NEWS FROM

ROCKETDYNE
A DIVISION OF NORTH AMERICAN AVIATION, INC.
6633 CANOGA AVENUE • CANOGA PARK, CALIFORNIA
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PROJECT SATURN

The nation's goal of landing American astronauts on the moon within this decade will be accomplished through the Saturn project, in which three versions of the Saturn rocket, the largest in the free world, will be used. These three major launch vehicles are the Saturn I, Saturn IB, and the Saturn V.

Four different rocket engines — A-3, H-1, F-1 and J-2 — will be used. The latter three are designed and developed by Rocketdyne, a division of North American Aviation, Inc. The A-3 is produced by Pratt and Whitney Division of United Aircraft Corporation.

Management of the Saturn launch vehicles and their propulsion systems is under the direction of the National Aeronautics and Space Administration's George C. Marshall Space Flight Center, Huntsville, Alabama.

The Saturn launch vehicle family of three will be employed in Project Apollo, which is the next step after Mercury and Gemini in the U. S. manned space flight program. Apollo has the objective of carrying three astronauts for earth-orbiting missions, flights in the vicinity of the moon, and a landing on the moon and return to earth. The latter mission is scheduled late in this decade, according to NASA's present timetable.

This following chronology of Project Saturn was compiled by the Public Relations Department of Rocketdyne, a division of North American Aviation, Inc., from publications of the National Aeronautics and Space Administration.

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Evolution of the Saturn Project

In the spring of 1957, detailed studies were started by Dr. Wernher von Braun's rocket development group at Huntsville, Alabama, on large, cluster-engine rockets. This group, then working with the Army Ballistic Missile Agency, submitted to the Department of Defense a "Proposal for a National Integrated Missile and Space Vehicle Development Program." This document indicated the need for a booster of 1,500,000 pounds thrust.

In July, 1958, DOD's Advanced Research Projects Agency expressed interest in a clustered booster of 1,500,000 pounds thrust that would use rocket engines already tested and of proven reliability. On August 15, 1958, ARPA Order 14-59 formally initiated what was to become the Saturn project by authorizing a research and development program of a 1,500,000-pound-thrust booster rocket based on the clustered engine concept.

As an immediate step toward development of the clustered booster, a contract was awarded Rocketdyne on September 11, 1958, to up-rate the Thor-Jupiter engine. After redesign, simplification, and modification, the engine was designated the H-1. Before the end of the year, the H-1 engine was static tested at full power.

Concurrently with the development program of the H-1 engine, studies were conducted to determine the feasibility of building a large single-chamber rocket engine capable of producing very high thrust. On January 9, 1959, a contract was awarded Rocketdyne to design, develop and test such an engine, designated the F-1.

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On November 18, 1959, technical direction of the Saturn project was transferred from the Department of Defense to NASA and on July 1, 1960, the Huntsville development group was transferred to NASA's newly-established Marshall Space Flight Center.

In early 1962, NASA decided to develop a much larger Saturn, the V, as the Apollo moon rocket, since the I will not be capable of placing men on the moon. In mid-1962, NASA decided to put together a rocket with a capability between that of the I and the V, to be composed of the first stage of the I and the third stage of the V.

Saturn I

The Saturn I vehicle has two stages known as the S-I and S-IV. Chrysler Corporation is the prime contractor for the S-I stage. Douglas Aircraft Corporation is the prime contractor for the S-IV stage.

The S-I is 81.6 feet high and has a diameter of 21.6 feet. It is powered by a cluster of eight Rocketdyne H-1 engines, each of which will ultimately produce 188,000 pounds of thrust to give a total stage thrust of 1,500,000 pounds -- equivalent to 32,000,000 horsepower. The H-1 engine, an advanced and compact offspring of Rocketdyne's Jupiter and Thor engines, was selected because of its relative simplicity, early availability and proven reliability. It burns RP-1 (kerosene) fuel and liquid oxygen.

The first several Saturn I flight boosters were produced at the Marshall Space Flight Center. Later ones will be produced by Chrysler Corporation at NASA's Michoud Operations plant, New Orleans, Louisiana.

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The S-IV second stage of the Saturn I is 40 feet in length and 18 feet in diameter. Its development was begun two years ago by the Douglas Aircraft Missiles and Space Division in Santa Monica, California.

The S-IV stage is powered by six 15,000-pound-thrust RL-10-A-3 liquid hydrogen-liquid oxygen engines, developed by Pratt and Whitney Division of United Aircraft Corporation, for a total stage thrust of 90,000 pounds.

The S-IV is in advanced development by Douglas. The first "live" S-IV was flown in the last half of 1963.

The Saturn I will be capable of launching about 20,000 pounds into a low-earth orbit. It will be used to place the three-man Apollo spacecraft into earth orbit of up to two weeks duration.

To date, the S-I stage has been flight tested four times with dummy upper stages and once with an operating second stage at Cape Kennedy, Florida. These launches were on October 27, 1961, April 25, 1962, November 16, 1962, November 28, 1963 and January 29, 1964. The five perfect flights were designated SA-I, SA-2, SA-3, SA-4 and SA-5.

