SATURN ENGINES

H-1

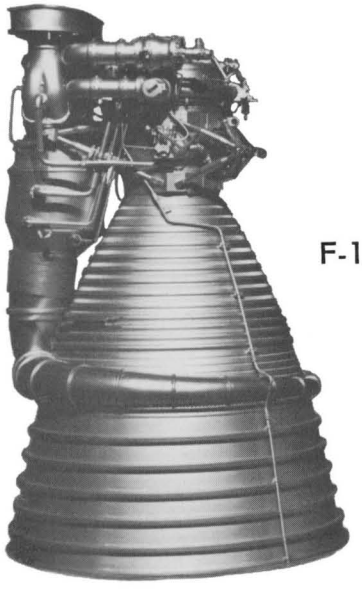
Length: About 8 1/2 feet.

Propellants: Kerosene and liquid oxygen.

Thrust: 188,000 pounds in one version, 200,000 pounds in uprated version.

Application: First stage of Saturn I, and first stage of Saturn IB in uprated version, both in cluster of eight.

Burning Time: Near 2 1/2 minutes (slightly longer in Saturn IB).



F-1

Length: About 20 feet.

Propellants: Kerosene and liquid oxygen.

Thrust: 1.5 million pounds.

Application: First stage of Saturn V, cluster of five.

Burning Time: About 2 1/2 minutes.

RL-10

Length: About 5 feet, 8 inches.

Propellants: Liquid hydrogen and liquid oxygen.

Thrust: 15,000 pounds.

Application: Second stage of Saturn I in cluster of six.

Burning Time: About 8 minutes.

J-2

Length: About 11 feet.

Propellants: Liquid hydrogen and liquid oxygen.

Thrust: 200,000 pounds.

Application: S-IVB stage of Saturn IB (single-engine stage).
S-IVB stage of Saturn V (single-engine stage).
S-II stage of Saturn V in cluster of five.

Burning Times: S-IVB, Saturn IB -- Almost 8 minutes.
S-IVB, Saturn V -- About 8 minutes (total of two burning times).
S-II, Saturn V - About 6 1/2 minutes.

(Note: Length and burn time figures are approximate, designed to show comparison in engine size and mission.)

F-1 engine is placed in test stand at Marshall Center test area.

MARSHALL SPACE FLIGHT CENTER

Located just outside Huntsville in north-central Alabama, the Marshall Space Flight Center is one of the largest of NASA's major space-age installations.

Three main missions have been assigned to the center. Primarily, scientists and engineers located there develop heavy launch vehicles in support of the nation's manned space flight program. Also, they perform applied research in related fields of astronautics and compile in-depth advanced system studies for future space transportation concepts.

Saturn rockets which use the engines shown here are developed at the Center. The engines are developed by contractors under supervision of the Marshall center.

MICHOUD AND MTO

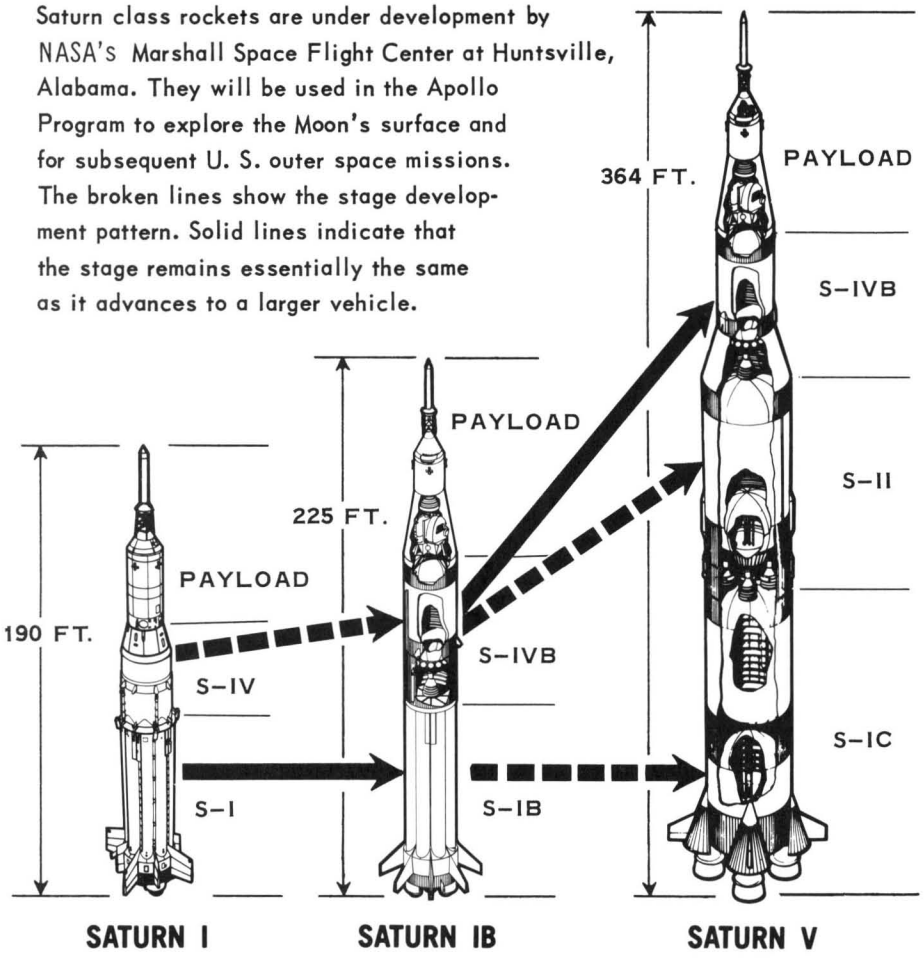
The Marshall Center has two large field divisions.

