipment	298.5	.9	297.6	--	--
Ordnance, combat vehicles, and related equipment	313.1	183.6	129.5	--	--
Other equipment	987.6	309.3	137.3	307.4	233.6
Programwide management and support	<u>420.7</u>	<u>78.8</u>	<u>102.4</u>	<u>227.9</u>	<u>11.6</u>
	7,398.0	<u>\$1,571.0</u>	<u>\$1,940.0</u>	<u>\$3,410.0</u>	<u>\$477.0</u>
Emergency fund	<u>125.0</u>				
Total	<u>\$7,523.0</u>				

To facilitate manageability, the research, development, test, and evaluation program is divided into six categories of effort:

Research - Includes all effort directed toward an increased knowledge of natural phenomena and environment and efforts directed toward the solution of problems in the physical, behavioral and social sciences that have no clear, direct military application. It includes all basic research and, in addition, that applied research directed toward the expansion of knowledge in various scientific areas. Examples: Research in astronomy, materials, passive night vision, atmospheric sciences.

Exploratory development - Includes all effort directed toward the solution of specific military problems, short of major development projects. This type of effort may vary from fairly fundamental applied research to quite sophisticated bread-board hardware, study, and programming and planning efforts. Examples: Initial development of boundary-layer control airfoils, inertial-guidance components.

Advanced development - Includes all projects that have moved into the development of hardware for experimental test. Examples: Development of experimental boundary-layer control aircraft, experimental missiles for tanks.

Engineering development - Includes development programs in which the item is being engineered for service use but has not yet been approved for procurement or operation. Example: Engineering of a main battle tank.

Operational systems development - Includes research and development effort directed toward the development, engineering, and test of systems, support programs, vehicles, and weapons that have been approved for production and service employment. Example: Development of armored reconnaissance/airborne assault vehicle system with SHILLELAGH missile.

Management and support - Includes effort directed toward support of installations or operations required for use in general research and development. Examples: Operation and support of test ranges, laboratories, test aircraft and ships; construction of facilities.

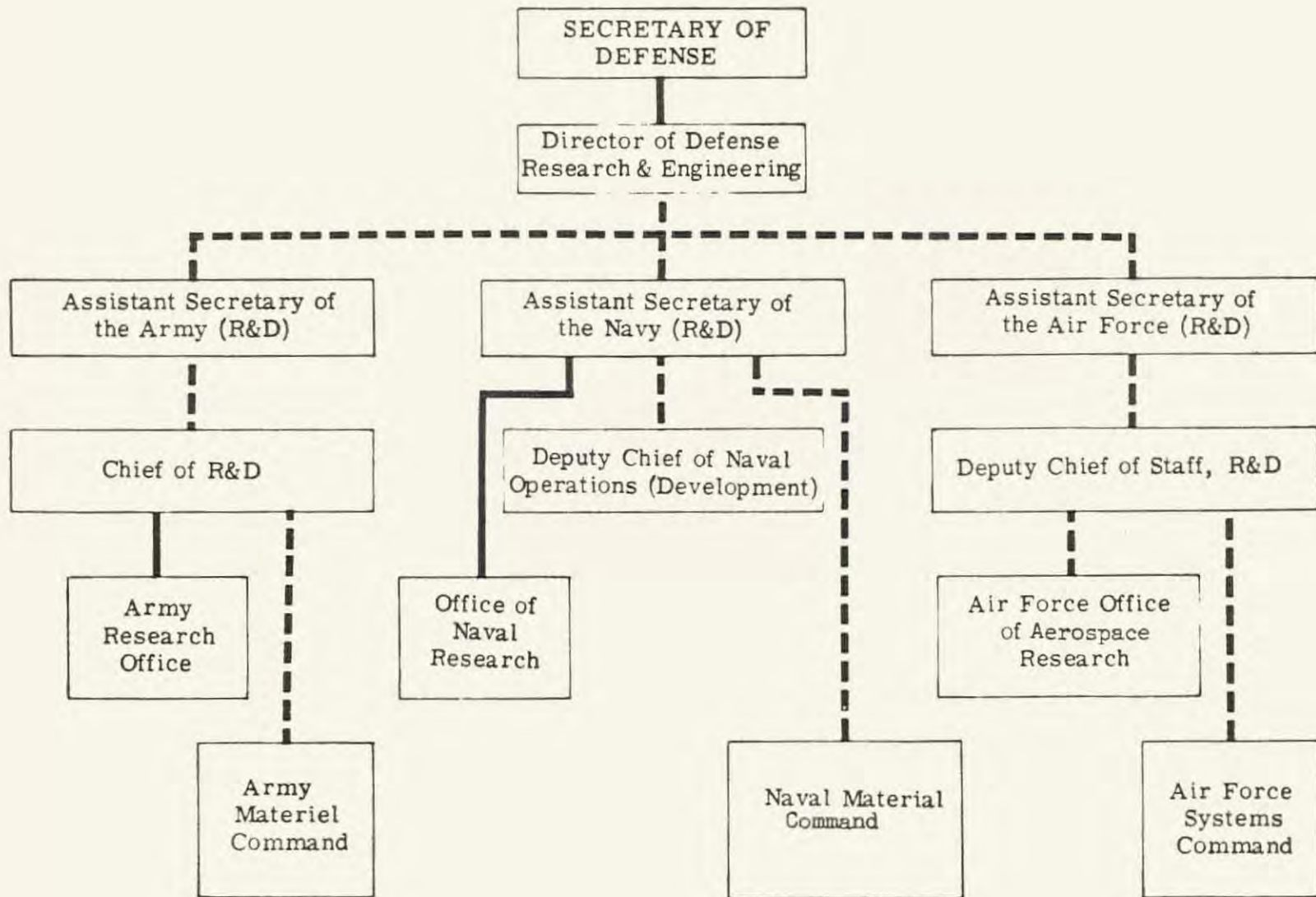
The proposed budget for Fiscal Year 1968 is summarized by the six categories of the program as follows (in millions of dollars):



	<u>Total</u>	<u>Army</u>	<u>Navy</u>	<u>Air Force</u>	<u>DOD Agencies</u>
Research	\$ 399.3	\$ 87.3	\$ 131.5	\$ 99.5	\$ 81.0
Exploratory development	964.0	216.3	271.7	260.9	215.1
Advanced development	1,248.0	217.9	283.5	746.6	--
Engineering development	1,197.7	575.9	294.3	327.5	--
Operational systems development	2,346.2	204.8	772.8	1,276.6	92.0
Management and support	<u>1,242.8</u>	<u>268.8</u>	<u>186.2</u>	<u>698.9</u>	<u>88.9</u>
Emergency fund	7,398.0 <u>125.0</u>	<u>\$1,571.0</u>	<u>\$1,940.0</u>	<u>\$3,410.0</u>	<u>\$477.0</u>
Total	<u>\$7,523.0</u>				

The main channels of research and development within the Department of Defense are shown in the attached chart. The solid lines indicate the addition of a command relationship to the channel so designated.

# R&D POLICY CHANNELS



## DEPARTMENT OF DEFENSE

The Defense Reorganization Act of 1958 clarified and strengthened the direction, authority, and control of the Secretary of Defense in the fields of research and engineering. The Act also created the position of Director of Defense Research and Engineering to assist the Secretary in effectively controlling the over-all Department of Defense program of research and development and to prevent unnecessary duplication of effort.

The Director of Defense Research and Engineering (DDR&E)--a civilian appointed by the President--takes civilian precedence in the Department of Defense after the Secretary of Defense, the Deputy Secretary of Defense, and the Secretaries of the Army, the Navy, and the Air Force. With respect to research and engineering, he is the principal advisor to the Secretary of Defense on all scientific and technical matters; he supervises all research and engineering activities in the Department of Defense; and he directs research and engineering activities the Secretary of Defense considers should be centrally managed.

Objectives of the Office of the Director of Defense Research and Engineering (ODDR&E) are to ensure that:

An adequate technological base for current developments is available and that it is replenished for future developments that may be needed as national purposes and strategies evolve.

Developments are pursued that will result in weapons and equipment systems best supporting the purposes and strategies of the United States and its allies in preference to developments that are technologically feasible or otherwise attractive but may produce systems of limited value.

Planning of the entire research and development program and adherence to that plan are firm enough to minimize uncertainty in

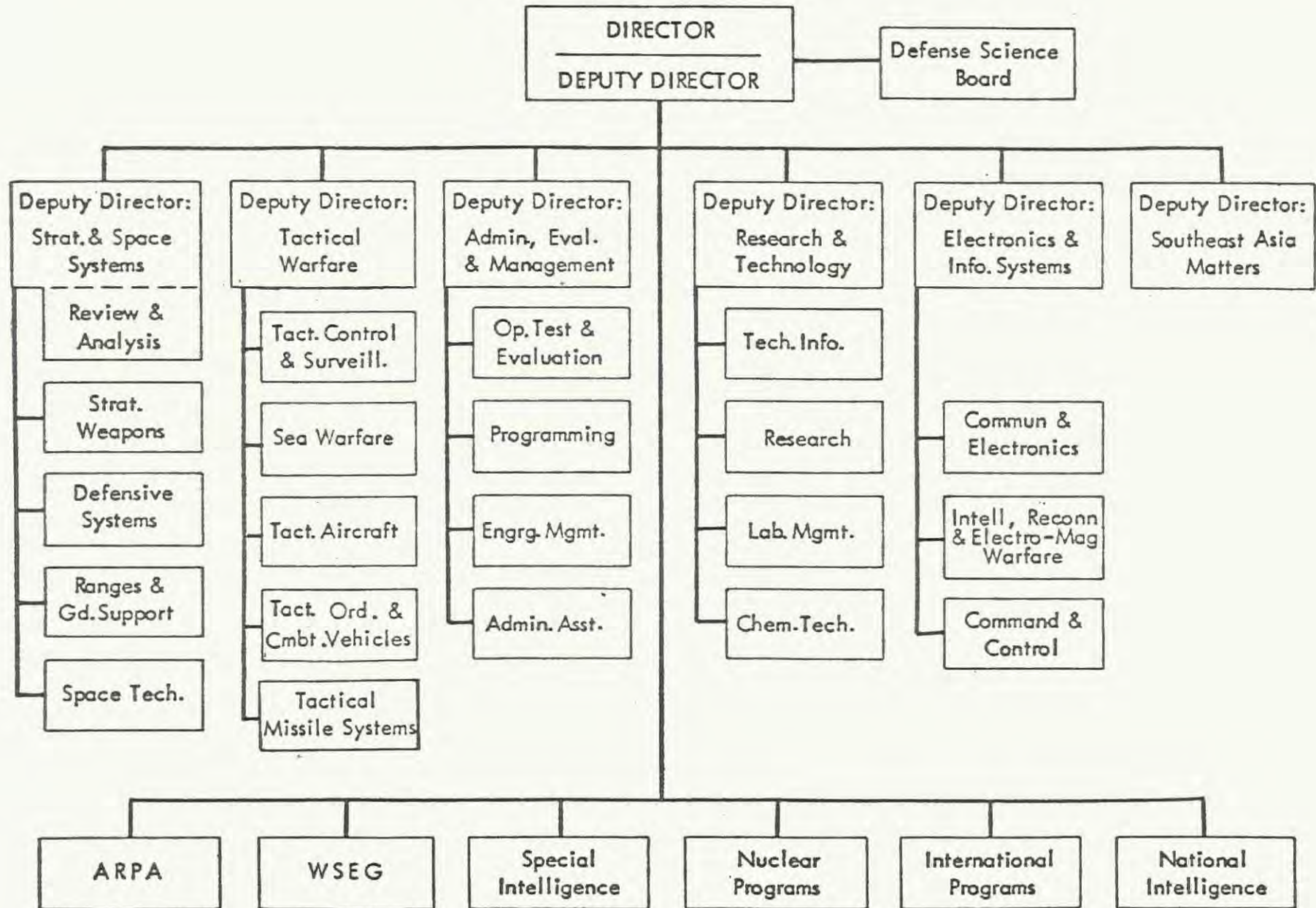
the budgetary processes of the Military Departments, as well as in the defense industry, but remain flexible enough to accommodate any desirable changes.

