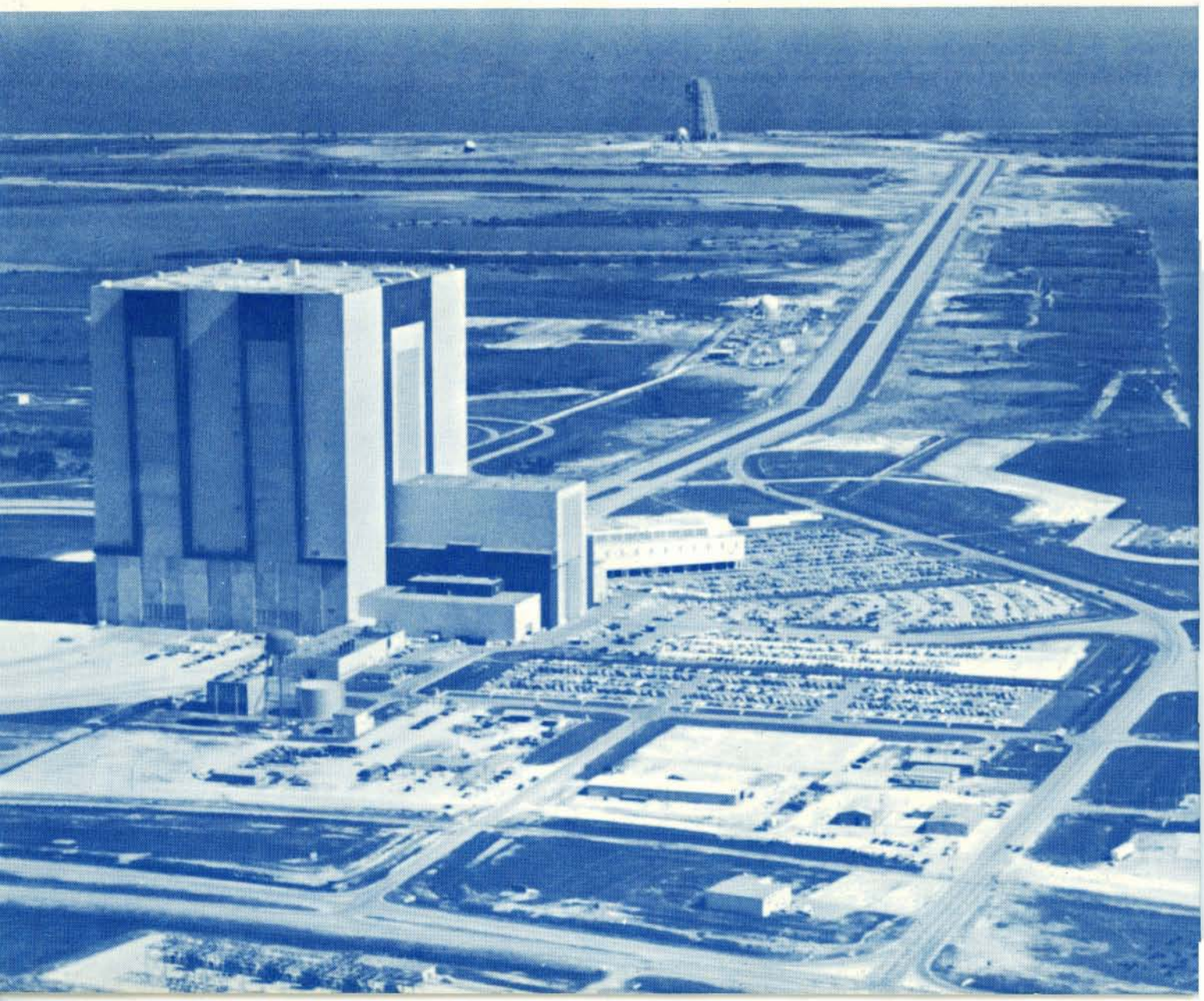
John F. Kennedy Space Center

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

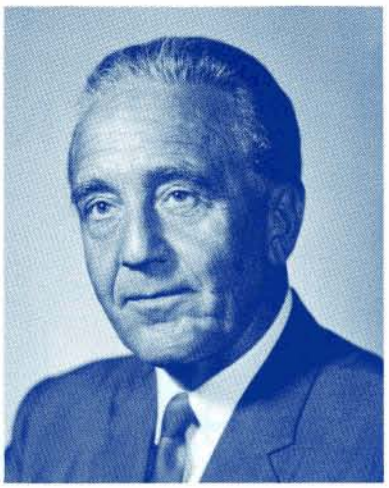
AMERICA'S SPACEPORT

"The story of man's achievement throughout history has been the story of his victory over the forces of nature. In that continuing story, our generation has been given the opportunity to write the grandest chapter of them all. It is on our schedule, in our plan, and in our determination to put men on the moon before 1970."

President Lyndon B. Johnson
Sept. 27, 1966



WELCOME...



Welcome to the John F. Kennedy Space Center, NASA.

This is the major launch base from which manned and unmanned spacecraft explore the environment beyond the Earth's atmosphere, reaching out to the Moon, the Sun and the planets.

Thousands of dedicated engineers, scientists, technicians and support personnel, members of an integrated Government-Industry team, have created these facilities. The Center's superb launch team has achieved many "firsts" in man's conquest of space. These accomplishments represent an important phase of the Nation's effort to achieve and maintain preeminence in space research and exploration.

I trust you will share our pride in the unique environment of the launch center and the historic work being carried on here.

Kurt H. Debus, Director
John F. Kennedy Space Center,
NASA

MISSION

John F. Kennedy Space Center is the major NASA launch organization for manned and unmanned space missions.

As the lead center within NASA for the development of launch philosophy, procedures, technology and facilities, Kennedy Space Center launches Apollo space vehicles; unmanned lunar, planetary and interplanetary spacecraft; and scientific, meteorological and communications satellites.

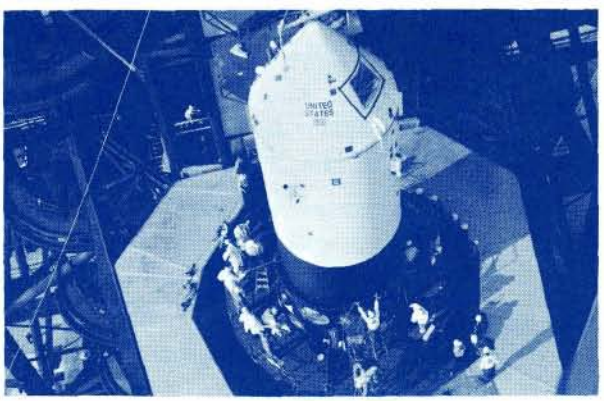
The mission encompasses planning and directing:

- Preflight Preparations
- Vehicle Integration
- Test and Checkout of Launch Vehicles, Spacecraft and Facilities
- Coordination of Range Requirements
- Countdown and Launch Operations

Supporting this primary mission are a host of technical and administrative activities. These include design engineering; testing, assembly and checkout of launch vehicles and spacecraft; launch operations; and purchasing and contracting.

The national Spaceport is the site from which American astronauts will be launched on lunar exploration missions before the end of the decade.

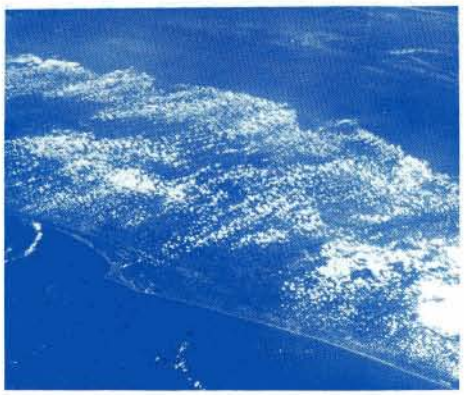
The Air Force Eastern Test Range, part of the Air Force Systems Command, operates and maintains the largest missile proving ground in the free world, one that spans 10,000 miles. The Test Range's mission is to provide launch facilities and support services for launching missiles and spacecraft, and gather useful data from the flights. The Range supports NASA-sponsored launches for the peaceful exploration of space.



The National Aeronautics and Space Administration was established October 1, 1958. This was 12 months after the launch of Sputnik 1, the first man-made Earth satellite, and nine months after the launch of Explorer 1, the first United States satellite.

The major focus of NASA's launch operations has centered on Cape Kennedy, formerly Cape Canaveral, Florida. The antecedents of these activities date back to the years following World War II when the War Department selected the site as a testing area for long-range guided missiles. This spit of land jutting into the Atlantic Ocean was selected because of the chain of islands stretching southeastward to Ascension Island which could accommodate tracking stations to measure the flight of research and development vehicles. The site was formally approved July 8, 1947.

Soon afterward, Congress authorized the acquisition and construction of the Atlantic Missile Range, now the Eastern Test Range. As a Department of Defense facility, the range was assigned to the Air Force for management. Subsequently, the range was extended to the Indian Ocean, a distance of more than 10,000 miles. The Army and Navy have also utilized the range facilities in the development of rocket-powered weapons systems.



As the NASA program got underway, the Cape became the headquarters of the Launch Operations Center, later renamed the John F. Kennedy Space Center, NASA.

In late 1964, the Kennedy Space Center was relocated on adjacent Merritt Island. The site occupies some 88,000 acres. Here, facilities have been installed to accommodate enormously powerful space vehicles to carry man to the Moon and back, and to undertake even more challenging missions in the vast reaches of the universe.

By noteworthy coincidence, the Spaceport has an unusual heritage. Numerous Indian burial mounds and middens (refuse piles) have been discovered on NASA property. Researchers have removed artifacts dating back to the time of Christ. Elsewhere, particularly along the beaches, traces have been found of early Spanish activity.

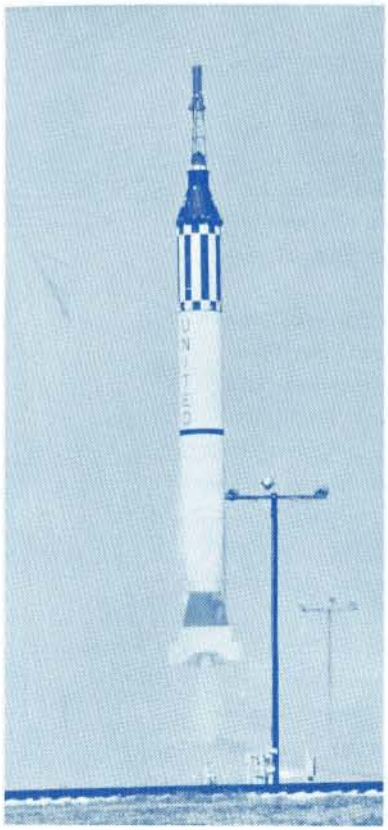
Dr. Charles Fairbanks of the University of Florida has pointed out: "This was one of the areas where Western civilization came to the New World, and now it is the area from which our civilization will go forth to other worlds."

