

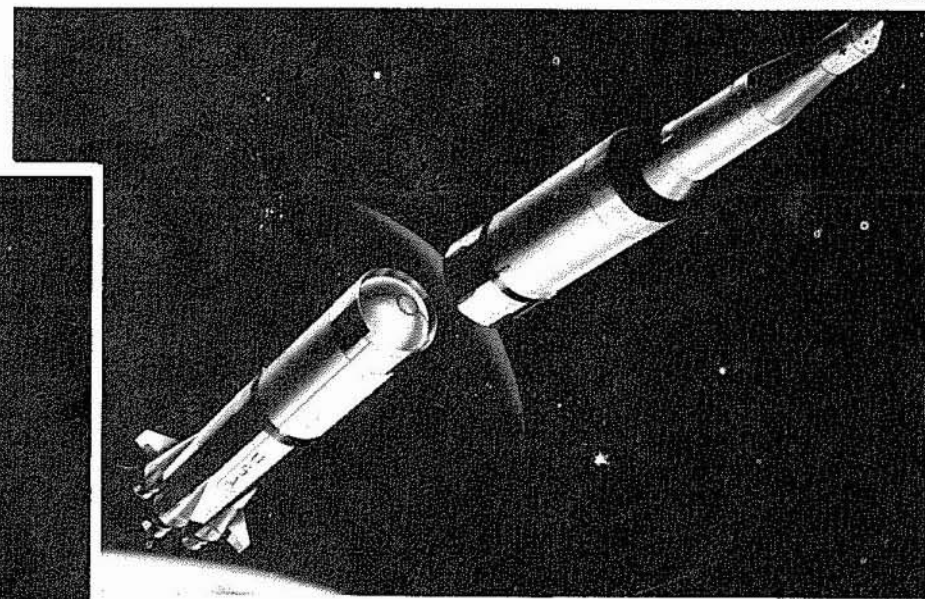
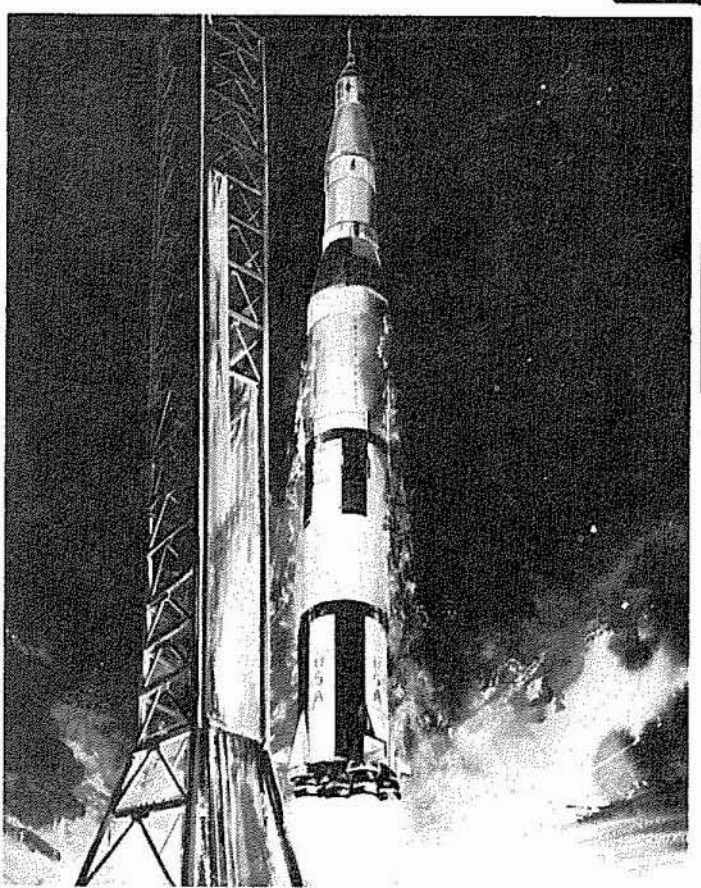
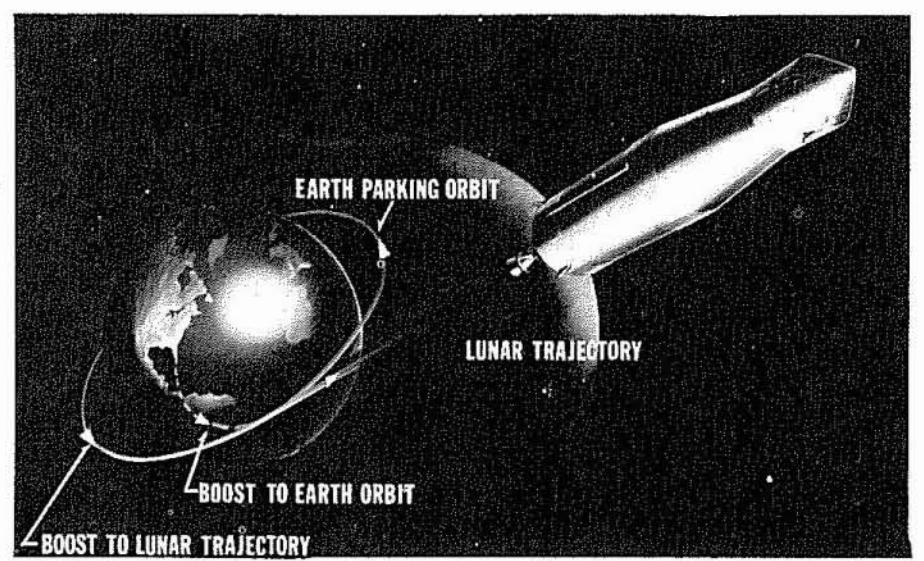
UNIVERSITY OF ALABAMA
RESEARCH INSTITUTE
HISTORY OF SCIENCE & TECHNOLOGY GROUP
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1967
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SATURN V