Individual projects are planned--and controlled in relation to the plans--so that weapons and equipment systems possessing the desired performance characteristics are operationally available when needed and within the intended cost.

Maximum carryover of technology to the civilian sector of the national economy is encouraged.

In performing his responsibilities, the Director of Defense Research and Engineering is advised by the Defense Science Board. As shown on the organization chart, he is assisted by his principal Deputy and by six Deputy Directors--Strategic and Space Systems; Tactical Warfare Programs; Administration, Evaluation and Management; Research and Technology; Electronics and Information Systems; and Southeast Asia Matters--who are responsible for specific functions as described in ODDR&E Office Order No. 22, dated February 23, 1967. Other officials are responsible to him for surveillance of special intelligence programs, nuclear programs, international programs, and national intelligence programs. The Director acts as Chairman of the DDR&E Policy Council, comprising the Assistant Secretaries and principal military officers of the Army, Navy, and Air Force charged with responsibilities for research and development.

# DDR&E ORGANIZATION



While most of the research, development, test, and evaluation carried on within the Department of Defense actually is performed by the Army, the Navy, and the Air Force, some research and development is conducted by other Defense organizations. Some of these organizations are discussed briefly below. The Director of Defense Research and Engineering directs and supervises the activities of the Advanced Research Projects Agency and exercises administrative direction over the Weapons Systems Evaluation Group.

The Defense Science Board serves as the senior technical advisory group in the Department of Defense. It was established in 1956 in response to a recommendation of the Hoover Commission, and advises the Secretary of Defense, through the Director of Defense Research and Engineering, on scientific and technical matters.

The Board consists of 28 members; 20 are selected on the basis of their eminence in the fields of research and engineering, including management and long-range planning, as necessary to represent the interests of the ODDR&E, and serve terms of not more than 4 years; 8 are ex-officio members--the Chairmen of the primary public advisory committees of the three military Departments and the Atomic Energy Commission; the President of the National Academy of Sciences; the Directors of the National Science Foundation and the National Bureau of Standards; and the Deputy Administrator of the National Aeronautics and Space Administration.

The activities of the Board are highly classified. General areas considered have included basic research, contract operations, technical information, air defense systems, military space problems, psychology and the social sciences, and limited warfare.

The Advanced Research Projects Agency (ARPA) is an operating entity attached to the Office of the Director of Defense Research and Engineering, responsible for basic and applied research and development for such projects as the Director may assign. It was established in 1958 in response to the urgent need for centralized management of selected research projects stemming from promising advanced ideas and requiring long-range study, especially those projects not definitely identified with a particular weapon system or a specific military mission.

ARPA has about 75 scientific and technical personnel located in the Pentagon and about 35 personnel in the field in continental United States and overseas. ARPA relies heavily on the military Departments and other Government agencies for both technical and administrative support.

When a decision is made by ARPA to support a proposal for research in a particular area, frequently it arranges with a research group of another agency--e.g., the Air Force Office of Aerospace Research--to act as its agent under an "ARPA Order." The agent may contract for the work--with ARPA furnishing the funds, stating the scope of work to be performed, stipulating the contract period, the reporting requirements, security considerations, and other details. Once a contract has been awarded through an agent, it becomes the responsibility of that agency to monitor all aspects of the program. In a few cases contracts are

awarded and monitored directly by ARPA. In 1966 about 850 contracts were awarded for ARPA-sponsored research.

Project responsibilities are assigned to ARPA by the Director of Defense Research and Engineering. Currently these projects include:

Project DEFENDER - Ballistic missile defense. This is ARPA's major project, and absorbs between 40 and 50 percent of its budget and involves the effort of about 25 percent of its technical personnel. The program supports the Army program in missile defense and the Air Force and Navy programs in penetration aids by carrying out work that looks beyond the system-oriented goals of the Service programs. The project is organized into six major areas of investigation--electromagnetics, mechanics, missile phenomenology, penetration aids, systems studies, and applied research.

Project VELA - Nuclear test detection. This project involves research, development, and system design work to improve the capability to detect, identify, locate, and verify the occurrence of nuclear explosions in space, in the atmosphere, underground, or underwater.

Project AGILE - Remote area conflict. This program is based on the thesis that remote area warfare is controlled in a major way by the environment in which it occurs, the sociological and anthropological characteristics of the people involved, and the nature of the conflict. Major emphasis is placed on the collection and analysis of data to provide a proper basis for future research and development. The project has four major categories--counterinsurgency analysis and requirements (operations research, environmental research, and information analysis centers); advanced technology (surveillance and reconnaissance, mobility communications, and biomedical research); behavioral research; and systems integration and evaluation.

Other areas of responsibility currently assigned to ARPA include behavioral sciences, information processing techniques, materials sciences, and advanced sensors.

The Weapons Systems Evaluation Group (WSEG) is an operating group, under the administrative direction of the Director of Defense Research and Engineering, organized under the National Security Act of 1947.



Studies are made at the request of the Secretary or Deputy Secretary of Defense, the Director of Defense Research and Engineering, or the Joint Chiefs of Staff; or they may be initiated by WSEG.

WSEG conducts independent, comprehensive, and objective operational analyses and evaluations on the basis of projected conditions of war-- which include such factors as present and future weapons systems, their influence upon strategy, organization, and tactics; and the comparative effectiveness and cost of weapons and systems.

The WSEG organization consists of Army, Navy, Marine Corps, and Air Force military personnel; civilian scientists provided by the Weapons Systems Evaluation Division (WSED) of the Institute for Defense Analyses (IDA); and an administrative staff of WSED and Civil Service personnel. A Review Board--comprising the Director of WSEG as Chairman, the Deputy Director of WSED, the three senior service representatives, and the Executive Secretary--reviews and approves project plans, follows the progress of studies, and reviews final reports on studies made.

Defense Documentation Center for Scientific and Technical Information (DDC). Department of Defense Instruction 5100.38 provides for policy direction by the Director of Defense Research and Engineering and operational control by the Director, Defense Supply Agency, of the Defense Documentation Center for Scientific and Technical Information. It also delineates participation responsibilities of all Department of Defense components engaged in research, development, test, and evaluation efforts. Headquarters are at Cameron Station, Virginia; field service offices are located at Boston, Dayton, Huntsville, Los Angeles, New York, San Francisco, and Washington.

The primary mission of DDC is to provide efficient interchange of military research and development information among Defense and other Government agencies and their contractors and grantees. This is accomplished by receiving, storing, and announcing practically all reports, with the exception of Top Secret documents and reports in highly sensitive areas, that formally record scientific and technical results of research, development, test, and evaluation activities conducted by the Department of Defense and its contractors; providing timely release of these documents on request, without charge, to registered organizations; and providing bibliographic services essential to the maximum use of the technical documents in its collections. DDC also cooperates with other Government documentation and information centers in making unclassified reports available to the scientific and technical communities in the United States and abroad.

Information Analysis Centers. The Department of Defense supports, in whole or in part, a number of Information Analysis Centers. Centers are either operated by the sponsoring military organization or are contractor-operated under the management supervision of one of the armed services, in some cases with the support and participation of other services or Government agencies. Each Information Analysis Center is responsible for a specific subject matter field. The subject area may be discipline-oriented (to a single scientific or engineering discipline) or mission-oriented (to a military undertaking of special DOD interest or to a specific large weapon system requiring an interdisciplinary approach).

## DEPARTMENT OF THE ARMY

The ultimate objective of Army research, development, test, and evaluation is to develop weapons, equipment, and techniques, qualitatively superior to those of any potential enemy, for use in any environment and under all conditions of war in the performance of its military mission with maximum effectiveness.

The Assistant Secretary of the Army (Research and Development) is responsible for all matters relating to research, development, test and evaluation within the Department of the Army. His responsibilities pertain to budgeting for and funding programs, conducting basic and applied research, developing and testing weapon systems and materiel, and integrating technology with military requirements. The Assistant Secretary is responsible for liaison with the Director, Defense Research and Engineering, and for coordination with the Navy, the Air Force, and other Government agencies.

Army organizations and officials that support the Assistant Secretary and the Army Chief of Staff--who is directly responsible to the Secretary of the Army for planning, programming, supervising, and directing the Army's research, development, test, and evaluation programs, activities, and facilities--include the Army Scientific Advisory Panel; the Chief of Research and Development; the Deputy Chiefs of Staff for Logistics and for Personnel; and the Assistant Chiefs of Staff for Force Development and for Intelligence.

The Army Scientific Advisory Panel is composed of about 25 outstanding civilian scientists, engineers, educators, and industrialists,

carefully chosen for competence in specific fields of science and technology. These members, who serve for two years, are aided by some 40 consultants appointed to assist Panel members in making ad hoc group studies in areas of high military materiel priority. It is the mission of the Panel to advise the Secretary of the Army, the Assistant Secretary of the Army (Research and Development), the Chief of Staff, and the Chief of Research and Development on overall scientific and technical matters of concern to the Army research, development, test, and evaluation program, and to provide long-range guidance in these areas, as appropriate.

The Chief of Research and Development--under the functional supervision of the Assistant Secretary of the Army (Research and Development) and responsible to the Chief of Staff--has responsibility for all Army research, development, test, and evaluation, including review and analysis, research and development objectives, policies, and funds essential to the discharge of this responsibility; plans, projects, tasks, and priorities relating thereto; qualitative materiel requirements and small development requirements for all Army materiel; and the research and development aspects of international military cooperation programs. He also directs the Army Research Office, and assigns and monitors all research and development actions of the Chief of Engineers and the Surgeon General.

The Deputy Chief of Staff for Logistics has responsibility for materiel maintenance support policy in conjunction with the research and development effort. He exercises general staff supervision over the Chief of Engineers.

The Deputy Chief of Staff for Personnel exercises supervision over the Surgeon General, who serves as Chief of the Army Medical Research and Development Command.

The Assistant Chief of Staff for Force Development is responsible for coordination of combat development and related policy in conjunction with functions assigned to the Chief of Research and Development. He is also responsible for Department of the Army approval of qualitative materiel development objectives and requirements, small development requirements, and determination of total feasibility of proposed materiel developments.

The Assistant Chief of Staff for Intelligence has responsibility for monitoring projects of intelligence and reconnaissance interest in the research and development program.

Major Army organizations conducting or administering research, development, test, and evaluation are the Army Research Office, the Army Materiel Command, the Office of the Chief of Engineers, the Army Combat Developments Command, the Army Security Agency, and the Army Medical Research and Development Command, discussed briefly below. Their major laboratories, development centers, and test facilities are listed and discussed in appendix A.

Army Research Office, Arlington, Virginia

The mission of the Army Research Office is to establish policy, plans, and program guidance for the Army's research and development program; develop and justify the research budget; supervise the execution of the research program; supervise and coordinate the Army's scientific and technical information program; and coordinate all Army Scientific

meetings and symposia and provide the civilian scientific community with a point of contact with the Army research community. The Director of Army Research directs the activities of the Army Behavioral Science Research Laboratory; the Army Research and Development Group (Europe); the Army Research and Development Group (Far East); the Army Element, Defense Research Office, Latin America; and the Army Research Office, Durham, North Carolina.

Army Materiel Command (AMC), Washington, D. C. A major field command under the supervision of the Chief of Staff, the AMC conducts or sponsors, through its subordinate organizations, most of the research, development, test, and evaluation for the Army within its assigned areas. The primary organizational units of AMC concerned with research, development, test, and evaluation are (1) seven subordinate "commodity" commands--each command having responsibility for the integrated commodity management of specific items, comprising, among other things, research, design, development, and modification; sponsorship of test and evaluation; and technical and engineering supervision and services, including product engineering; (2) a test and evaluation command whose mission is to plan and conduct comprehensive independent tests and evaluations of materiel intended for Army use and materiel developed by the Army for use by other agencies; and (3) nine central laboratories and research organizations.

The activities of the commodity commands, and the test and evaluation command, and certain other major organizations are discussed briefly below. The activities of their subordinate commands, and of the nine central laboratories and research organizations referred to above, are listed and discussed in appendix A.

