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The National Aeronautics and Space Administration

FIRST SEMIANNUAL REPORT TO THE CONGRESS

October 1, 1958–

March 31, 1959

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THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
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THE WHITE HOUSE

To the Congress of the United States:

Pursuant to the provisions of the National Aeronautics and Space Act of 1958, I transmit herewith for the information of the Congress the first semiannual report of the National Aeronautics and Space Administration, covering the period October 1, 1958 through March 31, 1959.

Dwight D. Eisenhower

The White House,
June 24, 1959.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WASHINGTON 25, D.C.

OFFICE OF THE ADMINISTRATOR *June 16, 1959*

THE PRESIDENT,
The White House.

DEAR MR. PRESIDENT: This, the First Semiannual Report of the National Aeronautics and Space Administration, covering the period October 1, 1958, through March 31, 1959, is submitted to you for transmittal to the Congress in accordance with the National Aeronautics and Space Act of 1958, section 206(a).

The achievements of the civilian-oriented aeronautical and space program of the United States during the first 6 months of NASA's existence have been numerous and substantial.

Three space probes transmitted invaluable information about the nature of the upper atmosphere and of space itself. One, Pioneer IV, passed within a few thousand miles of the Moon, and went on into orbit around the Sun.

The Vanguard satellite—equipped to record and transmit data on the Earth's cloud cover—was sent into orbit last February. The payload developed an erratic spin but the experiment demonstrated the feasibility of such satellites being used to survey worldwide weather patterns.

There were a number of other significant developments during NASA's first half-year of operation. Following an extremely careful selection process, seven Project Mercury astronauts were chosen for training to pilot the first United States manned satellite; tests were made of full-scale models of the Mercury space capsule; and a contract was awarded to develop and construct operational capsules.

The X–15, the rocket-powered research airplane, underwent prefinal tests, including "captive" flights under the wing of a B–52 carrier airplane, with the test pilot in the cockpit.

To provide greatly increased payloads, range and reliability for future space experiments, a new family of rocket engines is being developed. This program includes a contract for a single chamber engine of 1.5 million pounds thrust. Other contracts have been let for the Scout, Vega, Centaur, and Nova projects. These advanced general purpose vehicles will serve a wide variety of needs, and will be the basic power systems for NASA probes and satellites in the next few years.

Highlights of the foregoing programs and projects, and of other significant NASA activities are recounted in the attached report. Just as significant as the undertakings making headlines today are some of the qualitative aspects of NASA's first months.

In this respect, one of the foremost accomplishments lies in the progress made toward coordinating our National Space Program. Scientific and engineering skills, previously scattered among many Government projects and private groupings, are being drawn together into a more effective whole, dedicated to peaceful uses of aeronautics and space. Even while this effort is being completed, NASA is concentrating on organizing the scientific and engineering resources available to conduct a more effective program.

The first objective given in the National Aeronautics and Space Act is: "the expansion of human knowledge of phenomena in the atmosphere and space." NASA is enjoined to "arrange for participation by the scientific community in planning scientific measurements and observations to be made through use of aeronautical and space vehicles, and conduct or arrange for the conduct of such measurements and observations."

Implementation of the space science program has been proceeding well. NASA has sought the advice and counsel of the Space Science Board of the National Academy of Sciences, and the Board has been studying the scientific merits and priorities of the types of measurements to be made in space. The Board has also suggested qualified groups to attack various aeronautical and space problems.

NASA is formulating its research and development programs on the basis of this and other advice from its 14 advisory committees whose memberships include leading scientists and engineers from the universities, industry, the Armed Forces, and other Government agencies. In addition, NASA has negotiated with several private and Government groups to develop data-gathering instrumentation and later, to analyze the information obtained.

Our experiments, failures as well as successes, have clearly demonstrated that space is accessible to man. We have entered one of those pivotal stages of history when a great change in perspective is experienced. As we orient ourselves toward space, we should not lose sight of the fact that the goals can be attained only with great and continued expenditures of effort, skill, and time, expenditures that will certainly bring large benefits in their train to men everywhere.

Sincerely,

T. KEITH GLENNAN,
Administrator.

Contents

Introduction

The First Semiannual Report of the National Aeronautics and Space Administration (NASA) is submitted to Congress pursuant to section 206(a) of the National Aeronautics and Space Act of 1958 (Public Law 85–568) to provide for research into problems of flight within and outside the Earth's atmosphere, which states:

> The Administration shall submit to the President for transmittal to Congress, semiannually and at such other times as it deems desirable, a report on its activities and accomplishments.

PRESIDENT RECOMMENDS CIVILIAN AGENCY

On April 2, 1958, the President submitted to Congress a special message calling for the creation of a civilian space agency to conduct Federal aeronautical and space science activities, "except for those projects primarily associated with military requirements." The new agency, the President's message stated, should have the power to conduct research projects in its own facilities or by contract with other qualified organizations. The agency would thus be free "to enlist the skills and resources required for the space program wherever they may be found, and to do so under the arrangements most satisfactory to all concerned."

CONGRESS ACTS

After extended hearings during which the views of leading spokesmen for both the scientific communities and the military services had been obtained, Congress took final action on the National Aeronautics and Space Act of 1958 on July 16. (Full text of Act appears in Appendix A.)

In July also the House and Senate established new standing committees to guide the activities of NASA. The House Committee on Science and Astronautics was established on July 21 and the Senate Committee on Aeronautical and Space Sciences was established on July 24 (memberships are listed in Appendix B).

POLICY SET FOR AERONAUTICS AND SPACE

Policy for the national effort was enunciated in section 102(b) of the Act in these terms:

> The Congress declares that the general welfare and security of the United States require that adequate provisions be made for aeronautical and space activities. Such activities shall be the responsibility of, and shall be directed by, a civilian agency exercising control over aeronautical and space activities sponsored by the United States, except that activities peculiar to or primarily associated with the development of weapons systems, military operations, or the defense of the United States (including the research and development necessary to make effective provision for the defense of the United States) shall be the responsibility of, and shall be directed by, the Department of Defense; and that determination as to which such agency has responsibility for and direction of any such activity shall be made by the President * * *.

TERMS DEFINED BY ACT

The Act defines the term "aeronautical and space activities" in effect, as: (a) research into, and solution of, problems of flight within and outside the earth's atmosphere; (b) development, construction, testing, and operation for research purposes of aeronautical and space vehicles; and (c) such other activities as may be required for the exploration of space.

The Act further explains the term "aeronautical and space vehicles" as aircraft, missiles, satellites, and other space vehicles, manned and unmanned, linked with related equipment, devices, components, and parts. No attempt was made by Congress to define space activities separately; it was recognized that no exact line can be drawn between air space and outer space . . . between aeronautics and astronautics . . . the one merging imperceptibly into the other.

PRESIDENT'S ROLE

Since distinction between nonmilitary aeronautics and space activities on the one hand, and military activities on the other, also cannot be precise, the Act specifies that the President shall determine which agency—the National Aeronautics and Space Administration or the Department of Defense—shall have responsibility for, and direction of, a particular activity. Section 201(e) of the Act states the duties of the President as follows:

1. survey all significant aeronautical and space activities, including the policies, plans, programs, and accomplishments of all agencies of the United States engaged in such activities;

2. develop a comprehensive program of aeronautical and space activities to be conducted by agencies of the United States;

3. designate and fix responsibility for the direction of major aeronautical and space activities;

4. provide for effective cooperation between the National Aeronautics and Space Administration and the Department of Defense in all such activities, and specify which of such activities may be carried on concurrently by both such agencies notwithstanding the assignment of primary responsibility therefor to one or the other of such agencies; and

5. resolve differences arising among departments and agencies of the United States with respect to aeronautical and space activities under this Act, including differences as to whether a particular project is an aeronautical and space activity.

NATIONAL AERONAUTICS AND SPACE COUNCIL

In discharging his duties, the President is assisted by the National Aeronautics and Space Council, established by the Act. The Council is composed of the President (who is Chairman), the Secretary of State, the Secretary of Defense, the Administrator of the National Aeronautics and Space Administration, the Chairman of the Atomic Energy Commission, one additional member appointed by the President from the Executive Branch of the Government, and not more than three other members appointed by the President from private life. (Membership is listed in Appendix C.)

CIVILIAN-MILITARY LIAISON COMMITTEE

On a different level, the Act established a Civilian-Military Liaison Committee to: (1) facilitate communication between the Department of Defense and the National Aeronautics and Space Administration, and (2) provide a means of consultation for those two agencies. The President appointed as Chairman of the Civilian-Military Liaison Committee, William M. Holaday of the Office of the Secretary of Defense. The Committee also includes one representative from the Department of Defense, one from each of the Departments of the Army, Navy, and Air Force, and four from the National Aeronautics and Space Administration. (Membership is listed in Appendix D.)

TOP NASA ADMINISTRATORS APPOINTED

On August 8, the President appointed T. Keith Glennan, president-on-leave of Case Institute of Technology, Cleveland, Ohio, as the first Administrator of NASA. Hugh L. Dryden, Director for 9 years of NASA's predecessor—the National Advisory Committee for Aeronautics (NACA)—was appointed Deputy Administrator. The Senate confirmed the appointments on August 14, 1958.

NASA ABSORBS NACA AND ITS FUNCTIONS

Dr. Glennan, fulfilling the requirements of the National Aeronautics and Space Act, proclaimed on September 30 that the Administration had been organized and was now prepared to exercise the powers conferred upon it by the Act. (For text of Proclamation see Appendix E.) NACA thereupon ceased to exist. All its functions, powers, duties, property, and personnel were transferred to the new agency. NASA inherited from NACA a staff of 7,966 skilled scientists, engineers, technicians and administrative personnel required to carry out its responsibilities. It also acquired from NACA the Langley Aeronautical Laboratory, Langley Field, Va.; Ames Aeronautical Laboratory, Moffett Field, near San Francisco, Calif.; Lewis Flight Propulsion Laboratory, Cleveland, Ohio; the High Speed Flight Station, Edwards AFB, Calif.; and the Pilotless Aircraft Research Station, Wallops Island, Va. These facilities originally cost about $350 million.

Since its establishment in 1915, NACA had worked closely with the armed services in research necessary to provide the most effective types of military aircraft and missiles. This relationship continues with NASA. Thus NASA, although it is a civilian agency, plays an important role in support of national defense through continuation of research and experimentation of types that NACA carried on for the past 4 decades.

PARAMOUNT GOAL OF NASA

When the new NASA officially came into being, October 1, 1958, its organization—based upon the experienced nucleus of NACA scientists and engineers—was ready to move without delay into broader, more urgent activities. For these activities, section 102(a) of the Act had provided a beacon in the declaration that United States "activities in space should be devoted to peaceful purposes for the benefit of all mankind."

NASA Highlights

(October 1, 1958–March 31, 1959)*

1958

October 1.—NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA) began operating officially. Absorbed 43-year-old National Advisory Committee for Aeronautics (NACA), including NACA staff of scientists, engineers, technical and administrative personnel; NACA's Washington, D.C., Headquarters; and its five laboratories and field stations.

A NUMBER OF DEPARTMENT OF DEFENSE SPACE PROJECTS were transferred to NASA on this date by Executive Order. From *Navy*—Project Vanguard, with 158 scientists and technologists from the Naval Research Laboratory, including 25 scientists from other NRL divisions. From the *Advanced Research Projects Agency* (ARPA) and from the *Air Force* five space probes, three satellite projects, and several engine research programs, including development of nuclear engines, fluorine engines, and a 1.5-million-pound-thrust, single-chamber rocket engine.

October 5.—MERCURY—MANNED SATELLITE PROJECT—ORGANIZED under NASA management and direction, with advice and assistance of ARPA. Space Task Group formed at Langley Research Center to direct Project Mercury.

October 10.—PIONEER I—FIRST SPACE PROBE—launched from Atlantic Missile Range (AMR) Cape Canaveral, Fla., by Air Force under NASA direction, fell short of Moon objective but did travel about 70,700 miles into space.

October 15.—X–15 ROCKET-POWERED EXPERIMENTAL AIRPLANE—early step toward space flight—was rolled out at North American Aviation, Inc., plant, Los Angeles, Calif.

* Details appear in later sections.

October 23.—TWELVE-FOOT DIAMETER INFLATABLE SATELLITE was launched from AMR by Army under NASA direction. The rocket failed during boost phase.

November 7.—INDUSTRY INVITED TO SUBMIT MERCURY SPACE CAPSULE DESIGN PROPOSALS at Langley Research Center bidders' conference, attended by 39 missile and aircraft manufacturers.

November 8.—PIONEER II SPACE PROBE—launched from AMR by Air Force under NASA direction—failed when third stage did not ignite.

December 3.—JET PROPULSION LABORATORY (JPL) TRANSFERRED TO NASA from Army by Executive Order which also shifted DOD funds to NASA to continue active JPL projects-in-being.

NASA ENTERED AGREEMENT WITH ARMY on this date for services from Army Ballistic Missiles Agency, Huntsville, Ala., to work on various phases of NASA projects.

December 6.—PIONEER III SPACE PROBE—launched from AMR by Army under NASA direction—traveled 63,580 miles into space and produced valuable data on double-band Great Radiation Belt, before falling earthward and burning in atmosphere.

December 16.—INVENTIONS AND CONTRIBUTIONS BOARD ESTABLISHED by NASA to evaluate scientific or technical contributions to NASA and recommend monetary awards.

1959

January 10.—AGREEMENT FOR A NATIONAL PROGRAM to Meet Satellite and Space Vehicle Tracking and Surveillance Requirements for FY 1959 and FY 1960 signed by NASA and DOD.

January 12.—MERCURY CAPSULE DESIGN, DEVELOPMENT, AND CONSTRUCTION CONTRACT awarded by NASA to McDonnell Aircraft Corp., St. Louis, Mo.

January 19.—HIGH-THRUST ROCKET ENGINE CONTRACT awarded by NASA to Rocketdyne Division of North American Aviation, Inc., Canoga Park, Calif. Contract for this 1.5-million-pound-thrust, single-chamber rocket engine was for $102 million over 4- to 6-year period.

January 21.—SCREENING RECORDS OF PROSPECTIVE MERCURY ASTRONAUTS by NASA began; all candidates graduates of AF or Navy test pilot schools.

January 23.—CHAIRMEN OF 13 NASA RESEARCH ADVISORY COMMITTEES named by Administrator Glennan.

January 24.—AGREEMENT TO TRANSFER CHINCOTEAGUE (Va.) NAVAL AIR STATION to NASA, July 1, 1959, upon its disestablishment for Navy uses, was reached by Secretary of the Navy Thomas S. Gates, Jr., and NASA Administrator Glennan.

January 28.—TWELVE-FOOT DIAMETER INFLATABLE SATELLITE TEST FIRED successfully from Wallops Island, Va., reaching altitude of 75 miles and inflating.

February 2.—INTERVIEWS AND TESTING BEGAN FOR POTENTIAL MERCURY ASTRONAUTS—63 were selected in initial test—80 percent volunteered for further consideration.

February 7.—ASTRONAUT CANDIDATES BEGAN RIGOROUS PHYSICALS at Lovelace Clinic, Albuquerque, N. Mex.—32 were sent in groups of 6 each.

February 10.—MERCURY WIND TUNNEL TESTS, with McDonnell Space Capsule, began in hypersonic wind tunnel at Langley Research Center.

February 14.—ASTRONAUT CANDIDATES STARTED STRESS TESTS at AF Wright Air Development Center, Dayton, Ohio—32 were sent in groups of 5 each.

February 17.—VANGUARD II—CLOUD COVER SATELLITE—was successfully launched by NASA from AMR, and went into orbit. Although payload developed wobble, Vanguard II proved feasibility of cloud cover satellites.

March 3.—PIONEER IV SPACE PROBE—launched from AMR under NASA direction—achieved Earth-Moon trajectory. Passing within 37,300 miles of Moon, probe provided significant radiation data and went on to orbit Sun.

March 10.—FIRST X–15 CAPTIVE FLIGHT (suspended from wing of B–52), with pilot in cockpit, made from Edwards AFB. Test was generally satisfactory despite failure of one X–15 generator which curtailed flight time.

March 11.—PROJECT SCOUT DETAILS announced by NASA.

March 24.—VEGA VEHICLE CONTRACT—$5 MILLION—awarded to General Electric to develop second stage engine.

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The NASA Program

PROJECT MERCURY

Manned Satellite Project Organized

Responsibility for Program.—NASA has management and technical responsibility for Project Mercury—the U.S. manned satellite program—with the advice and assistance of the Advanced Research Projects Agency of the Department of Defense.

Space Task Group Specifications.—On October 5, 1958, NASA formally organized Project Mercury to: (1) place a manned space capsule in orbital flight around the Earth; (2) investigate man's reactions to and capabilities in this environment; and (3) recover capsule and pilot safely. A NASA Space Task Group (organized to direct the project) at Langley Research Center drew up specifications for the Mercury capsule, based on studies by NACA during the preceding 12 months, and on discussions with the Air Force which had been conducting related studies.

Design—Development.—Representatives of 39 prospective bidders attended a conference at Langley, November 7. By December 11, 12 firms had made detailed technical, cost, and management proposals. NASA announced January 12, 1959, that McDonnell Aircraft Corp. had been selected to design, develop, and build the capsule.

Boosters Procured.—During this report period (October 1, 1958–March 31, 1959)—NASA made arrangements to procure rocket motors for flight tests and for eventual orbital flights. A test propulsion vehicle, comprising a cluster of four large solid-propellant rocket motors, was designed and a contractor, North American Aviation, Inc., was selected. Orders were also placed for Redstone and Jupiter boosters to be used in the flight-test program, and for Atlas boosters to be utilized both in flight tests and in orbital flights.

Estimated Overall Cost.—Total cost of Project Mercury during fiscal years 1959 and 1960 is estimated at $128 million.

Mercury Development Programs

Flight Tests and Supporting Projects.—Development programs in which the NASA Space Task Group is engaged include: (1) Air-Drop Tests; (2) Escape-Systems Studies; (3) Free-Flight and Wind-Tunnel Investigations; (4) Impact Tests; (5) Parachute Tests; and (6) Tests of the Life-Support System.

Preliminary tests of the recovery parachute and measurement of impact forces were made in the drop area of Ft. Bragg, N.C., and over the airfield at West Point, Va. The recovery system is now being tested at NASA's Wallops Island Station by dropping full-scale model capsules from very high altitudes. From examination of the retrieved capsules and of films taken from jet aircraft, the behavior of the capsules during recovery are being studied in detail at Langley Research Center.

The manned Mercury capsule will be topped with a rocket system to free it from the booster if trouble develops at any time from launching through burnout of any stage of the propulsion system. At present, scientists are using full-scale models to determine the proper alinement of escape-rocket nozzles and of the forces that the rockets exert on the capsule.

Free Flight and Wind Tunnel Tests of Models.—At Wallops Island, research rockets are being employed to boost capsule models to high altitudes, where they are subjected to velocities approaching those of satellites. The purpose is to investigate stability, re-entry dynamics, and afterbody heating. Wind tunnel investigations will be made to determine the best aerodynamic shape and to determine lift, drag, stability, and pressure distribution, flutter, heat transfer, and other characteristics of the capsule in velocity ranges from Mach .5 to Mach 20—or up to some 13,000 miles per hour.

Water and Land Impacts Studied.—The recovery plan for the manned capsule is based on a water landing. Landing tests in tanks at Langley indicate that preliminary designs of the Mercury capsule can come to rest safely after striking water at a velocity of 30 feet per second. To withstand more severe shock in the event of ground landing, a variety of materials are being studied: for example, fibrous cellulose and honeycomb arrangements of corrugated plastic and aluminum.

Recovery Parachute.—The Mercury capsule will be wingless. To bring it safely and stably to Earth, two parachutes will be employed, with another two in reserve for emergency use. The first (or drogue) is a small ribbon parachute that will open at an altitude of about 70,000 feet. This drogue will trail the capsule and prevent tumbling, and at about 10,000 feet will drag out the second (or recovery) parachute. The recovery 'chute, 62 feet in diameter, will lower the capsule to water or ground. If the primary parachutes fail to be ejected, a pilot 'chute and another full-scale recovery 'chute will be released. Both automatic and manual release mechanisms are provided. Investigations are being made to test snatch and shock forces involved in parachute releases at high altitudes. Motion pictures and telemetry record performance data. Information derived from this work will be valuable in developing parachutes for high-altitude missions of all types.

Initial Accomplishment Goals

BALLISTIC, SUBORBITAL, AND ORBITAL FLIGHTS.—Before orbital flight is attempted, the Mercury capsule will be launched on ballistic paths of increasing range. The first short-range ballistic flights will be made at Wallops Island. Longer range flights will be made from the Atlantic Missile Range. Only after ballistic and suborbital flights prove the system sound will orbital flights be attempted.

MANNED FLIGHTS.—Some suborbital flights may be manned, but manned orbital flights will not be undertaken until repeated unmanned missions have been successful.

MERCURY ORBIT.—The manned Mercury capsule will be placed in orbit high enough to permit it a 24-hour lifetime. Initial flights, however, will be limited to three orbits, or to about 4½ hours. Descent will be started by firing retro-rockets.

