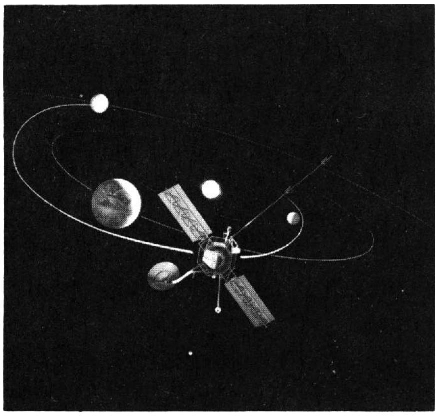


MARINER VENUS / MERCURY 1973
STATUS BULLETIN

Mariner 10 Status - Navigation Team Functions

The Mariner 10 mission status as of 16:00 PST, 6 December 1973 is normal with the exception of the previously noted problems. There has been no definitive resolution to the power problem that occurred following gyro turn-on in preparalion for the RCM-2.

1. SIGNIFICANT MISSION EVENTS/TIMES

CPT Calibration	15:20 PST 29 November 1973
U4.14 CC&S Update (Enable RCM-3 and Eoad PRM-2	11:00 PST 6 December 1973
CPT Calibration	15:38 PST 6 December 1973

2. NAVIGATION

Tracking data continues to be of good quality. Recent determinations of the orbit based on tracking data to TCM + 17 days confirm that TCM 1 overshot the desired aim point by approximately 1500 km. This conclusion is also confirmed by fits of all data from launch, through TCM 1 and up to TCM 1 + 17 days. Solutions of this latter type provide additional confidence in the orbit estimate since a much longer data arc is contained in the solution

Members of the Reconnaissance Group continue in their efforts to design effective science sequences for Earth-Venus cruise, Venus encounter, and Mercury encounter. Typical of these activities is the design of a near-Mercury encounter sequence which will easily adapt to the use of either the 22.05 or 117.6 Kilo-bit per second (Kbs) data rates for real time playback of TV pictures. This adaptability is achieved by imposing on the sequence design the requirement that changing from one rate to the other will necessitate only minimal changes to the program in the on-board computer. This adaptability is desirable since final determination of the error rate for the two data rates may be delayed to a day or two before the encounter and not require large changes to the computer program. The reliability of the sequence and quality of the pictures is thus enhanced.

3. SPACECRAFT

The spacecraft subsystems as of 6 December 1973 (D340) continue to be normal with the exception of the inoperative TV optics heaters and the principal detector facing sunward (a pair of scanning electrostatic analyzers SEA) of the Plasma Science Experiment. The TV activities will not be impaired, but no positive ion data will be available from the PSE. Probably little or no information can be obtained concerning the flow direction or flow velocity of the plasma.

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

6 December 1973
BULLETIN NO. 9

The SES and magnetometer continue to function well. The TV cathode beams were turned off on 29 November 1973 and will remain off for approximately seven days. This procedure was initiated to extend the lifetime of the TV cameras beyond the first Mercury flyby. The UVS and IRR have not been turned on.

On 29 November, a Charged Particle Telescope (CPT) calibration was performed and excellent data was obtained.

All spacecraft temperatures remain normal, as solar temperature has risen to 1.08 sun.

The spacecraft power is back to 454 W due to a downward toggle of one solar panel current (an expected temperature effect). The spacecraft has been stable on celestial references. Attitude control gas weight has not changed from the last report (based on tank telemetry which changes less frequently than the reporting period). The gas weight remains at 6.767 Ibm. Actual gas usage is approximately 0.010 Ibm per day during cruise.

Two High-Gain Antenna boom slews and one High-Gain Antenna dish slew were performed on November and the responses were as expected. The final analysis of HGA Calibration No. 1 has been completed and indicates the initial profile was off 1.1 deg in boom and 1.5 deg in dish. A corrected profile was loaded 6 December 1973 as part of U4.14 to adjust slightly the parameters of the high-gain antenna. The coldest HGA (T2 and T3) temperatures are expected to increase dramatically in the next two weeks as the backside of the dish is unshadowed per the automatic HGA profile.

Real-time analysis resulted in an acquisition frequency prediction which resulted in uplink lock being accomplished within two seconds.

An apparent particle was seen (flyback and sweep observed) by the star tracker on 4 December 73. The tracker functioned as designed and swept back to Canopus.

The P deck of the Fllght Data Subsystem has been reprogrammed so that power subsystem parameters may be observed more closely. Spacecraft responses may then reveal a cause for the FDS POR problem.

Spacecraft outboard commands	=	866
Ground commands	=	2,466
Spacecraft time (42 sec frames)	=	64,256*

*Total for the mission. Includes re-adjustment for the FDS frame counter reset at the power-on-reset (POR).

4. SCIENCE

Period: Wednesday, 28 November through Wednesday, 5 December 1973

CPT calibration 30 November—instrument performance was excellent
No status change on PSE, Magnetometer
No UVSA activities
No TV diagnostics

5. DSN

Normal continuous cruise support was provided during the period 29 November through 5 December 1973. On Day 338, Tuesday, 4 December 1973, DSS 44 provided support during a period when DSS 42 was required to support Pioneer 10 near-encounter activities.

