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MARSHALL SPACE FLIGHT CENTER



HUNTSVILLE, ALABAMA

NASA's largest launch vehicle, used for sending American astronauts to the Moon in Project Apollo and for placing the Skylab into Earth orbit.

SATURN V

The Marshall Space Flight Center and its contractors designed, developed and assembled the Saturn V launch vehicle stages. A review of the program reflects several historic achievements.

The first Saturn V was launched in an unmanned Earth orbital flight on November 9, 1967, with all three stages performing perfectly. Only one additional research and development flight test was made.

Then on its third launch the huge Saturn V was manned. It sent astronauts Frank Borman, James A. Lovell, Jr., and William A. Anders on a voyage highlighted by mankind's first orbits of the Moon, on Christmas Eve, 1968.

The sixth Saturn V, launched on July 16, 1969, resulted in the first manned lunar landing. Astronauts Neil A. Armstrong and Edwin E. Aldrin Jr. made mankind's first footprints on the Moon on July 20, 1969.

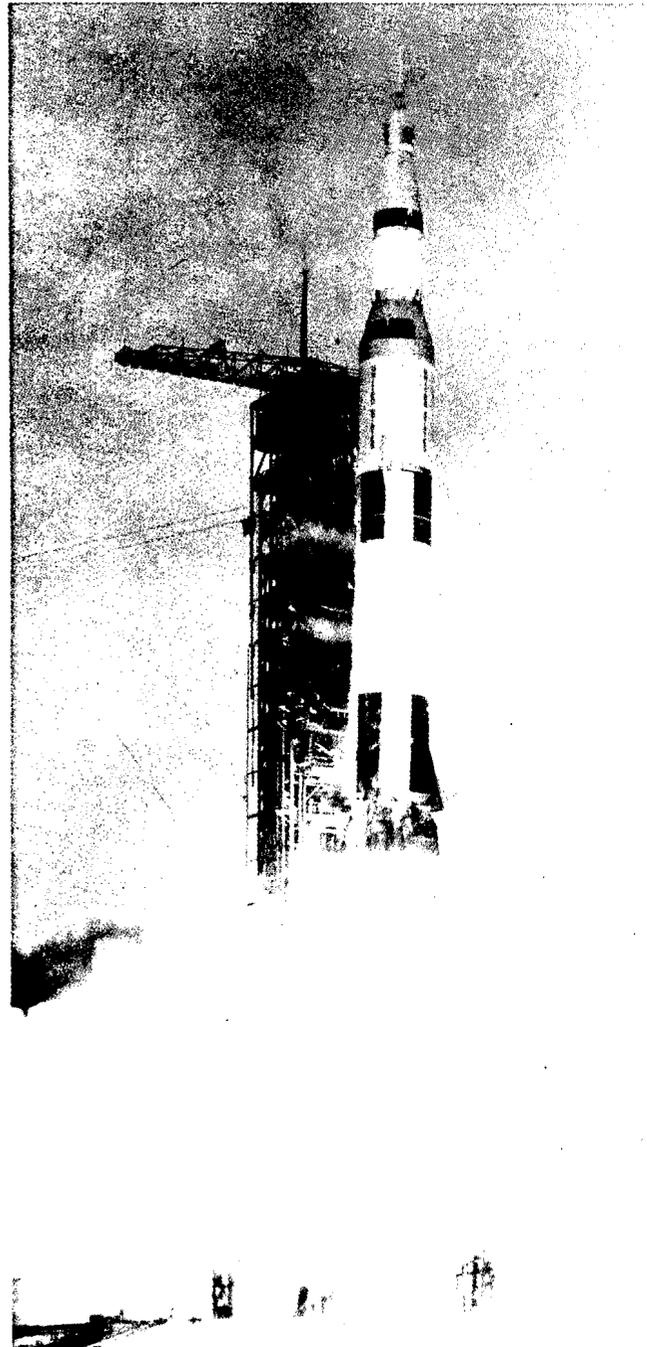
Other flights to the Moon followed, with the last manned lunar mission in Project Apollo, Apollo 17, launched on December 7, 1972.

