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This pamphlet lists career opportunities in aerospace technology announced by the Boards of the U. S. Civil Service for the National Aeronautics and Space Administration (NASA). Information given includes (1) the work of the NASA, (2) technical and administrative specialties in aerospace technology, (3) educational and experience requirements, and (4) how to apply and what to file. A comprehensive table of specialties and locations is also included. (GR)

# NASA



A GUIDE TO CAREERS IN AERO-SPACE TECHNOLOGY

Career Opportunities in Aerospace Technology Announced by the Boards of U.S. Civil Service Examiners for the National Aeronautics and Space Administration

# CONTENTS



## Location of Positions

The positions listed in this announcement are with the National Aeronautics and Space Administration installations throughout the Nation, including NASA Headquarters, Washington, D.C., Ames Research Center, Mountain View, Calif., Electronics Research Center, Cambridge, Mass., Flight Research Center, Edwards, Calif., Goddard Space Flight Center, Greenbelt, Md., John F. Kennedy Space Center, Kennedy Space Center, Fla., Langley Research Center, Hampton, Va., Lewis Research Center, Cleveland, Ohio, Manned Spacecraft Center, Houston, Tex., Marshall Spaceflight Center, Huntsville, Ala., Wallops Station, Wallops Island, Va., Western Support Office, Santa Monica, Calif. Similar positions in physical sciences, life sciences, mathematics and engineering in the Army Missile Command, Redstone Arsenal, Ala., will be filled from this announcement. Positions in physical sciences, life sciences, mathematics, and engineering in other Federal agencies may also be filled from this announcement where no appropriate examination for the specific position is announced.


Issued June 1, 1965
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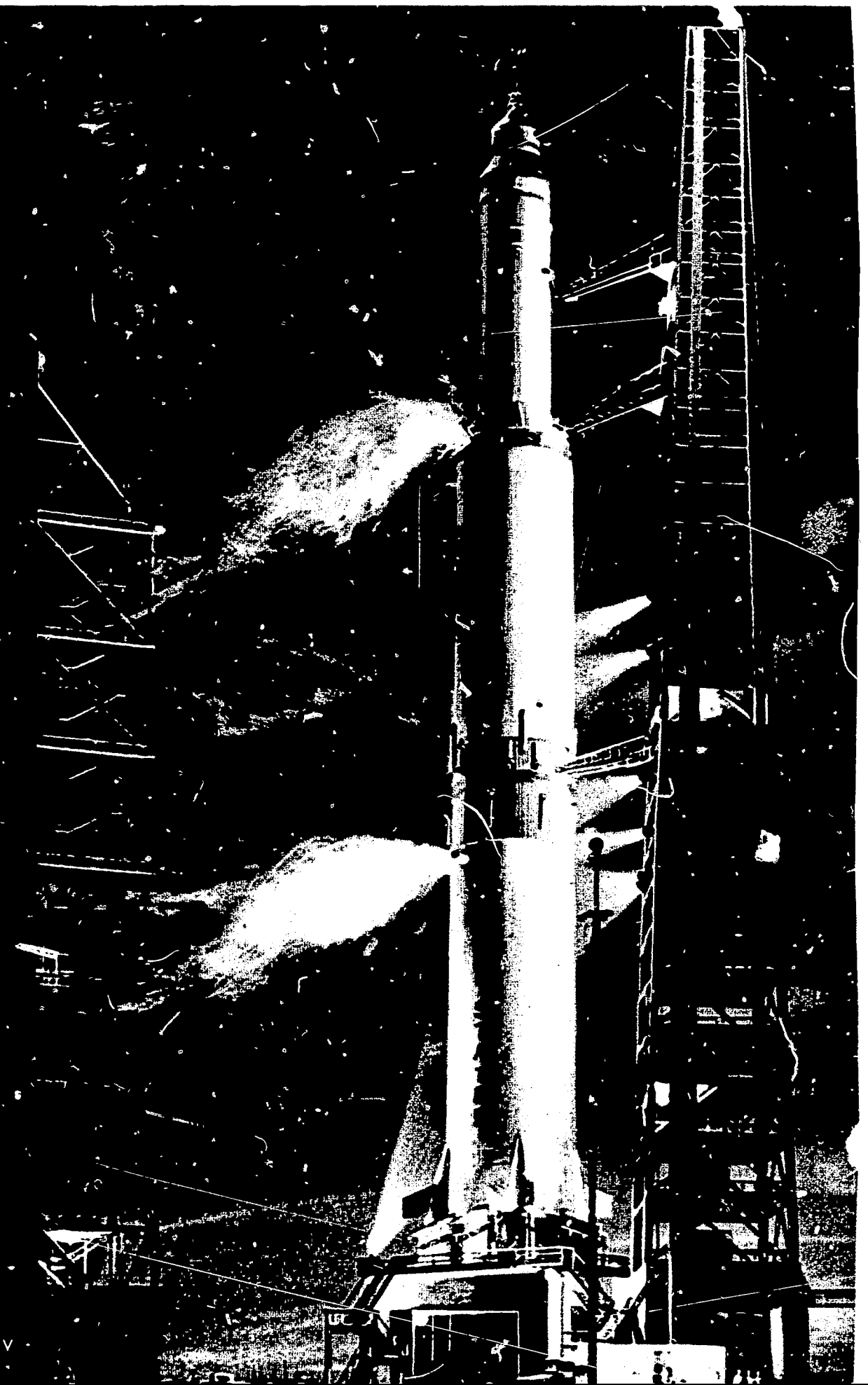
No Closing Date

Civil Service Commission
Announcement No. 347B

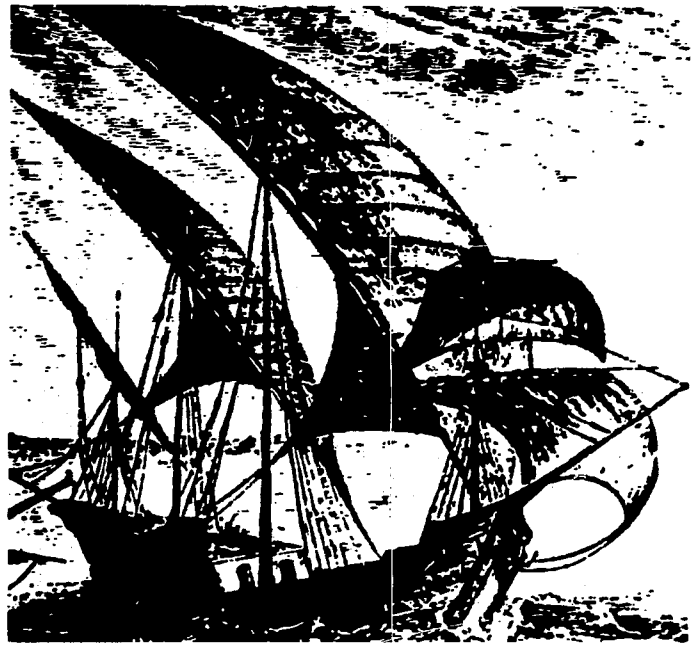



Saturn V

# NINA, PINTA and SANTA MARIA

. . . in these small ships, Christopher Columbus navigated the vast, unexplored Atlantic Ocean to lands which would some day be called the Americas. Searching only for a new route to the Orient, Columbus could not have foreseen the riches his accidental discovery would unlock . . . the new wealth of knowledge, profuse natural resources, new environments in which one-eighth of the world's people would ultimately settle and grow and progress.

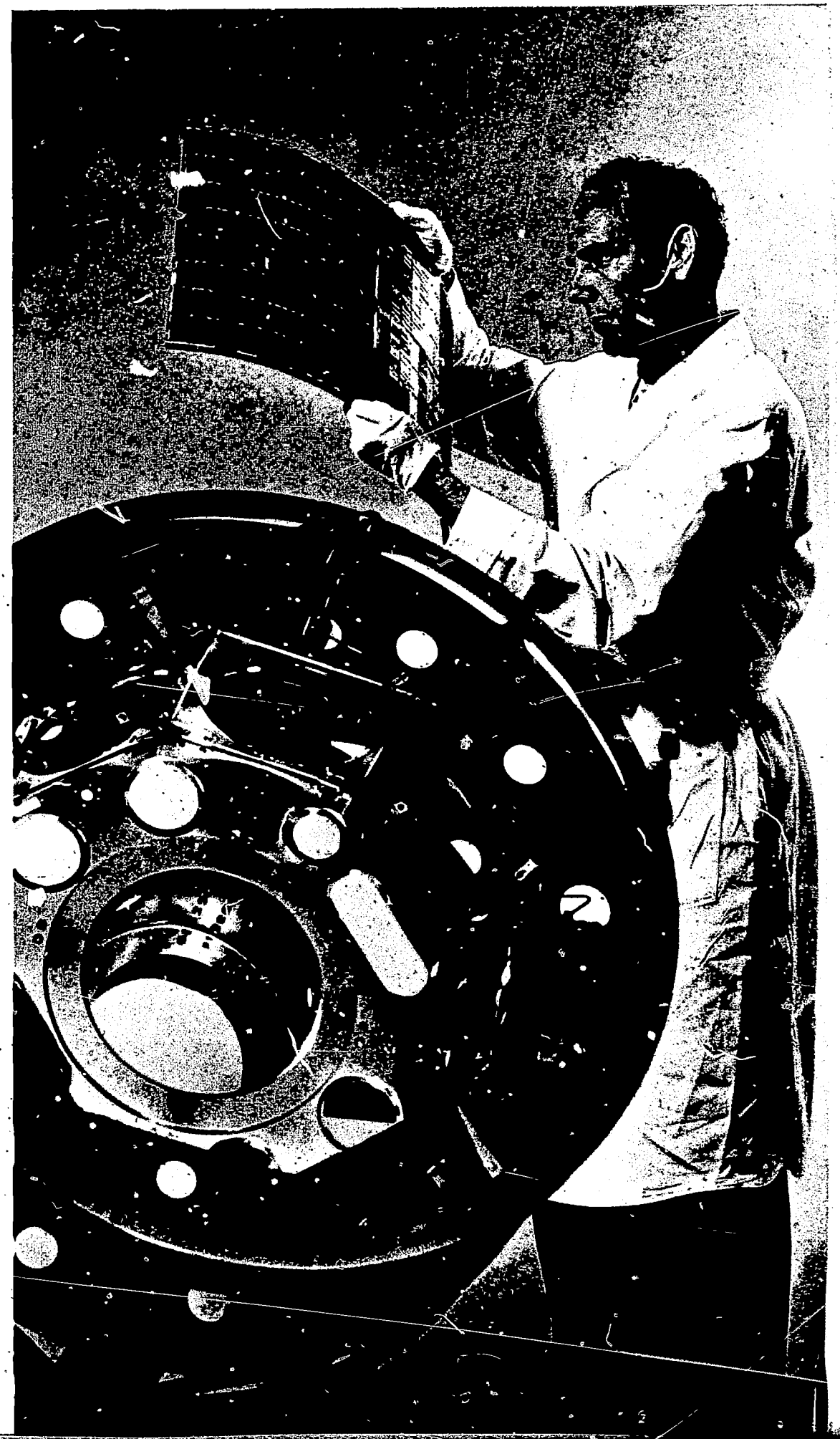
Now, in spacecraft of many different sizes and configurations—some of them carrying astronauts—the National Aeronautics and Space Administration (NASA) is exploring space. Prog ms range from scientific investigations to development of means for collecting weather data and carrying out long-range communication. The men and women engaged in space exploration have the most challenging assignment ever given to the American scientific and engineering community.




# THE WORK OF NASA AND ITS CENTERS

The National Aeronautics and Space Administration (NASA), an independent civilian government agency, was established October 1, 1958.

Broadly, NASA's mission includes all matters pertaining to the civilian space and aeronautical research activities of the Nation. Its work includes basic and applied research for the expansion of human knowledge of phenomena in the atmosphere and space; the improvement of the usefulness, performance, speed, safety, and efficiency of aeronautical and space vehicles; the development and operation of vehicles capable of carrying instruments, equipment, supplies, and living organisms through space; and the preservation of the role of the United States as a leader in aeronautical and space activities within and outside the atmosphere.



Syncom Fabrication

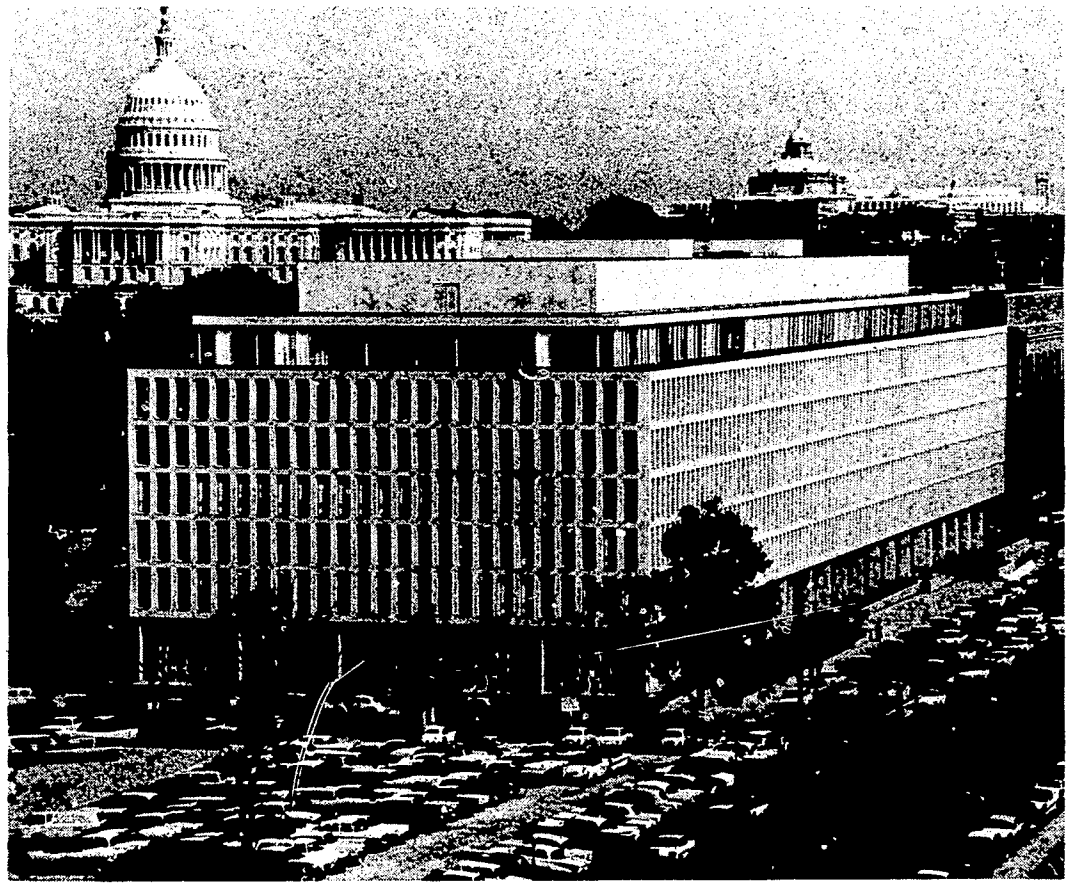
The NASA research centers, space flight centers, and other installations are briefly described below.

## NASA Headquarters, Washington, D.C.

NASA Headquarters exercises management over the space flight centers, research centers, and other installations which comprise the National Aeronautics and Space Administration. This includes the determination of programs and projects, establishment of management policies, procedures, and performance criteria, evaluation of progress, and the review and analysis of all phases of the aerospace programs. The broad program areas which incorporate the technical aspects of NASA headquarters activities are: Manned space flight, space sciences and their applications, advanced engineering and physical science research, and tracking and data acquisition. Functional management is exercised with respect to all phases of administration, including financial, contracting, personnel and security programs. The headquarters office is also responsible for sponsorship and participation in international programs for space exploration, public affairs and technical information programs.

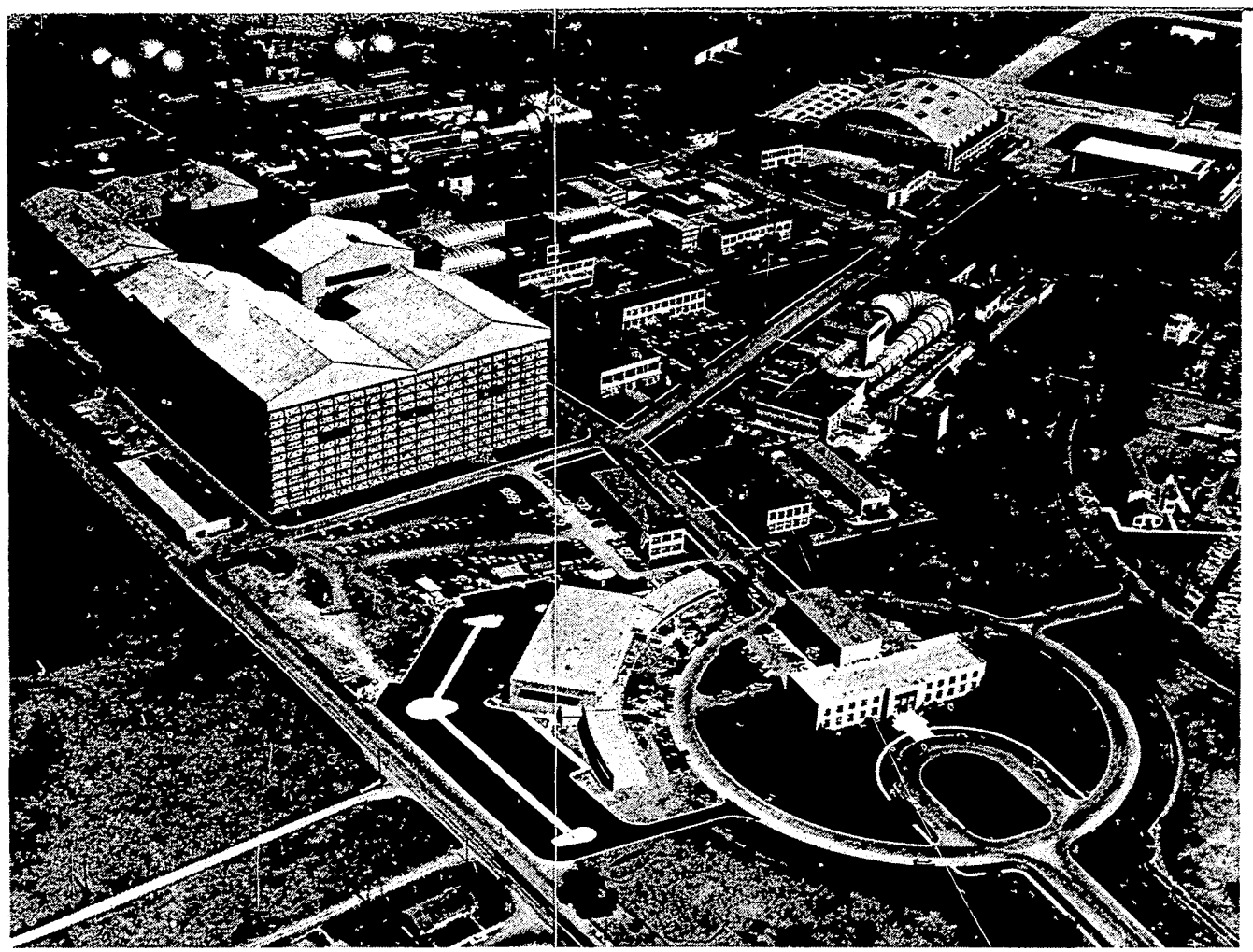
## Ames Research Center, Mountain View, Calif.

The mission of the Ames Research Center is basic and applied research in physical and life science areas of vital importance to the advancement of aeronautics and space technology. Space research areas include aerodynamics of space vehicles, space environment physics, space vehicle flight control, and such life sciences as exobiology, environmental biology, and biotechnology. Aeronautical research responsibilities embrace both subsonic and supersonic aircraft and include configurations, stability, aerodynamics, and structures.



NASA Headquarters

Reentry heating problems facing Apollo and other future spacecraft are a major concern of Ames' scientists and engineers. Of similar importance is Ames' work in helping develop the Apollo guidance system



Ames Research Center

(the particular Ames responsibility is midcourse and reentry guidance) and in pursuing other flight control studies relative to stabilization, navigation, and guidance of aircraft and manned and unmanned space vehicles. Space physics investigations include studies of micrometeorite bombardment of surfaces and techniques for detecting and understanding interplanetary gases and other matter. Aeronautical research is directed predominantly at V/STOL craft and supersonic transports, utilizing full-scale examples of the former as research vehicles.

Ames' life scientists are investigating the performance of man under conditions of space travel; developing systems for the support of life in space; determining the effects of the space environment on living organisms; investigating the synthesis of biological substances from inanimate materials; and developing means of detecting, collecting and analyzing extraterrestrial life.

In addition to its shops, hangars, flight simulators, and research vehicles, Ames has many specialized wind tunnels (a Mach 50 helium tunnel is the latest), hypervelocity test ranges, and diverse other laboratory facilities.

Ames is located at Moffett Field, Calif., at the southern tip of San Francisco Bay, approximately 8 miles northwest of San Jose and 40 miles south of San Francisco.

## Electronics Research Center, Cambridge, Mass.

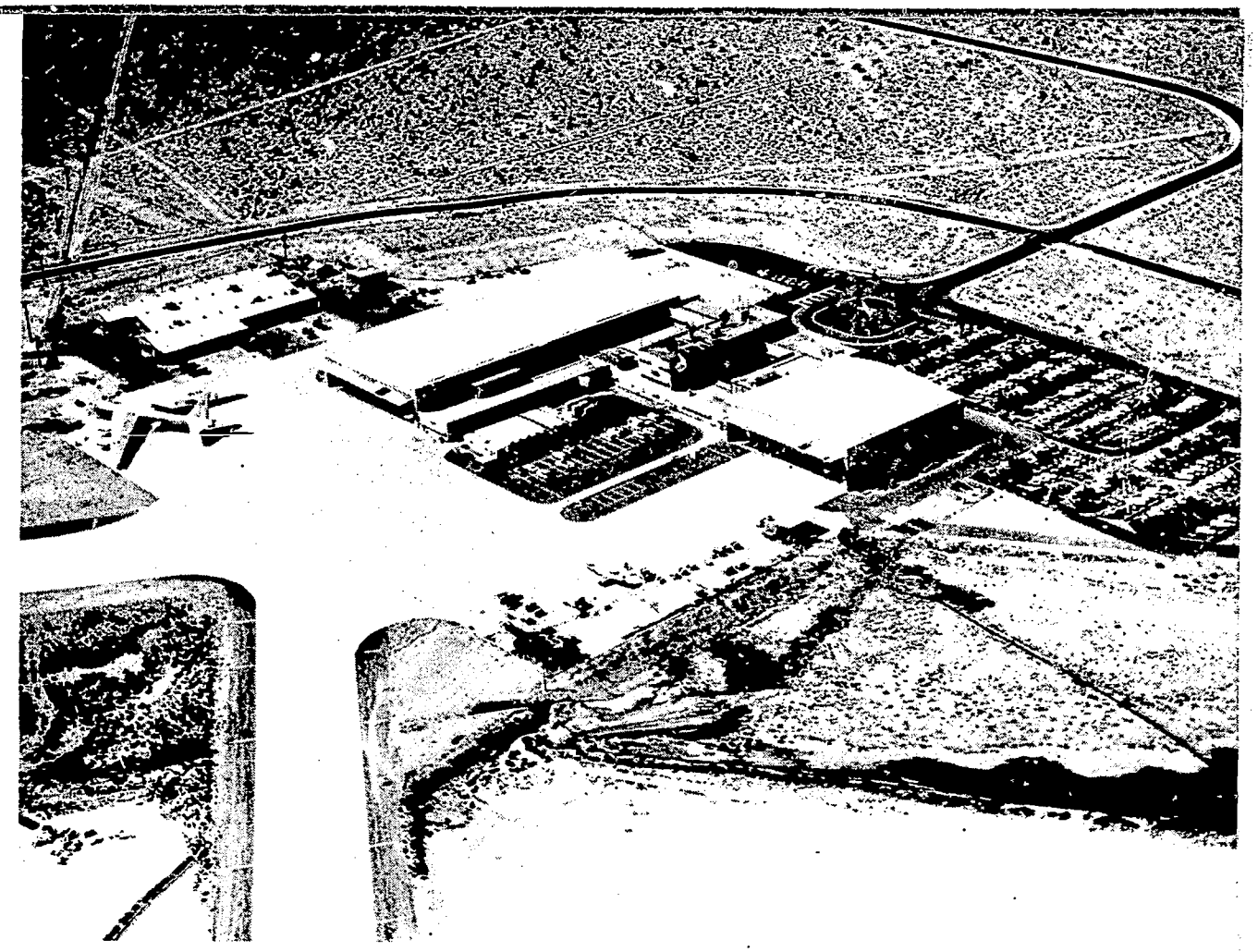
The Electronics Research Center, being built in the Greater Boston area, is the first and only functional Center of its kind. This Center will organize, sponsor, and conduct comprehensive programs of basic and applied research in space and aeronautical electronics. It will be the focal point of the national capability in space and electronics and coordinate nationwide research. Areas of research include control and guidance, electronics components, instrumentation, computer application, microwave radiation, optical communications systems, technology information and utilization, and other related electronics technology.

## Flight Research Center, Edwards, Calif.

The mission of the Flight Research Center is the conduct of research on flight, and the problems of manned flight, both within and outside the atmosphere. The work includes effort on problems of takeoff and landing, low-speed flight, supersonic and hypersonic flight, and reentry, in order to verify predicted characteristics and to identify unexpected problems in actual flight.