Army Tank-Automotive Command, Warren, Michigan. This Command is charged with research and development of the Army's tactical and general purpose vehicles and their components. It conducts or monitors research and development in vehicular design, suspension, power plants and auxiliary equipment, and environment; and on vehicular portions of combat vehicles in support of the Army Weapons Command.

Army Mobility Equipment Command, St. Louis, Missouri. This Command accomplishes production and maintenance engineering, basic and applied research, design and development of materiel, methods and techniques, design testing and test evaluation, and procurement for assigned categories of equipment, such as engineering and construction equipment; amphibious equipment; rail and marine equipment; barrier and bridging equipment; electric power generating equipment; selected industrial equipment; and selected troop support equipment. Army Engineering Research and Development Laboratories, Fort Belvoir, Virginia, is the principal Army facility for research and development in engineer materiel and in engineering methods and techniques.

Army Aviation Materiel Command, St. Louis, Missouri. This Command is responsible for two basic categories of equipment--Army aircraft and air-delivery equipment. For aircraft, the Command and a subactivity, the Army Transportation Research Command, Fort Eustis, Virginia, perform the full range of logistical support functions from research through obsolescence of equipment. Research and exploratory and advanced development are principal responsibilities of this subactivity. The research and development effort for air-delivery equipment is the responsibility of Natick Laboratories, Natick, Massachusetts.

Army Missile Command, Redstone Arsenal, Alabama. This Command has responsibility for the design, development, production, and procurement of free rockets; missile systems; rocket motors and components; air-defense missile-fire-coordination equipment; and related test equipment, including target missiles used in evaluation of surface-to-air missile systems. Research and development is conducted or sponsored to establish specific weapon concepts and to develop the technology required for missile systems for the Army, for the Advanced Research Projects Agency, Department of Defense, and for the National Aeronautics and Space Administration.

Army Weapons Command, Rock Island Arsenal, Rock Island, Illinois. The mission of this Command is the integrated commodity management of combat vehicles, field weapons and small arms; antitank and anti-aircraft weapons; artillery; Army aircraft weapon systems; fire control equipment; and related items. The Command supports and conducts research, development, and engineering to satisfy the need for new and novel weapons and for the improvement and modification of existing weapons. These activities are conducted either under contract, by industry, or by Weapons Command personnel at three major installations.

Army Munitions Command, Picatinny Arsenal, Dover, New Jersey. The mission of this Command includes design and development of nuclear and non-nuclear ammunition; rocket and missile warhead sections; demolition munitions; mines; bombs; grenades; pyrotechnics; boosters; jet-assist takeoff devices; gas generators; chemical and biological materials;



and propellant-activated devices. The Command also conducts or sponsors basic and applied research with respect to assigned materiel development.

Army Electronics Command, Fort Monmouth, New Jersey. The mission of this Command is to coordinate in a single organizational unit the research, development, procurement, and production of Army communications and electronics materiel. Most of the scientific and technical projects are conducted by contract with industrial laboratories or with educational and other non-profit institutions. For monitoring these projects and for conducting its own research, development, and testing, the Command maintains three major installations.

Army Test and Evaluation Command, Aberdeen Proving Ground, Maryland. The mission of this Command is to plan and conduct independent evaluations through engineering and service tests of materiel intended for Army use and materiel developed for the use of other agencies. Engineering design and production tests are performed for the Army commodity commands discussed above. Check tests, confirmatory tests, evaluation, surveillance tests, and renovation tests are conducted as required. The Command also conducts and participates in troop tests under field conditions to determine the suitability of weapons, equipment, clothing, and other materiel for Army-wide use.

Corps of Engineers, Gravelly Point, Virginia. This activity carries out an extensive program of research, development, test, and evaluation in construction techniques and materials; hydraulics; soil and beach erosion control; nuclear power reactor systems; electronic power generation equipment associated with nuclear reactor systems; Army nuclear weapons effects; and mapping and geodetic equipment, systems, and techniques in support of global systems.

Army Combat Developments Command (CDC), Fort Belvoir, Virginia. This is a major field command of the Army under the supervision of the Chief of Staff.

In the research, development, test, and evaluation area, CDC's principal functions are to develop, test, and recommend improved operational, organizational, and doctrinal concepts for the Army in the field; monitor research and development activities to insure that developments meet objectives and requirements; provide user guidance to materiel developing agencies during all phases of the development process; provide representation at all development project "in process" reviews; and review materiel developing agency test results to determine acceptability of tested items in relation to requirements and to improve combat effectiveness of the Army.

New concepts are tested and evaluated at the CDC's major field facility, the Combat Developments Experimentation Command, Fort Ord, California. Another subactivity, the Combat Operations Research Group, Fort Belvoir, Virginia, applies scientific methods to the solution of combat development problems and evaluates the effectiveness of weapons systems.

Army Security Agency, Arlington, Virginia. This agency is responsible for planning, programming, budgeting, coordinating, and supervising research and development programs and projects that are assigned to it. The activities of the agency are highly classified.

Medical Research and Development Command, Washington, D. C.

The mission of this Command is to direct a research, development, test, and evaluation program for improvement of the Army's combat

effectiveness. Specific objectives are to reduce casualties from disease during troop operations; reduce the logistical burden of the Army; maintain effective combat performance; improve methods for returning sick and wounded troops to duty; and develop medical field equipment in support of the above missions.

The Medical Research and Development Command supervises and directs the research, development, test, and evaluation programs and activities of laboratories and research facilities located in the United States and overseas. Major installations are listed and discussed in appendix A.

## DEPARTMENT OF THE NAVY

In order to provide maximum support to the Navy and Marine forces for the performance of their military missions, the Navy pursues a continuing program of research, development, test, and evaluation. This program ranges from basic research in the sciences underlying naval technology to the development and testing of end items and techniques for operational use.

The Assistant Secretary of the Navy (Research and Development) is responsible for all matters related to research, development, engineering, test, and evaluation within the Department of the Navy, including management of the appropriation "Research, Development, Test and Evaluation, Navy;" and for oceanography, ocean engineering, and closely related matters. His responsibilities include liaison with the Director, Defense Research and Engineering, Department of Defense, and supervision of the Office of Naval Research.

In fulfillment of his responsibilities, the Assistant Secretary requires support and assistance from his principal advisers: the Chief of Naval Research; the Chief of Naval Development; the Director of Navy Laboratories; the Deputy Chief of Naval Operations (Development); the Deputy Chief of Staff (RD&S) Marine Corps; and the Project Managers of CNM Designated Projects. The assignment of responsibilities to the respective offices they represent is set forth in SECNAV Instruction 5430.67.

The Chief of Naval Research--appointed by the President--is the advisor to the Assistant Secretary of the Navy (Research and Development)

on research and such other matters as the Assistant Secretary may direct; keeps the Assistant Secretary and the Chief of Naval Operations advised on Naval and other research; and is the principal representative of the Department of the Navy in dealings of Navy-wide interest on research matters with other Government agencies, corporations, educational and scientific institutions, and other organizations and individuals concerned with scientific research. He commands the Office of Naval Research; plans and coordinates research programs throughout the Navy; and collaborates with the Chief of Naval Operations, the Commandant of the Marine Corps, the Chief of Naval Development, and the commands and bureaus and offices in the formulation of the research, development, test, and evaluation programs of the Navy.

The Chief of Naval Research has additional responsibilities as the Assistant Oceanographer of the Navy for Ocean Sciences. In this capacity he is responsible for that effort in research, development, and technical guidance required in support of operations to advance the knowledge of the physical, chemical, biological, and geological nature of the world's oceans and their boundaries--surface and bottom.

The Chief of Naval Development is responsible to the Assistant Secretary of the Navy (Research and Development) for coordinating the Navy's total exploratory development program. He promulgates the exploratory development requirements; ensures the appraisal of new concepts; and implements the planning and programming.

The Director of Naval Laboratories (DNL) reports directly to the Assistant Secretary of the Navy (Research and Development) and also acts as the Director of Laboratory Programs in the Office of Naval

Material. He controls the in-house exploratory development technical program and is **responsible** for assuring "optimum responsiveness of the Navy RDT&E field activities to the sponsoring bureaus, offices and Project Managers." He guides the in-house laboratory independent research (Foundational Research) and Independent Exploration Development (FR/IED) programs. The Director acts as Chairman of the Advisory Group-- comprised of eminent individuals--on laboratory matters.

The Deputy Chief of Naval Operations (Development) implements the responsibilities of the Chief of Naval Operations for Navy research, development, test, and evaluation programs. He establishes standard management procedures for planning, programming, and appraising the research and development effort of the Navy, and provides staff assistance to the Assistant Secretary of the Navy (Research and Development) in the integration of the Navy's research, development, test, and evaluation program. The Deputy Chief of Staff (R&D) Marine Corps provides similar services for the Marine Corps programs.

Major Navy organizations conducting or administering research, development, test, and evaluation are the Office of Naval Research, the Naval Material Command, and the Bureau of Medicine and Surgery, discussed briefly below. Their major laboratories, development centers, and test facilities, and certain other organizations performing research and development functions, are listed and discussed in appendix B.

Office of Naval Research (ONR), Washington, D. C.

The mission of the Office of Naval Research is to encourage, promote, plan, initiate, and coordinate naval research to provide for the maintenance

of future naval power and the preservation of national security; to conduct naval research in augmentation of and conjunction with the respective bureaus, agencies, and offices of the Navy; and supervise, administer, and control all activities within or on behalf of the Navy relating to patents, inventions, trademarks, copyrights, and royalty payments. It provides financial management services to the Assistant Secretary of the Navy (Research and Development) in carrying out his responsibilities for management of the research, development, test, and evaluation appropriation.

ONR conducts and supports a broad program of basic and applied research and exploratory development in chemistry, physics, mathematics, earth sciences, biology and medicine, psychology, material sciences, energy conversion, engineering, and naval sciences. Objectives of the program are to ensure research for continued improvement and increased effectiveness of Naval equipment and operations, assure maximum advance recognition of scientific and technological progress effects on naval warfare, and provide for the smooth transition of significant research results into fleet or field needs. The Office maintains a program of systems and warfare analysis on a continuing basis, dealing with major problem areas of interest to the commands, bureaus, and offices of the Navy and Marine Corps.

Part of ONR's program is conducted in its own laboratories, development centers, and field stations. (See appendix B.) A substantial part of its program is accomplished through support of research and development projects in universities, nonprofit organizations, and industrial laboratories; this part of the program is supervised by three Groups, discussed below:

Naval Research Group. Programs are managed by six Divisions--Earth Sciences; Material Sciences; Physical Sciences; Mathematical Sciences; Biological Sciences; and Psychological Sciences--each of which determines the subject areas to be emphasized and alerts the scientific community to its current and long-range needs.

Naval Applications Group. Programs involve applied research and exploratory development in five program areas--three are concerned with weapons, systems, techniques, and problems relative to the three spatial environments in which the Navy operates: air, surface and amphibious, and underseas; the fourth is concerned with the interdisciplinary research and exploratory development required to translate basic research into engineering terms to meet naval requirements; the fifth area stresses fundamental physical acoustics, underwater acoustics, and all aspects of underwater acoustical signals.

Naval Analysis Group. Concerned primarily with matters related to naval warfare. It makes use of the techniques of operations analysis and systems analysis. Individual studies are made by special ONR teams or by contractors. The Group has three Divisions--Methodology; Advanced Planning; and Advanced Warfare Systems.

#### Naval Material Command

SECNAV Instructions 5430.67 assigned responsibilities to the Chief of Naval Operations for planning and preparing the Navy's research and development requirements and program objectives; and for providing direction and policy guidance for all matters relating to the overall research, development, test, and evaluation program. The Chief of Naval Material, the Chief of Naval Personnel, and the Chief, Bureau of Medicine and Surgery are responsible to the Chief of Naval Operations for the research, development, test, and evaluation functions within their organizations.