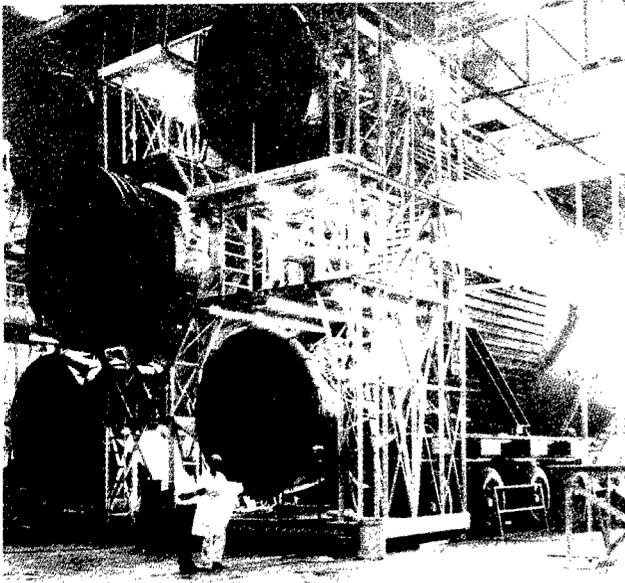
After Apollo, the next job for the Saturn V was to place the Skylab workshop into Earth orbit. The workshop was made from the third stage of the Saturn V, and only the first two stages were "live" during the launch, which occurred May 14, 1973.

The Saturn V was developed as a general purpose launch vehicle. It was designed to perform earth orbital missions through the use of the first two stages, while all three stages were used for lunar expeditions. The first stage is powered by five F-1 engines, which burn kerosene and liquid oxygen to produce more than 7.5 million pounds of thrust. The upper stage engines burn liquid hydrogen and liquid oxygen.

A large network of production, assembly, testing, and launch facilities was prepared for the Saturn V. The stages are mated to form the complete vehicle and checked out in a huge Vehicle Assembly Building at the Kennedy Space Center, then transported in an upright position to the launch site, more than three miles away.