Booster stages for all three Saturn rockets are manufactured at Michoud Operations in New Orleans.

Stages and engines will be tested at Mississippi Test Operations beginning in 1965. The site is located 35 miles northeast of the Michoud complex.

SATURN ROCKETS

In a directly ascending line, three separate Saturn class rockets are under development by NASA's Marshall Space Flight Center at Huntsville, Alabama. They will be used in the Apollo Program to explore the Moon's surface and for subsequent U. S. outer space missions. The broken lines show the stage development pattern. Solid lines indicate that the stage remains essentially the same as it advances to a larger vehicle.



Saturn I

Baby of the family, Saturn I was first launched October 27, 1961, at Cape Kennedy. It flew perfectly, just as it has on each subsequent launch, proving the workability of the concepts to be used in all three Saturn vehicles.

On the fifth launch test of Saturn I, January 29, 1964, the second (S-IV) stage was flown live for the first time, placing itself and a payload into orbit for a record-breaking total tonnage of 37,700 pounds.

Saturn I flights will continue through mid-1965. Manned flights will not be attempted in Saturn I, but the final three vehicles will conduct meteoroid measurement experiments

The booster, (S-I) stage, produces 1.5 million pounds thrust from a cluster of eight H-1 engines burning liquid oxygen and kerosene. The S-IV stage uses the new exotic propellant combination of liquid oxygen and liquid hydrogen, developing 90,000 pounds thrust with six RL-10 engines.

Saturn IB

The second generation vehicle, Saturn IB, uses essentially the same booster as its predecessor, except that the eight H-1 engines are uprated in thrust to produce a total of 1.6 million pounds. The second stage (S-IVB) will use liquid oxygen/liquid hydrogen but will be powered by a single J-2 engine producing 200,000 pounds thrust.

First test launch of the Saturn IB is scheduled early in 1966. Manned flights will follow, depending upon the success of vehicle development launches. Operation of the Apollo spacecraft, to be used later in the Moon shot, will be checked out in Earth orbit by the Saturn IB.

Because of the brilliant success of the Saturn I, proving reliability of the design and booster, Saturn IB is expected to be used in future years in a variety of U. S. space missions.

Saturn V

Using concepts tested in the two smaller Saturns, Saturn V is being developed for manned deep-space probes. For example, in the Apollo Program to explore the Moon's surface, the Saturn V will launch into Earth orbit 240,000 pounds. After orbiting the Earth, the third stage (S-IVB) will be restarted to send the 90,000-pound Apollo Spacecraft with three men aboard toward the Moon.

The booster stage (S-IC) is the largest known rocket stage in the world, 140 feet long and 33 feet in diameter, producing 7.5 million pounds thrust through five F-1 engines powered by liquid oxygen and kerosene.

Saturn V's second stage (S-II) produces one million pounds thrust from five J-2 engines, which burn liquid oxygen and liquid hydrogen.

One J-2 engine is used in the Saturn V third stage (S-IVB). The S-IVB, which is the second stage of the Saturn IB, moves up to become the third stage of Saturn V.

The first test launch of Saturn V is expected early in 1967. Development of all stages is underway at the present time.

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