The Naval Material Command (NMC), Washington, D. C., includes the Headquarters, Naval Material Command; six principal subordinate systems commands; separately organized project management offices; and shore



(field) activities. The Chief of Naval Material, under the Chief of Naval Operations, commands all activities of NMC--he assigns the work, provides the resources, and appraises the progress made.

Each systems command is responsible for providing and meeting those material support needs of the Navy that are within its assigned area. This responsibility includes, but is not limited to, the research, design, development, test, and technical evaluation of certain naval material, as shown below.

Naval Air Systems Command, responsible for complete Navy and Marine Corps aircraft, including components, and air-launched weapon systems.

Naval Electronics Systems Command, responsible for shore or ground electronics, complete (except for Marine Corps tactical), and certain shipboard and airborne electronics. It is the single authority for electronics standards and compatibility, and the single point of contact within the Naval Material Command on electronics matters.

Naval Ordnance Systems Command, responsible for shipboard weapon systems.

Naval Ship Systems Command, responsible for the design, construction, and maintenance of all ships.

Naval Supply Systems Command, responsible for providing supply management policies and technical guidance for Navy material to activities of the Navy and the Marine Corps. Research in logistics and supply systems is carried out mostly under contract by industry and other Government agencies.

Naval Facilities Engineering Command, responsible for providing support to the operating forces and other organizations of the Navy and to the Marine Corps in the general area of shore facilities and related material and equipment.

CNM Designated Projects. The Chief of Naval Material has designated Project Managers to conduct intensified management of programs. Their responsibilities focus ordinarily on specific systems and equipment, which constitute exceptions to the general cognizance of the Systems Commands for a given class of material. Even for these exceptions, however, the Systems Commands retain some development, procurement, or support responsibilities, as defined in Naval Material Command project management policies statements, in project charters, and in specific agreements between Systems Commanders and Project Managers.

Current Designated Project Offices, with headquarters in Washington, are the following:

- Special Projects Office (PM1)
- F-111B/PHOENIX Weapons Systems (PM2)
- Surface Missile Systems Project Office (PM3)
- Anti-Submarine Warfare Systems Project Office (PM4)
- Instrumentation Ships Project (PM5)
- All-Weather Carrier Landing Systems (PM6)
- Reconnaissance Electronic Warfare Special Operations (REWSON)  
and Naval Intelligence Processing Systems Project (PM7)
- Navy AIMS Project Office (PM8)
- OMEGA Navigation Systems Project (PM9)
- Fast Deployment Logistic Ship Project (PM10)
- Deep Submergence Systems Project (PM11)

Bureau of Medicine and Surgery (BUMED), Washington, D. C. It initiates and directs research in the fields of general medicine and dentistry, including preventive medical procedures, the medical

aspects of atomic and other special weapons defense, medicinal and dental substances, remedies, materials and devices; in the physical and mental characteristics and the endurance capabilities of the human being; and in the physiological problems pertinent to the naval service.

Bureau of Naval Personnel, Arlington, Virginia. Personnel research projects--in such fields as manpower utilization, personnel administration, and psychological evaluation--are conducted at the Bureau's two Naval Personnel Research Activities in Washington, D. C., and San Diego, California. Also, research projects in almost every aspect of engineering and the physical sciences are conducted by the faculty and students of the Naval Post Graduate School, Monterey, California, which is under management supervision of the Bureau.

DEPARTMENT OF THE AIR FORCE

Since World War II a constantly growing responsibility of the Air Force has been the conduct and support of research and development in all areas of science and technology related to its primary functions of deterrence, defense, and attack. It administers programs ranging from basic research, conducted to assure increased scientific understanding in the aeronautical and related sciences, to development and testing of aircraft, missiles, and related equipment for operational use by its combat, support, and service units.

The Assistant Secretary of the Air Force (Research and Development) is responsible for direction, guidance, and supervision over all matters relative to: the formulation, review, and execution of plans, policies, and programs relative to scientific and technical matters; basic and applied research, exploratory development, and advanced technology; integration of technology with, and determination of, qualitative Air Force requirements; research, development, test, and evaluation of weapons, weapon systems, and defense materiel; and technical management of systems engineering and integration. He is responsible for directing and supervising all space programs and space activities of the Air Force.

Air Staff officials who support the Assistant Secretary and the Air Force Chief of Staff--the Secretary's principal military advisor--in scientific matters are the Scientific Advisory Board; the Chief Scientist; the Deputy Chiefs of Staff for Research and Development and for Systems and Logistics; and the Surgeon General.

The Scientific Advisory Board, selected from outstanding men in various fields of science and technology, advises the Secretary of the

Air Force and the Chief of Staff on all scientific matters of interest to the Air Force mission. The Board reviews research and technological developments for possible further military application, reviews and evaluates the Air Force long-range plans for research and development, and provides advice on the adequacy of the Air Force program.

The senior scientific advisor to the Chief of Staff and the Air Force in all areas of research and technology is the Chief Scientist. He recommends changes in policies, plans, and organizations to improve research and development programs. He also serves as Chairman of the Council of Air Force Scientists, a forum for the exchange of scientific and technical matters of interest to all agencies of the Air Staff to whom scientists are assigned.

The Deputy Chief of Staff, Research and Development, identifies operational capabilities for aerospace systems and subsystems necessary to perform military tasks. He establishes policies, provides program guidance, defends, coordinates, and issues program approval for research, exploratory development, advanced development, engineering development, research support, and test activities for the Air Force. His Office is the Air Force focal point for all matters relating to space, including coordination with other Government agencies; it also acts as the office of prime responsibility for the Office of Aerospace Research.

The Assistant Surgeon Generals develop plans and policy guidance in the fields of medicine, dentistry, and related activities.

Major Air Force organizations conducting or administering research, development, test, and evaluation are the Office of Aerospace Research

and the Air Force Systems Command, discussed briefly below. Their major laboratories, development centers, and test facilities, and certain other organizations performing research and development functions, are listed and discussed in appendix C.

Office of Aerospace Research (OAR), Arlington, Virginia, an agency responsible directly to Headquarters, United States Air Force.

OAR plans, programs, and manages the Air Force basic research program and assigned portions of the applied research program. The objective is to increase scientific knowledge and analyze advanced concepts which may increase the ability of the Air Force to develop superior aerospace weapon systems. Its general functions are entirely scientific.

The Office of Aerospace Research pursues its activities for the Air Force in such fundamental scientific disciplines as physics, mathematics, chemistry, psychology, biology, astronomy, and meteorology. The broad basic research areas of interest are propulsion, materials, electronics, geophysics, life sciences, and aeromechanics. Three areas that relate to the Office's applied research interest are nuclear weapons effects, nuclear application, and aerospace environment. Specific problems of systems development are the responsibility of the Air Force Systems Command.

Research is accomplished in laboratories and field stations administered by OAR (see appendix C) or through contracts and grants with universities and industrial and nonprofit research organizations throughout the world.

Air Force Systems Command (AFSC), Andrews Air Force Base, Maryland, a major air command responsible directly to Headquarters, United States Air Force.

The over-all mission of the Systems Command, as stated in Air Force Regulation 23-8, is to advance aerospace technology, adapt it into operational aerospace systems, and acquire qualitatively superior aerospace systems and materiel needed to accomplish the Air Force mission. Systems Command is responsible for the research, development, production, and procurement actions required to place a complete aerosystem in operation. In addition, it has the task of meeting major space responsibilities of the Department of Defense by providing research, development, test, and engineering of satellites, boosters, space probes, and associated systems, and providing support for specific National Aeronautics and Space Administration projects and programs.

The Systems Command directs the research, development, test, and evaluation operations of 9 divisions and 5 development and test centers utilizing more than 9,000 officers and 20,000 airmen, 31,000 civilians, and 29,000 contractor personnel. It manages or controls 300 installations or separate activities in the United States and overseas, and manages more than 50 systems programs in varying stages of development acquisition. The Command directed the expenditure of about 32 percent of the Air Force budget for fiscal year 1967 in coordinating efforts toward the development of aerospace weapon systems. The activities of the Divisions are discussed briefly below, and the major laboratories and development centers and test facilities are listed and discussed in appendix C.

Research and Technology Division (RTD), Bolling Air Force Base,<sup>1/</sup>

Washington, D. C. Responsible for the System Command's exploratory and advanced development programs and for creating a broad base of technology to be applied as rapidly as possible in the development of superior, advanced aerospace systems for the Air Force.

One of RDT's primary objectives is the strengthening of Air Force in-house laboratories in such areas as rocket propulsion systems, components, and propellants; nuclear applications and effects, delivery techniques, and safety; non-nuclear, chemical, and biological munitions; electromagnetic surveillance and control; flight dynamics, mechanics, performance, and control; electronic techniques, optics, navigation, and guidance; turbine, reciprocating, ramjet, electric, and advanced propulsion systems, fuels, and lubricants; and materials, metals, ceramics manufacturing technology and application.

Aeronautical Systems Division (ASD), Wright-Patterson Air Force Base, Ohio. Manages the development and acquisition of aeronautical systems and related equipment. Currently manages about 50 aircraft and non-ballistic missile systems in support of the full range of Air Force operational missions and future requirements. The Office of the Deputy for Limited War at ASD is responsible for developing hardware and techniques to support all Air Force counter insurgency and special warfare operations.

Examples of current programs managed by ASD are the C-5A cargo aircraft, the F-111 fighter aircraft, the XB-70 aircraft, vertical take off and landing (VTOL) aircraft configurations, and the 463L materials handling systems. Through its flight-test activity, ASD also conducts

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<sup>1/</sup>The Air Force Systems Command has announced that a new Office of the Director of Laboratories will be established to assume many of the responsibilities of RTD.



weightlessness or "zero-gravity" flight tests, all-weather testing of new aircraft, adverse weather research, and flight tests of new research and development concepts and products.

Ballistic Systems Division (BSD), Norton Air Force Base, California.

Plans, programs, and manages acquisition of qualitatively superior ballistic systems and related equipment. Provides for activation of launch sites and facilities for designated ballistic missiles, including the TITAN and MINUTEMAN.

One of BSD's newer programs is the Advanced Ballistic ReEntry System (ABRES); supporting ABRES are 6 ATLAS pads at Vandenberg Air Force Base, California, and an inland effort from Green River, Utah, into the White Sands Missile Range, New Mexico.

BSD develops and acquires the weapon systems, locates and builds the missile sites, and coordinates a wide network of associate prime contractors and subcontractors in such diversified industries as aircraft, electronics, steel, and construction. Many universities are involved with BSD in advanced study relating to new weapon systems.

Space Systems Division (SSD), Los Angeles Air Force Station, California. Plans, programs, and manages space systems and related equipment. This includes responsibility for the research, development, engineering, test, on-orbit tracking, telemetry control, recovery, evaluation, procurement, production, quantity assurance, and installation and checkout of space systems.

Examples of SSD-developed standard space vehicles are the DOD Scout, thrust-augmented THOR, ATLAS, GEMINI-TITAN II launch vehicle, AGENA spacecraft, and the TITAN III booster. SSD actively supports programs to develop the Manned Orbiting Laboratory.

Electronic Systems Division (ESD), L. G. Hanscom Field, Massachusetts. Responsible for developing, acquiring, and delivering electronic systems and equipment for command and control of aerospace forces. It is the major development and procurement agent for electronic information and communications systems for a number of commands, such as the North American Air Defense Command (NORAD), the Strategic Air Command, the Tactical Air Command, and the U. S. Strike Command.

Examples of ESD systems developed or under development are the NORAD Underground Cheyenne Mountain complex in Colorado, the Back-Up Interceptor Control (BUIC) system to the Semi-Automatic Ground Environment (SAGE) system, and the Space Detection and Tracking System (SPADTS) used in computing satellite orbits.

National Range Division (NRD), Andrews Air Force Base, Maryland. It has national planning responsibility for a global flight-test facility--comprising range stations, aircraft and instrumented ships--in support of missile and space programs.

NRD is responsible for the management of two test ranges--the Eastern Test Range, Cape Kennedy, Florida, from which missiles, satellites, and manned space programs are launched; and the Western Test Range, Vandenberg Air Force Base, California, which specializes in polar-orbit launches of satellites and in the operational training launches of Strategic Air Command missiles.

