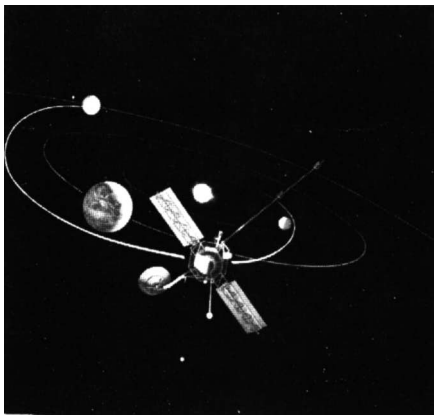
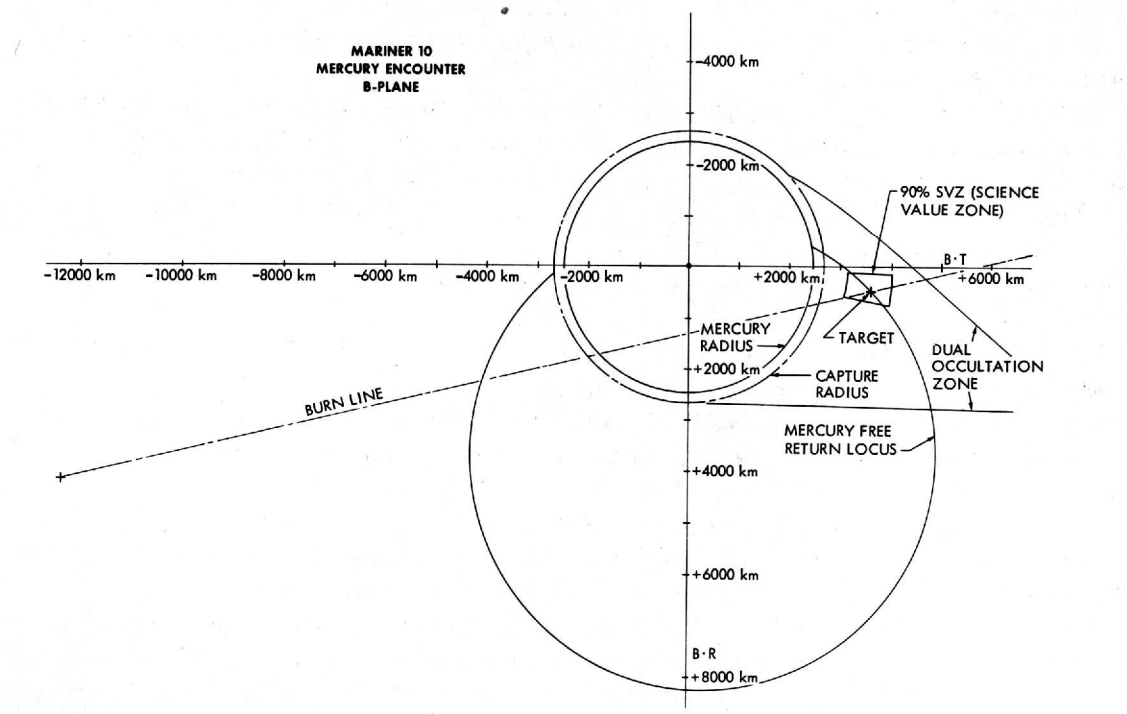


MARINER VENUS / MERCURY 1973
STATUS BULLETIN

Sun-Line Reference
TCM Scheduled For 16 March



NAVIGATION

On Saturday, March 16 at 04:54:42 PDT the propulsion system will be ignited and burn for 51.1 sec. to produce a velocity change of 17.8 m/sec directly away from the Sun. This will change the Mercury flyby from sunny side to dark side, as shown in the figure. The aim point has been carefully chosen to optimize all experimenter desires and also to allow a return to Mercury 6 months later by exchanging energy with the planet, in the same way that the Venus swingby allowed us to "drop-in" towards the Sun and Mercury.

