MARTIN MARIETTA
news
DENVER DIVISION

NUMBER 10/1976

Man's first view of the horizon of Mars came back to Earth in this 300 degree panorama within minutes of landing July 20 at 5:12.07 am (PDT). The lander is facing slightly southwest, east to the left, and the Sun on the right. The horizon is approximately 1.8 miles away. The time is just before sunset on Mars.

Precision landing leads to Viking mission rewards

JPL, Pasadena, Calif.—Viking 1 landed on Mars July 20 with the precision of the famed Radio City Music Hall Rockettes, but the real rewards of the mission began to surface the day after landing.

As Viking scientists studied data returned from Viking, their report to the world through late-night press briefings and written bulletins showed their excitement, their enthusiasm, sometimes their disappointments, but always their interest and confidence.

Following are excerpts from those briefings during the lander's first ten critical days on Mars.

July 21, 8:30 am (PDT)

Scientists have concluded measurements during landing yesterday showed the Martian atmosphere contained 3 percent nitrogen. Dr. Michael McElray said calculations indicate Mars produces a substantial amount of nitrogen usable to biological forms.

"It's clear . . . the planet has lots of water . . . probably in the form of ice that should go very deep. And, if I were a Martian, I would probably want to grow roots and crawl a little bit under the sand, poke my head up occasionally and get some energy from photosynthesis—but I'm not a Martian."

July 21, 10 am (PDT)

The Viking lander has sent its first color picture of Mars to Earth, and once again scientists and spectators here at JPL were amazed at the likeness to parts of the great American deserts.

Dr. Tim Mutch's first reaction to the photo: "Look at that sky—light blue sky—reddish hue. It's a very exciting thing to see this distinct reddish coloration to the surface. These are subtle hues. It's a geological scene—a natural scene. Even in the deserts here on Earth the reds are not crayon reds as painted by a child. This is a surprisingly terrestrial-like desert scene."

July 22, 5:40 pm (PDT)

At 10:20 am Mars time (1 pm PDT) computer commands were issued to the Viking 1 soil sampler mechanism to prepare it for Martian soil sampling next week. Commands were to initiate 17 events in sequence. Telemetry data . . . indicates only 13 commands properly executed. Since the temperature on Mars was relatively mild, -9°F, project officials do not believe the problem is related to temperature.

John D. Goodlette at console in Viking mission control.

July 22, 6:30 pm (PDT)

Preliminary indications are that perhaps the soil sampler control assembly, receiver for the computer commands, has had some kind of electronic problem.

Project Manager Jim Martin said, ". . . if we have an electronics problem we have a redundant soil sampler control assembly . . . that we can switch to. . . . The concern I have . . . is that unless we can solve or understand this problem and solve it in fairly short order we are likely to run the risk of impacting the soil acquisition sequence on Sol 8 (the Mars day)."

July 23, 9 am (PDT)

In spite of problems with two radios aboard (the lander), mission control reports no problems in sending commands from Earth to the spacecraft or in radioing data from the lander to the orbiter overhead.

Last night, Project Manager Jim Martin reported the problem with the soil sampler may not be as serious as originally thought and samples could be picked up on schedule.

Because of ground computer problems, no Mars weather data was processed last night.

Engineers hope to free the Viking lander's quake sensor, stuck in its caged position, by sending new commands Monday night.

Viking 2, now 2,080,000 miles from Mars, is sending optical navigation photos and temperature measurements of the planet to Earth.

July 23, 3 pm (PDT)

Viking 1 lander engineers have successfully tested a plan to free the craft's soil sampler boom of a retaining pin, which yesterday engineers feared might hamper the operation of the boom during soil collecting sequences on Mars next week.

Next Page, Please

Weather report

Weather report for Chryse Planitia on Sol 1 and 2 of the Viking era:

Light winds from the east in late afternoon, changing to southwesterly winds after midnight. Maximum wind speed was 8.3 meters per second (19 mph).

Chryse Planitia was slightly cooler than on the previous day. Maximum temperature was -86°C (-123°F) and the maximum recorded at 14:17 local Martian time was -31°C (-24°F). Each of these is a degree or two F cooler than on previous Sol.