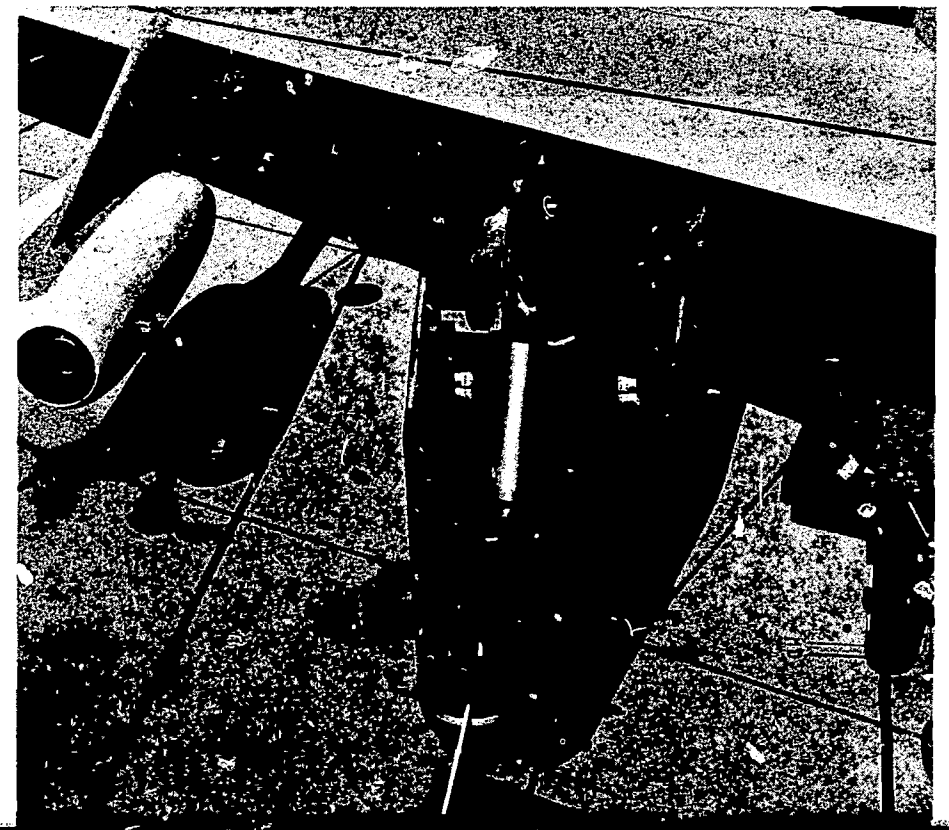
The major programs at Flight Research Center include aeronautics projects in which the problems of the X–15, supersonic transport, and hypersonic cruise are investigated; and space vehicle systems projects, in which the flight behavior of advanced reentry vehicles such as lifting bodies is studied. Investigations and flight testing of electronic systems are carried out, including problems of display, guidance, and control in advanced flight missions. In the area of biotechnology, man machine integration problems are studied both in the laboratory and in flight. The Center also maintains a program of continual improvements on systems and sensors used in tracking and data acquisition. Support of the manned flight program is provided to Project Apollo through effort on such projects as the lunar landing research vehicle.

The Flight Research Center has a number of facilities and special equipment for conducting these investigations. Most important are the aircraft, such as the X–15 rocket aircraft used for hypersonic research and reentry investigation. As required, special purpose



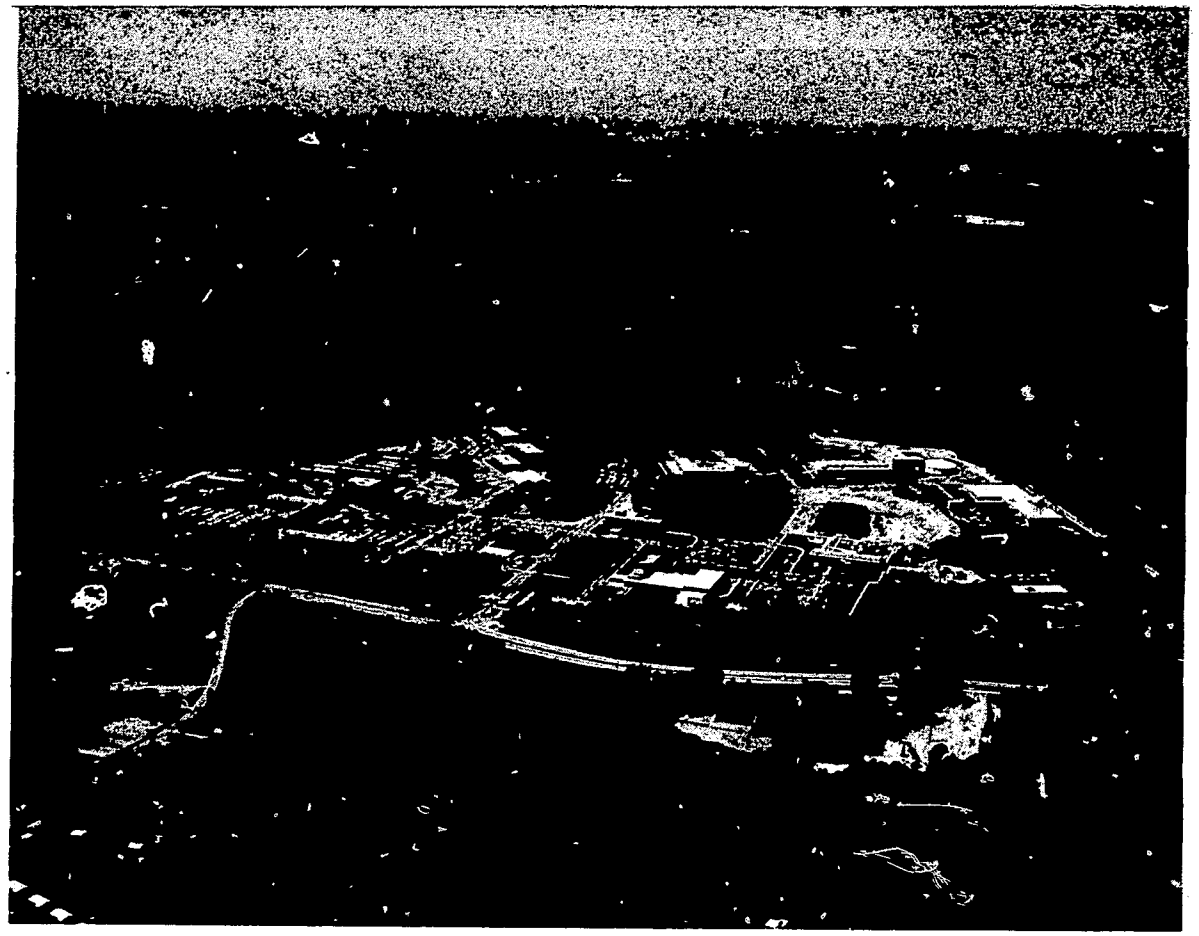
Flight Research Center

Lifting Body Research



vehicles such as paragliders, variable stability aircraft, or airborne simulators are obtained from contractors or developed in-house. Specialized laboratory facilities are available to complement the flight activities with proper preliminary research and testing. As an example, a high temperature loads vibration facility is available for full scale structural and heating tests. Simulation equipment is used to guide and assist in the performance of productive flight activities. A three station radar range is operated to support the flight activity. Technical experts in the fields of flight research, aerodynamics, loads and structures, thermodynamics, biotechnology, and electronics comprise the staff.

The Flight Research Center is located at Edwards Air Force Base, Edwards, Calif., 100 miles northeast of Los Angeles, approximately 35 miles northeast of Lancaster, Calif.



Goddard Space Flight Center

## Goddard Space Flight Center, Greenbelt, Md.

The Goddard Space Flight Center was the first major U.S. laboratory established solely for the investigation and peaceful exploration of space. Located on a 550-acre site in Greenbelt, Md., its staff numbers more than 3,800.

The Center conducts and is responsible for unmanned spacecraft and sounding rocket experiments in basic and applied research. Active programs are underway in the following scientific disciplines: aeronomy, energetic particles and fields, ionospheric physics, astronomy, planetary atmospheres, geophysics, and solar physics. In the area of applied sciences the Center has been given the mission of developing meteorological and communication satellites including the TIROS, NIMBUS, RELAY, SYNCOM, and advanced technology satellites.

Due to the extremely varied nature of the projects at Goddard, the Center has developed a wide range of talents and capabilities. It is in fact one of the few installations in the world capable of conducting a full-range space science experimentation program. This

Langley Research Center

involves carrying a concept from the initial planning . . . to experiment and spacecraft system design and engineering . . . to spacecraft tracking . . . to data acquisition and data reduction . . . and finally to analysis and publication of the results.

To implement this capability, Goddard has two worldwide satellite tracking, data acquisition, and data-reduction networks. These are the Space Tracking and Data Acquisition Network (STADAN) and the Manned Space Flight Network (MSFN). In addition, Goddard manages the development of NASA's Delta rocket and operates the Institute for Space Studies in New York City as a center for theoretical research.

Established in 1959, the Center was named after America's rocket pioneer, Dr. Robert H. Goddard.

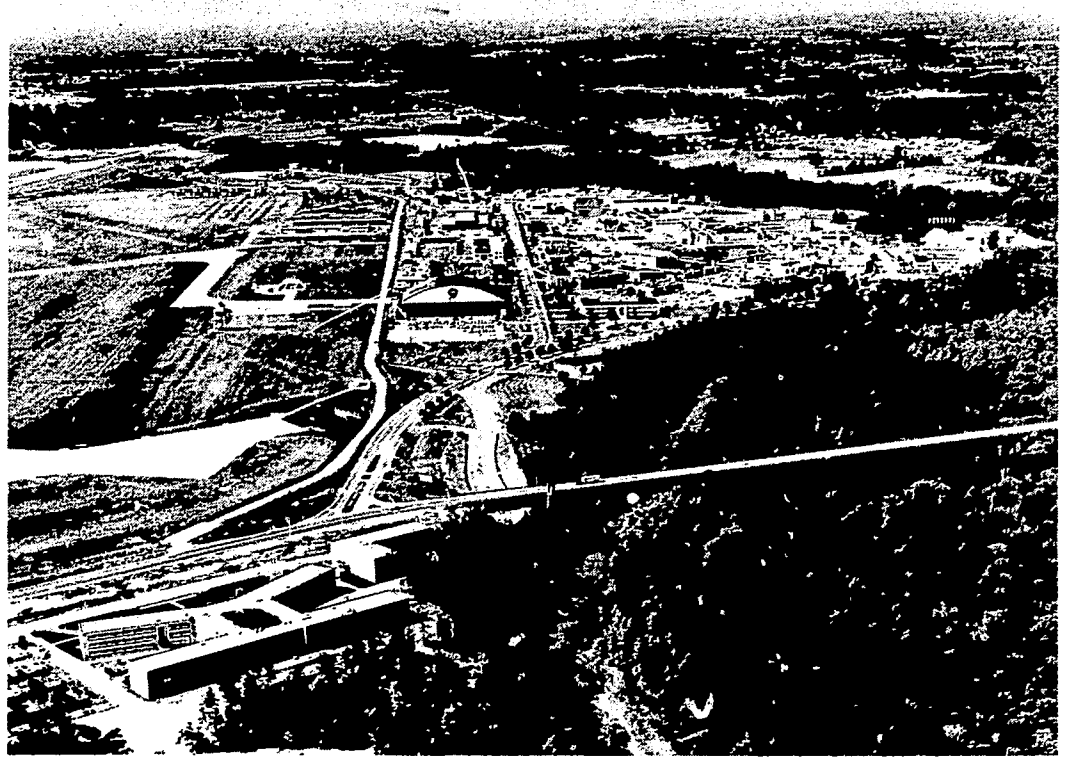
## Langley Research Center, Hampton, Va.

The Langley Research Center, which has been in operation in Hampton, Va., for nearly half a century, is the largest of the NASA centers engaged in basic research for the advancement of aeronautical and space flight.

The 770-acre Center has modern aerospace research facilities. Its unique new specialized laboratories and simulators, many of them the products of the imagination and pioneering technical contributions of the staff, are increasing Langley's capacity for providing the technical background necessary to accomplish NASA aerospace missions.

More specifically, the experimental and theoretical research at Langley is conducted in a variety of fields including space mechanics to determine nominal or optimum trajectories for different space missions, guidance and navigation techniques, propulsion requirements, methods of rendezvous in space, studies of space vehicle control and orientation, simulation studies of control, guidance, and navigation in manned space missions, human response and man machine integration, life support systems, power systems, thermal control sys-

tems, and communication and data processing systems, launch vehicle dynamics, ablation methods, reentry cooling, oxidation and emissivity of materials, refractory materials, structures of spacecraft and aircraft, hypersonic aerodynamics including real gas effects, heat transfer and boundary layer behavior, novel vehicle concepts, investigation of the problems of the supersonic transport, helicopter and low speed aircraft, magnetoplasmadynamics, instrumentation development, microminiaturization techniques, electronics, communications, vehicle environmental factors such as noise and vibration, computer theory, and development of advanced research facilities, models, space systems, and related equipment.



Lewis Research Center

## Lewis Research Center, Cleveland, Ohio

On a 350-acre site adjacent to the Cleveland Hopkins Airport, NASA has concentrated its main complex for research and development in advanced propulsion and space power systems. Scientists and engineers at this major NASA facility in Ohio play a critical role in conceiving and directing the aerospace propulsion and power generation activities of the Nation's space program.

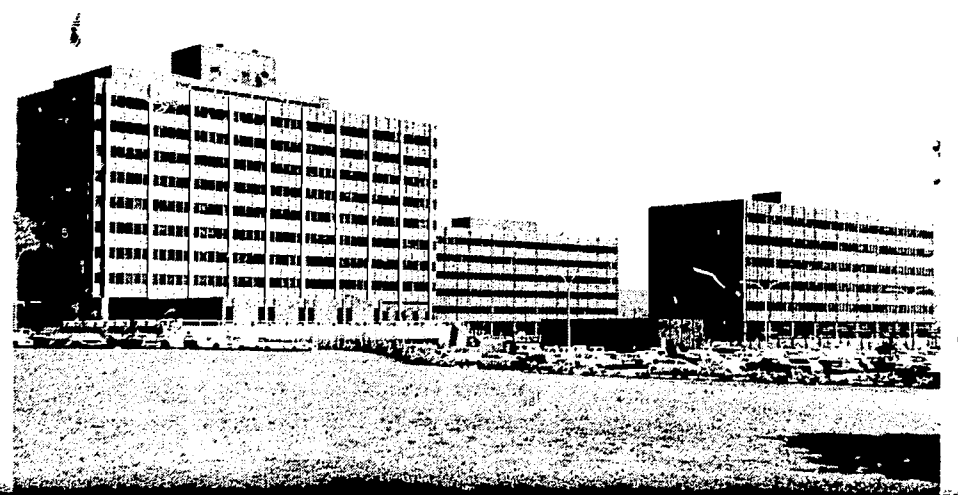
In addition to large-scale research and technology programs on chemical, electric, and nuclear propulsion systems, others on the professional staff are exploring the feasibility of more exotic systems, including those involving thermal and solar energy conversion processes. Important problem areas embrace structures, propellants, fluid systems, materials, controls, effects of space and atmospheric environments, missions, and payloads as they affect powerplant performance.

Complementing its research missions, the Center also has major responsibilities in several development and technology projects in the fields of aerospace propulsion and power. Examples are Project Offices which have management responsibility for intermediate weight launch vehicles for NASA's unmanned scientific programs. This includes Atlas, Atlas-Centaur, and Atlas-Agena vehicles. Responsibility starts with design of the vehicle to meet the needs of the mission, supervision of its construction, and follows through launch up to

injection of the payload into the proper orbit or trajectory. The Center manages numerous advanced technology programs such as for large solid chemical propellant rockets (260-inch diameter) and nuclear power generation systems.

Besides the project offices, Lewis staff members provide substantial backup and technical support for other National efforts such as the supersonic transport, NERVA (Nuclear Engine for Rocket Vehicle Applications), Project Apollo (manned moon landing), and the Saturn launch vehicle.

Lewis scientists and engineers have at their disposal numerous and varied facilities including space environment chambers, ion and plasma jet equipment, materials testing laboratories, supersonic and hypersonic test facilities, and rocket test stands.



Marshall Space Flight Center

Additional large-scale facilities for aerospace propulsion research and development are located at NASA's Plum Brook Station in Sandusky, Ohio. Operated as an arm of the Lewis Research Center, Plum Brook is the site for large-scale testing of nuclear propulsion components in NASA's nuclear test reactor. Full scale static and dynamic tests of complete space vehicles and propulsion components are performed in other facilities located here.

## Marshall Space Flight Center, Huntsville, Ala.

Saturn launch vehicles for the manned Apollo and other extended manned space exploration projects are being developed by the NASA-Marshall Space Flight Center. Named for General George C. Marshall, the Center is NASA's largest installation. It is located at Redstone Arsenal, outside Huntsville, Alabama.

Marshall Center scientists and engineers have designed many of this country's rockets, including the Redstone, Jupiter, Saturn I, Saturn IB and Saturn V. They are presently working on the groundwork for the Apollo Applications effort which will follow the Apollo. The future program will exploit the investment in the Apollo program by applying its wide range of capabilities to a number of other potential missions.

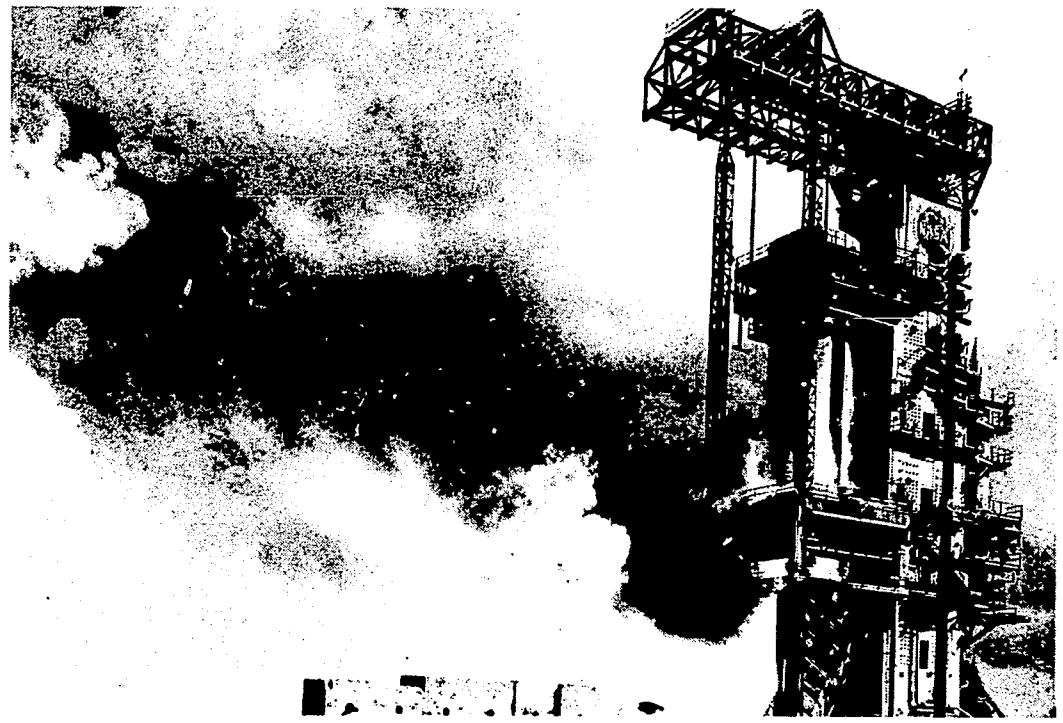
The "Huntsville Team", as the Marshall Center scientists and engineers are called, was responsible, along with the NASA-Jet Propulsion Laboratory, for placing America's first satellite (Explorer I) in orbit. They have also accomplished many other space feats including the successful launching of 10 straight Saturn I rockets.

Marshall earlier had the capability of developing and manufacturing launch vehicles almost singlehandedly within its own facility. This work was done in several major laboratories and manufacturing facilities. To maintain its role in the ever-expanding space exploration picture, the Marshall Center organization has adjusted to a changing role. While the Center still maintains its strength in the technical expertise of the space team built up in its major laboratories over the years, management has taken into account the fact that its space assignments are now too big to be handled in-house by one organization. As a result, work on the Saturn rockets is performed by industry through a series of prime contracts, to a much larger extent than previously.

One of Marshall's two major divisions, the Industrial Operations, directs the industrial contractors responsible for the manufacture of each of the key stages and engines. Industrial Operations includes three program offices, Saturn I/IB, Saturn V and Engine Program. There are also two industrial installations under Industrial Operations direction. They are Michoud Assembly Facility, New Orleans, Louisiana, where large Saturn IB and Saturn V first stages are being assembled, and the Mississippi Test Facility, Bay St. Louis, Mississippi, where static test of Saturn stages will be conducted.

Marshall's second major division is the Research and Development Operations. This division, which has the majority of the Center work force, carries out the in-house development and testing work, much of it in support of Industrial Operations. Eight laboratories are included: Aero-Astrodynamics, Astrionics, Computation, Manufacturing Engineering, Quality and Reliability Assurance, Research Projects, Test and Propulsion and Vehicle Engineering.

Marshall Center's 1,800-acre Redstone Arsenal complex includes extensive engineering, laboratory, fabrication and test facilities. These test facilities include a giant Saturn V S–IC static test stand and a dynamic test facility for the complete Apollo/Saturn V space vehicle.



Launch Vehicle Test

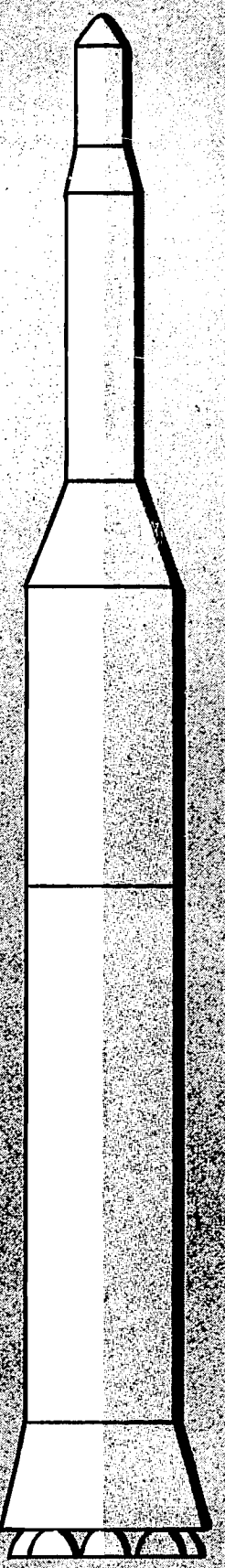
# THE VOLUTION OF BOOSTERS

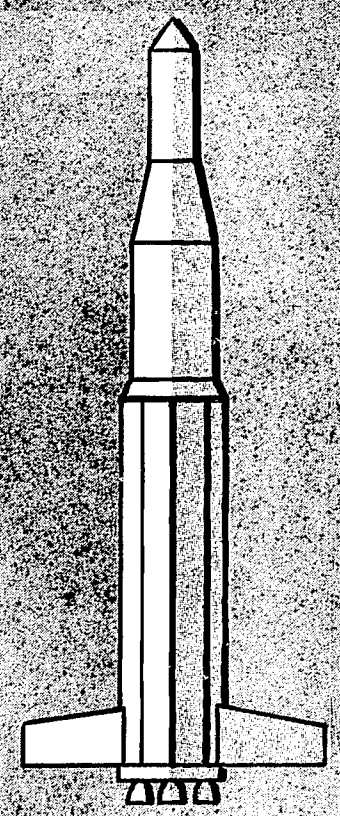
NASA requires launch vehicles of increasingly greater thrust as the man-in-space program progresses. The comparative size and capabilities of present and future launch vehicles for manned flight are shown here. NASA also utilizes a variety of other rockets for unmanned space probes and satellites.

