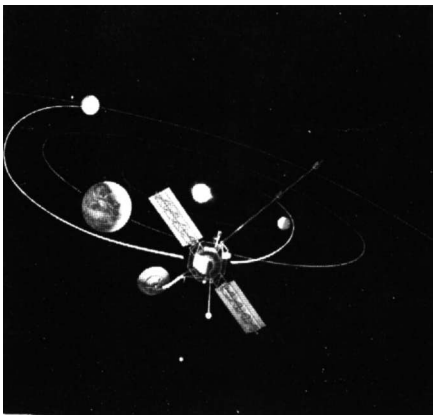

MARINER VENUS / MERCURY 1973
STATUS BULLETIN

VENUS FLYBY SET FOR TUESDAY AT 10:01 A.M. PDT

Mariner 10 is about 1,690,000 miles from Venus and is approaching it at 20,000 mph, constantly picking up speed. It is over 25.5 million miles from Earth. On 28 January, the spacecraft's gyros were turned off after it was discovered that 20% of the nitrogen gas supply had been lost near the end of a roll calibration maneuver under gyro control. A short in the roll gyro is suspected. To provide maximum protection against loss of roll reference during Venus encounter due to stray light from Venus-shine, it was planned to fly by the planet on inertial (gyro) control. This plan is being reassessed; celestial control, using Sun and Canopus as references, may be used instead. Current estimates of the remaining nitrogen gas versus requirements to get to Mercury and to execute all planned experiments indicate a comfortable margin at this time.

SCIENCE ACTIVITIES, 22 - 31 January

On 22 January the ultraviolet spectrometer continued its airglow measurements of the Comet Kohoutek, scanning back and forth across the comet from head to tail. The UVSA detected hydrogen Lyman α intensities out to 17° from the nucleus to map the hydrogen cloud.

On 23 January the movable scan platform upon which the TV cameras are mounted was given its final pointing calibration before Venus flyby at 10:00 PDT, 5 February. The cameras took 3 sequences of test pictures of star clusters and were then turned off for a week.

On 24 January the UVSA again scanned the Comet Kohoutek from head to tail for about 7 hours. Scientists are very pleased with data from the UVSA—the only instrument of its kind to observe the comet from outside Earth's own hydrogen cloud. Following the Kohoutek scans, the UVSA made additional observations of ultraviolet objects.

The Charged Particle Telescope (CPT) which has been collecting data on solar eruptions since launch on 3 November received one of its frequent calibrations.

On 28 January, Mariner 10 conducted its last roll calibration maneuver (RCM-7) before Venus flyby; eight rolls were performed in 79 minutes. At the end of each roll, the scan platform was moved in cone to obtain UVSA data on the diffuse extreme ultraviolet emissions observed over wide regions of the sky. When oscillations in the roll gyro rate telemetry channel were noted, it was found that the nitrogen gas supply had dropped from 6.0 to 4.7 pounds. The loss stopped when the gyros were turned off.

The Venus Encounter sequence on 5 February will be performed with the spacecraft oriented on the star Canopus and the Sun. The commands for this flyby sequence are now stored in the Mariner 10 CC&S.

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

1 February 1974
BULLETIN NO. 15

PAST SIGNIFICANT MISSION EVENTS/TIMES

TCM-2	09:45 - 19:00 PDT	21 January
Sequencer Safeload	18:38 PDT	21 January
Scan CAL 2	04:00 PDT	23 January
	22:00 PDT	24 January
UVSAG Scans Kohoutek	10:00 - 14:30PDT	24 January
DSS-63 ORT	07:30 - 08:30 PDT	25 January
Venus Encounter ORT	07:30 - 09:30 PDT	26 January
CC&S Update U-6.8	13:45 PDT	27 January
Enable RCM-7		
RCM-7	08:00 - 16:00 PDT	28 January
Roll Gyro Anomaly (RCM-7 Reacquire)	13:18 PDT	29 January
Science Turn-On and Initialization	About 16:00 - 18:00 PDT	28 January
CC&S Update U 8.0		
Load Venus Encounter Seq.	07:30 - 18:00 PDT	29 January
Venus Encounter ORT	07:30 - 09:30 PDT	30 January

PLANNED FUTURE SIGNIFICANT MISSION EVENTS/TIMES

Venus Encounter	10:00 PDT	5 February
CC&S Update U-10.0	07:40 - 23:00 PDT	6 February
Load and Enable Venus Far Encounter Intermittent Ground Command TV		
Start TV Cyclic 2	23:30 PDT	6 February
UVSAG Scans	07:40 and 11:40 PDT	8 February
CC&S Update U-10.2	09:20 PDT	8 February
Load and/or Tweak TCM-3		
Solar Panel Tilt	04:40 and 05:40 PDT	9 February
CC&S Update U-10.4	09:40 PDT	9 February
Enable TCM-3		

THE PLASMA SCIENCE EXPERIMENT

A relatively high priority has been assigned to research on the seething 300-600 km/sec (1-2 million mph) Solar Wind and its interaction with Venus and Mercury. Its importance is evidenced by the rather large team of 13 investigators selected from 7 research organizations to monitor and analyze the data expected from the Plasma Science Experiment onboard Mariner 10. Another 7-member team was chosen for the related Magnetometer Experiment, and 2 more for the Charged Particle Telescope.