Pressure fluctuated more than previously. Mean pressure was 7.7 millibars.

Mission rewards

From Preceding Page

...sion Direct Tom Young expressed confidence in the plan.

"We are now in a condition that all the deployments necessary to move into the next phase of Viking exploration on the surface of Mars have been accomplished. The lids on the biology instrument and on the gas chromatograph mass spectrometer instrument have been deployed. They're in a posture to receive samples."

About Viking's radio problem, Dr. Pete Lyman said it is possible there may have been some damage to the radios during landing.

July 24, 8:30 am (PDT)

Lander's second day on Mars was colder that its first. The low was -124°F and the high was -24°F. Winds changed from east to southwesterly at midnight, with a maximum speed of 19 mph. Mean pressure was 7.7. millibars.

Scientists have chosen a rock-free region near the lander to pick up samples Wednesday for analysis by chemistry and ...logy instruments, now in a ready ...dition.

Even if attempts to free a retaining pin on the sampler boom are not successful tonight, engineers are confident samples can be picked up Wednesday.

Special procedures are planned for ground transmitters to make contact with the lander's weak radio receiver no. 1 and to change the lander's relay radio transmitter from low power to high power.

July 24, 12 noon (PDT)

After mysteriously operating for two days in a low power mode, the Viking 1 lander's relay radio transmitted photos of the surface of Mars in a high power mode today. Engineers don't understand the behavior, but hope the radio does not switch itself back to low power again.

Photos showed the lander's inorganic chemistry and biology instruments open and ready to receive samples and that the sampler boom is pointed in the proper direction.

...y 25, 8 am (PDT)

...rst effort to free quake sensor from its caged position was unsuccessful and will be attempted again tomorrow night.

To the relief of engineers and scientists, lander's relay radio transmitter is still operating at high power. However, its receiver no. 1, through which commands are sent to the spacecraft, is still weak.

Photoscientist Dr. Alan Binder says what appear to be letters and numbers on a prominent rock in one of the Mars photos is an illusion caused by shadows.

Air temperatures remain about the same, with a slightly cooler high of -27°F. Winds are about the same, but with gusts up to 32 mph—a mere draft in the thin Martian atmosphere.

July 25, 1 pm (PDT)

Two photos show the faulty retaining pin on the lander's soil sampler boom has fallen free.

One photo showed the boom was in the position it was commanded to be in and the other photo clearly showed the pin itself lying on the Martian soil.

July 25, 5 pm (PDT)

Project Manager Jim Martin said the lander will dig the first soil sample Wednesday.

"It will be exactly the time it was planned and the only difference in the operation now is that we are now going to an alternate sample site. The original site had a rock right where we wanted to dig. . . .we have changed the commands to the soil sampler mechanism. . . ."

July 26, 8 am (PDT)

Viking 2 is now 1,666,000 miles from Mars. A small course change is scheduled tomorrow to accurately position it for its orbit maneuver Aug. 7. Viking 2's landing target will be between 44 and 50 degrees north latitude. However, Viking 1 orbiter cameras have not yet found a safe landing place for Viking 2.

July 27, 1 pm (PDT)

The biology instrument's three separate test cells are scheduled to receive a total of about a rounded teaspoonful. If necessary, three attempts will be made to pick up the soil.

The organic chemistry instrument will receive about a thimbleful with two trys possible, and a heaping teaspoonful of Martian soil is scheduled for the inorganic chemistry instrument in two loads.

The samples will be scooped from the surface about 8½ feet from the lander and about two inches deep.

No word yet on the stuck quake sensor as engineers continue to study data from the latest attempt to uncage it.

July 28, 12 noon (PDT)

One of three tests in lander's biology instrument is on, indicating it has received soil from the surface of Mars.

Photos received clearly show a trench dug by the lander's sampler scoop in the Martian soil.

The soil sampler completed its 4½-hour computer-directed digging at 5 am (PDT). At 6:30 am, first photo was sent showing some piled-up dirt on the Martian surface.