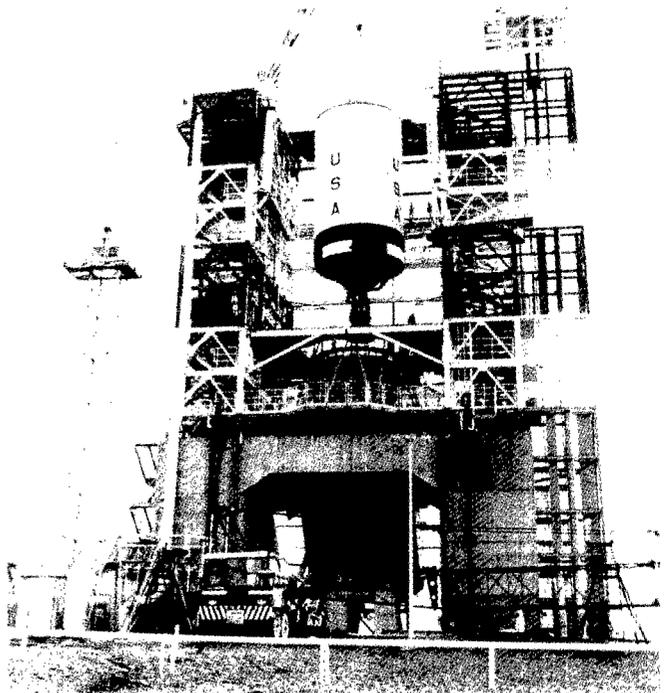
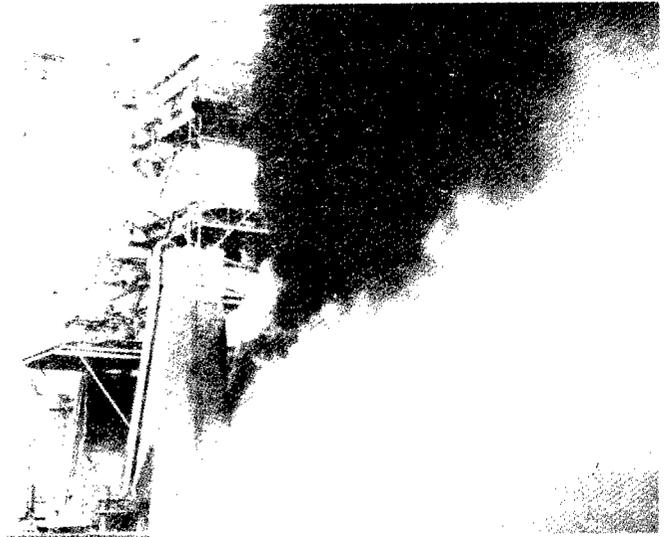
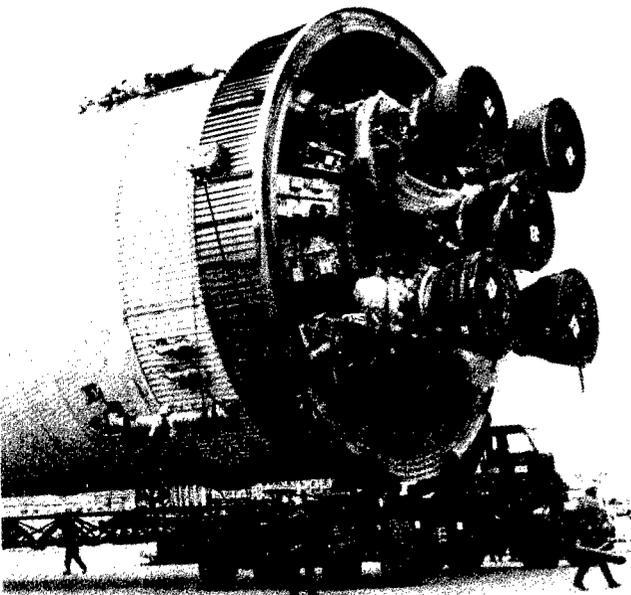
The Saturn V, including the Apollo spacecraft, stands 363 feet tall. Fully loaded, the vehicle weighs some 6.4 million pounds.





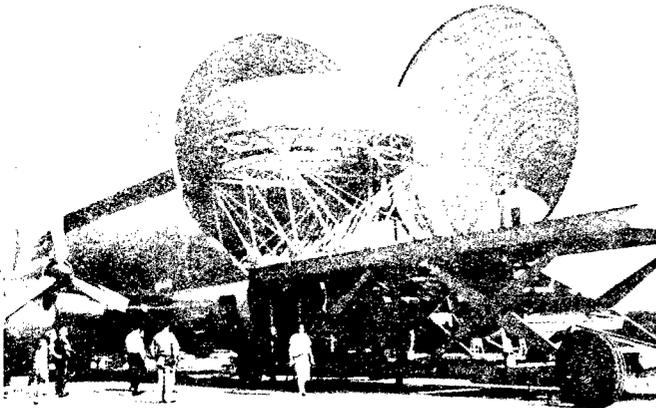
The Marshall Center and The Boeing Company jointly developed the first stage of the Saturn V. Powered by five Rocketdyne F-1 engines, this stage lifts the entire vehicle and Apollo spacecraft from the launch pad. Within 2-1/2 minutes the vehicle reaches 38 statute miles high, 50 miles downrange, and a speed of 6,200 miles-per-hour.

The second stage, powered by five J-2 engines that burn liquid hydrogen and liquid oxygen, was provided by the Rockwell International Corporation. Its engines ignite in flight after the first stage drops away. The second stage performs for 6-1/2 minutes, reaches a height of 115 statute miles, 935 miles downrange, and a speed of 15,500 miles-per-hour in its Apollo configuration.



