

# MARINER VENUS / MERCURY 1973 STATUS BULLETIN

## MARINER 10 SAILS ON TOWARD VENUS ENCOUNTER

*Mariner 10 mission status as of 0900 PST, 28 November 1973 (Day 332)—(L + 26 Days) is normal with the exception of the TV optics heaters which are not functioning, and there is still only partial data coming from the Scanning Electrostatic Analyzer portion of the Solar Wind Experiment.*

*A meeting is being held today to review the results of the analysis of data tapes from station 12 regarding the strange power occurrence aboard Mariner 10 at gyro turn-on last Wednesday. This occurred prior to the beginning of the roll calibration maneuver sequence which was cancelled.*

*The Ultraviolet Spectrometer team continues its analysis of calibration scans of the planet Mars on Monday.*

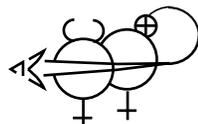
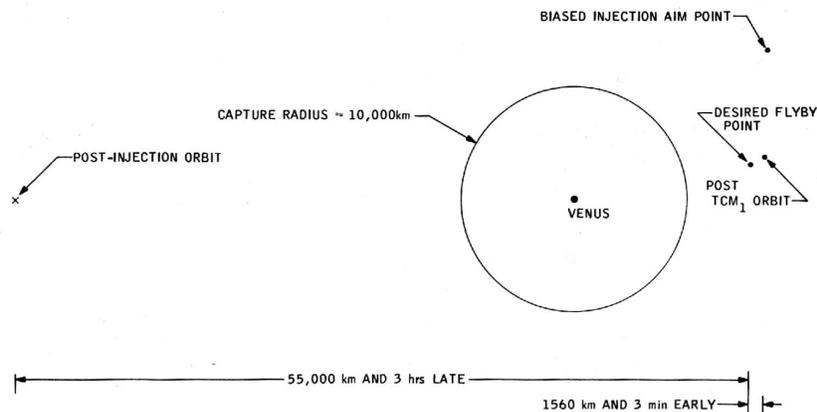
*The navigation team is analyzing its computations of Mariner's orbit about the Sun to determine the size of the next trajectory correction maneuver.*

*Mariner 10 is now 48.1 million miles from Venus traveling at an orbital speed relative to the Sun of 59,820 miles per hour.*

*Its distance from Earth is a little over 5.5 million miles.*

### NAVIGATION

Based on the orbital parameters as of 26 November 1973, TCM 2 will be required to correct for a miss of approximately 1560 km (970 miles) to attain the desired Venus flyby aiming point. The present orbit is 1560 km farther away from Venus than the desired aiming point. The maneuver will also have to correct for a timing error of 3 minutes (Mariner 10 would presently arrive at Venus 3 minutes earlier than desired). Below is a sketch of the desired flyby and post TCM 1 orbit points.



## **SPACECRAFT**

Temperature control reports much thermal activity occurred on Wednesday, 21 November due to scan platform unstowing and gyro turn on. The platform temperature drop was more rapid than expected and is being analyzed. All spacecraft temperatures are now back to cruise conditions.

The TV A camera rear optics is back on scale. The A camera cathode current is showing a downward trend with daily cycles of beam current. A duty cycle (power on/off) analysis is being performed by temperature control related to the TV temperatures to determine if the TV subsystem can be cycled on and off to extend the TV life.

## **SCIENCE**

The Charged Particle Telescope (CPT) calibration occurred on 1315 PST 15 November and 1538 PST on 22 November, 1973. There was no change in the PSE status and no further diagnostic tests are planned at this time. The principal investigator has requested the instrument from the 73-1 spacecraft so he can run special tests to investigate possible failure modes to identify diagnostic tests which may be run on the flight spacecraft.

The Roll Calibration Maneuver No. 2 (RCM) scheduled for 21 November was postponed because a power glitch resulted in a power reset (POR) in the Flight Data Subsystem. The Ultraviolet Spectrometer (UVS), television (TV) and Infrared Radiometer (IRR) were reset to the correct cruise state after the POR via ground commands.