A best-lock frequency measurement was supported by DSS 12 on Day 334 (30 November 1973). Data from this exercise is still being evaluated.

Command support was:

Commands transmitted this period	2453
Commands aborted	0
Commands transmitted to date	2456

6. MCCC

The MCCC status continues to be green. The 360-75 support has been in the critical configuration to support Pioneer encounter operations.

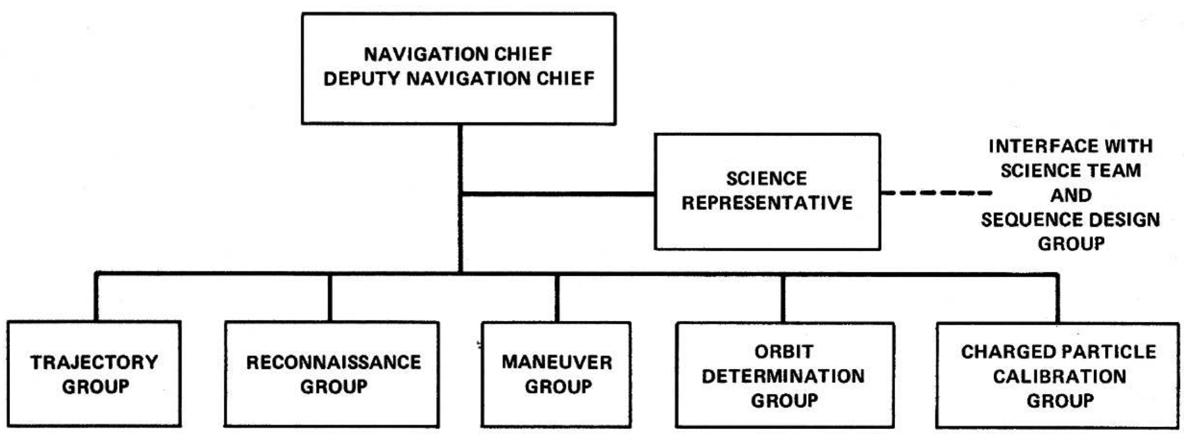
The capability to produce channel plots in DN on the 1108 now exists. The ability to produce these plots on the 1108 will help in reducing the MTC non-real time data products load which has been far more than predicted.

System reliability of the 360-75 (MCCF), 1108 (GPCF) and the 1230 (MTCF) computer facilities continues to be good.

Checkout of updates to all three computing systems' software to add capabilities and to correct discrepancies observed in flight is progressing smoothly. These updates are scheduled to be transferred from Data Systems Integration to Flight Operations on 17 December 1973 for the GPCF and MCCF and during the first week of January for the MTCF.

NAVIGATION TEAM

The Navigation Team is responsible for delivering the fields of view of each of the instruments on the spacecraft to positions suitable for the collection of their respective data types. Several functions evolve rather naturally from this responsibility. Consequently, as shown by the accompanying chart, the Navigation Team has been organized into five functional groups. The remainder of this bulletin will be devoted to brief discussions of each of those groups.

