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Two Stones with One Bird: Birth Pangs

"Providing the time of departure is carefully arranged, Mars and Mercury will be seen at close range, while a near approach to Venus will be made at least once, perhaps twice."

—Phillip E. Cleator, in *Rockets Through Space*, 1936

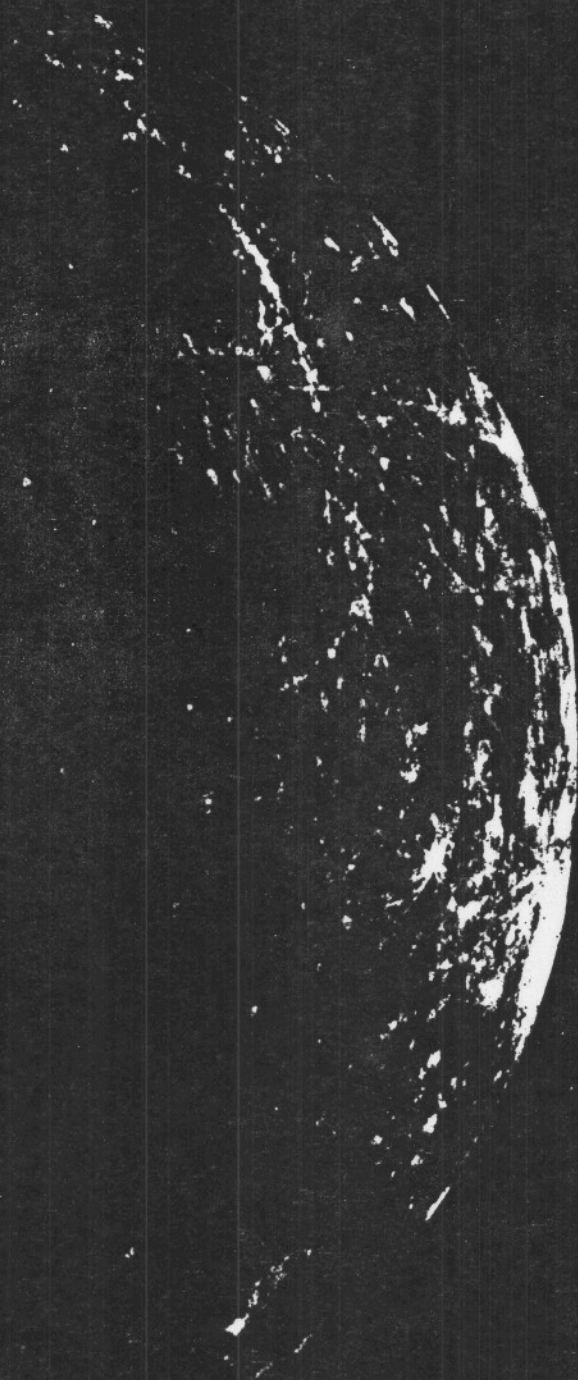
The exploration of Mercury was made possible by an exciting new idea in astronautics: the use of the gravitational attraction and orbital motion of Venus as a celestial slingshot to hurl a spacecraft sunward to intersect the orbit of Mercury. Without this technique a flight to Mercury could not be made with a conventional Mariner-class launch vehicle. Much larger systems had been developed to send astronauts into space and ultimately to the Moon in project Apollo, but they were considered far too costly for unmanned missions to the planets.

A dual-planet mission, actually a multi-planet mission, had been discussed as long ago as 1936 by Phillip Cleator. But almost 20 years passed before the real power of the multi-planet mission, the gravity-assist slingshot to conserve propellant mass, was mentioned again. In 1954, Derek F. Lawden said, in the *Journal of the British Interplanetary Society*:

[A] velocity increment [could be] induced in a space ship due to its attraction by a large moving body and without expenditure of fuel . . . a perturbation maneuver is seen as a means of economizing in the fuel requirements of an interplanetary journey.

But the technique remained virtually forgotten for another decade until the rocket rivalry of the United States and the Soviet Union began spreading beyond Earth to other worlds.

- 1961 Days of excitement and activity in the space race. Students, encouraged and financed through summer programs, work at aerospace companies and National Aeronautics and Space Administration (NASA) centers, excited by the challenge of this new frontier. Michael A. Minovitch, a graduate student at the University of California at Los Angeles, spends several summers at the Jet Propulsion Laboratory, Pasadena, California. His task: to calculate a series of Earth-Venus-Earth and other possible round trip missions.
- October, 1962 Minovitch's work at the Laboratory culminates in the discovery that in 1970 and 1973 a spacecraft launched to Venus could be perturbed by a close passage into a new trajectory that would encounter Mercury.
- By early 1967, the basic feasibility of the mission to Mercury via Venus has been established and its scientific and exploratory potential recognized. Furthermore, it is apparent that after the planetary configurations of 1970 and 1973, there will not be another practical opportunity for an economical voyage to Mercury until the middle 1980s. But the deadline to start work on any 1970 effort passes almost unnoticed, except by a few disappointed scientists.
- June, 1968 Good news. The Space Science Board of the National Academy of Sciences (NAS), after a study on planetary exploration, endorses a mission to Mercury at the 1973 opportunity:
- Our emphasis on obtaining broad knowledge of the solar system leads us to give the next [i.e., after a Mars orbiter] priority to a Mariner-class Venus/Mercury flyby in 1973 or 1975.
- Shortly after the NAS recommendation, the objectives of such a mission are defined by NASA, and serious engineering studies are begun. In addition to providing the first look at Mercury and new observations of Venus, the spacecraft would explore the interplanetary medium within the orbit of Venus for the first time. Moreover, the Venus/Mercury flight would provide experience in the gravity-assist technique that will also be needed for later exploration of the outer giants of the solar system—Jupiter, Saturn, Uranus, and Neptune.
- September, 1969 NASA selects a representative group of scientists to participate in planning the Venus/Mercury mission—a group that becomes the Science Steering Group (SSG). Such early involvement of scientists is an innovative approach by NASA for Mariner spacecraft. In the past, these spacecraft had been specified and designed before scientific experiments were solicited, a practice that in some cases had placed severe constraints on the experiments.
- Meanwhile, support for the mission to Mercury grows steadily. The Lunar and Planetary Missions Board, consisting of senior scientists from outside of NASA, strongly recommends the mission:



Flight to Mercury

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