N89-18371

PRESENT IMAGING LIMITATIONS TO PROVIDING A GEOLOGICAL ASSESSMENT OF POTENTIAL SAMPLE RETURN SITES ON MARS. James R. Zimbelman, Lunar and Planetary Institute, 3303 NASA Road 1, Houston, TX 77058.

A Mars sample return mission will provide a tremendous increase in knowledge about the region explored by the roving vehicle. However, presently there are some important limitations on the extent to which the geology of a potential site can be understood PRIOR to landing the sample return vehicle on Mars. These limitations could affect not only the potential science return of the mission but also the safety of the vehicle.

Orbital imaging is the single most important data source required in the selection of potential landing sites for the sample return mission. During the Viking mission images with 80 m/pixel resolution formed the primary data set used in selecting the landing sites and at the Lander 2 location this resolution was insufficient to reveal the full extent of potentially hazardous blocks at the landing site. What spatial resolution is necessary to adequately assess the relative roles of the geologic processes that have been active at a potential landing site? The Viking Orbiter images provide some useful clues to this important question.

The Viking Orbiters returned over 51,000 images of the martian surface (1) but only a small fraction of these images will be useful in assessing the details of the surface geologic history. It has been shown that aeolian features evident at 9 m/pixel resolution are not visible in images with >50 m/pixel resolution (2,3). Only about 1% of the Viking images have a spatial resolution of <10 m/pixel and are relatively free of obscuring dust or haze (3). Even increasing the resolution limit to <20 m/pixel only results in about 2700 <u>useable</u> images (data from 4; Fig. 1). Figs. 2 to 4 illustrate that 16 m/pixel resolution is sufficient to distinguish stratigraphic relationships, important to a proper evaluation of the geologic history, that are not evident at 100 m/pixel resolution. It is quite unlikely that all (or even most) of the proposed landing areas will be included in images with sufficient resolution to determine the history of the surface (particularly the extent of aeolian modification). The high resolution images from Mars Observer Camera will be <u>essential</u> to the site selection process.

Non-imaging remote sensing can provide information complimentary to the high resolution images. However, non-imaging data cannot take the place of missing high resolution images. Reflected and emitted radiation provide valuable constraints on the chemical and physical makeup of the surface but this information is relevant to only the uppermost materials, at best the top several centimeters of the surface. Since the surface materials are greatly affected by aeolian processes (5,6,7), the remote sensing results may not be well correlated with the geologic history of the surface (7).

REFERENCES: (1) Ezell, E.C., and L.N Ezell, <u>NASA SP-4212</u>, p. 423, 1984. (2) Zimbelman, J.R., <u>Lunar Planet. Sci. XVII</u>, 963-964, 1986. (3) Zimbelman, J.R., <u>Icarus 71</u> (in press), 1987. (4) Arvidson, R.E. <u>et al.</u>, <u>NASA Contr. Rep. 3299</u>, 1980. (5) Kieffer, H.H. <u>et al.</u>, <u>J. Geophys. Res. 82</u>, 4249-4291, 1977. (6) Christensen, P.R., <u>J. Geophys. Res. 91</u>, 3534-3546, 1986. (7) Zimbelman, J.R., and L.A. Leshin, <u>Proc. LPSC 17th</u>, <u>J. Geophys. Res. 92</u>, E588-E596, 1987.

Figure 1 (next page). Cumulative number of Viking Orbiter images as a function of slant range and spatial resolution. Note that almost one half of the images with spatial resolution <20 m/pixel are not useable due to obscuring atmospheric dust or haze. Data are from (4).