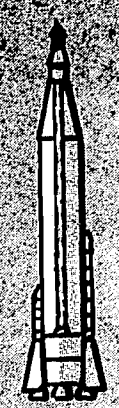
***Saturn V* (manned Apollo flights) . . . 7.5-million pounds of liftoff thrust .**

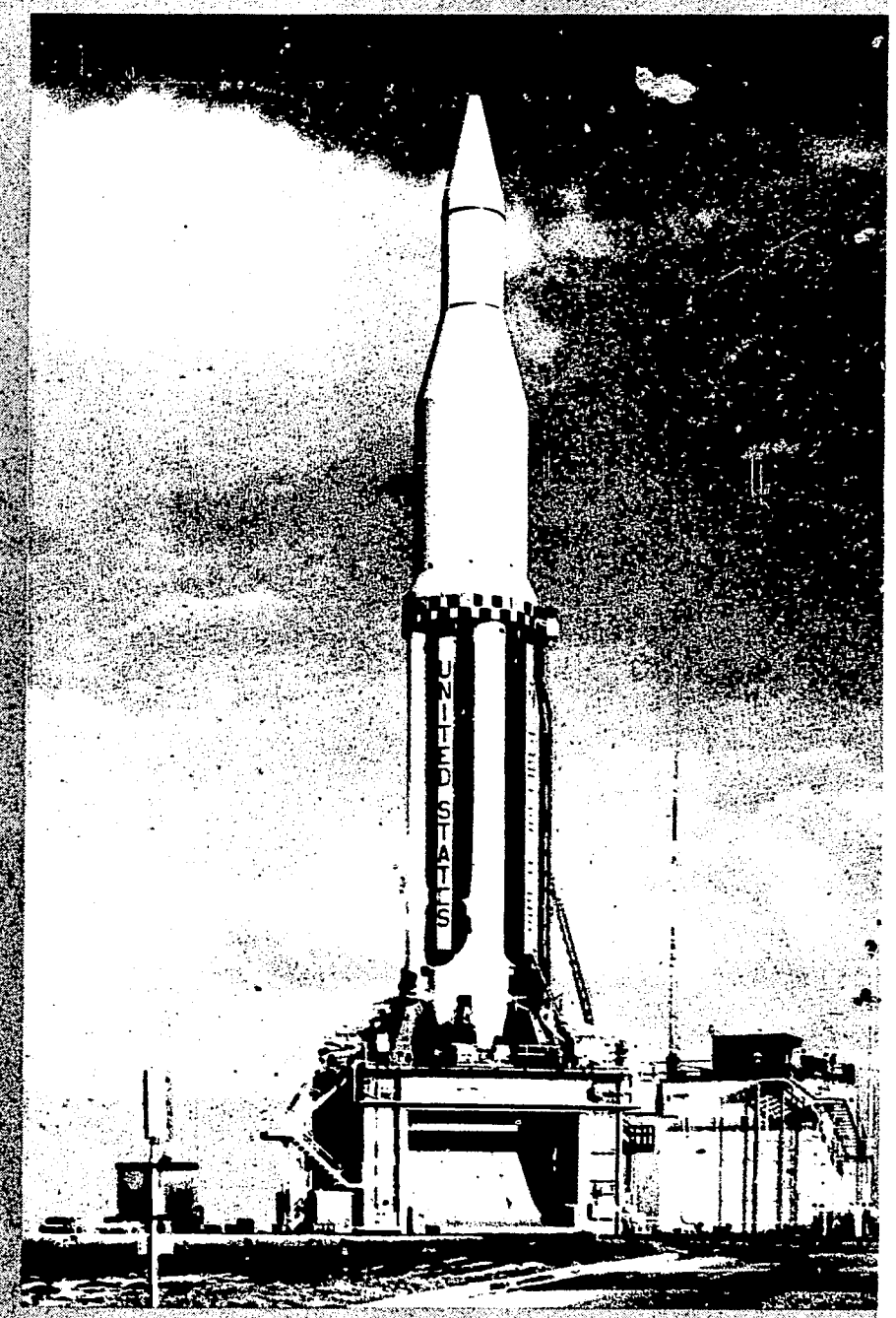
***Saturn I* (earth-orbiting Apollo flights) . . . 1.5-million pounds of liftoff thrust .**

***Atlas D* (used for Mercury flights) . . . 360,000 pounds of liftoff thrust .**

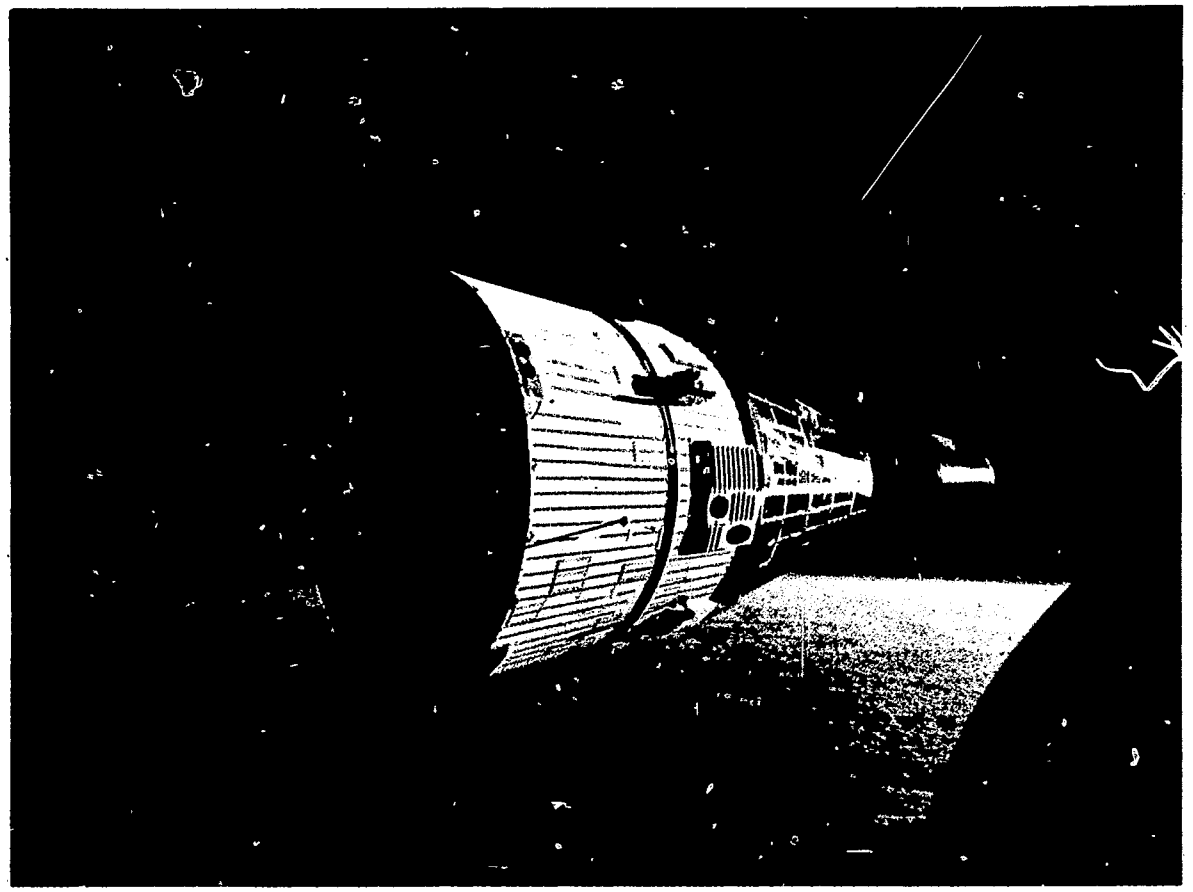









Saturn IB



Rendezvous in Space

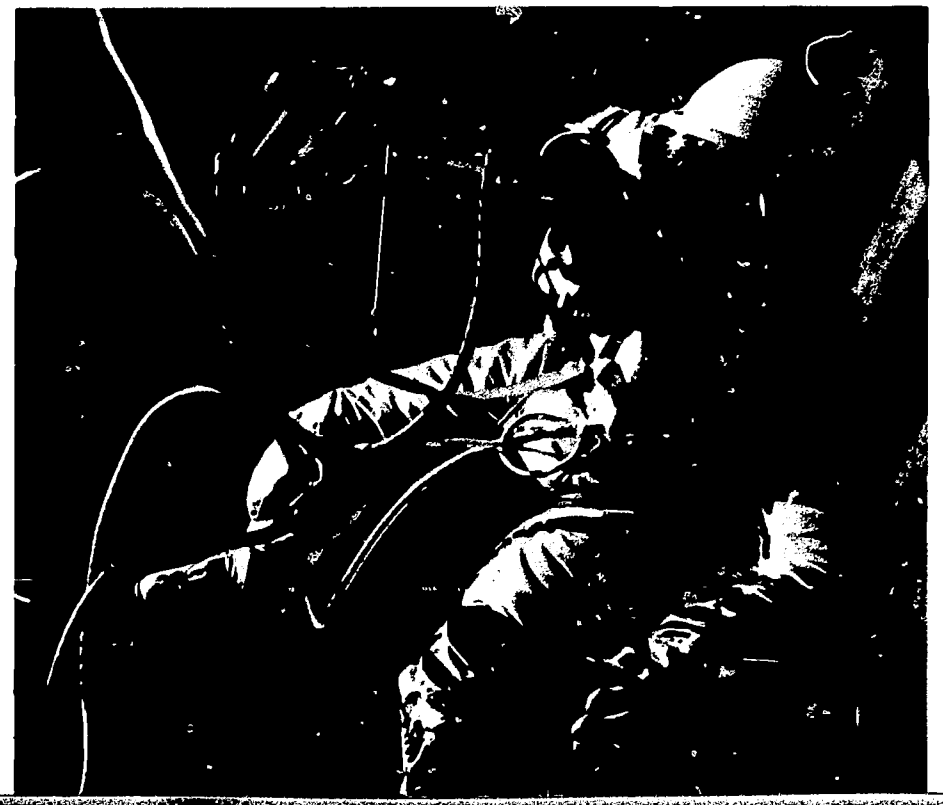
## Manned Spacecraft Center, Houston, Tex.

The Manned Spacecraft Center is a new NASA facility located 20 miles southeast of Houston, Tex., on the edge of Clear Lake. It has the responsibility for the design, development, and testing of manned spacecraft and associated systems, for the selection and training of flight crews (astronauts), and for actual operation of manned space flights.

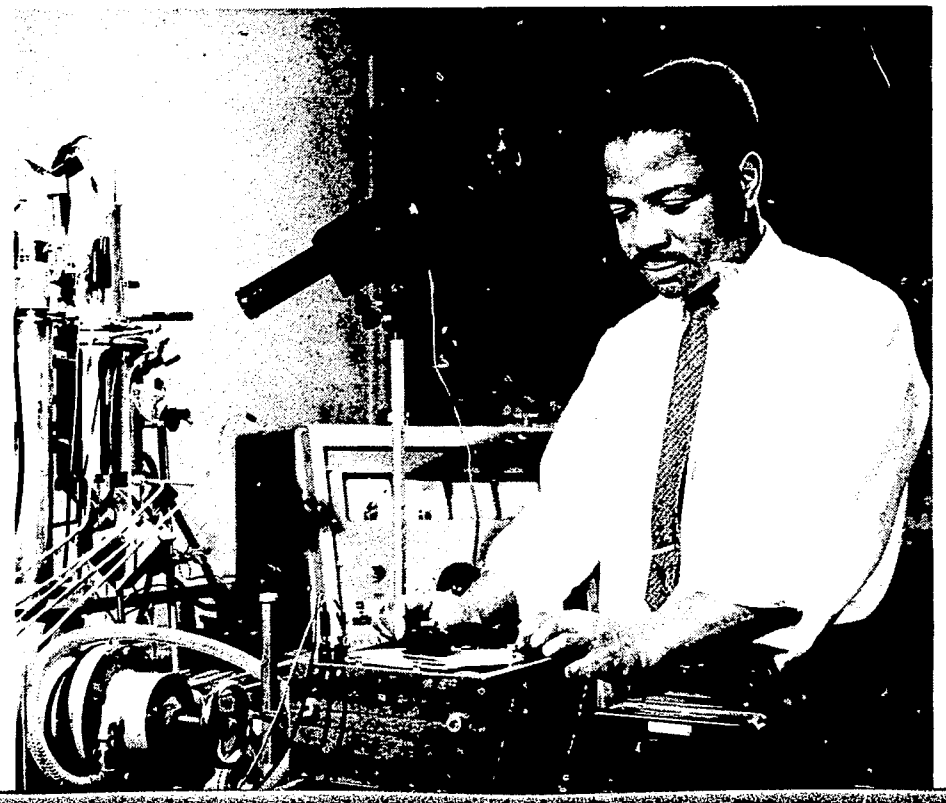
The scientists and engineers who make up the technical staff of the Manned Spacecraft Center were responsible for placing the free world's first man in space. The valuable experience gained by the Mercury team is now being utilized in Projects Gemini and Apollo.

The Gemini Program Office and the Apollo Program Office are integral parts of the Manned Spacecraft

Walk in Space



Aerospace Research



Center. These two program offices have the prime management responsibility for the United States two- and three-man space exploration programs. In support of these space flight programs the Manned Spacecraft Center has three major technical sectors—Engineering and Development, Operations, and Flight Crew Support. Engineering and Development includes guidance and control, structures and mechanics, crew systems, instrumentation and electronic systems, and computation and data reduction. Operations include flight control, recovery operations, and mission analysis. Flight Crew Support includes the astronaut office and aircraft operations office. In addition to these technical sectors there is the administrative directorate which supports all the technical sectors.

For testing of spacecraft the Manned Spacecraft Center has flight test facilities and personnel at Cape Kennedy, Florida and static test facilities at White Sands Missile Range, New Mexico.

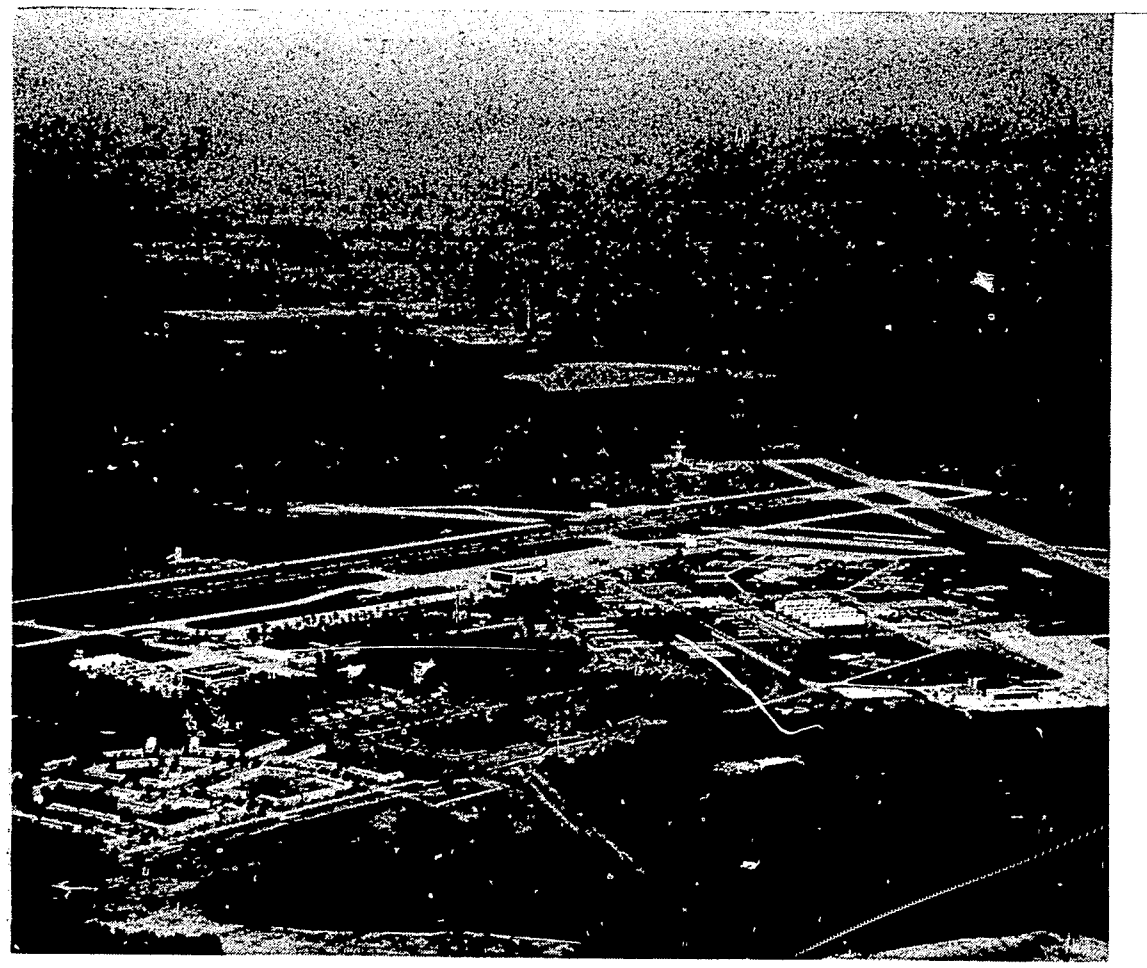
Although the spacecraft are launched from Cape Kennedy, Florida, the space flights are controlled from the Mission Control Center located at Houston, Texas.

Manned Spacecraft Center

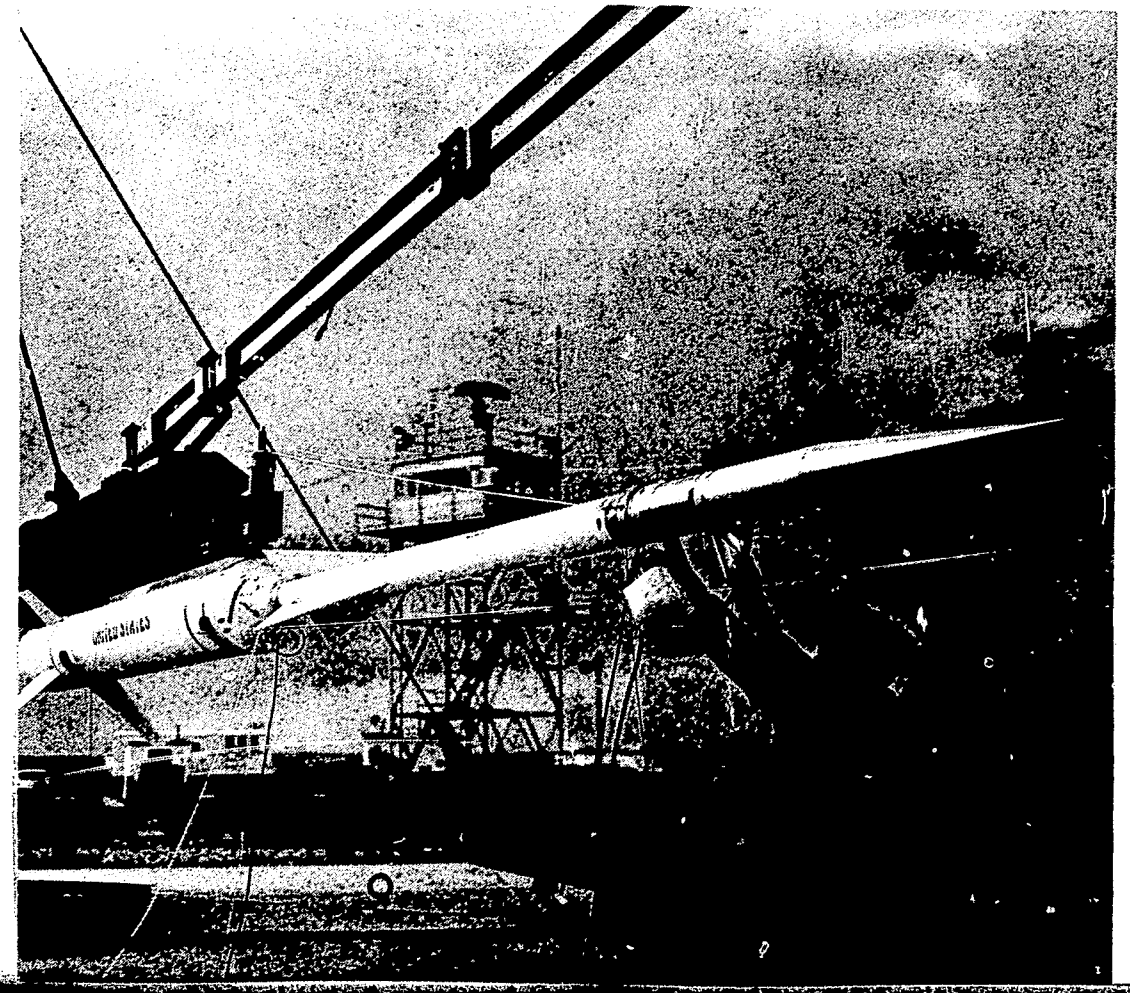
## John F. Kennedy Space Center, NASA
## Kennedy Space Center, Fla.

The John F. Kennedy Space Center, NASA (KSC), is the field installation of the National Aeronautics and Space Administration responsible for assembly, integration, preflight testing, preparation, flight readiness, and launch of manned and unmanned space vehicles. These include manned Gemini and Apollo missions; unmanned lunar, planetary, and interplanetary mis-

John F. Kennedy Space Center



Wallops Station



Sounding Rocket

sions; and scientific, meteorological, and communications satellites. The vehicles are launched by KSC on behalf of the various program offices of the development Centers of NASA.

Kennedy Space Center's facilities include Complex 39 from which the Apollo-Saturn V manned lunar exploration missions will be launched. In addition to launching NASA vehicles at the Eastern Test Range at Cape Kennedy, KSC also launches NASA vehicles from the Western Test Range in California.

## Wallops Station, Wallops Island, Va.

Wallops Station is an operational base for launching vehicles as a part of scientific experiments. The rocket-borne experiments launched from the Wallops Island Range are planned by scientists and engineers in the laboratories and research centers of NASA, other Government agencies, colleges and universities, and the world-wide scientific community. Wallops Station personnel assist the teams of experimenters in these functions and, if necessary, develop special types of instrumentation and equipment needed to complement a payload. However, the basic mission of Wallops Station is to prepare, assemble, and launch an experimental payload; position it correctly in space at the right velocity; track it; and acquire meaningful data.

## Additional NASA Installations

The NASA Western Support Office, Santa Monica, Calif., is the coordinating and liaison office for the southern California aircraft and the aerospace industry area. The work includes negotiation and administration of contracts and technical monitoring of NASA contract activities with the aerospace industry.

# SPECIALTIES OF AERO-SPACE TECHNOLOGY (AST)

## in Physical Sciences Engineering, Mathematics and Life Sciences

These specialties represent NASA's work as of the date of this announcement, but due to the rapidly changing frontiers of aerospace technology they are subject to change. When a new specialty is recognized, applications already on file will be reviewed, and qualified candidates will be given eligibilty for the new specialty. The NASA Boards of Examiners will maintain lists of eligibles only for those specialties for which a need exists at the NASA installations they service. (See inside front cover to determine location of positions.) The first specialty in each field is of a broad general nature including aspects of some or all of the other specialties in that field. Lists of eligibles for positions in Grades GS–5 and 7 are maintained only in the broad specialties.

Lists of eligibles for Grades GS–9 through 15 are maintained in the broad specialties as well as for the more specialized positions.

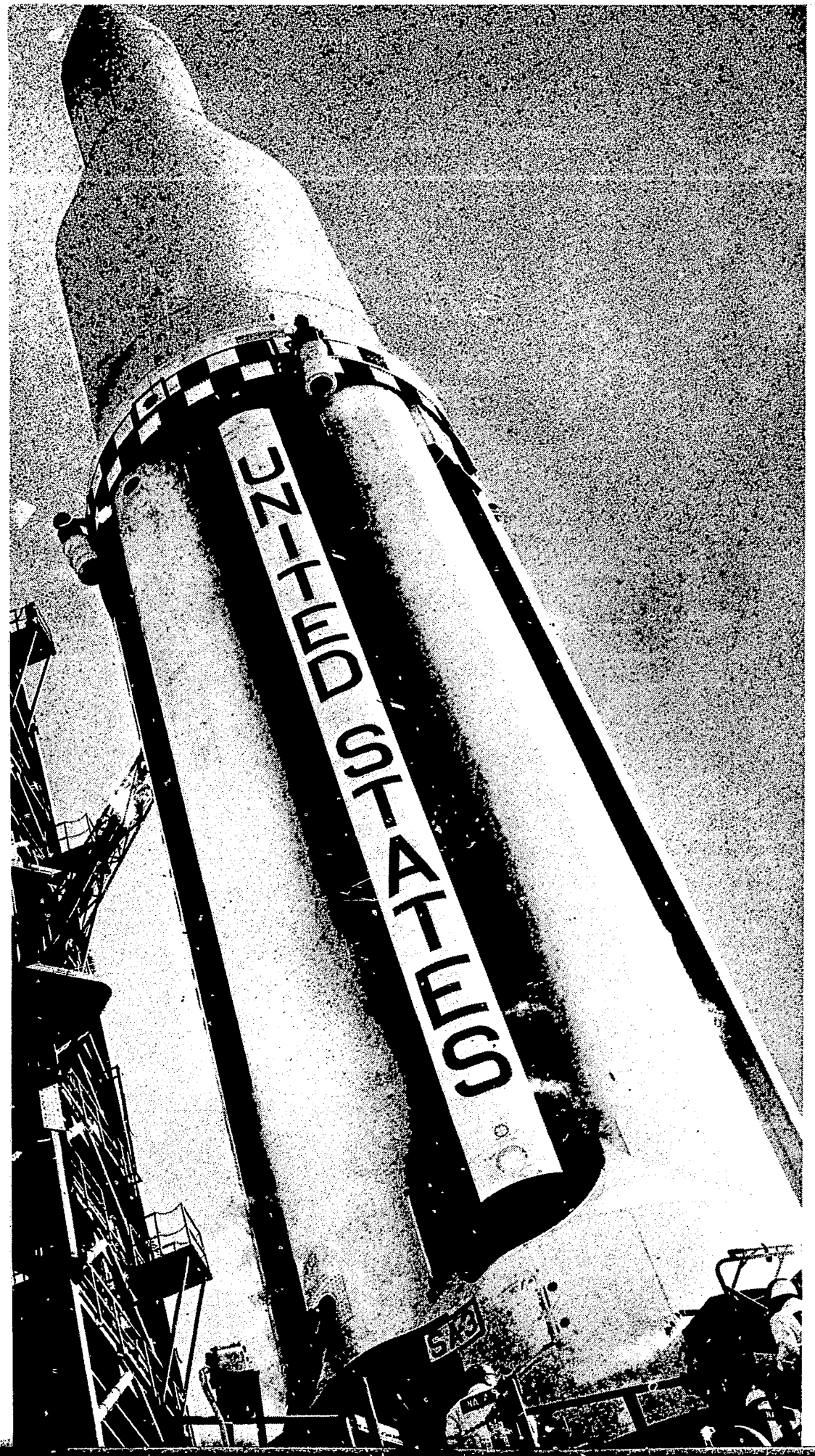
• *Space Sciences* includes positions engaged in the study and investigation of atmospheres and space phenomena, the heavenly bodies and their characteristics, astrophysics, and celestial mechanics. The following specializations are included in the group:

*Aeronomy* ☐ *Ionospheres* ☐ *Fields and Particles* ☐ *Stellar Studies* ☐ *Lunar and Planetary Studies* ☐ *Meteroid Studies* ☐ *Solar Studies*

Any of the undergraduate majors provided in the Basic Education Requirement (see p. 25) is acceptable for applicants with the required graduate study and/or professional experience that is closely related to one of these specialties.

Required college majors for applicants qualifying on the basis of undergraduate education only: Physics, astronomy, meteorology, geology, geophysics, astrophysics, or other appropriate field of basic physical science applicable to a specialty of AST Space Sciences, including or supplemented by at least one physics or engineering laboratory course in electronics, optics, materials, vibration, high-vacuum theory, heat transfer, or comparable field relating to aerospace instrumentation.

• *Fluid and Flight Mechanics* includes positions concerned with the study and investigation of dynamics of aerospace vehicle flight and the establishment of criteria for aerospace vehicle design based upon the dynamics of flight. These positions may also be concerned with the investigation of the interaction of the vehicle in flight and the environment. Positions are also engaged




Saturn I

in research, development, design, test, and evaluation of systems to guide and control the aerospace vehicle in flight. Specializations in this Group are:

*Flight Mechanics* ☐ *Control and Guidance Systems* ☐ *Fluid Mechanics* ☐ *Magnetofluid-dynamics* ☐ *Aerostructural Dynamics* ☐ *Flight Vehicle Acoustics* ☐ *Heat Transfer* ☐ *Stability, Control and Performance* ☐ *Flight Vehicle Atmosphere Environment* ☐ *Basic Properties of Gases*

Any of the undergraduate majors provided in the Basic Education Requirement (see p. 25) is acceptable for applicants with the required graduate study and/or professional experience that is closely related to one of these specialties.

Required college majors for applicants qualifying on the basis of undergraduate education only: Engineering physics, engineering mechanics, astronautics, aeronautical engineering, mechanical engineering, physics (except major nuclear physics), electrical engineering (except major in production, transmission, and use of large scale industrial electric power), or other appropriate field of physical science or engineering; or major in mathematics supplemented by at least 18 semester hours in some combination of appropriate physical science or engineering courses.

- *Materials and Structures* includes positions engaged in research, development, design, test and evaluation of aerospace flight vehicle structures and the study of their behavior in the advanced aerospace flight regimes. These positions are also engaged in research into the

behavior and characteristics of materials for use in flight vehicles and systems for the purpose of developing and using them for aerospace systems. Included in this group are the following specialties:

*Materials* ☐ *Structural Materials* ☐ *Aerospace Metals* ☐ *Basic Properties of Materials* ☐ *Aerospace Polymers* ☐ *Refractory Compounds* ☐ *Friction and Lubrication* ☐ *Structural Mechanics* ☐ *Flight Structures*

Any of the undergraduate majors provided in the Basic Education Requirement (see p. 25) is acceptable for applicants with the required graduate study and/or professional experience that is closely related to one of these specialties.