LAUNCH VEHICLES

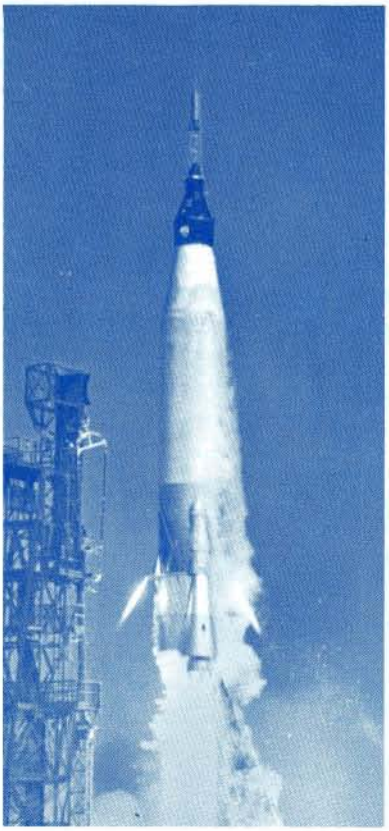
The United States space program depends on the ability of scientists and engineers to provide the means for propelling useful payloads into Earth orbit and into the farther reaches of space. For this task, launch vehicles of varying sizes and capabilities are necessary.

The flight path chosen for a payload determines what performance is required of the particular launch vehicle. Obviously, it would be impractical to use our most powerful launch vehicle, the Saturn V, to orbit a small, lightweight group of scientific satellites, or to risk failure of a mission by placing too much weight on a launch vehicle of any size.

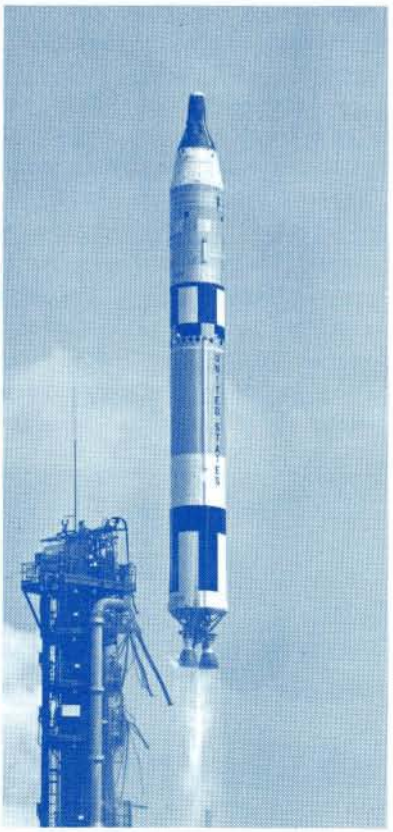
For these reasons, NASA has developed a family of reliable launch



MERCURY/REDSTONE



MERCURY/ATLAS



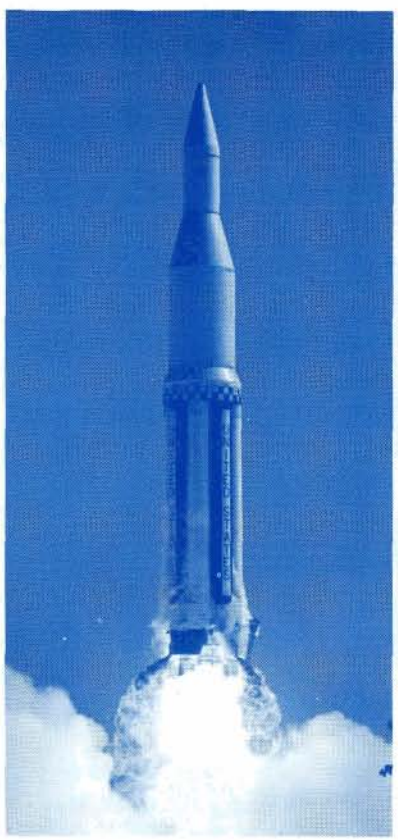
GEMINI/TITAN

vehicles of different sizes, shapes and capabilities. The objective has been to develop the smallest number of vehicles consistent with the full scope of the space program.

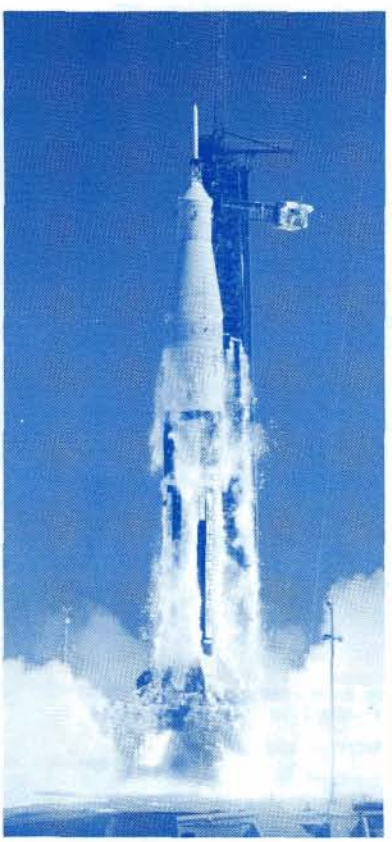
Launch vehicles employed for space missions in the recent past evolved principally from basic military systems developed and tested during the previous decade. Technological exchange between military and scientific projects continues to benefit the national space program.

The first United States satellite was orbited by an Army-developed Jupiter-C missile. Delta, the workhorse of NASA's unmanned spacecraft program, employs components developed by the Air Force and Navy. Modified Army/Air Force developed Redstone and Atlas boosters were utilized for the Mercury program, this country's initial manned space flight effort. The Gemini launch vehicle was a modified Air Force Titan II booster. Centaur, the world's first space launch vehicle to be powered by liquid hydrogen fuel, and the highly successful Ranger and Mariner space probes were boosted into space by modified Air Force Atlas vehicles.

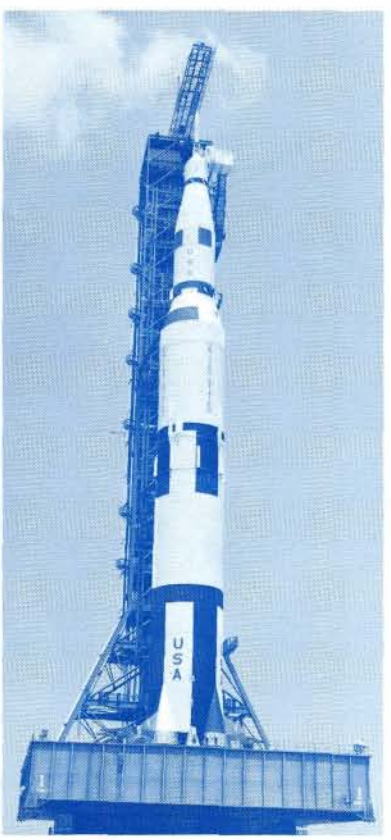
The Saturn family of heavy launch vehicles, which was developed by NASA expressly for the peaceful exploration of space, evolved from technology acquired during the Army's early Redstone, Jupiter and Juno missile development programs.



SATURN I



APOLLO/UPRATED SATURN



APOLLO/SATURN V

MANNED SPACE FLIGHT

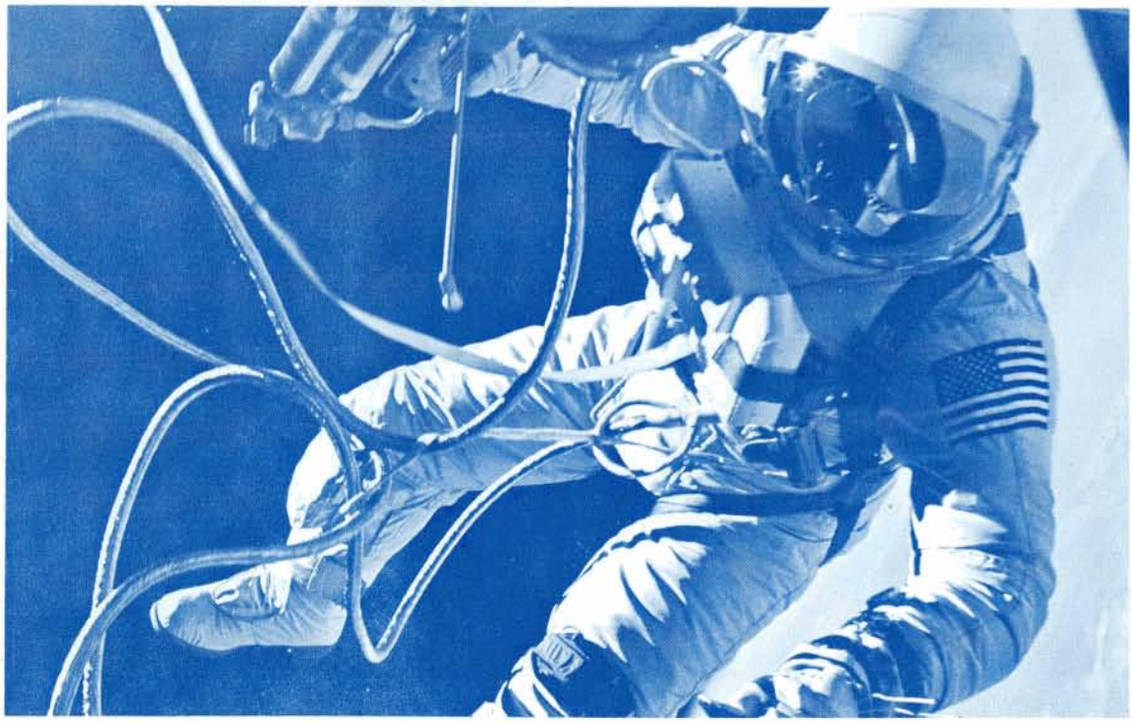
For thousands of years man has dreamed of the day when he would explore the vast universe that surrounds his tiny planet. This aspiration has stemmed from his fundamental thirst for knowledge and his readiness to accept the challenge of the unknown.