INSTRUMENTATION.—Instruments will be incorporated to evaluate the pilot's reaction to space flight and to measure and monitor conditions inside and outside the capsule. There will be a system for two-way communication between pilot and ground stations where telemetered data will also be recorded. Other ground instrumentation will track the Mercury satellite in orbit, trigger the descent system, and predict where the capsule will land.

Mercury Pilot Selection

SPECIAL ADVISORY COMMITTEE ON LIFE SCIENCES ESTABLISHES CRITERIA.—As important as developing a space-worthy capsule are the selection and training of the capsule's human occupant. On October 27, 1958, NASA established a Special Advisory Committee on Life Sciences, to "act in consulting capacity in assisting NASA in carrying out its responsibilities to conduct a manned space vehicle program." Dr. W. Randolph Lovelace II, of the Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex., was designated Chairman of the Committee. (Membership is listed in Appendix F.)

Qualifications and attributes required of the pioneer U.S. astronaut were established by NASA's Special Committee on Life Sciences late in 1958. To qualify, a candidate had to: (1) have a degree, or the equivalent, in physical science or engineering; (2) be a graduate of a military test-pilot school; (3) have at least 1,500 hours flying time including a substantial amount in high-performance jets; (4) be younger than 40; (5) be no taller than 5′11″; (6) be in superb physical condition; and (7) possess psychological attributes specified by the Life Sciences Committee.

The committee also gave advice on other human aspects of Project Mercury, including training criteria. Several members made suggestions on human engineering and equipment design while the mock-up for the capsule was being constructed by McDonnell Aircraft.

AIR FORCE, NAVY, MARINE TEST PILOTS SCREENED.—Early in January 1959, NASA screened the records of 473 Air Force, Navy, and Marine Corps officers, all graduates of Air Force or Navy test-pilot schools. One hundred and ten were selected as potential candidates, to be brought to NASA Washington Headquarters in three groups for preliminary briefing and personal interviews.

Of the two groups interviewed on February 2 and February 9, 63 men met all basic requirements. These were given the choice of continuing through more rigorous testing that would narrow the field to the men who would actually be trained for the Mercury program. When 80 percent of the 63 men volunteered, plans to interview and test the third group were cancelled as unnecessary.

FURTHER TESTS NARROW FIELD.—On the basis of technical interviews, psychiatric interviews, and psychological and aptitude tests, the number of candidates was reduced to 32. Between February 7 and March 28, these men were given intensive, week-long physical examinations at the Lovelace Foundation, Albuquerque, N. Mex. Thirty-two candidates were sent to the Air Force Wright Air Development Center, Dayton, Ohio, for stress, heat, cold, altitude and other tests.

FINAL SEVEN SELECTED IN APRIL.—Records of candidates were evaluated by the Space Task Group and seven pilots were selected.

TRAINING.—The pilots chosen for the Project Mercury satellite capsule will be based with the Langley Space Task Group and will undergo extensive technical training and conditioning at other research centers and at Navy and Air Force bases before suborbital and orbital flights are made.

THE X–15—RESEARCH AIRPLANE

First X–15 Airplane Rolls Out

EARLY STEP TOWARD MANNED SPACE FLIGHT.—On October 15, 1958, the first of three X–15 rocket-powered research aircraft was rolled out at the Los Angeles plant of North American Aviation, Inc. The X–15 is not intended as a true space vehicle, and it will not be launched into an Earth orbit. It is, instead, a "near-space" vehicle that will reach altitudes of about 100 miles, permitting study of flight problems outside the atmosphere.

EXPERIMENTAL DATA TO BE GATHERED.—After being carried aloft by a B–52 mother ship, the X–15 will be launched for manned flight at the periphery of the atmosphere. This plane, which will operate at much higher speeds than any achieved in previous manned flights, will give much new operational experience and data from the following: (1) Full-scale in-flight measurements will be made of skin temperatures at various locations throughout the plane under the severe heating conditions of the test; (2) First actual experience will be obtained in determining the ability of the pilot to control the plane under the great accelerations and high g-loads of near-space flight; (3) Two separate sets of controls—aerodynamic and space (rocket)—will be tested; (4) Aeromedical information on the pilot and his ability to control the plane during conditions of prolonged weightlessness will be obtained.

Status of X–15

JOINT NASA-AIR FORCE-NAVY PROJECT.—A joint NASA-Air Force-Navy project, begun in 1954, the X–15 was delivered to Edwards Air Force Base shortly after roll-out, where for several weeks it underwent extensive ground testing by the Government and by North American. Modifications were found to be necessary; these included rerouting some electrical wiring from areas where high temperature is expected and installing additional inspection hatches.

"CAPTIVE" FLIGHT TEST FOR STABILITY.—The B–52 mother ship was modified to incorporate a pylon under the right wing from which the X–15 is suspended. On March 10, 1959, at Edwards AFB, the X–15 was taken aloft for the first time with the test pilot in the cockpit. Major objective was to determine the stability of the mother ship and the X–15 in flight, but tests were also made of some of the X–15's instrumentation. The B–52 circled at a speed of Mach 0.8 at 38,000 feet; stability was found to be excellent; there was no appreciable flutter of the X–15 on the pylon.

GENERATOR FAILURE SHORTENS TEST FLIGHT.—The test period, intended to last 2 hours, was curtailed after an hour and 8 minutes of flight, when a generator in the X–15 failed and smoke entered the cockpit. The coupled planes were brought down without further incident.

FURTHER CAPTIVE AND GLIDE FLIGHTS TO BE MADE.—In some later runs, the emergency fuel jettison system will be tested; in other flights the plane will glide to the ground without power to test its controls and landing gear.

Powered Flight Tests Planned.—Flights with an interim engine should take place later this year. On these flights, the X–15 will not achieve maximum performance because the interim engine—called the LR–11—has only about one-fourth the power expected from the final engine, the XLR–99. The final engine is in advanced stages of developmental testing at the North American plant; delivery is expected late in 1959 or early in 1960.

New Facilities To Monitor X–15

Tracking Range Ready.—The X–15 tracking network (Project High Range) was built by the Air Force, with the Electronic Engineering Co., Santa Ana, Calif., as design and construction contractor. The network will facilitate tracking the X–15 on its first free flights later this year. Electronic data on pilot safety and aircraft conditions will be transmitted to the ground by a combination of radar, telemetering, and radio equipment. The range will be operated and maintained by NASA personnel during the X–15 flight program.

Three Ground Stations.—The network extends 485 miles from Wendover AFB, Utah, to Edwards AFB, Calif.; three ground stations will remain in communication with each other and with the aircraft pilot at all times via ultra-high-frequency radio transmitters and ground lines. The master control station is at Edwards AFB; two uprange stations are at Beatty and Ely, Nev.

Instrumentation.—Instrumentation provides a continuous flow of information on temperatures, strains, pressures, etc., at numerous check points inside and outside the X–15, plus physiological data on the pilot.

DYNA-SOAR RESEARCH GLIDER

Follow-On to the X–15

Joint Air Force-NASA Project.—A hypersonic, rocket-boosted vehicle with swept-back delta wings capable of glide-speeds in excess of 12,000 feet per second, Dyna-Soar (DS–1) is a joint NASA-Air Force undertaking. Preliminary studies began in 1956. The purpose of the glider, which will be manned, is to provide research information more advanced than that obtainable from the X–15 and to indicate whether such a vehicle has military possibilities.

Project Responsibility and Status.—Over-all technical control of the project is the responsibility of the Air Force, acting with the advice and assistance of NASA, which is also responsible for the research instrumentation. In addition, NASA is providing contractors with technical information on their proposals through wind tunnel and analytical research on the Dyna-Soar project.

NASA SPACE PROBES

Four Missions in 6 Months

THREE OUT OF FOUR ATTAIN IMPORTANT GOALS.—In October, November, and December 1958, and in March 1959, four space probes were attempted under NASA management. All were of the Pioneer series. Their payloads were variously instrumented to report radiation, magnetisms, micrometeor impacts, and other scientific data. Three of the missions succeeded in attaining important objectives. One failed completely.

Pioneer I—First Space Probe

CHARACTERISTICS AND MISSION.—Launched from the Atlantic Missile Range (AMR), Cape Canaveral, Fla., on October 10, 1958—with the Air Force as executive agent—Pioneer I employed a Thor-Able-I booster with a payload 29 inches in diameter, 30 inches long, weighing 39 pounds. Its primary mission was to achieve a flight path that would closely approach the Moon.

FLIGHT DATA.—Launching was at 3:42 a.m., 13 seconds after scheduled liftoff. The first and second stages performed well, but at third-stage burnout the velocity was about 500 feet per second less than that required to escape Earth's gravity. In addition, the third stage had yawed about 16°, and had pitched up nearly 15°. An attempt was made to convert the payload of the probe into a high-altitude satellite by firing the fourth stage. The temperature inside the probe, however, was too low for the mercury batteries to function; the fourth stage could not be ignited. The payload traveled approximately 70,700 statute miles above the Earth's surface during its 43-hour flight before reentering the atmosphere and burning.

PERFORMANCE.—Analysis by NASA, the Air Force, and Space Technology Laboratories, Inc., disclosed that uneven gas flow during separation from the second stage was probably the cause of disorientation in the third stage. Accordingly, booster modifications were made and second-stage retro-rockets installed for Pioneer shots to come to eliminate this trouble. Other performance data from the Pioneer I flight included:

1. The magnetometer, micrometeor detector, and the command receiver and transponder functioned satisfactorily.

2. The ionization chamber measuring radiation intensity developed a leak, making information from it difficult to interpret. However, data verifying the existence of the new-found Great Radiation Belt, between 2,000 and 13,000 miles, were obtained.

3. Because the probe did not get close enough to the Moon, a scanner in the payload did not operate. Its triggering mechanisms were designed to be set off by photoelectric cells activated by the light of the Moon if the probe had approached closely enough.

Pioneer II Fails

Mission Same as That of Pioneer I.—The second NASA space probe—again with the Air Force as executive agent—was launched, November 8, 1958, from AMR. It was similar in all basic respects to Pioneer I. After launching at 2:30 a.m., the first and second stages of the Thor-Able-I booster fired on schedule. The third stage separated cleanly, but failed to ignite. The unseparated third and fourth stages reached an altitude of 963 miles and traveled some 7,500 miles before burning out.

Cause of Failure Under Study.—Although there are a number of possible causes for third-stage ignition failure, the specific cause has yet to be determined. A review of the possibilities was begun in November 1958, to ascertain possible corrective action.

Pioneer III Is Qualified Success

Characteristics and Mission.—The third NASA-directed space probe—with the Army as executive agent—was launched from AMR at 12:45 a.m., December 6, 1958, by a Juno II rocket. The probe consisted of a 12.95-pound, gold-plated, instrumented package boosted by a modified Army Jupiter rocket as the first stage; clustered, scaled-down, JPL-developed Sergeant rockets as the second and third stages; and a single scaled-down Sergeant rocket as fourth stage. The primary mission of Pioneer III, to place the scientific payload in the vicinity of the Moon, was not accomplished.

Flight Data; Radiation.—However, the probe produced excellent radiation data on both upward and downward legs of its flight, slicing through the radiation region on its 63,580-mile journey. Pioneer III established the existence of two bands of radiation: an inner belt having peak intensity at about 2,000 miles, and an outer belt having a peak at about 10,000 miles from the Earth. Beyond 10,000 miles, the radiation diminishes steadily; Pioneer III indicated it becomes very weak beyond 40,000 miles.

Slightly Early Cutoff Prevents Escape.—The first-stage Jupiter cut off several seconds too early, preventing the vehicle from attaining escape velocity. Exact cause of the early cutoff is unknown, but indications are that the fuel depletion switch malfunctioned. The vehicle traveled 63,580 miles into space during a 38.6-hour flight before it reentered the atmosphere and burned over Africa.

PERFORMANCE.—Preliminary evaluation of data gathered from Pioneer III indicates:

1. Cluster spin-up, liftoff, and initial flight phase up to approximately 176 seconds were normal.

2. At 176.2 seconds, the cutoff signal was given to the power plant by the fuel depletion switch, 3.7 seconds too early.

3. These early evaluations indicated two major deviations of the Pioneer probe from the predicted flight path: (a) The early cutoff of the booster due to malfunction of the depletion switch circuitry resulted in a velocity deficit of 382 miles per hour and 1° (down) pitch velocity angle deviation at ignition of Stage 2; (b) Further angular deviations developed during burning of Stages 3 and 4, resulting in an additional velocity loss of 88 miles per second, a pitch deviation of 1.1° down and a yaw deviation of 4.6° to the right.

4. The payload included two Geiger-Mueller tube radiation detectors, a photo-cell switching unit and a "de-spin" mechanism. The radiation detectors and the associated telemetering equipment performed satisfactorily during the flight, giving additional data on the Great Radiation Belt.

5. The photo-cell switch was intended to trigger as the Moon was approached. The desired trajectory was not realized, and this device did not operate.

PIONEER III SUCCESSES.—The first flight test of the four-stage Juno II vehicle used for Pioneer III was deemed a qualified success (other than for early cutoff) because the main power phase, first separation, retro-rocket operation, coasting phase, spatial attitude control, shroud ejection, lateral rocket firing, second separation, and second stage ignition all proceeded satisfactorily. The guidance system performed well. The flight test of the heat-protecting shroud for the upper stages was also successful, as were the radiation measurement experiment, and operation of the telemetering system and of the tracking equipment at Puerto Rico and at Goldstone, Calif.

Pioneer IV Succeeds

CHARACTERISTICS AND MISSION.—On March 3, 1959, at 12:11 a.m., the fourth NASA space probe—with the Army as executive agent—was launched by a Juno II rocket from AMR. The probe consisted of a conical instrument package of gold-washed fiberglass. It was 20 inches long, 9 inches in diameter, and weighed 13.40 pounds. Its instrumentation included a battery-powered radio designed to transmit at 180 milliwatts for 90 hours on a frequency of 960.05 megacycles; two Geiger-Mueller tubes to measure radiation; and a photoelectric sensor to be triggered by light from the Moon.

ACHIEVES PRIMARY MISSION.—Pioneer IV achieved its primary mission, an Earth-Moon trajectory, yielded excellent radiation data, and provided a valuable tracking exercise. It is now orbiting the Sun.

TOO DISTANT FROM MOON FOR INSTRUMENTS.—While the probe reached the vicinity of the Moon, it did not come close enough (the requirement: about 20,000 miles) to trigger the sensor or to sample the Moon's radiation. The probe passed within 37,300 miles of the Moon at 5:24 p.m. on March 4, 1959—41 hours and 13 minutes after liftoff. At that time, the probe was 7.2 degrees east and 5.7 degrees south of the Moon and was traveling at 4,490 mph.

PIONEER IV'S SUN ORBIT.—Pioneer IV reached its perihelion (nearest point to the Sun)—91.7 million miles—at 9 p.m., March 17, 1959; it is expected to reach its aphelion (greatest distance from the Sun)—106.1 million miles—at 6 a.m., October 1, 1959.

FLIGHT DATA.—Final flight data for Pioneer IV will take several months to evaluate. Early information indicates that:

1. The first-stage Jupiter performed as scheduled but the upper stages, each programmed to burn nine seconds, burned 10 seconds.

2. The third stage pitched down 3° and yawed 1° to the left and the fourth stage pitched down 14° and yawed 1° to the right.

3. The combination of these factors resulted in an injection velocity of 24,790 mph—188 mph below planned velocity. At injection, the probe was 4.51° down in elevation and 1.35° to the right of the planned angle. Exact causes of the pitching, yawing, and what appears to have been over-burning of the stages, are not yet known.

PERFORMANCE.—Preliminary evaluation also indicates:

1. A hydraulic timer, scheduled to activate the photoelectric sensor, functioned successfully 18 hours after liftoff, when the probe was more than 100,000 miles from Earth.

2. A mechanism to slow spin rate of the probe far out in space was also a success. This device, consisting of two small weights at the end of 60-inch wires, slowed the spin rate from 700 rpm to 12 rpm, so that the sensor could have "seen" the Moon had it come close enough.

3. The probe was tracked for a total of 82 hours and 4 minutes to 407,000 miles, the greatest distance a manmade object has ever been tracked, some 32,000 miles farther than the Russians stated they had tracked Mechta (Lunik). Long-range tracking was accomplished by the 10-foot diameter dish antenna in Puerto Rico, the 85-foot dish antenna at Goldstone tracking station in California (both operated

by JPL) and the 250-foot radio telescope at Jodrell Bank, near Manchester, England. Although the Puerto Rico antenna was designed for a 50,000-mile tracking range, it held the probe to 103,000 miles.

Early data from Pioneer IV confirmed the existence of two radiation bands around the Earth. However, this data indicated that the outer radiation zone registered on the instruments up to 56,000 miles, some 16,000 miles farther than Pioneer III had reported. On March 3, launching day, total radiation trapped within the Earth's magnetic field was more than double that reported on December 6, 1958, by Pioneer III. It is believed that solar disturbances accounted for the increase in total radiation.

NASA SATELLITES

Vanguard II—Cloud Cover Satellite

Characteristics and Mission.—At 10:55 a.m., on February 17, 1959, NASA launched a 20-inch diameter, 21.74-pound satellite from AMR. Called Vanguard II, its mission was to measure cloud cover during the daylight portion of the sphere's equatorial orbit for a two-week period, to permit correlation of cloud cover with the over-all meteorology of the Earth. In general, the satellite and its instrumentation—in a container 5½ inches in diameter and 12 inches long—functioned as planned. However, interpretation of the data transmitted has been difficult, because the satellite developed a precessing (wobbling) motion. Scientists are still interpreting the data and trying to ascertain the cause of the wobbling motion and means of correcting it.

How Cloud Cover Satellite Works.—Here, in brief, is how the cloud cover satellite works: Clouds, sea and land masses have different qualities of reflection which can be translated into electrical impulses. The satellite contains two photocells mounted behind circular, gridded windows that project from opposite sides of the satellite. The information is transmitted to Earth where the data is recorded, reduced, and interpreted.

Flight Data.—The cloud cover satellite was fired into orbit by Vanguard Launching Vehicle 4, the tall (72 feet), slim (45 inches in diameter at base) three-stage rocket developed for the Vanguard IGY program. The rocket's first two stages used a liquid propellant, the third stage a solid propellant. The launching vehicle approached maximum achievable performance. All three propulsion stages of the vehicle, and the guidance, retro, and spin rockets functioned as planned. The satellite achieved an orbit with a perigee of 347 statute miles and an apogee of 2,064 miles with an orbital period of 125.85 minutes.

PERFORMANCE.—Data gathered from Vanguard II, yet to be fully evaluated, shows that:

1. The batteries powering the weather data transmitter lasted 23 days—4 days longer than expected; the tracking batteries lasted 27 days.

2. As of 9:30 p.m., March 7, when the satellite ceased transmitting data, it had been interrogated successfully 152 times. Data were sent by two transmitters, one sending cloud cover information, the other the temperature within the scientific payload as measured by a sensitive crystal.

3. The satellite maintained within 1° its designed internal temperature of 110° F. during its passage over the sunlit portion of the Earth. Solar cells, behind gridded windows, activated a switch operating a magnetic recorder containing a 75-foot loop of quarter-inch erasable tape when the photocells were scanning the sunlit side of the Earth. Tape motion was halted when the satellite was in the shadow of the Earth to conserve battery power.

4. When the satellite passed over the appropriate tracking station, it was interrogated from the ground, and transmitted its 50 minutes of data in one 60-second burst. The data already telemetered to the ground were erased from the tape; a trigger reset the system to begin recording again.

Inflatable Satellites

TWELVE-FOOT DIAMETER SPHERES.—*First Attempt Fails.*—On October 23, 1958, NASA—with the Army as executive agent—attempted to launch a 12-foot diameter inflatable satellite ("Beacon") of microthin plastic covered with highly reflective aluminum foil. It was fired from AMR by a Juno I, a modified Redstone. The shot failed when the payload and the fourth stage were thrown clear during the boost phase.

The purposes were to: (1) Measure the density of the upper atmosphere, and (2) Flight test the "kick in the apogee" technique—use of additional thrust when the satellite first reaches apogee, causing it to attain both higher apogee and perigee altitudes for the final orbit.

Test Inflation Successful.—Later the package was test fired from Wallops Island to an altitude of about 75 miles, where the sphere was ejected and inflated. In addition, capabilities of the new NASA Wallops Island radar and of the new Massachusetts Institute of Technology radar, Millstone Hill, Vt., were explored by tracking the inflated sphere and the final-stage rocket.