Required college majors for applicants qualifying on the basis of undergraduate education only: Ceramics or ceramic engineering (if 12 semester hours in refractory ceramics, cermets, protective coatings), metallurgy or metallurgical engineering (if 12 semester hours of physical or adaptive metallurgy, high-temperature metals and alloys, cermets), physics, engineering physics, aeronautical engineering, mechanical engineering, civil engineering (if 12 semester hours in strength of materials, structures, thermodynamics), chemistry, or other appropriate field of physical science or engineering; or major in mathematics supplemented by at least 18 semester hours in some combination of physics, structures, materials, thermodynamics, or other appropriate courses. In addition for Basic Properties of Materials: at least one course in atomic or nuclear physics.

• *Propulsion Systems* includes positions engaged in the research, development, design, test and evaluation of aerospace propulsion systems and systems for conversion of energy into power for aerospace systems. Specializations in this group are:

*Liquid Propulsion Systems* ☐ *Solid Propulsion Systems* ☐ *Electrical Propulsion and Power* ☐ *Direct Energy Conversion* ☐ *Nuclear Energy Processes* ☐ *Nuclear Propulsion and Power* ☐ *Chemical Energy Processes* ☐ *Internal Flow Dynamics*

Any of the undergraduate majors provided in the Basic Education Requirement (see p. 25) is acceptable for applicants with the required graduate study and/or professional experience that is closely related to one of these specialties.

Required college majors for applicants qualifying on the basis of undergraduate education only: Chemical engineering, chemistry, nuclear engineering, electrical engineering (if included at least one course in thermodynamics or nuclear physics), engineering physics, engineering mechanics, physics (classical or nuclear), aeronautical engineering, mechanical engineering, astronautics, or other appropriate field of physical science or engineering; or major in mathematics supplemented by at least 18 semester hours in some combination of physics, thermodynamics, chemistry, or closely related fields.

• *Flight Systems* includes research, development, design, test, and evaluation of aerospace flight systems and subsystems. Positions in this specialty are concerned with systems integration, reliability studies, evaluation of systems and subsystems design and performance characteristics. Included in the specialty are positions performing research, development, and evaluation of manufacturing and quality assurance programs for aerospace flight systems and subsystems. The following specializations are included in this group:

*Reliability* ☐ *Flight Systems Test* ☐ *Experimental Manufacturing Techniques* ☐ *Quality Assurance* ☐ *Electrical Systems* ☐ *Manned Space Flight Systems (at Headquarters, NASA only)*

Any of the undergraduate majors provided in the Basic Education Requirement (see p. 25) is acceptable for applicants with the required graduate study and/or professional experience that is closely related to one of these specialties.

Required college majors for applicants qualifying on the basis of undergraduate education only: Physics, engineering mechanics, engineering physics, aeronautical engineering, electrical engineering, mechanical engineering. Majors in electronics, mathematics, chemistry, ceramic engineering, chemical engineering, and electronic engineering must be supplemented by at least 9 semester hours in some combination of machine design, mechanics, hydraulics, dynamics, thermodynamics, mechanical design or mechanical measurements.



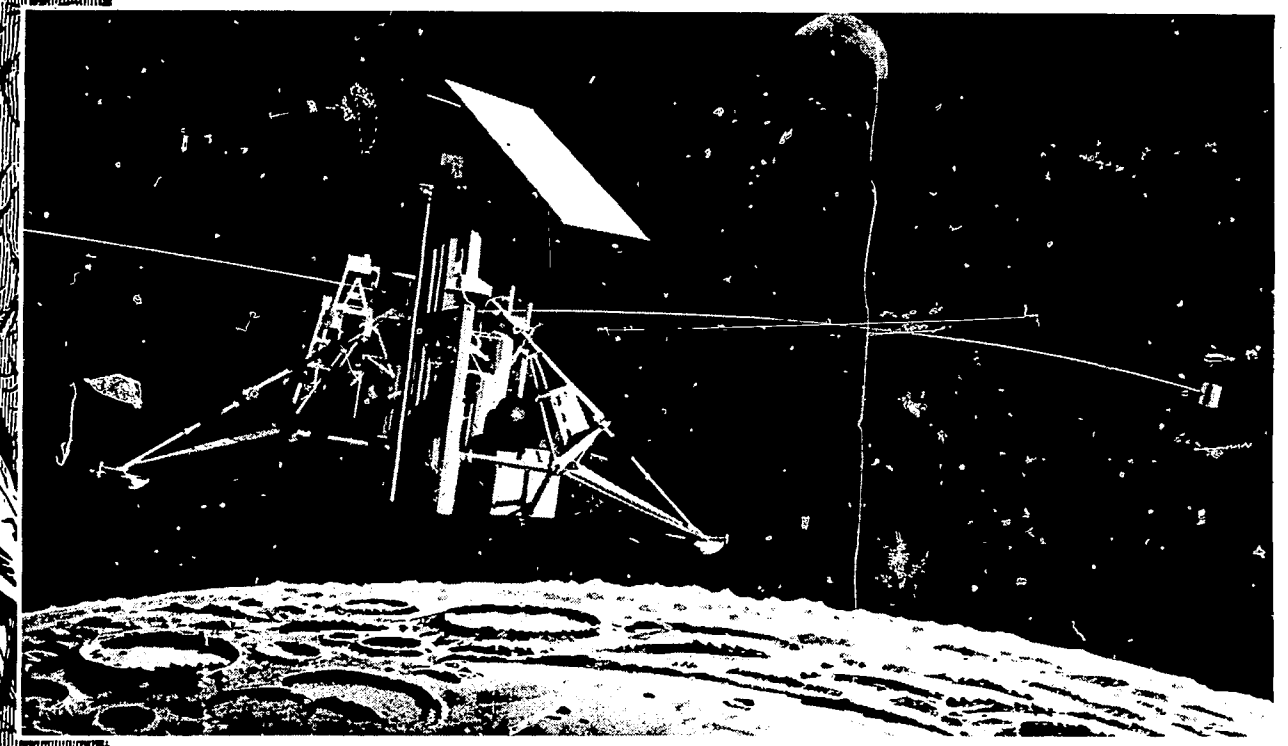
• *Measurement and Instrumentation Systems* includes positions in research, development, design, test and evaluation of equipment and systems to measure and record aerospace physical phenomena and information and to control environments and processes by means of various types of instrumentation e.g., electrical, electronic, mechanical, and combinations. This work includes tracking systems, telemetry, radio, optical, and mechanical systems and subsystems. Included in the group are:

*Sensors and Transducers* ☐ *Space Optics* ☐ *Measurement Standards and Calibration* ☐ *Control Systems* ☐ *Tracking and Telemetry Systems* ☐ *Antennas* ☐ *Telemetery Systems* ☐ *Tracking Systems* ☐ *Tele-Communications* ☐ *Electronics of Materials*

Any of the undergraduate majors provided in the Basic Education Requirement (see p. 25) is acceptable for applicants with the required graduate study and/or professional experience that is closely related to one of these specialties.

Required college majors for applicants qualifying on the basis of undergraduate education only: Electronics, electronic engineering, electrical engineering (except major in production and use of large scale industrial power), physics, engineering physics, mechanical engineering, or other appropriate field of physical science or engineering. Such major should have included at least two of the following courses: solid state physics, materials, optics, statics and dynamics, electricity and elec-

Weightlessness as portrayed in 1865 Jules Verne's "From the Earth to the Moon"



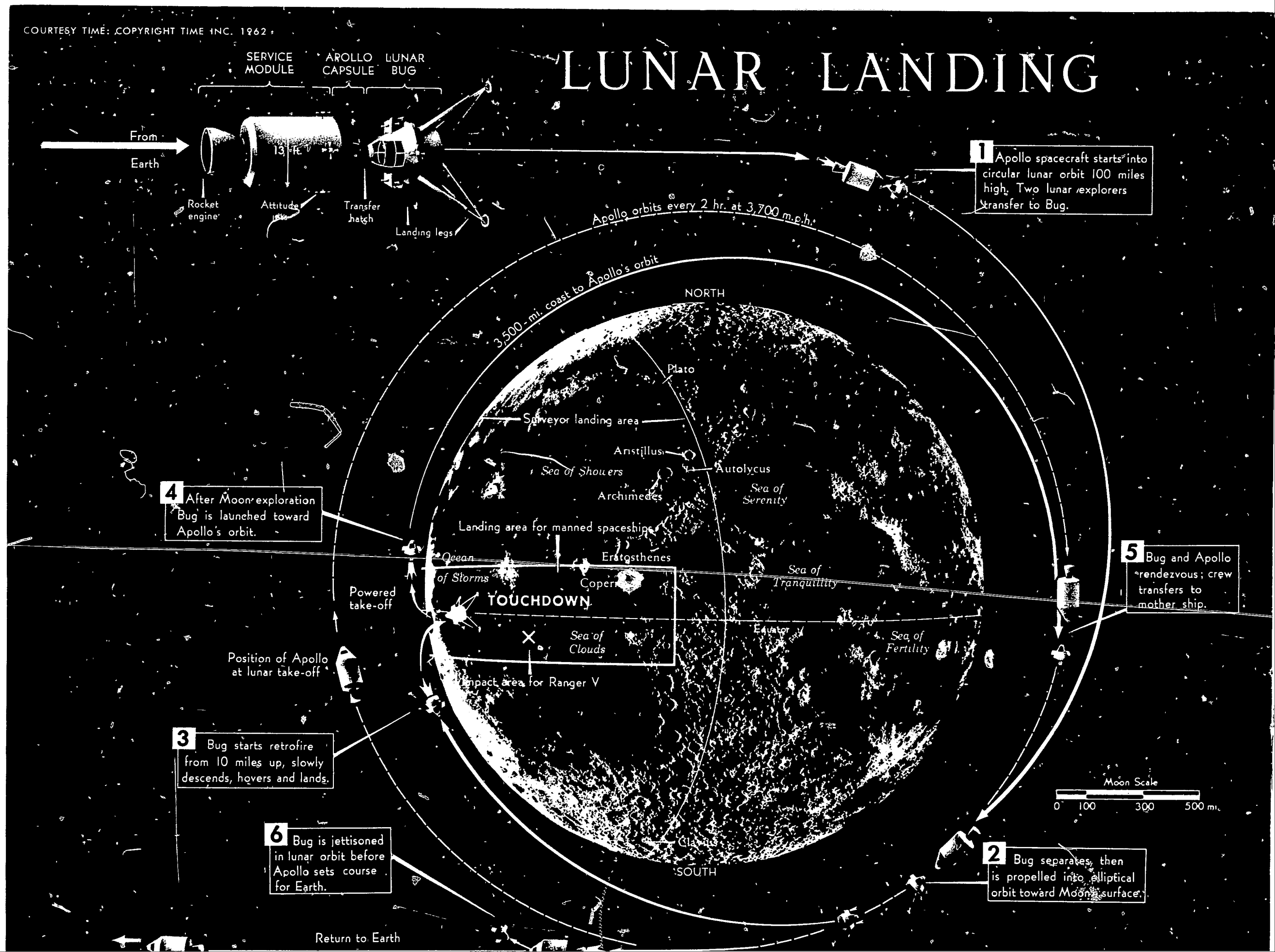
Surveyor Lunar Spacecraft

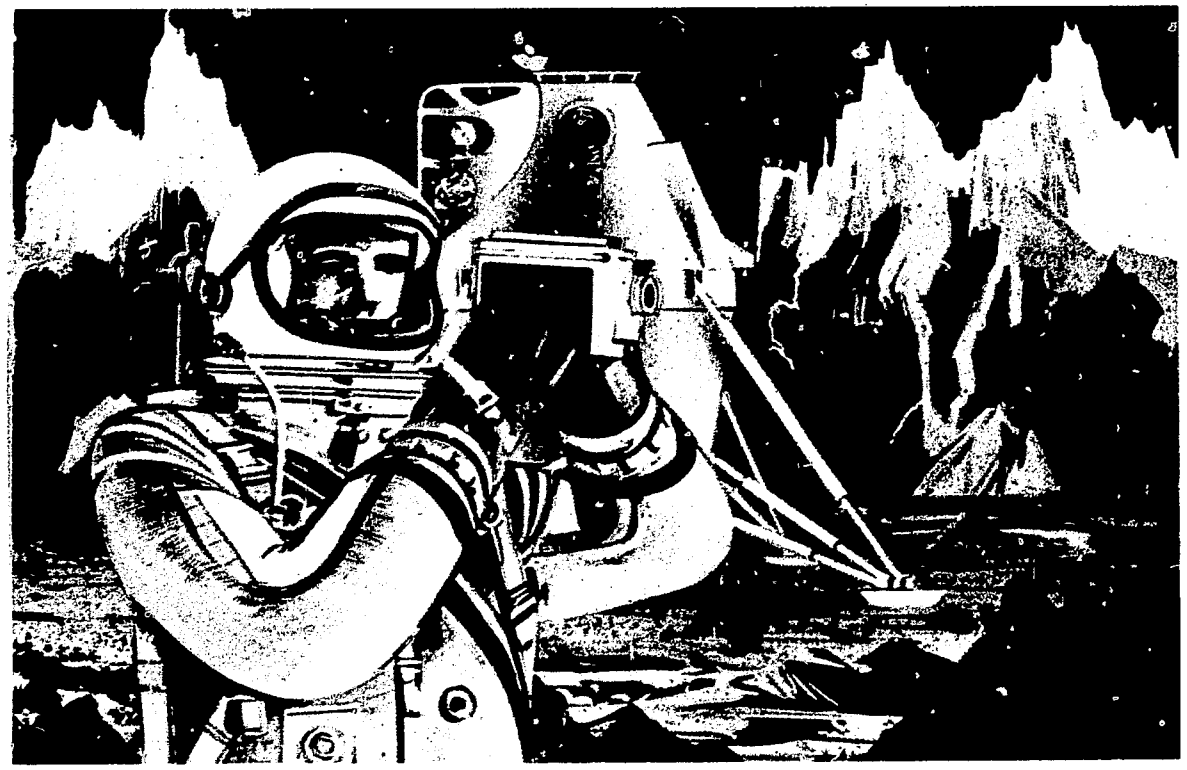
tronics, electron optics, kinetic theory of gases, heat transfer, electromagnetic propagation or radiation, semiconductors, vibration, high-vacuum theory, information theory.

- *Data Systems* includes positions in research, development, design, test and evaluation of equipment and systems for recording, handling and computing aerospace data by use of mathematical and numerical techniques and methods. Also included are positions concerned with the use of mathematics and numerical analysis to compute or simulate aerospace problems. The specializations in this group are:

  *Data Analysis* ☐ *Data Equipment* ☐ *Theoretical Simulation Techniques*

Any of the undergraduate majors provided in the Basic Education Requirement (see p. 25) is acceptable


COURTESY TIME: COPYRIGHT TIME INC. 1962
LUNAR LANDING
SERVICE MODULE
APOLLO CAPSULE
LUNAR BUG
From Earth
13 ft.
Rocket engine
Attitude jets
Transfer hatch
Landing legs
1 Apollo spacecraft starts into circular lunar orbit 100 miles high. Two lunar explorers transfer to Bug.
Apollo orbits every 2 hr. at 3,700 m.p.h.
3,500-mi. coast to Apollo's orbit
NORTH
Plato
Surveyor landing area
Aristillus
Autolycus
Sea of Showers
Archimedes
Sea of Serenity
Landing area for manned spaceships
Eratosthenes
Ocean of Storms
Copernicus
Sea of Tranquillity
TOUCHDOWN
Sea of Clouds
Equator
Sea of Fertility
Impact area for Ranger V
Tycho
SOUTH
4 After Moon exploration Bug is launched toward Apollo's orbit.
Powered take-off
Position of Apollo at lunar take-off
3 Bug starts retrofire from 10 miles up, slowly descends, hovers and lands.
6 Bug is jettisoned in lunar orbit before Apollo sets course for Earth.
5 Bug and Apollo rendezvous; crew transfers to mother ship.
Moon Scale
0 100 300 500 mi.
2 Bug separates, then is propelled into elliptical orbit toward Moon's surface.
Return to Earth



Lunar Exploration

Inside Apollo Mock-Up

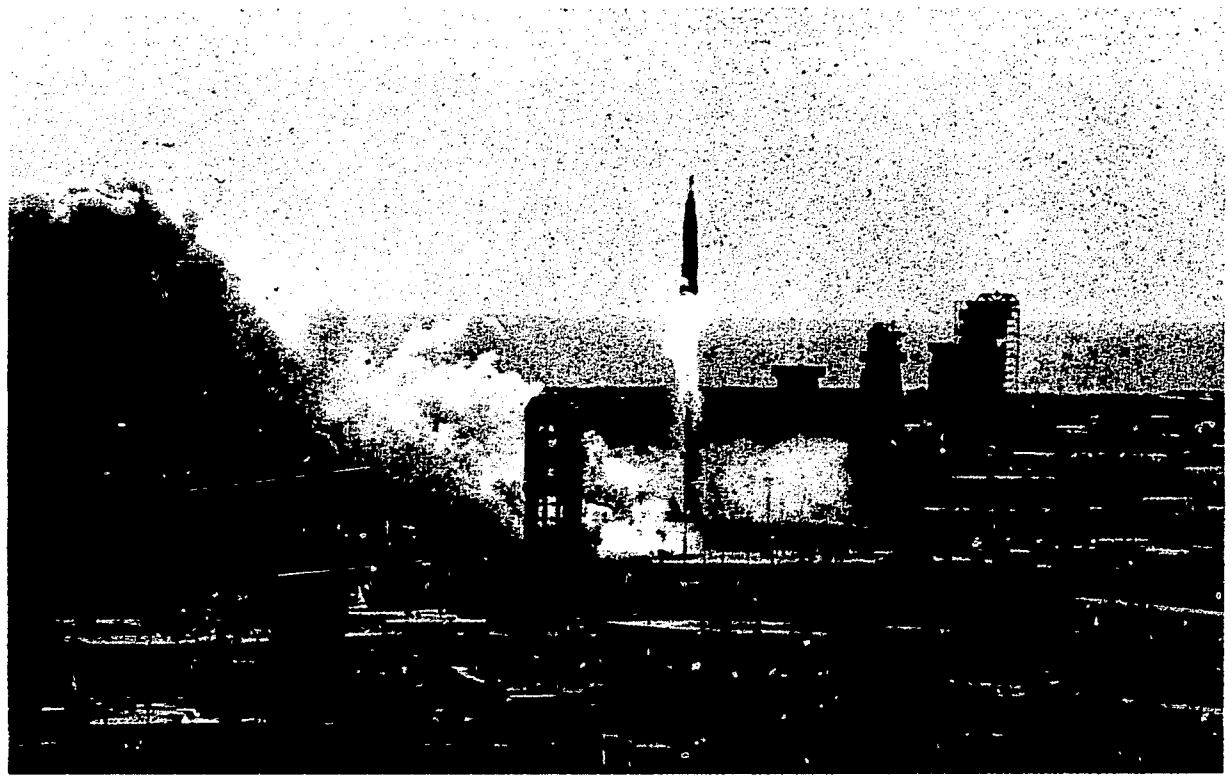
for applicants with the required graduate study and/or professional experience that is closely related to one of these specialties.

Required college majors for applicants qualifying on the basis of undergraduate education only: Either (*a*) a major in mathematics supplemented by at least 12 semester hours in some combination of appropriate physical science or engineering courses; or (*b*) a major in physical science or engineering including or supplemented by at least 6 semester hours of mathematics beyond calculus. Included or in addition, applicants must have had at least two courses in subjects closely related to data systems (such as computing systems, digital logic, analog systems) or data systems equipment.

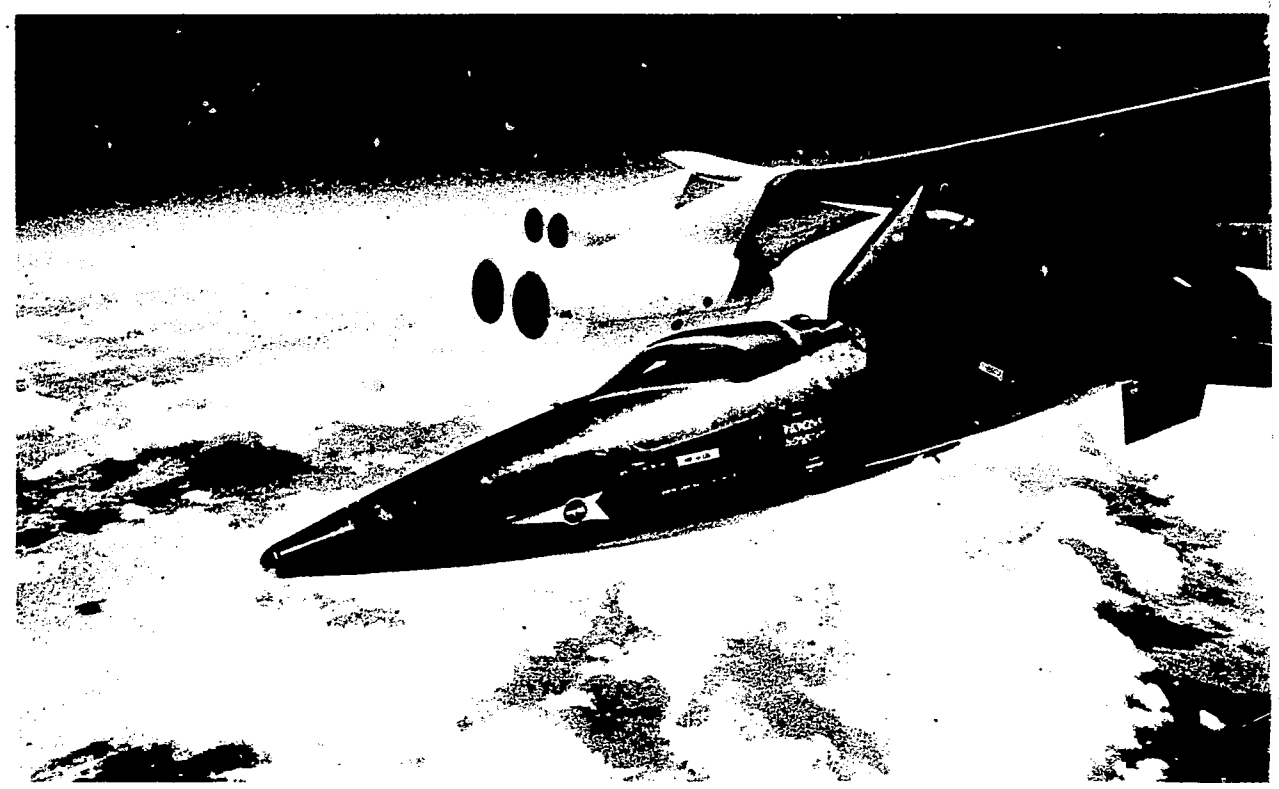
● *Experimental Facilities and Equipment* includes the design, development, tests and evaluation, operation and management of aerospace research and development facilities and equipment for experimental and operational purposes. Positions concerned with aerospace flight operations and planning and with research and development of equipment and facilities which are used in aerospace research and operations are included. This group includes the following specialties:

> *Launch and Flight Operations* ☐ *Experimental Tooling and Equipment* ☐ *Fluid and Flow Systems* ☐ *Electrical Experimental Equipment* ☐ *Experimental Facilities Techniques* ☐ *Nuclear Experimental Techniques*

Any of the undergraduate majors provided in the Basic Education Requirement (see p. 25) is acceptable



Early Morning Launch at Cape Kennedy



X–15 Preparing for Drop

for applicants with the required graduate study and/or professional experience that is closely related to one of these specialties.

Required college majors for applicants qualifying on the basis of undergraduate education only: Mechanical engineering, electrical engineering, electronic engineering, aeronautical engineering, chemical engineering, civil engineering, nuclear engineering, structural engineering, industrial engineering, physics, engineering physics, engineering mechanics, metallurgy, ceramics, architecture, or other appropriate field of engineering or physical science.

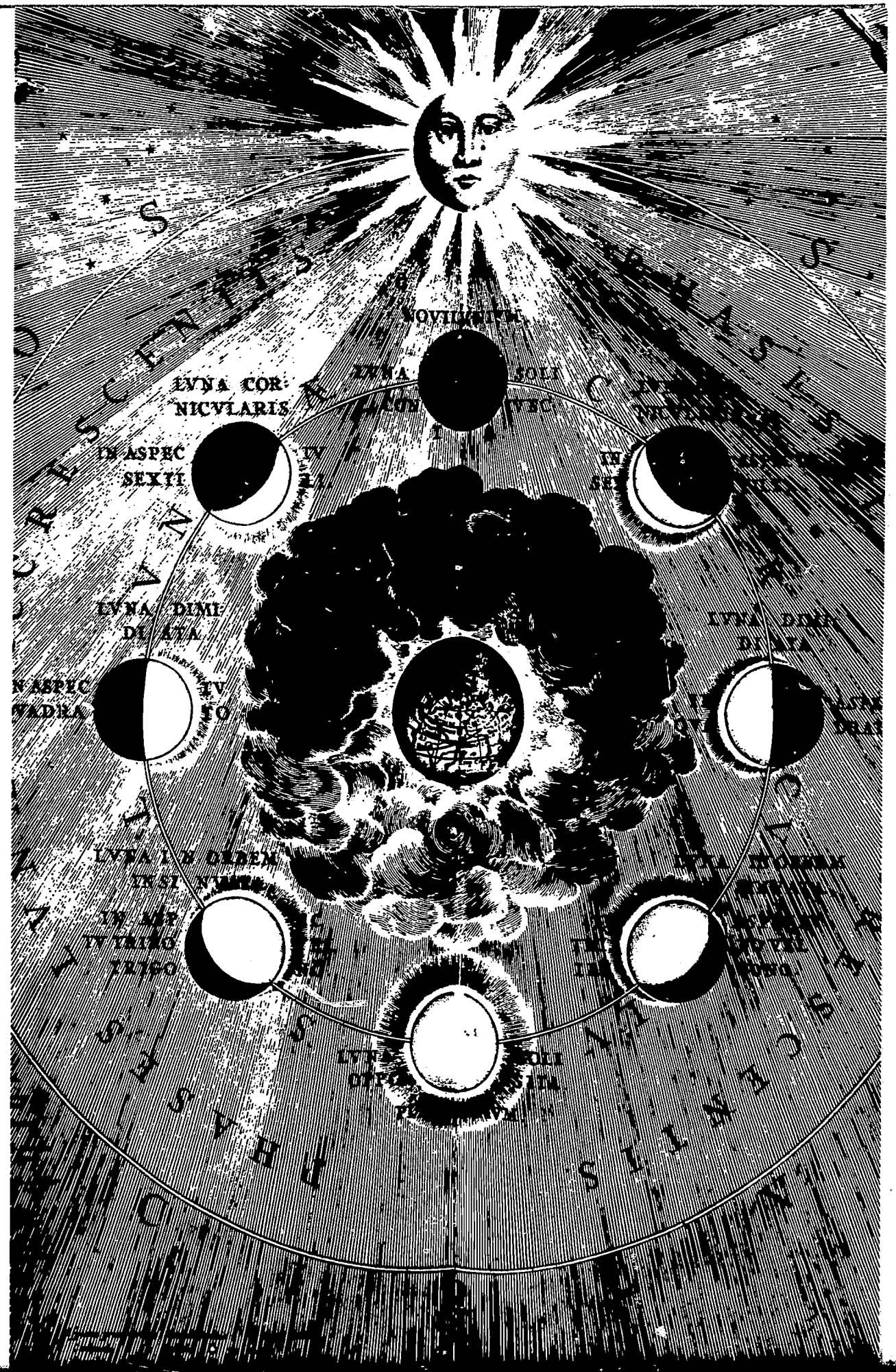
- *Management* positions involve the technical and management direction of aerospace research and development programs or projects. Incumbents of these positions prepare technical plans, budget and cost estimates, determine resources required for programs or projects, and schedule phases of the work. Based upon technical reviews and evaluation of the status of the program and projects, they initiate or ap-

prove the reallocation of funds and resources as dictated by the situation. They deal extensively with other NASA activities and contractors regarding their area of responsibility. Competence in the subject matter area of the program or project is required in combination with ability to manage and direct an aerospace program or project. Specialties in the Management group are:

> *Program Management (limited to Headquarters, NASA)* ☐ *Project Management* ☐ *Technical Management* ☐ *Technology Utilization*

Any of the undergraduate majors provided in the Basic Education Requirement (see p. 25) is acceptable for applicants with the required graduate study and/or professional experience that is closely related to one of these specialties.