Aerospace Medical Division (AMD), Brooks Air Force Base, Texas.

Manages bioastronautics research and development programs in support of Air Force systems development, and assigned research programs in support of the Air Force personnel system, clinical, and aerospace medicine requirements. Supervises specialized educational programs in aerospace medical subjects.

AMD units include a hospital and laboratories at Lackland Air Force Base, Texas; a school of aerospace medicine at Brooks Air Force Base, Texas; and aeromedical laboratories at Holloman Air Force Base, New Mexico, and Fort Wainwright, Alaska.

Foreign Technology Division (FTD), Wright-Patterson Air Force Base, Ohio. Acquires, evaluates, analyzes, and disseminates foreign aerospace technology, in cooperation with other divisions and centers, to prevent possible technological surprise by a potential enemy. Provides foreign technological support for aerospace and other systems research and development activities.

Air Force Contract Management Division (AFCMD), Los Angeles Air Force Station, California. Responsible for the Department of Defense contract management activities in 25 major defense contractor plants. Manages the administration of contracts executed by Systems Command organizations and by other air commands and other agencies when required. It provides a vital link between the Air Force and industry in research and development and major systems procurement.

Office of the Surgeon General, Washington, D. C. Administers all medical services of the Air Force. The Surgeon General establishes

physical standards, collects and analyzes biostatistics, and represents the Air Force in interagency medical and bioastronautics activities.

Research and development responsibilities of the Surgeon General are supervisory in nature. They encompass all Air Force medical research, most of which is performed by personnel and contractors of the Aerospace Medical Division of the Air Force Systems Command and, to a lesser extent, by grantees of the Office of Aerospace Research.

## SCOPE OF SURVEY

In making this survey we visited headquarters organizations and a number of field installations--concerned with research, development, test, and evaluation activities in the Department of Defense and the Departments of the Army, the Navy, and the Air Force--and certain other Government agencies. Officials of these organizations discussed, and/or briefed us on, their respective activities; they also furnished us copies of pertinent regulations, instructions, manuals, statements of fact, printed brochures, and other documents.

The principal purpose of this survey was to identify, and obtain information on, the major organizations in the Department of Defense with responsibilities for research, development, test, and evaluation. Consequently, we did not evaluate or test controls established for the management of programs or projects.

Organizations and installations visited during this survey are listed below.

### DEPARTMENT OF DEFENSE

- Office of the Director of Defense Research and Engineering
- Office of the Assistant Secretary of Defense (Comptroller)
- Office of the Assistant Secretary of Defense (Systems Analysis)
- Advanced Research Projects Agency, Washington, D. C.
- Weapons Systems Evaluation Group, Arlington, Virginia
- Institute of Defense Analyses, Arlington, Virginia
- Defense Communication Agency
- Defense Contract Audit Agency
- Joint Task Force II

### DEPARTMENT OF THE ARMY

- Office of the Deputy Assistant Secretary of the Army (Research and Development)
- Headquarters, Army Materiel Command, Washington, D. C.

Headquarters, Army Missile Command, Redstone Arsenal, Alabama  
Headquarters, Army Combat Developments Command, Fort Belvoir,  
Virginia  
Headquarters, Army Weapons Command, Rock Island, Illinois  
Headquarters, Army Test and Evaluation Command, Aberdeen, Maryland  
Army Limited Warfare Laboratory, Aberdeen Proving Ground  
Army Tank-Automotive Center, Warren, Michigan  
NIKE-X Antimissile Project Office, Redstone Arsenal, Alabama  
Natick Laboratories, Natick, Massachusetts  
Harry Diamond Laboratories, Washington, D. C.

#### DEPARTMENT OF THE NAVY

Office of the Deputy Chief of Naval Operations (Development)  
Office of the Chief of Naval Research  
Office of the Chief of Naval Development/Deputy Chief of Naval  
Material (Development)  
Office of Naval Research, Washington, D. C.  
ONR Pasadena Branch, Pasadena, California  
Naval Ordnance Laboratory, Corona, California  
Naval Ordnance Test Station, China Lake, California

#### DEPARTMENT OF THE AIR FORCE

Office of the Deputy Chief of Staff, Research and Development  
Headquarters, Air Force Auditor General, Norton Air Force Base,  
California  
Office of the Deputy Inspector General, Norton Air Force Base,  
California  
Office of Aerospace Research, Arlington, Virginia  
Headquarters, Air Force Systems Command, Andrews Air Force Base,  
Maryland  
Research and Technology Division, Bolling Air Force Base,  
Washington, D. C.  
Rome Air Development Center, Rome, New York  
Rocket Propulsion Laboratory, Edwards Air Force Base,  
California  
Armament Laboratory, Eglin Air Force Base, Florida  
Ballistic Systems Division, Norton Air Force Base, California  
Space Systems Division, El Segundo, California  
Flight Test Center, Edwards Air Force Base, California

#### BUREAU OF THE BUDGET - MILITARY DIVISION

#### NATIONAL SCIENCE FOUNDATION

#### FEDERAL COUNCIL OF SCIENCE AND TECHNOLOGY

DEPARTMENT OF THE ARMYMAJOR LABORATORIES, DEVELOPMENT CENTERS, TEST FACILITIES,AND OTHER ORGANIZATIONS PERFORMING RESEARCH,DEVELOPMENT, TEST AND EVALUATION FUNCTIONSOFFICE OF THE CHIEF OF RESEARCH AND DEVELOPMENT

Limited War Laboratory, Aberdeen Proving Ground, Maryland. Chief of Research and Development has under his command a centralized research and development activity with a quick reaction capability for meeting Army operational requirements related to limited war, particularly war of low intensity in developing or remote areas of the world. This includes specifically the provision of a quick reaction facility for accomplishing short range development of specialized limited warfare items.

ARMY MATERIEL COMMANDArmy Missile Command

Redstone Arsenal Laboratories, Alabama. The major part of the Missile Command's in-house research and development is carried out in its laboratories at Redstone Arsenal. There are eight laboratories--Physical Sciences; Propulsion; Electromagnetics; Inertial Guidance and Control; Ground Support Equipment; Structures and Mechanics; Test and Evaluation; and Advanced Systems.

Most flight testing of Army Missile Command rockets and missiles is performed at the White Sands Missile Range, New Mexico, the Air Force Atlantic Missile Range, Cape Kennedy, Florida, and the Navy Pacific Missile Range, Point Mugu, California.

Army Weapons Command

Watervliet Arsenal, Watervliet, New York. Responsible for the development, procurement, and testing of the Army's cannon, mortars, and recoilless rifles; conducts research in metallurgy and physics on a macroscopic as well as a microscopic level.

Springfield Armory, Springfield, Massachusetts. The principal Weapons Command installation for the development and industrial engineering of small-caliber weapon systems, automatic weapons, aircraft armament, weapons dynamics, and auxiliary items such as feed mechanisms and gun chargers. The Armory supports research in heat-resistant and erosion-resistant materials, and in such areas as rates of fire and ultrasonic cleaning processes.

Rock Island Arsenal, Rock Island, Illinois. Responsible for research and production engineering in mounts, recoil mechanisms, loaders, carriages, limbers, and wagons for artillery and anti-tank and antiaircraft weapons. It also conducts research in elastomers, corrosion prevention, power-transmission fluids, and friction and wear characteristics.

#### Army Munitions Command

Picatinny Arsenal, Dover, New Jersey. The Munition Command's commodity center for nuclear munitions, and the research and engineering center for conventional ammunition (with the exception of small-caliber ammunition). Laboratories at the Arsenal conduct basic and applied research in the physical and engineering sciences as they relate to explosives, pyrotechnics, propellants, packaging, and materials. In the field of ammunition engineering, the Arsenal supports research, development, and pilot production of artillery and mortar ammunition, grenades, mines, bombs, and demolition munitions.

Edgewood Arsenal, Edgewood, Maryland. The Munition Command's commodity center for chemical and biological material. Its in-house research and development projects are supplemented by about an equal number of grants and contracts.

Army Chemical Research and Development Laboratories, Edgewood Arsenal, Maryland. Conducts research and development in both offensive chemical systems and defense against such systems.

Army Biological Laboratories, Fort Detrick, Maryland. Established as the National Center for research and development in defensive and offensive biological warfare. The laboratories conduct or sponsor physical, biochemical, and medical research in human, animal, and plant pathogens, host-parasite relations, and infectious diseases. Defense aspects of biological weapons are developed jointly with the Army Medical Research and Development Command and with the Navy Bureau of Medicine and Surgery.

Frankfort Arsenal, Philadelphia, Pennsylvania. The Munition Command's commodity center for small-caliber munitions and propellant-actuated devices. Its responsibilities include development, engineering, and procurement of small-caliber munitions; propellant-actuated devices; artillery ammunition components, such as cartridge cases, projectiles, and mechanical time fuzes; and fire-control systems in support of the Army Weapons Command. The Arsenal also performs research in metallurgy, optics, surface finishes, corrosion prevention, lubricants, material degradation, and technology pertinent to the miniaturization of ammunition.



Army Electronics Command

Electronics Laboratories, Fort Monmouth, New Jersey. Conducts and supports research in disciplines related to military electronics, equipment, and systems. About 70 percent of the work is performed by contract. The remaining work is conducted in installation facilities and is about evenly divided between exploratory research and applied development in five well-defined areas: exploratory research; communications; surveillance; components; and engineering sciences.

Electronics Research and Development Activity, Fort Huachuca, Arizona. The primary mission is research and design of automatic data processing systems and development of new command control systems for tactical use. It also conducts basic and applied research in micrometeorology and improved meteorological techniques. Meteorological services and equipment are provided to other activities. A subactivity, the Army Electronics Test Agency, also at Fort Huachuca, operates an electromagnetic test facility where engineering tests of electronic equipment and systems are conducted.

Electronics Research and Development Activity, White Sands, New Mexico. Provides electronic support to the testing and evaluation programs of the White Sands Missile Range. It conducts continuing research in the environmental sciences, including meteorology, and in fields related to missiles; provides meteorological support to the Army missile program; and coordinates the Army's missile electronic countermeasures effort.

Army Test and Evaluation Command

Fourteen major test boards, several proving grounds, and other field installations are under the jurisdiction of the Command.

Airborne, Electronics, and Special Warfare Board, Fort Bragg, North Carolina. Tests and evaluates airborne equipment, including communications and surveillance systems; equipment peculiar to special warfare; and aircraft used in air drops and in the transport of troops and materiel.

Air Defense Board, Fort Bliss, Texas. Specializes in tests of air defense weapons systems; fire distribution systems; associated items such as target drones and air defense electronic countermeasures; and atomic demolition munitions.

Armor Board, Fort Knox, Kentucky. Uses natural terrain for testing combat engineering equipment and armored vehicles under field conditions; maintains ranges for testing tank armament and munitions; and utilizes water resources for swim-testing of vehicles and for testing the design capabilities of bridges, rafts, and assault boats.

Artillery Board, Fort Sill, Oklahoma. Concerned with tests which determine the suitability and operational safety of field artillery cannon; fire-control equipment; ammunition; vehicles; new surface-to-surface guided missiles; and associated field artillery equipment and systems.

Aviation Board, Fort Rucker, Alabama. Plans and conducts logistical evaluation and other tests of aircraft and allied aviation equipment intended for Army use.

Infantry Board, Fort Benning, Georgia. Tests and evaluates materiel used by the infantry, such as field-type clothing and equipment; rations for individuals and small units; hand-held and crew-served weapons; antitank weapons; and chemical and biological warfare equipment.

Aberdeen Proving Ground, Maryland. Plans and conducts tests of weapons and weapons systems, ammunition and ammunition components, combat vehicles and other automotive material; devises new test procedures when necessary; improves existing test methods and test procedures; develops instrumentation for ballistic testing; and plans and coordinates the testing of all foreign materiel acquired through intelligence channels.

Dugway Proving Ground, Dugway, Utah. The Army proving ground for chemical, biological, and radiological warfare munitions, protective equipment, and related materiel.