When Orville Wright made the first powered flight in 1903 at a speed of 31 miles per hour, the significance of his achievement was barely recognized. Yet, in little more than half a century following that historic event at Kitty Hawk, man has succeeded in orbiting the Earth at speeds measured in thousands of miles per hour. Now, he is literally reaching for the Moon as the first stop on the way to exploration of the solar system and the infinite reaches of interstellar space beyond.

The achievements in space since the first satellites were launched have paled to insignificance when compared with future projects. Only in the light of what he has already accomplished can man look ahead with the almost certain knowledge that he eventually will realize his age-old dream of exploring the universe.

Viewed in terms of time and distance, the challenge of space exploration seems insurmountable. Yet, a review of the technological accomplishments of the 20th century indicates that what appears as impossible is merely difficult.

The exploration of space is following the pattern by which flight within the atmosphere was mastered. Each new development provides a platform from which to take the next step, and each step is an increment of scientific knowledge and technological skill.

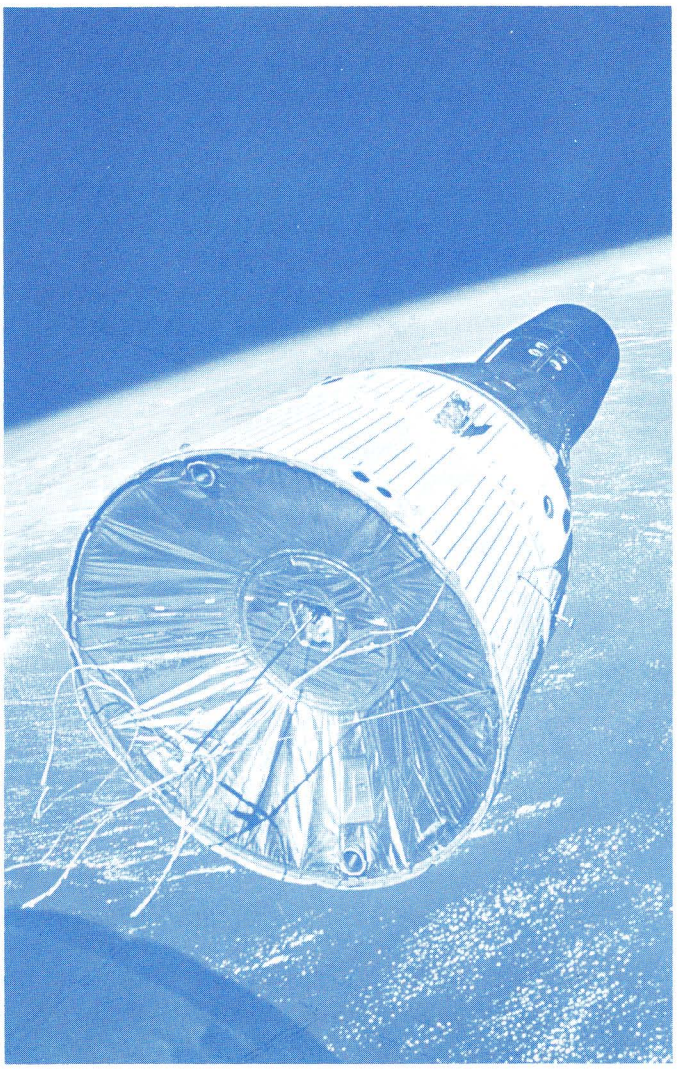


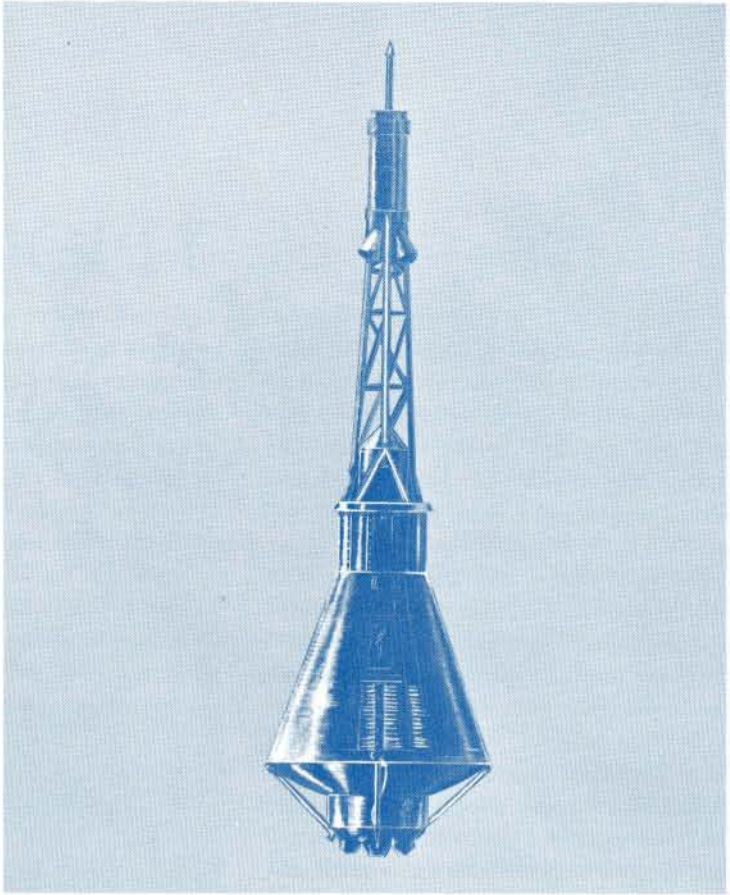
In all probability man will establish permanent stations in space laboratories, experimental testing platforms, and way stations as he develops the transportation and life support systems which would make them possible. He will visit the Moon. Someday he also may visit Venus and Mars. He will send probes to the more distant planets and perhaps even the stars. He may discover that life exists elsewhere in the universe. He may communicate with other beings. Regardless of what form his exploration takes, or what other results he may achieve, the greatest benefit will be the knowledge man brings back for the betterment of all mankind.

The benefits that will inevitably result from manned space exploration are just beginning to emerge. But if the history of scientific exploration in the past can serve as a valid guideline to the future, the knowledge to be gained from manned ventures into space will far exceed the most optimistic hopes and dreams.

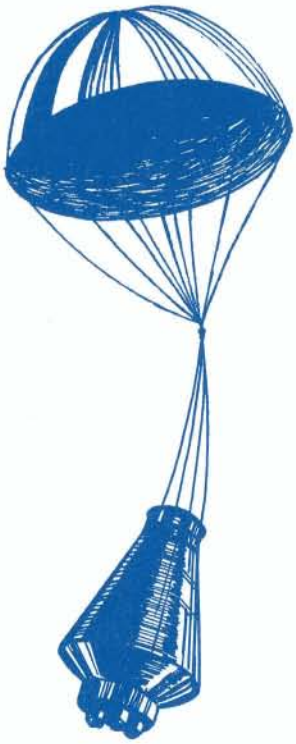
Although the landing of American astronauts on the Moon has been set as a major national goal, the three projects directed toward achieving this aim – Mercury, Gemini, and Apollo, have been designed to lay the foundation for additional progress.

Project Mercury, the initial step in the United State's manned space flight program, was completed on May 16, 1963, after six successful manned missions. The Gemini program, involving two-man spacecraft, was completed in November, 1966, following ten Earth orbital missions. The knowledge and skills acquired in both programs are now being applied to the Apollo program.





MERCURY



Project Mercury, the first of the manned space flight programs, was organized October 5, 1958, and successfully executed in less than five years.

The primary objectives of Project Mercury were:

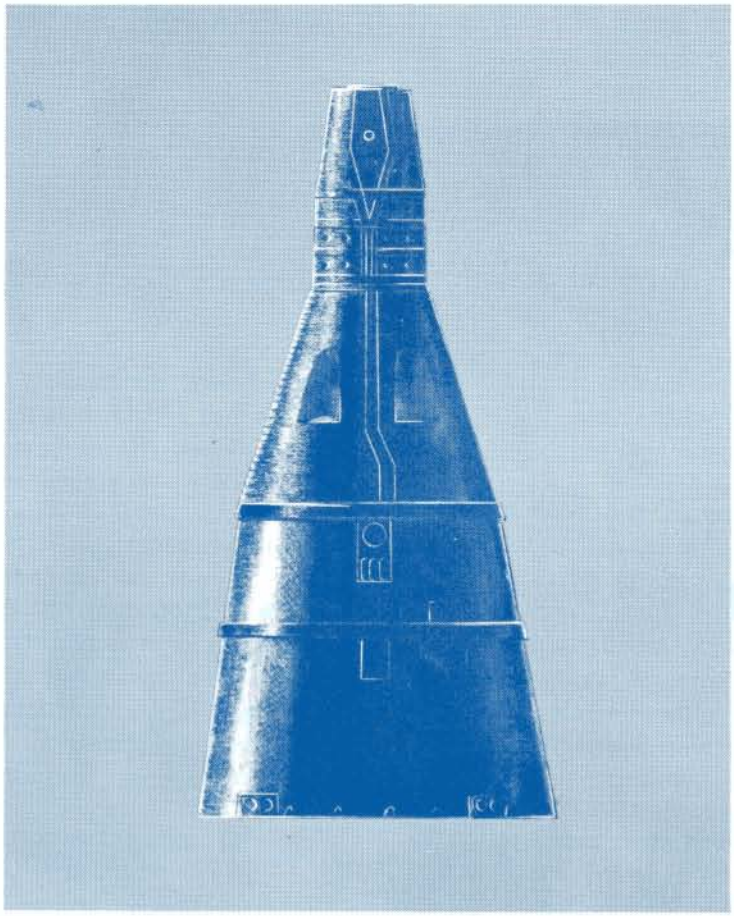
- To place a manned spacecraft in orbital flight around the Earth.
- To investigate man's performance capabilities and his ability to function in the environment of space.
- To recover, safely, both man and spacecraft.

Project Mercury demonstrated that the high-gravity forces of launch and reentry, and weightlessness in orbit for as much as 34 hours, did not impair man's ability to control a spacecraft. It proved that man not only augments the automated spacecraft controls, but also can conduct scientific observations and experiments.

