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VIKING LANDING SITES

A valley near the mouth of the 20,000-foot-deep Martian Grand Canyon has been chosen by NASA as the site of its first automated landing on the planet Mars.

The landing site for the second mission of the 1975-76 Viking spacecraft will probably be an area about 1,000 miles northeast of the first site, where the likelihood of water increases the chances of finding evidence of life.

Both sites are fairly smooth, relatively calm areas in the planet's lowlands.

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Selection of the tentative landing areas was announced by NASA today, culminating a year-long study and evaluation of 22 potential sites by teams of prominent scientists.

The two Viking spaceships, carrying life-detection instruments, are scheduled to be launched towards Mars in the summer of 1975, the second about a month after the first. The journey will take nearly a year.

The prime target for the first mission is a region known as Chryse (19.5° N, 34° W), at the northeast end of the giant 3,000-mile-long rift canyon discovered on Mars by the still-orbiting Mariner 9 spacecraft. The rift system runs out into a series of long channels which resemble dried-out river beds.

The landing site chosen for the second mission is Cydonia, in the Mare Acidalium region (44.3° N, 10° W), at the edge of the southernmost reaches of the north polar hood -- a hazy veil which shrouds each polar region during the winter season, and which some scientists believe may carry moisture.

The sites were chosen on the basis of scientific interest and the probability of landing successfully. Such factors as elevation, terrain roughness and slope, and wind velocities and directions are critical to a successful landing.

Detailed study was made of the maps produced by Mariner 9, including pictures with resolutions as fine as 100 meters (328 feet). These photographs were correlated with data taken by other Mariner 9 instruments -- infrared spectrometer, and radio -- which provided information on temperature, pressure, humidity, and general atmospheric and surface characteristics of Mars. Ground-based radar observations were used to predict the elevation, surface roughness and bearing strength of the landing areas.

Sites were chosen on the basis of these characteristics:

- Low Elevation. The Martian atmosphere is very thin. The lower elevations, with a higher atmospheric pressure, provide a greater margin of safety for the Viking Lander, which uses a combination of aeroshell, parachutes and braking rockets to slow down its descent.

- Possibility of Water. Since Viking has as one of its principal objectives the search for life, the search for water is very important. Regions of high pressure are the most likely to harbor liquid water.

- Interesting Geological Features. The Mariner pictures were studied very carefully in an attempt to select sites smooth enough to land safely while at the same time possessing features of high geological interest.

- Favorable Meteorological Conditions. High winds are known to exist on Mars, as evidenced by the planet-wide dust storm observed by Mariner 9 and Earth-based telescopes. Very high winds are potentially hazardous to spacecraft landing. By studying wind-induced streaking marks shown on Mariner photographs, scientists can identify and avoid high wind regions. The Viking lander is designed to land in winds with velocities up to 150 miles an hour.

- Smoothness and Slope of Terrain. The nine-inch clearance under the lander body requires a relatively smooth surface, and to assure landing stability the sites should have slopes no greater than 19° . At the same time, the area must be free of extensive smooth-rock surfaces or thick dust layers. Landing on a smooth-rock surface would make sample acquisition difficult or impossible; a site thought to be covered by a deep layer of soft material could mean inadequate surface bearing strength.

Project Viking seeks to advance significantly scientific knowledge of the planet Mars, with emphasis on determining if life once existed or is now present.

After a trip of 460 million miles, the two spacecraft will go into highly elliptical orbits from which they will study the preselected sites in an attempt to certify that they are safe and scientifically attractive. Then each spacecraft will separate into two parts, an orbiter and a lander. Together they will conduct scientific studies of the Martian atmosphere and surface.

Each lander carries a miniature chemical laboratory which will analyze samples of Martian soil for signs of life. A ten-foot retractable claw will be used to scoop the soil samples for analysis. Other instruments will analyze the atmosphere, measure pressure, temperature, wind velocity, composition of the soil, and quake activity. The data, transmitted to Earth directly or via relay link with the orbiter, will include panoramic, stereo, color and infrared pictures of the lander's immediate surroundings.

The lander capsule will have been heat-sterilized before launch to comply with international planetary quarantine requirements, and to prevent false signals in the life-detection experiments.

While the Viking lander probes the Martian surface, the orbiter will perform visual (television), thermal, and water vapor mapping.

The Chryse (rhymes with "icy") site is scientifically interesting because it appears to be at the lower end of a long valley where the largest group of "stream" channels on Mars starts to diverge. The site may have been a drainage basin for a large portion of equatorial Mars, and hence would be expected to have collected deposits of a variety of surface materials. It is also one of the lowest regions studied, about 5 kilometers (16,000 feet) lower than the mean surface of the planet.

Cydonia, the prime site for the second mission, is even lower than Chryse -- 18,000 feet below the mean surface. Cydonia (Sy-don'-i-a) was selected because of the possibility of finding biologically-available water.

To look for life is to search for the water. Mars is known to have water vapor in its atmosphere, and the sub-surface polar caps are believed to be made up in part of water ice. But scientists are searching for a region that would permit, for short periods, the existence of liquid water. This means landing in a region where the pressure on the surface is at least 6.1 millibars, the minimum pressure required for liquid water to exist, and where the temperature rises at least to 273° K (0° C).