Table I.—NASA Satellites, Lunar Probes, and Space Probes, Oct. 1, 1958—Mar. 31, 1959

(Official statistics prepared by the National Aeronautics and Space Administration)

Name; By; Type; Orbit weight; Payload weight	*Lifetime*	*Launching vehicle*	*Payload instrumentation*	*Test results*	*Perigee (miles)*	*Apogee (miles)*
PIONEER I. United States. Lunar Probe (Toroidal). Total weight in flight: 84.4 pounds, including 43.7 pounds of verniers and retrorockets. Scientific instrumentation in payload: 39 pounds.	Oct. 11, 1958–Oct. 12, 1958, or 43 hours and 17½ minutes.	Thor Able I.	*Dimensions:* 29 inches in diameter, 30 inches long. *Experiments:* measurements of radiation in space; magnetic fields of earth and moon; density of micrometeor matter; internal temperatures; electronic scanner. *Shell composition:* fiberglass. *Antennas:* two 12-inch whips. *Transmitter:* (*a*) 108.06 mc at 300 mw (telemetry and Doppler command); (*b*) 108.06 mc at 1 watt (controls). *Power supply:* mercury batteries. *Transmitter lifetime:* 10 days.	Reentered atmosphere over South Pacific Oct. 12, 1958. (*a*) Determination of radial extent of radiation band. First observation that radiation is a band. (*b*) Mapped total ionizing flux. (*c*) First observation of hydromagnetic oscillations of magnetic field of earth. (*d*) Discovered departure of magnetic field from theoretical prediction. (*e*) First determination of the density of micrometeors in interplanetary space. (*f*) First measurements of the interplanetary magnetic field.	Altitude: about 70,700 statute miles.	
BEACON. United States. Inflatable satellite (sphere). Payload case: 18.3 pounds; rocket case: 11.27 pounds. Total: 31.5 pounds. Weight of inflatable satellite when free of payload case: 9.26 pounds.	Oct. 23, 1958–0	Jupiter C.	*Dimensions:* 50 inches long and 7 inches in diameter; contained the folded sphere, tracking transmitter, kick motor and pressurized bottle. *Experiments:* ejection of sphere from payload package; sphere itself would be used to study atmospheric density at various levels during lifetime of about 2 weeks. *Shell composition:* Mylar polyester film and micro-thin aluminum foil. *Transmitters:* none.	Part of the cluster, including payload, separated from the booster prior to booster burn-out. Flight time of payload: 424 seconds. Flight time of booster: 526 seconds.	0	0

PIONEER II. United States. Lunar Probe (Toroidal). Total weight in flight: 86.4 pounds. Scientific payload: 34.3 pounds.	Nov. 8, 1958; 42.4 minutes.	Thor-Able I.	*Dimensions:* 29 inches in diameter; 30 inches long. *Experiments:* total ionizing radiation; cosmic ray flux; magnetic fields of earth and moon; density of micrometeoric matter; internal temperatures; electronic scanner. *Shell composition:* fiberglass. *Antennas:* Two 12-inch whips. *Transmitters:* 108.06 mc at 300 mw (telemetry and Doppler command) and 108.09 mc at 100 mw (telemetry). *Power supply:* mercury batteries. *Transmitter lifetime:* 10 days.	Third stage failed to ignite. Reentered atmosphere 28.7° N., 1.9° E. (*a*) Evidence that equatorial region about earth has higher flux and higher energy radiation than previously considered. (*b*) Suggestion that micrometeor density is higher around earth than in space.	Altitude: 963 miles.	
PIONEER III. United States. Space Probe (conical). Total weight in flight and scientific payload: 12.95 pounds.	Dec. 6, 1958–Dec. 7, 1958 or 38 hours, 6 minutes, after launch.	Juno II Stages: Four. 1st: Jupiter (liquid). 2d: 11 clustered. Sergeants (solid) 3d: 3 clustered Sergeants (solid). Gross take-off weight: 121,000 pounds.	*Dimensions:* 23 inches long; 10 inches maximum diameter. *Experiments:* measurement of radiation in space. *Shell composition:* gold-washed fiberglass. *Antenna:* cone itself serves as antenna; gold is conductor. *Transmitters:* 960.05 mc at 180 mw. *Power supply:* mercury batteries. *Transmitter lifetime:* 90 hours.	Discovered second radiation belt around earth. Reentered atmosphere over French Equatorial Africa on Dec. 7, 1958. Designed velocity: 24,897 mph. Attained velocity: about 24,000 mph.	Altitude: 63,580 miles.	
VANGUARD II. United States (sphere). Total weight in orbit and scientific instrumentation: 20.74 pounds.	Feb. 17, 1959. Expected lifetime: 10 years or more.	Vanguard Rocket. (Same as Test Vehicle 3.)	*Dimensions:* 20 inches in diameter. *Experiments:* cloud cover. *Shell composition:* highly polished silicon-monoxide-coated magnesium. *Antennas:* Four metal rods. *Transmitters:* (*a*) 108.00 mc at 10 mw; (*b*) 108.03 mc at 80 mw triggered from ground. *Power supply:* mercury batteries. *Transmitter lifetime:* (*a*) 23 days; (*b*) 27 days. Satellite contained 2 photocells designed to produce crude images of cloud cover for 2-week period.	Period: 125.85 minutes. Inclination to equator: 32.88 degrees. In general the satellite and its instrumentation functioned as planned. However, interpretation of data has been difficult because satellite developed a wobbling (precessing) motion.	347	2,064

Table I.—NASA Satellites, Lunar Probes, and Space Probes, Oct. 1, 1958—Mar. 31, 1959—Continued

(Official statistics prepared by the National Aeronautics and Space Administration)

Name; By; Type; Orbit weight; Payload weight	*Lifetime*	*Launching vehicle*	*Payload instrumentation*	*Test results*	*Perigee (miles)*	*Apogee (miles)*
PIONEER IV. United States (conical). Total weight in flight and scientific instrumentation: 13.40 pounds.	Mar. 3, 1959. In orbit around sun.	JUNO II. (Same as Pioneer III.)	*Dimensions:* 20 inches long; 9 inches in diameter. *Experiments:* Measurement of radiation in space. Test photoelectric sensor in vicinity of moon. *Shell composition:* gold-washed fiberglass. *Antenna:* cone itself serves as antenna; gold is conductor. *Transmitter:* 960.05 mc at 180 mw with 3 subcarriers. *Power supply:* mercury batteries. *Transmitter lifetime:* about 90 hours.	Probe achieved its primary mission, an earth-moon trajectory, yielded excellent radiation data and provided a valuable tracking exercise. It is now orbiting the sun. While the probe reached the vicinity of the moon, it did not come close enough (20,000 miles) to trigger photoelectric sensor or sample moon's radiation. The probe passed within 37,300 miles of moon at 5:24 p.m. on Mar. 4, 1959. It passed 7.2 degrees east and 5.7 degrees south of moon at 4,490 mph. Probe reached perihelion, 91.7 million miles, at 9 p.m. Mar. 17, 1959; scheduled to reach aphelion, 106.1 million miles on October 1, 1959. Injection velocity of 24,790 mph was 188 mph below planned velocity. Pioneer IV was tracked for 82 hours to distance of 407,000 miles.		

NOTE: (Statistics on Vanguard II and Pioneer IV are subject to updating after study of their data has been completed.)

(All distances are given in statute miles above the surface of the earth. Except where indicated, this chart does not include description and weights of spent rocket casings etc. that have gone into orbit or flight trajections along with payloads.)

A second 12-foot inflatable sphere may be launched later in 1959.

HUNDRED-FOOT DIAMETER SPHERES.—*Goal Is Teleradio Reflector Satellites.*—During the fall and early winter of 1958, NASA continued design work on a 100-foot inflatable satellite at Langley. Much engineering and testing remains before this satellite will be ready for launching. Constructed of aluminized Mylar plastic, the payload will weigh about 150 pounds. It is intended to be placed in an orbit of between 700 and 1,000 miles above the Earth's surface as a step toward development of passive communications satellites—i.e., satellites that simply reflect radio and television beams back to broad areas of the Earth's surface.

TRACKING RESOURCES ENLARGED

International Aspects

Much of NASA's satellite tracking program has grown directly out of arrangements originally made by other organizations in the United States with agencies abroad as part of the program for the IGY. A high degree of international cooperation marked the satellite tracking program; the same teamwork prevailed in the lunar and space probe tracking activities. U.S. and Russian satellites were tracked with a global network of optical and radio telemetry receiving stations. Among the overseas stations tied in with the satellite tracking network were Antigua, West Indies Federation; Quito, Ecuador; Lima, Peru; Antofagasta and Santiago, Chile; Woomera, Australia; and Esselen Park, Union of South Africa. These countries, in a program originally established by the U.S. Naval Research Laboratory in cooperation with other agencies here and abroad, were all a part of the "Minitrack" telemetry system. An important foreign contributor to the tracking of lunar and space probes was the giant University of Manchester radio telescope at Jodrell Bank, England.

NASA–DOD Tracking Agreement

On January 10, 1959, representatives of NASA and DOD met to coordinate the separate requirements of the two agencies, and arrived at an agreement for a "National Program To Meet Satellite and Space Vehicle Tracking and Surveillance Requirements for FY 1959 and FY 1960." The agreement, signed by Secretary of Defense McElroy and Administrator Glennan, established respective responsibilities, mutual use of tracking data wherever possible, and led to the formation of a continuing NASA–DOD Space Flight Tracking Resources Committee.

NASA Program

NASA plans for the immediate future include the following:

1. The Minitrack system will be improved with added capacity for high inclination and polar orbits; four new stations are planned.

2. The 12 Optical Stations originally set up under the IGY by the Smithsonian Astrophysical Observatory, Cambridge, Mass., will be supported by a grant from NASA to permit increased capabilities for the heavier program expected this year.

3. The Tracking and Data Acquisition for deep space probes now being supplied by the Goldstone Station of JPL will be augmented by two similar large parabolic antenna systems in accordance with present plans.

4. Three radar tracking stations will be added for Project Mercury to supplement those already in existence at the missile ranges: one at Hawaii to determine the retrorocket firing point for reentry; one in Texas to close a gap which is not filled by existing missile ranges so that continuous tracking during the critical reentry phase may be maintained; and one location, not finally decided, to determine whether the capsule is in the proper trajectory immediately after insertion into orbit from Cape Canaveral. In addition, equipment will be provided at several existing stations and for a few shipboard installations to provide communications with the capsule during its flight.

NATIONAL SPACE VEHICLE PROGRAM

Five Vehicles Involved

Responsibility and Objectives.—The National Space Vehicle Program comprises a series of vehicles—Scout, Vega, Centaur, Saturn, and Nova—each capable of carrying a larger payload and performing a more complex mission than its predecessors. The program is a studied attempt to get maximum capability with minimum development work. Each vehicle type of the series will be used in numerous tests to achieve high reliability, and will make use of engines and hardware previously flight-tested.

General-Purpose Vehicles Planned.—Plans for Scout, Vega, and Centaur are far enough along for some details to be reported. The fourth general-purpose vehicle is Saturn, which is under development by the Army Ballistic Missile Agency. The fifth vehicle of the series is Nova, which will be based upon use of the 1.5 million-pound-thrust engine recently initiated by NASA.

Project Scout

Will Serve Wide Range of Research Needs.—Scout is a rocket designed to exploit the properties of solid propellants and to provide a relatively simple vehicle suitable for a wide range of space research needs. A four-stage rocket, it will employ engines of advanced design.

Air Force Use.—The Air Force also has use for a test vehicle with capabilities similar to those of Scout. NASA has provided the Air Force with copies of its specifications. An Air Force contractor will design modifications required for Air Force experiments. A joint team has been set up to coordinate this aspect of the project.

Easy Handling and Transportability.—Scout will have a range of applications, such as high-altitude probes and orbital experiments with small payloads. Because of its simplicity in on-site handling and its transportability, launching facilities for Scout need not be elaborate or expensive. These factors establish it as a vehicle that could be made available for cooperative programs with other nations.

Vehicle Capabilities.—The Scout vehicle will weigh about 36,000 pounds and will be 70 feet long. It will be capable of putting a payload of about 200 pounds in a nominal 300-mile orbit. In high-altitude shots, Scout will be able to send a 100-pound instrument pack to an altitude of about 5,000 miles.

Scout Contracts.—Each Scout will cost substantially less than other test vehicles of similar size and capability. Components of the vehicle, for which most contracts have been let, include: *First Stage:* Aerojet Senior, a modification of an early Polaris motor—Aerojet General, Azusa, Calif. *Second Stage:* An improved Sergeant—Thiokol, Huntsville, Ala. *Third Stage:* A new rocket, a scale-up of the Vanguard third stage—Allegany Ballistics Laboratory of Hercules Powder Co., Cumberland, Md. *Fourth Stage:* Same as the third stage of the Vanguard—also being built by Allegany Ballistics Laboratory. The vehicle will have a simple gyro guidance system and spin stabilization to be supplied by Minneapolis-Honeywell Corp. The spin stabilization will be used initially for the last stage.

As this report period ended, NASA expected to let contracts in the near future for vehicle airframes and assembling components at Langley Research Center, and for developing the launching structure.

Vega Program

May Place 5,800-lb. Payload in Orbit.—Vega has the potential of placing 5,800 pounds in an earth orbit or of carrying hundreds of pounds as a space probe. Vega, which should be available by late 1960, has a modified Atlas booster as the first stage. The second stage, using modifications of the Vanguard first-stage engine, will be fueled by liquid oxygen and kerosene.

STORABLE-PROPELLANT THIRD STAGE BEING DEVELOPED.—Increased capabilities are anticipated by adding the third stage, powered by a 6,000-pound thrust storable-propellant engine now being developed at JPL.

CONTRACT FOR VEGA ROCKET ENGINE SIGNED.—A contract for the second-stage engine of the Vega space vehicle was signed, March 24, 1959. Under the terms of the contract, General Electric Co. will develop a liquid propellant engine, a modification of the Vanguard first-stage engine. Changes will include development of an ignition system capable of starting and restarting under space conditions. This feature will be used on missions where it is necessary to achieve a coasting period, followed by reignition, in order to establish an orbit at high altitudes.

Centaur Program

NEW OXYGEN-HYDROGEN SECOND-STAGE CLUSTER.—Like Vega, the Centaur will use a modified Atlas booster as the first stage. Atlas tooling will also be used in the construction of Centaur tanks. The difference between the Vega and Centaur vehicles lies in the type of second stage employed. The Centaur second stage will use a high-energy propellant combination. A new rocket motor for this combination is now under development. For advanced space missions, the same type of third stage will be used in both Vega and Centaur—a 6,000-pound thrust rocket motor.

ARPA ORIGINATED; NASA DIRECTS AFTER JULY 1, 1959.—The Centaur program was initiated by ARPA; all funds for Fiscal Year 1959 are supplied by ARPA. The Centaur program will be entirely transferred to NASA as of July 1, 1959.

1.5 Million-Pound-Thrust Single-Chamber Rocket Engine

BASED ON EARLIER AIR FORCE FEASIBILITY STUDY.—One of the first major programs undertaken by the newly created NASA was development of a 1.5 million-pound-thrust single-chamber rocket engine. Full advantage was taken of a earlier Air Force study of the project's feasibility.

DESIGN SPECIFICATIONS TO BE ADAPTABLE.—This giant engine will be developed to use liquid oxygen and a hydrocarbon as propellants. Thrust will be 1.5 million pounds at sea level, and 1.73 million pounds in the near-vacuum condition of very high altitudes. The program will provide a booster large enough to launch into space payloads and experiments weighing several tons. Performance flight-rating tests of the engine will be based on unmanned vehicle applications, but this rocket may eventually propel manned satellites and spacecraft.

CONTRACT AWARDED.—On October 21, 1958, 3 weeks after NASA began operating, prospective contractors were invited to a briefing at NASA Headquarters, Washington, D.C. Six companies submitted proposals by November 24. After evaluating the technical aspects of these proposals and assessing the management, facilities, and staffs of the bidders, NASA announced on December 12 that the Rocketdyne Division of North American Aviation, Inc., had been selected. The development contract, signed January 19, 1959, was for a total of $102 million to be spent over a period of 4 to 6 years.

DEVELOPMENT FACILITIES PROVIDED BY AIR FORCE.—Cooperative arrangements are being worked out with the Air Force for use of engine test stands at Edwards AFB. According to the development schedule, preliminary flight-rating tests should be completed in about 46 months from the date of contract.

RESEARCH PRIMARILY FOR SPACE ACTIVITIES

Investigations of Space Environment

DISCOVERIES.—During this report period, the most important discoveries made through use of satellites and space probes were in the fields of geodesy, cosmic radiation, atmospheric densities and temperatures, and ionospheric properties.

In geodesy, it has been found that the Earth is slightly pear-shaped, with the stem at the North Pole.

In cosmic radiation, the Explorers I, III, and IV satellites revealed the existence of the Great Radiation Belt surrounding the Earth, and the Pioneers III and IV space probes showed that there are two zones to the belt.

The upper atmosphere was found to be denser than had been theorized before satellite data were available. Temperature of the high atmosphere was also found to be higher than expected.

A very slow decrease in electron density was discovered above the F–2 maximum (about 180 miles) of the ionosphere.

These unexpected findings have emphasized the importance of exploring the composition, spatial extent, and origin of the two radiation belts and their relation to solar activity.

Research programs in the physical sciences have been divided into Atmospheres, Ionospheres, Energetic Particles, Electric and Magnetic Fields, Gravity Fields, and Astronomy.

ATMOSPHERES.—This program includes an intensive investigation of the structure and composition of the Earth's atmosphere, using sounding rockets and satellites. Particular emphasis is being placed on obtaining and understanding daily, geographic, and seasonal variations, and the relationship between surface meteorology and the structure and dynamics of the upper atmosphere.

IONOSPHERES.—Here the object is to learn how electron density varies at altitudes above the F-2 region, using both sounding rockets and deep space probes. Latitude and time variations of electron density will be obtained by use of polar-orbiting satellite beacons. Very low frequency propagation measurements will be made by polar-orbiting satellites. Plans call for ion spectrum studies to be extended to the low mass numbers and higher altitudes by means of mass spectrometers in both space probes and satellites. Direct measurements, using antenna probes, ion probes, and electric field meters, will be made in rockets and satellites to define in detail ionospheric structure and to study interactions between the ionosphere and space vehicles.

ENERGETIC PARTICLES.—In the energetic particles program, the interactions of high energy particles with the Earth's atmosphere and field will be studied intensively, and the types and energy of such particles and their spatial distribution will be measured. Measurements will be made of: (1) cosmic ray intensity in interplanetary space; (2) time and latitude variations in cosmic ray intensity; (3) composition and spatial extent of the Great Radiation Belt; (4) the cosmic ray energy and charge spectrums; and (5) the nature of the particles producing auroras.

ELECTRIC AND MAGNETIC FIELDS.—The program includes: (1) satellite investigations with proton magnetometers to study ring currents above the ionosphere and their relations to magnetic storms; (2) numerous sounding rocket experiments to investigate ionospheric currents; and (3) the use of magnetometers in space probes to observe electric currents and the form of the Earth's magnetic field at great distances, and to investigate whether the Moon has a magnetic field.

GRAVITY FIELDS.—In this program, an instrumented satellite will be launched into a very high orbit to obtain precise geodetic data over a long period of time. In addition, a highly accurate clock in a satellite will be launched into orbit to test the general theory of relativity.

ASTRONOMY.—The survey of nebulosities in the far ultraviolet, a phenomenon discovered during the IGY, will be extended to the southern sky by means of rockets. Plans call for particular emphasis to be placed on scanning satellites and rockets to observe the previously unexplored infrared and high-energy gamma ray spectral regions. Such studies will lay the groundwork for the satellite observatory program, leading to orbiting astronomical observatories on platforms, controlled from the Earth. A program of lunar explorations will include hard landings, lunar orbiters, and finally soft landings in which the instruments will not be damaged.

Working groups have been set up in four areas of research: (1) Orbiting Astronomical Observatories, (2) Interplanetary Probes, (3) Satellite and Ionospheric Beacons, and (4) Lunar Explorations. These groups incorporate a broad representation from the educational, industrial and scientific communities to help NASA carry out its space sciences research program. As the need arises, more working groups will be formed.

Nuclear Energy Applications For Space

PROJECT SNAP.—The Atomic Energy Commission is developing nuclear power plants to provide electricity over long periods of time for the satellite instrumentation and other space applications specified by the military services and the NASA. This is "Project SNAP" (Systems for Nuclear Auxiliary Power). As part of the program, a SNAP III device producing electricity from the energy released by the radioactive decay of a radioisotope by means of solid state converters has recently been demonstrated. Application of direct conversion systems to nuclear reactor power sources is also being pursued. For example, in late March 1959, the Los Alamos Scientific Laboratory demonstrated a plasma diode in a test reactor, directly converting the thermal heat of fission to electricity. Much work is still required beyond this small-scale experiment to achieve an efficient, long-lived, direct-conversion reactor system.

PROJECT ROVER.—Work on Project Rover, a joint AEC–NASA endeavor to develop nuclear rockets, is centered at the Commission's Los Alamos Scientific Laboratory and at its Nevada Test Site where high-temperature experimental reactors will be operated in ground tests only. The initial experimental reactor, christened "Kiwi-A," after the flightless New Zealand bird, has been operated at critical conditions at very low power. This experimental device and the test facility at the Nevada Test Site are undergoing further checkout prior to operation up to the design power level late this spring. In addition, NASA has provided funds to the AEC to support development of a liquid hydrogen pump for a nuclear reactor propellant feed system application.