July 28, 2 pm (PDT)

. . .a hitch has developed in the instrument called the gas chromatograph mass

Next Page, Please

Thomas G. Pownall, Martin Marietta Corporation executive vice president, James Martin, Viking Project Manager, and Tom Young, mission director relax after successful landing on Mars.

Mission rewards

From Preceding Page

spectrometer, which performs organic chemical analyses of the soil. Dr. Al Hibbs reports:

. . . there are indications one of the three instruments did not get its sample. At least the special indicator that says its sample holder is full did not turn on. . . . this particular chemical analysis unit cannot continue its cycle. . . . data is being analyzed . . . to figure out why that happened."

July 30, 8:30 am (PDT)

Plans are being made to pick up some more Martian dirt next week for the lander's organic chemistry unit, which indicates it did not receive a full load. Engineers believe this may be the problem or that the level indicator in the instrument has malfunctioned, causing it not to start its soil analysis.

July 30, 2:30 pm (PDT)

Results of the inorganic chemical analysis show sample chamber is at least 80 percent full. Major constituents detected are iron, calcium, silicon, titanium, aluminum. Iron oxides may be present, but sample is not pure elimonite, other iron oxides or iron carbontrioxide.

Silicate material is present.

If iron oxides coat silicate particles, the coatings are either discontinuous or very thin.

The trace elements rubidium, strontium, and zirconium are present only in very low concentrates, if at all.

The calcium/potassium ratio is high.

The biology team plans to incubate samples for up to 20 days in its quest for biological information.

The first ten days on Mars were exciting, sometimes puzzling, but always interesting.

The remainder of lander's exploration on Mars will be just as exciting, just as puzzling, and just as interesting.

MARTIN MARIETTA NEWS
Published by Public Relations
MARTIN MARIETTA AEROSPACE
Call Ext. 5364 with suggestions or information for articles.
Denver Division
P.O. Box 179
Denver, Colorado 80201
August 1976

Lander support office doing what it does best

The lander support office in the division's general purpose laboratory (GPL) is still doing what it does best—support the Viking mission to Mars.

How important that round-the-clock support is became clear when the problem developed with the soil sampler.

Using the proof test capsule (PTC)—a duplicate of the Viking lander—the lander support office team simulated the problem. In doing so, they actually jammed the locking pin—just as indicated from data from the lander sitting on Mars.

Working with the Viking flight team, suggested solutions were verified here and the one tested cleared the jam and the pin was ejected. The commands used here were sent to the Mars-based lander; the jam was cleared and the pin ejected.

This kind of activity has been going on throughout the flight and landing, using the PTC and the Viking controls mockup (VCMU). Commands to the spacecraft were verified here before being sent; both software and hardware problems have been defined; solutions to problems have been tested and proved.

"Everyone in the LSO has been working as many hours as necessary to support the mission," Kenneth H. Farley, who is leading the effort, said.

Francis D. Nold heads the test operations; B. A. Claussen leads the software area; and Farley has responsibility for systems engineering.

"Although hardware seems to take the spotlight in missions like this," Claussen said, "the software is equal in importance. Our software group provides testing of mission scenarios in a real-time simulation facility that verified the descent sequence and will validate the science sequences."

"Besides the physical activity, like finding the soil sampler locking pin solution, we provide data, facility, and personnel resources for the flight team," Farley said.

"Many employees who worked on Viking are now assigned to other division programs, but they still have an interest in this project," Nold said.