Electronics Proving Ground, Fort Huachuca, Arizona. Performs field engineering and service tests of communication-electronic equipment, avionics devices, and combat surveillance equipment. It also tests and evaluates electronic equipment used in meteorological observations, automatic data processing, and electronic warfare.

Yuma Proving Ground, Yuma, Arizona. Maintains a controlled impact test facility to simulate conditions encountered in air drops, and a space-positioning range for testing materiel and devices used in actual air drops. As one of the three environmental test centers of the Test and Evaluation Command, it has a continuing responsibility to refine and advance environmental field testing, with emphasis on evaluation of materiel and performance in hot, dry, desert climates.

Arctic Test Center, Fort Greely, Alaska. Provides and maintains the environmental facilities, equipment, and services required for engineering, service, and troop tests in arctic climates; monitors and conducts tests and evaluations of materiel for Army commodity commands.

Army Tropic Test Center, Fort Clayton, Canal Zone. Plans and conducts research, development, test, and evaluation for the Army Materiel Command and a number of other Government agencies. The many test sites and installations in the area, whose facilities are made available to the Center, make it ideal for conducting research and tests relative to the humid tropics.

General Equipment Test Activity, Fort Lee, Virginia. Carries out field evaluations, engineering studies, surveys, and service tests of equipment for general use throughout the Army, including Quartermaster supplies, equipment, and systems ranging from food items and clothing components to heavy equipment such as laundry trailers and forklift trucks. It maintains eight "accelerated wear courses" for testing handwear, footwear, clothing, tents, and 55-gallon drums.

White Sands Missile Range, New Mexico. Managed by the Test and Evaluation Command but utilized by the Army, Navy, Air Force, National Aeronautics and Space Administration, and by other Government agencies. It maintains facilities for tracking and controlling missiles and space vehicles and for testing interceptor weapons systems.

Army Ballistics Research Laboratories, Aberdeen Proving Grounds, Maryland. Its mission is the conduct of research in weapons technology and ballistics; weapons systems effectiveness studies; weapons concept evaluation; and military target vulnerability determinations. Research is oriented to contribute to the solution of current problems in weapons development and to anticipate trends in weapon technology that will meet future Army requirements for general and limited warfare. The research program is carried out, primarily, in the following seven major Divisions:

Ballistic Measurements Laboratory. Conducts research in correlation theory, information theory, the theory of measurements, and circuit design to obtain information applicable to target acquisition and weapon guidance.

Computing Laboratory. Prepares firing tables for all Army weapons (except some selected guided missiles); investigates information retrieval and data reduction systems; and performs computing services for the Ballistics Research Laboratories, contractors, and other organizations, as required.

Exterior Ballistics Laboratory. Investigates such basic research areas as fluid dynamics and flight mechanics, and conducts applied research in shock formation, supersonic and hypersonic flight, drag, stability, and the dispersion of bombs, shells, and missiles.

Interior Ballistics Laboratory. Performs basic research in chemical kinetics and combustion; and applied research in the physics of propulsion systems and the chemistry of propellants.

Terminal Ballistics Laboratory. Studies the physics of detonation; the propagation of stress waves; and their effects on the propagating media. Basic and applied research is conducted in the effects of intense nuclear and electromagnetic radiation on materiel.

Weapons Systems Laboratory. Makes overall evaluations of weapons systems; prepares cost-effectiveness and operations research type studies of such systems; and makes military target vulnerability determinations.

Army Coating and Chemical Laboratory, Aberdeen Proving Grounds, Maryland. The primary Army facility for research, development, and evaluation of protective coating, cleaners, fuels and lubricants, and chemicals for automotive use. Work is devoted almost exclusively to applied research in the materiel field.

In-house research, development, and testing program is carried out by four Branches: Paint, Varnish, and Lacquer; Chemical Cleaning and Corrosion; Automotive Chemical; and Fuels and Lubricants.

Army Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire. Its mission is the conduct of snow, ice, and frozen ground research and engineering investigations for the purpose of supporting and improving military capabilities in the cold regions. Environmental and climatological research is conducted in support of the primary mission. The Laboratory's program is carried out by four technical divisions--Research; Experimental Engineering; Photographic Interpretation Research; and Technical Services.

Harry Diamond Laboratories, National Bureau of Standards, Washington, D. C. Conducts research and development, in nine separate laboratories, in the physical and engineering sciences to meet Army requirements for fuzes and other ordnance specialties, with emphasis on electronic and electrical devices. The Laboratories provide consulting and engineering services in these areas, fabricate models and prototypes, and conduct development tests.

In addition to work on fuzes, effort is concentrated in basic research; systems research; instrumentation, measurement and simulation research; electronic and electrical components, materials, and techniques; and nuclear weapons effects.

Army Human Engineering Laboratories, Aberdeen Proving Grounds, Maryland. Provides assistance to the Army Materiel Command in resolving human factors engineering problems. In addition to performing the required research, the agency gives courses in human factors engineering for

personnel of other Army agencies. This facility is composed of three separate laboratories--Systems Research; Supporting Research; and Engineering Research.

Army Materials Research Agency, Watertown, Massachusetts. Conducts research in metals, ceramics, and armor; and coordinates the entire Army Materiel Command materials research, development, and testing programs, including those performed by other Army laboratories, by developing, collecting, and evaluating information regarding materials employed in systems or equipment used by the Army.

This Agency comprises a group of operating laboratories with their attendant service organizations, two offices engaged in a coordination and advisory capacity, and a specifications and standardization office.

Army Nuclear Defense Laboratory, Edgewood Arsenal, Maryland. Conducts research and field experiments in the nuclear weapons effects areas of initial radiation, residual radiation and fallout, shielding, and thermal radiation phenomena, to provide technical information and assistance in the fields of radiological and nuclear defense and health physics; and to provide environmental monitoring and other radiological safety support.

The Laboratory is composed of four Divisions--Evaluation; Nuclear Chemistry; Nuclear Physics; and Nuclear Testing.

Natick Laboratories, Natick, Massachusetts. Conducts research and development in the physical, life, and earth sciences and in engineering to meet military requirements in assigned development areas which include air drop equipment; body armor, clothing, footwear and headgear, organic materials, and textiles; containers; food and food service equipment; field support equipment including printing and composing equipment; fungicides and insecticides; materials handling equipment; petroleum, oils, and lubricants handling and dispensing equipment; and tentage and equipage.

Army Aeronautical Research Laboratory, Moffett Field, California. Conducts basic and applied aeronautical research, and provides consultation on aeronautical problems to all Army agencies. Implements and directs Army portion of joint Army-National Aeronautics and Space Agency (NASA) agreement for aeronautical research, and participates in joint research programs in NASA facilities.

#### OFFICE OF THE CHIEF OF ENGINEERS (CE)

Waterways Experiment Station, Vicksburg, Mississippi. The principal CE research, testing, and development facility in the fields of hydraulics, soil mechanics, concrete, mobility of military vehicles,

nuclear weapons effects, and flexible pavement design. Through basic and applied research, the development of methods and techniques, and the testing of materials and equipment, it assists in the accomplishment of both the civil works and military missions of the Corps of Engineers, and provides consulting and scientific reference services in its specialized fields.

Coastal Engineering Research Center, Washington, D. C. Sponsors investigations of possible methods of preventing erosion of coastal and lake shores by waves and currents, and develops techniques for protecting, restoring, and maintaining beaches. Studies are made of specific localities in cooperation with state governments, and detailed reports are submitted to the Congress. The Center conducts about 15 projects a year in various aspects of erosion. Similar studies are conducted by various universities under contract.

Ohio River Division Construction Engineering Laboratory, Cincinnati, Ohio. Specializes in the development and improvement of design criteria and maintenance procedures for rigid and composite pavements and for military structures, and in investigation of materials for military construction applications.

Rock Island Army Engineer District Paint Laboratory, Rock Island, Illinois. The principal CE facility for investigating problems related to paint and protective coatings. The laboratory evaluates experimental equipment and industrial materials; conducts research on protective coatings and cathodic protection; and tests paints and paint materials for compliance with military standards.

Other laboratories. Nine other CE laboratories operate to support design and construction of specific projects. These are located at Troutdale, Oregon; Marietta, Georgia; Waltham, Massachusetts; Omaha, Nebraska; Dallas, Texas; Sausalito, California; Chicago, Illinois; Cincinnati, Ohio; and Athens, Greece.

Army Engineer Reactors Group, Fort Belvoir, Virginia. A joint DOD-Atomic Energy Commission activity under the management of the CE. It is responsible for the Army nuclear power program, which is designed to meet the nuclear power requirements of all three military services (with the exception of naval, air, and space vehicle propulsion). About 80 percent of the Group's research is conducted by private industry, universities, and research institutions under contract.

Protective Structures Development Center, Fort Belvoir, Virginia. An interagency organization of the CE, the Navy's Ship Systems Command, and the Office of Civil Defense. Facilities consist of two experimental shelter structures and a radiation test facility. Radioactive fallout is simulated for testing operations. The

Center acts as a repository for technical information on protective structures and associated equipment

Army Engineer Geodesy, Intelligence, and Mapping Research and Development Agency (known as GIMRADA), Fort Belvoir, Virginia.

The CE's principal laboratory for development of equipment to be used in surveying, geodetics, engineer intelligence, strategic systems, photogrammetry, and graphics. Basic research is concerned with such subjects as atmospheric refraction, the effects of gravity, and other phenomena on inertial positioning systems, and geodetic application of satellite orbit theory. Applied research and development projects are concerned with the design and development of surveying and geodetic systems and topographic mapping systems utilizing aircraft, missile, or satellite-borne data and ground-based data reduction subsystems.

THE ARMY MEDICAL RESEARCH AND DEVELOPMENT COMMAND

Walter Reed Army Institute of Research, Walter Reed Army Medical Center, Washington, D. C. Primary mission is the conduct of research in military aspects of the biomedical sciences and supervision of the Army's graduate and advanced technical medical educational program. About 100 research projects are conducted annually by the Divisions of the Institute--Communicable Disease and Immunology; Clinical Surgery; Basic Surgical Research; Biochemistry; Medicine; Neuropsychiatry; Nuclear Medicine; Preventive Medicine; and Veterinary Medicine. The Institute also commands the Army Component SEATO Medical Research Laboratory, Bangkok, Thailand, and the Army Medical Research Team, Saigon, Vietnam.

Armed Forces Institute of Pathology, Walter Reed Army Medical Center, Washington, D. C. This Institute, the central laboratory of pathology for the Department of Defense, conducts and sponsors experimental, statistical, and morphological research for the three military services and for other Federal agencies and civilian medical institutions as well. It maintains a consultation service for the diagnosis of pathologic tissue for civilian and military pathologists.

Army Institute of Dental Research, Walter Reed Army Medical Center, Washington, D. C. Primary mission is to provide programs of instruction and research in specialized aspects of dentistry pertinent to problems of the military.

Army Medical Research Unit, Balboa Heights, Canal Zone. Investigates medical problems of military importance to Latin America, including histoplasmosis and microbial diseases.

Army Medical Research Unit, Kuala Lumpur, Malaysia. Studies vectors and reservoirs of diseases with potential military importance in Southeast Asia, with emphasis on arthropod-borne diseases.

Army Medical Research Unit, Europe, Landstuhl, Germany. Studies radioactivity in man and correlates the data obtained with similar data developed by the Walter Reed Army Institute of Research and the Atomic Energy Commission.

Army Medical Unit, Fort Detrick, Maryland. Concerned exclusively with defense against biological warfare. Conducts about 40 projects a year in three areas--vulnerability of man to biological warfare; prevention and treatment of casualties; and laboratory identification of biological warfare agents.

Army Research Institute of Environmental Medicine, Natick, Massachusetts. Conducts and sponsors research in environmental biology and medicine to determine means of improving the performance of soldiers in environmental extremes.

Medical Equipment Research and Development Laboratory, Fort Totten, Flushing, New York. Develops new military medical equipment, and is concerned with the production and testing of prototype equipment.