RESEARCH SUPPORTING AERONAUTICS AND SPACE ACTIVITIES

Aircraft As Well As Space Projects

The types of aeronautical research formerly carried on by NACA are still decidedly important and constitute nearly half of the total research program of NASA. This work is largely a continuation of the activities of the old NACA Laboratories, supplemented by the addition of JPL and of the groups that were transferred to NASA from the Naval Research Laboratory. During the past six months, the following areas were under intensive study by NASA:

1. Shorter Take-Offs, Landings. Much research effort is going into designs for VTOL (vertical takeoff and landing) and STOL (short takeoff and landing) aircraft. Gains, based on work already done, appear worthwhile, and investigation is continuing of problems such as the effect of the jet blast on the wing structure, and on stability and control.

Tests have shown that a large increase in lift can be obtained by distributing the exhaust of jet engines chordwise along the trailing edge of the wing, then deflecting it downward in a thin jet sheet through a large angle by a small trailing-edge flap.

Further research is in progress to learn how to use jet engines effectively for powering VTOL type airplanes. Under study are two types: (1) "tail sitters" and (2) planes in which the fuselage remains in a horizontal position while the jet blast is turned downward, either by rotating the engine to change the direction of the jet, or by turning the blast with a cascade of vanes or deflectors.

Flight models, powered by small hydrogen peroxide rockets, are being used experimentally, controlled electrically from a mobile crane through a slack cable. Gyroscopic forces are simulated by flywheels mounted in the models so that critical stability and control problems can be studied.

Stability and control characteristics and flying and handling qualities of research airplanes (called "flying test beds") are being studied jointly with the military services developing the planes. At present, NASA is making measurements in coordination with those being made by the manufacturers. However, it is planned that later some of these aircraft will be turned over to NASA for detailed flight investigations.

The results appear promising for application to light transports (2 to 4 tons) of the turboprop type. There has also been fairly promising research for turbojet interceptors.

2. Supersonic and Hypersonic Aircraft. Studies are in progress to pinpoint problems that occur with supersonic and hypersonic

(above Mach 5) airplanes, to determine the nature of research that still needs to be done. Problems center in two major areas: (1) aerodynamic heating, and (2) stability and control. Developing aircraft that combine low heating rates and good aerodynamic characteristics is extremely difficult, for solutions are often in conflict with each other.

Aerodynamic Heat Studies.—Substantial research is going on to obtain improved materials, structures, and configurations. Models are tested in "hot" wind tunnels in which electric arcs are struck between central electrodes and the walls of the tunnel, and air is passed through, reaching temperatures of 15,000° to 20,000° F. Heat transfer is measured at various points on the model's outer surface, the nose region being the most critical.

Stability and Control Studies.—To test stability and control characteristics with models without the complications of very high temperatures, light gases (particularly helium) are used in wind tunnels; the light gases require less pressure than air to achieve high speeds, and Mach numbers as high as 25 can be achieved, with apparently good simulation. Free-flight tunnels are also used, in which Mach numbers of 12 to 15 are obtained. Velocities can be changed in incremental steps by using different types of nozzles—one for Mach 1, another for Mach 2, etc. Small models are then fired from 20 mm. (or larger) guns powered by charges that can also be changed in increments. As the models progress down the tube against the stream, dynamic behavior is recorded through windows by high-speed cameras. Simple ballistic ranges are also used, 250 to 500 feet in length. They are essentially long, closed tanks in which pressures can be varied above or below normal atmospheric values. A helium-powered gun with a long barrel is used to fire small models at speeds of 20,000 feet per second or higher (about Mach 20). Work on supersonic aircraft (Mach numbers lower than 5) is centered about flight efficiency, aerodynamic drag, powerplant performance, stability and control, and structural aspects.

3. Helicopters. Useful data have been obtained through the use of "variable stability" helicopters. By changing the gain of the autopilot, it is possible to get the effect of a flying simulator. Studies are being made of combinations of stability and control power considered optimum by research and test pilots who have been flying the helicopters. These data will assist designers in providing desired characteristics while the helicopter is still on the drawing board. This will be particularly helpful for helicopters to be employed in all-weather operations.

4. Powerplant Research. Studies of high-energy fuels are being carried out at NASA laboratories and at those of other cooperating Government agencies. Considerable basic research remains before

air-breathing engines for hypersonic aircraft will become practical realities. Research applicable to electric-propulsion systems is under way. Special tanks and facilities for simulating space environment are being constructed. Preliminary experiments with ion and plasma accelerators and with fuel cells are being conducted.

5. FLIGHT SIMULATORS. New techniques are constantly being developed for using flight simulators to perform tests and obtain data that would be difficult and dangerous, if not completely impossible, to get from conventional flight tests. Conditions for high-speed, high-performance craft have been simulated for some time, but similar techniques are being extended to helicopters and VTOL and STOL aircraft. Much work of this type is aimed at determining stability and control of these very unconventional configurations.

Simulators are also useful for training pilots in new types of craft that are radically different from the machines they have been flying. An important research tool that has been highly useful for NASA work is the Navy centrifuge at Johnsville, Pa. This device has been rigged to provide pilot experience under high acceleration flight conditions. Tests have also been run in which aerodynamic and control characteristics of the X–15 were simulated, to see if the pilot could keep the craft under control. At the same time, physiological information on the pilot was obtained.

6. THE "SIDEARM CONTROLLER". The conventional aircraft "stick" control, standard almost from the beginning of flying, has been found unsuitable for extremely high-performance aircraft such as the X–15. Since the pilot's arm is unsupported, there is a strong possibility that under the unusual aerodynamic conditions of extremely high speeds and accelerations, the pilot may inadvertently over-control, or overshoot in making corrective movements, and thus put the craft into dangerous positions.

To remedy these difficulties, a new type of control has been devised. Known as the "side-arm controller," it fully supports the pilot's arm, and the only movement necessary is a relatively slight one of the hand and wrist, which controls the aircraft through electrical circuits.

7. NASA PLUM BROOK REACTOR. Work on NASA's 60–megawatt (thermal) test reactor at Plum Brook (formerly an Army Ordnance Station) near Sandusky, Ohio, has proceeded on schedule. Similar in general design to AEC's Materials Testing Reactor (MTR) at the National Reactor Testing Station in Idaho, it will be used to test under radiation materials and small components for aircraft and space vehicles—particularly aircraft reactor and rocket reactor fuel elements. Studies of shielding and experiments in nuclear and solid-state physics will also be conducted. Water-cooled and moderated, the reactor is composed of a core contained in a pressure vessel (tank) shielded by concrete and water in a circular pool, and further enclosed in a cylin-

drical steel containment vessel. Only after exhaustive and definitive tests will the Plum Brook Reactor be brought to criticality (start of chain reaction), possible late in 1959 or early in 1960.

8. OTHER AREAS OF INVESTIGATION. During this report period, NASA research centers and test stations also carried on work in the following areas: (a) Aircraft noise reduction; (b) Structures and materials, especially for use at high temperatures; (c) Research problems of rockets using high-energy fuels; (d) Improved aerodynamic efficiency of supersonic and hypersonic aircraft; (e) Rocket-control problems, especially for new types of high-performance rockets; (f) Reentry and heating tests; (g) Flutter characteristics of various configurations; (h) Ditching aids; (i) Crash survival; and (j) Landing and takeoff procedures.

RESEARCH FELLOWSHIPS PROGRAM

On March 11, 1959, NASA announced a program of research fellowships in theoretical and experimental physics associated with exploration of space. To be administered by the National Academy of Sciences and the National Research Council, which will jointly receive an initial grant of $350,000 from NASA, the program is expected to stimulate basic research in the space sciences.

NASA will provide the facilities and staff required for research by the appointees at one of its space centers. Theoretical research will be supervised by Robert Jastrow, Chief of the Theoretical Division of the Beltsville Space Center. This research will include: physics of planets and satellites; astrophysics; and plasma physics. Experimental research will be under L. H. Meredith, Chief of the Space Sciences Division, and will include: fields and particles; planetary atmospheres; astronomy; solar physics; and meteorology.

The program includes Research Associateships and Senior Research Associateships (both at the post-doctoral level) for scientists of exceptional creative ability who wish to free themselves from academic responsibilities in order to devote an extended period to basic research. Stipends begin at $8,000 a year, with larger amounts for the Senior Associateships, which will be granted to experienced scientists with substantial records of accomplishment.

RESEARCH ADVISORY COMMITTEES

On January 23, 1959, Administrator Glennan announced the appointment of the chairman of 13 new research advisory committees to NASA. These committees, with membership drawn from industry, universities, and Government organizations, will review national space and aeronautical research in progress and recommend problems that should be investigated by NASA or other research organizations. They will assist in formulating and coordinating these research programs, and will also serve as a medium for the exchange of information on these subjects among members of the scientific community.

Each committee, composed of about 15 members, will meet several times a year. (Memberships are listed in Appendix G.)

INTERNATIONAL COOPERATION

Multilateral Cooperation

On February 5, Deputy Administrator Dryden was named by the Secretary of State as an alternate U.S. Representative to the United Nations *Ad Hoc* Committee on the Peaceful Uses of Outer Space. The Committee is scheduled to begin discussions in New York early in May. U.S. Ambassador Henry Cabot Lodge will lead the U.S. delegation.

In March, NASA pledged its support to scientific (non-military) research of the Committee on Space Research of the International Council of Scientific Unions, making a satellite launching capability available for the Union's Committee on Space Research (COSPAR) coordinated instrumentation or payloads; particular attention is also being given to developing a vehicle (such as Scout or Thor Delta) for possible launching of foreign instrumentation or payload packages.

The NASA Fellowship Program, recently announced under contract with the National Academy of Sciences, will give financial support to foreign as well as American scientists, and furnish them an opportunity to participate in NASA's scientific programs.

Regional Cooperation

NASA is active in NATO on two fronts—supporting discussions of space in the NATO Science Committee and discussing both aeronautical and space problems in the NATO Advisory Committee on Aeronautics (AGARD).

Bilateral Agreements

Negotiations are underway for bilateral agreements to formalize arrangements with some of the countries that have cooperated with this country in setting up radio "Minitrack" facilities.

NASA—Its Organization and Functions

NASA FOUNDED ON GOING RESEARCH ORGANIZATION AND PROGRAMS

NACA AS NUCLEUS.—As detailed earlier, it was not necessary to organize the new National Aeronautics and Space Administration from scratch. Under the Act, NASA absorbed the well-developed research organization of NACA. In addition, section 302(a) of the Act provided for transfer to NASA of other related functions in these terms:

> Subject to the provisions of this section, the President, for a period of 4 years after the date of enactment of this Act, may transfer to the Administration any functions (including powers, duties, activities, facilities, and parts of functions) of any other department or agency of the United States, or of any officer or organizational entity thereof, which relate primarily to the functions, powers, and duties of the Administration as prescribed by section 203 of this Act. In connection with any such transfer, the President, may, under this section or other applicable authority, provide for appropriate transfer of records, property, civilian personnel, and funds.

OTHER PROGRAMS AND FACILITIES SHIFTED TO NASA

SATELLITES, PROBES, ROCKET ENGINES.—On October 1, 1958, NASA's first day of business, the President issued Executive Order No. 10783, which transferred to it several Department of Defense projects whose paramount objectives were of a non-military nature. First was Project Vanguard, the scientific satellite program that had been carried out under Navy Department direction. The order also transferred from ARPA responsibility for space projects such as lunar probes and scientific satellites, and from the Air Force certain space-related projects, principally in the field of "super-thrust" propulsion systems which are primarily applicable to future space vehicles.

JET PROPULSION LABORATORY FROM ARMY TO NASA.—By Executive Order No. 10793, on December 3, 1958, the President transferred the functions and facilities of the Jet Propulsion Laboratory, Pasadena, Calif., from the Department of the Army to NASA. (Text of Executive Order is in Appendix H.) Although the laboratory is a part of the California Institute of Technology, the property occupied and utilized in Pasadena is Government-owned. In signing the order, the President stated:

> "This decision is necessary in the national interest. It prevents unnecessary duplication and effects economies in space research and development. This development will enhance close cooperation between the National Aeronautics and Space Administration and the Department of Defense to the end that the peaceful use of space will redound to the benefit of all mankind."

NASA-ARMY AGREEMENT ON ABMA.—Also on December 3, it was announced that NASA and the Department of the Army had reached an agreement under which the Army Ballistic Missiles Agency, (ABMA), Huntsville, Ala., and its subordinate organizations, would be continuously responsive to NASA requirements. (Text of agreement is in Appendix I.)

The Commanding General, Army Ordinance Missile Command, is responsible for scheduling the space and missile activities under his control to meet priority requirements of NASA "in a manner consistent with overall national priorities." Under this agreement, NASA has placed a small technical staff at ABMA to direct assigned NASA projects.

With these transfers, plus the extensive research facilities of the NACA, the NASA field and laboratory complex had attained capacity for a major portion of its mission.

ORGANIZATIONAL STRUCTURE

THREE MAIN AREAS OF ACTIVITY.—The organizational structure of NASA (Fig. 1) provides for three main areas of activity: (1) Space Flight Development; (2) Aeronautical and Space Research; and (3) Business Administration.

When Directors of the Offices responsible for these activities were named, October 5, 1958, Administrator Glennan defined the areas as follows:

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

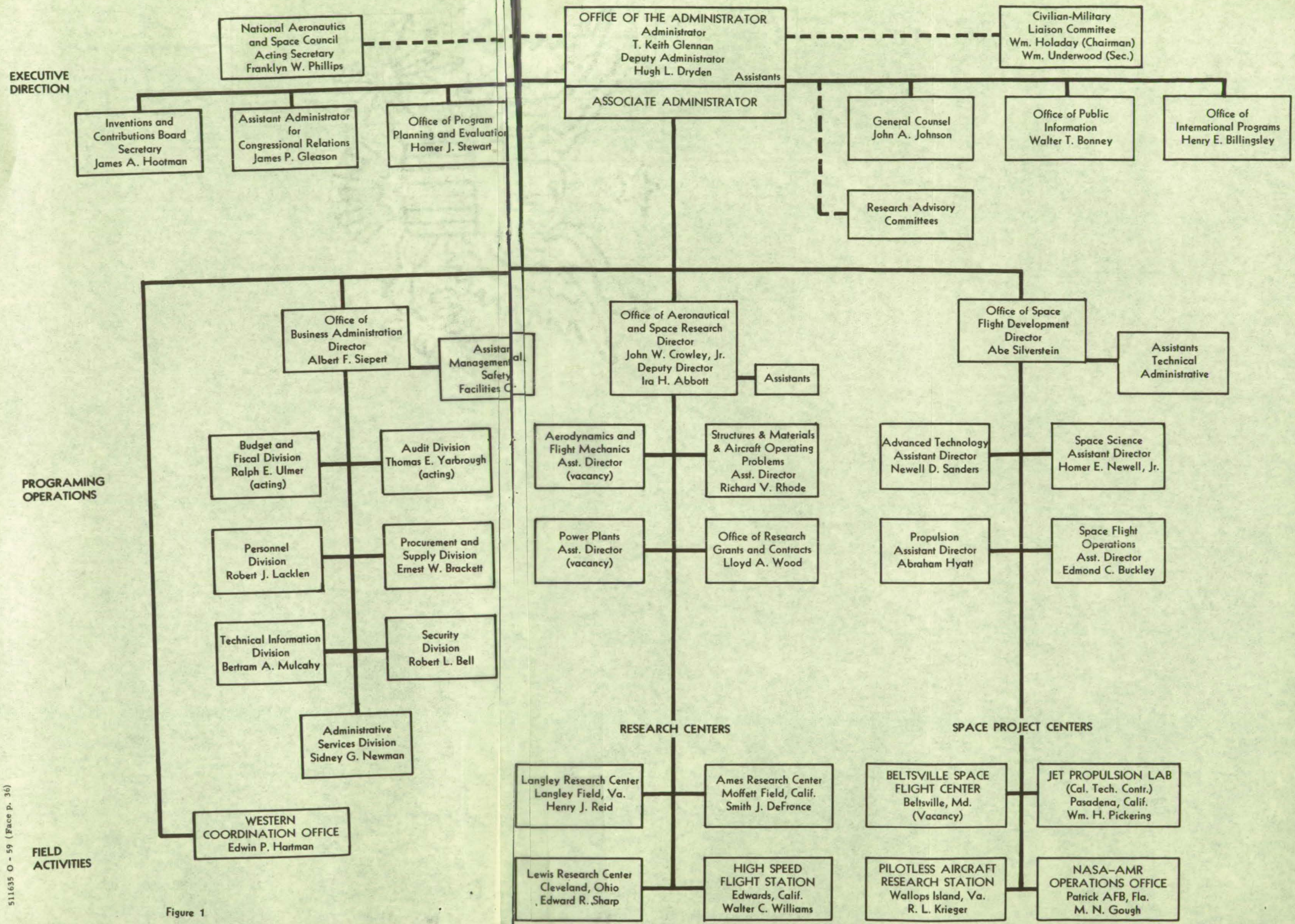

Figure 1

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"In the first category, NASA will be concerned with the entire spectrum of space flight operations including the design and procurement of vehicles and satellite payloads, the launching and monitoring of scientific satellites, the accumulation and reduction of data, and activities supporting the objective of launching man into space.

"In the second category, the long-established and highly regarded laboratories acquired from the NACA will continue their programs of basic and applied research in support of aeronautics and space science and technology. Additional effort in this area of activity will be supported in the laboratories of industry and educational and non-profit institutions.

"The third category, business administration, includes the business functions of any well-run organization, such as the development of fiscal and budgetary policies, of contracting policies and their implementation, of policies relating to personnel administration, plant operation, and security, and the provision of administrative policy guidance for the decentralized operation of NASA's research centers and field stations."

Reporting to the Administrator are the Directors of each of these areas: Abe Silverstein, Director of Space Flight Development; John W. Crowley, Jr., Director of Aeronautical and Space Research; and Albert F. Siepert, Director of Business Administration.

OFFICE OF SPACE FLIGHT DEVELOPMENT.—Silverstein, whose responsibilities include all Space Flight operations and direction of the Wallops Island rocket launching station, is assisted by Homer E. Newell, Jr., Assistant Director for Space Sciences; Abraham Hyatt, Assistant Director for Propulsion; Newell D. Sanders, Assistant Director for Advanced Technology; and Edmond C. Buckley, Assistant Director for Space Flight Operations.

OFFICE OF AERONAUTICS AND SPACE RESEARCH.—In Aeronautics and Space Research, Crowley is assisted by Ira H. Abbott, Deputy Director, and Richard V. Rhode, Assistant Director for Materials, Structures, Loads and Aircraft Operating Problems. The positions of Assistant Director for Aerodynamics and Space Mechanics and Assistant Director for Power Plants were vacant as this report period closed, March 31, 1959. Research is conducted at NASA's field installations as well as through contractual support by industrial and educational research organizations.

PERSONNEL

EXPANSION INTO 1960.—NASA has expanded rapidly since October 1. As of March 31, 1959, the agency had 8,685 * employees, an increase of 719 over October 1. Through July 1960, NASA is scheduled to grow to a planned total of 9,988. An additional 2,450 employees of JPL are under contract to NASA by the California Institute of Technology.

ALIEN SCIENTISTS.—NASA's charter permits the hiring of alien scientists. The Civil Service Commission has set the limit at 50 persons, 27 of whom are now on the payroll.

NASA RELATIONS WITH OTHER GOVERNMENT ORGANIZATIONS

DRAWS ON EXPERIENCE AND SKILLS OF CIVILIAN AGENCIES.—Earlier in this report, NASA dealings with various branches of the Department of Defense were outlined. In addition, research and development in support of aeronautics and space investigations require programs of close cooperation and coordination with other Federal agencies. Chief among these are the Atomic Energy Commission (nuclear energy programs are reported in a later section), the National Science Foundation; the U.S. Weather Bureau, the U.S. Coast Guard and Geodetic Survey, and the National Bureau of Standards of the Department of Commerce; and the Astrophysical Observatory of the Smithsonian Institution.

The National Academy of Sciences, with support from the NSF, directed the U.S. part of the International Geophysical Year program. Among contributions by other agencies to NASA work during the past six months were projects ranging from basic research in analyzing meteorological conditions and electromagnetic and gravity fields, to aid in designing and testing many of the thousands of components needed for satellites and space probes. In addition, some of

* Approximate breakdown of the 8,685 NASA employees as of March 31, 1959, is as follows: (1) research scientists, 26 percent; (2) support personnel, including engineers and mathematicians, 7.5 percent; (3) technicians, 9.5 percent; (4) professional, administrative and clerical, 14 percent; (5) unskilled, semiskilled and skilled craftsmen, 43 percent.

Breakdown by installation: (1) Washington, D.C. Headquarters, 354; (2) Beltsville, Md., Space Center, including 14-man field station at Atlantic Missile Range, Cape Canaveral, Fla., 296; (3) Langley Research Center, including 97-man staff at Wallops Station, Va., 3,587; (4) Lewis Research Center, 2,711; (5) Ames Research Center, 1,434; (6) High-Speed Flight Station, Calif., including a seven-man liaison office in Los Angeles, 303.

these agencies were active in work supporting ground-based facilities for launching, tracking, and telemetering.

