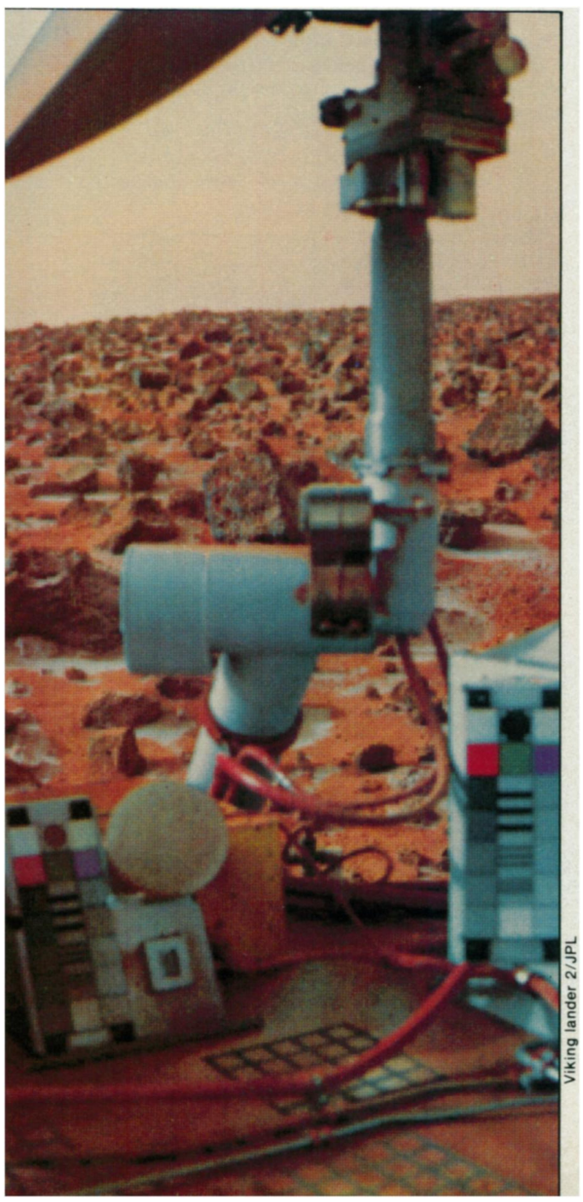
Viking Lander Sees Frost on Mars

Twenty years ago, the world was changed forever: On October 4, 1957, Sputnik I—the first man-made object to orbit the earth—was launched from the Soviet Union. Since that electrifying inauguration, the Space Age has grown to where, as of this week, there were 4,470 satellites, space stations, spent rockets and other pieces of hardware circling the planet. A dozen human beings have walked on the moon; unmanned probes have visited every planet from Mercury to Jupiter, with spacecraft now on the way to Saturn and perhaps to Uranus and Neptune. Various orbiting objects relay phone calls, watch the weather, guide ships and aircraft, spy on the enemy, monitor crop conditions and look at the stars. As this is written, researchers are pondering frost on Mars, a new station in space and a satellite in pieces on the bottom of the ocean. Just another week in the Space Age . . . .



Viking lander 2/JPL

Back in earth's January, when the northern hemisphere of Mars was still in the autumn of its 688-day year, scientists with the Viking project were forecasting frosty times to come for Viking lander 2, less than 43° of latitude away from the ruddy planet's north pole. There were expectations that winter might see the ground around the lander covered in a blanket of white, and that perhaps the polar cap itself would extend its borders until they impinged on the spacecraft's very feet. As one researcher put it, lander 2 could find itself in "an honest-to-god polar environment" (SN: 2/5/77, p. 84).

The northern Martian winter began with the solstice on May 31, and will end in less than a month with the Nov. 5 vernal equinox. But the frost has remained elusive, leaving Viking's meteorologists and others struggling to understand the movements of carbon dioxide and water in and out of the Martian polar caps, atmosphere and rocky ground. When the northern cap was still shrinking, for example, giving up its substance to the atmosphere, the Viking orbiters failed to find signs of the expected neatly matching growth at the south pole. Mars provides an elegantly simplified laboratory for meteorologists seeking to understand the far more intricate weather mechanisms at work on the earth, but it still has its mysteries—and its surprises.

Last week, Kenneth Jones of Jet Propulsion Laboratory, a member of Viking's lander imaging team, was showing a friend through part of the elaborate, computerized image-processing system. They were in a section known as FOVLIP (First Order Viking Lander Image Processing), a tiny room in which a computer console is used to "punch up" new Viking photos onto a video monitor for their first look prior to the detailed enhancement procedures that follow. As a demonstration, Jones ordered up a recent lander 2 photo for the monitor, glanced at it—and then looked again.

There, spread among the rocks of the lander's bumpy terrain, were a number of bright white patches that very much resembled frost. Hazes, fogs and even possible surface frosts had been seen in photos taken from orbit, but no such patches had ever before been identified in the hundreds of lander images. At first, says Jones, he thought it might be a mistake in the processing. Other researchers, viewing the image the next day, suggested that the patches might be very light-colored sand, deposited or freshly turned by the wind. Further study, however, has virtually confirmed that they are frost: the first visual signs of winter to be seen at the lander 2 site, more than two-thirds of the way through the season.

But what kind of frost are the patches composed of? The photo was taken in the early afternoon of Sept. 13, when the temperature was about 174° K—approximately 23° to 26° too warm for CO_2 (the most common constituent of the atmosphere) to freeze. On the other hand, the local atmosphere this late in winter is seemingly too dry to have provided much in the way of water. The only remaining possibility seems to be a "clathrate"—a sort of ice/dry ice amalgam in which the CO_2 has become trapped in the molecular structure of the frozen water.

The frost spots continued to show up in photos taken as recently as the end of the month, and project officials were making plans this week to take more. Because of the "high" temperatures, says Viking meteorologist Robert Henry, it seems likely that the patches are actually remnants of larger frosty areas that have been sublimating away since they formed in colder times as much as 50 to 150 days ago. Limited photo coverage, variable lighting conditions and a dusty atmosphere kept them from being seen clearly until now, but a look back at earlier images, says Jones, shows almost certain signs in a photo from mid-August, with "50-50 possibilities" in pictures several weeks before that.

The lander team is now planning to take a series of pictures of the frosty spots at intervals over a single day, to see whether the patches shrink visibly under the planet's chill sunshine. Another possibility being considered is to reactivate the lander's soil-sampling arm, which carries a temperature sensor, and to guide the sensor to rest on top of one of the patches.

The frost has created quite a stir among the Viking researchers, whose mission is funded only through May 1978. There is hope of finding money to extend operations an additional eight months, so that the orbiters and landers will have been able to observe a full Martian year, and the frost discovery could help turn the trick. "It's one of the most exciting things to happen," says Jones, "since the landing." □

Second satellite blow-up in 16 days

An Intelsat IV-A communications satellite was destroyed when its Atlas-Centaur rocket exploded barely one minute after taking off from Cape Canaveral on Sept. 29. It was the second such disaster in 16 days, following the destruction of the European Space Agency's Orbital Test Satellite on Sept. 13 when its NASA-provided Delta rocket also blew up in midair (SN: 9/17/77, p. 181).

The malfunctions are not believed to