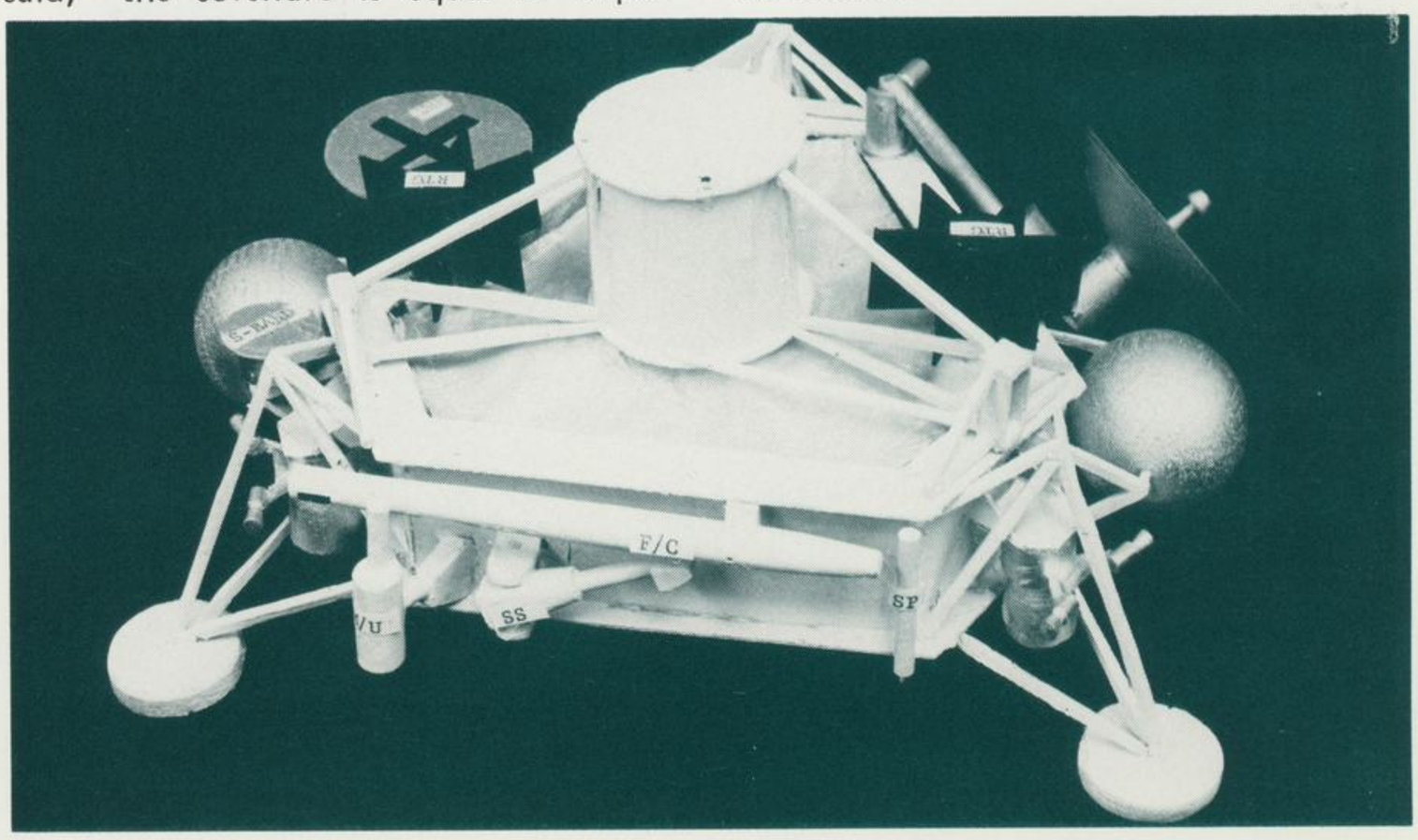
"We have had calls from most of them offering to help," Farley said, "and we have called on some of them to assist in problem solving."

The division established and maintains a Viking data library that contains all the documents on lander 1 and lander 2, including test history, quality control records, and photographs of assembly and test of the vehicle.