Moreover, Project Mercury proved that man can respond to and record the unexpected, a faculty beyond the capability of a machine which can be programmed only to deal with what is known or expected. In addition, the Mercury flights confirmed that man can consume food and beverages and perform other normal functions while in a weightless environment. Finally, Mercury laid a sound foundation for the technology of manned space flight.

The Mercury spacecraft, a one-man, bell-shaped vehicle, 9.5 feet high and 6 feet across at its reentry heat shield base, weighed approximately 4,000 pounds at liftoff and 2,400 pounds at recovery.

The launch vehicle for the Mercury suborbital missions was a modified Redstone rocket generating 78,000 pounds of thrust at liftoff. A modified Atlas rocket whose three engines produced 367,000 pounds thrust was employed for Mercury orbital flights. Complexes 56 and 14 at Cape Kennedy were utilized for the Mercury missions.



GEMINI

Gemini was the intermediate step toward achieving a manned lunar landing, bridging the flight experience gap between the short-duration Mercury missions and the long duration missions of Apollo.

Major objectives achieved during the program included demonstration that man can perform effectively during extended periods in space, both within and outside the protective environment of a spacecraft, development of rendezvous and docking techniques, and perfection of controlled reentry and landing procedures.

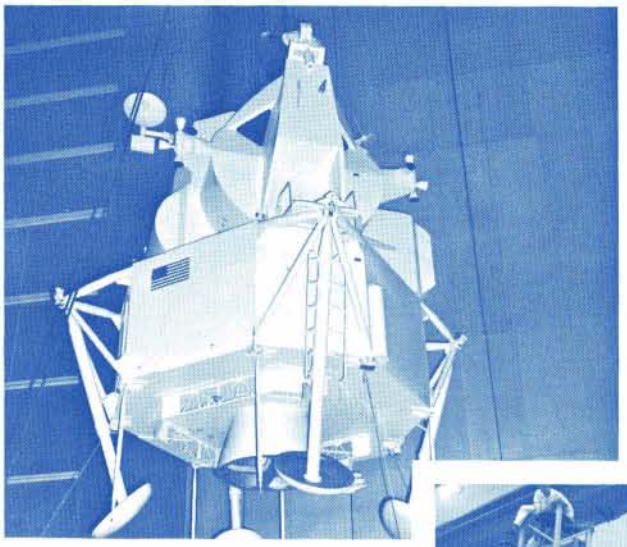
The Gemini program provided the first American demonstration of orbital rendezvous – a skill which must be developed to land American explorers on the Moon and to conduct the advanced ventures of the future.

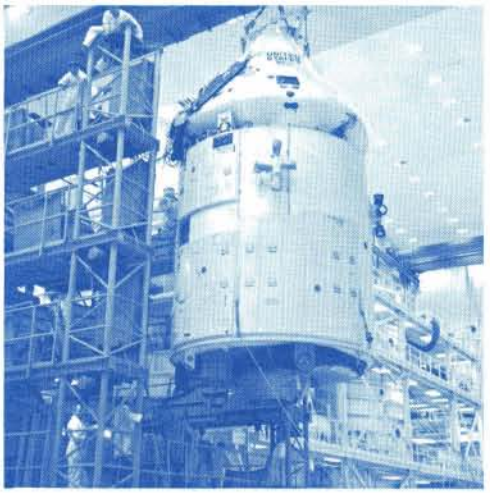
The two-man Gemini spacecraft was also a bell-shaped vehicle; however, it was almost twice as heavy, 20 percent larger and contained 50 percent more volume than the Mercury spacecraft.

The launch vehicle employed in the Gemini program was the modified Air Force Titan II rocket which developed a thrust of 430,000 pounds at liftoff. The overall length of the Gemini-Titan II space vehicle was 109 feet. Gemini flights were launched from Complex 19 at Cape Kennedy.

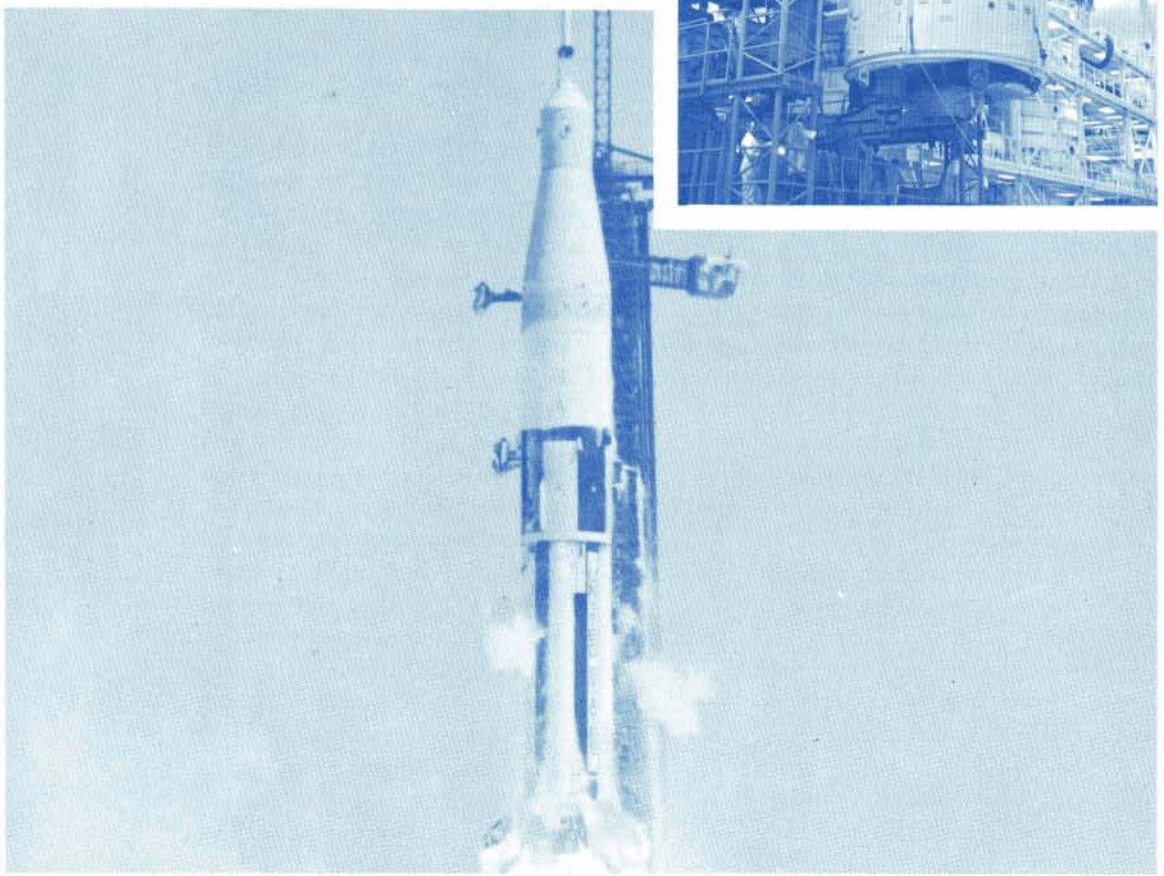
The target vehicle for the Gemini rendezvous and docking missions was a modified Agena-D vehicle with a forward mounted target docking adapter, which provided the connecting point for mating with the Gemini spacecraft.

The Agena-D, with a multiple restart capability, had a rated thrust of approximately 16,000 pounds. It was launched on an Atlas Standard Launch Vehicle which generates about 390,000 pounds of thrust. Gemini Atlas/Agena target vehicles had an overall length of 104 feet. They were launched from Complex 14 at Cape Kennedy.





APOLLO



Apollo is the largest and most complex of the manned space flight programs. Its goal is to land American astronauts on the Moon and return them safely to Earth.

The astronauts will travel to the Moon in the three-man Apollo spacecraft. Weighing 45 tons, the spacecraft consists of three sections – a command module, a service module and a lunar module.

The command module may be likened to the crew compartment of a commercial jet airliner. It is designed so that three men can eat, sleep and work in it without wearing pressure suits. Of the three modules, only the command module will return to Earth. Thus, it is constructed to withstand the tremendous deceleration forces and intense heating caused by reentry into the Earth's atmosphere.

The service module contains supplies, fuel and a rocket engine so the astronauts can maneuver their craft into and out of lunar orbit and alter their course and speed in space.

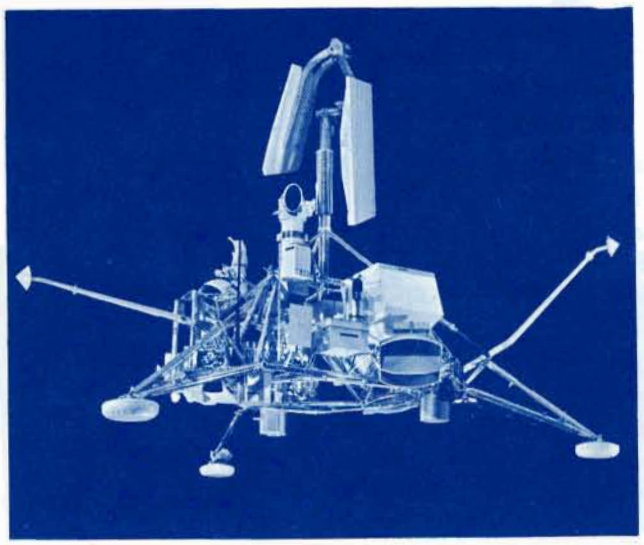
The lunar module is designed to carry two men from lunar orbit to the Moon's surface for exploration and and then back into lunar orbit for rendezvous with the command and service modules. After the crew transfers back to the command module, the lunar module is jettisoned and left in lunar orbit.

Providing the muscle for the Apollo program is the Saturn family of heavy launch vehicles. The first of these to be flight tested by the Kennedy Space Center was the Saturn I. Developing 1.5 million pounds of thrust at liftoff, the Saturn I demonstrated the feasibility of clustered rocket boosters and qualified vehicle guidance and control systems. It also tested the structure and design of the Apollo command and service modules, physical compatibility of the launch vehicle and spacecraft and jettisoning of the Apollo launch escape system. Additionally, Saturn I vehicles orbited large Pegasus micrometeoroid detection satellites to monitor the frequency of micrometeoroids and to determine if they would be a hazard to manned space flights.

