



**DESCRIPTION OF SCENE**

Viking Lander 1 faces southeast. This view south of the lander shows a rock-strewn landscape with several small drifts of very fine grained material scattered among the rocks (line 230, sample 2850). The rocks range from a centimeter to several meters in size. Bedrock is exposed in some places through the thin covering of fragmental material (line 300, sample 3200). The blocky ridge forming the horizon southeast of the Lander (line 90, sample 2800) is the rim of 150 meter diameter crater C. The large blocks (line 70, sample 2600) setting on the crest of the rim are about 1 m across and about 80 m from the lander. A shallow depression forms the surface immediately in front of the lander. The surface rises gradually towards the south, until the rim of the depression forms the near horizon about 130 m from the lander. Two large blocks (line 120, sample 3500) each about 3 m across, lie on the rim. In the far distance, a broad flat ridge (line 120, sample 2400) is just barely visible above the near horizon. The near end of the ridge (r-4) is about 3 km from the lander. The object at right center of the scene (line 700, sample 3700) is the surface sampler instrument. The true form of the instrument is not apparent because the image is a mosaic of three pictures taken when the instrument was in different positions so that it would block a minimum of the surface. The boxlike structure at the lower left (line 1300, sample 2900) is the housing in which the meteorology instruments were stowed during launch and transit to Mars.

**THE VIKING MISSION**

Two Viking spacecraft, each consisting of an orbiter and lander, were launched from Kennedy Space Center on August 20 and September 9, 1975. The Viking 1 spacecraft arrived at Mars on June 19, 1976, and was placed in a highly elliptic orbit around the planet at a periastris altitude of nearly 1500 km. The orbiter camera was used in conjunction with other instrumental methods to find a suitable landing site for the lander. After about 30 days in orbit, the lander was separated from the orbiter, and on July 20, 1976, Viking Lander 1 touched down on the surface of Mars at 22.48° N and long 47.768° W. (Morris and Jones, 1980) on the west edge of a large basin called Chryse Planitia. It landed in a stable position at a 3° tilt downward in the direction 248.9° clockwise from north. The side of the lander on which the two cameras are mounted faces southeast. When the cameras are pointed in a direction normal to the front of the lander, the viewing direction is 141.6° clockwise from north along the horizon. The first picture from the surface of Mars, of an area near the lander's footprint, was taken immediately after landing by camera 2. During the ensuing 43 days, the cameras responded to all commands and successfully carried out their assigned mission. On September 2, the activities of Lander 1 were reduced to accommodate the planned receipt of data from Viking Lander 2. On September 3, 1976, Viking Lander 2 successfully landed on Utopia Planitia of Mars (42.966° N, 225.736° W), more than 6500 km northeast of Lander 1 (May and others, 1977; Davies and others, 1978). Lander 2 faces approximately north and tilt 8.2° downward in the direction of 277.4° clockwise from north. The viewing direction of its camera when pointed in a direction normal to the front of the lander is 29.0° clockwise from north along the horizon. The cameras on Viking Lander 2 operated successfully for 61 days until the primary mission of both landers was completed on November 15, 1976, at solar conjunction. During the primary mission, 454 pictures of the martian surface were processed from Viking Lander 1 data and 582 pictures from Viking Lander 2 data. The extended mission of Viking Lander 1 data, the extended mission of Viking Lander 2 data, began December 15, after solar conjunction, and ended in June 1978. During this period, an additional 1646 pictures were obtained from Lander 1 data and 1111 pictures from Lander 2 data. A comprehensive description of the Viking primary mission and the results of eight scientific experiments on board the landers were published in the *Journal of Geophysical Research* (v. 82, no. 28, Sept. 30, 1977; see References).

