

## SPACE

# Reusable Rocket Designed

Passenger and freight payloads could be shuttled between earth and the moon by the 1970s, with a reusable, multipurpose booster rocket—By Jonathan Eberhart

➤ A HUGE, REUSABLE, single-stage rocket has been designed for traveling to and from an earth orbit, the surface of the moon, and even Mars and other planets.

Supported by a fleet of refueling tankers, the booster could be shuttling crews and cargo between the earth and the moon by the late 1970s, says Phil Bono, advance project engineer of space launch vehicles for Douglas Aircraft Company, Santa Monica, Calif.

Mr. Bono reported on the booster at the 15th annual International Astronautical Federation Congress in Warsaw, Poland.

Although a space vehicle designed for an individual mission would be less costly than a multipurpose vehicle adapted for that mission, savings would result in the long run by eliminating the cost of research and development for each specific job, he said.

In a typical moon mission, the basic manned reusable booster, ROMBUS (Reusable Orbital Module—Booster and Utility Shuttle), would be launched into an earth orbit. There it would be refueled from "tanker" vehicles, which would also be modifications of ROMBUS. The fuel, liquid hydrogen and liquid oxygen, would be transferred in tanks to be fastened to the outside of the booster.

The used tanks would be carried along to the moon, where they would be converted into living quarters and storage space. Before returning to earth, the empty tanks would be detached from ROMBUS, reducing the weight at launch.

Reusable multipurpose boosters, depending upon the number of refueling rendezvous either in orbit or on the moon, could carry as much as half a million pounds of payload to the lunar surface and return with 50,000 pounds.

A series of ROMBUS launches could make possible a permanent lunar refueling base, with a staff of several hundred men.

For a trip to Mars, a ROMBUS would be refueled in earth orbit by means of ten consecutive rendezvous operations. Two hundred days later it would take up an orbit around Mars, from which a "Mars excursion module," something like a lunar excursion module (LEM) in Project Apollo, would land on the planet.

At the beginning of the 330-day return trip, the emptied fuel tanks would be jettisoned, and ROMBUS would return to earth. Hence a single reusable booster would serve as the earth-launch vehicle, the orbit-to-orbit vehicle, the Mars-orbit vehicle, the return-trip vehicle and the earth reentry module.

The U.S. lunar program, on the other hand, now calls for many different vehicles. The launch from earth will be by a Saturn rocket. The flight to the lunar orbit will

include only the command, service and lunar excursion modules. The LEM will land on the moon and return to the lunar orbit leaving its legs and superstructure behind. The crew will then transfer to the command module for the return trip to earth, and the Apollo capsule will reenter the earth's atmosphere by itself.

The reusable booster could have many other uses as well, not all of them involving the nation's space program. One possible application might be a huge ballistic-rocket troop transport, capable of carrying 1,200 full-equipped GI's anywhere in the world within 45 minutes.

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## SPACE

## Next Space Capsule Will Have Satellite Inside

➤ THE NEXT APOLLO space capsule, scheduled to go into orbit aboard Saturn 8 sometime in December, will have as a passenger not an astronaut—but a satellite.

Its name is Pegasus, after the winged horse of Greek mythology. Like its namesake, it will have wings of a sort, although they will not be used for flying. The wings,

made of two many-layered, metal "Dagwood sandwiches," will measure the size and number of meteoroids puncturing their surfaces during a year in orbit.

Pegasus will ride up to its orbit inside a "boilerplate" mockup of an Apollo service module. Once in orbit, the Apollo, still attached to the S-IV stage of the Saturn rocket, will rocket itself forward slightly, while Pegasus lags behind.

When Pegasus is clear of the satellite, a series of springs and explosive bolts will unfold the wings, like an accordion, until they reach a span of 96 feet. The four exposed wing surfaces of Pegasus will have a total area of almost 2,500 square feet, making it one of the largest meteoroid-detection satellites.

Three Pegasus flights are scheduled in this Saturn rocket series, on Saturns 8, 9 and 10, ending in mid-1965.

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## AERONAUTICS

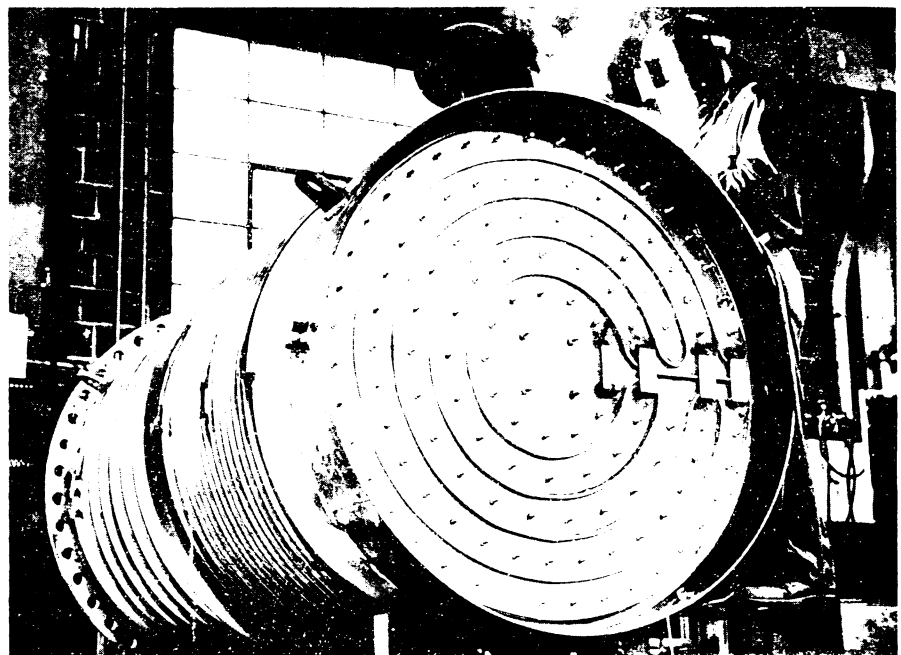
## Jets to Be Available In 'Compact' Models Soon

➤ JET PASSENGER PLANES will soon be coming out in "compacts."

The Douglas DC-9, scheduled to make its initial flight in March 1965, is designed to operate over route segments of 100 to 1,500 miles with the same levels of speed and comfort as the larger transcontinental and intercontinental jets.

Now being built by the Douglas Aircraft Division, Long Beach, Calif., the DC-9 is scheduled to enter airline service in 1966.

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NRC Equipment Corp.

**GIANT PUMP**—This four-foot diameter vacuum diffusion pump for use in space simulation chambers and large furnaces has a pumping rate of 95,000 liters of air per second, approximately twice the rate of previous units. It is shown prior to shipping, at the NRC Equipment Corporation, Newton, Mass.