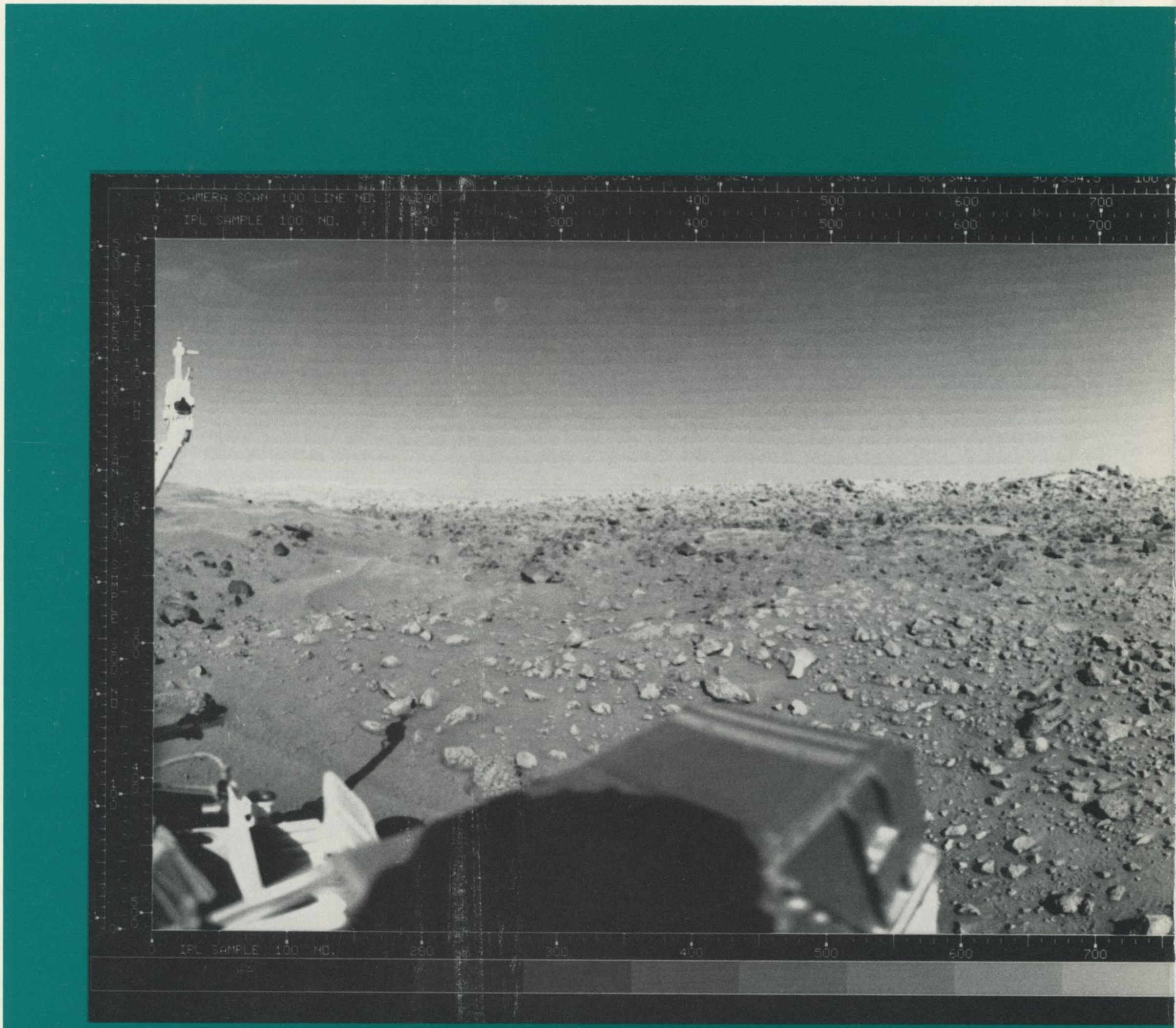
When a problem crops up, the LSO team defines the problem, searches for a probable cause, suggests solutions, serves as a sounding board for the flight team, and verifies solutions.

