SPACE

Mariner Alters Projects

Information on the density of the atmosphere on Mars received from Mariner 4 has already had profound effect on designs of future spacecraft—By Jonathan Eberhart

➤ THE MARINER SPACECRAFT data, still being analyzed, are already causing changes in the space programs of the future.

An elaborate, pilot-controlled parachute system for manned landings on Mars, for example, designed only a few weeks ago, is now on shaky ground because of Mariner's measurements of the density of the Martian atmosphere.

The landing system, designed by R. N. Worth of Northrop Corporation, Newbury Park, Calif., requires between 0.009 and 0.131 times normal atmospheric pressure at sea level on earth for the parachutes to provide enough deceleration. According to the "occultation experiment," which sent radio signals to earth through the fringes of Mars' atmosphere, just before and just after passing behind the planet, Mars has just barely enough atmosphere to make the grade.

The rarefied "air," with a density falling almost at the lower workable limit for the parachutes, would probably cause the National Aeronautics and Space Administration—which strongly believes in double and triple safety factors—to think twice about entrusting a man's life to such a system.

Even with Mariner's information, however, man's knowledge of the Martian atmosphere—its composition, density (Mariner's data is only sketchy), temperature distribution at various altitudes—ranges from woefully limited to non-existent. For this reason, many space experts, from both Government and private industry, are trying to "go ahead blind" with manned-lander designs that will keep down the inevitable weight penalty caused by not knowing what to expect.

One such design, shaped like a four-foot-long pencil stub with a rather bulbous eraser, is the brainchild of NASA's George M. Levin, an "advanced missions analyst" at Goddard Space Flight Center in Maryland. He calls it a "non-surviving needle-nosed probe," which is not a bad comparison, since the pointed nose of the vehicle spans an angle of only 18 degrees.

The sharp point is designed to help the probe cut cleanly through the atmosphere, minimizing the plasma layer around the nose caused by ionized gases from entry heating. The plasma layer can distort or even blank out radio communications.

A possible solution to the problem, injection of a stream of water into the plasma layer, has already been tried on the Gemini 3 flight with partial success, but since the whole "pencil stub" will weigh only 60 pounds it would be difficult to build in the necessary equipment.

Changing estimates of surface atmospheric pressure on Mars have had a great effect on lander designs, said Mr. Levin. For example, one model based on a surface pressure of about 0.039 atmospheres, could have used a 176-pound spacecraft to land a 12-pound payload on Mars. A similar design based on Mariner's 0.009-atmosphere estimate would need three times as heavy a spacecraft, and could only handle an eight-pound payload.

The "pencil stub" is planned as a stepping-stone to precede soft-landing vehicles such as Voyager or any manned spacecraft.

The instrument package would measure dynamic and static pressure on the spacecraft, atmospheric composition and deceleration.

The vehicle would be launched from a flyby spacecraft "bus," and due to the limited space and weight available for transmitting equipment it would send its data to the bus, which would act as a relay station with earth. Another reason for the relay system is the slow data transmission rate necessary between such distant points as Mars and earth. Because it would be crash-landing, the pencil stub would have to transmit its data at a high rate to the bus, which would record the data to be retransmitted at its own slow pace. These designs were reported at the second annual meeting of the American Institute of Astronautics and Aeronautics in San Francisco.

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War Spacecraft Designed

➤ A SPACE VEHICLE designed to handle any military task from "open sky" surveillance to shooting down satellites or space stations during a full-scale war was discussed by several hundred space scientists at the second annual meeting of the American Institute of Astronautics and Aeronautics.

Although such a vehicle may never become a reality, said its designer, Alvin C. Eulberg of General Dynamics Corporation, San Diego, the United States cannot afford to neglect the idea, "for no other reason than to avoid the surprise of having our adversaries employ it first."

Mr. Eulberg's vehicle would have wings, carry a two-man crew, and be capable of changing the plane of its orbit as much as 15 degrees to make tracking difficult.

Three kinds of missions could be carried out by the spacecraft. Reconnaissance tasks could range from spying during a "limited war," to information on the damage caused by bombs, missiles, etc.

A second category is inspection, which could ultimately lead to intercepting other objects in orbit, perhaps dismantling or destroying them.

Finally, as a support vehicle, the spacecraft could be used to deliver supplies, rotate the crews of space stations and even provide a quick "emergency exit" from orbit.

All sorts of evasive maneuvers would be possible with the vehicle, in addition to the orbital plane change. It could dip down below its orbit, or "fly" still higher, over a range of nearly 200 nautical miles.

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NASA

MARS, NOT MOON—This is a photographic representation of digital data radioed from Mars by Mariner 4 just prior to the spacecraft's closest approach of about 6,000 miles. The information was processed by computer to enhance detail.