A total of ten Saturn I vehicles are to be launched in the research and development portion of the program. The first four in this program simulated three-stage rockets, but only the first stage was powered. Saturn I flights with two live stages began with SA-5. Both the live second stage and a dummy Apollo spacecraft were placed in earth orbit on the SA-5 flight. While the primary purpose of the first ten flights is to prove the vehicle, flight SA-6 and beyond have secondary missions of testing early versions of the Apollo three-man spacecraft.

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Saturn IB

The Saturn IB, which will be used to test the Apollo spacecraft in earth orbit, will be an interim step between the present Saturn I and the Saturn V.

The first stage of the Saturn I will be mated with the third of the Saturn V to form the Saturn IB, a vehicle capable of orbiting 16 tons. The Saturn IB will place the Apollo into earth orbit for qualification tests, including the transfer of two astronauts from the command module to the lunar excursion model. This maneuver will ultimately be done in lunar orbit in preparation for lunar landing.

First stage of the Saturn IB will be powered by a cluster of eight Rocketdyne H-I engines for a total thrust of 1,500,000 pounds. The second stage of the vehicle will be powered by a single Rocketdyne hydrogen-fueled J-2 engine developing 200,000 pounds of thrust.

Saturn V

The third and largest launch vehicle in the Saturn program is the Saturn V, which will become the workhorse of the Apollo program. It will be composed of three stages, S-IC, S-II and S-IVB. Prime contractors for these stages are as follows: Boeing Company (S-IC), Space and Information Systems Division of North American Aviation, Inc. (S-II), and Douglas Aircraft Company (S-IVB).

The S-IC stage stands 138 feet high, has a diameter of 33 feet, and will weigh nearly 5,000,000 pounds at liftoff. It will be powered by a cluster of five Rocketdyne F-I engines for a total stage thrust of 7,500,000 pounds (five times that of the Saturn I).

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The 1,500,000-pound-thrust F-1 is the most powerful known rocket engine. First test of the complete engine at approximate flight duration of two and a half minutes at its full thrust of 1,500,000 pounds occurred on May 26, 1962, at NASA's High Thrust Test Area, Edwards, California.

The F-1 uses kerosene and liquid oxygen as propellants. The first engine was delivered to NASA by Rocketdyne in October, 1963.

The S-IC stage will be assembled at the NASA Michoud Operations plant, New Orleans, Louisiana. Static testing will be conducted at the NASA Mississippi Test Facility, 35 miles east of New Orleans, and at the NASA Marshall Space Flight Center, Huntsville, Alabama.

The S-II stage of the Saturn V is 82 feet tall and 33 feet wide. This stage will be powered by a cluster of five 200,000-pound-thrust liquid oxygen-hydrogen J-2 engines, built by Rocketdyne for a total stage thrust of 1,000,000 pounds.

A major milestone in the development of the J-2 occurred October 4, 1962, when it underwent its first long-duration static test at full thrust. The test, which took place at Rocketdyne's Propulsion Field Laboratory, was a complete success with all objectives achieved. First delivery of a J-2 production engine simulator to NASA was made in 1963. The first fireable production engine was delivered in the spring of 1964.

The S-II is the largest hydrogen stage thus far attempted by the United States. It carries close to 1,000,000 pounds of liquid oxygen and liquid hydrogen fuel. Sufficient propulsive power can be obtained if only four of the five engines are operative. The so-called engine-out capability (if one of the engines fails in flight, all the propellant in the stage will be consumed by the other engines with essentially no loss in performance) greatly enhances the reliability of the stage.

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The S-IVB stage is 21½ feet in diameter and is nearly 60 feet high. Douglas was selected to develop and produce the S-IVB in order to utilize the same design concept and much of the same tooling and test equipment already being developed for the S-IV stage. The S-IVB will be powered by a single 200,000-pound-thrust J-2 hydrogen-fueled engine.

The three-stage Saturn V will stand about 350 feet high with payload and escape tower. It will have a take-off weight of more than 6,000,000 pounds, which is equal to the weight of about 25 fully-loaded 707 jet aircraft.

It will be able to hurl into a 300-mile earth orbit about 220,000 pounds — almost the equivalent of one 707 aircraft. Only two stages will be used for earth orbital missions, whereas three stages will be needed for escape velocity or moon missions. The Saturn V will be able to hurl about 90,000 pounds to escape velocity and lunar orbit.

The ultimate mission of the Saturn V will be to launch the Apollo spacecraft into a lunar orbit. Descent to the moon will then be made by two of the three astronauts in the lunar excursion module (LEM).

Flight testing of the Saturn V launch vehicle is expected to start late in the mid-1960's. The flight test program will be an intensive one in order to develop the high reliability required for earth orbit rendezvous and subsequent lunar missions. The first manned circumlunar missions will be accomplished with Saturn V.

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