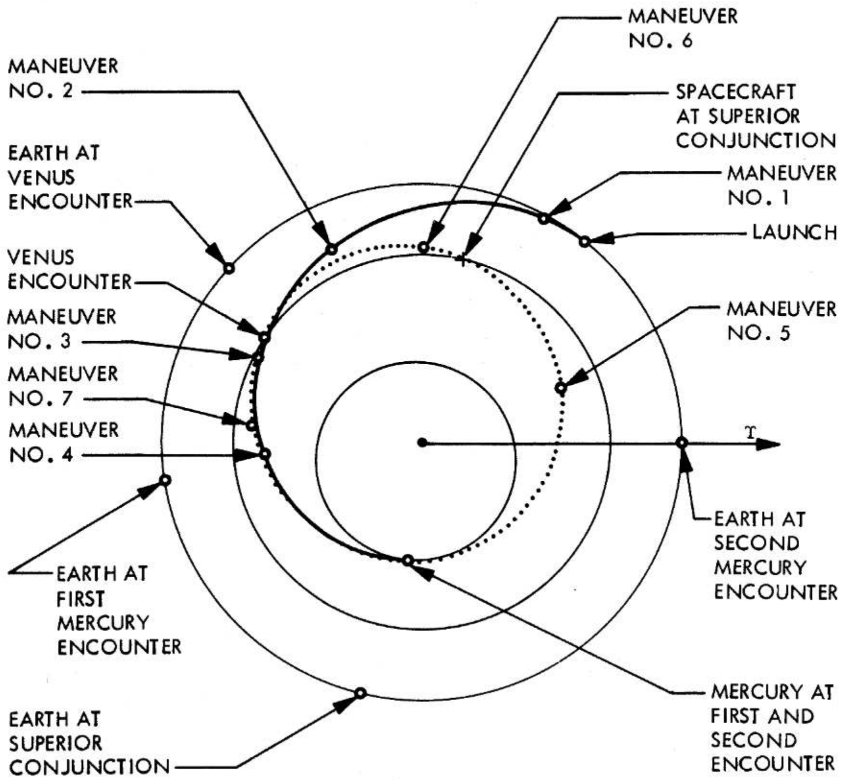


Trajectory Group

Leading up to and during the launch phase the Trajectory Group generates nominal flight path information for use in operations planning. The most urgent task for the members of the Trajectory Group is the timely delivery of information to the DSN for their use in computing station view periods (when the spacecraft will be observable by each station), spacecraft-station geometry (where do I look to see the spacecraft) and expected characteristics of the spacecraft-station radio signal. Similar information is required throughout the mission but the urgency is not as great since the relative geometry between the station and spacecraft is not changing as rapidly. In addition, data are supplied to the Spacecraft Team for use in (1) the analysis of telecommunications performance, (2) determining the celestial attitude of the spacecraft and (3) determining the pointing profile for the articulating High-Gain Antenna.

Finally, data are generated for the SEDR (Supplementary Experimental Data Record) and for the PI0 (Public Information Office). The SEDR information provide all the geometric relationships necessary to interpret the scientific measurements. On the other hand, the geometric relationships of general interest to the public are provided to the PI0 (Public Information Office) for dissemination.

The projection of trajectory into an ecliptic plane is shown in the following diagram.



Reconnaissance Group

The Reconnaissance Group works with the Science Team via the Science Representative to design sequences of events which are to be performed by the spacecraft for purposes of optimizing the quantity and quality of the scientific data. These activities continue throughout the flight to correct for trajectory differences and to implement new requirements imposed by the experimenters. After the sequences have been executed, small variations in the attitude of the spacecraft (obtained from engineering telemetry data processed by the Spacecraft Team) as well as improved estimates of the orbit of the spacecraft (obtained from the Orbit Determination Group) are combined to determine more precisely what orientation the various fields-of-view of the scientific instruments possessed during the sequence.

Orbit Determination Group

The Orbit Determination Group participates in tracking station scheduling to ensure that adequate data, range and range rate, will be accumulated to allow accurate determination of the orbit of the spacecraft. During flight operations approximately 2500 data points per day are collected from stations in the DSN. These data are edited, catalogued, and processed to obtain an estimate of the actual orbit of the spacecraft. Typically, two or three weeks of data are required to determine the orbit. Parameters other than those defining the orbit can be determined. Indeed up to 70 separate parameters can be estimated, e.g., tracking station locations, forces arising from non-gravitational sources such as solar pressure, mass of the Earth, Moon, Venus and/or Mercury.

In addition to performing the activities just listed, several demonstrations of new data types are being attempted. As stated above current orbit determination technique uses range and range-rate data types, obtained from Earth-based tracking, to determine the orbit. For MVM'73, the accuracies to which the orbit can be determined from these two data types is adequate. However, future missions have tighter accuracy requirements which may benefit from additional data types. These data types include optical data (e.g., using pictures taken by the on-board TV cameras of star-moon combinations), Simultaneous Interferometric Tracking Technique, and Very Long Baseline Interferometry (VLBI). These last two types again use Earth-based tracking, but in ways somewhat different than presently used.

Charged Particle Calibration Group

The Earth-based tracking data used by the Orbit Determination Group is degraded by charged particles and the troposphere. The Charged Particle Calibration Group, often referred to as the Tracking System Analytic Calibration (TSAC) Group, has the responsibility for removing the effects of these error sources from the tracking data. Since this activity is similar to part of the activity performed by the Radio Science Team in the execution of their experiments, a close relationship has been developed between that Team and the TSAC Group. In this activity the TSAC Group will aid in the experiments designed to determine properties of the atmospheres of Venus and Mercury.

Maneuver Group

The Maneuver Group determines the corrections to the orbit of the spacecraft which are required to achieve the Mercury encounter conditions appropriate to the experiments scheduled to be performed. Pre-flight analysis showed that, nominally, four Trajectory Correction Maneuvers (TCM's) would be necessary to achieve the desired Mercury f!y-by conditions to the specified tolerances. The first TCM (TGM1) was performed at launch plus 10 days (Nov. 13, 1973), and corrected a launch error of approximately 65,000 km at Venus. TCM2 is scheduled for January 18, 1974 and will correct an error resulting from TCM1 of approximately 1500 km at Venus. TCM3 is scheduled for four days after Venus encounter (February 9, 1974) and TCM4 will be performed 28 days prior to Mercury encounter (March 1, 1974). This rigorous schedule of maneuvers is necessitated by the extreme accuracy to which the Venus encounter must be controlled (an allowable error less than approximately 250 km is required), and by the magnification of errors in the Mercury encounter which result from errors in the Venus encounter (a 1 km error at Venus, when uncorrected, gives a 1000 km error at Mercury).

Of the 10,000 commands sent to the spacecraft for the entire mission through Mercury encounter, 100 of the commands relate specifically to navigation.