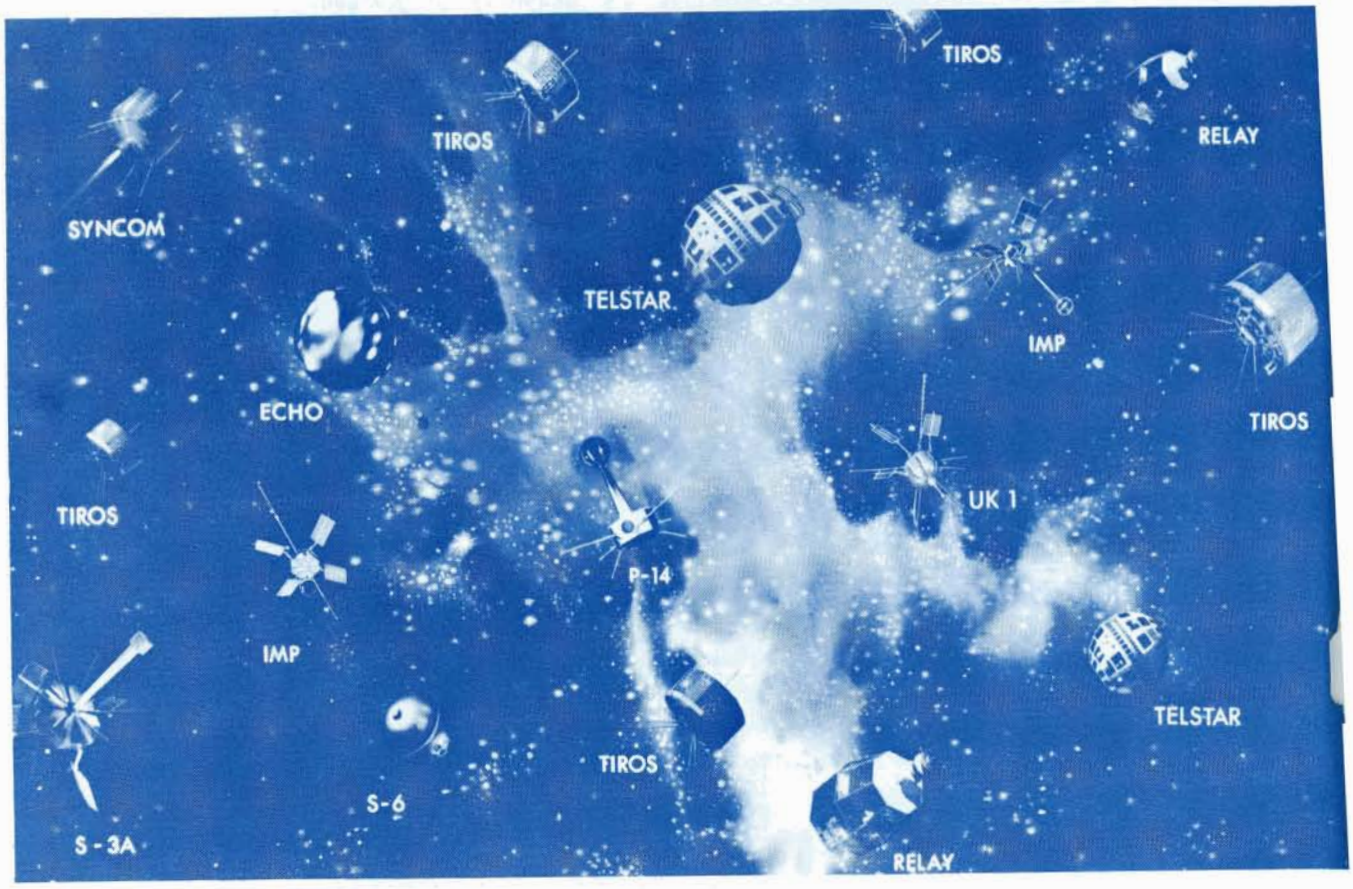
Currently, uprated Saturn flight programs are underway at Kennedy Space Center. With the greater power of the uprated Saturn, all three modules of the Apollo spacecraft are launched into Earth orbit. Initially, the flights are unmanned. Soon, uprated Saturn vehicles will launch three astronauts on Earth orbital missions up to 14 days in duration.

Lunar missions will use the enormous power of the Saturn V launch vehicle. Together with the three modules of the Apollo spacecraft, the Saturn V stands 364 feet, weighs about 6 million pounds at launch and develops 7.5 million pounds of thrust at liftoff.

Development of the Saturn vehicles is the responsibility of the Marshall Space Flight Center, Huntsville, Alabama. The Manned Spacecraft Center, Houston, Texas, has responsibility for Apollo spacecraft development, training of the flight crews and conducting the flight missions. Assembly, checkout and launch of the Apollo-Saturn space vehicles are conducted at Cape Kennedy and at the Nation's Spaceport by Kennedy Space Center.



SATELLITES AND SPACE PROBES



Unmanned spacecraft are making important contributions to man's knowledge about the world in which he lives and the universe around him. Much of this knowledge is derived from the growing family of scientific satellites and space probes launched by Kennedy Space Center.

Explorer satellites have mapped the Earth's magnetic field and have pioneered in gaining new knowledge of the Earth's shape and mass distribution. Explorer I, this country's first satellite which was launched from Cape Kennedy on January 31, 1958, discovered that the Earth was partially surrounded by a belt of deadly radiation, subsequently named the Van Allen Radiation Region.

Other satellites have furnished information on micrometeoroids, temperatures in space, radiation and magnetic fields, upper atmospheric conditions, solar activity and other phenomena.

Meteorological satellites have achieved the most significant advances in weather forecasting since the invention of the barometer over three centuries ago. TIROS satellites, the first of a series of orbiting "weathermen," were launched from Cape Kennedy Complex 17 by Delta vehicles beginning in April 1960. These satellites returned well over a million cloud-cover photographs of the Earth's surface.

Starting in 1966, operational weather satellites were launched for the Environmental Science Services Administration by Kennedy Space Center personnel. Placed into polar orbit from the Western Test Range in California, these satellites photograph cloud cover and transmit pictures to weather stations around the world. This type of fast, accurate weather reporting coupled with long-range weather prediction can be worth untold millions of dollars to agriculture, business and industry.

Communications satellites such as Echo, Telstar, Relay, Syncom and Early Bird, launched on Delta vehicles from Cape Kennedy's Complex 17, are shrinking the distances between continents, and are leading to better understanding among the world's people.

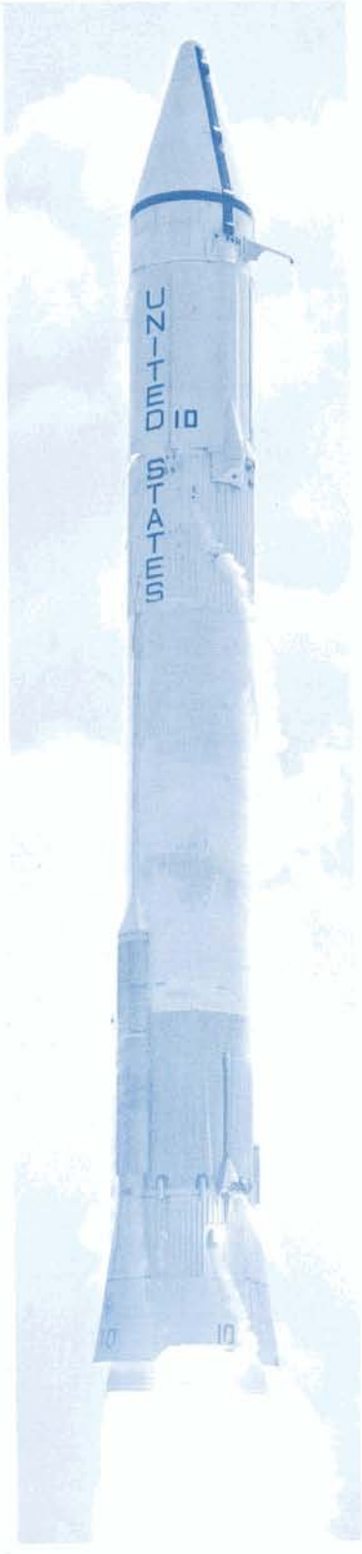
Exploration of the Moon's surface and environment by unmanned space probes is essential to obtain data for manned lunar landings. This type of information is also important in yielding clues to the origin of the Moon, the solar system and perhaps even the universe.

Rangers 7, 8 and 9 returned thousands of close-up pictures of the Moon before smashing into the lunar surface. On June 2, 1966, the Surveyor I spacecraft, the first of a series of instrumented soft-landers, settled gently onto the lunar surface and transmitted thousands of detailed photographs back to Earth. Other Surveyor soft-landers are making detailed examinations of the Moon's physical phenomena and surface composition. These spacecraft are launched by Atlas/Centaur vehicles from Cape Kennedy Complex 36.

Lunar Orbiter spacecraft, circling the Moon in low orbit, have photographed with amazing clarity wide areas of the lunar landscape. Launched from Complex 13 at Cape Kennedy, the Lunar Orbiter missions have provided significant data on potential landing sites for Apollo astronauts.

Investigations of other planets of the solar system are conducted by unmanned Mariner spacecraft. On December 14, 1962, Mariner 2 became the first spacecraft to scan another planet at close range as it passed within 21,600 miles of Venus. Mariner 4, after an eight-month journey, passed within 6,000 miles of Mars on July 14, 1965. Instrument observation of the planet yielded invaluable clues to scientists seeking clues to the possibility of life on Mars. Mariner spacecraft are launched by Atlas/Agena vehicles from Cape Kennedy Complexes 12 and 13.

Goddard Space Flight Center manages NASA's unmanned scientific, meteorological and communications satellite programs. Unmanned lunar, planetary and interplanetary programs are managed by Jet Propulsion Laboratory. Launch operations for these programs are conducted by the Kennedy Space Center.



LAUNCH COMPLEX 39

Launch Complex 39, the nation's first operational spaceport, ranks as one of history's great engineering achievements. Developed and operated by the Kennedy Space Center, the immense facility is designed to accommodate the massive Apollo/Saturn V space vehicle which will carry American astronauts to the Moon.

Complex 39 reflects a new approach to launch operations. In contrast to the launch facilities presently utilized at Cape Kennedy, Complex 39 permits a high launch rate, economy of operation and superior flexibility. This new approach, known as the "mobile concept," provides for assembly and checkout of the Apollo/Saturn V vehicle in the controlled environment of a building, its subsequent transfer to a distant launch site and launch with a minimum of time on the launch pad.