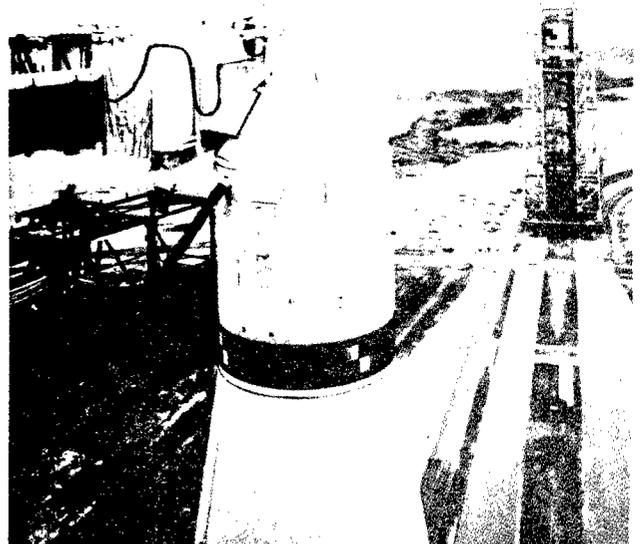
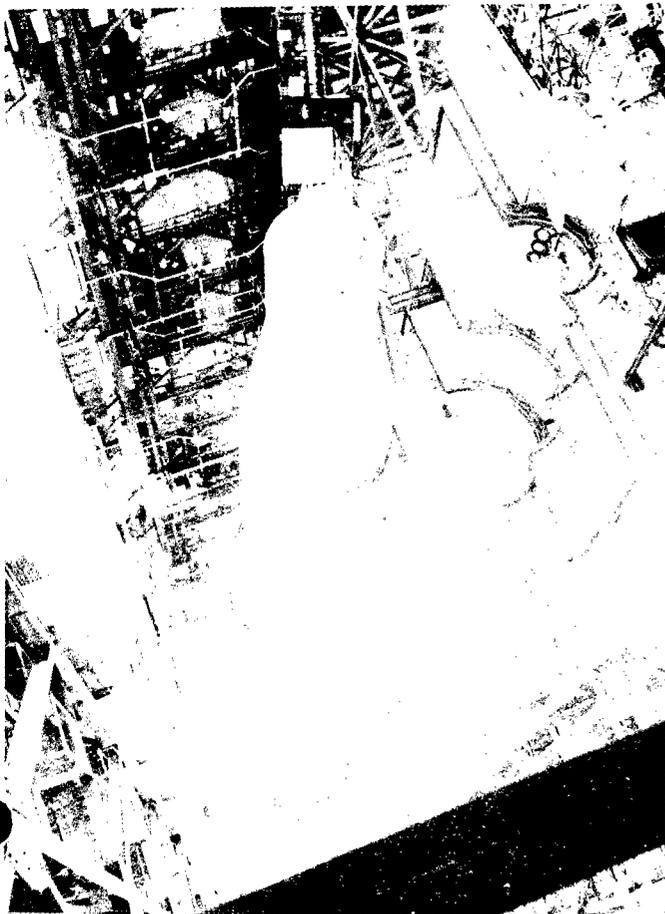
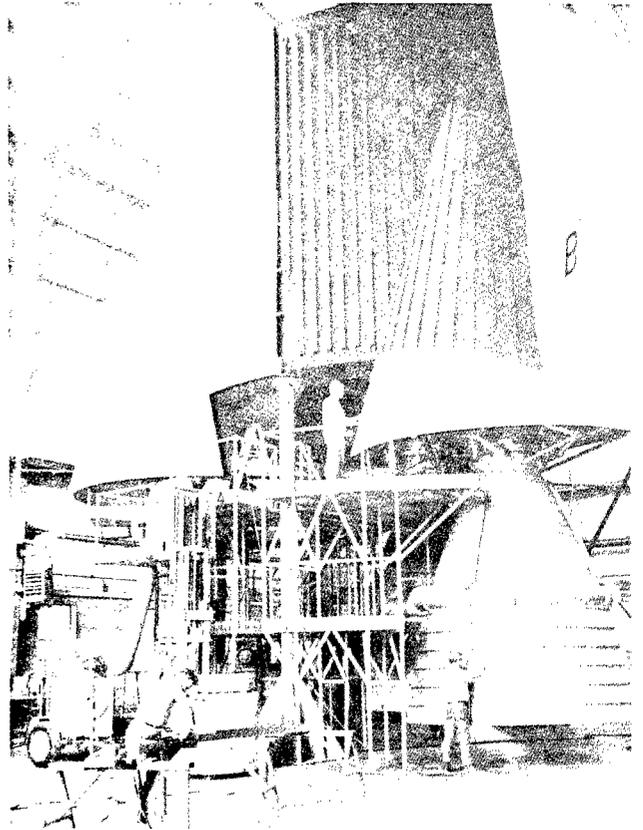
At this point the Saturn V's single engine third stage ignites, burning for about two minutes to place itself, the instrument unit, which contains the guidance system, and the Apollo spacecraft into orbit at an altitude of 115 miles and a speed of almost 17,500 miles-per-hour. After a thorough checkout of equipment in earth orbit, the engine is reignited and burns for 5-1/2 minutes to reach the lunar transfer velocity of 25,000 miles per hour, enough to escape earth orbit.