Army Medical Research Laboratory, Fort Knox, Kentucky. Investigates military medical problems of a biochemical, biophysical, or psychophysiological nature which affect human behavior and performance.

Tropical Research Medical Laboratory, Fort Brooke, Puerto Rico. Manages research programs concerned with internal medicine, communicable diseases, and metabolism.

Medical Research and Nutrition Laboratory, Fitzsimons General Hospital, Denver, Colorado. Investigates the adequacy of the soldier's diet and determines the nutritional status of troops in all environments.

Medical Biomechanical Research Laboratory, Forest Glen, Maryland. Sponsors research, development, and testing of internal and external prosthetics and prosthetic materials.

Aeromedical Research Unit, Fort Rucker, Alabama. Provides aviation medical research in direct support of Army aviation and airborne activities.

Surgical Research Unit, Brooke Army Medical Center, Fort Sam Houston, Texas. Carries out studies in surgery and shock, blood and blood derivatives, burns, and the care of patients with such injuries.

Armed Forces Epidemiological Board, Washington, D. C. Administered by the Army, the Board reviews and evaluates, for the three services, research sponsored by its 14 commissions in 14 areas--acute respiratory diseases; cutaneous diseases; enteric infections; environmental hygiene; epidemiological survey; immunization; influenza; malaria; military accidents; parasitic diseases; radiation and infection; rickettsial diseases; streptococcal and staphylococcal diseases; and viral infections.



DEPARTMENT OF THE NAVYMAJOR LABORATORIES, DEVELOPMENT CENTERS, TEST FACILITIES,AND OTHER ORGANIZATIONS PERFORMING RESEARCH,DEVELOPMENT, TEST AND EVALUATION FUNCTIONSOFFICE OF NAVAL RESEARCH

Naval Research Laboratory (NRL), Washington, D. C. Performs basic and applied research and development in virtually every area of the physical sciences of interest to the Navy, in systems research and analysis, in management, psychology, and physiology. Many of its projects are sponsored by other Navy components, the Army, the Air Force, and other Government agencies.

The Laboratory groups its research effort into three major fields--electronics, materials, and nucleonics. Investigations are carried out by 13 Divisions--Applications Research; Atmosphere and Astrophysics; Chemistry; Electronics; Mechanics; Metallurgy; Nucleonics; Optics; Radio; Radar; Radiation; Solid State; and Sound.

NRL's Washington facility comprises about 100 buildings and has a research staff of about 1,500 civilians. It also maintains a sound, radio, mechanics, and optics facility at Chesapeake Beach, Maryland; an extraterrestrial radio research facility at Stump Neck, Maryland; an observatory at Maryland Point, Charles County, Maryland; a corrosion laboratory at Miraflores, Canal Zone; a tropical exposure site at Coco Solo, Canal Zone; and the Underwater Sound Reference Division, Orlando, Florida. It operates several ships and aircraft as floating and flying laboratories.

Naval Training Device Centers (NTDC), Orlando, Florida. Responsible for the design, development, maintenance, modification, and improvement of training devices, aids, and their components. These items are developed and produced by the Center or its contractors for the Army and Air Force as well as for the Navy. It collaborates closely with the Army Training Aids Subcenters.

The Center's program includes both engineering and human engineering aspects of training devices in the fields of basic seamanship; weapons and military operations; antisubmarine warfare; survival training; and space travel. It maintains strategically located regional and area offices to aid the fleet and shore establishments in the evaluation and use of training equipment.

Arctic Research Laboratory, Point Barrow, Alaska, operated and maintained by the University of Alaska. Conducts research in the fields of Arctic oceanography and meteorology, permafrost, sea ice, periglacial geomorphology, and the ecology and physiology of Arctic life.

Naval Biological Laboratory (NBL), Oakland, California, operated by the University of California. Its staff is augmented by a research unit assigned by the Bureau of Medicine and Surgery. The Laboratory is concerned chiefly with the study of selected characteristics and behavior of disease agents, and develops and improves diagnostic, preventive, and therapeutic procedures for airborne contagion.

Cooperative projects. ONR provides complete or partial support to a number of activities performing research in specialized fields. Some examples are:

The Arctic Institute of North America, Washington, D. C.

The Naval Warfare Research Center, Stanford Research Institute, Menlo Park, California (Mostly classified studies)

The White Mountain Research Station Laboratories, California  
Project SQUID, University of Virginia

The Management Sciences Group, University of Maryland

The Radiation Laboratory, Columbia, University

The Research Laboratory of Electronics, Massachusetts  
Institute of Technology

#### NAVAL MATERIAL COMMAND

##### Naval Air Systems Command

Naval Ordnance Laboratory, Corona, California. Responsibilities in several areas related to the Navy's guided missile program, particularly in the fields of missile fuzing and missile evaluation. Also performs investigations in missile guidance and control, telemetry, and missile instrumentation.

Naval Ordnance Test Station, China Lake, California. Concerned with the testing and technical evaluation of ordnance materials and systems, principally in rockets, guided missiles, underwater ordnance, and fire control. The only facility available to the Navy for full-scale POLARIS testing. Conducts research and development on thrust-vectoring systems, and investigations into combustion, fluid dynamics, chemical and nonchemical thrust production, and the magneto-thermodynamics of hot gases. Responsible for coordination of the Navy's research program in missile propulsion ignition.

Naval Missile Center, Point Mugu, California. A test environment for flight testing and evaluation of guided missiles, their components, and space weapon systems.

Naval Air Development Center, Johnsville, Pennsylvania. Concerned with electronics, pilotless aircraft, armament, theoretical analysis and computations, experimental photography, airborne anti-submarine warfare systems, aviation instruments, and aviation medicine.

Naval Aeronautical Engineering Center, Philadelphia, Pennsylvania. Responsible for the development and testing of aircraft materials and equipment used in missile handling and launching. Has responsibilities for the development and testing of recovery devices, launching devices, escape and crash safety devices, survival equipment, and special equipment; for research and development on aircraft power plants, components, and accessories, and on fuels and lubricating oils; and for human engineering studies to determine the physiological, psychological, and anatomical requirements of airborne and space equipment.

Ordnance Aerophysics Laboratory, Daingerfield, Texas, operated by General Dynamics Corporation under the technical direction of the Applied Physics Laboratory of The Johns Hopkins University. Test and evaluation effort in thermodynamics, aerodynamics, and propulsion is directed toward the improvement of missile and air-breathing engines.

#### Naval Ordnance Systems Command

Applied Physics Laboratory, Silver Spring, Maryland, operated by The Johns Hopkins University. Primary responsibilities are the development and technical coordination of Navy surface-to-air missiles and other advanced systems; and the operational analysis of the POLARIS missile system, including its submarine vehicle, launches, and its fire control and navigation systems.

Naval Ordnance Laboratory, White Oak, Maryland. Develops complete ordnance systems, assemblies, components, and materials pertaining to existing, advanced, and proposed weapons, principally in the fields of missiles and underwater ordnance. Originates and evaluates new ordnance ideas and develops hardware prototypes that can eventually be massproduced for the fleet. Performs basic research in the physical sciences not directly related to any weapon system; and applied research in aeroballistics, the casting and molding of plastics, and in high-altitude equipment for meteorological observations. Field facilities are located at:

Fort Lauderdale, Florida, for deep-water testing of mines;  
Fort Monroe, Virginia, for magnetic and acoustic research on ordnance;  
Solomons, Maryland, for research on diverse phenomena, such as infrared spectrum of jet exhaust, and for field trails of completed weapons.

Naval Weapons Laboratory, Dahlgren, Virginia. Research, design, and technical evaluation programs in weapons, ballistics, ordnance, and astronautics. Exercises technical direction over the Hazards of Electromagnetic Radiation to Ordnance (HERO) program which provides for the development of radio frequency-immune devices. Also conducts the Navy's computation and satellite analysis programs.

Naval Underwater Research and Engineering Station, Newport, Rhode Island. Research, development, test, and evaluation of underwater weapons, principally torpedoes, and components such as launchers, propulsion systems, sound systems, and fire control systems.

The Applied Physics Laboratory, Seattle, Washington, operated by the University of Washington. Conducts fundamental studies on underwater ordnance, with special emphasis on torpedoes. Also performs feasibility studies on certain applications of nuclear energy to naval problems.

Ordnance Research Laboratory of Pennsylvania State University, University Park, Pennsylvania. Conducts research in underwater ordnance--principally torpedoes--hydrodynamics, acoustics, and guidance and control.

#### Naval Ship Systems Command

Naval Underwater Sound Laboratory, New London, Connecticut. Conducts research and development in acoustic, electronic, and communication aspects of submarine and antisubmarine warfare. In addition to the New London laboratories, there are three ships equipped for testing sonar, radio, and infrared equipment; an underground facility for testing submarine radio communication systems; facilities for environmental testing of materials; ranges for acoustic and infrared testing; and test barges for calibrating underwater acoustical measuring equipment.

Naval Applied Science Laboratory, Brooklyn, New York. Conducts research, development, testing, and evaluation of materials including high-strength metals and plastics, coatings, and fire-fighting

foams; electronics test equipment and devices and systems performance effectiveness; precise inertial navigation systems and inertial navigation components; and chemical and biological warfare defense.

Naval Ship Research and Development Center (formerly David Taylor Model Basin), Carderock, Maryland. Conducts research, and testing of models, in the stability, motion, resistance, and propulsion of waterborne bodies and the analysis of noise and its relation to hydrodynamic effects; a field facility at Lake Pend Oreille, Idaho, does testing of full-scale devices. Conducts research, testing, and evaluation in all areas of ship structures, including submarine hulls and deep-diving submersibles; it maintains an Underwater Explosion Research Division at the Norfolk Naval Shipyard, Portsmouth, Virginia, for large-scale explosion tests and shock testing. Applies mathematical methods to solutions of design and vibration problems, and to analysis and evaluation of model tests conducted in the facilities of the Model Basin. Develops aerodynamic characteristics of aircraft, missiles, and components for satisfactory flight in the subsonic, transonic, supersonic, and hypersonic speed ranges.

A Division at Annapolis, Maryland, (formerly the Navy Marine Engineering Laboratory) conducts research and development in the field of noise reduction, to enable ships and submarines to avoid detection by enemy listening devices. In the field of Naval power plants and propulsion systems, its emphasis is advanced types of propulsion and advanced concepts, such as fuel cells and magneto-hydrodynamics. It is also concerned with research and testing of marine lubricants and bearings; fuels; hydraulic fluids; and various marine equipment.

Navy Mine Defense Laboratory, Panama City, Florida. Responsible for the development of equipment and techniques for mine defense, acoustic torpedo countermeasures, and inshore warfare. Conducts systems research in the design and evaluation of systems, including swimmer/diver operations. Develops swimmer/diver equipment. Facilities available to Laboratory personnel include mine-sweepers, helicopters, and two fixed sea platforms.

Navy Electronics Laboratory, San Diego, California. Projects in systems research include communications systems, radar, sonar, and inertial navigation systems for nuclear submarine use. Studies are concerned with radio and microwave communications and the development of hydrophones and projectors for underwater application. One of the Laboratory's largest programs, conducted jointly with the Office of Naval Research, involves studies of the sea floor. It has a field station at Cape Prince of Wales, Alaska.

Naval Radiological Defense Laboratory, San Francisco, California. Provides the Department of Defense with a multidiscipline approach to the solution of radiological problems. Provides the Navy with information for use in ship design, health physics, detection and measuring equipment, counter-measures, reclamation methods, and the use of radioisotopes. It also investigates the effects of thermal radiation resulting from nuclear explosions.

Naval Facilities Engineering Command

Naval Civil Engineering Laboratory, Port Hueneme, California. Conducts research to develop, test, and evaluate techniques, equipment, materials, and structures best suited for advanced bases, and amphibious operations as assigned by the Command.

BUREAU OF MEDICINE AND SURGERY

National Naval Medical Center, Bethesda, Maryland. Comprises 7 research and training units: the Naval Hospital; the Naval Medical School; the Naval Dental School; the Naval Medical Research Institute; the Navy Toxicology Unit; the Armed Forces Radiobiology Research Institute; and the Naval School of Hospital Administration.