● *Research Piloting* includes positions which involve piloting of space vehicles and aircraft for research purposes and ground simulation of advanced missions. These positions require use of technical and operational background and skills in determination of feasible use of existing equipment as well as additional requirements. This work also requires participation in vehicle and powerplant design selection, assisting in establishing criteria leading to mission accomplishment, evaluation of pilot tolerance and efficiency in various acceleration fields, and recommendation of additional research required.



• *Life Studies* includes positions engaged in theoretical and experimental research on the effects of space environmental stresses upon living organisms and systems. The following specialties are included in this group:

*Biochemical Processes* ☐ *Psychological Studies* ☐ *Plant Studies* ☐ *Physiological Studies* ☐ *Molecular Biodynamics* ☐ *Radiobiological Studies* ☐ *Neurobiology*

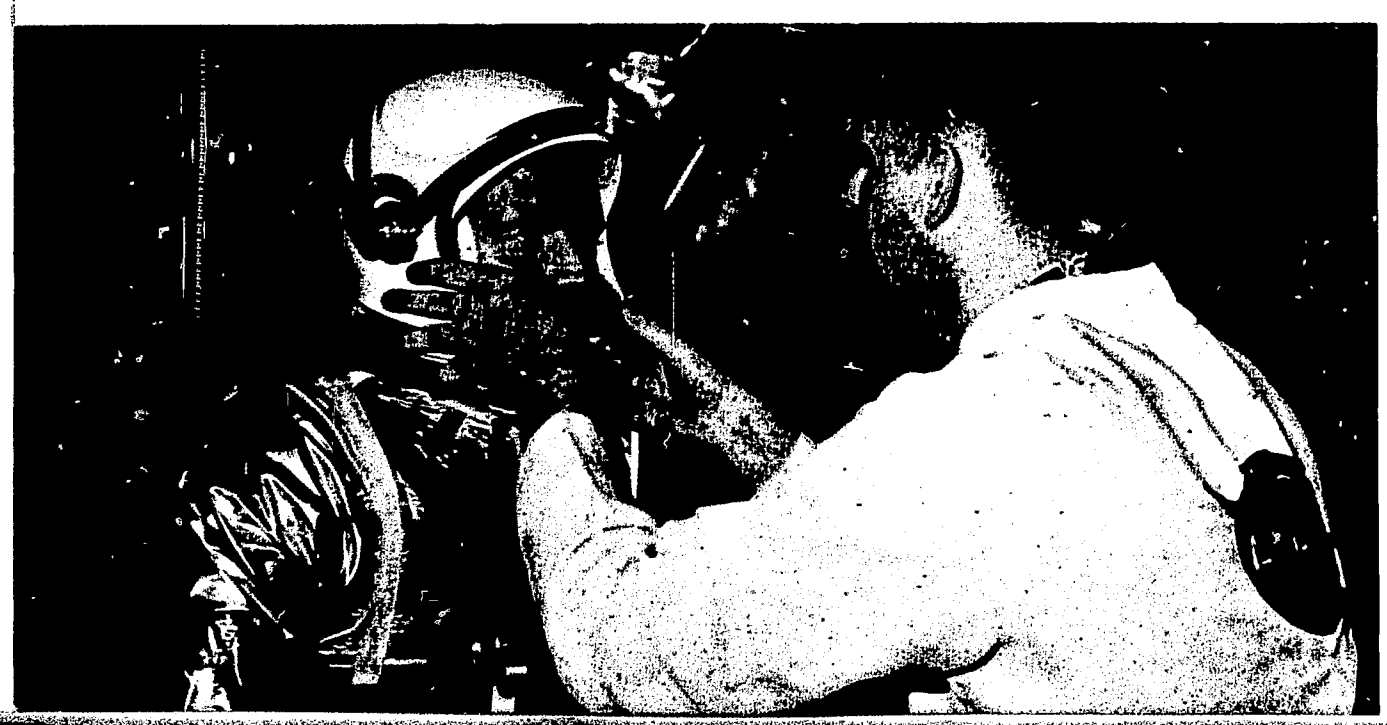
• *Exobiology* includes positions engaged in theoretical and experimental research on the nature and origin of life in the universe. Involves studies directed toward understanding the nature and basic mechanisms involved in the synthesis of biologically significant compounds; the evolution and adaptation of life forms; and the development of life detection systems and devices suitable for space flights and explorations. Specialties within this group are:

*Chemical Evolution* ☐ *Biological Adaptation* ☐ *Life Detection Systems*

• *Man-Machine Systems* includes positions engaged in theoretical and experimental research on the effects of space environmental stresses upon man functioning as an integral component of a man-machine system for aerospace flight and exploration. The following specialties are included in this group:

*Environmental Physiology* ☐ *Human Performance Studies* ☐ *Environmental Control* ☐ *Manned Systems Engineering Studies* ☐ *Bionics Studies*

Suiting Up



Aerospace Research

# EDUCATION AND EXPERIENCE REQUIREMENTS FOR SPECIALTIES

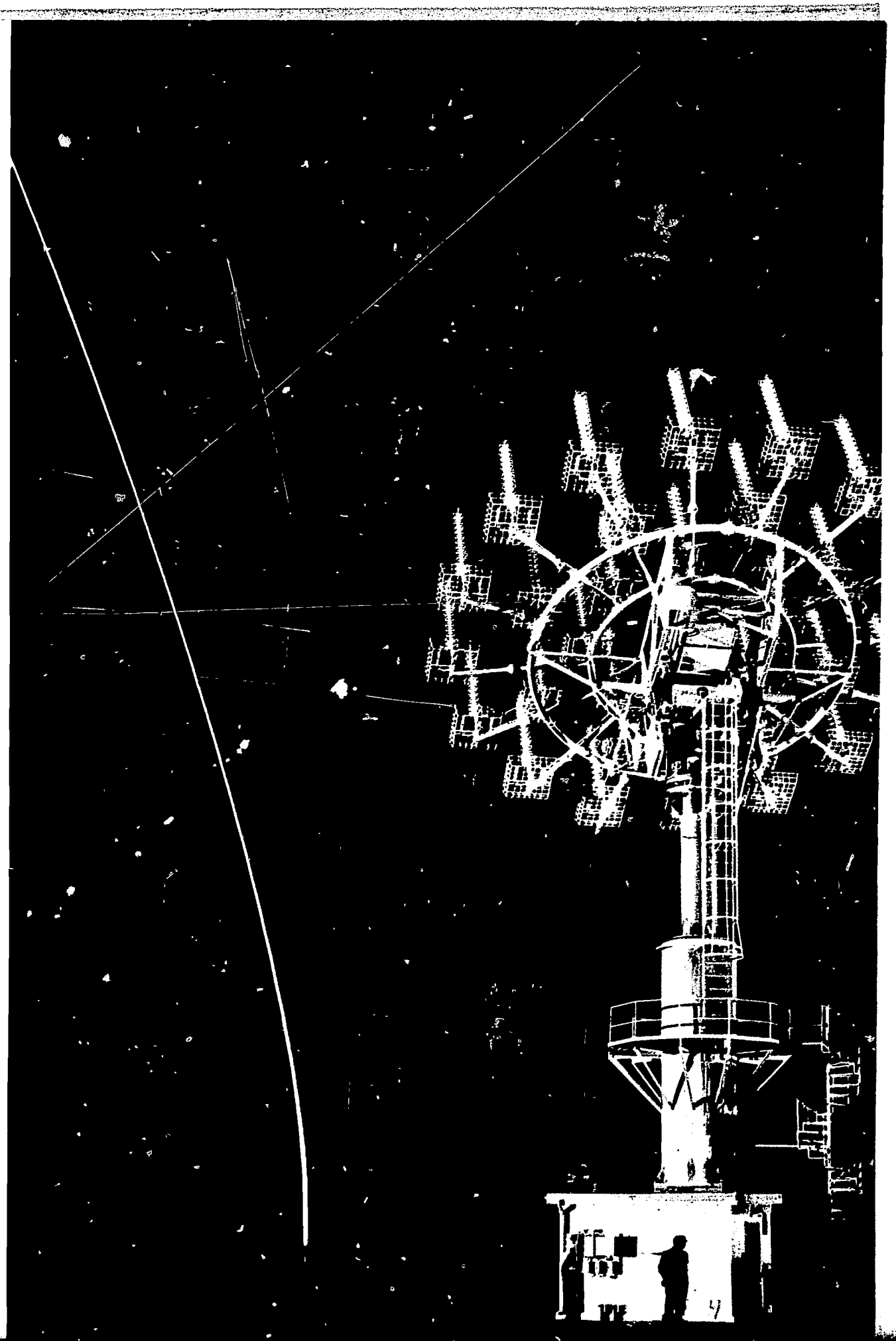
## in Physical Sciences Engineering, Mathematics and Life Sciences

### Basic Education Requirements for All Positions

All applicants must have successfully completed a standard professional curriculum in an accredited college or university leading to a bachelor's degree with major study in an appropriate field of engineering, physical science, life science, or mathematics. An applicant who did not complete a standard professional curriculum may nevertheless be eligible if he has obtained a graduate degree or has been accepted as a candidate for an advanced degree in an appropriate field by an accredited institution.

### Physical Sciences, Mathematics and Engineering

Below is a list of preferred fields of major study for the physical science, mathematics and engineering specialties of aerospace technology.



Scout Liftoff

## Preferred College Majors

| | |
|---|---|
| Astronautics | Aeronautical Engineering |
| Astronomy | Ceramic Engineering |
| Ceramics | Chemical Engineering |
| Chemistry | Civil Engineering |
| Electronics | Electronic Engineering |
| Geology | Electrical Engineering |
| Geophysics | Industrial Engineering |
| Mathematics | Mechanical Engineering |
| Metallurgy | Metallurgical Engineering |
| Meteorology | Nuclear Engineering |
| Physics | Engineering Mechanics |
| Architecture | Engineering Physics |

## Life Sciences and Systems

Appropriate backgrounds for life sciences and systems specialties must include a combination of life sciences and physical sciences, preferably including graduate study, of either type "A" or "B" described below:

A. Major study in biology (botany, zoology, biophysics, radiation biology, biochemistry, microbiology, physiology, toxicology) or in behavioral science (experimental, physiological, or clinical psychology) or other field of life science appropriate for one of these specialties, including or supplemented by at least 20 semester hours of physical science or engineering, undergraduate or graduate, or experience sufficient to provide a basis for understanding, use, and interpretation of the highly specialized ground-based or in-flight measurement, environmental control, vehicle control, and other equipment required for manned or organism-bearing aerospace flights and voyages; or

B. Major study in engineering or physical science appropriate for one of these specialties, including or supplemented by at least 20 semester hours of physiology, experimental or physiological psychology, or other appropriate life science, undergraduate or graduate, or experience in biotechnology, human factors engineering, or other appropriate life science field.

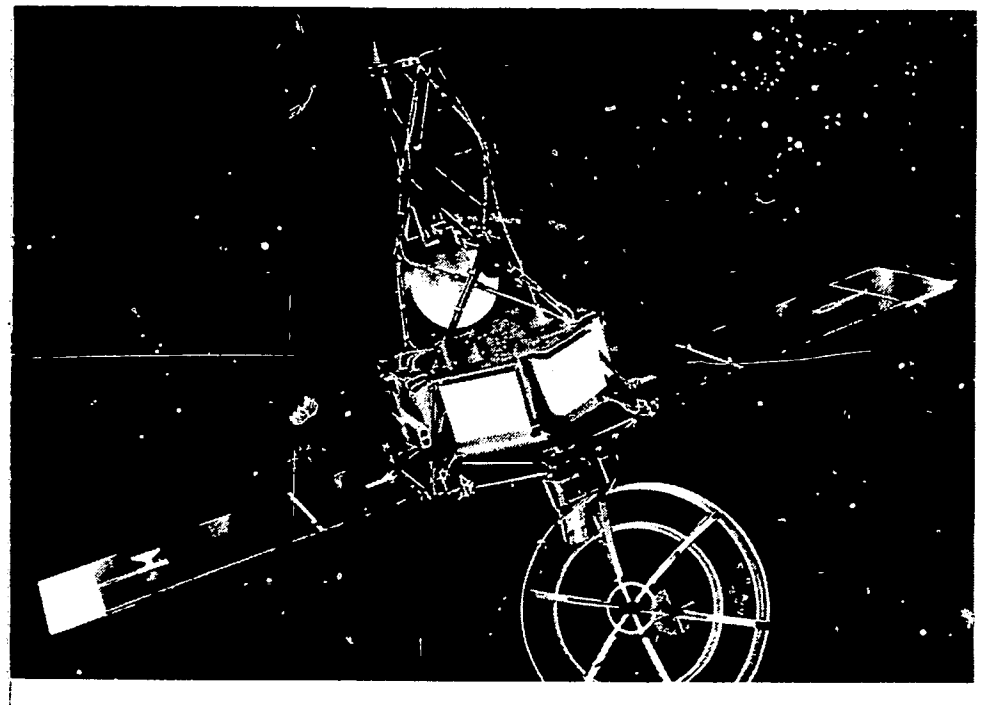
*Positions in Life Sciences and Systems at grades GS–5 and 7 are not filled through this announcement. Information concerning these positions may be obtained from the Personnel Office at Ames Research Center.*

## Requirements for GS–5

Applicants must meet the basic education requirements defined above. The major study must be in one of the fields listed as "Required College Majors" following the listing of the specialties of aerospace technology in the preceding section.

## Requirements for GS–7

In addition to the basic education requirements, applicants must have had (*a*) 1 year of appropriate professional experience that has positively demonstrated ability or aptitude to do aerospace research, development, design, operations, or closely related function in one of the NASA technological specialties; or (*b*) successful completion of 1 full academic year of graduate study in an appropriate field in an accredited institution; or (*c*) any equivalent combination of experience and graduate study.



Mariner II

## Special Provisions for GS–7 for Superior Applicants

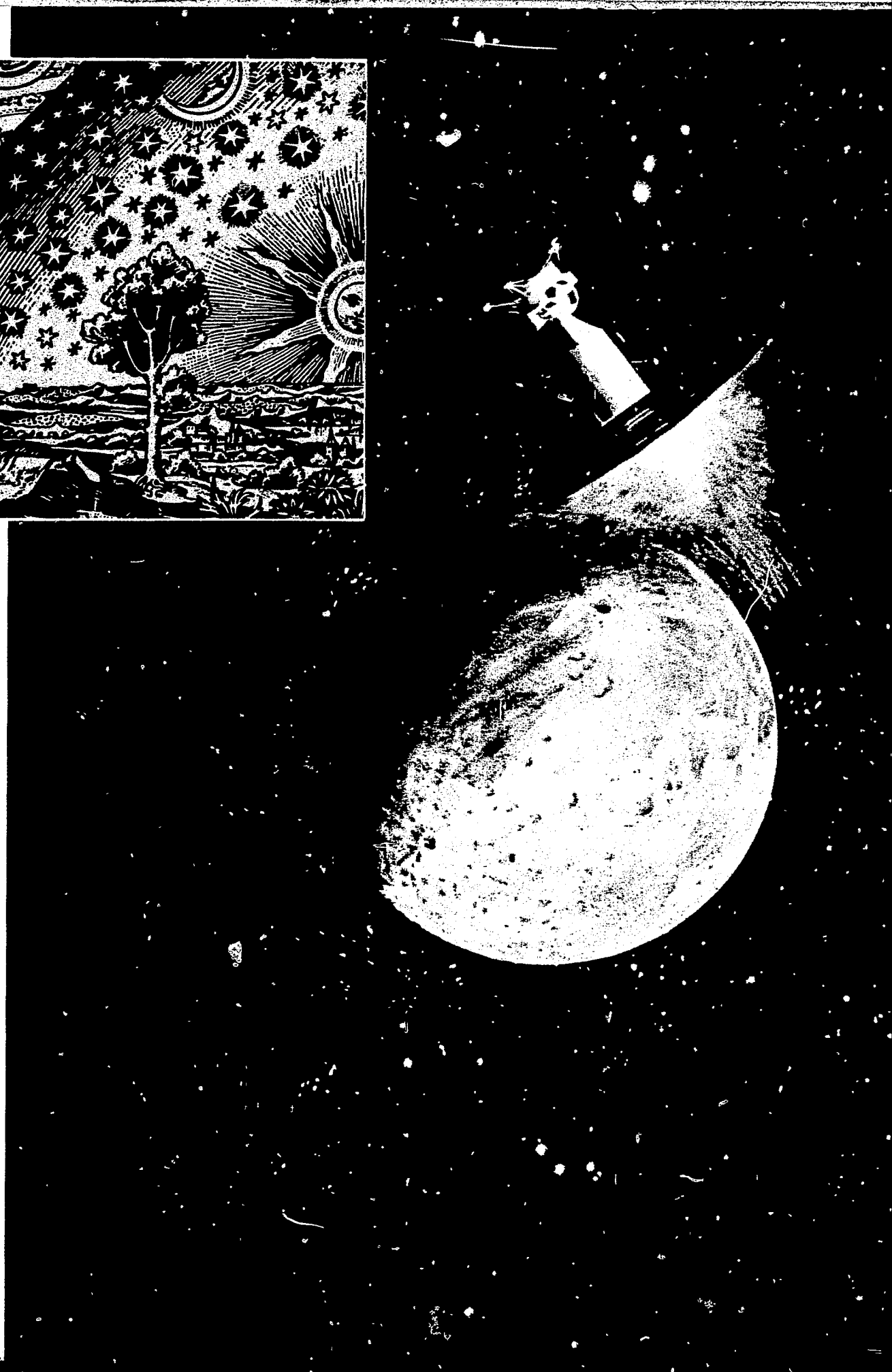
Persons who, within the last 2 years, have completed all requirements for a bachelor's degree with appropriate majors may be eligible for GS–7, if they meet one of the following criteria:

A. They are in the upper 25 percent of their class based on completed college work at time of filing application.

B. They have a "B" average or better (or its equivalent) based on completed college work at time of filing application.

C. They have achieved a grade average of B+ (3.5 on a 4.0 scale) or better in the major field of study where such field is fully qualifying.

D. They have achieved a score of 600 or better on an area test or on an advanced test in the Graduate Record Examination.



Apollo, Lem and Service Module

E. They have been elected to membership in Phi Beta Kappa, Sigma Xi, or one of the national honorary scholastic societies meeting the minimum requirements of the Association of College Honor Societies (other than freshman honor societies).

F. College graduates who have had student trainee experience (in government or industry) may have such experience credited towards meeting the specialized experience requirements for GS–7, in full, if all of the following requirements are met:

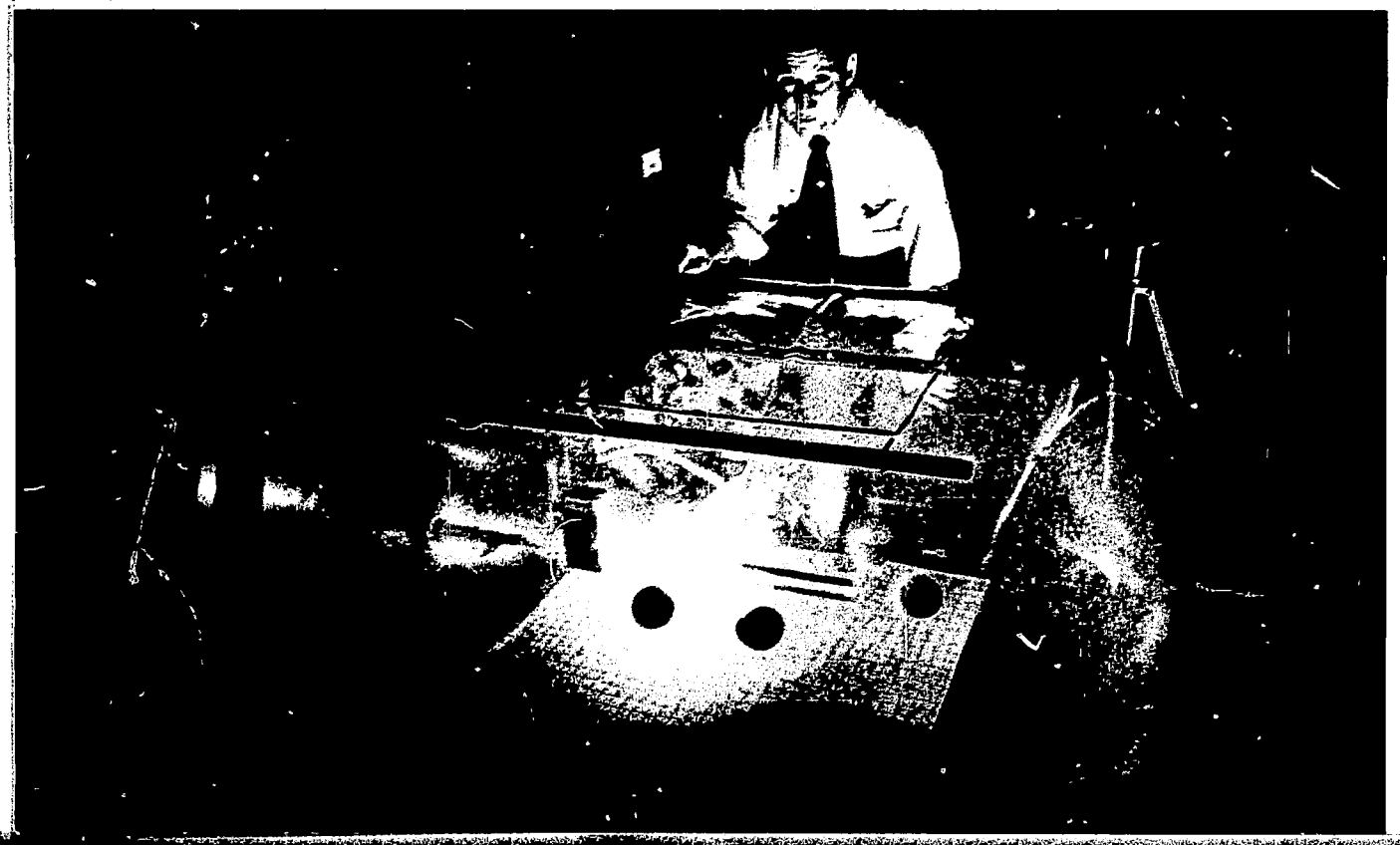
a. It was closely related to and integrated with the college career.

b. The applicant successfully completed 12 months of student trainee experience which included one period (no less than 60 days) equivalent to work at the GS–5 level in the Federal service, or at least 15 months of student trainee work experience in a cooperative work-study education curriculum which included one work period equivalent to work at the GS–4 level in the Federal service.