The major components of Complex 39 include: the Vehicle Assembly Building, where the space vehicle is assembled and tested; the Launch Control Center, which houses display, monitoring and control equipment for

checkout and launch operations; the Mobile Launcher, upon which the space vehicle is erected for checkout, transfer and launch and which provides internal access to the vehicle and spacecraft during testing; the Transporter, which transfers the space vehicle and Mobile Launcher to the launch site; the Crawlerway, a specially prepared roadway over which the Transporter travels to deliver the Apollo/Saturn V to the launch site; the Mobile Service Structure, which provides external access to the vehicle and spacecraft at the launch site; and the launch site, from which the space vehicle is launched on Earth orbital and lunar missions.

The Vehicle Assembly Building provides a startling contrast to the low Merritt Island landscape. Covering 8 acres of ground, the Vehicle Assembly Building consists of two major working areas: a 525-foot-high high bay area and a 210-foot-high low bay area.

The high bay contains four vehicle assembly and checkout bays, each capable of accommodating a fully assembled, heavy-class space vehicle. The low bay contains eight preparation and checkout cells for the upper stages of the Saturn V vehicle.

Vehicle stages are shipped by barge from fabrication centers to a turning basin near the Vehicle Assembly Building, off-loaded onto special carriers and transported to the building. The first stage is towed to the high bay area and erected on the Mobile Launcher. Four holddown-support arms on the Mobile Launcher platform secure the booster in place. Work platforms are positioned around the booster for inspection and testing. Concurrently, upper stages of the Saturn V are delivered to the low bay cells, inspected, and tested.

When testing of the individual stages is completed, the upper stages are prepared for mating and moved to the high bay area. All components of the space vehicle, including the Apollo spacecraft, are assembled vertically in the high bay area. The fully assembled space vehicle then undergoes final integrated checkout and simulated flight tests.

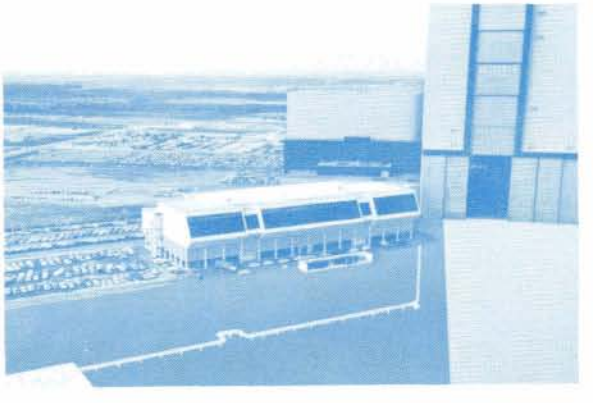
Located adjacent to the Vehicle Assembly Building and connected to the high bay area by an enclosed bridge is the Launch Control Center. All phases of launch operations at Complex 39 are controlled from this four-story concrete structure.

The first floor of the Launch Control Center contains offices, a dispensary and a cafeteria. The second floor is allocated to telemetry, measuring and checkout systems for use during stage and vehicle assembly in the Vehicle Assembly Building, and for launch operations at the launch site.

Four firing rooms occupy the third floor – one for each high bay in the Vehicle Assembly Building. These rooms contain control, monitoring and display equipment required for automatic vehicle checkout and launch. Each firing room is supported by a computer room, which is a key element in the automatic checkout and launch sequence.

The Mobile Launcher, the key to launch operations at Complex 39, actually performs a dual function. It serves as an assembly platform within the Vehicle Assembly Building and as a launch platform and umbilical tower at the launch site located several miles away.

The Mobile Launcher is a 446-foot-high structure with a base platform measuring 25 feet high, 160 feet long and 135 feet wide. It weighs 10.6 million pounds. Whether in the Vehicle Assembly Building, at the launch site,



or in its parking area, the Mobile Launcher is positioned on six 22-foot-high steel pedestals.

Nine swing arms extend from the Mobile Launcher's tower. The three astronauts will enter the Apollo spacecraft via the top swing arm. These arms are designed to swing rapidly away from the vehicle during launch. Besides carrying vital umbilical lines – propellant, pneumatic, electrical, data link – to the space vehicle, the swing arms also permit a catwalk access to the vehicle during the final phase of countdown.

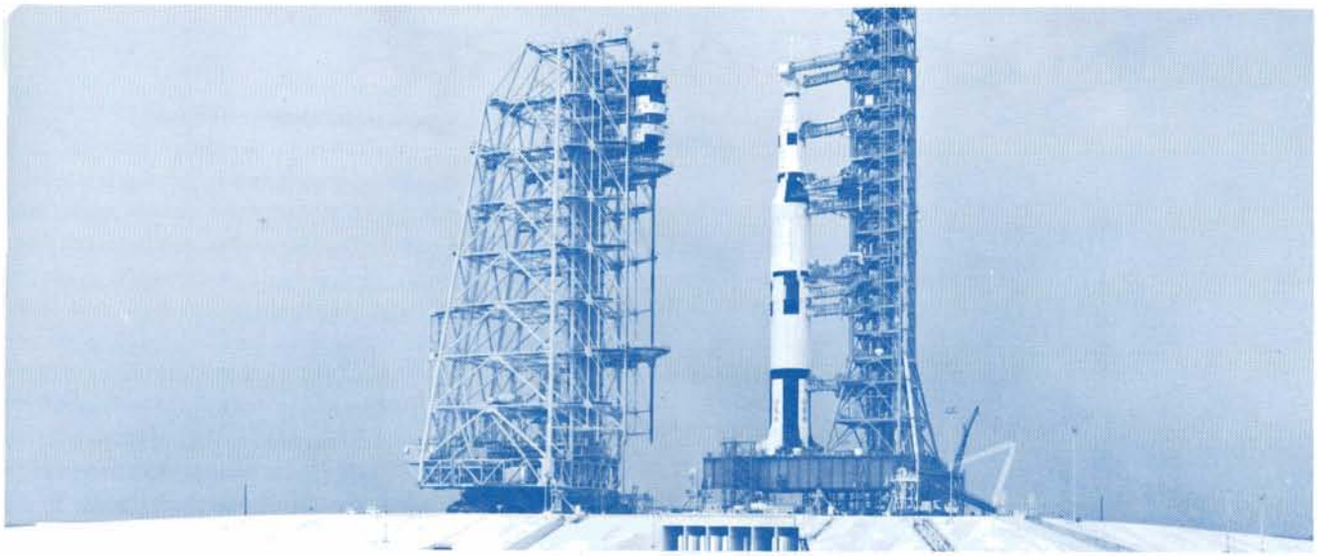
The Apollo/Saturn V is positioned on the Mobile Launcher and secured by four support and holddown arms. At the pad these arms hold the vehicle during thrust buildup of the engines. A 45-square-foot opening in the base platform permits passage of engine exhausts at ignition. Three Mobile Launchers have been constructed at Complex 39.

A tracked vehicle known as the Transporter moves the 36-story Apollo/Saturn V space vehicle and Mobile Launcher from the Vehicle Assembly Building to the launch site. Two Transporters are stationed at Complex 39.

The Transporter is similar to machines used in strip mining operations. Weighing approximately 6 million pounds, it is 131 feet long and 114 feet wide. Its height is adjustable from 20 to 26 feet. The vehicle moves on four double-tracked crawlers, each 10 feet high and 40 feet long. Each shoe of the crawler track weighs about a ton. There are 57 shoes on each track and a total of 8 tracks on the entire vehicle.

Two main drive diesel engines provide 5,500 horsepower. Two other diesels generate 2,130 horsepower for leveling, jacking, steering, lighting, ventilating and electronic systems. Auxiliary generators provide power to the Mobile Launcher when carried by the Transporter.

In operation, the Transporter slips under the Mobile Launcher while inside the Vehicle Assembly Building. Its 16 hydraulic jacks raise the Mobile Launcher, with the space vehicle aboard, from support pedestals. The loaded Transporter then backs out of the Vehicle Assembly Building and transfers the 11.5-million-pound-load 3.5 miles to the



launch site.

The Transporter has a speed of 1 mile per hour when fully loaded and twice that when unloaded. It can negotiate curves of 500 feet mean radius. A leveling system provides the capability to maintain the entire load in level position during the transfer operation.

The combined weight of the Transporter, the Mobile Launcher and the Apollo/Saturn V exceeds 17 million pounds at the time of transfer from the Vehicle Assembly Building to the launch site. To accommodate this load, a specially constructed Crawlerway was prepared.

The Crawlerway extends from the Vehicle Assembly Building to the launch site, and consists of two 40-foot-wide lanes separated by a 50-foot-wide median strip. The overall width of the roadway is 130 feet or about equal to an eight-lane parkway.

Unsuitable material was removed from the roadbed before beginning construction of the Crawlerway. The area then was compacted with hydraulic fill and selected materials, topped with crushed graded limerock, paved with asphalt, sealed and covered with gravel, forming a roadbed approximately 7 feet thick. From eight to twelve thousand pounds-per-square-foot in surface pressures are exerted on the Crawlerway; this is equivalent to a stress of 40 jetliners landing at the same time on a runway.

The Mobile Service Structure is a 402-foot-high tower which weighs 12 million pounds. The structure contains five service platforms that provide circular access to the space vehicle for final servicing at the launch site. The two lower platforms can be adjusted up and down the vehicle, while the three upper platforms have a fixed elevation.

Like the Mobile Launcher, the Mobile Service Structure is transported to the launch site by the Transporter. It is removed from the pad a few hours prior to launch and returned to its parking area.

Two launch sites are located at Complex 39, three and one-half miles from the Vehicle Assembly Building. Each site is an eight-sided polygon measuring 3,000 feet across.

The major elements of the launch sites include the launch pads; storage tanks for liquid oxygen, liquid hydrogen and RP-1 propellants; gas compressor facilities; and associated umbilical connection lines necessary for launching the space vehicle.

The launch pad itself is a reinforced concrete hardsite measuring 390 feet by 325 feet. Top elevation of the pad is 48 feet above sea level, sufficient distance for the rocket's engine nozzles to rest above a 700,000-pound flame deflector.

INDUSTRIAL AREA

The Industrial Area of the Kennedy Space Center is located 5 miles south of Launch Complex 39. The area was planned so that all functions not required at the launch complexes could be grouped for ease of administration and efficient operations. Here, the administrators, scientists, engineers and technicians plan and accomplish many of the detailed operations associated with prelaunch testing and preparing space vehicles for a mission.

