



# A Brief History of Marshall Space Flight Center

Years before either the National Aeronautics and Space Administration (NASA) or the Marshall Space Flight Center (MSFC) was established, a group of scientists and engineers known as the Von Braun rocket team became prominent in America's fledgling space program. Von Braun and his team had developed the famous V-2 rocket during World War II for their native Germany. But Von Braun's real interest was developing rockets for space exploration.

As World War II ended, Von Braun and other German rocket experts surrendered to Allied forces and eventually moved from Germany to work for the U.S. Army. Initially assigned to Fort Bliss, Texas, the Von Braun team was later transferred to Redstone Arsenal in Huntsville, Alabama. There the team expanded during the 1950's to include hundreds of U.S.-born engineers and scientists as well as those who had worked with Von Braun in Germany. On January 31, 1958, the team used a modified Redstone rocket called a Jupiter-C to launch Explorer I, America's first orbiting satellite.

Two years later, Von Braun became director of NASA's new George C. Marshall Space Flight Center in Huntsville where he and his team would develop the Saturn rockets that launched astronauts to the moon in 1969.

The Marshall Space Flight Center was activated on July 1, 1960, with the transfer of buildings, land, space projects, property, and personnel from the Development Operations Division of the U.S. Army Ballistic Missile Agency. It was dedicated on September 8, 1960, by President Dwight David Eisenhower. The Center was named in honor of General George C. Marshall, the Army Chief of Staff

during World War II, Secretary of State, and Nobel Prize Winner for his world-renowned "Marshall Plan."



Shortly before activating its new field Center in 1960, NASA described the Marshall Center as "the only self-contained organization in the nation which was capable of conducting the development of a space vehicle from the conception of the idea, through production of hardware, testing and launching operations." Initial design for the launch complex in Florida was performed in Huntsville. At that

time, engineers from Huntsville also traveled to Florida to conduct launch activities. They then returned to Huntsville to analyze the data.

Not long after the Marshall Center officially opened for business, the United States sent its first astronaut into space. Today, visitors to the Marshall Center can still see the Historic Redstone Test Stand where the rockets were tested for the Mercury-Redstone vehicle that boosted America's first astronaut, Alan B. Shepard, on a suborbital flight in 1961.

In the wake of Shepard's successful flight, President Kennedy presented the nation with an even greater challenge. He committed the United States to "achieving the goal, before this decade is out, of landing a man on the Moon and returning him safely to Earth". The Marshall Center's role in meeting that challenge was absolutely vital. The Center was assigned the task of building the Saturn V rocket that would launch the astronauts on their way to the moon.

Engineers, scientists, administrators, and contractors worked night and day to develop the technology powerful



enough to lift the 363-foot tall, 6.2-million pound Saturn V rocket into space. Some estimates stated that the Saturn V engines produced as much power as 85 Hoover Dams. Saturn components and rocket engines were tested at various sites including Huntsville.

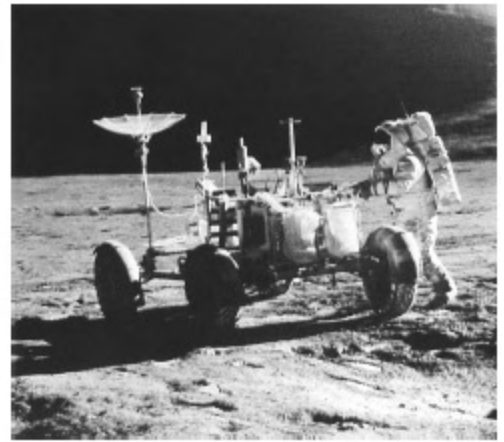


Saturn testing was an unparalleled spectacle of sight and sound in Huntsville. A visiting magazine writer once called Huntsville the "Land of the Earth Shakers." One "leaves the observation bunker with a weakness in the knees that is just short of collapse... It was total flame, total sound, total power." The noise was sometimes heard in a radius in excess of 100 miles.