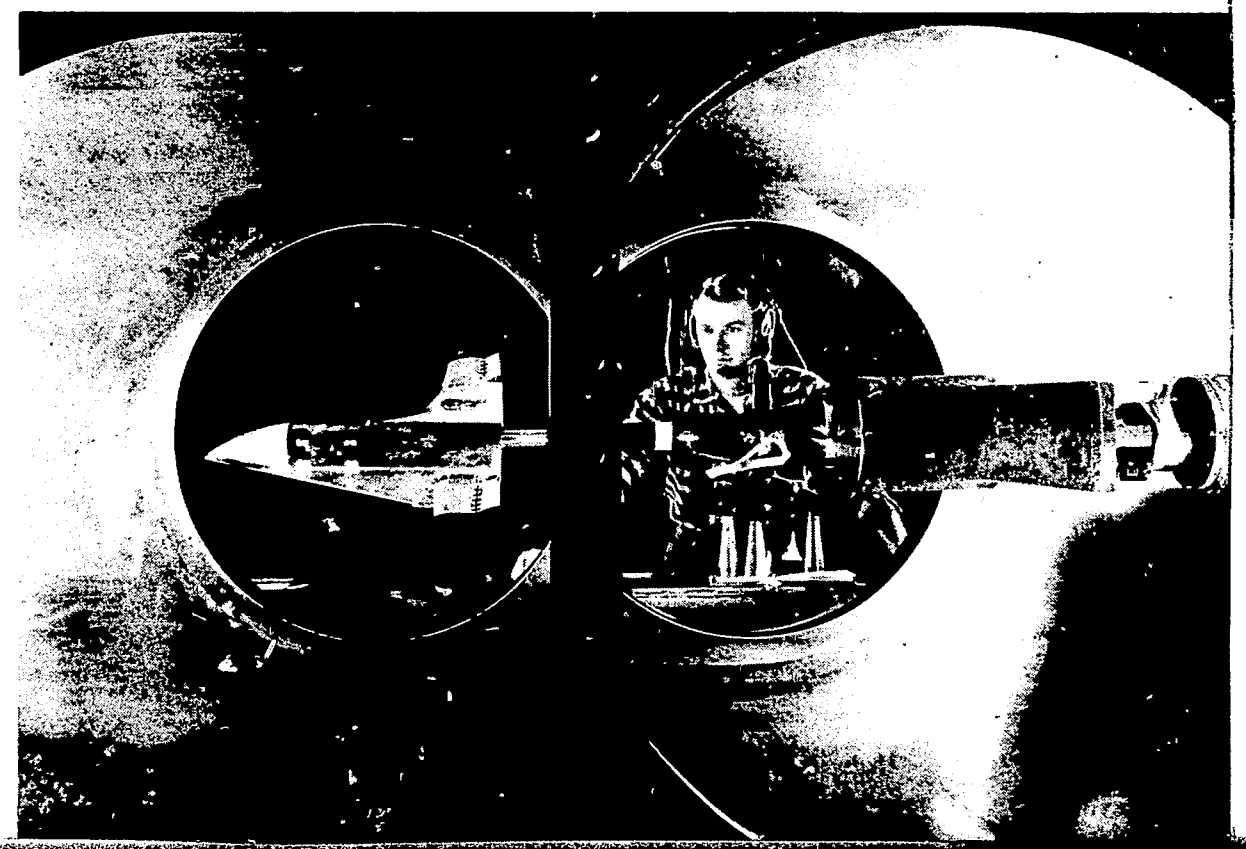
G. They have successfully completed a 5-year curriculum of the noncooperative type (i.e., not requiring alternate periods of study and employment) leading to a bachelor's degree in an appropriate field of science or engineering.

H. They have successfully completed all requirements for two bachelor's degrees, one in an appropriate field of science or engineering.

Electric Propulsion Research



Reentry Vehicle Testing



I. They have 6 months aggregate of specialized experience or training, including 3 months gained after the junior year, in a subprofessional, semiprofessional or technician status, which may have been obtained in a laboratory or elsewhere during a summer period, or assisting a professor, or on active military duty. This may have been on a part-time or intermittent basis, and may have been paid or unpaid, and must have been appropriate for NASA technological work.

J. They have received honors or elective positions indicating superior leadership other than scholastic, provided that the applicant's academic standing was in the upper half of his graduating class.

K. They have a pattern of courses having unusual preparatory value or direct relatedness to the particular aerospace specialty for which they are being considered.

L. They have creative research aptitude or special talent for NASA scientific or engineering work, as shown by evidence obtained and documented by NASA by means of certifications from college professors or officials, standardized questionnaires, or similar techniques.

NOTE.—Criteria A through F apply to applicants for any of the positions covered by this announcement. However, criteria G through L are based on the National Aeronautics and Space Act of 1958 which applies only to positions in NASA, so that positions in other Federal agencies cannot be filled at the GS–7 level by certification of eligibles who meet one of these criteria but fail to meet one of criteria A through F.

### Requirements for GS–9

In addition to the basic education requirement, applicants must have had (*a*) 2 years of appropriate professional experience, including 1 year equivalent in difficulty and responsibility to grade GS–7 that has positively demonstrated ability to do aerospace research, development, design, operations, or closely related function in one of the NASA technological specialties; or (*b*) 2 academic years of graduate study in an appropriate field in an accredited institution; or (*c*) any equivalent combination of experience and graduate study.

### Special Provision for GS–9 for Superior Masters Degree Students

Applicants who have completed all requirements for the master's degree, within the last 2 years, may be rated eligible if, in the judgment of the appropriate faculty member(s) of their college or university, they have demonstrated superior ability in their graduate studies. "Superior ability" is defined as that demonstrated by a student who, on the basis of a total evaluation, would fall into approximately the upper quarter of all master's degree graduates in his field.

### Requirements for GS–11

In addition to the basic education requirement, applicants must have had (*a*) 3 years of appropriate,

progressive, professional experience, including 1 year equivalent in difficulty and responsibility to grade GS–9 that has positively demonstrated ability to do aerospace research, development, design, operations, or closely related function in one of the NASA technological specialties; or (*b*) successful completion of all requirements for the doctor's degree, including the thesis, in an appropriate field in an accredited university; or (*c*) any equivalent combination of experience and graduate study.

### Special Provision for GS–11 for Superior 2-Year Graduate Degree Students

Applicants who have completed all requirements for a graduate degree for which the minimum university requirement is a full 2 years of graduate study, within the last 2 years, may be rated eligible if, in the judgment of the appropriate faculty member(s) of their college or university, they have demonstrated superior ability in their graduate studies. "Superior ability" is defined as that demonstrated by a student who, on the basis of a total evaluation, would fall into approximately the upper quarter of all graduates in his field who are awarded this same type of degree.

### Requirements for GS–12 Through GS–15

In addition to the basic education requirement, applicants must have had (*a*) 3 years of appropriate, progressive, professional experience, including 1 year equivalent in difficulty and responsibility to the grade next below that for which they are being considered, that has positively demonstrated ability to perform high-level aerospace research, development, design, operations, or other technological work, or to organize, direct, or coordinate technological projects and programs of increasing breadth and complexity, in one of the NASA technological areas; or (*b*) any equivalent combination of experience and graduate study.

### Special Provision for Superior Ph. D. Degree Students

Applicants who have completed all requirements for the Ph. D. degree (or an equivalent degree), within the last 2 years, may be rated eligible if, in the judgment of the appropriate faculty member(s) of their college or university, they have demonstrated superior ability in their graduate studies. "Superior ability" is defined as that demonstrated by a student who, on the basis of a total evaluation, would fall into approximately the upper half of all Ph. D. graduates in his field.

### Combination of Superior Academic Achievement and Subsequent Professional Work Experience

An applicant who within the past 3 years has met one of criteria A through E under the "Special GS–7 Provisions for Superior Applicants" and who has subsequently obtained appropriate professional experience may be rated eligible for GS–9, provided that at least 1 year of his professional experience has been directly pertinent to a specialty field of aerospace technology included in this announcement and at a level of difficulty and responsibility equivalent to the GS–7 level in the Federal service. In like manner, an applicant who has a similar combination of (1) superior academic achieve-

ment at the graduate school level, as defined in one of the "Special Provision" paragraphs for grade GS–9, GS–11, or GS–12, and (2) at least 1 year of subsequent professional work experience of the appropriate level and directly pertinent to a specialty field of aerospace technology included in this announcement may be rated eligible for the next higher professional grade than the grade for which he would otherwise be eligible.

### Extra Credit for Creative Research or Development Contribution

Applicants who have professional research or development experience and meet the criterion described below may be rated eligible for the next higher grade than that for which they would otherwise qualify on the basis of the standard requirements paragraphs. However, an applicant who achieves a higher grade on the basis of one of the preceding "Special Provision" paragraphs cannot become eligible for a still higher grade based on this criterion.

To receive such credit, an applicant must have achieved the distinction of making a creative research or development contribution to the field. Such research or development must have been on a hither-to unsolved problem or problems related to aerospace technology. It must have been creative, in that it must have produced a basic principle, concept, method, approach, or technique that not only solves the specific problem at hand, but also is directly applicable in the solution of other problems, and may open a new area of research or development.

### College Teaching

Teaching experience in a college or university with professional status (i.e., above teaching assistant) in engineering, physical science, mathematics, or other appropriate field will be considered qualifying for the required general professional experience, except for the required 1 year of specific technological experience at the next lower grade level.

Research or other technological work accompanying college teaching, when done on a part-time or intermittent basis, must generally aggregate the total amount of such experience required for the grade level for which application is made. However, the teaching of graduate-level courses in an appropriate field, if accompanied by a reasonable amount of technological performance or supervision, may be accepted as constituting technological experience.

### Research Pilot—GS–9 to GS–15

In addition to the basic education requirement, all applicants must have a current FAA commercial pilot's license with instrument rating or a pilot rating and instrument rating from the armed services. In addition:

***GS–9 applicants must have—***

*a.* A minimum of 900 hours of flight time which included at least 500 hours on jet aircraft having at least 3,000 pounds of thrust per engine;* or

*b.* One year of research piloting experience; or

*c.* Any equivalent combination of *a.* and *b.*

### *GS–11 applicants must have—*

*a.* A minimum of 1,100 hours of flight time which included at least 500 hours on jet aircraft having at least 3,000 pounds of thrust per engine;* or

*b.* Two years of research piloting experience of which 1 year must have been equivalent in level of difficulty and responsibility to grade GS–9; or

*c.* Any equivalent combination of *a.* and *b.*

### *GS–12 applicants must have—*

*a.* A minimum of 1,500 hours of flight time which included at least 500 hours on jet aircraft having at least 3,000 pounds of thrust per engine;* plus 1 year of research piloting experience equivalent in level of difficulty and responsibility to grade GS–11; or

*b.* Three years of progressive research piloting experience of which 1 year must have been equivalent in level of difficulty and responsibility to grade GS–11; or

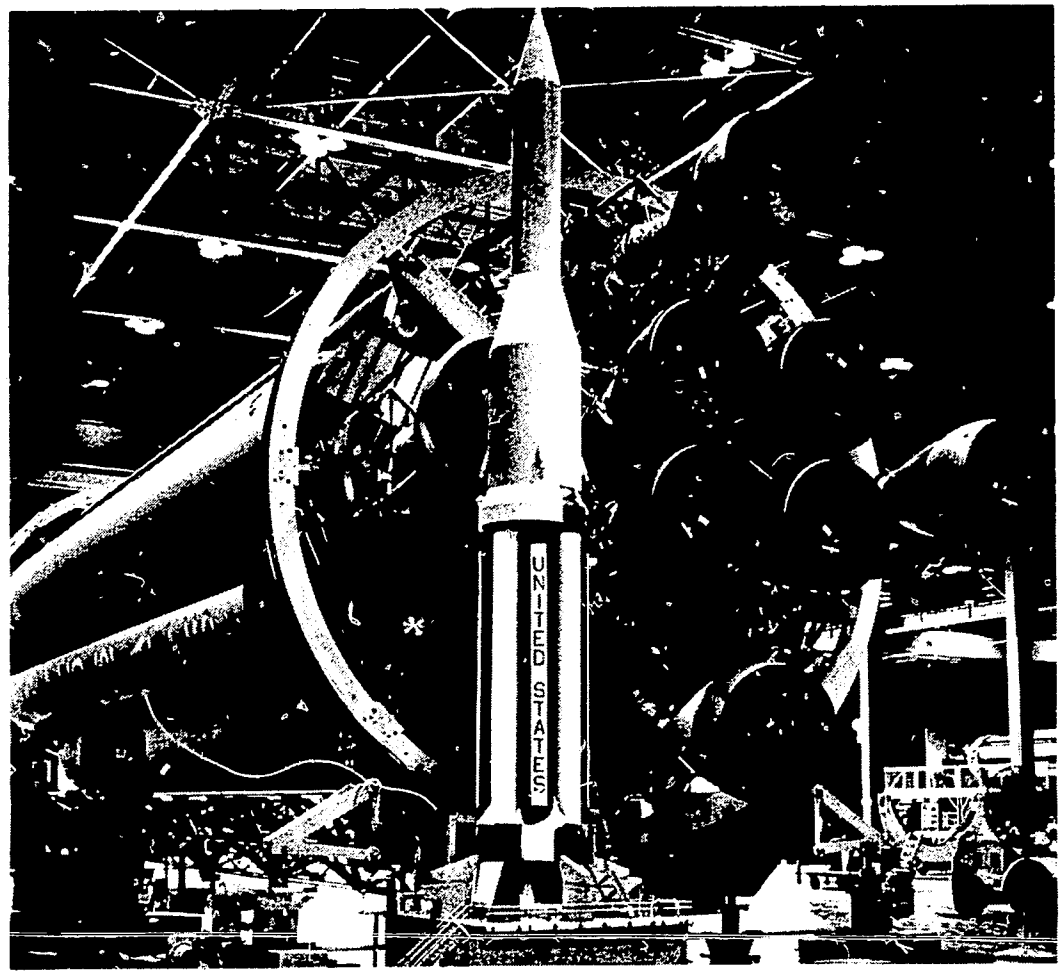
*c.* Any equivalent combination of *a.* and *b.*

### *GS–13, GS–14 and GS–15—*

The same minimum number and kind of hours of flight time and/or years of research piloting experience required for GS–12, including or supplemented by at least 1 year of research piloting experience equivalent in level of difficulty to the next lower grade.

**Applicants for research pilot positions with Langley Research Center may substitute flight time in aircraft powered by engines having 1,000 horsepower or more (per engine, if multiengine) in lieu of flight time in jet aircraft, required above for all grades.*






Scale Model Compared to Actual Saturn IB

Eligible applicants at all grade levels, when considered for appointment, will be required to qualify in a flight check.

## Requirement for Recent Experience and/or Education

For positions in physical sciences, life sciences, mathematics or engineering (including Research Piloting), at least 1 year of the required specialized education or experience must have been obtained within the three years immediately preceding the date of receipt of application.

# SPECIALTIES OF AERO-SPACE TECHNOLOGY (AST)

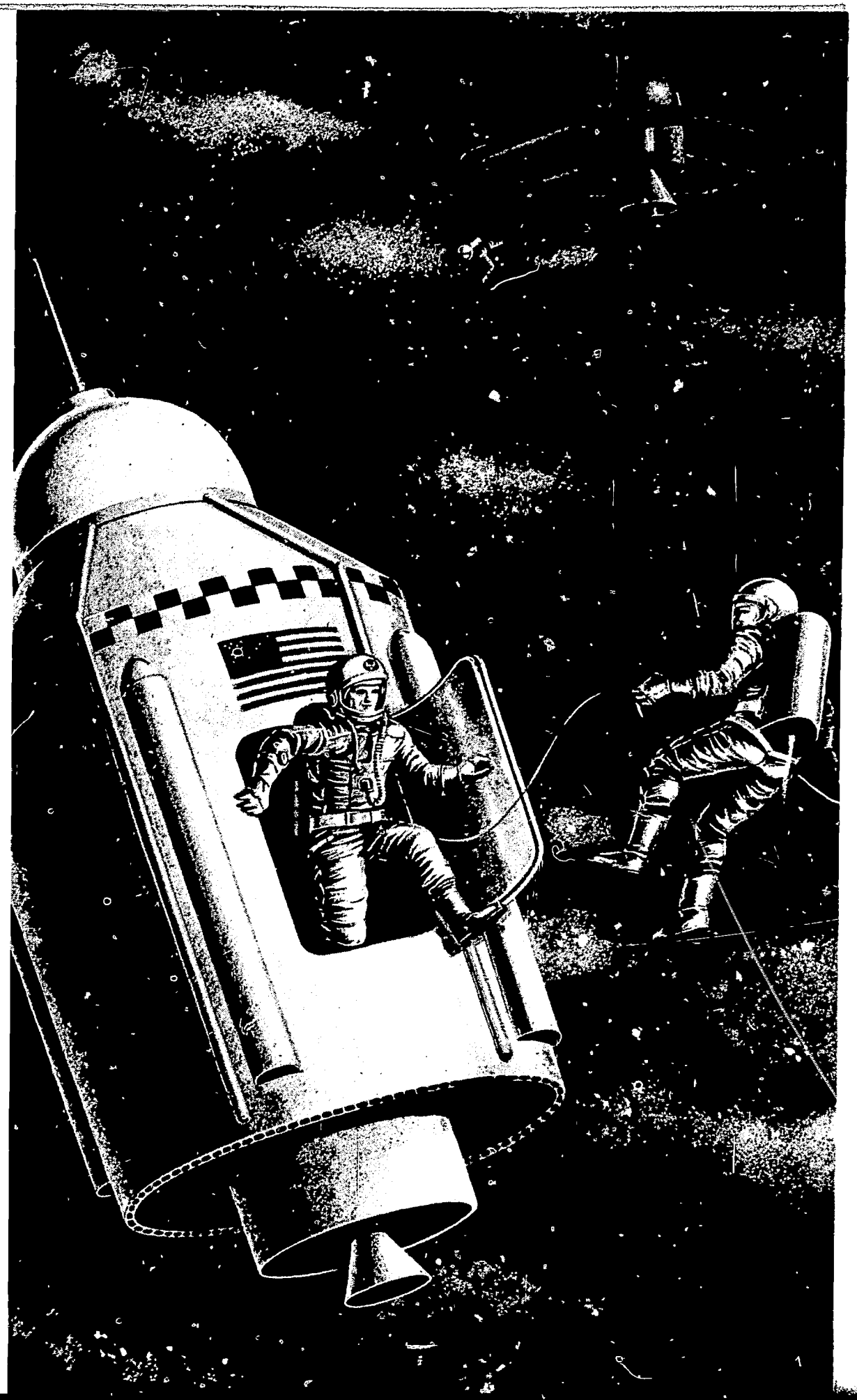
## in Research and Development Administration

These specialties represent administrative positions in NASA for which applications will be accepted. See page 48 to determine location of positions.

- *Administration* includes positions engaged in general administrative functions, management analysis, and program evaluation review techniques in support of aerospace research and development missions. The following specialties are included in this group:

  *Administrative Operations* ☐ *Organization and Management Planning* ☐ *Project Analysis and Control*

*Appropriate graduate majors:* Graduate study with major work in one or a combination of the following is appropriate for one or more specialties in this occupational field: Research administration, engineering management, industrial management, industrial engineering, business administration, economics (except agricultural), public administration, government, law, or other comparable major.



Manned Space Station

• *Contract administration* includes positions engaged in negotiation, price analysis, and administration of contracts let in support of aerospace missions and functions. The following specialties are included in this group:

*Contract Negotiation* ☐ *Contract Administration* ☐ *Contract Operations (General)* ☐ *Contract Pricing and Analysis*

*Appropriate graduate majors:* Graduate study with major work in one or a combination of the following is appropriate for one or more specialties in this occupational field: Industrial management, engineering management, business administration, industrial engineering, law, marketing (other than agricultural), or other comparable major.

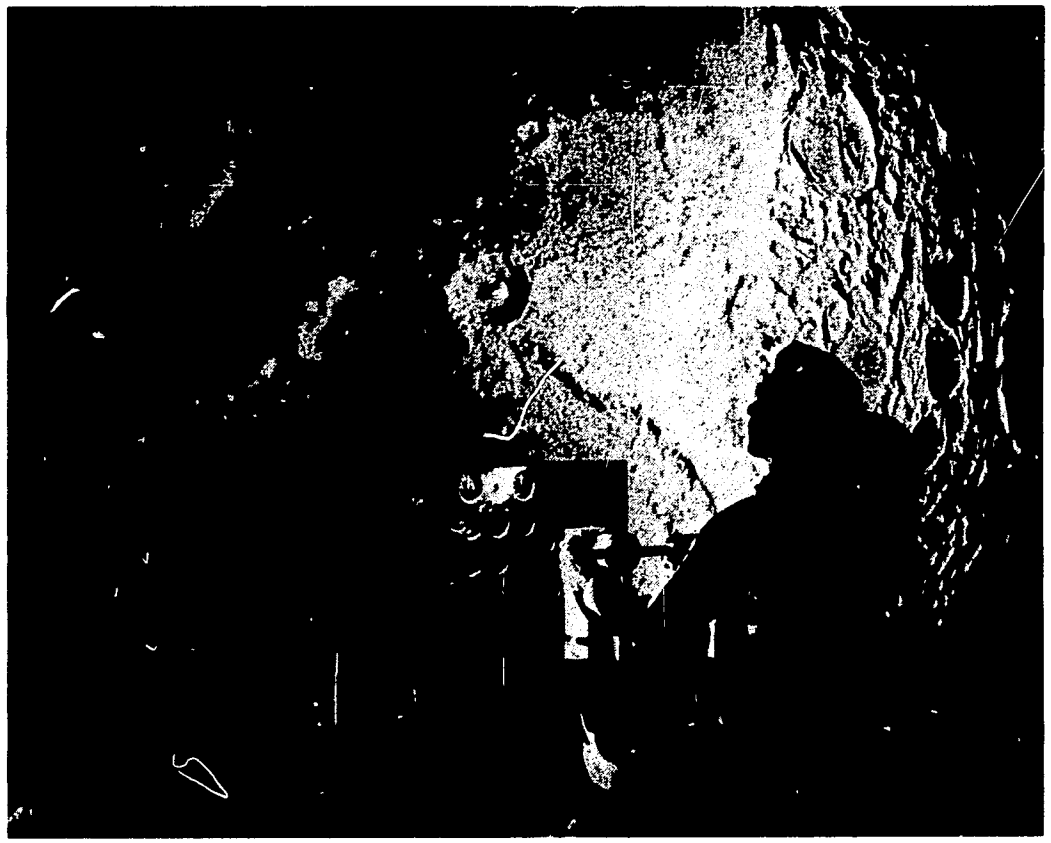
• *Procurement management (general)* includes positions engaged in procurement of specialized equipment, materials and services for aerospace programs and projects. Duties include two or more of the following functions: Direct procurement, procurement expediting, contract liaison, development of procurement regulations and procedures, and contract development.

*Appropriate graduate majors:* Graduate study with major work in one or a combination of the following is appropriate for one or more specialties in this occupational field: Industrial management, engineering management, business administration, industrial engineering, law, marketing (other than agricultural), or other comparable major.

• *Financial management* includes positions engaged in developing and maintaining special accounting and financial management systems including accumulation of cost data and interpretation and analysis of the condition of research and development financial programs. Also included are positions engaged in budget management. The following specialties are included in this group:

*Financial Operations* ☐ *Financial Systems* ☐ *Resources Programming* ☐ *Budget Management*

*Appropriate graduate majors:* Graduate study with major work in one of the following is appropriate for one or more specialties in this occupational field: (1) Business administration, public administration, Government, industrial management, industrial engineer-



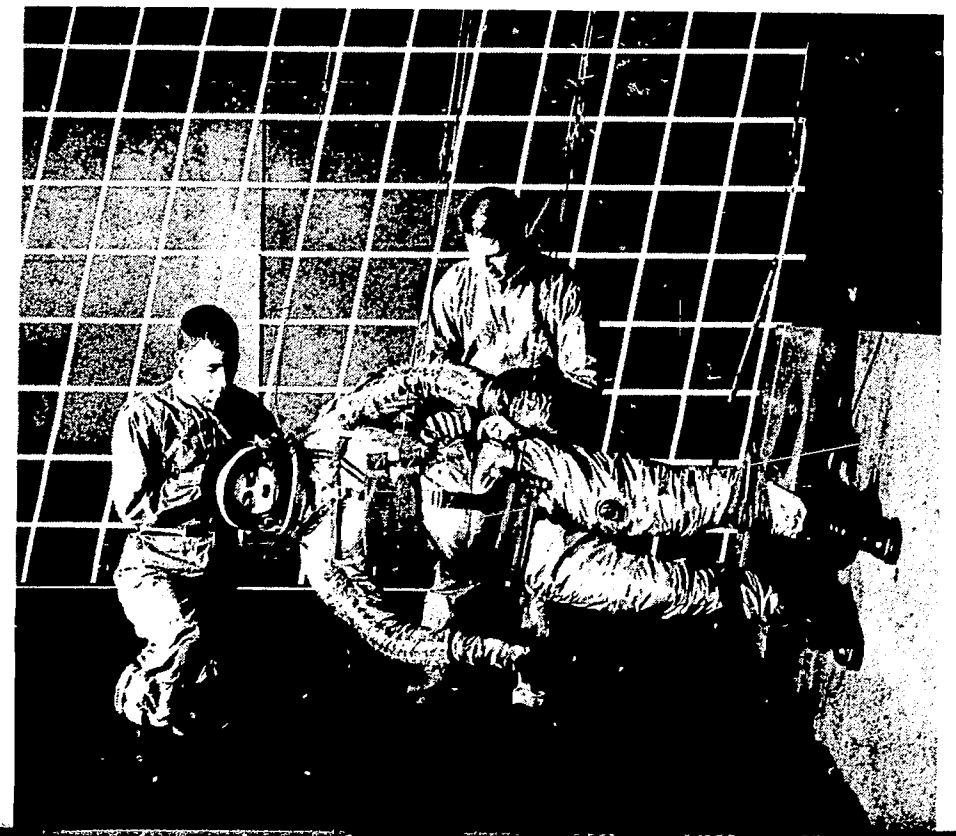
Lunar Landing Simulation

ing, or other comparable major if study has clearly provided a substantial working knowledge of accounting, auditing, budgeting, or other financial management principles and practices; or (2) finance or accounting.

- *Personnel management* includes positions engaged in providing professional advice to management in one or more of the personnel functions such as personnel staffing (i.e., recruitment, placement, and examining), position classification, wage administration, employee development, and employee management relations. The following specialties are included in this group:

  *Personnel Management and Operations* ☐ *Personnel Staffing* ☐ *Occupational and Salary Systems* ☐ *Staff Development* ☐ *Employee Management Relations*

Lunar Walker Being Readied for Test



*Appropriate graduate majors:* Graduate study with major work in one or a combination of the following is appropriate for one or more specialties in this occupational field: Personnel administration, public administration, industrial or labor relations, industrial or personnel psychology, industrial engineering, industrial management, or other comparable major.

- *Public information and news service* includes positions engaged in the acquisition, preparation, and releases of technical and organizational information which has news value. Work in this specialty requires a comprehensive understanding of aerospace concepts, terminology and program objectives.

