ASTRONOMY

Mercury Flyby Proposed

Suggestions for an unmanned Mercury flyby that would pass 1,100 miles from Venus and provide data about both planets have been offered by scientists—By Jonathan Eberhart

➤ AN UNMANNED SPACE probe that would pass 1,100 miles from Venus and then come within 4,700 miles of Mercury has been proposed.

Planned for launching in late July or August of 1970, the spacecraft would need less than a third as much thrust as one going directly to Mercury without visiting Venus. Even an Atlas-Centaur rocket, much smaller than the huge Saturn-class boosters used for manned flights, could launch a 1,150-pound vehicle, twice the weight of the Mariner Mars probe.

The mission was suggested by Francis Sturms Jr. and Elliott Cutting, both of California Institute of Technology's Jet Propulsion Laboratory, Pasadena, which was largely responsible for the success of Ranger 7 and the current promise of Mariner 4.

Flight time to Mercury would be between 158 and 182 days, depending upon the launch date, but the closest pass to Venus, 1,100 miles, would fall on the Nov. 26, 1970. The spacecraft would finally hurtle past Mercury in late January 1971.

Once the probe had left earth and become settled on its path to Mercury, it would need fuel only for changing direction.

Among the many scientific instruments that could be carried aboard are infrared and microwave spectrometers for making temperature "maps" of Mercury's surface. This is particularly important for the "terminator" zone that divides the hot and cold sides of the planet.

Mercury's day is the same length as its year, 88 days, which means that the same side always faces the sun; the temperature on the hot side reaches 750 degrees Fahrenheit, while the dark side of the planet descends almost to absolute zero (—459.7 degrees F.).

Television pictures of Mercury's surface, at least in the terminator zone, would be very valuable, since the planet is difficult to observe from earth.

Almost more important than the Mercury flyby, however, is the approach to Venus. The only Venus-bound spacecraft yet launched by the United States was Mariner II, which approached the planet only as close as 21,648 miles.

The dense layer of clouds that surrounds Venus is at least 45 miles deep, and according to Mariner, has no holes. However, a space vehicle only 1,100 miles above the surface would be in a much better position to record the temperature and composition of the cloud layer.

The flight plan of the Venus-Mercury probe would be a relatively simple one that could be controlled completely from earth, without the need for on-board computers and guidance systems. The trajectory is also one that is relatively insensitive to errors. The nearest point of the Venus flyby, for example could be predicted with an error of less than 90 miles.

Neither NASA nor JPL are as yet planning such a mission as this, but the techniques involved are applicable to other multi-planet flights. The mission was suggested at the second Aerospace Science Meeting of the American Institute of Aeronautics and Astronautics in New York City.

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SPACE

Spacecraft Could Fly Itself

➤ SPACESHIPS could keep cool automatically during reentry with a new guidance system that watches hot air instead of stars.

In this system, known as the Temperature Rate Flight Control System (TRFCS), either the vehicle's trajectory or the way it is facing would be changed if friction of the atmosphere raises the heat above a certain point.

A network of thermocouples, supersensitive thermometers, imbedded in the outer skin of the spacecraft, would monitor the temperature and feed a running stream of data to a central computer. The computer in turn would control the attitude and propulsion motors of the vehicle.

The system would not replace the regular guidance system, however. It would be used as a separate safety device in conjunction with conventional navigation-and-guidance equipment. In an emergency, however, the pilot could use the temperature indicators as guides by which to fly the vehicle.

Normally, the regular guidance system performs the reentry maneuvers automatically, while the TRFCS makes occasional changes to keep the temperature under control. If the navigation equipment breaks down, the pilot can fly the craft on information radioed from the ground, as the TRFCS stands by to override any of his decisions that would create too much heat.

The temperature-rate system, developed by J. Stalony-Dobrzanski of Northrop Corporation, Hawthorne, Calif., may be used on a number of different spacecraft, although it was originally planned for the now-defunct Dyna-Soar winged reenty vehicle.

A similar currently active project is the U.S. Air Force's ASSET space glider, of which five have been test-launched so far. The relatively shallow reentry angles of winged craft, as well as their tendency to "skip" around the fringes of the atmosphere, makes temperature control both critical and difficult.

The TRFCS has been studied also for use in a Mercury-type space capsule.

Of the two flight characteristics controlled by the system, attitude and direction of travel, attitude posed by far the greater problem. A special research program was needed to develop thermocouples that could respond quickly to tiny temperature changes in an emergency.

The TRFCS was reported at an aerospace sciences meeting of the American Institute of Aeronautics and Astronautics in New York.

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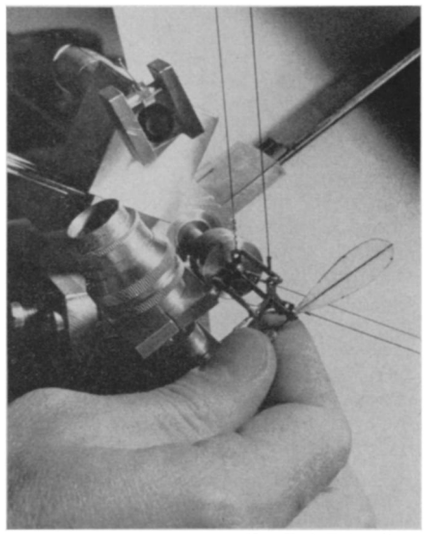

New York University

BEETLE MACHINE—This life-sized mechanical beetle wing was built to duplicate the movement of the actual beetle wing in flight by scientists at the New York University's School of Engineering and Science.

AERONAUTICS

Mechanical Beetle Wing Gives Flying Lessons

➤ A FLYING BEETLE that theoretically cannot fly has inspired scientists to build themselves a fully instrumented mechanical beetle wing.

The beetle, *Melolontha vulgaris,* according to generally accepted flight theory, should require at least two or three times as much lift as it appears able to produce with its wings.

To investigate this unusual ability, scientists at New York University have constructed an actual-size artificial wing with an elaborate linkage that enables it to flap as much as possible like the real beetle.

Even the most efficient man-made unflapped wings give only half as much lift as the wing of *M. vulgaris,* said the head of the study program, senior research scientist Leon Bennett.

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