Three launch vehicles were developed in the Saturn program. The Saturn I was primarily used as a research and development vehicle. The Saturn IB was used for orbital missions with Apollo spacecraft. Its first stage was powered by eight H-1 engines generating a total thrust of 1.6 million pounds. The Saturn V, used for the Apollo manned lunar landing missions, depended on a first stage powered by five F-1 engines, each generating 1.5 million pounds of thrust. Saturns also orbited the Skylab and later the Apollo spacecraft into the historic linkup with the Russian-Soyuz spacecraft in 1975. In all, Marshall provided NASA with 32 Saturn rockets, including six used to land astronauts on the moon.

Early in its history, Marshall Center scientists and engineers took advantage of the opportunity to use space as a place for scientific study. As a bonus on two of the early Saturn engineering test flights in 1962, the dummy upper stages were used for a scientific experiment called Project Highwater. Thousands of gallons of ballast water from the inert stages were released into the upper atmosphere. This effort to investigate the effects of water clouds marked the first use of a Saturn vehicle for scientific purposes, even though the research was clearly secondary to engineering objectives of the flights. The first genuine scientific payloads launched by Saturn vehicles, and the first satellites for which the Marshall Center had full responsibility, were three Pegasus micrometeoroid detection satellites orbited in 1965.

Marshall's contribution to the Apollo lunar landing program also included development of the Lunar Roving Vehicle for transporting astronauts on the lunar



surface. It was an open-space vehicle about 10 feet long with large mesh wheels, antenna appendages, tool caddies, and cameras. Powered by two 36-volt batteries, it had four 1/4-hp drive motors, one for each wheel. The unique vehicle was collapsible until needed when it could be unfolded by hand. Its speed limit was about 9 miles per hour. A lunar rover was used on each of the last three Apollo missions in 1971 and 1972 to permit the crew to travel several miles from the landing craft. Outbound they carried a load of experiments to be set up on the moon; on the return trip, they carried more than 200 pounds of lunar rock and soil samples.



Marshall Space Flight Center's activities broadened in the 1970's with the development of Skylab. Skylab was the United States' first crewed orbiting space station and the first American space program wholly dedicated to scientific research. Skylab operated in orbit from May 1973 through February 1974. Three astronaut crews spent a total of 171 days conducting scientific research in space. Marshall supplied the Skylab workshop itself, plus the four Saturn launch vehicles, the solar observatory and many of the scientific experiments for each mission. Skylab results included significant discoveries in all the experiment disciplines and far more data than anticipated. It opened the era of comprehensive scientific research in space.

A Marshall Saturn rocket was used for the last time in the mid-1970s as part of the joint U.S.-Soviet Apollo-Soyuz Test Project mission. In 1975, a Saturn IB sent American astronauts to rendezvous with Russian cosmonauts. As part of the mission, the Marshall Center also provided several scientific experiments and a multipurpose electric furnace for processing material samples.



The focus was also on science for other Marshall-managed space missions in the 1970's. These included the Laser Geodynamics Satellite. Laser beams from the ground were bounced off the prismatic mirrors on the satellite to track movements in the Earth's crust. Another scientific project, Gravity Probe-A, was also called the Redshift Experiment. It used an extremely precise clock to confirm part of Einstein's general theory of relativity.



During the 1970's, Marshall also had responsibility for the High Energy Astronomy Observatory series of spacecraft. That project provided

revolutionary insights into celestial objects by studying their high-energy radiation from space. Each of the three observatories launched in the late 1970's was about 18 feet in length, weighed between 6,000 and 7,000 pounds and carried about 1.5 tons of experiments.