The angle between the TCM, velocity change and the Earth-spacecraft direction is 103°. Therefore the Doppler shift will only show a small component, namely DV cos 77° ≈ 4 m/sec. Near real time analysis will be able to determine whether the Doppler shift is "ball-park" right, or grossly wrong, but no precise estimate of TCM_3 performance can be obtained from the tracking data until about 10 days of data are accumulated. However, the high rate engineering telemetry of thrust chamber pressure should provide a near-real-time of the actual magnitude of the velocity change. If the motor burns too "hot", we overshoot and can not correct with a Sun line maneuver. If the motor burns too "cold", we undershoot and have the option of performing a tiny burn within 24-48 hrs.

MARINER VENUS/MERCURY 1973 PROJECT OFFICE
Jet Propulsion Labratory California Institute of Technology
National Areonautics and Space Administration
Pasadena, California

15 March 1974
BULLETIN NO. 21

SIGNIFICANT MISSION EVENTS/TIMES

TCM_3 — load and enable	**08:40**	**March 15**
TCM_3 — Executed	**04:52**	**March 16**
Near simultaneous ranging for navigation	**12:00**	**March 16**
Science Instruments turned on for Mercury encounter	**08:00 - 11:00**	**March 17**
Near simultaneous ranging for navigation	**12:00**	**March 17**
Load Encounter Sequence	**07:45**	**March 18**

Mariner 10 continues its deep penetration into the inner solar system. Mariner is now over 65 million miles from Earth and less than 8.5 million miles from Mercury, and is travelling at a speed of 23,310 mph relative to the planet. The round trip signal time to Mariner is now over 13.5 minutes.

On 14 March, Mariner's instruments which measure magnetic fields and charged particles from the Sun received their regular calibrations.

On 13 March, the final project conference was held to finalize the Sun-line course change maneuver to be held early Saturday morning, 16 March. This maneuver will enable Mariner to fly past the shadow side of Mercury within 540 miles of the surface at closest approach on 29 March.

On 12 March, Mariner 10 remained in a normal cruise condition with its roll attitude stabilized by the action of solar wind pressure on its tilted solar panels.

This mode of operation will be possible for some time as Mariner cruises toward Mercury and beyond.

On 11 March the spacecraft was not oriented in roll on the star Canopus as it went out of the star sensor's view early in the morning due to the distraction of stray bright particles.

However, the spacecraft was stable in its roll attitude because the tilt of Mariner's solar panels is such that solar pressure on the panels created a torque counter to the natural drift in roll of the spacecraft.

This stable condition was the result of skilled testing over the weekend to develop various combinations of panel tilt angles. One panel is at 66 deg and the other at 66-1/2 degrees. The Mariner 10 roll attitude can be controlled by judicious tilting of the spacecraft solar panels.

On 8 March a command was sent to Mariner to prevent the gyros from turning on automatically. Now, when the Canopus star sensor is distracted by bright particles and starts a spacecraft roll, Mission Control can control gyro turn-on and the amount of attitude control gas to be used during stabilization of the spacecraft.

On 6 March a group of bright particles disturbed Mariner's Canopus star tracker, again causing the spacecraft to roll and the gyros to turn on. They stayed on for about 40 minutes and for a short time during reacquisition of Canopus, the roll gyro oscillated causing some excess use of attitude control gas, but most engineering and science data were recovered during recording playback on 7 March. The DSS 14 personnel at Goldstone were commended for their quick reaction to the emergency.

On 4 March the Mariner 10 high-gain directional radio antenna, through which high-speed TV and science data about Mercury will be transmitted starting 23 March at far encounter started operating properly.

On 1 March the solar power panels were tilted 10 degrees more away from an increasingly hot sun. On this date Mariner 10 was well inside a region of the solar system never before charted scientifically by a spacecraft.

On 28 February, Mariner's solar power panels were tilted another 10 degrees away from the increasingly warm sun, which will make the total panel tilt angle 68 deg to their original positions at launch.

On 27 February the Mariner star tracker received another of its frequent disturbances from a group of several bright particles which distracted the tracker momentarily from its guiding star Canopus. However, the tracker reacquired Canopus before Mariner's gyros turned on automatically.

The occurrence of these particle disturbances has increased from 1 or 2 a week after launch on 3 November to about 10 a week now. This is probably related to the increasing brightness of the Sun on small dust particles traveling along with Mariner.