The McDonnell Douglas Astronautics Company provided the Saturn V's third stage. It was the basis in the Skylab Program for the workshop in space for three men which was launched in the spring of 1973. After the propulsion system was removed, the stage was fitted on the ground with equipment that permitted three astronauts to live and work in space for long periods.



The Saturn V's instrument unit, which directed the vehicle in flight, was provided by International Business Machines Corporation.

Directly above the instrument unit on Apollo flights is the Apollo spacecraft, the responsibility of the Johnson Space Center at Houston. The spacecraft consists of the lunar module, the service module, the command module, and the launch escape system. Total height of these items is about 80 feet. The Skylab workshop was provided by the Marshall Center.



SATURN V FLIGHT RECORD

Apollo 4 mission -- November 9, 1967. First Saturn V flight. Unmanned, Earth orbital. The spacecraft's command module reentry tested.

Apollo 6 -- April 4, 1968. Second unmanned Earth orbital flight. Despite propulsion difficulties in the second and third stages, Apollo spacecraft tested satisfactorily.

Apollo 8 -- December 21, 1968. First manned test of Saturn V. Frank Borman, James A. Lovell, Jr., and William A. Anders made mankind's first orbits of the Moon.

Apollo 9 -- March 3, 1969. James A. McDivitt, David R. Scott, and Russell L. Schweickart tested the Apollo spacecraft during 151 orbits of Earth. First flight of lunar module.

Apollo 10 -- May 18, 1969. Second manned circumlunar flight, by Thomas P. Stafford, John W. Young, and Eugene A. Cernan. Lunar module piloted within 9.26 miles of surface.

Apollo 11 -- July 16, 1969. First manned lunar landing made on July 20. Neil A. Armstrong and Edwin E. Aldrin, Jr. spent 2.8 hours outside lunar module in Sea of Tranquility. Michael Collins orbited overhead.

Apollo 12 -- November 14, 1969. Second landing, made in Ocean of Storms. Charles Conrad Jr., Richard F. Gordon, and Alan L. Bean. Two EVA's, much science equipment set up.

Apollo 13 -- April 11, 1970. James A. Lovell Jr., Fred W. Haise Jr., and John L. Swigert circled the Moon, without landing, and returned to Earth after trouble with the service module of the Apollo spacecraft.