America's Moon Rocket



SECOND STAGE IGNITION

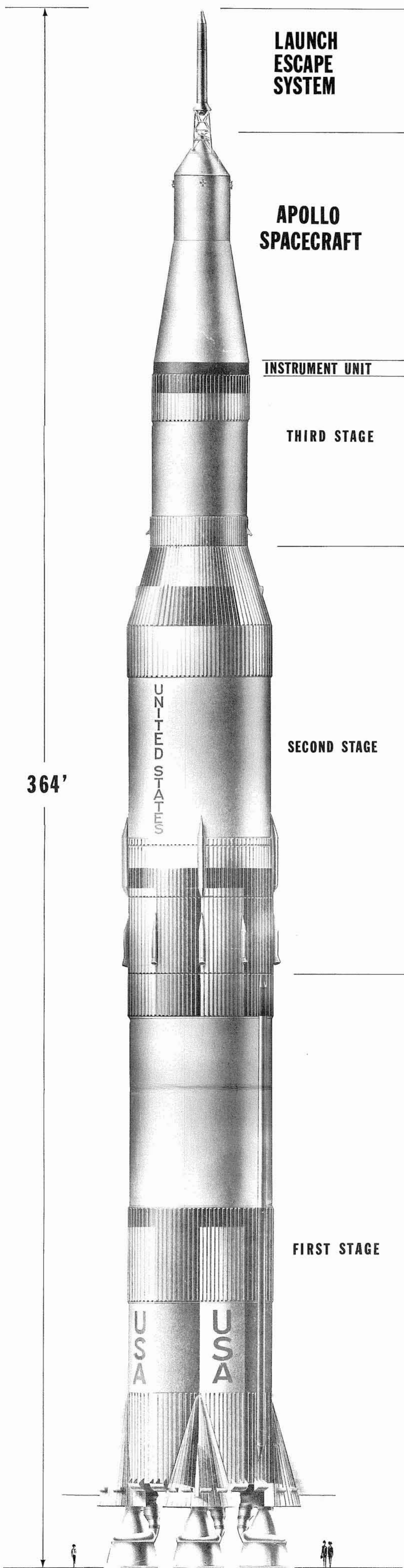
THIRD STAGE OPERATIONS
Earth Parking Orbit
Boost to Lunar Trajectory

SATURN HISTORY DOCUMENT
University of Alabama Research Institute
History of Science & Technology Group

Date ----- Doc. No. -----



GEORGE C. MARSHALL SPACE FLIGHT CENTER
National Aeronautics and Space Administration
HUNTSVILLE, ALABAMA