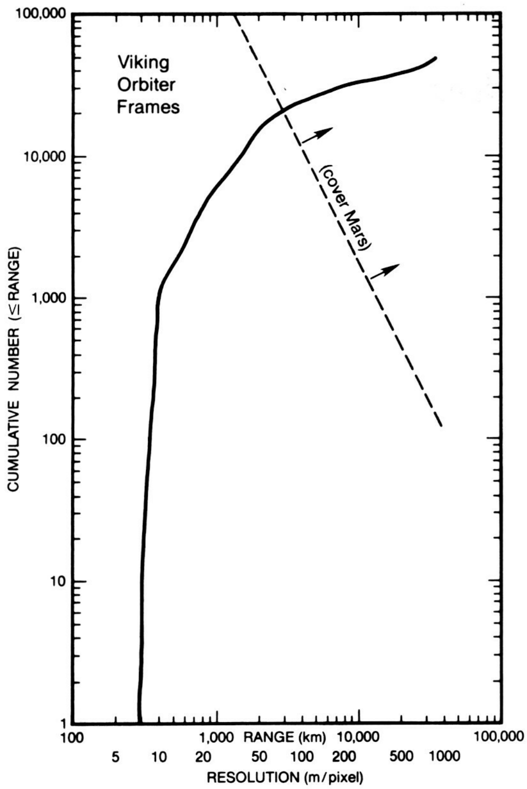

Figure 1.

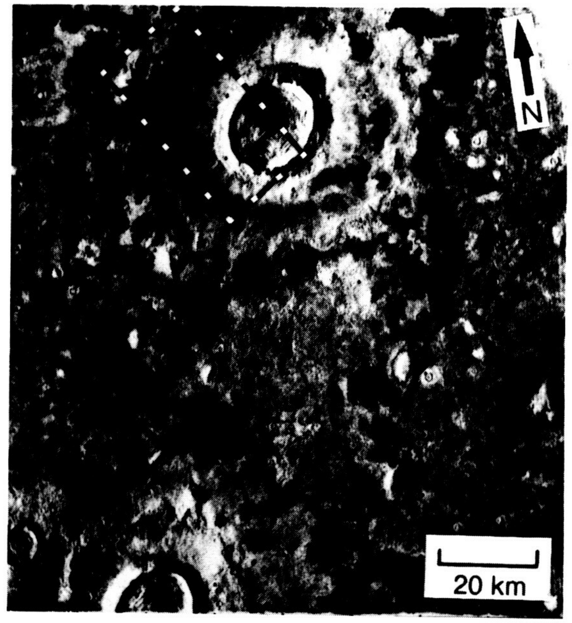

Figure 2.

Figure 3.

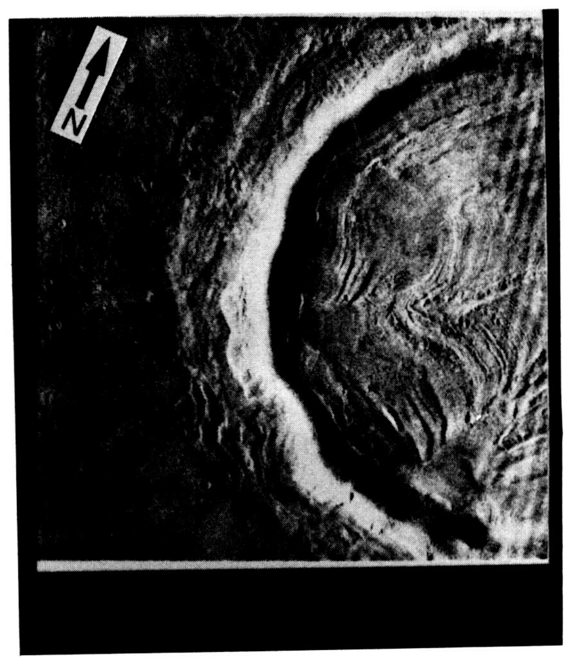

Figure 4.

Figure 2. 100 m/pixel image of the northern Utopia plains. Dashed lines indicate area shown in Figures 3 and 4. Frame 10B70, 42°N, 272°W.

Figures 3 and 4. 16 m/pixel images. Note that the ejecta is covered by the smooth plains material. Similarly, the crater interior deposits may be related to material that was draped over the surface. The crater interior morphology could result from erosion of this material. Frames 425B11 and 7.