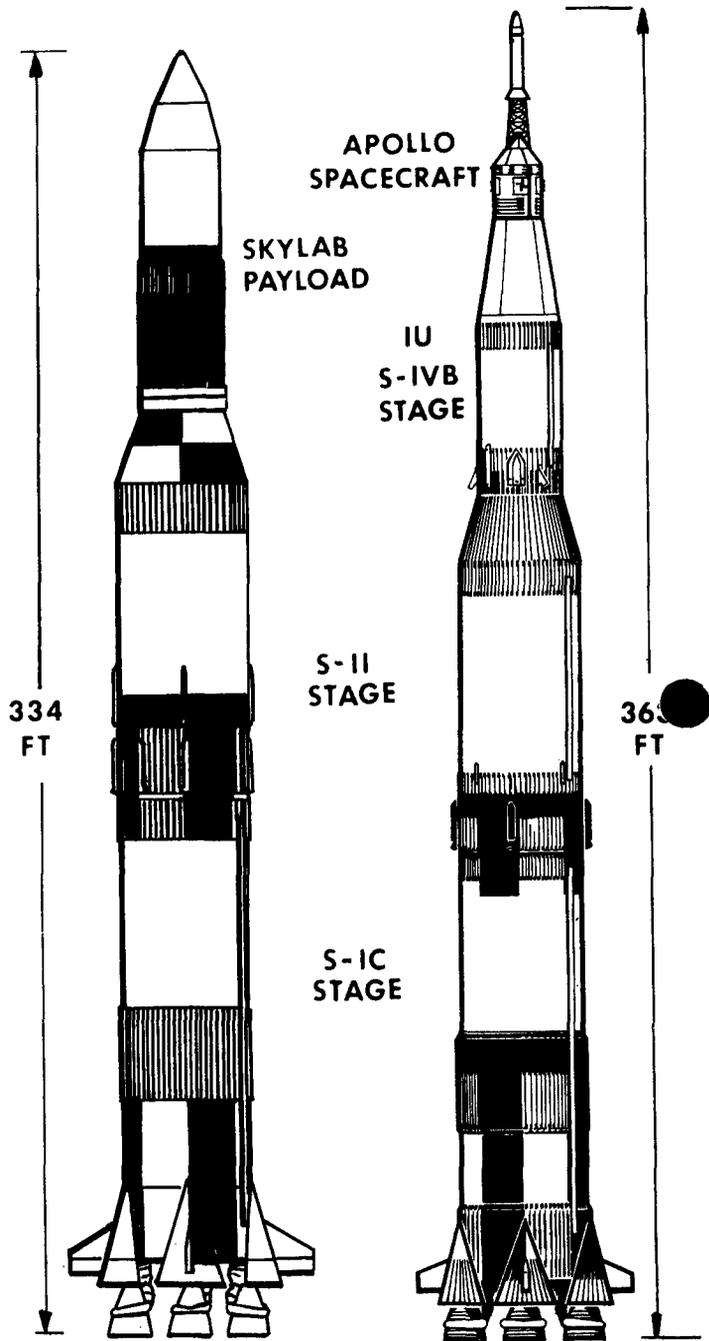
Apollo 14 -- January 31, 1971. Alan B. Shepard Jr., Stuart A. Roosa, Edgar D. Mitchell. First exploration of lunar highlands, made in Fra Mauro area. Pull-cart used to transport scientific equipment and tools.

Apollo 15 -- July 26, 1971. David R. Scott, Alfred M. Worden, and James B. Irwin. First use of Lunar Roving Vehicle. Stay time on surface doubled, reaching 66 hours, 56 minutes.

Apollo 16 -- April 16, 1972. John W. Young, Thomas K. Mattingly II, and Charles M. Duke Jr. LRV used to explore Descartes area.

Apollo 17 -- December 7, 1972. Eugene A. Cernan, Ronald E. Evans, and Harrison H. Schmitt. Last lunar mission in Project Apollo.

Skylab 1 -- May 14, 1973. Unmanned Skylab cluster placed in earth orbit, later followed by manned visits by three separate crews, launched by smaller Saturn IB rockets.



SATURN/SKYLAB CONFIGURATION

SATURN/APOLLO CONFIGURATION