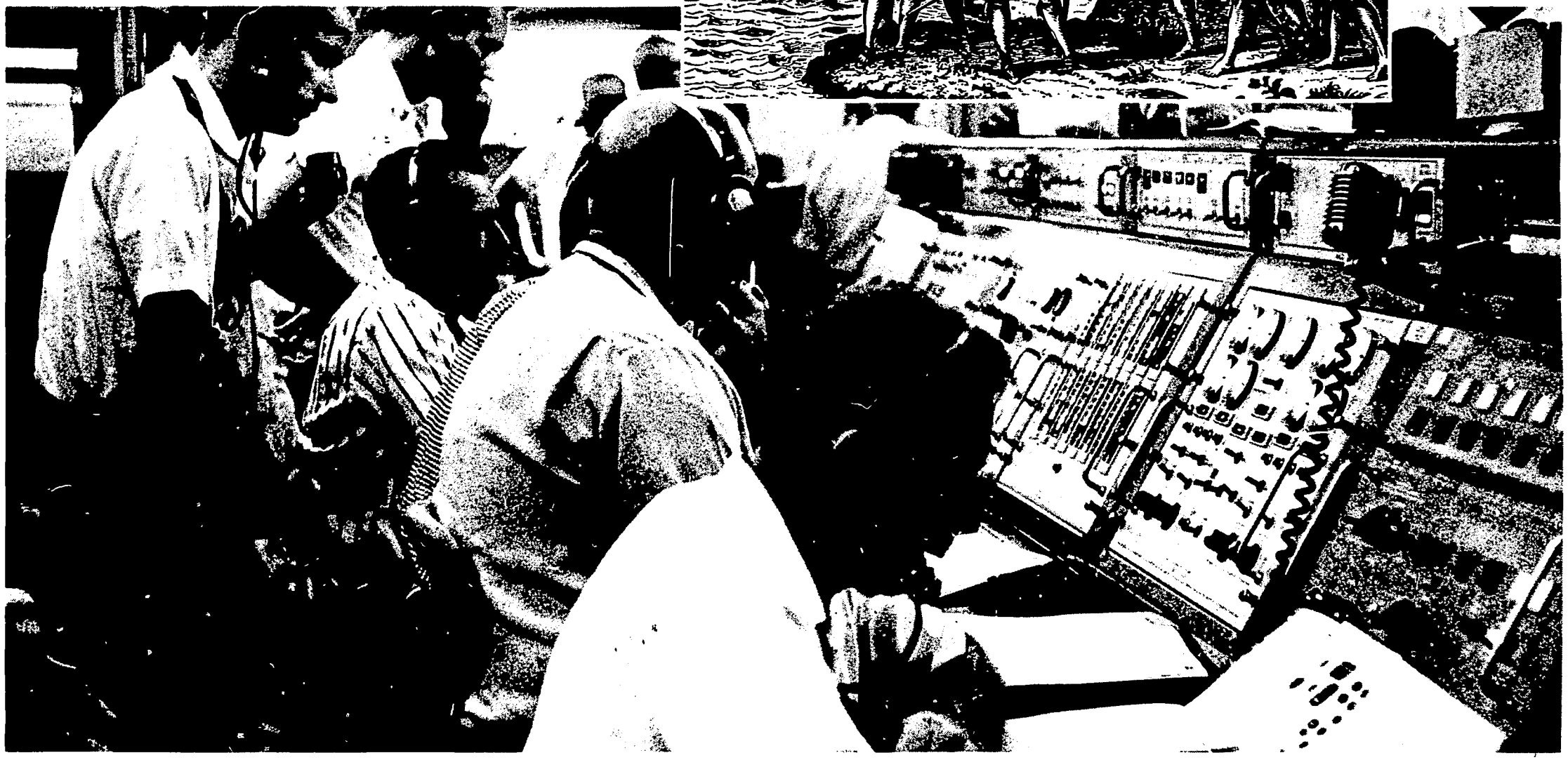
  *Appropriate graduate study:* Graduate study in technical writing; science reporting, technical editing or similar subjects is appropriate for this occupational field.

- *Technical publications* includes positions engaged in the writing, editing, and dissemination of technical information relating to aerospace research, developments and achievements for the benefit of scientific, engineering, educational and general industry and public interest. Specialties include:

  *Technical Writing and Editing* ☐ *Technical Documentation and Information*

  *Appropriate graduate study:* Graduate study in technical writing, science reporting, technical editing, technical document classification, abstracting, and retrieval, or similar subjects is appropriate for one or more of the specialties in this occupational field.

The Landing of Columbus



# EDUCATION AND EXPERIENCE REQUIREMENTS FOR SPECIALTIES

## in Research and Development Administration

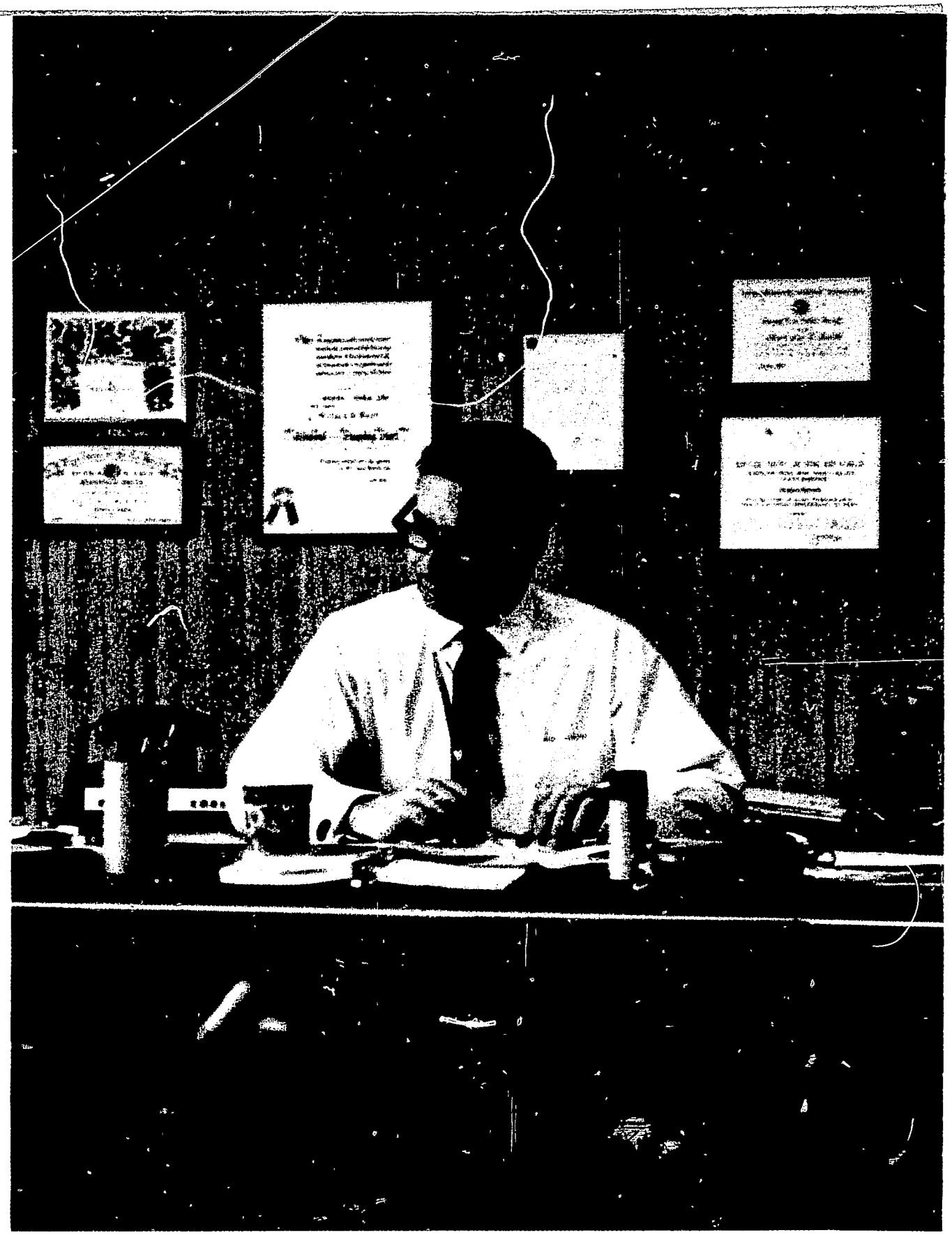
All applicants for positions in research & development administration covered by this announcement must meet three basic requirements, as follows:

A. A bachelor's degree or equivalent experience; and

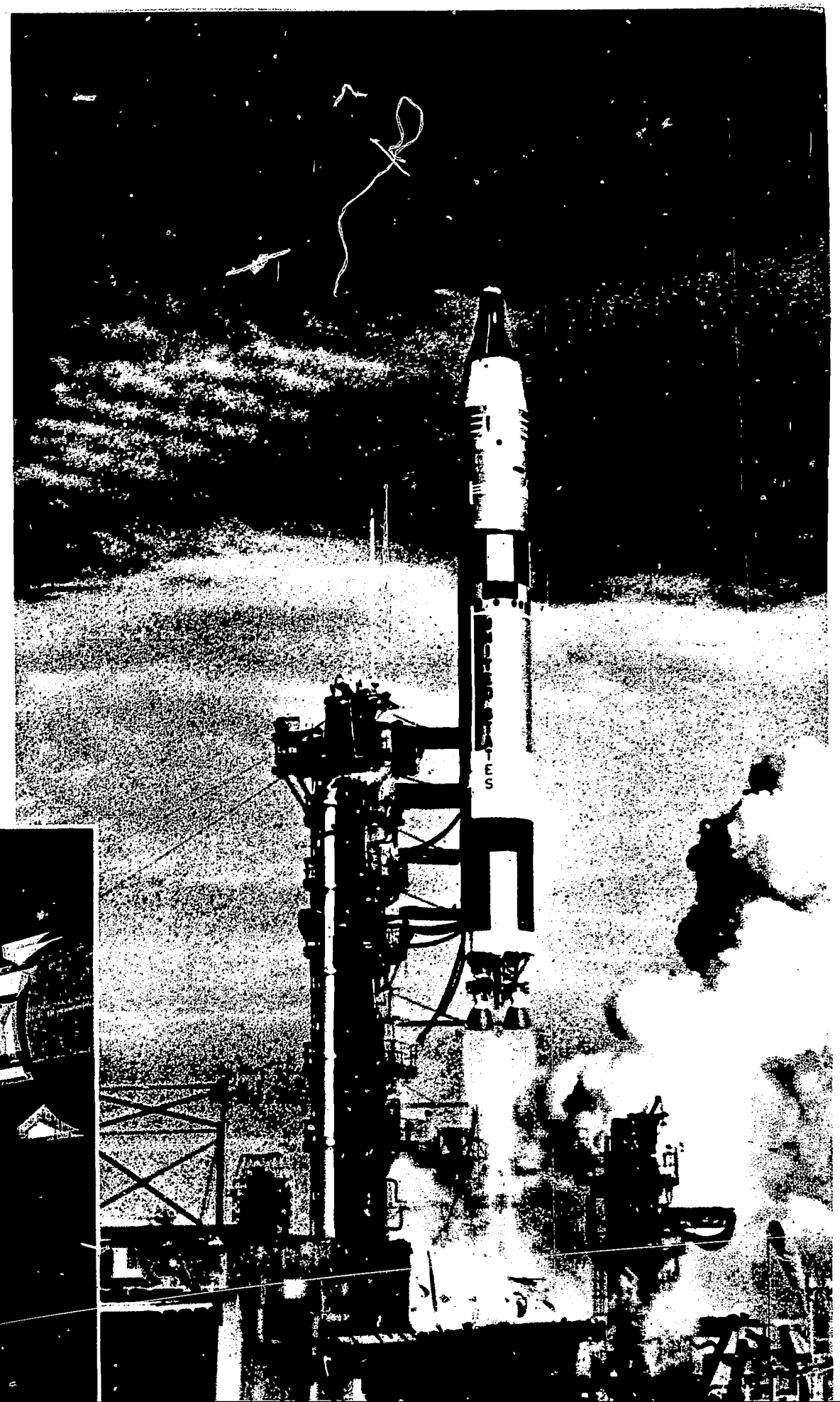
B. Experience and/or graduate study of the type, level, and quality required for the particular specialty and grade for which the applicant is being considered; and

C. For positions at the GS–11 level and above, evidence of knowledge of the basic concepts, methods, and objectives of science or engineering, and also (for grade GS–13 and above) evidence of understanding of research and development organizations and their specialized problems, organizational structures, functions, operations, and characteristics.

These requirements are described and defined in the following paragraphs.



Gemini Liftoff



The standards for these positions are high, the requirements are specialized and the number of positions to be filled in NASA is limited. For any grade or specialty, the required lengths, levels, and types of education and/or experience are minimum standards. The applicant's total record of education and/or experience and his performance therein must clearly establish that he has the ability to perform fully and proficiently the duties of the particular specialty or position in the particular aerospace program or organization for which he is being considered.

## A. Basic Requirement of a Bachelor's Degree or Equivalent Experience

All applicants must have successfully completed a full 4-year course leading to a bachelor's degree from

Gemini-Agena Docking Simulator

an accredited college or university or equivalent. The successful completion of college work in nonaccredited institutions will be accepted on the same basis as indicated for accredited colleges, provided that such institutions give instruction of definitely collegiate level and that the State University of the State in which the insitution is located accepts the courses and gives advanced credit for them. (In those States where there is no State university the evaluation and acceptance of college credit as made by the State Department of Education will be accepted.) This evaluation must be obtained by the applicant.

Applicants not possessing a bachelor's degree from an accredited college or university may also be eligible for these positions, provided that they can positively demonstrate the full equivalent in knowledges, skills, and intellectual background required for work in AST Research and Development Administration. Such applicants must have had 3 years of qualifying experience in administrative, managerial, professional, technical, investigative, or comparable work or an equivalent combination of such work and formal college or other acceptable study. Any time equivalent combination of education and experience is also acceptable. In combining education and experience, 1 academic year of under-graduate study will be considered equivalent to 9 months of experience.

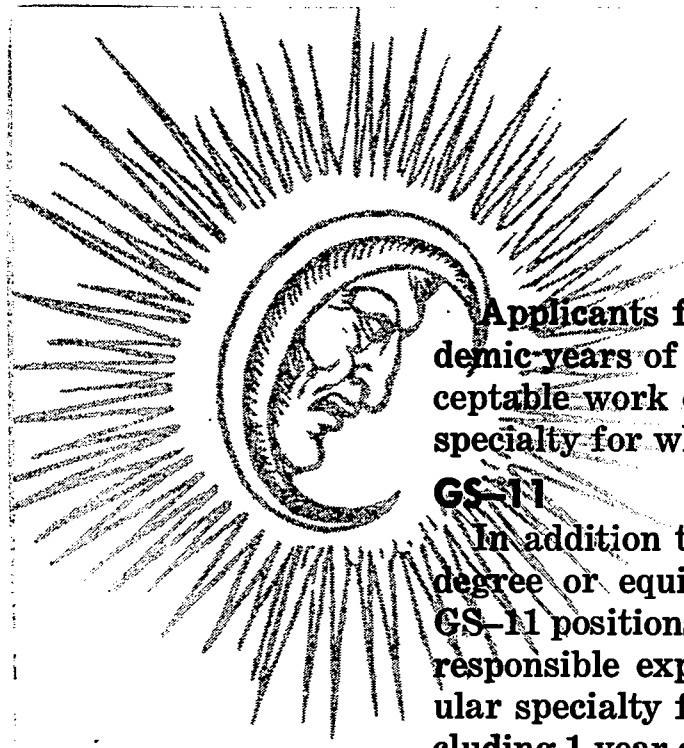
In order to meet the basic requirements, applicants for positions in AST Technical Writing and Editing must have completed a minimum of 15 semester hours in science, mathematics, engineering, or any combination thereof, or have successful and pertinent experience of such nature and level as to have provided technical or scientific subject matter knowledge equivalent to that which would have been acquired through study; or any equivalent combination of such study and experience.

In order to meet the basic requirement, applicants for positions in AST Financial Operations and AST Financial Systems must have had either (1) a full 4-year course of study in an accredited college or university which has included at least 24 semester hours in accounting and/or auditing subjects; or (2) 3 years of successful and pertinent experience of such nature and level as to have provided accounting or auditing subject matter knowledge equivalent to that which would have been acquired through such study; or (3) any equivalent combination of such study and experience. Applicants for these positions in grades GS–9, GS–11 or GS–12 who (*a*) lack successful completion of a full 4-year course of study in an accredited college or university which has included 24 semester hours of courses in accounting and/or auditing subjects; or (*b*) do not possess a CPA certificate obtained through written examination; or (*c*) are not rated eligible for GS–13 or higher, must demonstrate satisfactory knowledge of accounting principles and theory by passing a written test in accounting.

## B. Experience Requirements

### GS–9

In addition to the basic requirement of a bachelor's degree or equivalent described above, applicants for GS–9 positions must have had 2 years of progressively responsible experience broadly relevant to the particular specialty for which they are being considered, including 1 year of experience at GS–7 level within or closely related to that specialty; or 2 full academic years of appropriate graduate study; or equivalent combination.



Applicants for GS–9 positions who have 2 full academic years of appropriate graduate study but lack acceptable work experience will be rated eligible for the specialty for which their study is the most pertinent.

### GS–11

In addition to the basic requirement of a bachelor's degree or equivalent described above, applicants for GS–11 positions must have had 3 years of progressively responsible experience broadly relevant to the particular specialty for which they are being considered, including 1 year of experience at the GS–9 level within or closely related to that specialty; or 2 full academic years of appropriate graduate study, and 1 year of experience at the GS–9 level within or closely related to the particular specialty for which they are being considered; or equivalent combination.

### GS–12 Through GS–15

In addition to the basic requirement of a bachelor's degree or equivalent described above, applicants for GS–12, GS–13, GS–14, or GS–15 positions must have had at least 3 years of progressively responsible experience broadly relevant to the specialty, which has included 1 year of experience at the next lower grade level within or closely related to the specialty for which they are being considered; or 2 full academic years of appropriate graduate study, and 1 year of experience at the next lower level within or closely related to the specialty for which they are being considered; or equivalent combination.

At these grade levels, applicants must have positively demonstrated ability to develop, organize, direct, coordinate, monitor, and/or operate with superior effectiveness in the AST Administrative specialty or position for which they are being considered.



## C. Special Requirements for Administrative Positions at the GS–11 Level and Above

The duties of NASA administrative positions involve working with scientists and engineers to solve administrative problems directly interwoven with technical programs, and to develop administrative systems and techniques specifically conceived for R&D organizations and their specialized personnel. To successfully perform these duties applicants must have an understanding of the basic concepts, methods, and objectives of scientific or engineering efforts. In addition, all applicants for positions at GS–13 and above must also possess an understanding of research and development organizations and their specialized operations, organization structures, functions, and characteristics. To demonstrate these qualifications applicants must meet the following requirements:

*For positions at GS–11 and GS–12:*

A. One year of experience in an administrative position with a research and development organization; or

B. Successful completion of undergraduate or graduate courses totaling 30 semester hours, of which 15 semester hours must have been in physical science, biological science, mathematics, engineering, or a combination thereof. The remaining 15 semester hours must have been in the same subjects or in business administration, public administration, engineering management, industrial management, or comparable subjects; or

C. Any equivalent combination of A and B.

*For positions at GS–13 through GS–15:*

Two years of experience in an administrative posi-

tion with a research and development organization. For 1 year of this experience, applicants may substitute successful completion of undergraduate or graduate courses totaling 30 semester hours, of which 15 semester hours must have been in physical science, biological science, mathematics, engineering or a combination thereof. The remaining 15 semester hours must have been in the same subjects or in business administration, public administration, engineering management, industrial management, or comparable subjects.

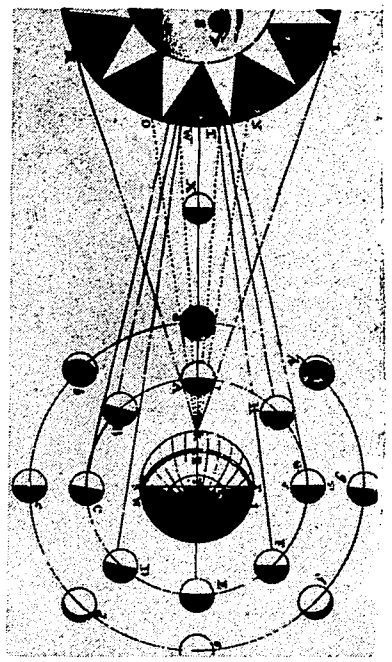
## Definition of Terms

The term "broadly relevant" refers to responsible administrative, managerial, or other experience that has clearly and positively provided subject matter qualifications or functional qualifications applicable to the specialty or position for which the applicant is being considered. Such experience or graduate study may have been obtained in an occupational field other than that for which the applicant is being considered, including education in an appropriate field of science or engineering or experience in a supervisory or managerial capacity in a research and development organization.

The term "within or closely related to the specialty" refers to experience that has provided the specific knowledges and skills and demonstrated the specific abilities and characteristics required for effective performance of the duties of the particular specialty or position for which the applicant is being considered, at the required level of competence.

## Definition of a Research and Development Organization

A research and development organization is one engaged in basic or applied research or in developmental work with the objective of producing or creating new knowledge, concepts, techniques, materials, devices, or systems. Such organizations require nonrepetitive work, have distinctive functions and operations, and require characteristic staffing patterns and occupational specializations which differ markedly from those of production and other types of organization.



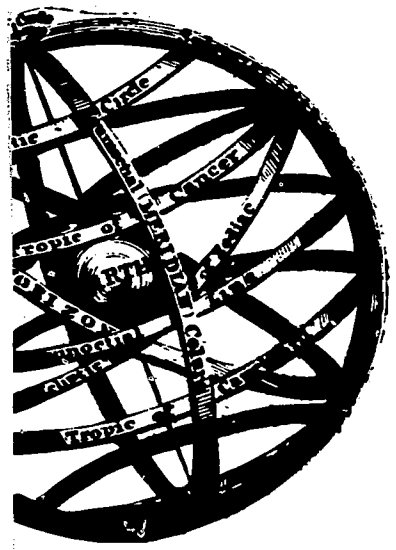
Characteristically, R&D functions, when included within a larger non-R&D organization, not only differ from other operations in type of work, type of staff, and staffing patterns, but are also usually in a separate organizational entity.

Excluded from definition of R&D organizations are those which are engaged in testing and evaluation of production articles with respect to present quality or performance standards, or are engaged in maintenance and repair of production or service equipment or facilities.

Included within the definition are organizations which are devoted to scientific or engineering testing or evaluation work such as development tests of prototype or one-of-a-kind articles. Also included are organizations devoted to theoretical or analytical research in scientific or engineering fields.

An organization which does not actually perform research and development work, but which is engaged in closely related functions such as providing contracts or grants for research and development, is considered to be an R&D organization within the meaning of this definition, provided that the work to a substantial degree involves substantive technical evaluation and creative guidance through monitoring or related functions.

In certain instances experience for and with rather than actually in an R&D organization may be considered acceptable. For example, experience in technical infor-



mation writing or editing work as a member of the staff of a periodical or publishing organization, is acceptable if such work was for and with scientists and engineers in R&D organizations or their scientific and engineering personnel.

Where the experience of an applicant has been in an organization which includes both R&D and non-R&D units, full credit is given if a significant portion of the time was devoted to problems of the R&D components.

## GENERAL INFORMATION

*Students*

Applications will be accepted from students who expect to complete the required education within 9 months after date of filing application. Students may receive and accept job offers from NASA prior to graduation but may not enter on duty before completing all required education.

### Part-Time or Unpaid Experience

Credit will be given for all pertinent experience of the type required, regardless of whether compensation was received or whether the experience was gained on a part-time or intermittent basis. Part-time or unpaid experience will be credited on the basis of the aggregate or total time actually spent in appropriate activities.

If you wish to receive credit for such experience, you must indicate clearly the nature of your duties and responsibilities in each activity, and the number of hours a week spent in each.

### Basis of Rating and Certification

No written test is required, except for applicants not meeting educational requirements for certain accounting positions. Qualifications will be rated by NASA professionals serving as expert members of Boards of U.S. Civil Service Examiners. The ratings will be on a scale of 100, based on evaluation of experience, education, and training as shown on the application and on further corroborative and supplementary information which may be obtained.

Separate ratings will be made and separate lists of eligible candidates will be maintained at the various grade levels for each NASA specialty by NASA Boards of Examiners as indicated on page 48. These lists may be further subdivided for certification purposes in terms of specialized education and experience according to the varying needs of NASA.

All eligible competitors must submit up-to-date information about their qualifications at intervals of not more than 12 months. For additional information concerning nature of appointments, physical requirements, veterans preference, employee benefits, etc., see Pamphlet 4, "Working for the U.S.A." This pamphlet is available at all offices where forms may be obtained. (See page 44.)

## ENTRANCE SALARIES FOR AST POSITIONS

*Specialties in Physical Sciences, Engineering, and Mathematics*

| | | | |
|---|---|---|---|
| GS-5 | $6,387 | GS-12 | $10,927 |
| GS-7 | $7,729 | GS-13 | $12,873 |
| GS-9 | $8,479 | GS-14 | $15,106 |
| GS-11 | $9,536 | GS-15 | $17,550 |

*Specialties in Life Sciences and Research and Development Administration*

| | | | |
|---|---|---|---|
| GS-9 | $ 7,696 | GS-13 | $12,873 |
| GS-11 | $ 9,221 | GS-14 | $15,106 |
| GS-12 | $10,927 | GS-15 | $17,550 |

## HOW TO APPLY

Send your application to one of the NASA Boards of U.S. Civil Service Examiners listed below. If you wish to be considered for employment at more than one NASA center apply separately with the Board of Examiners serving the installation where you will accept employment.

The Boards of Examiners at Ames Research Center and Lewis Research Center will accept applications for administrative positions only in grades GS–9 through GS–13. Until further notice, applications for administrative positions will not be accepted by the Board of Examiners, Manned Spacecraft Center. Except for Research Piloting positions, applications for grades GS–14 and 15 will not be accepted by the Board of Examiners, Flight Research Center.

Applications for positions in physical sciences, engineering, and mathematics at the GS–5 level will be accepted by the Boards of Examiners at Flight Research Center and Langley Research Center only.

See pages 45–48 to determine the specialties for which applications will be accepted by each NASA Board of Examiners.

The applicability of your education and experience for positions in physical sciences, engineering, mathematics, and life sciences may vary among the centers. This may affect the numerical ratings you receive from different NASA Boards of Examiners. Ratings assigned for positions in Research and Development Administration by a NASA Board of Examiners will be accepted by any other NASA Board of Examiners accepting applications for the same position and grade when a copy of the Notice of Rating is filed with application (SF–57).