National Science Foundation Support.—Important among arrangements for strengthening the space program is that between NSF and NASA. Under law and Executive orders, the Foundation is responsible for the support through grants of general purpose basic research, while other agencies undertake basic research related to their missions. In the past, the Foundation has awarded grants, based on proposals from research scientists, for projects which involve fundamental studies leading to new discoveries in aeronautics and space science. Under the stimulus of Federal support for space exploration and research, a larger number of proposals in these fields will be received by the Foundation. It is anticipated that the Foundation will be able to support an increasing number of such proposals in the future through research grants, chiefly to university scientists and engineers.

At the same time, NASA is supporting basic research more directly related to its own program. NASA is responsible also for scheduling rocket and satellite flights and packaging, recovery, and data receptions, working directly with the scientists and organizations concerned.

National Academy of Sciences Space Science Board.—In cooperation with NASA, NSF has undertaken support of the Space Science Board of the National Academy of Sciences Research Council. The Board, consisting of 16 leaders in scientific fields related to space, will advise NASA and NSF on a vigorous and balanced program in space science, will assist in establishing working relationships with civilian science and with scientific activities in other Federal agencies. It will provide a channel for scientific cooperation in international space research activities, and will assist in the consideration of immediate and long-range effects of activities in space science.

NASA RESEARCH CENTER AND FIELD STATIONS

Langley Research Center (H. J. E. Reid, *Director*)

Langley Research Center, Langley Field (near Newport News, Va.) is the oldest and largest NASA field establishment. From its modest beginning in 1917, it has grown to a complex 710-acre plant with a staff of 3,490. There are 30 major wind tunnels, numerous specialized laboratories and test centers, and a dozen large shops for model building and support work. A Structures Research Laboratory specializes in study of structures of metal and other materials used in the design of airplanes, missiles, and spacecraft. Langley's hydrodynamic research includes model investigations of the design characteristics of high-speed seaplanes, missiles launched from submerged submarines, and space vehicles landing in water.

A major part of Langley's effort is in basic research, with emphasis increasing on space problems. The Space Task Group for Project Mercury is housed at Langley, although it is not administratively a part of the Center. Many of Langley's research facilities are being used for this project. Work is also being done here on rocket-glider flight, inflatable satellites, atmosphere reentry problems, and other space undertakings.

In Langley's Flight Research Division, test pilots fly conventional vehicles, modified and instrumented to supply space-flight (simulated) information that will be used to improve safety and performance of future space vehicles.

Langley continues to do aeronautical research. Problems of aerodynamic heating, as they affect high-speed aircraft, as well as missiles and rockets, are under study. In addition, studies and work on VTOL (vertical takeoff and landing) and STOL (short takeoff and landing) aircraft are in progress.

Pilotless Aircraft Research Station, Wallops Island, Va. (Robert L. Krieger, *Engineer-in-Charge*)

Operating under the jurisdiction of the Langley Research Center, the Pilotless Aircraft Research Station at Wallops Island, Va., was established 13 years ago to obtain aerodynamic data at transonic and low supersonic speeds; the facility is now being used almost exclusively on hypersonic and space flight problems. At present, the staff numbers 97; some increase in personnel (to some 250 employees) and facilities is planned. Since future work will be heavily in the area of Space Flight Development, a decision has been made to operate the expanded facility under the direct cognizance of the Headquarters Office of Space Flight Development instead of that of the Langley Center. Facilitating the planned expansion, and permitting a large saving in costs, is the Navy Department's decision to disestablish the 2,400-acre Naval Air Station at Chincoteague, Va., by June 30, 1959. By agreement reached between the Secretary of the Navy and the NASA administration on January 24, 1959, Chincoteague is being made available to NASA for use in its space research program. Technical and scientific facilities of the air station, four miles from Wallops Island, will be operated as part of the same complex, with Wallops as the launching site, and Chincoteague as the telemetering and test check-out center.

Lewis Research Center (Edward R. Sharp, *Director*)

Lewis Research Center—NASA-owned and operated—near the municipal airport at Cleveland, Ohio, was established in 1941 by NASA's predecessor as the NACA Lewis Flight Propulsion Laboratory. Its 2,711-man staff specializes in studies of propulsion for space and aeronautics applications. Major facilities at the Center include: Engine Research Building, Rocket Laboratory, Materials and Stresses Laboratory, two Supersonic Wind Tunnels, Altitude Wind Tunnel, and Propulsion Systems Laboratory.

Lewis also operates at Sandusky, Ohio, the Plum Brook Research Facility, a 60-megawatt (thermal) reactor now nearing completion of construction, and a Rocket Research Facility at the same location for studying components and systems.

Emphasis at Lewis has been rapidly shifting from research primarily on air-breathing power plants, to rockets—chemical, liquid propellant, nuclear, and electrical. However, work is still in progress on turbojet and ramjet power plants for missiles and aircraft. Research now in progress at Lewis include: propulsion chemistry, aerodynamics, materials, solid-state physics, controls, magneto hydrodynamics, and fluid dynamics. The Lewis Space Task Group is working on instrumentation and controls for the Project Mercury capsule. This group is temporarily detailed to Lewis until the Beltsville Space Center is completed.

Ames Research Center (Smith J. DeFrance, *Director*)

NASA's Ames Research Center, Moffett Field, Calif.—originally established in 1940 by NACA as a second center of aeronautical research—has, since 1948, been doing space research as well. At present, nearly 50 percent of Ames' research and development work is applicable to this area. More than one-third of the 1,434-man staff are scientists and engineers. The extensive research facilities include: 19 major wind tunnels (one, the world's largest—40 x 80 ft., full-scale); a Hypervelocity Ballistic Range in which test models are propelled by helium gas from a "gun" 200 feet long; an Atmosphere Entry Simulator; a 25-foot Shock Tube; and an Ion Accelerator. Also important in experimental work is a fleet of more than 10 military fighter aircraft, specially instrumented for research.

In support of Project Mercury, wind tunnel and piloting studies and electronic simulator experiments are in progress. Wind tunnel tests are being made on various types of craft, including Dyna-Soar and various hypersonic (Mach 5 and above) configurations. Other research is directed toward new methods of increasing aerodynamic efficiency.

High Speed Flight Station (Walter C. Williams, *Chief*)

NASA's High Speed Flight Station, Edwards Air Force Base, Calif., 100 miles north of Los Angeles in the Mojave Desert, carries out research into problems of flight, primarily those concerned with piloted high-speed aircraft of most advanced types, at extreme speeds and altitudes. Organized in 1947, the staff has grown from 13 scientists and technicians to its present size of 300 professional, technical, and supporting personnel.

Currently the major effort is being devoted to flight research with the X–15 manned research vehicle. Other specialized research projects conducted there have included flight testing of reaction controls utilizing tip rockets installed on the X–1B research airplane to study the problems of control during reentry into the atmosphere.

Research planes tested at this station have provided data and experience for spacecraft and atmospheric craft design. Swept, delta, and variable wing configurations all were test flown here.

Jet Propulsion Laboratory (William H. Pickering, *Director*)

The Jet Propulsion Laboratory—A Government-owned facility operated by the California Institute of Technology, near Pasadena, Calif., under contract to NASA, was transferred from Army to NASA jurisdiction on December 3, 1958. JPL has been active in various rocket developments under Army Ordnance contracts, and in the space vehicle field, had built, designed, and tested upper stages, payloads, and tracking systems for the Explorer satellite series.

The JPL Pasadena installation includes two supersonic wind tunnels (a third for hypersonic testing is being constructed), as well as individual laboratory and associated facilities for fundamental research. Combined laboratory and test facilities permit applying basic research data to controlled tests. Cells for propellant testing and evaluation facilitate recording and test data reduction.

The Laboratory has facilities at four other locations: a static-testing area for large rocket motors at Edwards AFB; a field-testing operational unit for missile flight tests at Army's White Sands Proving Ground, N. Mex.; other testing facilities at the Atlantic Missile Range, Cape Canaveral, Fla., and the Goldstone Tracking Facility, Camp Irwin, Calif.

On December 6, 1958, JPL personnel took part in launching Pioneer III, the upper stages and payload of which JPL had designed and developed. During this space probe firing and the one in March 1959, JPL operated the principal ground tracking station at Goldstone and the secondary station at Mayaguez, Puerto Rico.

Most JPL research and engineering development is in the fields of:

liquid (including storable) and solid propellants; guidance and control systems; communications; aerodynamics; materials and structures; chemistry; physics; heat transfer and cooling; fluid mechanics; instrument development and instrumentation; combustion; and vehicle development and testing.

As an agent for NASA, JPL will have technical supervision of the construction of deep-space tracking stations in Australia and The Union of South Africa; technical supervision of the Vega space vehicle program; and studies of overall requirements for deep space exploration.

Beltsville Space Flight Center (Directorship vacant)

Work is scheduled to begin soon on construction of a space research facility (authorized by Congress) near Beltsville, Md. NASA has been assigned some 553 acres of land from the Department of Agriculture reservation east of Beltsville, where a central flight control operations building, a space science laboratory, a tracking and telemetering data reduction center, and related facilities are to be constructed. Tentative schedules call for completing the first offices for occupancy in the early Spring of 1960. The new center is designed to accommodate more than 500 employees, of whom some 200 will be personnel now at the Naval Research Laboratory, Anacostia, D.C. Many NRL transferees were assigned to the Vanguard project turned over to NASA by the Navy.

The new laboratory will:

1. Conduct advanced planning and theoretical studies leading to the development of payloads for scientific and manned space flights.
2. Conduct necessary supporting research in scientific payloads, applications systems, instrumentation, communications, guidance, and vehicles.
3. Develop payloads for approved scientific programs, applications programs, and manned space flights.
4. Develop, subject to specific approval in each case, vehicles to launch payloads.
5. Supervise Space Center flight operations.

In addition, the laboratory will:

1. Supervise tracking, data acquisition, communications and computing operations to provide orbital and reduced flight data from satellites and space vehicles for NASA space flight programs.
2. Interpret results of flight programs for which the Center is responsible.
3. Furnish technical and procurement management of selected projects, including monitoring of contractors.

Other Activities

INFORMATION

Dissemination Policy

The legislation creating NASA stipulates that the Administration "shall provide for the widest practicable and appropriate dissemination of information concerning its activities." This provision is the core of NASA's policy for both technical and public information.

Technical Information

TECHNICAL PUBLICATIONS; JOURNAL ARTICLES.—NASA is following the established practices of its predecessor, NACA, in disseminating technical information arising from its scientific investigations. These practices are in accord with the information provisions of the Act.

NASA publications include: (a) NASA technical memoranda (about 675 each year); (b) papers for scientific journals (about 75 each year); (c) oral presentations made before scientific organizations such as the American Rocket Society, the American Helicopter Society, the Institute of the Aeronautical Sciences, etc.; (d) papers from conferences held by NASA each year (two or three such conferences are held, each attended by about 500 persons; the papers at these conferences are presented orally by NASA personnel and are compiled and published in documents containing about 25 technical presentations each); (e) technical reports of projects in process and completed experiments (about 75 a month); (f) translations of foreign technical documents (between 60 and 75 per year).

RESEARCH CENTERS HOLD INSPECTIONS AND BRIEFINGS.—Each year an inspection is conducted at one of the Research Centers to brief the scientific and industrial community on the current status of certain unclassified projects. Such inspections often involve 4 days of technical presentations and are attended by about 500 persons a day. Over and above the inspections, several thousand scientists and engineers visit the Research Centers each year, NASA encourages these informal meetings to resolve detailed questions of a technical nature.

"Publications Announcements" Abstracts NASA Technical Reports.—At intervals of 2 to 4 weeks, NASA issues "*Publications Announcements*," in which are abstracted all NASA reports released since the last issue. Copies of these announcements are sent to some 4,800 addressees in industry, universities, military and other Government agencies, and 28 libraries abroad (operated by foreign governments, universities and other organizations) receive reports relevant to their work. In addition, copies of the reports are automatically distributed to university and public libraries and other addressees with sustained interest in the technical fields where NASA is active.

Needs for NASA Technical Information Being Reassessed.—Because NASA's activities are expanding, the needs for NASA technical information are being redetermined. Within the next few weeks, each of the addressees on NASA's reports mailing lists will be asked to complete a questionnaire defining his specific requirements. New mailing lists will be developed covering 53 fields. Inquiries should be addressed to:

TECHNICAL INFORMATION DIVISION (CODE BID)
National Aeronautics and Space Administration
WASHINGTON 25, D.C.

Public Information

Details of Seven Launchings Furnished.—During the formative months, NASA was concerned not only with developing a public information policy for the agency as a whole, but also with information aspects of specific space experiments. Plans to facilitate press access to information were prepared for each of the seven satellite and space probe experiments carried out by NASA between October 1, 1958, and March 31, 1959.

Arrangements were made for press coverage of rocket launchings from the Atlantic Missile Range and subsequent release of information about the results of the experiments—i.e., details of orbits and trajectories, description of the data collected by the instrumentation in the scientific payloads, and other information.

Round-the-Clock Service for Press.—NASA maintained a round-the-clock press center in Washington Headquarters during each space experiment. The center was linked by telephone and teletype to the Atlantic Missile Range at Cape Canaveral, as well as to the Jet Propulsion Laboratory in Pasadena, to the Space Technology Laboratories in Los Angeles, and to the Army Ballistic Missiles Agency in Huntsville, Ala., depending upon the executive agent for the individual experiment. Provisions were made to enable the press to cover the launchings at AMR and for press conferences and briefings to be held in Washington Headquarters where top officials and scientists of the space program were available to answer reporters' questions.

NASA also prepares annual, semiannual, quarterly and other special reports to the President or to Congress, and provides services to radio, television, magazines, and publishing houses as requested.

PROCUREMENT

NASA Utilizes the Armed Services Procurement Act

In accomplishing its mission, NASA contracts, wherever practicable, for the skills of industry, research organizations, and educational institutions. Contracts are made in accordance with provisions of Title 10, Chapter 137, of the United States Code, as amended by Public Law 85–568. Contracting policies and procedures formulated by NASA Headquarters are, for the most part, consistent with those of the Armed Services Procurement Regulations. Wherever possible, there is formal advertising for competitive fixed-price bids. When required work is of a research and development nature and cannot be clearly defined in specifications and/or drawings, contracts are negotiated with qualified firms, usually on a cost-plus-fixed-fee basis.

Small Business Participation

Care is taken to see that small firms have opportunities to supply NASA procurement needs, to the fullest extent possible consistent with the purposes of the National Aeronautics and Space Act.

Technical Direction and Supervision by NASA

NASA normally provides its own technical direction (including project office supervision) for all prime contracts, except for standard hardware more easily obtained by extending military contracts.

Contract Negotiation

For the most part, NASA employs its own staff for contract negotiation and administration. Prime contracts are negotiated directly with the contractor. In contract administration, NASA seeks to use the on-the-site services of DOD and other Government agencies, wherever this appears to be the most efficient and economical method.

PATENTS

Procedures and Regulations

During the period of this report, NASA's work in the patent field was directed primarily toward establishing procedures and regulations which are being published in the *Federal Register.*

Acquisition of Rights in Inventions

Section 305(a) of the National Aeronautics and Space Act of 1958 provides that inventions made in performance of work under NASA contracts and under the specific conditions described in that section, shall be the exclusive property of the United States unless the Administrator waives the rights of the United States to the invention. Section 305(b) of the Act provides that NASA contracts must require contractors to furnish the Administrator written reports containing complete technical information on any invention, discovery, improvement, or innovation made in performing work under the contract.

Property Rights Clause Circulated

The first task in carrying out NASA's responsibilities was that of drafting a "Property Rights in Inventions" clause fulfilling the requirements of section 305(b) of the Act for use in NASA contracts. This clause was widely circulated to industry and the patent bar for comments and suggestions. Other Government agencies entering into contracts on NASA's behalf were advised that the NASA "Property Rights in Inventions" clause must be included in such contracts.

Waiver of U.S. Rights in Inventions

The Government's rights to inventions may be waived by the Administrator under terms and conditions that he determines are required to protect the interests of the United States. Each waiver is subject to the reservation of an irrevocable, nonexclusive, nontransferable, royalty-free license for use of the invention throughout the world by or on the behalf of the United States or any foreign government pursuant to treaty or agreement with the United States.

Hearings Scheduled on Waiver Regulations

Interim regulations dealing with the subject of waiver of patent rights were published in the *Federal Register* on March 5, 1959, and notification was given then that hearings on these interim regulations would be held on May 18, 1959.

NASA Review of Patent Applications

Section 305(c) of the Act provides that no patent may be issued to any applicant other than the Administrator for any invention that the Commissioner of Patents deems to have "significant utility in the conduct of aeronautical and space activities" unless the applicant files with the Commissioner within a specified time a sworn statement setting forth the full circumstances under which the invention was made and stating the relationship of the invention to work done under any contract of NASA. The Commissioner of Patents is required to transmit to NASA copies of such statements and the patent applications to which they relate. If the invention is patentable, the Commissioner may issue a patent to the applicant unless the Administrator of NASA, within 90 days after receiving the application and statement, requests that the patent be issued to him on behalf of the United States.

No Patent Requests by NASA to Date

In the period ending March 31, 1959, 125 patent applications were transmitted by the Commissioner of Patents to NASA for review. In no case did the Administrator request that the patent be issued to him on behalf of the United States. Of the cases transmitted, more than 35 percent are licensed to the Government and cover inventions made under research contracts sponsored by the Department of Defense. Discussions have been held with Patent Office officials in an effort to reduce the number of applications for patents transmitted to NASA for review.

CONTRACTS

Major Contracts

Since NASA came into existence, several large research and development contracts have been awarded to industry. Largest was the contract with Rocketdyne Division of North American Aviation for a single-chamber rocket engine designed to produce a thrust of 1.5 million pounds. The contract has an estimated cost of approximately $100 million. Work on the 1.5-million-pound-thrust rocket engine was begun on January 10, 1959, less than 3 months after proposals were invited.

Another contract went to McDonnell Aircraft Corp., for development of the manned Project Mercury capsule. Estimated cost will be approximately $18 million, with 12 capsules to be delivered during the next 14 months.

Contracts with Other Government Agencies

Research and development contracts are not confined to those made directly between industry and NASA. The Administration has broad authority under the Act to use, with their consent, the services and facilities of other Federal agencies, with or without reimbursement; other Federal agencies are enjoined by the statute to make their services, equipment, personnel, and facilities available to NASA. Consequently, NASA has placed a number of orders with military agencies for research and development equipment—items for which these agencies, because of their own programs, can most conveniently contract from industry.

Contracts with Private Research Organizations

The Office of Research Grants and Contracts initiated 50 grants and contracts totaling $2,985,000 between October 1, 1958 and March 31, 1959. The grants and contracts—going to universities, non-profit research institutions, and a few industrial concerns, in 16 States—cover space-related physical, cosmological, and life sciences.

Principal NASA Contracts, October 1, 1958–March 31, 1959 are listed in Appendix J.

Table 2. Financial Statement

As of March 31, 1959

FISCAL YEAR 1959 APPROPRIATIONS AND TRANSFERS

	Salaries and expenses	*Research and development*	*Construction and equipment*
Appropriations to National Advisory Committee for Aeronautics: Independent Offices Appropriation Act. 1959; Public Laws 85–844	$78,100,000		$23,000,000
Appropriations to National Aeronautics and Space Administration: Supplemental Appropriation Act, 1959; Public Laws 85–766	5,000,000	$50,000,000	25,000,000
Transfers from the Department of Defense (72 Stat. 433)		154,619,532	
Total appropriations and transfers	83,100,000	204,619,532	48,000,000

STATUS OF FISCAL YEAR 1959 FUNDS AS OF MARCH 31, 1959

	Allotments	*Obligations*	*Expenditures*
Salaries and expenses	[1] $86,454,000	$63,996,368	$53,596,222
Research and development:			
Aircraft, missile, and spacecraft research	$11,745,300	$8,599,615	$1,873,364
Scientific investigations in space	79,305,032	60,197,110	6,144,424
Satellite applications investigation	5,960,000	2,843,500	24,352
Space operations technology	37,661,200	30,673,601	667,842
Space propulsion technology	23,000,000	16,286,570	1,048,100
Space systems technology	1,000,000		
Supporting activities	3,300,000	1,608,895	638,758
Vehicle development	42,648,000	11,081,356	13,916
Total research and development	[2] 204,619,532	131,290,647	10,410,756
Construction and equipment	[3] 48,000,000	5,662,497	951,836

[1] Includes $3,354,000 for fiscal year 1959 costs of the Federal Employees' Salary Increase Act of 1958 presently under consideration by the Congress (H.R. 5916).

[2] Request for additional appropriation of $20,750,000 presently under consideration by the Congress.

[3] Request for additional appropriation of $24,250,000 presently under consideration by the Congress.

Public Law 85-568
85th Congress, H. R. 12575
July 29, 1958

AN ACT

To provide for research into problems of flight within and outside the earth's atmosphere, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, National Aeronautics and Space Act of 1958.