At Cydonia, the atmospheric pressure is 7.8 millibars and temperature may rise as high as 0° C. Cydonia is at a latitude that is far enough north to believe that seasonal ice is deposited, and southerly enough to predict that in the summer the temperature rises to the melting point.

In addition to satisfying the selection criteria, the sites offer a unique advantage due to their relative positions; both landers will be within communication and viewing range of both orbiters. Thus one orbiter can be released from synchronous orbit over its lander for low-altitude observations of other regions of interest, while the second orbiter acts as a monitor and data relay station for both landers.

Although mission operations are being planned on the basis of selected sites, Viking can be retargeted to alternate sites up to the last midcourse correction (about 10 days before encounter), if necessary. In addition, the spacecraft itself has a limited capability to retarget the lander if observations from orbit prior to lander separation show the preselected site to be unsafe or undesirable.

The backup site for Chryse is Tritonis Lacus (Tree-tone'is Lah'cuss) at 20.5° North latitude, 252° West longitude. If site certification by the Viking Orbiter indicates that Chryse is unsuitable for any reason, the lander will be retargeted to Tritonis Lacus.

Alba, "The White Region," is the backup site for Cydonia. It lies at 44.2° North latitude and 110° West longitude.

Both the prime and backup sites for the second mission are in the area of maximum biological interest, 40° to 50° north latitude. Current plans call for landings along the 44-degree line, but the project has the flexibility to switch to 50° if observations from the first Viking orbiter indicate that there is a safe landing site at that latitude for the second mission.

Viking is managed for NASA's Office of Planetary Programs by the Langley Research Center, which also has responsibility for two of the six major systems constituting the project: the Lander System and the Launch and Flight Operations System. Martin Marietta Aerospace, Denver, Colorado, is the prime contractor, responsible for the lander and for project integration. The Jet Propulsion Laboratory manages the Orbiter System, the Viking Mission Control and Computer Center, and the Deep Space Network; and the Lewis Research Center manages the Launch Vehicle System.

Walter Jakobowski, NASA Headquarters, is program manager, and James S. Martin, Jr., Langley, is project manager.

VIKING SITE SELECTION GROUPS

Viking landing sites were selected by NASA on the basis of recommendations by the Viking Landing Site Working Group, a panel of 17 noted scientists, and evaluation of these recommendations by the Viking Science Steering Group, which is comprised of the team leaders for the 13 investigations to be conducted during the mission.

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DERIVATION OF MARTIAN NAMES

The Nomenclature for Mars, adopted by the International Astronomical Union in 1958, designates the main features on Mars by names drawn from the Bible and mythology, in accordance with the classical system adopted in 1877 by Giovanni Schiaparelli -- best remembered for his observations of Martian "canals."

Well-known in his own day for his researches on the Bible and the classics, he was steeped in the traditions of Greeks and Hebrews alike. So it seemed natural to Schiaparelli to draw on his familiarity with the ancient world of Earth, and to transfer its geography to new scenes of the world of Mars.

The bright areas of the planet, called "lands" and "continents," were named after terrestrial countries, either real, such as Arabia, Hellas (Greece) and Syria; or mythical, such as Elysium and Amazonis.

The dark areas were designated seas; for example, Boreum Mare (North Sea) and Tyrrhenum Mare (Tyrrhenian Sea). Schiaparelli followed his predecessors, in identifying a number of bays, such as Sabaeus Sinus (Sabian Bay), and Aurorae Sinus (Aurora Bay); some large bays he called

gulfs, as for example, Golfo Sabeo. Several small dark areas were designated lakes; thus, Solis Lacus (Lake of the Sun) and Niliacus Lacus (Egyptian Lake).

In fact, a map of Mars looks very much like a map of the ancient Mediterranean world -- viewed upside down, of course, since Schiaparelli had formed his picture in the astronomer's telescope which inverts the image.

Thus Hellas (Greece), Ausonia (Italy), and Libya (Africa) border a large "sea," with Aeria (the ancient Greek name for Egypt) and Arabia below. Eden (Moab) and the four rivers of Paradise -- Phison, Gehon, Hiddekel and Euphrates -- are all there, as are Mare Erythraeum (Red Sea) and Bosporos Gemnatus (the Bosphorus).

Far to the north (if viewed with south at the top) is Thyle (Thule), and beyond that is Ulyxis Fretum (the furthest of lands). At an opposite corner of the Mars map are Hades and Chaos. And not much more distant are Uchronia, which means a place-without-time, and Utopia, which is no-where.

Chryse, the tentative landing site for the first Viking Mission, means "land of gold," and is believed to be derived from the writings of Ptolemy and later pinpointed as modern-day Burma. Appropriately enough, it is bordered on the Martian map by the Indus and Ganges.

The landing site for the second mission, Cydonia, is the name of a town in Crete, which in turn is named for Kydon, son of the fabled king of Crete, Minos. Mare Acidalium is named after the waters in which Aphrodite (Venus), accompanied by the Graces, is supposed to have bathed daily.

The backup landing site for the first mission, Tritonis Lacus, the Lake of Triton, is named for a legendary river in Tunisia visited by Jason and the Argonauts.