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N72-10927 (NASA-News-Release-71-225) MARS MAPPING:
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MARS MAPPING

Man will learn to know the wrinkled face of Mars this winter almost as well as he knows his own Earth.

In a three-month period beginning Nov. 13, two television cameras on Mariner 9 will take some 5,000 pictures which will be transmitted over distances up to 240 million kilometers (150 million miles) to scientists at the Jet Propulsion Laboratory, Pasadena, Calif.

Other scientific instruments and a radio signal experiment on the orbiting spacecraft will determine, along with other measurements, Martian surface elevations and atmospheric pressures.

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When all pictures and data are received on Earth, the National Aeronautics and Space Administration hopes to assemble a topographic map of over 70 per cent of Mars -- roughly 130 million square kilometers (50 million square miles).

"This is equivalent to mapping all of the dry land areas of Earth," Harold Masursky, leader of the Mariner television science team, points out. "And with our improved camera resolutions, we should obtain by far the best pictures of Mars ever."

The two TV cameras -- wide and narrow-angle -- will take 60 pictures each day. From closest orbital approach of about 1200 kilometers (750 miles), the wide-angle camera can detect objects one kilometer in size (less than two-thirds of a mile). The narrow-angle camera can detect features as small as a football field -- 90 meters (100 yards) or less.

Orbiting Mars twice a day, Mariner's cameras will sweep the surface and lower atmosphere in carefully-plotted swaths to cover the entire circumference of the planet from the south pole up to near 45 degrees north latitude. By comparison, close-up pictures from Mariners 6 and 7 in 1969 covered about ten per cent of Mars -- and from no closer than 3200 kilometers (2000 miles).

Each morning during the 90-day mission scientists will meet to fix subsequent day's experiments for Mariner's cameras and allied instruments. "Features that excite our curiosity on a first pass can be restudied in closeups later," Masursky says.

The TV team leader is chief scientist, Center of Astrogeology, United States Geological Survey at Flagstaff, Ariz. Other Principal Investigators on the 27-man team are Dr. Gerard deVaucouleurs, University of Texas; Dr. Joshua Lederburg, Stanford University; Bradford Smith, New Mexico State University; and Dr. Geoffrey A. Briggs, JPL.

Basically, the 1969 mission showed Mars to be a cold, dry, primitive world of varying terrain. Large craters dominate, but there are some featureless areas, and a chaotic, jumbled area. All will be closely restudied during Mariner's orbiting of Mars starting Nov. 13.

Among questions Mariner investigators hope to answer:

Is Mars several million years behind Earth in its development? What geological and chemical forces are at work on the planet? Is there some hope of a developing life?

And how extensive are mountains and valleys? Recent Earth-based radar studies from radio astronomers at JPL and the Massachusetts Institute of Technology indicate Mars has some interesting high and low terrain that the 1969 mission barely suggested.

Radar measurements this summer indicate Mars' surface elevation ranges about 15 kilometers -- about ten miles, or 50,000 feet -- from lowest crater to highest elevation. Most of these measurements were made in a narrow belt just south of the equator.

High elevations, either mountains or lofty plateaus, were found near the Phoenicis Lacus area at 110 degrees, west longitude, and near Syrtis Major, 300 degrees, west longitude. A high plateau or range exists in the Phoenicis Lacus area and appears to be an extension of a similar feature observed in 1969 measurements in the northern hemisphere, the radar astronomers reported.

A 4.5-kilometer (three-mile) deep valley at Pyrrhae Regio (60 degrees, W. long.) was measured by the MIT team led by Dr. G. E. Pettengill in observations at Haystack Observatory, Westford, Mass.

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Both the MIT observers and a JPL group directed by Dr. Richard M. Goldstein verified a huge crater about 2000 kilometers (1240 miles) across at Iapigia (293 degrees, W. long., and 10 degrees, S. lat.). The JPL team used the 64-meter (210-foot) antenna at Goldstone Station, Calif., for its observations.

Another major crater or trough, some 250 kilometers (150 miles) long and four kilometers (2.5 miles) deep, was located at Zephyria.

The 1969 Mariner photographs partly substantiate these findings. The 1971 cameras should be able to zero in on these provocative areas for more details.

The cameras are mounted on a swiveling scan platform also carrying an infrared radiometer, infrared interferometer spectrometer and ultraviolet spectrometer. These instruments are aligned (boresighted) to observe and measure the exact area being photographed.

Scientists thus hope to plot temperature and atmospheric conditions on Mars for all of the terrain mapped. The two infrared instruments play major roles in making a temperature profile, while the ultraviolet instrument will aid in determining surface elevations from surface pressure measurements.

Another experiment -- using the planet's occultation (cutting off) of Mariner's S-band radio signal -- will also measure the atmosphere and surface of Mars. The fall-off of the radio signal will yield some 70 measurements of the Martian atmospheric and ionospheric density and pressure along with the height of the cut-off point on Mars. Previous Mariner occultation tests first established that Martian atmospheric pressure is only about 1/100th that of Earth.

All these factors will help determine the true size and shape of Mars. And certain sets of pictures -- called geodesy photographs -- will fix the exact position of prominent features -- plateaus, peaks, or craters. These sets will establish precise latitude and longitude locations as well as elevations.

Such determinations can be made by shooting pictures of the same region from different angles to provide a stereo or 3-D effect. The repetitive orbits make this possible.

Moreover, the repeated photo reconnaissance will permit observation of day-to-day surface and atmospheric changes. Much could be learned about Mars' storms, whether the planet has any active volcanoes or gas fissures, and what happens at the edge of the south polar cap during Martian summer.

Detection of any life forms on Mars is beyond the cameras' capabilities. However, photographs plus atmospheric and temperature data may point out areas that conceivably could foster primitive organisms. Such areas would be prime targets for a Viking Mars lander in 1976.

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