Naval Aerospace Medical Center, Pensacola, Florida. Conducts a broad program of research in aviation and space medicine.

Naval Medical Field Research Laboratory, Camp Lejeune, North Carolina. Conducts research, development, and testing in the medical, dental, and allied sciences with emphasis on amphibious and field medicine.

Naval Submarine Medical Research Laboratory, Groton, Connecticut. Conducts research and development on problems peculiar to ship-board, submarine, and diving medicine.

Naval Medical Research Unit (NAMRU)-1, at the University of California, Berkley. Conducts research on airborne infectious diseases and the psychology of cold weather stress.

NAMRU-2, Taipei, Taiwan. Studies endemic and epidemic diseases in the Far East.

NAMRU-3, Cario, Egypt. Specializes in similar diseases of military importance in the Near East.

NAMRU-4, Great Lakes Naval Hospital, Illinois. Conducts research relative to the control of communicable respiratory diseases and rheumatic fever.

OTHER NAVY ORGANIZATIONS INVOLVED IN  
RESEARCH, DEVELOPMENT, TEST, AND  
EVALUATION IN SPECIALIZED FIELDS

Naval Oceanographic Office, Suitland, Maryland, under the jurisdiction of the Office of the Chief of Naval Operations. Research activities are concerned with many aspects of oceanography and hydrography including ocean thermal structure; oceanographic instrument development; navigation; geophysical, oceanographic, and hydrographic charting and prediction; and improvement of data collection and handling procedures.

Naval Observatory, Washington, D. C., under the jurisdiction of the Chief of Naval Operations. Conducts research in astronomy.

DEPARTMENT OF THE AIR FORCEMAJOR LABORATORIES, DEVELOPMENT CENTERS, TEST FACILITIES,AND OTHER ORGANIZATIONS PERFORMING RESEARCH,DEVELOPMENT, TEST AND EVALUATION FUNCTIONSOFFICE OF AEROSPACE RESEARCH

Air Force Office of Scientific Research (AFOSR), OAR Headquarters, Arlington, Virginia. Its seven Directorates--Engineering Sciences, Chemical Sciences, Life Sciences, Mathematical Sciences, Physical Sciences, Informational Sciences, and Procurement--monitor basic research contracts and grants in the United States, Canada, Australia, Japan, and other areas not serviced by OAR's European Office and Latin American Office.

Air Force Cambridge Research Laboratories (AFCRL), Laurence G. Hanscom Field, Massachusetts. About one-half of its work is in basic research. Part of its support is received from the Systems Command, the Advanced Research Projects Agency (ARPA), and other military and civilian agencies. The staff numbers about 1,100, of which more than one-half are scientific personnel.

AFCRL conducts research and development in the environmental and physical sciences. Its facilities include 9 laboratories--Space Physics, Meteorology, Upper Atmosphere Physics, Solid State Sciences, Aerospace Instrumentation, Microwave Physics, Optical Physics, Terrestrial Sciences, and Data Sciences--and numerous field sites for work in such fields as communications, propagation, weather, solar physics, radar and radio astronomy, and balloon research.

Aeronautical Research Laboratories (ARL), Wright-Patterson Air Force Base, Ohio. These laboratories pursue extensive programs in the physical and mathematical sciences. The major part of the research program is directed toward long-range basic research. About one-half of the dollar value of the program is carried out by contracts--with universities, non-profit research organizations, and private industry--in support of the laboratories' in-house efforts or in performing tasks which cannot be accomplished in the laboratory.

ARL has 9 research laboratories--Energetics, Metallurgy and Ceramics, Solid State Physics, Plasma Physics, General Physics, Applied Mathematics, Thermo-mechanics, Hypersonic, and Fluid Dynamics.

European Office, OAR, Brussels, Belgium. It acts as the European representative of Air Force research and development activities



conducted in Europe, the Middle East, and Africa. The European Branch negotiates contracts with scientists and monitors them jointly with the responsible OAR activity--AFOSR, AFCRL, ARL, and other appropriate Air Force research and development activities. In its role as scientific liaison officer to foreign contractors, this Office promotes the exchange of technical information between the scientific communities and Free Europe.

Latin American Office, OAR, Rio de Janeiro, Brazil. It acts as the South American representative of Air Force research and development activities.

Frank J. Seiler Research Laboratory, Colorado Springs, Colorado. It is the OAR laboratory at the Air Force Academy, concerned with research in the physical and engineering sciences. It contracts basic research in chemistry, aerospace mechanics, and applied mathematics.

Office of Research Analyses, Holloman Air Force Base, New Mexico. It evaluates and analyzes future Air Force Systems and provides technical consultant services to Air Force organizations.

#### AIR FORCE SYSTEMS COMMAND

##### Research and Technology Division

Air Force Weapons Laboratory, Kirtland Air Force Base, New Mexico. Carries out development programs associated with nuclear, laser, directed energy, and other non-conventional advanced weapons; the effects, delivery techniques and hazards of these weapons; the utilization of nuclear power; and conducts the Systems Command's civil engineering research program.

Air Force Rocket Propulsion Laboratory, Edwards Air Force Base, California. Programs encompass rocket propulsion components, systems, propellants, and associated ground equipment.

Rome Air Development Center (RADC), New York. Carries out development programs in the electro-magnetic areas of transmission and reception (below 15 GC), information processing, display, reliability and compatibility, ground-based surveillance; ground communications; and intelligence.

Air Force Aero-Propulsion Laboratory, Wright-Patterson Air Force Base, Ohio. Work in air breathing, electric and advanced propulsion, fuels and lubricants, and flight vehicle power.

Air Force Materials Laboratory, Wright-Patterson Air Force Base. Research in material sciences, metals and ceramics, non-metallic materials, manufacturing technology, materials application, and materials design data analysis and dissemination.

Air Force Flight Dynamics Laboratory, Wright-Patterson Air Force Base. Concerned with flight vehicle dynamics, performance, control, launching, alighting and structures, crew station environmental control and escape, and aerodynamic decelerations.

Air Force Avionics Laboratory, Wright-Patterson Air Force Base. Carries out development programs in the electro-magnetic areas of transmission and reception (above 15 GC), molecular electronics, bionics, lasers, vehicle environment, photo materials and optronics, position and motion sensing devices, navigation, guidance and defense, reconnaissance, avionics communications, electro-magnetic warfare, and airborne surveillance.

Air Force Armament Laboratory, Eglin Air Force Base, Florida. Plans and executes research and development involving non-nuclear, biological, and chemical munitions, targets, and scorers. Provides technical support to weapon systems. Responsible for preparation of all Air Force ballistic tables except those for ballistic reentry of spatial sub-orbital vehicles.

#### Development and Test Centers

Air Force Flight Test Center (AFFTC), Edwards Air Force Base, California. Responsible for test and evaluation of manned aircraft and aerospace vehicles. Conducts aircraft Category II testing. Provides facilities for Category I contractor tests and the final functional test and military demonstration intended to determine the capability and suitability of a complete system in meeting established Air Force requirements and design objectives. Currently being tested are the XB-15 research rocket plane, and the XB-70, F-111, YF-12A, SR-71, and XC-142 V/STOL aircraft.

Air Force Missile Development Center (AFMDC), Holloman Air Force Base, New Mexico. Conducts Category II research and development testing of air-to-air missiles and drones. Operates an inertial and stellar inertial guidance test facility. Missile subsystems and components are tested on the 35,000 foot high-speed, captive missile test track. AFMDC also supports reentry technology programs.

Air Force Special Weapons Center (AFSWC), Kirtland Air Force Base, New Mexico. Conducts test projects and provides operational and technical support on programs assigned by the

Systems Command. Generally, these programs are in the nuclear field and are concerned with weapons, weapon systems, support equipment, and effects simulation facilities.

Air Proving Ground Center (APGC), Eglin Air Force Base, Florida. Conducts and supports Air Force weapons effectiveness testing; electro-magnetic warfare, electronic surveillance and control, aeronautical weapon, support, and target systems, subsystems and techniques testing; radar cross-section measurements; vertical probe operations; and non-nuclear munitions testing. APGC works closely with the Tactical Air Command in the operation of the Air Force Tactical Warfare Center and the Special Air Warfare Center, and supports test and evaluation programs of other commands and agencies. APGC also operates the Air Force Climatic Laboratory.

Arnold Engineering Development Center (AEDC), Arnold Air Force Station, Tennessee. The Center has five major Divisions-- Large Rocket Facility; Rocket Test Facility; von Karman Gas Dynamics Facility; Propulsion Wind Tunnel; and Aerospace Environmental Facility. Its test laboratories can simulate various conditions of atmospheric, ballistic, orbital, and space flight. AEDC's work directly serves industry contractors for all the military services, educational institutions, NASA, and other agencies involved in aerospace research and development.

OTHER AIR FORCE ORGANIZATIONS INVOLVED  
IN RESEARCH, DEVELOPMENT, TEST, AND  
EVALUATION IN SPECIALIZED FIELDS

Air Force Logistics Command (AFLC), Wright-Patterson Air Force Base, Ohio. Responsible for maintenance engineering, repair, modification, standardization, and calibration. It operates 15 calibration laboratories and supervises the operation of about 175 others throughout the Air Force; one of the most advanced calibration facilities in the free world is the Heath installation of the Calibration Division at Newark, Ohio, which serves as the maintenance depot for inertial guidance components of Air Force operational missiles. The Logistics Command also develops advanced logistics devices and techniques and specializes in scientific methods of logistics problem-solving

Air Force Air University (AU), Maxwell Air Force Base, Alabama. Its Aerospace Studies Institute, located at Maxwell, conducts research, develops concepts, and prepares studies, responsive to the needs of the Air Force, on aerospace power and on the relationship to other instruments of national power. The program of the

Air Force Institute of Technology, located at Wright-Patterson Air Force Base, is coordinated with the activities of the Aeronautical Research Laboratories and of the Aeronautical System Division of the Systems Command.

Air Weather Service (AWS), Military Airlift Command, Scott Air Force Base, Illinois. Processes raw meteorological data and evaluates new theories and techniques in such fields as meteorology, space environment, geophysics, astrophysics, and climatology.

Aeronautical Chart and Information Center (ACIC), St. Louis, Missouri, an independent organization under the command of Headquarters, USAF. Provides the Air Force with aerospace charts, graphic target materials--including terrain models, target charts, and mosaics--and geodetic data required for the accurate flight of guided and ballistic missiles. It is not authorized to conduct independent full-scale research, but determines cartographic support requirements of new and existing weapon systems and develops techniques for their use. Most research and development relative to cartographic and data reduction equipment and systems is performed by the Air Force Systems Command at the request of the Center. Operational testing and evaluation is conducted largely by the Center. Such research as the Center does perform relates to the design and development of new cartographic products, to improvements in their compilation and production, and new presentation techniques.

Project RAND Office, Headquarters, USAF, Washington, D. C., under the Director of Operational Requirements and Development Plans, Office of the Deputy Chief of Staff for Research and Development. The project was initiated in 1946 to assist in long-range Air Force planning and programs of research and development in selected areas of the physical sciences, economics, mathematics, and the social sciences.

The research is performed by the RAND Corporation, an independent nonprofit research organization with headquarters in Santa Monica, California. The research staff consists of about 500 full time professional personnel, with an additional 300 consultants available for work on projects in their special fields. Three-fourths of the work of the Corporation is performed for the Air Force under Project RAND. The remaining effort is devoted to contractual research for other Government Agencies--the Advanced Research Projects Agency, the National Aeronautics and Space Administration, the Atomic Energy Commission, the National Science Foundation--and private foundations. The Corporation also conducts independent research with its own funds.

Project RAND does not manage any Air Force programs; it investigates areas and research and recommends projects. Its primary mission is to provide the Air Force with objective advice in the formulation and implementation of plans, policies, and programs, through studies, analyses, and syntheses in the fields of scientific research and development, intelligence, operations, logistics, and other applicable areas. It helps the Air Force determine the character and limitations of future air-combat weapons and strategies.



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