The Ultraviolet Airglow Spectrometer (UVSA) search for Mars as a calibration source was conducted on Wednesday, 26 November. The initial review of the UVSA slews indicate Mars was missed. Calibration scans are now being analyzed. The analysis of the data obtained by the UVSA during the first RCM indicate that significant scientific results were achieved.

The TV investigators have run diagnostic engineering tests following the TCM to verify that the subsystem performance was not degraded by the motor burn. Although the tests were limited, the results look good.

The Magnetometer has been removed from the 73-1 spacecraft and will be tested at Goddard Space Flight Center so it will be possible to establish a better understanding of how it works at lower than prescribed temperatures.

## **MCCC**

The MCCC operations have been routine.

## **DSN**

The DSN operations have been routine.

*In the future, in addition to publication of Mariner 10 status and released science data, a series of bulletins will be issued describing the mission operations functions and data processing activities necessary for a successful mission. The on-board science experiments will also be described in detail. This bulletin will summarize the mission operations organizations.*

# **MISSION OPERATIONS ORGANIZATIONS**

## **Mission Control and Computing Center (MCCC)**

The Mariner Venus/Mercury 1973 mission operations require the interaction of three major organizations: the Mission Operations System (MOS), consisting of the analyst teams operated by the MVM project; the Deep Space Network (DSN), which provides the Earth-based antennas and ground communications with the spacecraft; and the Mission Control Computing Center (MCCC), which provides the computer operating systems necessary for spacecraft control and data analysis. This first bulletin of a series, describing these three key elements of the Mariner Venus/Mercury mission operations will present the MCCC description and interaction functions for the Mariner Venus/Mercury.

The Mission Control and Computing Center (or MC cubed) assignment is to accept data from the Deep Space Network and process it to produce the data products required by each project to meet its mission objectives. The Mariner Venus/Mercury 1973 Project has requested displays of incoming telemetry, command, and tracking data as soon as possible after those data has been received. Usually, this is within one or two minutes. Displays of this sort are called 'real time' (RT) displays. Some operations, usually of an analytical nature, require hours of computer time to execute and these are labeled 'non-real time' (NRT).

To produce the various real time and non-real time products requested by the Mariner Venus/Mercury Project, the capabilities of all three major facilities within the MCCC are required. These facilities are the Mission Control and Computing Facility (MCCF), General Purpose Computing Facility (GPCF), and the Mission Test Computing Facility (MTCF).

### **MISSION CONTROL AND COMPUTING FACILITY**

The Mission Control and Computing Facility (MCCF) consists of three IBM 360/75 computers for real time support and an EMR 6050 computer for production of simulated data for ground data system validation, test, and training. The IBM computers are equipped with a large amount of memory, disk storage, magnetic tape drives, and other equipment vital to communication between operators, Project personnel, Deep Space Stations, and the computer.

The project makes use of the 360/75 computers to run computer programs that translate the desires of the project for spacecraft actions into the specific commands for the spacecraft to execute. Some of these programs are: COMGEN (Command Generator), SPOP (Scan Platform Operations Program), and SEG (Sequence of Events Generator). Another major function of the 360/75 computers is the processing of tracking data received from the DSN into a form useful for the complex analysis programs in the General Purpose Computing Facility (GPCF). A first in this area is a new function programmed for the scientists using the spacecraft radio system to conduct a number of studies of Venus, Mercury, and the space between. This software, called the Celestial Mechanics/Radio Science (CMRS) program, does a preliminary reduction of the data in real time, allowing rapid determination of first order results and more dynamic use of the Deep Space Station (DSS) equipment for optimization of the experiments.

The 360/75 computer is also the tool used by projects to transmit commands to the Deep Space Station for eventual transmission to the spacecraft. This function requires careful double checking of the commands both as sent to the DSS and as sent to the spacecraft.

There are three 360/75 computers, two are identical and are used to provide the real time support for projects as a prime and backup pair of computers. The third is presently not equipped with enough hardware to be a flight support computer and is therefore primarily for program development. It will be upgraded to flight computer configuration after the MVM'73 primary mission.