TITLE I—SHORT TITLE, DECLARATION OF POLICY, AND DEFINITIONS

SHORT TITLE

SEC. 101. This Act may be cited as the "National Aeronautics and Space Act of 1958".

DECLARATION OF POLICY AND PURPOSE

SEC. 102. (a) The Congress hereby declares that it is the policy of the United States that activities in space should be devoted to peaceful purposes for the benefit of all mankind.

(b) The Congress declares that the general welfare and security of the United States require that adequate provision be made for aeronautical and space activities. The Congress further declares that such activities shall be the responsibility of, and shall be directed by, a civilian agency exercising control over aeronautical and space activities sponsored by the United States, except that activities peculiar to or primarily associated with the development of weapons systems, military operations, or the defense of the United States (including the research and development necessary to make effective provision for the defense of the United States) shall be the responsibility of, and shall be directed by, the Department of Defense; and that determination as to which such agency has responsibility for and direction of any such activity shall be made by the President in conformity with section 201 (e). 72 Stat. 426.

(c) The aeronautical and space activities of the United States shall be conducted so as to contribute materially to one or more of the following objectives: 72 Stat. 427.

(1) The expansion of human knowledge of phenomena in the atmosphere and space;

(2) The improvement of the usefulness, performance, speed, safety, and efficiency of aeronautical and space vehicles;

(3) The development and operation of vehicles capable of carrying instruments, equipment, supplies, and living organisms through space;

(4) The establishment of long-range studies of the potential benefits to be gained from, the opportunities for, and the problems involved in the utilization of aeronautical and space activities for peaceful and scientific purposes;

(5) The preservation of the role of the United States as a leader in aeronautical and space science and technology and in the application thereof to the conduct of peaceful activities within and outside the atmosphere;

(6) The making available to agencies directly concerned with national defense of discoveries that have military value or significance, and the furnishing by such agencies, to the civilian agency established to direct and control nonmilitary aeronautical and space activities, of information as to discoveries which have value or significance to that agency;

(7) Cooperation by the United States with other nations and groups of nations in work done pursuant to this Act and in the peaceful application of the results thereof; and

(8) The most effective utilization of the scientific and engineering resources of the United States, with close cooperation among all interested agencies of the United States in order to avoid unnecessary duplication of effort, facilities, and equipment.

(d) It is the purpose of this Act to carry out and effectuate the policies declared in subsections (a), (b), and (c).

DEFINITIONS

SEC. 103. As used in this Act—

(1) the term "aeronautical and space activities" means (A) research into, and the solution of, problems of flight within and outside the earth's atmosphere, (B) the development, construction, testing, and operation for research purposes of aeronautical and space vehicles, and (C) such other activities as may be required for the exploration of space; and

(2) the term "aeronautical and space vehicles" means aircraft, missiles, satellites, and other space vehicles, manned and unmanned, together with related equipment, devices, components, and parts.

TITLE II—COORDINATION OF AERONAUTICAL AND SPACE ACTIVITIES

NATIONAL AERONAUTICS AND SPACE COUNCIL

Establishment. SEC. 201. (a) There is hereby established the National Aeronautics and Space Council (hereinafter called the "Council") which shall be composed of—

(1) the President (who shall preside over meetings of the Council);

72 Stat. 427.

72 Stat. 428.

(2) the Secretary of State;

(3) the Secretary of Defense;

(4) the Administrator of the National Aeronautics and Space Administration;

(5) the Chairman of the Atomic Energy Commission;

(6) not more than one additional member appointed by the President from the departments and agencies of the Federal Government; and

(7) not more than three other members appointed by the President, solely on the basis of established records of distinguished achievement, from among individuals in private life who are eminent in science, engineering, technology, education, administration, or public affairs.

Alternate. (b) Each member of the Council from a department or agency of the Federal Government may designate another officer of his department or agency to serve on the Council as his alternate in his unavoidable absence.

(c) Each member of the Council appointed or designated under paragraphs (6) and (7) of subsection (a), and each alternate member designated under subsection (b), shall be appointed or designated to serve as such by and with the advice and consent of the Senate, unless at the time of such appointment or designation he holds an office in the Federal Government to which he was appointed by and with the advice and consent of the Senate.

(d) It shall be the function of the Council to advise the President with respect to the performance of the duties prescribed in subsection (e) of this section.

(e) In conformity with the provisions of section 102 of this Act, it shall be the duty of the President to— Duties of President.

(1) survey all significant aeronautical and space activities, including the policies, plans, programs, and accomplishments of all agencies of the United States engaged in such activities;

(2) develop a comprehensive program of aeronautical and space activities to be conducted by agencies of the United States;

(3) designate and fix responsibility for the direction of major aeronautical and space activities;

(4) provide for effective cooperation between the National Aeronautics and Space Administration and the Department of Defense in all such activities, and specify which of such activities may be carried on concurrently by both such agencies notwithstanding the assignment of primary responsibility therefor to one or the other of such agencies; and

(5) resolve differences arising among departments and agencies of the United States with respect to aeronautical and space activities under this Act, including differences as to whether a particular project is an aeronautical and space activity.

(f) The Council may employ a staff to be headed by a civilian executive secretary who shall be appointed by the President by and with the advice and consent of the Senate and shall receive compensation at the rate of $20,000 a year. The executive secretary, subject to the direction of the Council, is authorized to appoint and fix the compensation of such personnel, including not more than three persons who may be appointed without regard to the civil service laws or the Classification Act of 1949 and compensated at the rate of not more than $19,000 a year, as may be necessary to perform such duties as may be prescribed by the Council in connection with the performance of its functions. Each appointment under this subsection shall be subject to the same security requirements as those established for personnel of the National Aeronautics and Space Administration appointed under section 203 (b) (2) of this Act. Employees. Compensation. 63 Stat. 954. 5 USC 1071 note. Security check.

(g) Members of the Council appointed from private life under subsection (a) (7) may be compensated at a rate not to exceed $100 per diem, and may be paid travel expenses and per diem in lieu of subsistence in accordance with the provisions of section 5 of the Administrative Expenses Act of 1946 (5 U.S. C. 73b–2) relating to persons serving without compensation. Per diem. ~~72 Stat. 428.~~ 72 Stat. 429. 69 Stat. 394.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

SEC. 202. (a) There is hereby established the National Aeronautics and Space Administration (hereinafter called the "Administration"). The Administration shall be headed by an Administrator, who shall be appointed from civilian life by the President by and with the advice and consent of the Senate, and shall receive compensation at the rate of $22,500 per annum. Under the supervision and direction of the President, the Administrator shall be responsible for the exercise of all powers and the discharge of all duties of the Administration, and shall have authority and control over all personnel and activities thereof. Administrator.

(b) There shall be in the Administration a Deputy Administrator, who shall be appointed from civilian life by the President by and with the advice and consent of the Senate, shall receive compensation at the rate of $21,500 per annum, and shall perform such duties and exercise Deputy Administrator.

such powers as the Administrator may prescribe. The Deputy Administrator shall act for, and exercise the powers of, the Administrator during his absence or disability.

Restriction. (c) The Administrator and the Deputy Administrator shall not engage in any other business, vocation, or employment while serving as such.

FUNCTIONS OF THE ADMINISTRATION

SEC. 203. (a) The Administration, in order to carry out the purpose of this Act, shall—

(1) plan, direct, and conduct aeronautical and space activities;

(2) arrange for participation by the scientific community in planning scientific measurements and observations to be made through use of aeronautical and space vehicles, and conduct or arrange for the conduct of such measurements and observations; and

(3) provide for the widest practicable and appropriate dissemination of information concerning its activities and the results thereof.

(b) In the performance of its functions the Administration is authorized—

Rules and regulations. (1) to make, promulgate, issue, rescind, and amend rules and regulations governing the manner of its operations and the exercise of the powers vested in it by law;

Employees. (2) to appoint and fix the compensation of such officers and employees as may be necessary to carry out such functions. Such officers and employees shall be appointed in accordance with the civil-service laws and their compensation fixed in accordance with the Classification Act of 1949, except that (A) to the extent the Administrator deems such action necessary to the discharge of his responsibilities, he may appoint and fix the compensation (up to a limit of $19,000 a year, or up to a limit of $21,000 a year for a maximum of ten positions) of not more than two hundred and sixty of the scientific, engineering, and administrative personnel of the Administration without regard to such laws, and (B) to the extent the Administrator deems such action necessary to recruit specially qualified scientific and engineering talent, he may establish the entrance grade for scientific and engineering personnel without previous service in the Federal Government at a level up to two grades higher than the grade provided for such personnel under the General Schedule established by the Classification Act of 1949, and fix their compensation accordingly;

63 Stat. 954.
5 USC 1071 note.
72 Stat. 429.
72 Stat. 430.

Acquisition of property. (3) to acquire (by purchase, lease, condemnation, or otherwise), construct, improve, repair, operate, and maintain laboratories, research and testing sites and facilities, aeronautical and space vehicles, quarters and related accommodations for employees and dependents of employees of the Administration, and such other real and personal property (including patents), or any interest therein, as the Administration deems necessary within and outside the continental United States; to lease to others such real and personal property; to sell and otherwise dispose of real and personal property (including patents and rights thereunder) in accordance with the provisions of the Federal Property and Administrative Services Act of 1949, as amended (40 U. S. C. 471 et seq.); and to provide by contract or otherwise for cafeterias and other necessary facilities for the welfare of employees of the Administration at its installations and purchase and maintain equipment therefor;

63 Stat. 377.

(4) to accept unconditional gifts or donations of services, money, or property, real, personal, or mixed, tangible or intangible; Gifts.

(5) without regard to section 3648 of the Revised Statutes, as amended (31 U. S. C. 529), to enter into and perform such contracts, leases, cooperative agreements, or other transactions as may be necessary in the conduct of its work and on such terms as it may deem appropriate, with any agency or instrumentality of the United States, or with any State, Territory, or possession, or with any political subdivision thereof, or with any person, firm, association, corporation, or educational institution. To the maximum extent practicable and consistent with the accomplishment of the purpose of this Act, such contracts, leases, agreements, and other transactions shall be allocated by the Administrator in a manner which will enable small-business concerns to participate equitably and proportionately in the conduct of the work of the Administration; Contracts, etc. 60 Stat. 809.

(6) to use, with their consent, the services, equipment, personnel, and facilities of Federal and other agencies with or without reimbursement, and on a similar basis to cooperate with other public and private agencies and instrumentalities in the use of services, equipment, and facilities. Each department and agency of the Federal Government shall cooperate fully with the Administration in making its services, equipment, personnel, and facilities available to the Administration, and any such department or agency is authorized, notwithstanding any other provision of law, to transfer to or to receive from the Administration, without reimbursement, aeronautical and space vehicles, and supplies and equipment other than administrative supplies or equipment; Agency cooperation.

(7) to appoint such advisory committees as may be appropriate for purposes of consultation and advice to the Administration in the performance of its functions; Advisory committees.

(8) to establish within the Administration such offices and procedures as may be appropriate to provide for the greatest possible coordination of its activities under this Act with related scientific and other activities being carried on by other public and private agencies and organizations; Coordination.

72 Stat. 430.
72 Stat. 431.

(9) to obtain services as authorized by section 15 of the Act of August 2, 1946 (5 U. S. C. 55a), at rates not to exceed $100 per diem for individuals; 60 Stat. 810.

(10) when determined by the Administrator to be necessary, and subject to such security investigations as he may determine to be appropriate, to employ aliens without regard to statutory provisions prohibiting payment of compensation to aliens; Employment. Aliens.

(11) to employ retired commissioned officers of the armed forces of the United States and compensate them at the rate established for the positions occupied by them within the Administration, subject only to the limitations in pay set forth in section 212 of the Act of June 30, 1932, as amended (5 U. S. C. 59a); Retired officers. 68 Stat. 18.

(12) with the approval of the President, to enter into cooperative agreements under which members of the Army, Navy, Air Force, and Marine Corps may be detailed by the appropriate Secretary for services in the performance of functions under this Act to the same extent as that to which they might be lawfully assigned in the Department of Defense; and Agreements.

(13) (A) to consider, ascertain, adjust, determine, settle, and pay, on behalf of the United States, in full satisfaction thereof, any claim for $5,000 or less against the United States for bodily injury, death, or damage to or loss of real or personal property Claims.

resulting from the conduct of the Administration's functions as specified in subsection (a) of this section, where such claim is presented to the Administration in writing within two years after the accident or incident out of which the claim arises; and

Report to Congress.

(B) if the Administration considers that a claim in excess of $5,000 is meritorious and would otherwise be covered by this paragraph, to report the facts and circumstances thereof to the Congress for its consideration.

CIVILIAN-MILITARY LIAISON COMMITTEE

SEC. 204. (a) There shall be a Civilian-Military Liaison Committee consisting of—

(1) a Chairman, who shall be the head thereof and who shall be appointed by the President, shall serve at the pleasure of the President, and shall receive compensation (in the manner provided in subsection (d)) at the rate of $20,000 per annum;

(2) one or more representatives from the Department of Defense, and one or more representatives from each of the Departments of the Army, Navy, and Air Force, to be assigned by the Secretary of Defense to serve on the Committee without additional compensation; and

(3) representatives from the Administration, to be assigned by the Administrator to serve on the Committee without additional compensation, equal in number to the number of representatives assigned to serve on the Committee under paragraph (2).

(b) The Administration and the Department of Defense, through the Liaison Committee, shall advise and consult with each other on all matters within their respective jurisdictions relating to aeronautical and space activities and shall keep each other fully and currently informed with respect to such activities.

(c) If the Secretary of Defense concludes that any request, action, proposed action, or failure to act on the part of the Administrator is adverse to the responsibilities of the Department of Defense, or the Administrator concludes that any request, action, proposed action, or failure to act on the part of the Department of Defense is adverse to the responsibilities of the Administration, and the Administrator and the Secretary of Defense are unable to reach an agreement with re-

72 Stat. 431.

72 Stat. 432.

spect thereto, either the Administrator or the Secretary of Defense may refer the matter to the President for his decision (which shall be final) as provided in section 201 (e).

Chairman.

(d) Notwithstanding the provisions of any other law, any active or retired officer of the Army, Navy, or Air Force may serve as Chairman of the Liaison Committee without prejudice to his active or retired status as such officer. The compensation received by any such officer for his service as Chairman of the Liaison Committee shall be equal to the amount (if any) by which the compensation fixed by subsection (a) (1) for such Chairman exceeds his pay and allowances (including special and incentive pays) as an active officer, or his retired pay.

INTERNATIONAL COOPERATION

SEC. 205. The Administration, under the foreign policy guidance of the President, may engage in a program of international cooperation in work done pursuant to this Act, and in the peaceful application of the results thereof, pursuant to agreements made by the President with the advice and consent of the Senate.

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REPORTS TO THE CONGRESS

SEC. 206. (a) The Administration shall submit to the President for transmittal to the Congress, semiannually and at such other times as it deems desirable, a report of its activities and accomplishments.

(b) The President shall transmit to the Congress in January of each year a report, which shall include (1) a comprehensive description of the programed activities and the accomplishments of all agencies of the United States in the field of aeronautics and space activities during the preceding calendar year, and (2) an evaluation of such activities and accomplishments in terms of the attainment of, or the failure to attain, the objectives described in section 102 (c) of this Act.

(c) Any report made under this section shall contain such recommendations for additional legislation as the Administrator or the President may consider necessary or desirable for the attainment of the objectives described in section 102 (c) of this Act.

(d) No information which has been classified for reasons of national security shall be included in any report made under this section, unless such information has been declassified by, or pursuant to authorization given by, the President.

TITLE III—MISCELLANEOUS

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

SEC. 301. (a) The National Advisory Committee for Aeronautics, on the effective date of this section, shall cease to exist. On such date all functions, powers, duties, and obligations, and all real and personal property, personnel (other than members of the Committee), funds, and records of that organization, shall be transferred to the Administration. Termination. Transfer of functions.

(b) Section 2302 of title 10 of the United States Code is amended by striking out "or the Executive Secretary of the National Advisory Committee for Aeronautics." and inserting in lieu thereof "or the Administrator of the National Aeronautics and Space Administration."; and section 2303 of such title 10 is amended by striking out "The National Advisory Committee for Aeronautics." and inserting in lieu thereof "The National Aeronautics and Space Administration." Definitions. 70A Stat. 127.

(c) The first section of the Act of August 26, 1950 (5 U. S. C. 22–1), is amended by striking out "the Director, National Advisory Committee for Aeronautics" and inserting in lieu thereof "the Administrator of the National Aeronautics and Space Administration", and by striking out "or National Advisory Committee for Aeronautics" and inserting in lieu thereof "or National Aeronautics and Space Administration". 64 Stat. 476. 72 Stat. 432. 72 Stat. 433.

(d) The Unitary Wind Tunnel Plan Act of 1949 (50 U. S. C. 511–515) is amended (1) by striking out "The National Advisory Committee for Aeronautics (hereinafter referred to as the 'Committee')" and inserting in lieu thereof "The Administrator of the National Aeronautics and Space Administration (hereinafter referred to as the 'Administrator')"; (2) by striking out "Committee" or "Committee's" wherever they appear and inserting in lieu thereof "Administrator" and "Administrator's", respectively; and (3) by striking out "its" wherever it appears and inserting in lieu thereof "his". 63 Stat. 936.

(e) This section shall take effect ninety days after the date of the enactment of this Act, or on any earlier date on which the Administrator shall determine, and announce by proclamation published in the Federal Register, that the Administration has been organized and is prepared to discharge the duties and exercise the powers conferred upon it by this Act. Effective date. Publication in F.R.

TRANSFER OF RELATED FUNCTIONS

SEC. 302. (a) Subject to the provisions of this section, the President, for a period of four years after the date of enactment of this Act, may transfer to the Administration any functions (including powers, duties, activities, facilities, and parts of functions) of any other department or agency of the United States, or of any officer or organizational entity thereof, which relate primarily to the functions, powers, and duties of the Administration as prescribed by section 203 of this Act. In connection with any such transfer, the President may, under this section or other applicable authority, provide for appropriate transfers of records, property, civilian personnel, and funds.

Reports to Congress.

(b) Whenever any such transfer is made before January 1, 1959, the President shall transmit to the Speaker of the House of Representatives and the President pro tempore of the Senate a full and complete report concerning the nature and effect of such transfer.

(c) After December 31, 1958, no transfer shall be made under this section until (1) a full and complete report concerning the nature and effect of such proposed transfer has been transmitted by the President to the Congress, and (2) the first period of sixty calendar days of regular session of the Congress following the date of receipt of such report by the Congress has expired without the adoption by the Congress of a concurrent resolution stating that the Congress does not favor such transfer.

ACCESS TO INFORMATION

SEC. 303. Information obtained or developed by the Administrator in the performance of his functions under this Act shall be made available for public inspection, except (A) information authorized or required by Federal statute to be withheld, and (B) information classified to protect the national security: *Provided*, That nothing in this Act shall authorize the withholding of information by the Administrator from the duly authorized committees of the Congress.

SECURITY

Requirements.

SEC. 304. (a) The Administrator shall establish such security requirements, restrictions, and safeguards as he deems necessary in the interest of the national security. The Administrator may arrange with the Civil Service Commission for the conduct of such security or other personnel investigations of the Administration's officers, employees, and consultants, and its contractors and subcontractors and their officers and employees, actual or prospective, as he deems appropriate; and if any such investigation develops any data reflecting that the individual who is the subject thereof is of questionable loyalty the matter shall be referred to the Federal Bureau of Investigation for the conduct of a full field investigation, the results of which shall be furnished to the Administrator.

72 Stat. 433.
72 Stat. 434.

Referral to F.B.I.

Access to AEC restricted data.

(b) The Atomic Energy Commission may authorize any of its employees, or employees of any contractor, prospective contractor, licensee, or prospective licensee of the Atomic Energy Commission or any other person authorized to have access to Restricted Data by the Atomic Energy Commission under subsection 145 b. of the Atomic Energy Act of 1954 (42 U. S. C. 2165 (b)), to permit any member, officer, or employee of the Council, or the Administrator, or any officer, employee, member of an advisory committee, contractor, subcontractor, or officer or employee of a contractor or subcontractor of the Administration, to have access to Restricted Data relating to aeronautical and space activities which is required in the performance of his duties and so certified by the Council or the Administrator, as the case may be,

68 Stat. 942.

but only if (1) the Council or Administrator or designee thereof has determined, in accordance with the established personnel security procedures and standards of the Council or Administration, that permitting such individual to have access to such Restricted Data will not endanger the common defense and security, and (2) the Council or Administrator or designee thereof finds that the established personnel and other security procedures and standards of the Council or Administration are adequate and in reasonable conformity to the standards established by the Atomic Energy Commission under section 145 of the Atomic Energy Act of 1954 (42 U. S. C. 2165). Any individual granted access to such Restricted Data pursuant to this subsection may exchange such Data with any individual who (A) is an officer or employee of the Department of Defense, or any department or agency thereof, or a member of the armed forces, or a contractor or subcontractor of any such department, agency, or armed force, or an officer or employee of any such contractor or subcontractor, and (B) has been authorized to have access to Restricted Data under the provisions of section 143 of the Atomic Energy Act of 1954 (42 U. S. C. 2163).