**GEOMETRY OF THE MOSAICS**

The cameras on the Viking Lander acquire data by sampling in equal increments of elevation and azimuth angle. In the accompanying mosaic, 4 mm subtends a 1° horizontal or vertical angle, regardless of the place of measurement within the panorama. If the martian surface were flat, one pixel (0.04° on the surface) would be 1 mm wide at 60° camera elevation and 2 m wide at the horizon 3 km away. Characteristically for this type of imaging system, most straight lines in the scene appear curved in the reconstruction. This is the result of the perspective geometry of the camera and the projection of the picture data differs from that of a con-

**VIKING LANDER MOSAICS**

The Viking Lander camera acquired many high-resolution pictures of the Chryse Planitia and Utopia Planitia landing sites. Each picture is the product of computer processing of Earth of digital image data transmitted from Mars as a result of "camera events" carried out by one of the lander camera systems. Further computer processing of data from a selected number of these events yielded a total of 10 mosaics. Two pairs of mosaics from Lander 1 data (one mosaic from each camera) consisted of one pair made from data taken in the morning (0700-0800 hours) and one pair made with data acquired in mid-afternoon (1400-1530 hours). Similarly, three pairs of mosaics for the Lander 2 site consisted of one pair between 0700 and 0800 hours, one pair at noon, and one pair between 1700 and 1800 hours. Procedures used for processing the Viking Lander camera data were described by Levinthal and others (1977). The individual camera events used in each mosaic are identified in the outline of the accompanying camera view. Detailed descriptions and reproductions of these camera events were given by Tucker (1978). Copies of the Viking Lander pictures can be obtained from the National Space Science Data Center, Goddard Space Flight Center, Greenbelt, MD, 20771. The Lander camera system (Huck and others, 1975a) has selectable focus settings for a depth of field from 1.2 m to infinity in the high-resolution (0.04° instantaneous field of view) mode. The survey (low-resolution) mode has an instantaneous field of view of 0.17°. This mode was used in the mosaics only where no high-resolution data were acquired. Each complete mosaic extends 34.25° in azimuth, from approximately 5° above the horizon to 60° below. A complete mosaic incorporates approximately 15 million picture elements (pixels). In order to manage the processing of such large data bases, each mosaic was compiled from four individual azimuthal sectors.

**REFERENCES**

- Davies, M. F., Karyama, F. V., and Roth, J. A., 1978, Control net of Mars, February 1978, *Rand Corp. R-2309*, NASA, 91 p.
- Huck, F. O., McGill, H. J., Patterson, W. R., and Taylor, G. R., 1975a, The Viking Mars Lander camera: Space Science Instruments, 1, no. 2, p. 189-241.
- Huck, F. O., Buehler, E. J., Taylor, E. J., and Wall, S. D., 1975b, Radiometric performance of the Viking Mars Lander camera, U.S. National Aeronautics and Space Administration Technical Memorandum TMX-72692.
- Levinthal, E. C., and Jones, K. L., 1980, The mosaics of Mars as seen by the Viking Lander camera, NASA Contract Report 7226.
- Levinthal, E. C., Green, William, Jones, K. L., and Tucker, Robert, 1977, Processing the Viking Lander camera data, *Journal of Geophysical Research*, v. 82, no. 41, p. 4412-4420.
- Mayo, A. F., Blackhear, W. T., Tolson, R. H., Michael, W. H., Jr., Kelly, G. M., Brenke, J. P., and Komarek, T. A., 1977, Lander location, Mars physical characteristics, and solar system parameters: Determination from Viking Lander tracking data, *Journal of Geophysical Research*, v. 82, no. 28, p. 4297-4303.
- Morris, E. C., and Jones, K. L., 1980, Viking 1 Lander on the surface of Mars: Revised location, *Science*, v. 44, no. 1, p. 217-222.
- Patterson, W. R., III, Huck, F. O., Wall, S. D., and Wolfe, M. R., 1977, Calibration and performance of the Viking Lander camera, *Journal of Geophysical Research*, v. 82, no. 28, p. 4301-4309.
- Tucker, R. B., 1978, Viking Lander imaging investigation: picture catalog of primary mission experiment data, *Journal of Geophysical Research*, v. 83, no. 1, p. 1-10.
- de Vaucouleurs, G. D., Davies, M. F., and Strum, F. M., Jr., 1973, The Merritt 9 geographic coordinate system, *Journal of Geophysical Research*, v. 78, no. 20, p. 4395-4404.
- Wolfe, M. R., 1979, Viking Lander camera geometric calibration report, California Institute of Technology, Jet Propulsion Laboratory, (in press).
- Wolfe, M. R., Atwood, D. L., and Morrill, M. E., 1977, Viking Lander camera radiometry calibration report, California Institute of Technology, Jet Propulsion Laboratory Publication 73-62, v. 1, 90 p.