Since the non-imaging Science teams, including the Ultraviolet Investigators, wanted to obtain precise information on solar wind interactions with planet Mercury, the Mariner 10 flight path was targeted originally to fly past Mercury's dark side rather than over one of its poles or across the sunlit side. During Venus Encounter (Fig. 1), it was hoped to get a confirmation for the existence of a bow-shock front or a Mach compression cone toward the sunward side far above the visible cloud blanket where the solar plasma first interacts with the Venus outer atmosphere.

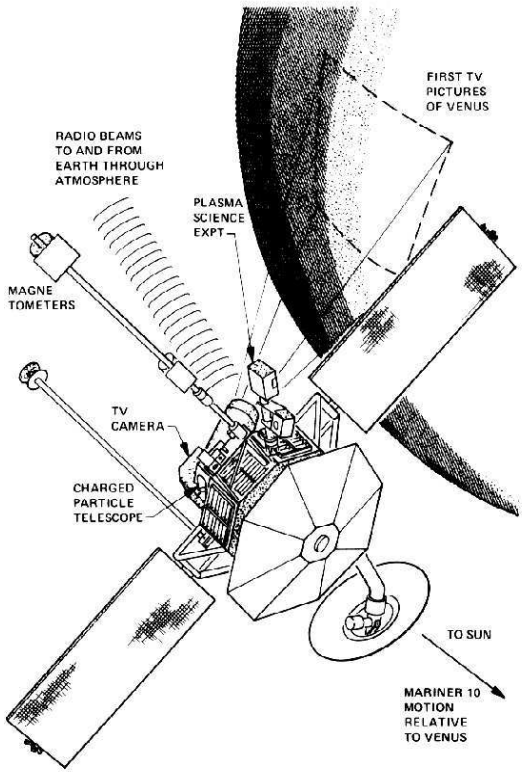

Fig. 1. Mariner 10 Science Instrument Orientations During Venus Flyby

The Principal Investigator for the Plasma Science Experiment (PSE, shown in Fig. 2), is Herbert S. Bridge of the Massachusetts Institute of Technology. Two major Co-investigators are: Dr. Samuel J. Bame of the Los Alamos Scientific Laboratory, who provided the Scanning Electrostatic Analyzer (Fig. 3), one part of the PSE, which was to have measured the arrival angles and energies of positively charged particles (ions) and negative electrons entering from the sunward-facing direction; and Keith W. Ogilvie of the Goddard Space Flight Center, who furnished the functioning Scanning Electron Spectrometer part of PSE which is busily counting the electrons entering at various speeds from the anti-solar direction. These combined PSE instruments are mounted on a short boom (see Fig. 1) deployed vertically relative to the Ecliptic Plane, along or near which both Mariner 10 and Venus are moving. There the PSE can be scanned right and left $\pm$ 60 degrees.

Also attached to the PSE boom is the Infrared Radiometer which senses planet temperatures through two portholes, facing 60 degrees to the right and left of the Sun line. The Magnetometers are carried on a 6-meter boom deployed alongside the PSE boom to measure the rapid fluctuations encountered in magnetic fields (25 samples/sec) along three orthogonal axes. The Charged Particle Telescope is mounted on the bus so as to point obliquely relative to the Sun line.

As mentioned earlier, the solar plasma consists of positively charged particles or ions (mostly hydrogen nuclei or protons) darting among about an equal number of swarming negative electrons that were previously stripped from the neutral atoms either by high temperatures, collisions, or energetic electromagnetic radiations such as ultraviolet and x-rays. These hot ionized gases are erupting continually from the Sun's surface and corona at speeds greater than 450 km/sec. The protons and heavier positive ions spiral outward along more or less elliptical and hyperbolic paths except when they interact with or are deflected by planetary magnetic fields and atmospheres. But the electrons which are 1836 times lighter than protons erratically switch and reverse directions because of rapidly fluctuating magnetic forces that originate from the Sun's turbulent storms and flares as well as plasma jet streams resembling 4th of July pinwheels. Therefore the electrons appear to arrive at detecting instruments in nearly equal numbers and speeds from every direction except when they interact with planet magnetic fields or are partly blocked in the wake of a planet body.

Even though precise measurements of arrival directions for positively charged ions are not available, Mariner 10's redundant instruments should permit the inferrence of perhaps half of the desired information. It might still be possible to determine whether Mercury has a tenuous atmosphere or ionosphere and also whether a bow-shock wave exists above the sunward side of Venus.

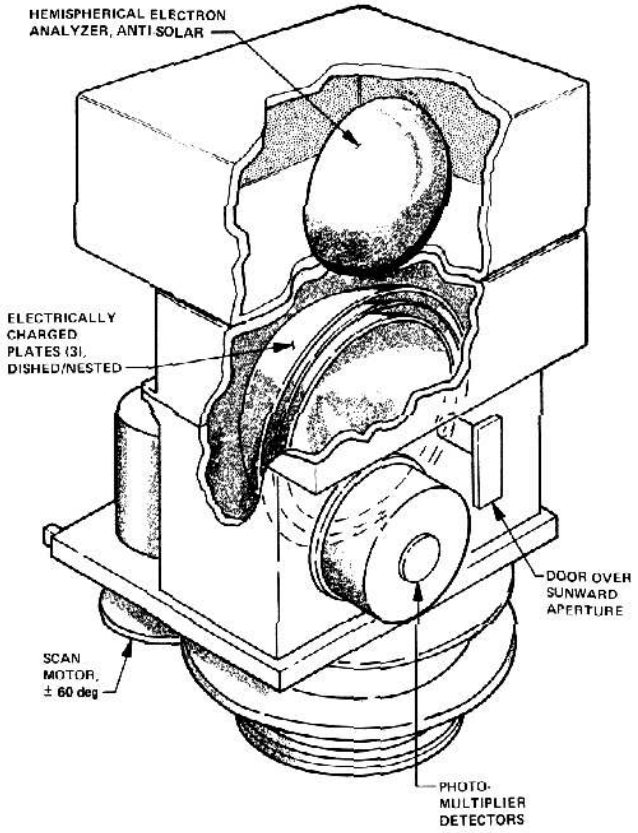

Fig. 2. Cutaway views of PSE Scanning Electron Spectrometer (upper part) and Scanning Electrostatic Analyzer (lower part)

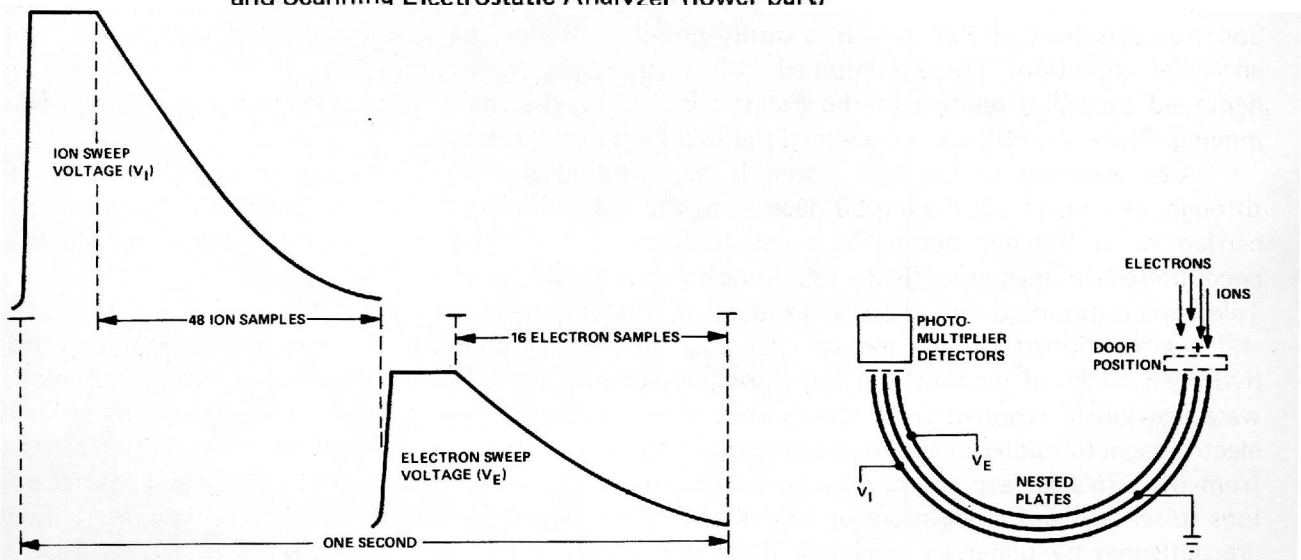

Fig. 3. Operation Scheme for PSE Scanning Electrostatic Analyzer