**LAUNCH
ESCAPE
SYSTEM**

**APOLLO
SPACECRAFT**

INSTRUMENT UNIT

THIRD STAGE

SECOND STAGE

364'

FIRST STAGE

THE SATURN V



The SATURN V □ The World's Largest Space Vehicle

- The first mission of the Saturn V launch vehicle will be to start the Apollo spacecraft, with three astronauts aboard, on a journey to the Moon. Project Apollo is directed by NASA's office of Manned Space Flight. The Marshall Center is providing the Saturn launch vehicles. The Manned Spacecraft Center at Houston is providing the three separate modules of the spacecraft, selecting and training the astronauts, and will operate the Mission Control Center. The Kennedy Space Center in Florida will launch the astronauts on their epic flight.
- In the lunar flight, the Saturn V will orbit its own third stage, linked physically to the spacecraft, about 115 miles above the earth. This first phase of the lunar journey is called an earth parking orbit. Sometime before the completion of three orbits, the third stage is reignited. It burns for about six minutes to inject the spacecraft and astronauts into an earth-escape trajectory toward the moon.
- When fully operational, the Saturn V will be able to launch into orbit more than a quarter of a million pounds. The total orbiting tonnage in the lunar mission will be about 280,000 pounds. This includes the weight of the third stage and instrument unit section. The fully fueled and loaded Apollo Spacecraft, in its lunar mission configuration, will weigh about 95,000 pounds.

The Saturn V is a three-stage launch vehicle. With its Apollo payload, it is 364 feet tall. Physical and performance characteristics of the stages, in a mission such as the lunar trip, are as follows:

□ FIRST STAGE

The first stage burns over 15 tons of propellants per second during its two and one-half minutes of operation to take the vehicle to a height of about 36 miles and to a speed of about 6,000 miles-per-hour.

Power: Five F-1 engines with combined thrust of 7.5 million pounds.
 Propellants: RP-1 kerosene--214,200 gallons or 1,444,700 pounds.

Liquid oxygen--346,400 gallons or 3,278,600 pounds.

Fueled weight of stage: 5,028,000 pounds.

Stage contractor: The Boeing Company

□ SECOND STAGE

The second stage burns over one ton of propellants per second during about six and one-half minutes of operation to take the vehicle to an altitude of about 108 miles and a speed of near orbital velocity, which in this case is about 17,400 miles-per-hour.

Power: Five J-2 engines with combined thrust of 1,000,000 pounds.

Propellants: Liquid hydrogen--267,700 gallons or 155,000 pounds.

Liquid oxygen--87,400 gallons or 827,200 pounds.

Fueled weight of stage: 1,064,000 pounds.

Stage contractor: North American Aviation, Inc.

□ THIRD STAGE

The third stage has two important operations during the Project Apollo lunar mission. After the second stage drops away, the third ignites and burns for about two minutes to place itself and the spacecraft into the desired earth orbit. At the proper time during this earth parking orbit, the third stage is reignited to speed the Apollo spacecraft to escape velocity. In this second sequence, the stage burns for about six minutes.

Power: Single J-2 engine, 200,000 pounds thrust

Propellants: Liquid hydrogen--66,900 gallons or 38,770 pounds.

Liquid oxygen--20,400 gallons or 193,700 pounds.

Fueled weight of stage: 265,000 pounds.

Stage contractor: Douglas Aircraft Company

□ INSTRUMENT UNIT

The instrument unit, located atop the third stage, between the stage and the payload, contains guidance and control equipment for the launch vehicle.