For Ames Research Center, send application to—

**Board of U.S. Civil Service Examiners**
**NASA Ames Research Center**
**Mountain View, Calif. 94035**

For Flight Research Center, Western Support Office or Space Nuclear Propulsion Office (Nevada), send application to—

**Board of U.S. Civil Service Examiners**
**NASA Flight Research Center**
**P.O. Box 273, Edwards, Calif. 93523**

For Goddard Space Flight Center, or NASA Headquarters, send application to—

**Board of U.S. Civil Service Examiners**
**NASA Goddard Space Flight Center**
**Greenbelt, Md. 20771**

For Langley Research Center or Wallops Station, send application to—

**Board of U.S. Civil Service Examiners**
**NASA Langley Research Center**
**Hampton, Va. 23365**

For Lewis Research Center, send application to—

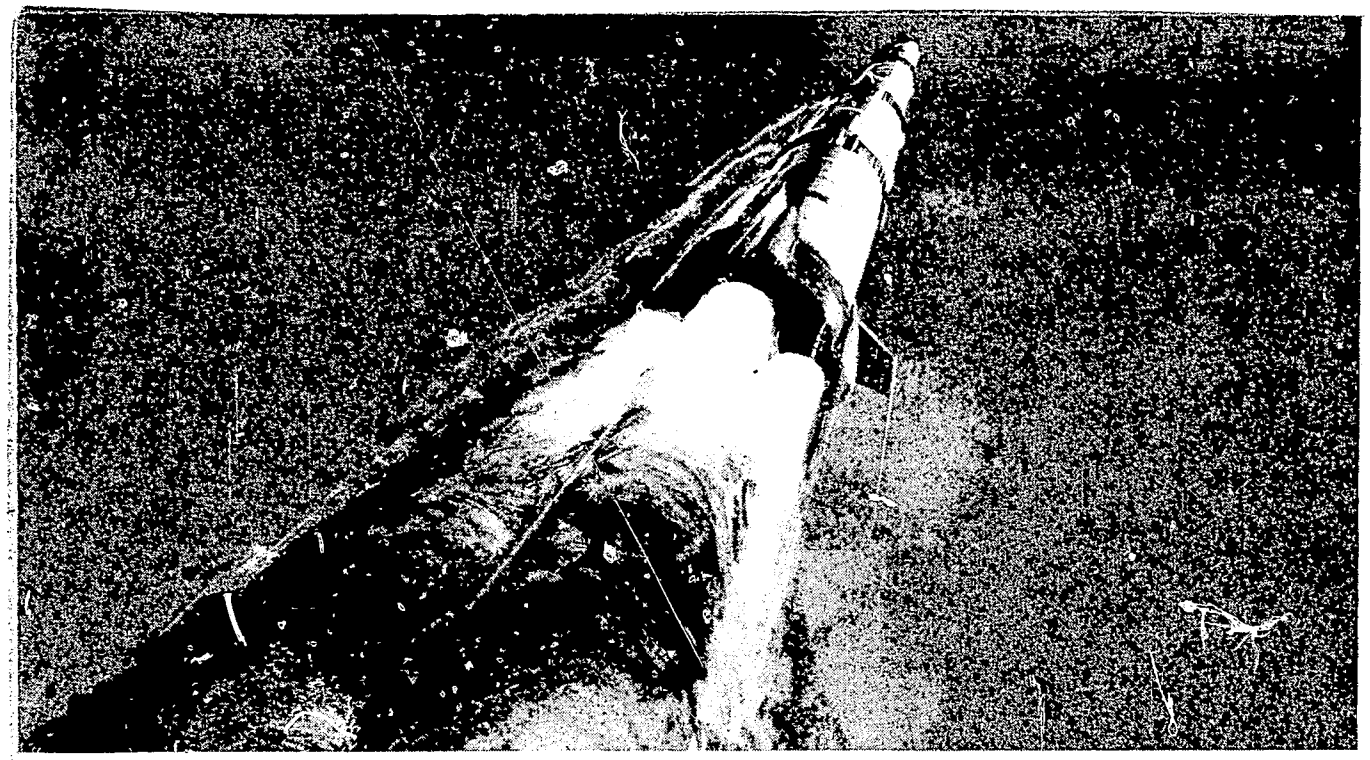
**Board of U.S. Civil Service Examiners**
**NASA Lewis Research Center**
**Cleveland, Ohio 44135**

For Marshall Space Flight Center, John F. Kennedy Space Center, Kennedy Space Center, Fla., or Army Missile Command, Redstone Arsenal, Ala., send application to—

**Interagency Board of U.S. Civil Service Examiners for Northern Alabama**
**806 Governors Drive SW.**
**Huntsville, Ala. 35801**

For Manned Spacecraft Center and for Manned Spacecraft Center Test Facilities at White Sands Missile Range, N. Mex., send application to—

**Interagency Board of U.S. Civil Service Examiners**
**NASA Manned Spacecraft Center Branch**
**Houston, Tex. 77058**



Artist's Concept of Saturn 5 Liftoff

For the new Electronics Research Center to be built in the greater Boston, Mass. area, send application to—

**Board of U.S. Civil Service Examiners**
**NASA Electronics Research Center**
**575 Technology Square**
**Cambridge, Mass. 02139**

***GS-5 AND GS-7 POSITIONS IN R&D ADMINISTRATION***

**R&D administration positions in grades GS-5 and GS-7 are not included in this announcement. Such positions will be filled by selection from the Federal Service Entrance Examination, Management Intern Examination, or other appropriate examinations administered by the U.S. Civil Service Commission.**

***GS-13, GS-14, and GS-15 POSITIONS IN R&D ADMINISTRATION***

**Persons who have been rated eligible for GS-13, GS-14, or GS-15 on the Federal Administrative Management Examination No. 167 administered by the U.S. Civil Service Commission *do not thereby become eligible for this examination.* Such persons, if they are interested in and consider themselves qualified for positions covered by this announcement, must file applications under the terms of this announcement with the appropriate NASA Board of U.S. Civil Service Examiners.**



## WHAT TO FILE

1. Application for Federal Employment (SF–57) and card Form 5001 ABC.

2. Standard Form 15, with the documentary proof required therein, if you are claiming:
   a. 10-point veteran preference (disability, widow, wife, or mother preference) or
   b. 5-point veteran preference based on service in a campaign or expedition for which a campaign badge is authorized.

Documentary proof will be returned to applicants.

3. If you are now a student and/or you have less than 2 years of professional experience, send a copy or photostat of your college transcript(s), or a complete list of courses showing the college where the courses were taken, hours of credit obtained for each course, grades received, and dates of completion. In addition, if you are now a college senior or graduate student, be sure to include a list of courses you are now taking or plan to take, including course titles and catalog numbers, hours of credit, and anticipated dates of completion of such courses, and also anticipated date of completion of all requirements for the degree.

4. Research pilots: Submit a year-by-year tabulation of your flying record, showing types of aircraft flown and number of hours in each, distinguishing between pilot and copilot time, and indicating the total number of hours each of pilot and copilot time. Personal logs and licensing certificates should not be submitted.

Application forms may be obtained from any of the NASA Centers, most Post Offices or from U.S. Civil Service Commission offices.

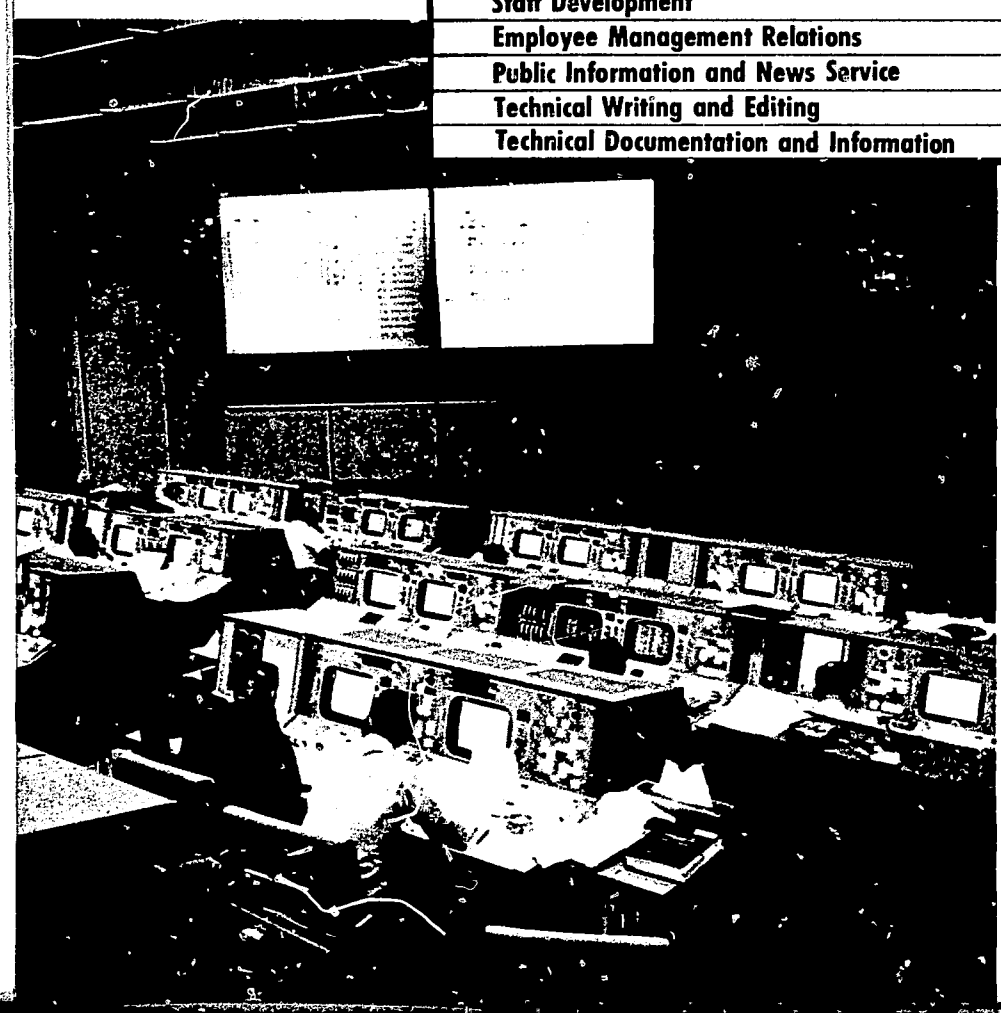
All qualified applicants will receive consideration for employment without regard to sex, race, color, creed, or national origin.

| SPECIALTIES OF AERO-SPACE TECHNOLOGY IN PHYSICAL SCIENCES, ENGINEERING AND MATHEMATICS | Board of Examiners Ames Research Center | Board of Examiners Flight Research Center | Board of Examiners Goddard Space Flight Center | Board of Examiners Langley Research Center | Board of Examiners Lewis Research Center | Board of Examiners Marshall Space Flight Center | Board of Examiners Manned Spacecraft Center | Board of Examiners Electronics Research Center |
|---|---|---|---|---|---|---|---|---|
| **SPACE SCIENCES** | x | | x | x | | x | x | x |
| Aeronomy | | | x | | | | | x |
| Ionospheres | | | x | | | | x | x |
| Fields and Particles | | | x | | x | | x | x |
| Stellar Studies | | | x | | | | x | x |
| Lunar and Planetary Studies | | | x | | | | x | x |
| Meteoroid Studies | | | x | | | | x | x |
| Solar Studies | | | x | | | | x | x |
| **FLUID AND FLIGHT MECHANICS** | x | x | x | x | x | x | x | x |
| Flight Mechanics | x | x | x | x | x | x | x | x |
| Control and Guidance Systems | x | x | x | x | x | x | x | x |
| Fluid Mechanics | x | x | | x | x | x | x | x |
| Magnetofluiddynamics | x | | | x | x | | | x |
| Aerostructural Dynamics | x | x | x | x | x | x | | |
| Flight Vehicle Acoustics | | x | | x | | | x | |
| Heat Transfer | x | x | x | x | x | x | x | |
| Stability, Control and Performance | x | x | x | x | x | x | x | x |
| Flight Vehicle Atmospheric Environment | x | x | | x | | x | x | x |
| Basic Properties of Gases | x | | | | x | x | x | x |
| **MATERIALS AND STRUCTURES** | x | x | x | x | x | x | x | x |
| Materials | x | | x | x | x | x | x | x |
| Structural Materials | x | | x | x | x | x | x | x |
| Aerospace Metals | x | | x | x | x | x | x | x |
| Basic Properties of Materials | x | | x | x | x | x | x | x |
| Aerospace Polymers | x | | | x | x | x | x | x |
| Refractory Compounds | | | | x | x | x | x | x |
| Friction and Lubrication | | | | | x | | | x |
| Structural Mechanics | x | x | x | x | x | x | x | x |
| Flight Structures | x | x | x | x | x | x | x | x |
| **PROPULSION SYSTEMS** | x | x | x | x | x | x | x | x |
| Liquid Propulsion Systems | | x | x | | x | x | x | |
| Solid Propulsion Systems | | x | x | x | x | x | x | |
| Electrical Propulsion and Power | | x | x | | x | x | x | x |
| Direct Energy Conversion | | | x | | x | x | x | x |

| SPECIALTIES OF AERO-SPACE TECHNOLOGY IN PHYSICAL SCIENCES, ENGINEERING AND MATHEMATICS | Board of Examiners Ames Research Center | Board of Examiners Flight Research Center | Board of Examiners Goddard Space Flight Center | Board of Examiners Langley Research Center | Board of Examiners Lewis Research Center | Board of Examiners Marshall Space Flight Center | Board of Examiners Manned Spacecraft Center | Board of Examiners Electronics Research Center |
|---|---|---|---|---|---|---|---|---|
| **PROPULSION SYSTEMS** *(Continued)* | | | | | | | | |
| Nuclear Energy Processes | | | | | x | x | | |
| Nuclear Propulsion and Power | | x | x | | x | x | x | x |
| Chemical Energy Processes | | | x | | x | x | x | x |
| Internal Flow Dynamics | | x | | x | x | | | x |
| Propulsion System Dynamics | x | x | x | x | x | | | |
| **FLIGHT SYSTEMS** | x | x | x | x | x | x | x | x |
| Reliability | x | x | x | x | x | x | x | x |
| Flight Systems Test | x | x | x | | x | x | x | |
| Experimental Manufacturing Techniques | | x | x | | x | x | | |
| Electrical Systems | x | x | x | x | x | x | x | x |
| Manned Space Flight Systems | | | x | | | | | |
| Quality Assurance | x | x | x | x | x | x | x | x |
| **MEASUREMENT AND INSTRUMENTATION SYSTEMS** | x | x | x | x | x | x | x | x |
| Sensors and Transducers | x | x | x | x | x | x | x | x |
| Space Optics | | | x | | | | x | x |
| Measurement, Standards and Calibration | x | x | x | x | | x | x | x |
| Control Systems | x | x | x | x | x | x | x | x |
| Tracking and Telemetry Systems | x | x | x | x | x | x | x | x |
| Antennas | x | | x | x | x | x | x | x |
| Telemetry Systems | x | x | x | x | x | x | x | |
| Tracking Systems | x | x | x | x | | x | x | x |
| Tele-Communications | | x | x | | | x | x | x |
| Electronics of Materials | x | | x | x | x | | x | x |
| **DATA SYSTEMS** | x | x | x | x | x | x | x | x |
| Data Analysis | x | x | x | x | x | x | x | x |
| Theoretical Simulation Techniques | x | x | x | x | x | x | x | x |
| Data Equipment | x | x | x | x | x | x | x | x |
| **EXPERIMENTAL FACILITIES AND EQUIPMENT** | x | x | x | x | x | x | x | x |
| Launch and Flight Operation | x | x | x | x | x | x | x | |
| Experimental Tooling and Equipment | x | | x | | x | x | | x |
| Fluid and Flow Systems | | | x | x | x | x | x | x |
| Electrical Experimental Equipment | x | | x | x | x | x | x | x |

| | Board of Examiners Ames Research Center | Board of Examiners Flight Research Center | Board of Examiners Goddard Space Flight Center | Board of Examiners Langley Research Center | Board of Examiners Lewis Research Center | Board of Examiners Marshall Space Flight Center | Board of Examiners Manned Spacecraft Center | Board of Examiners Electronics Research Center |
|---|---|---|---|---|---|---|---|---|
| **SPECIALTIES OF AERO-SPACE TECHNOLOGY IN PHYSICAL SCIENCES, ENGINEERING AND MATHEMATICS** | | | | | | | | |
| **EXPERIMENTAL FACILITIES AND EQUIPMENT** *(Continued)* | | | | | | | | |
| Experimental Facility Techniques | x | x | x | x | x | x | x | x |
| Nuclear Experimental Techniques | x | x | | | x | | x | |
| **RESEARCH PILOTING** | x | x | | x | x | | x | |
| **MANAGEMENT** | | | | | | | | |
| Program Management | | | x | | | | | |
| Project Management | | x | x | x | x | x | x | |
| Technical Management | x | x | x | x | x | x | x | x |
| Technology Utilization | x | x | x | x | x | x | x | x |
| **SPECIALTIES OF LIFE SCIENCES AND SYSTEMS** | | | | | | | | |
| **LIFE STUDIES** | x | | x | x | | | x | x |
| Biochemical Studies | x | | | | | | x | |
| Psychological Studies | x | | | | | | | |
| Plant Studies | x | | | | | | | |
| Physiological Studies | x | | | | | | | |
| Molecular Biodynamics | x | | | | | | | |
| Radiobiological Studies | x | | | | | | | |
| Neurobiology | x | | | | | | | |
| **EXOBIOLOGY** | x | | x | | | | x | x |
| Chemical Evolution | x | | | | | | | |
| Biological Adaptation | x | | | | | | | |
| Life Detection Systems | x | | | | | | | |
| **MAN-MACHINE SYSTEMS** | x | | x | x | | | x | x |
| Environmental Physiology | x | | | | | | x | x |
| Human Performance Studies | x | | | | | | x | x |
| Environmental Control | x | | | | | | x | |
| Manned Systems Engineering Studies | x | | | | | | x | x |
| Bionics Studies | x | | | | | | x | x |

| SPECIALTIES OF AERO-SPACE TECHNOLOGY IN RESEARCH & DEVELOPMENT ADMINISTRATION | Board of Examiners Ames Research Center | Board of Examiners Flight Research Center | Board of Examiners Goddard Space Flight Center | Board of Examiners Langley Research Center | Board of Examiners Lewis Research Center | Board of Examiners Marshall Space Flight Center | Board of Examiners Manned Spacecraft Center | Board of Examiners Electronics Research Center |
|---|---|---|---|---|---|---|---|---|
| Administrative Operations | | | x | | x | x | | |
| Organization and Management Planning | | | x | | x | x | | |
| Project Analysis and Control | | | x | x | x | x | | |
| Contract Negotiations | | x | x | x | x | x | | |
| Contract Administration | x | | x | x | x | x | | |
| Contract Operations | | x | x | x | x | x | | |
| Contract Pricing and Analysis | | x | x | x | x | x | | |
| Procurement Management | x | | x | | x | x | | |
| Financial Operations | x | x | x | x | x | x | | |
| Financial Systems | | | x | x | x | x | | |
| Budget Management | | x | x | x | x | x | | |
| Resources Programming | | | x | | x | | | |
| Personnel Management and Operations | | x | x | | x | x | | |
| Personnel Staffing | | | x | x | x | | | |
| Occupational and Salary Systems | | | x | x | x | x | | |
| Staff Development | | | x | x | x | x | | |
| Employee Management Relations | | | x | | x | x | | |
| Public Information and News Service | x | | x | x | x | x | | |
| Technical Writing and Editing | | | x | | x | x | | |
| Technical Documentation and Information | | | x | | x | x | | |



Gemini Control

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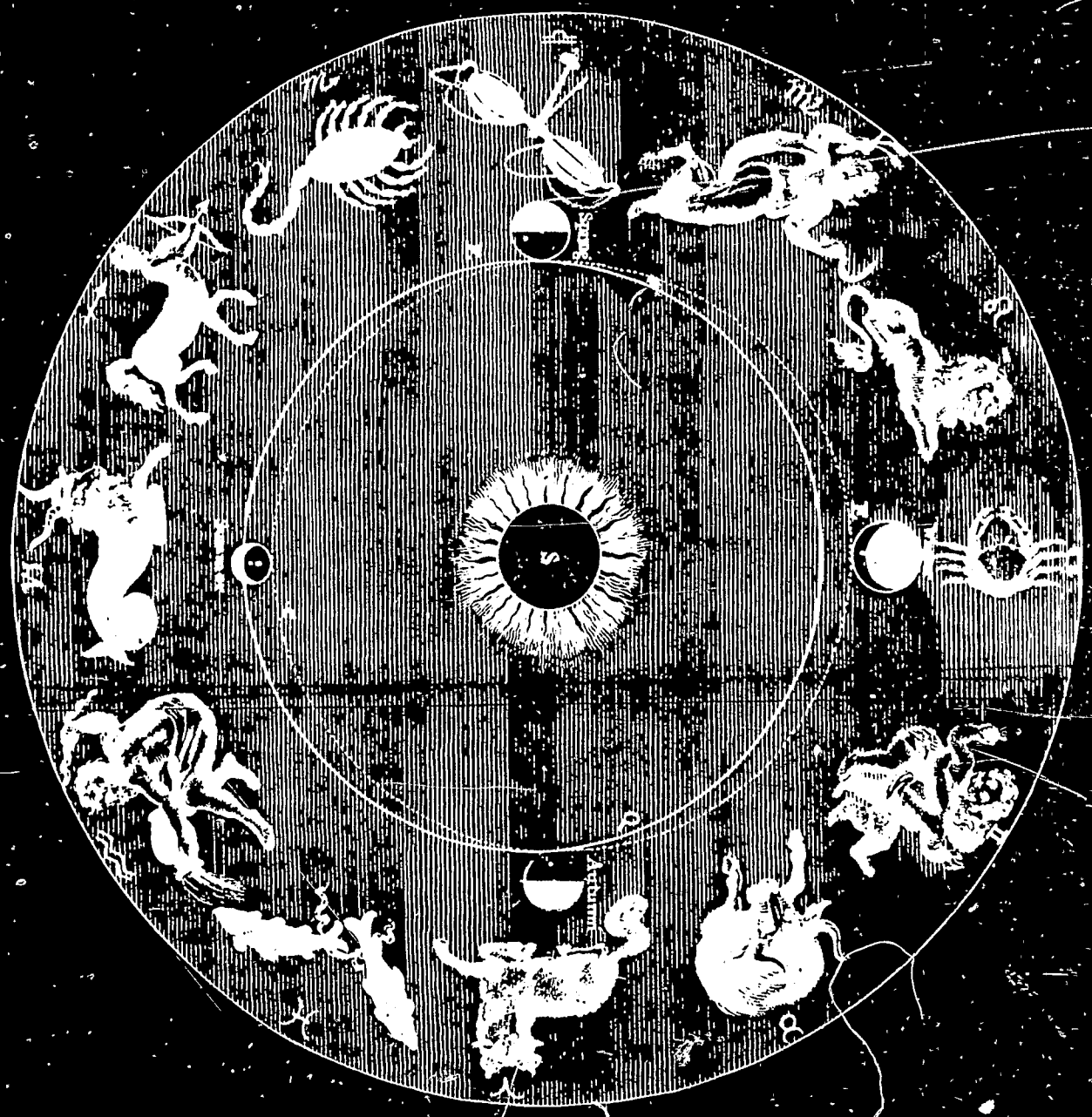
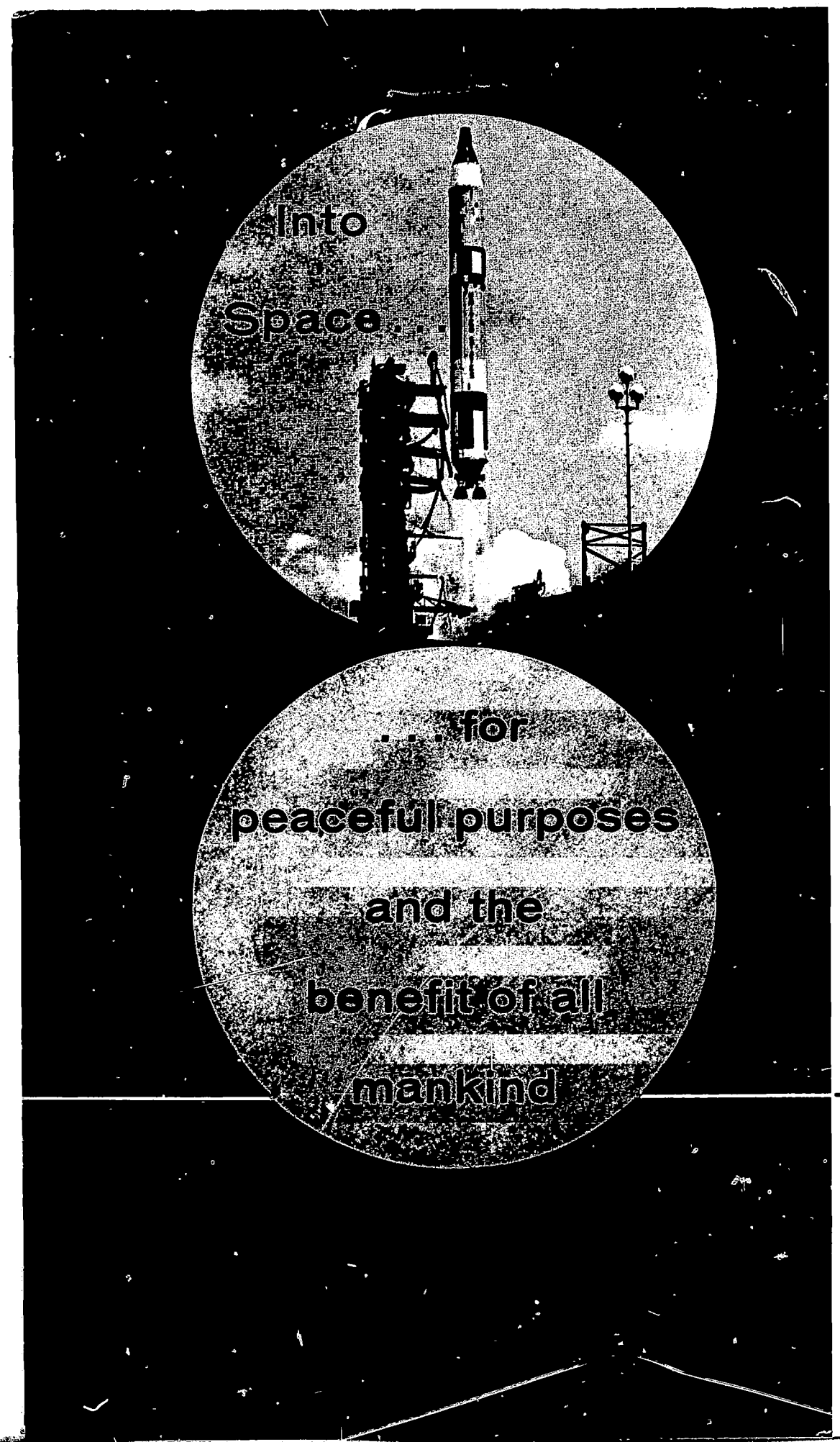

Sirius
Aquarius

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