A second part of the MCCF is the 6050 simulation computer. This system, in conjunction with a mathematical model of the spacecraft operating in the GPCF, provides realistic data to the MVM personnel and ground data system for training and test purposes. The 6050 computer 'handshakes' with on-site computers at the DSS sites to provide realistic data from the stations as well as providing data directly to the users.

## **GENERAL PURPOSE COMPUTING FACILITY**

The General Purpose Computing Facility, otherwise known as the UNIVAC 1108, consists of two UNIVAC 1108 computers and the remote input and output devices scattered throughout JPL and the JPL Crest building annex. Using terminals located in the Mission Support area in Building 230, members of the MVM'73 navigation team process tracking data to determine the flight path of the spacecraft. Once that information is available it is put to a variety of uses such as determining the strategy of the spacecraft rocket burns to change the spacecraft flight path, computing predicted and actual locations of TV pictures and other instrument measurements, determining how the scan platform should be moved to point the television cameras, and so on. In addition to these jobs, the 1108 is used by members of the spacecraft team to analyze the performance of their subsystems and predict future performance during various maneuvers and mission phases.

The 1108 computers were installed at the Jet Propulsion Laboratory (JPL) in 1969 and after several years of system software development have become a very stable, reliable, and flexible system. Although one computer is used as a backup to the other, there is sufficient redundancy within one machine to tolerate several discrete failures in memory or peripherals with little visible degradation in performance.

## **MISSION TEST AND COMPUTING FACILITY**

The Mission Test and Computing Facility consisting of the Mission Test Computing System (MTCS), Mission Test Video System, and Mission Test Imaging System was assigned by the MVM'73 Project the task of receiving and displaying telemetry from the Mariner spacecraft during system test and flight operations.

### **Mission Test Computing System**

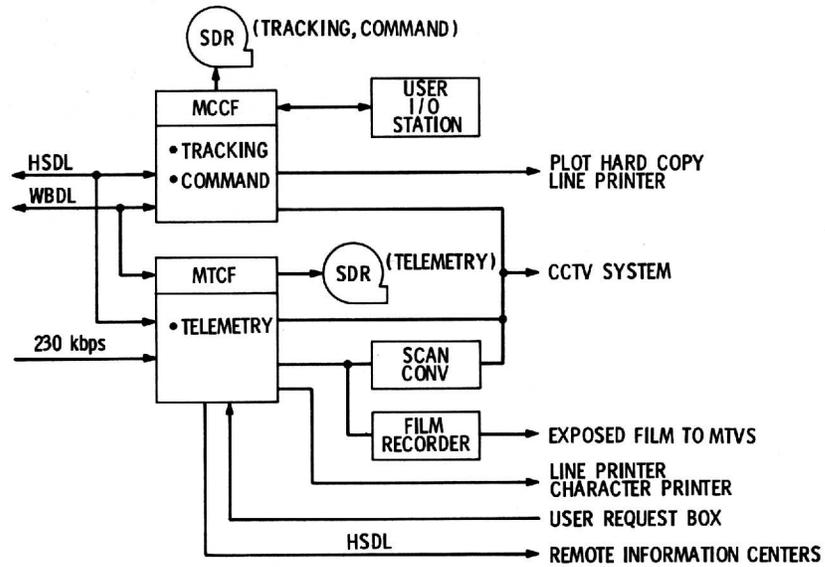
The MTCS was originally conceived to support Surveyor System Test operations. Since one of the prerequisites for supporting system test was portability and reliable hardware, a military line of UNIVAC computers was chosen. The rugged nature of the hardware has been borne out by the history of successful, rapid moves from the Kent, Washington site of the MVM system test activity to JPL's Space Flight Operations Facility (Building 230) for thermal vacuum chamber testing, to the Kennedy Space Center for prelaunch testing, and back to JPL for Flight operations. The present MTCS complement of equipment includes two 1230 dual processors, three 1219 processors, one 1218 processor, and two 9300 processors. The configuration of these computers committed to Mariner Venus/Mercury has the 1219 acting as a display formatter, and the 1230 doing the preliminary processing and all the TV picture formatting and enhancement work.