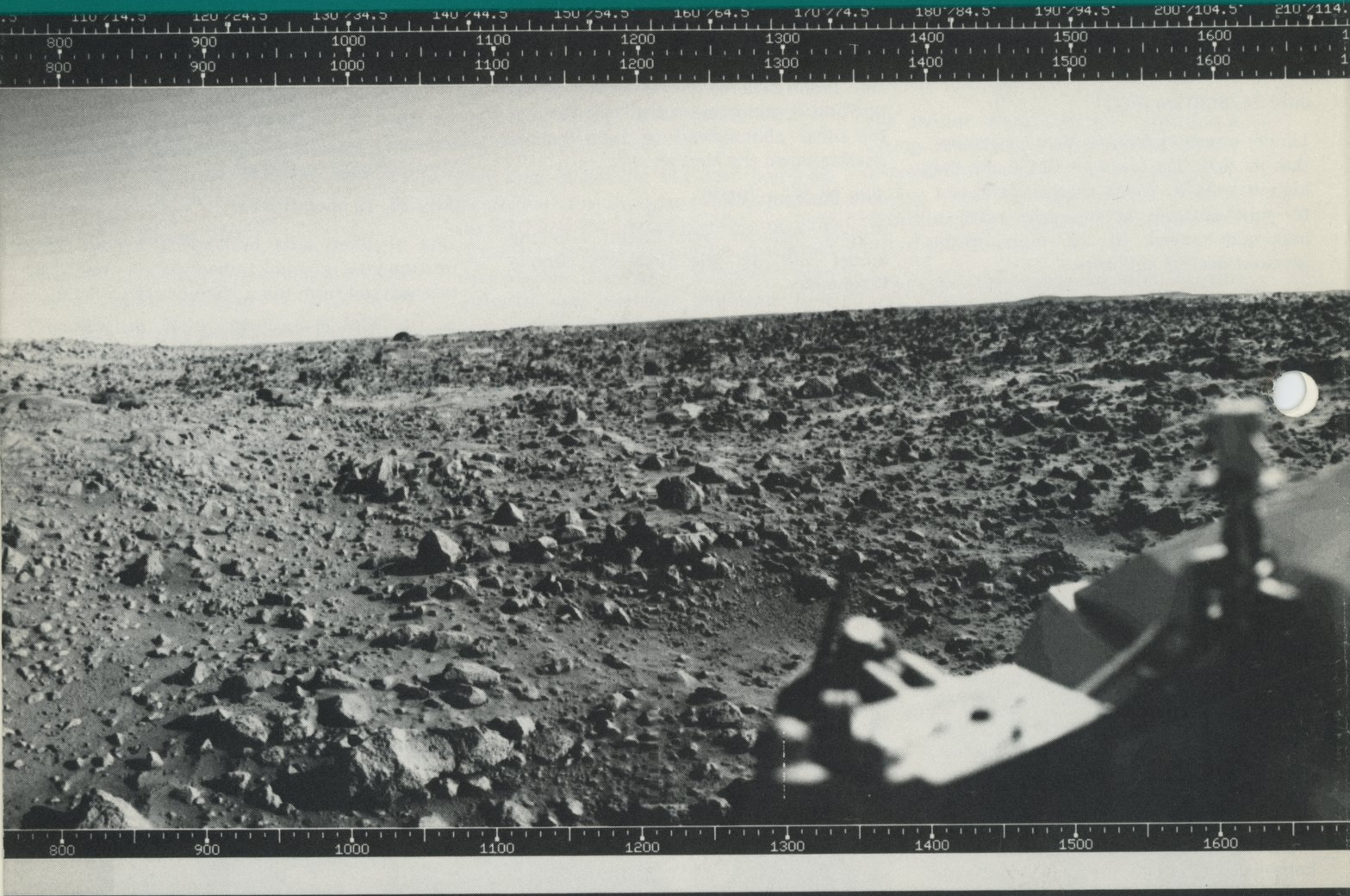
"We are part of the flight team and we are doing everything possible to assure success of the mission," Farley said.

"Don't forget," Nold said with a smile, "Viking 2 goes into orbit around Mars Aug. 7 with landing scheduled for Sept. 4. Our work is far from over. We are just as anxious to support the second landing as we were the first. We want both to be successful."



During the early proposal days of Viking, the exact configuration of the lander was often in question. William King, currently a section chief in structures at Michoud operations, helped answer some of them when, in 1968, he designed and built the first known model of a Viking lander. His 1/16th scale model is shown here.


0 CAMERA SCAN 100 LINE NO. 200 300 400 500 600 700
0 IPL SAMPLE 100 NO. 200 300 400 500 600 700
0 IPL SAMPLE 100 NO. 200 300 400 500 600 700



VIKING LANDER 1 CAMERA 2 CE LABEL 12A002/000