The Headquarters building is the administrative center for spaceport operations. Dr. Kurt H. Debus, Director of the Kennedy Space Center, and his immediate staff maintain offices on the top floors. Procurement, program management, legal and other support functions occupy lower floors.

The largest structure in the Industrial Area is the Manned Spacecraft Operations building. This facility is used for modification, assembly and nonhazardous checkout of Apollo spacecraft. It also provides astronaut quarters and medical facilities, spacecraft automatic testing stations and complete supporting laboratories.

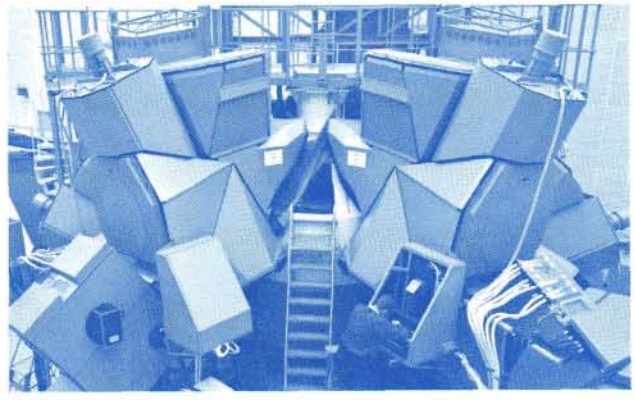
Following systems testing and Apollo service module static firing, Apollo spacecraft are delivered to this building for integrated systems testing. Here, individual spacecraft modules undergo acceptance testing and integrated systems and altitude chamber testing. Two 50-foot altitude chambers environmentally test Apollo spacecraft in conditions simulating altitudes up to 250,000 feet. Space-suited astronauts participate in these simulated flight tests.

The Information Systems facility is the hub of the Spaceport's instrumentation and data processing operations. It provides instrumentation to receive, monitor, process, display and record information received from the space vehicle during test, launch and flight.

The Industrial Area contains special laboratories and testing facilities for the hazardous checkout operations associated with spacecraft pyrotechnic devices and toxic fluids.

Among the other major facilities located in the Industrial Area are:

- Flight Crew Training Building – this facility provides an environment where astronauts and flight controllers – under the direction of Manned Spacecraft Center personnel – can practice for manned Apollo space missions. actual Apollo spacecraft and creates nearly complete realism for simulated missions. For about three weeks prior to a mission, astronauts go through make-believe flights and cope with purposely contrived emergency situations.
- Life Support Test – this facility is used for high-pressure testing and liquid oxygen supply testing of environmental control systems.
- Fluid Test Support – this facility is a single-story structure housing laboratories, shops and service areas to support the entire test area. Critical component testing of spacecraft fluid test systems are conducted in the laboratories which maintain special clean-room conditions.
- Hypergolic Test – this facility is used to test and check out stabilization and attitude control systems, orbital maneuvering systems and reentry control systems for spacecraft. Hypergolic fluids utilized in these systems are especially hazardous since they ignite upon contact with each other.
- Cryogenic Test – this facility is used for checking the cryogenic systems of spacecraft. Cryogenic fluids are supercooled. An example would be liquid hydrogen which must be maintained at a temperature of 423 degrees below zero.
- Pyrotechnic Installation – this ten-story-high facility is used to install spacecraft pyrotechnic devices and to statically weigh and balance the spacecraft in its mission configuration to determine its center of gravity. The facility is also used for optical alignments of critical components of the guidance and navigation systems, as well as acceleration tests on dynamic fixtures.



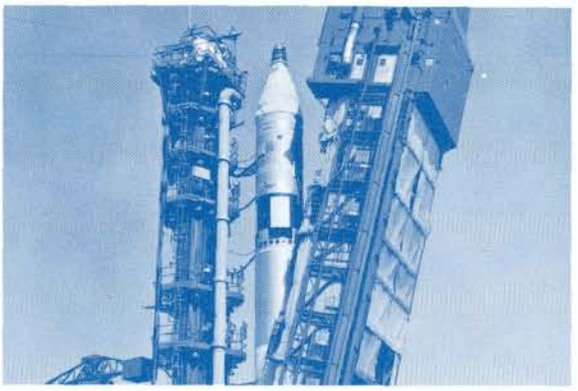
- Ordnance Storage – this facility provides remote, safe storage for solid fuel motors, pyrotechnic devices and aligned launch escape towers.
- RF Systems Test – this facility is used to adjust, test and check out spacecraft rendezvous apparatus and procedures in a simulated free space condition. Transmitting antenna height, elevation, squint and azimuth angles and transmitter frequency are remotely controlled from an operator's console.

Additional support structures in the Industrial Area include cafeteria, warehouses, fire station, security offices, utilities and occupational health facilities.

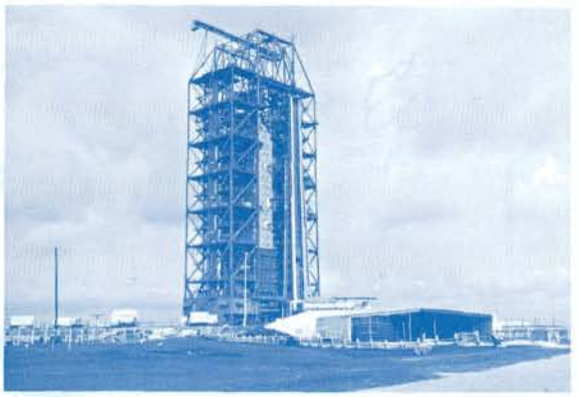
CAPE KENNEDY FACILITIES

Stretching northward along the Atlantic Ocean are the famous launch complexes of Cape Kennedy. The Cape is managed by the U. S. Air Force for the Department of Defense and designated as Station 1 of the Eastern Test Range which reaches 10,000 miles to the Indian Ocean. The U. S. Army, Navy and Air Force have used the Cape's facilities for missile development programs. Since the advent of the national space program in 1958, however, the area has also been utilized by NASA as a launch site for space vehicles. In the foreground are the two pads of Launch Complex 36 from which Surveyor spacecraft are launched toward the Moon.

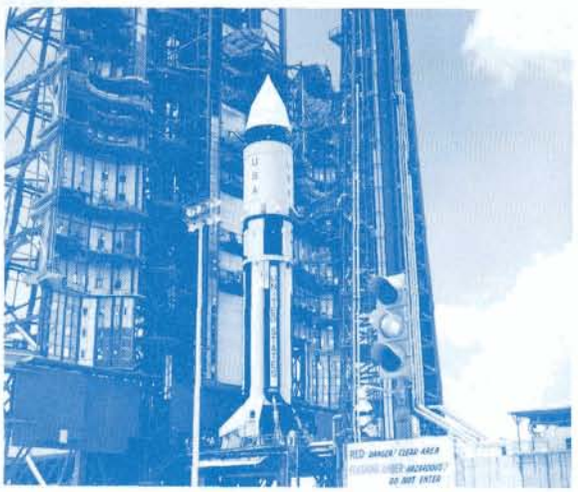
Ten manned space missions were launched from Complex 19 during the highly successful Gemini program. Here, the Gemini 12 vehicle, the final flight in the program, is readied for launch. At the right is the erector which is employed in servicing the space vehicle. Prior to launch, the erector is lowered to the ground. The umbilical tower on the left carries electrical, communications and propellant lines to the rocket. It remains attached to the vehicle until liftoff.



At Launch Complex 34, one of two Saturn launch sites on Cape Kennedy, the 300-foot-tall service structure encloses an uprated Saturn launch vehicle. Unlike the erector used at Complex 19, this structure moves back from the launch ready vehicle on rails. At nearby Complex 37, another Saturn launch site, a similar structure serves two launch pads that are connected by rails. From these sites, astronauts will be launched on Earth orbital missions in the three-man Apollo spacecraft.

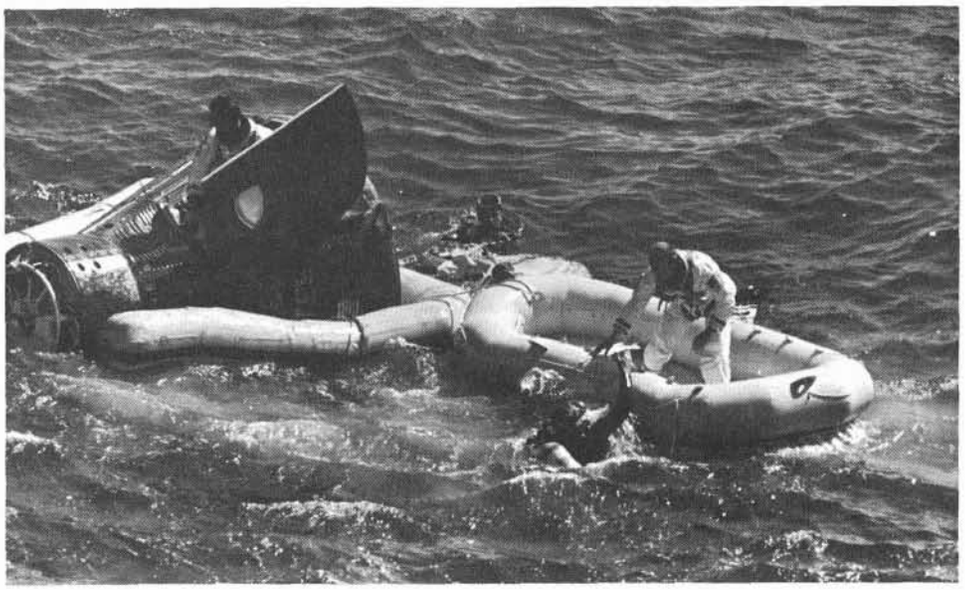


This view of Launch Complex 37 shows the service structure in an open position with an uprated Saturn launch vehicle on the pad. To afford launch crews access to the rocket, the service structure closes around the Saturn. The platforms, which can be seen in the photograph, provide work levels at various stages of the configuration. This unmanned Saturn, AS-203, was successfully launched July 5, 1966. The mission was an orbital flight to examine the effects of weightlessness on the liquid hydrogen fuel of the second stage. For this reason, it was equipped with a nose cone instead of an Apollo spacecraft.