### **Mission Test Video System**

The Mission Test Video System (MTVS), now operating with new and much faster equipment, is the photo processing center for the film products distributed to the Mariner experimenters and the operations teams. It is expected that each Mariner 10 image will have been reproduced two hundred times on a variety of film and photographic paper mediums before the MVM'73 task is completed. That totals nearly two million images! To process this volume of data, high-speed film and photographic paper exposing and developing machines have been installed on the second floor of Building 230.

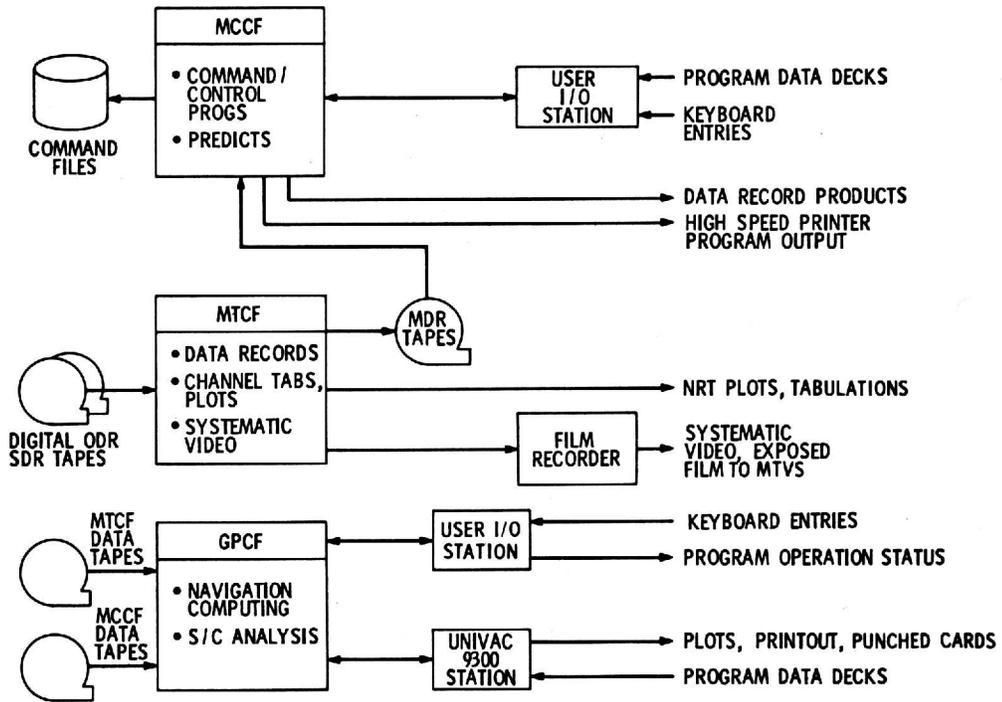
### **Mission Test Imaging System**

The Mission Test Imaging System (MTIS) is the newest system in the MTCF. The MTIS is being developed primarily for Viking using equipment capable of producing high quality TV images of 800 lines (as compared to 480 lines for a home television set) and printers to produce real time high quality photographs. The MTIS is being designed around a new UNIVAC mini-computer to drive these displays. The MTIS will be first used to produce prints for the MVM'73 Earth/Moon mosaic activities. In addition, the 800 line volatile displays are being planned to support Mercury and Venus encounter sequences.



SDR - SYSTEM DATA RECORD  
 HSDL - HIGH SPEED DATA LINE  
 WBDL - WIDE BAND DATA LINE  
 KBPS - KILO BITS PER SECOND  
 SCAN CONV - SCAN CONVERTER  
 I/O - INPUT/OUTPUT

**MVM MCCC Real Time Data Flow**



MDR - MASTER DATA RECORD

**MVM MCCC Non-real Time Data Flow**