68 Stat. 942.

(c) Chapter 37 of title 18 of the United States Code (entitled Espionage and Censorship) is amended by—

Espionage and Censorship. 62 Stat. 736-738;65 Stat., 719. 18 USC 791-798.

(1) adding at the end thereof the following new section:

"§ 799. Violation of regulations of National Aeronautics and Space Administration

Violation.

"Whoever willfully shall violate, attempt to violate, or conspire to violate any regulation or order promulgated by the Administrator of the National Aeronautics and Space Administration for the protection or security of any laboratory, station, base or other facility, or part thereof, or any aircraft, missile, spacecraft, or similar vehicle, or part thereof, or other property or equipment in the custody of the Administration, or any real or personal property or equipment in the custody of any contractor under any contract with the Administration or any subcontractor of any such contractor, shall be fined not more than $5,000, or imprisoned not more than one year, or both."

Penalty.

(2) adding at the end of the sectional analysis thereof the following new item:

"799. Violation of regulations of National Aeronautics and Space Administration."

72 Stat. 434. 72 Stat. 435.

(d) Section 1114 of title 18 of the United States Code is amended by inserting immediately before "while engaged in the performance of his official duties" the following: "or any officer or employee of the National Aeronautics and Space Administration directed to guard and protect property of the United States under the administration and control of the National Aeronautics and Space Administration,".

Protection of U.S. officers and employees. 62 Stat. 756.

(e) The Administrator may direct such of the officers and employees of the Administration as he deems necessary in the public interest to carry firearms while in the conduct of their official duties. The Administrator may also authorize such of those employees of the contractors and subcontractors of the Administration engaged in the protection of property owned by the United States and located at facilities owned by or contracted to the United States as he deems necessary in the public interest, to carry firearms while in the conduct of their official duties.

Permission to use firearms.

PROPERTY RIGHTS IN INVENTIONS

SEC. 305. (a) Whenever any invention is made in the performance of any work under any contract of the Administration, and the Administrator determines that—

(1) the person who made the invention was employed or assigned to perform research, development, or exploration work and the invention is related to the work he was employed or

assigned to perform, or that it was within the scope of his employment duties, whether or not it was made during working hours, or with a contribution by the Government of the use of Government facilities, equipment, materials, allocated funds, information proprietary to the Government, or services of Government employees during working hours; or

(2) the person who made the invention was not employed or assigned to perform research, development, or exploration work, but the invention is nevertheless related to the contract, or to the work or duties he was employed or assigned to perform, and was made during working hours, or with a contribution from the Government of the sort referred to in clause (1),

such invention shall be the exclusive property of the United States, and if such invention is patentable a patent therefor shall be issued to the United States upon application made by the Administrator, unless the Administrator waives all or any part of the rights of the United States to such invention in conformity with the provisions of subsection (f) of this section.

Contract provision.

(b) Each contract entered into by the Administrator with any party for the performance of any work shall contain effective provisions under which such party shall furnish promptly to the Administrator a written report containing full and complete technical information concerning any invention, discovery, improvement, or innovation which may be made in the performance of any such work.

Patent Application.

(c) No patent may be issued to any applicant other than the Administrator for any invention which appears to the Commissioner of Patents to have significant utility in the conduct of aeronautical and space activities unless the applicant files with the Commissioner, with the application or within thirty days after request therefor by the Commissioner, a written statement executed under oath setting forth the full facts concerning the circumstances under which such invention was made and stating the relationship (if any) of such invention to the performance of any work under any contract of the Administration. Copies of each such statement and the application to which it relates shall be transmitted forthwith by the Commissioner to the Administrator.

(d) Upon any application as to which any such statement has been transmitted to the Administrator, the Commissioner may, if the invention is patentable, issue a patent to the applicant unless the Administrator, within ninety days after receipt of such application and statement, requests that such patent be issued to him on behalf of the United States. If, within such time, the Administrator files such a request with the Commissioner, the Commissioner shall transmit notice thereof to the applicant, and shall issue such patent to the Administrator unless the applicant within thirty days after receipt of such notice requests a hearing before a Board of Patent Interferences on the question whether the Administrator is entitled under this section to receive such patent. The Board may hear and determine, in accordance with rules and procedures established for interference cases, the question so presented, and its determination shall be subject to appeal by the applicant or by the Administrator to the Court of Customs and Patent Appeals in accordance with procedures governing appeals from decisions of the Board of Patent Interferences in other proceedings.

72 Stat. 435.
72 Stat. 436.

Board of Patent Interferences.

(e) Whenever any patent has been issued to any applicant in conformity with subsection (d), and the Administrator thereafter has reason to believe that the statement filed by the applicant in connection therewith contained any false representation of any material fact, the Administrator within five years after the date of issuance of such patent may file with the Commissioner a request for the transfer to the Administrator of title to such patent on the records of the Commissioner. Notice of any such request shall be transmitted by the Commissioner to the owner of record of such patent, and title to such patent shall be so transferred to the Administrator unless within thirty days after receipt of such notice such owner of record requests a hearing before a Board of Patent Interferences on the question whether any such false representation was contained in such statement. Such question shall be heard and determined, and determination thereof shall be subject to review, in the manner prescribed by subsection (d) for questions arising thereunder. No request made by the Administrator under this subsection for the transfer of title to any patent, and no prosecution for the violation of any criminal statute, shall be barred by any failure of the Administrator to make a request under subsection (d) for the issuance of such patent to him, or by any notice previously given by the Administrator stating that he had no objection to the issuance of such patent to the applicant therefor.

(f) Under such regulations in conformity with this subsection as the Administrator shall prescribe, he may waive all or any part of the rights of the United States under this section with respect to any invention or class of inventions made or which may be made by any person or class of persons in the performance of any work required by any contract of the Administration if the Administrator determines that the interests of the United States will be served thereby. Any such waiver may be made upon such terms and under such conditions as the Administrator shall determine to be required for the protection of the interests of the United States. Each such waiver made with respect to any invention shall be subject to the reservation by the Administrator of an irrevocable, nonexclusive, nontransferrable, royalty-free license for the practice of such invention throughout the world by or on behalf of the United States or any foreign government pursuant to any treaty or agreement with the United States. Each proposal for any waiver under this subsection shall be referred to an Inventions and Contributions Board which shall be established by the Administrator within the Administration. Such Board shall accord to each interested party an opportunity for hearing, and shall transmit to the Administrator its findings of fact with respect to such proposal and its recommendations for action to be taken with respect thereto. Waiver. Inventions and Contributions Board.

(g) The Administrator shall determine, and promulgate regulations specifying, the terms and conditions upon which licenses will be granted by the Administration for the practice by any person (other than an agency of the United States) of any invention for which the Administrator holds a patent on behalf of the United States. License regulations. 72 Stat. 436. 72 Stat. 437.

(h) The Administrator is authorized to take all suitable and necessary steps to protect any invention or discovery to which he has title, and to require that contractors or persons who retain title to inventions or discoveries under this section protect the inventions or discoveries to which the Administration has or may acquire a license of use. Protection of title.

(i) The Administration shall be considered a defense agency of the United States for the purpose of chapter 17 of title 35 of the United States Code. Defense agency. 66 Stat. 805-808.

(j) As used in this section— Definitions.

(1) the term "person" means any individual, partnership, corporation, association, institution, or other entity;

(2) the term "contract" means any actual or proposed contract, agreement, understanding, or other arrangement, and includes any assignment, substitution of parties, or subcontract executed or entered into thereunder; and

(3) the term "made", when used in relation to any invention, means the conception or first actual reduction to practice of such invention.

CONTRIBUTIONS AWARDS

SEC. 306. (a) Subject to the provisions of this section, the Administrator is authorized, upon his own initiative or upon application of any person, to make a monetary award, in such amount and upon such terms as he shall determine to be warranted, to any person (as defined by section 305) for any scientific or technical contribution to the Administration which is determined by the Administrator to have significant value in the conduct of aeronautical and space activities. Each application made for any such award shall be referred to the Inventions and Contributions Board established under section 305 of this Act. Such Board shall accord to each such applicant an opportunity for hearing upon such application, and shall transmit to the Administrator its recommendation as to the terms of the award, if any, to be made to such applicant for such contribution. In determining the terms and conditions of any award the Administrator shall take into account—

(1) the value of the contribution to the United States;

(2) the aggregate amount of any sums which have been expended by the applicant for the development of such contribution;

(3) the amount of any compensation (other than salary received for services rendered as an officer or employee of the Government) previously received by the applicant for or on account of the use of such contribution by the United States; and

(4) such other factors as the Administrator shall determine to be material.

(b) If more than one applicant under subsection (a) claims an interest in the same contribution, the Administrator shall ascertain and determine the respective interests of such applicants, and shall apportion any award to be made with respect to such contribution among such applicants in such proportions as he shall determine to be equitable. No award may be made under subsection (a) with respect to any contribution—

(1) unless the applicant surrenders, by such means as the Administrator shall determine to be effective, all claims which such applicant may have to receive any compensation (other than the
72 Stat. 437. award made under this section) for the use of such contribution or
72 Stat. 438. any element thereof at any time by or on behalf of the United States, or by or on behalf of any foreign government pursuant to any treaty or agreement with the United States, within the United States or at any other place;

(2) in any amount exceeding $100,000, unless the Administrator has transmitted to the appropriate committees of the Congress a full and complete report concerning the amount and terms of, and the basis for, such proposed award, and thirty calendar days of regular session of the Congress have expired after receipt of such report by such committees.

APPROPRIATIONS

SEC. 307. (a) There are hereby authorized to be appropriated such sums as may be necessary to carry out this Act, except that nothing in this Act shall authorize the appropriation of any amount for (1) the acquisition or condemnation of any real property, or (2) any other item of a capital nature (such as plant or facility acquisition, construction, or expansion) which exceeds $250,000. Sums appropriated pursuant to this subsection for the construction of facilities, or for research and development activities, shall remain available until expended.

(b) Any funds appropriated for the construction of facilities may be used for emergency repairs of existing facilities when such existing facilities are made inoperative by major breakdown, accident, or other circumstances and such repairs are deemed by the Administrator to be of greater urgency than the construction of new facilities.

Approved July 29, 1958.

Appendix B

MEMBERSHIPS OF CONGRESSIONAL COMMITTEES

Senate Committee on Aeronautical and Space Sciences

DEMOCRATS

LYNDON B. JOHNSON, Tex., *Chairman*
RICHARD B. RUSSELL, Ga.
WARREN G. MAGNUSON, Wash.
CLINTON P. ANDERSON, N. Mex.
ROBERT S. KERR, Okla.
STUART SYMINGTON, Mo.
JOHN STENNIS, Miss.
STEPHEN M. YOUNG, Ohio
THOMAS A. DODD, Conn.
HOWARD W. CANNON, Nev.

REPUBLICANS

STYLES BRIDGES, N.H.
ALEXANDER WILEY, Wis.
MARGARET CHASE SMITH, Maine
THOMAS E. MARTIN, Iowa
CLIFFORD P. CASE, N.J.

House Committee on Science and Astronautics

DEMOCRATS

OVERTON BROOKS, La., *Chairman*
JOHN W. MCCORMACK, Mass.
GEORGE P. MILLER, Calif.
OLIN E. TEAGUE, Tex.
VICTOR L. ANFUSO, N.Y.
B. F. SISK, Calif.
ERWIN MITCHELL, Ga.
JAMES M. QUIGLEY, Pa.
DAVID M. HALL, N.C.
LEONARD G. WOLF, Iowa
JOSEPH E. KARTH, Minn.
KEN HECHLER, W. Va.
EMILIO Q. DADDARIO, Conn.
WALTER H. MOELLER, Ohio
DAVID S. KING, Utah
J. EDWARD ROUSH, Ind.

REPUBLICANS

JOSEPH W. MARTIN, Jr., Mass.
JAMES G. FULTON, Pa.
GORDON L. MCDONOUGH, Calif.
J. EDGAR CHENOWETH, Colo.
FRANK C. OSMERS, Jr., Wis.
WILLIAM K. VAN PELT, Wis.
A. D. BAUMHART, Jr., Ohio
PERKINS BASS, N.H.
R. WALTER RIEHLMAN, N.Y.

Appendix C

National Aeronautics and Space Council

(As of March 31, 1959)

President DWIGHT D. EISENHOWER, *Chairman*

JOHN FOSTER DULLES
Secretary of State

NEIL MCELROY
Secretary of Defense

JOHN A. MCCONE
Chairman Atomic Energy Commission

T. KEITH GLENNAN
Administrator, National Aeronautics and Space Administration

DR. DETLEV W. BRONK
President, National Academy of Sciences

DR. ALAN T. WATERMAN
Director, National Science Foundation

JAMES H. DOOLITTLE
Chairman of Board, Space Technology Laboratories, Los Angeles, Calif.

WILLIAM A. M. BURDEN
General Partner, William A. M. Burden and Company, Investment Bankers, New York City, N.Y.

Appendix D

Membership of the Civilian-Military Liaison Committee

(As of March 31, 1959)

WILLIAM M. HOLADAY, *Chairman*

NASA MEMBERS

DR. HUGH L. DRYDEN, *Deputy Administrator*
ABE SILVERSTEIN, *Director of Space Flight Development*
HOMER J. STEWART, *Director of Program Planning*
IRA H. ABBOTT, *Assistant Director of Aerodynamics and Flight Mechanics Research*

ALTERNATES

DEMARQUIS WYATT, *Technical Assistant to the Director of Space Flight Development*
ABRAHAM HYATT, *Assistant Director for Propulsion Development*

DEPARTMENT OF DEFENSE MEMBERS

Representative

ROY W. JOHNSON, OSD, *Director*, Advanced Research Projects Agency
MAJ. GEN. W. W. DICK, Army, *Director of Special Weapons*, Office Chief of Research and Development, Dept. of Army.
VICE ADM. R. B. PIRIE, Navy, *Deputy Chief of Naval Operations* (Air)
MAJ. GEN. R. P. SWOFFORD, Air Force, *Asst. Deputy Chief of Staff*, Development

Alternate

JOHN B. MACAULEY, OSD, *Deputy Assistant Secretary of Defense* (Research and Engineering)
COL. J. F. SMOLLER, Army, *Deputy Director of Special Weapons*, Office Chief of Research and Development, Dept. of Army
REAR ADM. J. T. HAYWARD, Navy, *Asst. Chief of Naval Operations* (Research and Development)
MAJ. GEN. M. C. DEMLER, Air Force, *Director of Research and Development, Asst. Deputy Chief of Staff*, Development

Appendix E

Administrator's Proclamation

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WASHINGTON, D.C.

A PROCLAMATION

1. By virtue of the authority vested in me by the National Aeronautics and Space Act of 1958 (Public Law 85–568, approved July 29, 1958, 72 Stat. 426, 433) I hereby proclaim that as of the close of business September 30, 1958, the National Aeronautics and Space Administration has been organized and is prepared to discharge the duties and exercise the powers conferred upon it by said law.

2. In accordance with the provisions of the Act, all functions, powers, duties, and obligations, and all real and personal property, personnel (other than members of the Committee), funds, and records of the National Advisory Committee for Aeronautics are hereby transferred to the National Aeronautics and Space Administration.

3. The existing National Advisory Committee for Aeronautics Committees on Aircraft, Missile and Spacecraft Aerodynamics; Aircraft, Missile and Spacecraft Propulsion; Aircraft, Missile and Spacecraft Construction; Aircraft Operating Problems; the Industry Consulting Committee; and the Special Committee on Space Technology and their subcommittees are hereby reconstituted advisory committees to the Administration through December 31, 1958, for the purpose of bringing their current work to an orderly completion.

4. Existing policies, regulations, authorities, and procedural instructions governing the activities of the National Advisory Committee for Aeronautics, not inconsistent with law, and which are applicable to the activities of the National Aeronautics and Space Administration, shall be continued in effect until superseded or revoked.

5. The Langley Aeronautical Laboratory, the Ames Aeronautical Laboratory, and the Lewis Flight Propulsion Laboratory are hereby renamed the Langley Research Center, the Ames Research Center, and the Lewis Research Center, respectively.

DONE at the City of Washington, District of Columbia this 25th day of September in the year Nineteen Hundred and Fifty-Eight.

T. KEITH GLENNAN,
Administrator.

Appendix F

Membership of Special Committee on Life Sciences

(As of March 31, 1959)

Dr. W. Randolph Lovelace II, *Chairman*
Director of the Lovelace Foundation, Albuquerque, New Mexico

Boyd C. Myers II, *Secretary*
National Aeronautics and Space Administration

MEMBERS

Capt. Norman L. Barr, (Medical Corps)
Director, Astronautical Division, Navy Bureau of Medicine and Surgery, Washington, D.C.

LCdr. John H. Ebersole, (Medical Corps)
Medical Officer, *USS Seawolf*, Fleet Post Office, New York, N.Y.

Brig. Gen. Donald D. Flickinger, (Medical Corps)
Surgeon and Assistant Deputy Commander for Research, Headquarters, Air Research and Development Command, Washington, D.C.

Lt. Col. Robert H. Holmes, (Medical Corps)
Chief of BioPhysics and Astronautics Branch, Army Medical Research and Development Command, Washington, D.C.

Dr. Wright H. Langham
Los Alamos Scientific Laboratory, University of California

Dr. Robert B. Livingston
Director of Basic Research in Mental Health and Neurological Diseases, National Institutes of Health, Bethesda, Md.

Dr. Orr Reynolds
Director of Science, Office of the Assistant Secretary of Defense for Research and Engineering, Washington, D.C.

Appendix G

Memberships of Research Advisory Committees

RESEARCH ADVISORY COMMITTEE ON FLUID MECHANICS

Professor WILLIAM R. SEARS, *Chairman, Head*, Graduate School of Aeronautical Engineering, Cornell University, Ithaca, N.Y.

Dr. KEITH BOYER, *Associate J Division Leader*, Los Alamos Scientific Laboratory, P.O. Box 1663, Los Alamos, N. Mex.

Professor ANTONIO FERRI, *Professor of Aeronautical Engineering and Director of Aerodynamics Laboratory*, Polytechnic Institute of Brooklyn, Freeport, N.Y.

Dr. WAYLAND C. GRIFFITH, *Associate Director*, Spacecraft and Missiles, Missiles and Space Division, Lockheed Aircraft Corporation, P.O. Box 504, Sunnyvale, Calif.

Mr. A. HERTZBERG, *Assistant Head*, Aerodynamic Research Department, Cornell Aeronautical Laboratory, Inc., Buffalo 21, N.Y.

Professor OTTO LAPORTE, *Professor of Physics*, Univesity of Michigan, Ann Arbor, Mich.

Professor HANS W. LIEPMANN, *Professor of Aeronautics*, California Institute of Technology, Pasadena 4, Calif.

Professor C. C. LIN, *Professor of Mathematics*, Massachusetts Institute of Technology, Cambridge 39, Mass.

Dr. ROBERT W. PERRY, *Chief*, Re-Entry Simulation Laboratory, Republic Aviation Corporation, Farmingdale, Long Island, N.Y.

Dr. HARRY E. PETSCHEK, *Principal Research Scientist*, Avco Research Laboratory, Avco Manufacturing Corporation, Everett 49, Mass.

Professor S. A. SCHAAF, *Chairman for Aeronautical Sciences*, College of Engineering, University of California, Berkeley 4, Calif.

Dr. JOSEPH STERNBERG, *Chief*, Exterior Ballistic Laboratory, Ballistic Research Laboratories, Aberdeen Proving Ground, Md.

Dr. H. H. KURZWEG, *Associate Technical Director for Aeroballistic Research*, U.S. Naval Ordnance Laboratory, White Oak, Silver Spring, Md.

Dr. CARL KAPLAN, *Chief Scientist*, Air Force Office of Scientific Research, SRR, Washington 25, D.C.

Dr. G. B. SCHUBAUER, *Chief*, Fluid Mechanics Section, National Bureau of Standards, Washington 25, D.C.

NASA Staff Representatives

Mr. CLINTON E. BROWN, Langley Research Center
Mr. ROBERT T. JONES, Ames Research Center
Mr. WOLFGANG E. MOECKEL, Lewis Research Center
Dr. P. P. WEGENER, Jet Propulsion Laboratory
Mr. E. O. PEARSON, Headquarters, Secretary

RESEARCH ADVISORY COMMITTEE ON AIRCRAFT AERODYNAMICS

Mr. R. RICHARD HEPPE, *Chairman, Manager*, Advanced Aerodynamics Research, California Division, Lockheed Aircraft Corporation, Burbank, Calif.

Mr. L. L. DOUGLAS, *Vice President*—Engineering, Vertol Aircraft Corporation, Morton, Pa.

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Mr. ALEXANDER H. FLAX, *Vice President for Research*, Cornell Aeronautical Laboratory, Inc., Buffalo 21, N.Y.

Mr. CHARLES W. FRICK, Jr., *Chief of Applied Research*, Convair—6–704, Division of General Dynamics Corp., San Diego 12, Calif.

Mr. L. P. GREENE, *Chief*, Aero Science, Los Angeles Division, North American Aviation, Inc., International Airport, Los Angeles 45, Calif.