Blockhouse personnel of the Kennedy Space Center's Government-industry launch team follows liftoff of uprated Saturn AS-203 on television monitors inside Complex 37 launch control center. Seated at a console and pointing (front center) is Dr. Kurt H. Debus, Director of the Kennedy Space Center. Manning the periscope directly behind Dr. Debus is the Marshall Space Flight Center Director, Dr. Wernher von Braun. The launch control center is located approximately 1,200 feet from the launch pad. Constructed of heavy reinforced concrete, the two-story, dome-shaped structure can withstand blast pressures of 2,188 pounds per square inch.

THE HUMAN ELEMENT



The John F. Kennedy Space Center is many things. It is the tremendous power of space vehicles carrying precious cargoes of men and equipment; it is scientific progress in action; it is material and hardware—some minute and delicate, some huge and powerful—in various stages of being born and growing up; it is all these . . . and more. The John F. Kennedy Space Center is also people.

From New York City; Nashville, Tennessee; Dallas, Texas; San Jose, California—virtually from all over the United States—these people, representing all racial and ethnic backgrounds and professions and skills, have been molded into one of the greatest teams ever assembled for a peacetime endeavor.

More than 24,000 strong and representing the best launch talent in government and industry, this team devotes its skills and talents to the United States' goal of space preeminence. Additionally, thousands of Air Force Eastern Test Range personnel and Air Force-associated contractor personnel are providing vital range and mission support to NASA activities.

Because the continuing progress of the space program is dependent upon the total, coordinated efforts of many people, no task is inconsequential, no job trivial and no individual unimportant. Each success hinges on the premise that the people involved will do the best job they know how to do at all times.

The entire space program is varied and complex, as are the skills required to successfully accomplish the job. Welders, radio technicians, doctors of medicine, engineers, scientists, mechanics, tinsmiths, writers, photographers, truck drivers, policemen—all these and more are employed. This is but a fragment of the whole.

As each day expands the scope and technology of space activities, the need for people who can cope with and contribute to the growth of the space program also expands. People are the most important asset of the program.

PRIVATE INDUSTRY

More than 300,000 men and women are involved in the national space program. Approximately 24,000 of them are employed by the John F. Kennedy Space Center, NASA. This work force is composed of NASA employees and contractor personnel moulded into an efficient Government-industry team.

The aerospace industry has made notable contributions to the success of NASA launch missions. Some of the companies engaged at the Kennedy Space Center are among the giants of American industry. Others are smaller and more specialized organizations.

The largest employer is Trans World Airlines. TWA provides plant engineering, maintenance and logistics support. The Wackenhut Corporation, a TWA subcontractor, is responsible for security operations.

Bendix Corporation provides launch support services for Complex 39, the Nation's lunar launch site. Federal Electric Corporation provides instrumentation and data acquisition services for the Center, while RCA Service Company handles communications support.

Publications, photography, business data processing and reproduction services are provided by Ling-Temco-Vought, Inc., and its subcontractors, Technicolor Corporation, Computer Applications, Inc., and McGregor & Werner, Inc.

General Electric Company furnishes services and equipment for checkout and integration of manned spacecraft as well as other support services. Catalytic-Dow provides engineering support and modification services for launch, test, laboratory and supporting facilities at the Center.

Two firms have both support and stage contracts at the Center. The Boeing Company, which builds the Saturn V first stage, is also engaged in site activation and launch support. Chrysler Corporation, manufacturer of the uprated Saturn first stage, also performs launch support services.

Other stage contractors are McDonnell Douglas Corporation, which fabricates the uprated Saturn second stage, the Saturn V third stage and the Delta launch vehicle; North American Aviation, Inc., builder of the Saturn V second stage and the Apollo spacecraft; International Business Machines Corporation, which provides the uprated Saturn and Saturn V instrument units; and Grumman Aircraft Engineering Company, Inc., contractor for the Apollo lunar module.

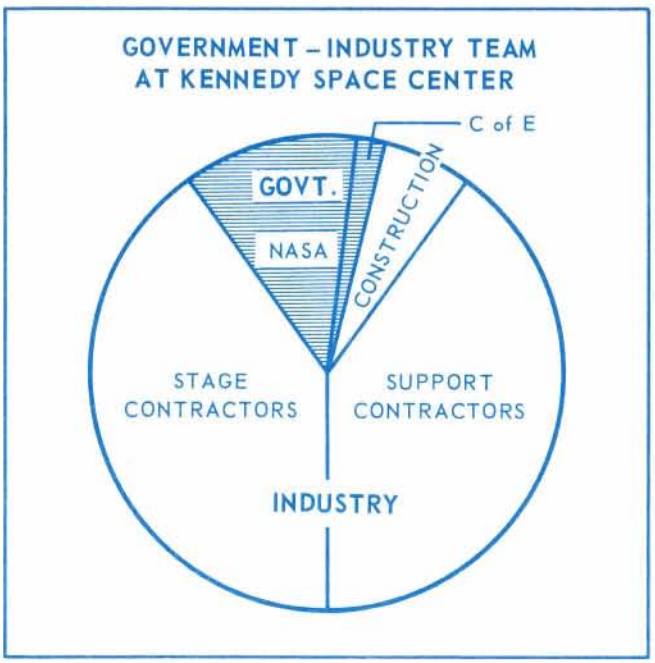
For unmanned launch missions, Lockheed Missiles and Space Company manufactures the Agena space vehicle, and General Dynamics Corporation is contractor for the Atlas-Centaur vehicle.

As the Kennedy Space Center's role in the exploration of space expands in scope and complexity, other firms, both large and small, will be called upon to furnish products and services. The role of private industry in the Nation's space program will become even more significant as man reaches beyond the Moon toward the vast regions of the solar system.

FACTS & FIGURES

MANPOWER	
Federal Service Personnel	3,022
Support Contractor Personnel	9,755
Stage Contractor Personnel	9,986
Corps of Engineers Personnel (C of E)	455
Construction Workers	1,575
NASA and NASA Related Manpower–July 1, 1967	24,793

BUDGET	
Research and Development of Ground-Support Equipment and Instrumentation	$339,800,000
Construction of Facilities	$ 37,876,000
Administrative Operations	$ 93,620,000
Total Budget Estimate (Fiscal Year 1967)	$471,296,000



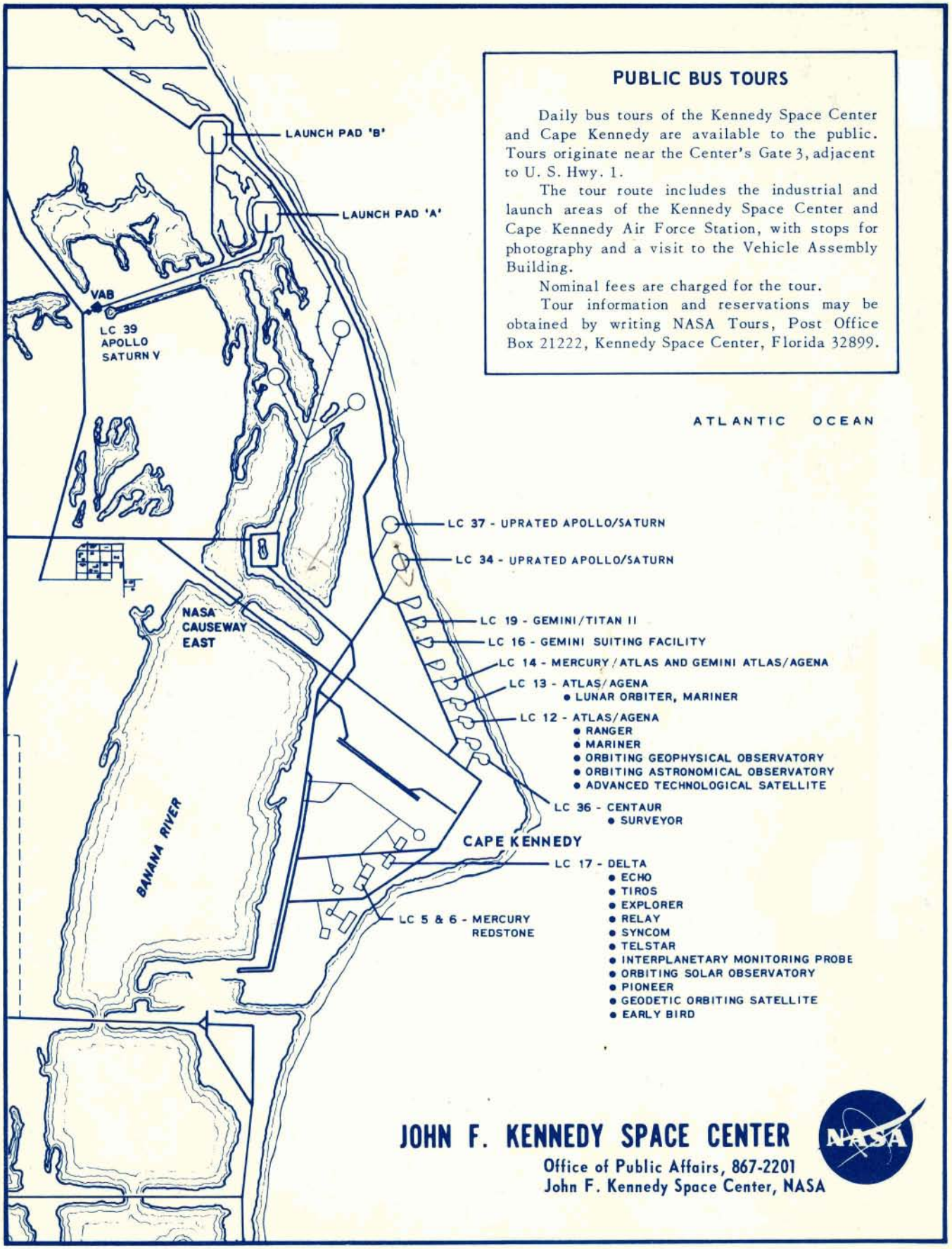
PUBLIC BUS TOURS

Daily bus tours of the Kennedy Space Center and Cape Kennedy are available to the public. Tours originate near the Center's Gate 3, adjacent to U. S. Hwy. 1.

The tour route includes the industrial and launch areas of the Kennedy Space Center and Cape Kennedy Air Force Station, with stops for photography and a visit to the Vehicle Assembly Building.

Nominal fees are charged for the tour.

Tour information and reservations may be obtained by writing NASA Tours, Post Office Box 21222, Kennedy Space Center, Florida 32899.



JOHN F. KENNEDY SPACE CENTER

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