On January 5, 1972, President Richard M. Nixon announced plans to develop the Space Shuttle for routine access to space. As part of that program, Marshall designed the shuttle's main engines, its solid rocket boosters, and its external tank as well as a variety of scientific payloads. Marshall also received responsibility for Spacelab, a



versatile laboratory carried within the Shuttle's cargo bay. Other Center assignments included the upper stage boosters that would lift Shuttle payloads into higher orbits and on interplanetary voyages. One of Marshall's prime responsibilities included developing the Hubble Space Telescope, an optical observatory that is returning unprecedented views of the universe.

The first Space Shuttle main engine was test fired in 1975, followed by the first test firing of its solid rocket motor in 1977. That same year, tests on the huge external tank began at the Marshall Center. In March 1978, throngs of employees and citizens greeted the Orbiter *Enterprise* upon its arrival at the Marshall Center for testing. The orbiter was hoisted into a modified Dynamic Test Stand originally built for the Saturn V. It was then mated to an external tank, and subjected to vibration frequencies comparable to those expected during launch and ascent.



April 12, 1981 marked a new era in the history of space flight. The world's first reusable space vehicle, powered by Marshall-developed propulsion systems, was thrust into

orbit with two astronauts aboard. This new chapter in the history of the Center would feature Marshall at the forefront of the nation's space exploration efforts, among them launch of the Hubble Space Telescope in 1990, responsibilities for more than 20 Spacelab missions, and much more.





## National Historic Landmarks

The NASA Marshall Space Flight Center announced on January 22, 1986, that the U.S. Department of the Interior's National Park Service had designated four Marshall Center facilities as National Historic Landmarks. On July 15, 1987, a fifth designation was announced.

The first four facilities are the Redstone Test Stand, Propulsion and Structural Test Facility, Saturn V Dynamic Test Stand, and Neutral Buoyancy Simulator. The Saturn V on display at the United States Space and Rocket Center represents the fifth designation.

### Historic Redstone Test Stand

The Redstone Test Stand was used during the 1950's in early development of the Redstone missile propulsion system. This was the test stand where the modified Redstone missile that launched the first American into space, Alan Shepard, was static tested as the last step before the flight occurred.



### Propulsion and Structural Test Facility

The Propulsion and Structural Test Facility, developed in support of Jupiter missile development, was modified and used for testing on the first clustered engine stage in the American space program, the S-IB stage of the Saturn I launch vehicle. It was also used as the primary test stand for the development of the F-1 engine, the largest liquid rocket engine ever developed. The F-1 generated 1.5 million pounds of thrust.

### Neutral Buoyancy Simulator

The Neutral Buoyancy Simulator was designed to provide a simulated weightless environment needed to perform engineering tests in preparation for space missions. The extra-vehicular activity protocols for the Skylab rescue and Apollo Telescope Mount film retrieval were developed in the facility.

## Dynamic Test Stand

The Saturn V Dynamic Test Stand was used in 1966-67 for ground vibration testing of the Saturn V launch vehicle and the Apollo spacecraft. Completion of this program was the final step prior to the launch of Apollo 11, the first manned lunar landing mission. In 1972-73 the stand was used for tests involving the Skylab Space Station, and in 1978-79 for ground vibration testing of the complete Space Shuttle vehicle.



### Saturn V Display

The Saturn V on display at the United States Space and Rocket Center is the actual test rocket that was used in dynamic testing of the Saturn facilities at Marshall. The stages of the rocket were used to check out all the Saturn facilities at Huntsville. Although the rocket was not intended to be flown, it was a working vehicle that prepared the way for the Apollo expeditions to the moon. Officials from the Department of the Interior referred to the vehicle as "a unique engineering masterpiece that formed the key link in the chain that enabled Americans to travel to the moon. The success of the Saturn V made possible the success of the American space program." The Saturn V at the United States Space and Rocket Center was delivered by Marshall in 1969 after all three stages were taken from the Center's Dynamic Test Stand.

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### To Learn More

You can learn more about the history of Marshall Space Flight Center on the World Wide Web.

<http://history.msfc.nasa.gov/>