Weight: About 4,100 pounds

Contractor: International Business Machines Corporation

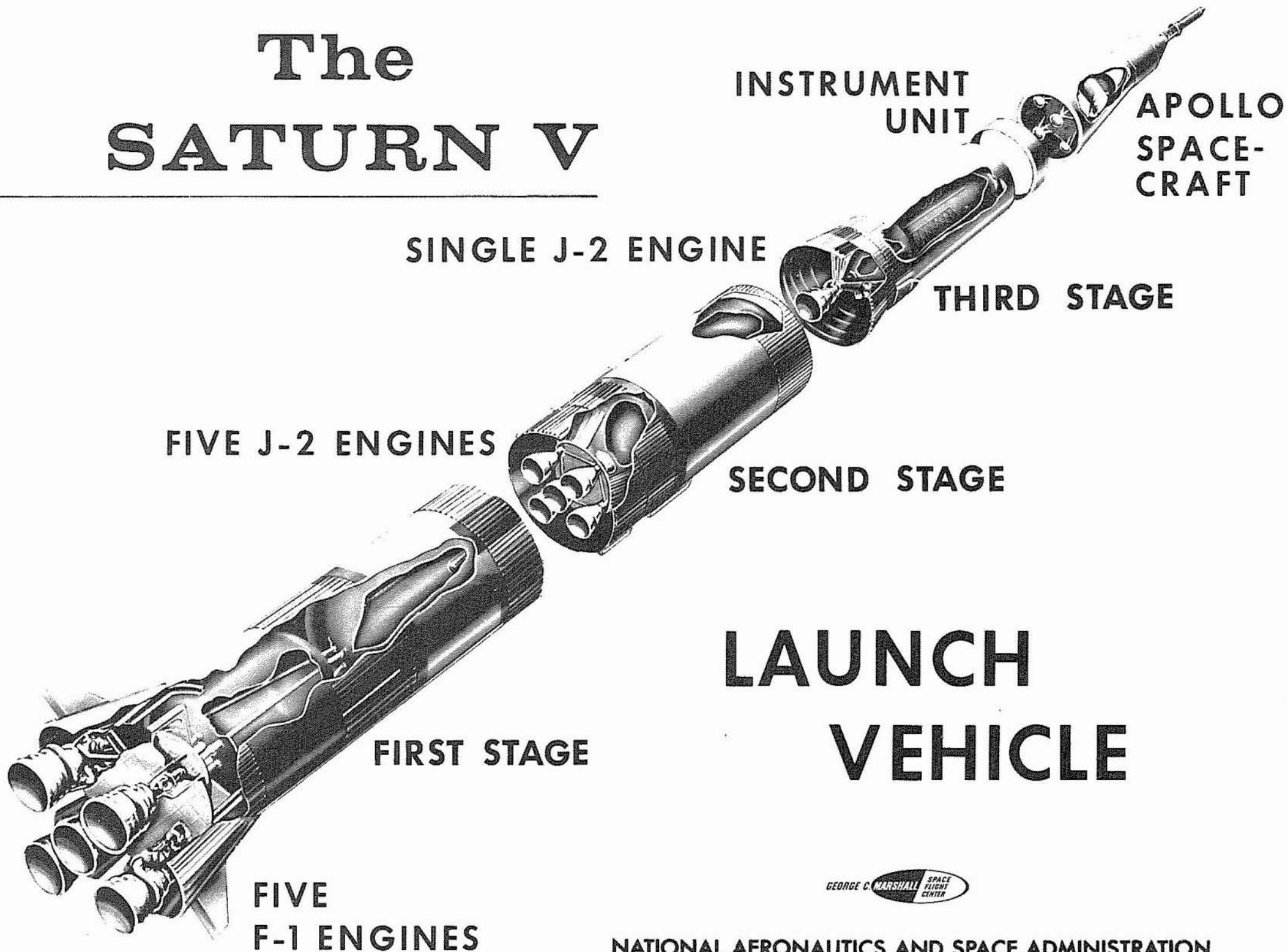
□ APOLLO SPACECRAFT

Command Module: 13 feet in diameter; weight, 11,000 pounds.
 North American Aviation, Inc., contractor.

Service Module: 13 feet in diameter, 15 feet in height; weight, 50,000 pounds; 22,000-pound thrust engine. NAA, contractor.

Lunar Module: Two stages; total weight, 30,000 pounds. Descent engine's thrust can be varied from 1,050 to 10,500 pounds.
 Grumann Aircraft Engineering Corporation, contractor.

The SATURN V



INSTRUMENT
UNIT

APOLLO
SPACE-
CRAFT

SINGLE J-2 ENGINE

THIRD STAGE

FIVE J-2 ENGINES

SECOND STAGE

LAUNCH VEHICLE

FIRST STAGE

FIVE
F-1 ENGINES



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION