

Mariner Holds Secret of Mystery Planet

By HENRY KEYS

United Press International
Washington — (UPI) — When the tiny, spidery spacecraft Mariner 2 flashed across the face of the planet Venus on Dec. 14 it had accomplished one of the most exciting voyages of exploration in the history of mankind.

For the first time, man had reached out into distant space to unlock some of the secrets of another planet.

For Dr. William Pickering, Director of the Jet Propulsion Laboratory at Pasadena, Calif., and hundreds of fellow scientists and technicians it was as if they had been partners in a miracle.

For three long months, ever since Mariner 2 was flung into space in late August, they had been living in a state of high tension, filled with real fears and anxieties that Mariner might not make it. From time to time, things did go wrong, some strange and inexplicable.

An American Epic

The story of Mariner's 182-million-mile flight to its rendezvous with the evening star as told by Pickering and colleagues is an American epic. Pickering is a slight, small-boned man with lively, laughing eyes who reveals in the intellectual excitement of his trade and talks of Mariner in terms that any layman can understand.

A New Zealander by birth, Pickering came to the United States at age 16 to continue his education at the Technical Institute of California (Cal Tech). He has remained here ever since and become an American in the process.

As Director of Cal Tech's JPL laboratories he is the man primarily responsible for Mariner's flight. He talks of it as if it is indeed part of him. All spacemen chained to the laboratories do that, of course. But when Pickering says "we're 37 million miles out today" you feel that he is in heart and spirit out there with Mariner racing toward the searing embrace of the sun.

The day before Mariner's successful probe of Venus, men walked around the laboratory not because they were going anywhere but just to be doing something. Others sat quietly doing nothing — just "sweating it out." The stress showed on everyone.

Call Fears

Every time a telephone rang heads would jerk around. The man answering it would seem to freeze before he picked it up, fearing it might be a call from the Goldstone Tracking Station, or someone in the lab reporting something wrong with Mariner.

"The telephone became such a 'thing' in people's mind that when the project manager, Jack James, called me up one day his first words were, 'don't worry...'" Pickering said with a laugh.

One of the tense moments of Mariner's three-month space voyage came with the turning on of the Earth Lock. As Pickering described it, Mariner was slowly rolling round in space. To stop it, a pre-arranged signal had to go to Mariner's tiny, Earth-seeking telescope instructing it to stop rolling, find the Earth and lock on to it. Mariner's Sun Sensor, of course, was pointed at the Sun virtually from the beginning as this was essential for Mariner's Solar plates to gather and store electrical energy from the Sun. But the spacecraft had to line up on Earth, too. Otherwise it would not beam its space reports back, or, for that matter, carry out its program.

It was a fairly complex operation," Pickering said. "We were eight days out and a million miles off in space. We knew when it should happen, but we could not help worrying whether it would. Everybody seemed to be standing around, waiting. Sure enough, right on time, it did."

From the time Mariner's built-in electronic brain and

masterlock, the central computer and sequencer (CCS) initiated the signal it took half an hour for Mariner to settle down, locked on Sun and Earth.

"But the really big event was the mid-course maneuver," Pickering said.

The mid-course maneuver was necessary to correct the path of Mariner's flight. If it continued on the course it was on at launch it would have missed Venus by a quarter of a million miles. The mid-course correction was aimed at bringing Mariner to within 21,000 miles of Venus.

In essence, Mariner, on instruction from Earth, had to turn itself around, turn on a tiny rocket engine, run it for 27 seconds and turn it off again. It then had to find the Sun and the Earth again.

To enable the rocket engine to fire, Pickering explained, the high gain antenna (used to beam Mariner's messages back to Earth) had to move out of the way, out of the line of fire of the rocket engine, and then, when the maneuver was over, move back into position.

Tense, Exciting

"It was tense and exciting. The data line was pitching and rolling," Pickering said, describing how the signals from Mariner appeared in the laboratory. "The whole operation took four hours to do. We were then out about 1-1/2 million miles. We had to tell it what engines to turn on, otherwise we would miss Venus by that quarter of a million miles. We had to wait 18

Science Finds 32 Particles of Use In Orderly World

Washington — (UPI) — New laboratory devices, new techniques and new avenues of research are expected to produce exciting advances in several scientific fields during 1963.

Among the possibilities: Physics — Already scientists have found 32 "basic" particles of the matter which makes up the universe. They have found additional particles which may turn out to be old ones interacting together in what is called "resonance." This year may see order beginning to develop out of this chaos.

Atomic Energy — Both Russia and the United States are trying to perfect man-made plutonium as a fuel for nuclear power reactors. Success would make it possible to multiply atomic fission resources by "breeding" new fuel out of presently inert materials. A \$34.5 million plutonium "breeder" goes into operation this year at the U.S. reactor test station in Idaho.

May Speed Drugs — Radiation-improved understanding of radiation effects and the operation of living cells may speed progress toward development of anti-radiation drugs.

Water — Several promising methods of converting sea water into fresh are being pushed. They are man's best bet for preventing a catastrophic shortage in the next several decades.

Mantle — This year some 20 nations will embark on a three-year "upper mantle project" to plumb the hidden depths of the earth. They hope to explore the outermost 600 miles of the planet's rocky insides. This project, scientists say, is needed to provide understanding of the earth's origin and history.

Lunar Bases — The space agency contracted for a six-month study in 1963 preliminary to future construction of observatories and depots on the moon.

The Sea — Preliminary design is being done on a nuclear reactor to operate at the bottom of the sea. It would supply power to undersea communities — when and if such submarine cities are built to harvest resources on the ocean floor.

Progress is being made toward control of cancer and cholesterol, and in many another field of medicine and biological research, and toward development of robots with electronic brains which eventually will do most of man's work for him.

The greatest challenge, as some see it, is to develop means for controlling man himself. Prof. Thomas Park of the University of Chicago, believes man is in danger of multiplying himself out of existence.

"One thing is certain," Park said recently. "If man does not manage his biology, it will manage him."

CALL ME BILL
Caerphilly, Wales — (UPI) — The 450-member staff of a clothing factory staged a half-hour walkout Wednesday when management issued an order to call the foreman "minister."

minutes for the midcourse motor to operate."

It was a tense 18 minutes upon which everything hung. "After it, we actually watched Mariner pick up speed," Pickering said. "It was very complicated and it was a very satisfying feeling when it was over."

Pickering and his colleagues regard the whole of Mariner's journey as a series and sequence of miracles, for Mariner had many hazards to survive, not the least of them, collisions with micrometeorites.

But there was no fluke or luck about it. A complex series of "what-if" situations had been built into Mariner.

Loss of Signal

The next point of crisis was an unexpected loss of signal. Mariner was about a month out when the photocell-telescope signal faded and JPL scientists were mystified. "The signal got so low it just disappeared. When you lose this signal it means Mariner has lost Earth," Pickering explained.

Pickering said that he was due to leave for Europe at this time and was very worried about this situation. "I was in Munich when one of the boys phoned me. His first words were, 'you won't believe this, but...'" Pickering said.

The telephone call was to tell him that the trouble had righted itself. The signal from Mariner to Earth came back to exactly what it should have been.

"The only explanation," Pickering said, "is that somewhere in the telescopic arrangement we got a ghost image of the Earth and Mariner was looking at that instead of at Earth itself. The signal from a ghost image would of course be very weak."

On Oct. 31, there was a sudden failure in the power supply. "The spacecraft was operating beautifully, but the measurements from one of the solar panels had gone bad. We were very concerned about this and turned off one of the experiments to conserve power. We were about to take a course of action from the ground when again the trouble righted itself," Pickering continued.

"The same kind of thing happened a week later. We worked it out on the ground that there was a short circuit in one part of the solar panel (which traps light from the Sun and converts it into electric energy to operate Mariner's equipment).

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"This trouble has existed today. It is not serious and has not hurt the operation of the spacecraft. We started all experiments up again and we have not turned any off since."

The Mariner raced closer to its encounter with Venus, the temperatures it was encountering became higher than had been planned for. Tension at JPL soared, too.

"It looked like there might be a catastrophe," Pickering said.

Battery Problem

Causing the anxiety was a sealed, liquid-filled battery which had been designed to withstand temperatures up to 120 degrees Fahrenheit. The high temperatures threatened expansion of the liquid so that there was danger that it could have blown itself up. Not even the designer, a

Japanese, could hazard a guess what upper limits of temperature the battery would withstand.

"The closer Mariner got to Venus, the more worried I got that I would get up one morning and it would quit," said Pickering.

But it didn't. Indeed, Mariner raced still nearer the Sun, in steadily increasing temperatures, until Dec. 28 when Mariner came within 65.5 million miles of the Sun and then started to head away from it.

Mariner is expected to continue transmitting information about distant space for the best part of another three months.

New anxieties developed on Wednesday, Dec. 12, two days before the expected encounter with Venus.

"We detected trouble in the encounter mode," Pickering said.

At NASA, JPL press officer Chris Clausen was on an open line to the laboratories in Pasadena, listening to the

signals from the spacecraft showed that Mariner would not work in response to signals from the CCS.

The job of the CCS on approach to Venus was to give signals that would automatically set into operation Mariner's two radio-meters — a microwave and an infrared radiometer — which were to scan Venus during the fly-by and send back to Earth all the information which was expected of this probe.

The discovery on that Wednesday that the CCS was not going to work the radio-meters therefore caused the gravest anxiety.

It had two opportunities to function — once at 2:21 a.m. E.S.T. on Friday, Dec. 14, and again 3 hours and 20 minutes later. It failed.

By this time Pickering was in Washington — in bed at the club of the nation's intellectuals, the Cosmos Club.

Hear Mariner

At NASA, JPL press officer Chris Clausen was on an open line to the laboratories in Pasadena, listening to the

organ-like chords from Mariner and receiving up to the minute information on its progress.

Periodically, throughout the night, he would call up Pickering and give him the latest news.

"We were 38 million miles out in space," Pickering said. "We had one chance left, to send from Earth a signal that should perform the function that the CCS had failed to carry out. We had to do this."

"The instructions went out to Mariner in a long series of 'ones' and 'O's', or dots and dashes, about 15 of them. It is the order in which these go out that tell Mariner precisely what to do," said Pickering.

The command zipped out to Mariner at the speed of light — 186,300 miles a second — but because Mariner was 36 million miles away took 3-1/4 minutes to reach it. It took another 3-1/4 minutes for Mariner to signal back that it had received and acted upon the signal and that the radio-meters were all set to scan

of the mystery planet, Earth's nearest neighbor in the planetary system, will be secrets no longer.

Pickering Asleep
And what was Pickering doing?

"I was sound asleep in the Cosmos Club. I was pretty sure it (the signal from Earth) would work. Before I left JPL we had 'locked up the loop,'" he said.

In broad terms, this meant a check operation had indicated Mariner would respond. "I rather liked Jack James' comment that when it did happen 'out there' he got 'sort of relaxed,'" Pickering said.

As Mariner sped across Venus the radiometers scanned its atmosphere for 42 minutes, nodding backwards and forwards slowly three times, sending a wealth of information to Earth in electronic code that will take JPL's computers some time yet to work out in detail.

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