Mr. WILLIAM T. HAMILTON, *Chief of Flight Technology*, Seattle Division, Boeing Airplane Company, Box 3707, Seattle 24, Wash.

Mr. FRANK W. KOLK, *Director*, Equipment Research, American Airlines, Inc., LaGuardia Airport Station, Flushing 71, N.Y.

Mr. CONRAD A. LAU, *Chief of Advanced Aircraft*, Chance Vought Aircraft, Inc., P. O. Box 5907, Dallas, Tex.

Mr. JOHN G. LEE, *Director of Research*, United Aircraft Corporation, East Hartford 8, Conn.

Dr. WILLIAM J. O'DONNELL, *Chief Engineer of Aircraft and Missiles*, Republic Aviation Corporation, Farmingdale, Long Island, N.Y.

Mr. WILLIAM M. ZARKOWSKY, *Program Manager*, Grumman Aircraft Engineering Corp., Bethpage, Long Island, N.Y.

Mr. D. M. THOMPSON, *Chief*, Air Research and Development Div., Office of the Chief of Transportation, Department of the Army, TCARD, Washington 25, D.C.

Mr. G. L. DESMOND, *Head*, Aero and Hydro Branch, Bureau of Aeronautics, Department of the Navy, Room 2 W 78, Washington 25, D.C.

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NASA Staff Representatives

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Mr. R. G. ROBINSON, Ames Research Center
Mr. CARL F. SCHUELLER, Lewis Research Center
Mr. D. E. BEELER, High-Speed Flight Station
Mr. A. J. EVANS, Headquarters, Secretary

RESEARCH ADVISORY COMMITTEE ON MISSILE AND SPACECRAFT AERODYNAMICS

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Dr. M. EIMER, Jet Propulsion Laboratory
Mr. RALPH W. MAY, Headquarters, Secretary

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Dr. William T. Russell, *Director*, Electromechanical Systems Laboratory, Space Technology Laboratories, Inc., P.O. Box 95001, Los Angeles 45, Calif.

Mr. O. H. Schuck, *Director of Aero Research*, Aeronautical Division, Dept. 630, Minneapolis-Honeywell Regulator Co., 2600 Ridgway Road, Minneapolis 13, Minn.

Dr. Walter Haeussermann, *Director*, Guidance and Control Development Operations Division, Army Ballistic Missile Agency, ORDAB–DG, Redstone Arsenal, Ala.

Dr. W. B. McLean, *Technical Director*, Naval Ordnance Test Station, China Lake, Calif.

Lt. Col. F. M. Box, USAF, Air Force Ballistic Missile Division, Headquarters ARDC, United States Air Force, Air Force Unit Post Office, Los Angeles 45, Calif.

NASA STAFF REPRESENTATIVES:

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Mr. Harry J. Goett, Ames Research Center
Mr. A. S. Boksenbom, Lewis Research Center
Mr. Hubert M. Drake, High-Speed Flight Station
Dr. C. R. Gates, Jet Propulsion Laboratory
Mr. Bernard Maggin, Headquarters, Secretary

RESEARCH ADVISORY COMMITTEE ON CHEMICAL ENERGY PROCESSES

Mr. James A. Reid, *Chairman, Executive Vice President and General Manager*, Astrodyne, Inc., Box 548, McGregor, Tex.

Dr. David Altman, *Manager*, Vehicle Technology, Space Technology Division, Aeronutronic Systems, Inc., 1234 Air Way, Glendale, Calif.

Dr. A. L. Antonio, *Vice President*—Chemical Division, Aerojet-General Corporation, Azusa, Calif.

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Appendix H

Cooperative Agreement on Jet Propulsion Laboratory

Between the

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

and the

DEPARTMENT OF THE ARMY

A. AUTHORITIES

This Agreement is authorized by Public Law 85–568 as implemented by Executive Order *10793*, dated *December 3, 1958.*

B. PURPOSE

The purpose of this agreement is to establish the relationships between the National Aeronautics and Space Administration (NASA) and the Department of the Army (Army) that will govern the following:

1. Implementation of Executive Order No. 10793, dated December 3, 1958, which is incorporated herein by reference.

2. Planning for the orderly transition from current Army military operations and weapons systems development programs to programs predominately in the field of exploration and exploitation of space science and technology for peaceful purposes under NASA direction.

3. Provision for certain Army administrative and logistical support desired by NASA in the operation of JPL.

C. POLICY

The Army states and NASA recognizes that an abrupt transfer or cessation of Army activities relating to military operations and weapons systems development programs performed at the JPL would be deleterious to both national defense and the accomplishement of NASA objectives. Both NASA and the Army recognize that NASA is not fully staffed to perform certain administrative functions and to provide the administrative and logistical support essential to the uninterrupted operation of JPL and that NASA may request that certain services and support be provided by the Army.

D. OPERATING CONCEPTS

1. NASA will provide for the general management and technical direction of the JPL, except as to projects relating to military operations and weapons systems development programs.

2. For calendar year 1959 the Army will continue its contractual relations with the California Institute of Technology for continued effort by the JPL on the following programs which are specifically related to military operations and weapons systems development programs:

a. The SERGEANT guided missile program.

b. Special intelligence investigations.

c. Secure communications research.

d. Aerodynamic testing and research.

It is expected that these specific Army activities will be largely phased out during calendar year 1959; however, if it is necessary to continue certain activities for a longer period of time, this may be done by direct Army contract or through NASA as may be mutually agreed by NASA and the Army.

3. The Army budgets on a program basis and Army installations receive funds on the basis of assigned program activities. Traditionally, the Army has funded the activities performed at JPL on a calendar rather than fiscal year basis. For these reasons, a firm 1959 program had been agreed to by the Army and JPL prior to the publishing of the Executive order effecting transfer of JPL. NASA, through assumption of technical direction of the general supporting research portion of the program on January 1, 1959, can reorient the effort toward NASA objectives by the end of the first half of the calendar year 1959. Therefore, the Army and NASA reached prior agreement and the Executive order provided for transfer of Army funds in the amount of $4,078,250 to NASA for this general supporting research program for the first half of calendar year 1959. The additional funds for general supporting research during calendar year 1959 will be provided by NASA.

4. NASA may request from time to time, and the Army agrees, that certain administrative and logistical support can and will be furnished to NASA on a non-reimbursable basis for servicing contract activities at JPL for calendar year 1959. Provision of this support may require in certain instances delegations of authority from NASA to the Army where appropriate to the service or support action requested. After calendar year 1959 such services and support may be provided in such scope and under such conditions as may be mutually agreed upon.

The following types of services and support are contemplated:

a. Assistance in preaward contractual activities such as negotiation, price analysis, financial and legal services, contract clauses and conditions, etc. Also, the same type of services in connection with change order, amendments, and other subsequent contract actions.

b. Audit services to be rendered by the Army Audit Agency in connection with contract performance and determination of allowable costs.

c. Administrative supervision of contractors' maintenance of property and cost accounting records; and advice as to whether management systems employed by contractor are adequate and in accordance with contract provisions.

d. Administrative services in connection with contractor's Safety and Security Programs under contract standards.

e. Exercise of such administrative controls over the performance of contracts as may be delegated by NASA and accepted by the Army.

f. Such other support services (including, but not limited to, litigation matters and proprietary rights matters) as may be required from time to time and as may be agreed upon between NASA and the Army.

5. An Army Liaison Group may be established at JPL for the purpose of providing direct and continuing exchange of technical information on supporting research in the aeronautical, missile, and space field to enable the Army to carry out its responsibility for Army activities.

6. It is agreed that, while general management and technical direction of the JPL passes from the Army to NASA effective with the publishing of Executive Order No. 10793, an orderly transfer of records and accountability for the facilities and equipment will require a period of time. It is planned goal of both NASA and the Army to complete this orderly transfer by December 31, 1959. Accountability for property transferred by the Executive Order will be formally assumed by NASA upon completion of such documentation as may be required under existing law and this agreement.

7. It is agreed by the Administrator and the Secretary of the Army that implementation of this instrument will be effected by designees of each for the purpose of dealing with—

a. Contract administration;

b. Property transfer; and

c. Such other matters as fall within the purview of this instrument.

The Administrator, NASA, and the Secretary of the Army hereby designate respectively The Director of Business Administration, NASA, and the Chief of Ordnance, Army, to jointly formulate the necessary teams to effectuate this Agreement.

8. It is understood and agreed that the Administrator will delegate to the Secretary of the Army, or his designee, such authority as may

be required to authorize the Army to fulfill the intent and purposes of this Agreement.

Date: December 3, 1958.

WASHINGTON, D.C.

(S) T. KEITH GLENNAN,
Administrator, NASA

(S) WILBER M. BRUCKER,
Secretary of the Army

Appendix I

Cooperative Agreement on Army Ordnance Missile Command

Between the

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

and the

DEPARTMENT OF THE ARMY

A. AUTHORITY

This agreement is authorized by Public Law 85–568.

B. PURPOSE

This agreement is for the purpose of establishing relationships between the National Aeronautics and Space Administration and the Department of the Army for the efficient utilization of United States Army resources in the accomplishment of the purposes of the National Aeronautics and Space Act of 1958. This agreement is intended to provide for relationships in the national interest that will prevent undue delay of progress in the national space program, and prevent undesirable disruption of military programs. This agreement is also intended to contribute to effective utilization of the scientific and engineering resources of the country by fostering close cooperation among the interested agencies in order to avoid unnecessary duplication of facilities.

C. POLICY

The National Aeronautics and Space Administration (NASA) and the Department of the Army recognize the often inseparable nature of the efforts of this Nation in meeting military and scientific objectives in the missile and space field. Continuation of the organizational strength of the Army Ballistic Missile Agency (ABMA) of the U.S. Army Ordnance Missile Command (AOMC) and its established contractor structure and support from other elements of the Army has been stated by the Defense Department to be essential to the Defense mission. The proper provisions for making the capabilities of this organization available for meeting objectives of NASA permit the application of these resources to the needs of both civilian space activities and essential military requirements. Accordingly, this agreement establishes relationships between NASA and the Department of the

Army which makes the AOMC and its subordinate organizations immediately, directly, and continuously responsive to NASA requirements.

D. PROCEDURES

1. The CG, AOMC, will have full authority, as the principal agent of the Army, to utilize the resources of his Command, those organizations directly under his control through contractual structure, and other elements of the Department of the Army with which he deals directly, for the accomplishment of assigned NASA projects.

2. Key personnel of AOMC and appropriate subordinate elements, as may be requested by NASA, will serve on technical committees under the chairmanship of NASA, or on advisory groups, or will serve as individual consultants to:

a. Assist in the development of broad requirements and objectives in space programs.

b. Assist in the determination of specific projects and specific methods (including hardware development) by which NASA may accomplish its overall objective.

3. Specific orders for projects to be accomplished for NASA will be placed direct by NASA upon AOMC with provision of funds for their accomplishment. AOMC will accept full responsibility for the fulfillment of the assigned projects as accepted from NASA.

4. NASA will have direct and continuing access, through visits or resident personnel, for technical contact and direction of effort on assigned NASA projects. In this connection, NASA is invited to place a small staff in residence at AOMC. This staff will provide for a continuing exchange of information on all projects assigned by NASA, as well as exchange of information on supporting research in the entire missile and space field.

5. On request by NASA, in connection with projects funded by NASA, the prime and sub-contractor facilities of the Army in weapons systems and other programs, including scientific and educational institutions and private industry, will be made available through identical procurement channels and with use of the special authorities delegated to the CG, AOMC, by the Secretary of the Army. In addition, resources of other elements of the Army, available to AOMC on a direct basis for space and missile system development, will be used as deemed necessary in the fulfillment of assigned NASA projects.

6. The CG, AOMC, is responsible for scheduling the space and missile activities under his control to meet the priority requirements of NASA in a manner consistent with overall national priorities. He is further responsible for anticipating in advance any possible conflict in the commitment of effort to NASA and Defense programs, and for

providing a timely report to NASA, as well as to the Department of the Army, for the purpose of resolving such conflicts.

7. Public information and historical and technical documentation of assigned NASA projects will be under the direction and control of NASA.

8. The CG, AOMC, is authorized to enter into specific agreements with the duly designated representative of the Administrator, NASA, in implementation of this agreement.

Date: December 3, 1958.

WASHINGTON, D.C.

(S) T. KEITH GLENNAN,
Administrator

(S) WILBER M. BRUCKER,
Secretary of the Army

511635 O—59——7

Appendix J

Principal NASA contracts, Oct. 1, 1958–Mar. 31, 1959

ACTIVITY: NASA HEADQUARTERS

Program	*Contract No.*	*Purpose*	*Contractor*	*1959 obligations*	*Total amount of contract*
Aircraft, missile, and spacecraft research: Support of JPL plant.	NASW-6	Conduct of research	JPL (California Tech.)	$8,160,000	$8,160,000
Aircraft, missile, and spacecraft: Research contracts.	NASW-21	Molecular study	Yale University	110,000	110,000
Scientific investigations in space:					
Sounding rockets	HS-26	10 Nike ASP rockets	Ordnance (Army)	20,000	20,000
Do	HS-47	Partial support of Space Sciences Division (Townsend) (see also Earth satellites).	NRL (ONR-Navy)	1,900,000	1,900,000
Scientific satellites	HS-6	Earth satellites (including Thor-Able boosters)	BMD (ARDC-Air Force)	7,120,000	7,120,000
	HS-21	Juno II boosters	AOMC (Army)	8,540,000	8,540,000
	HS-37	Computing services (60 percent) (see also Lunar probes and deep-space probes).	Bureau of Standards (Commerce).	80,000	80,000
	NASW-20	Alterations to buildings 5-7, Bellevue Annex	Alton Engineering Co	130,000	130,000
	HS-47	Partial support of Space Sciences Division (Townsend) (see also Sounding rockets).	NRL (ONR-Navy)	2,000,000	2,000,000
	HS-48	Research on rubidium frequency standards	Bureau of Standards (Commerce).	270,000	270,000
	NASW-17	Reduction analysis (see also Deep-space probes)	Iowa State University	10,000	19,320
Lunar probes	HS-1	Lunar probe projects	AOMC (Army)	2,110,000	2,600,000
	HS-2	do	BMD (ARDC-Air Force)	2,000,000	2,000,000
	HS-3	do	NDTS (ONR-Navy)	200,000	200,000
	HS-37	Computing services (30 percent) (see also Earth satellites and Deep-space probes).	Bureau of Standards (Commerce).	40,000	40,000
Do	HS-66	Conduct research and development on television for space vehicles.	NOTS (ONR-Navy)	100,000	100,000
Deep-space probes	HS-5	Space probes	BMD (ARDC-Air Force)	8,990,000	8,990,000
	HS-20	Deep-space study	ABMA (Army)	340,000	340,000
	NASW-6	do	JPL (California Tech.)	1,300,000	1,300,000

	HS-37	Computing services (10 percent) (see also Earth satellites and Lunar probes).	Bureau of Standards (Commerce).	10,000	10,000
	HS-40	Construction of addition to building No. 125 at JPL.	Corps of Engineers (Army)	150,000	150,000
	NASW-17	Space probe instrumentation (see also Earth satellites).	Iowa State University	40,000	292,000
Vanguard Division	HS-23	Support of the Vanguard Division, Space Projects Center.	NRL (ONR-Navy)	23,500,000	23,500,000
Satellite applications investigations:					
Meteorology	HS-11	Meteorological analysis	U.S. Weather Bureau (Commerce).	150,000	150,000
	HS-126	Project Tiros	Signal Corps (Army)	540,000	540,000
Communications	HS-4	100-foot inflatable sphere	AOMC (Army)	2,150,000	2,150,000
Space propulsion technology:					
High-energy fuel rockets	HS-13	"State-of-art" work on rocket engines	WADC (ARDC-Air Force)	430,000	430,000
	NASW-6	Develop 6-000-pound-thrust storable propellant system.	JPL (California Tech.)	2,000,000	3,400,000
High-energy propellant rockets	NASW-28	Feasibility of liquid fluorine-liquid hydrogen in a rocket engine.	Bell Aircraft Corp	1,070,000	1,070,000
1,000,000-pound-thrust single-chamber engine.	NASW-16	1,000,000-pound-thrust rocket engine	Rocketdyne Division of North American Aviation, Inc.	10,000,000	102,000,000
Nuclear rocket engines	HS-15	Rover program	AEC	1,900,000	1,900,000
Supporting activities:					
Tracking and data acquisition	NASW-7	Operation of earth satellite radio tracking and receiving stations for 6 months beginning Jan. 1, 1959.	Government of Peru	70,000	70,000
Do	NASW-19	Operation of 2 earth satellite tracking and receiving stations beginning Jan. 1, 1959.	University of Chile	80,000	80,000
	NASW-11	Operations of minitrack stations in South America and Cuba for 18 months beginning Jan. 1, 1959.	Bendix Radio Corp	600,000	[1]
	HS-22	Photo reduction equipment	Smithsonian Astrophysics Laboratory.	120,000	120,000
	HS-32	Tracking and data reduction services	Smithsonian Institution	470,000	2,500,000
	HS-115	Procurement test equipment for telemetry stations.	NRL (ONR-Navy)	260,000	260,000
Vehicle development: Vega	NASW-6	Vega space vehicle and related payloads	JPL (California Tech.)	3,000,000	3,000,000
	NASW-30	Development liquid propellant rocket engine	General Electric Co	4,120,000	4,120,000

[1] Total amount of contract still under negotiation.

Principal NASA contracts, Oct. 1, 1958–Mar. 31, 1959—Continued

Program	Contract No.	Purpose	Contractor	1959 obligations	Total amount of contract
ACTIVITY: LANGLEY RESEARCH CENTER					
Aircraft, missile and spacecraft research: Support of NASA plant.	NA1-3679	Modification of the impact basin to provide working space for Space Projects Center personnel.	Endebrock-White Co	$60,000	$60,000
Space operations technology: Manned space flight.	NAS5-57	Destruct system and design of transport vehicles and launcher.	North American Aviation	930,000	930,000
ACTIVITY: SPACE PROJECTS CENTER (LEWIS)					
Do	NAS3-305	Furnishing automatic flight control systems	Minneapolis-Honeywell Regulator Co.	140,000	140,000
	NAS3-335	Furnishing 2 telemetering systems for prototype man-in space capsule.	Electro Mechanical Research, Inc.	120,000	120,000
	NAS3-343	Furnishing 5 3-channel miniature airborne tape recorders.	Cook Electronic Co	80,000	80,000
High-energy fuel rockets	NAS3-262	Propellant tank assemblies	Douglas Aircraft Co	110,000	110,000
	NAS3-234	Furnishing rocket-thrust chambers and necessary tooling.	Solar Aircraft Co	180,000	180,000
	NAS3-354	3,600-gallon liquid hydrogen trailer	Herrick L. Johnson, Inc	50,000	50,000
	NA1-3654	Recruit motor rockets	Thiokol Chemical Corp	60,000	60,000
ACTIVITY: SPACE PROJECTS CENTER (LANGLEY)					
Scientific investigations in space:					
Earth satellites	S-1000(G)	X-248 rockets	Bureau of Ordnance (Navy).	100,000	100,000
	S-1010(G)	X-254 rockets	do	1,120,000	1,120,000
	NAS5-53	Jupiter Seniors	Bureau of Aeronautics (Navy).	1,020,000	1,020,000
	S-1013(G)	XM-45 rockets (see also Manned space flight)	ABMA (Chief of Ordnance, Army).	90,000	90,000
Do	L-55,931(G)	TX-33-20 rockets (see also Manned space flights).	do	620,000	620,000
Space operations technology:					
Manned space flight	HS-24	Atlas D Boosters	BMD (Air Force)	1,400,000	(1)
	HS-36	do	do	5,600,000	(1)
	S-1013(G)	XM-45 rockets (see also Earth satellites)	ABMA (Chief of Ordnance, Army).	120,000	120,000

	NAS5-51	Booster hardware, sets for TX-33	Aerolab Development Co	70,000	70,000
	NAS5-55	XM-19E1 rockets	Thiokol, Inc	110,000	110,000
	L-55,931(G)	TX-33-20 rockets; TX-33-22 rockets (see also Earth satellites).	ABMA (Chief of Ordnance, Army).	2,200,000	2,200,000
	HS-44	Part of Redstone boosters	AOMC (Army)	4,490,000	15,500,000
	HS-54	Jupiter boosters	do	2,740,000	4,450,000
ACTIVITY: BELTSVILLE SPACE CENTER (LANGLEY GROUP)					
Do	NAS5-59	12 capsule systems, 12 ablation and 6 beryllium heat shields, 6 escape and 6 retrorocket systems, 9 adapter sections, 9 release mechanisms, a mockup of the capsule system.	McDonnell Aircraft Corp	10,500,000	10,500,000
	NAS5-69	Landing and recovery system	Radioplane Division of Northrup Aviation Corp.	60,000	60,000
Vehicle development: Scout	NAS5-61	Attitude control system	Minneapolis-Honeywell Regulator Co.	770,000	770,000

[1] Total amount of contract still under negotiation.

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