HIGHLAND VALLEY NETWORKS AND EPHEMERAL LAKE BASINS, LIBYA MONTES, SW ISIDIS BASIN MARGIN. ***L. S. Crumpler****; New Mexico Museum of Natural History and Science, 1801 Mountain Rd NW, Albuquerque, NM 87104; crumpler@nmmnh-abq.mus.nm.us*

Introduction. This summarizes the analysis of geology and surface engineering criteria for an area on the southwestern border of Isidis Planitia. In this area basin plains adjoin volcanic plains of Syrtis Major Planum and dissected ancient highlands of Libya Montes. Previously three general categories of landing site [1] have been discussed for this area: scarp-like terrain along the western margin of Isidis Planitia, marginal ridged plains, and terminus of a significant valley network basin draining Libya Montes. On the basis of geologic mapping and reconnaissance around the southwest perimeter, the plains-

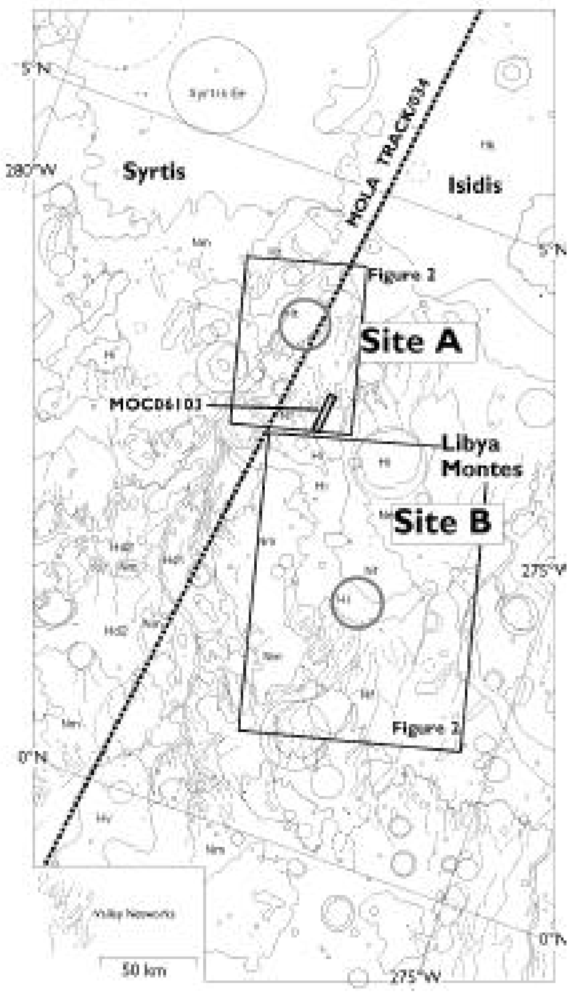

Figure 1. Segment of geologic map prepared for southwestern Isidis Planitia, Syrtis Major Planum, and Libya Montes (1) showing location of MOLA track, MOC image, and sites of A and B. Selected geologic units are noted and discussed in the text. Boxes outline image areas shown in Figure 2.

marginal slopes adjacent to Libya Montes appear to best satisfy the thematic, geologic, and engineering goals and constraints of the Mars Surveyor program.

Science Rationale. Two significant sites are identified in this region within imposed latitudinal constraints. Both sites are areas of recurring valley network formation and/or paleo lake basins as well as significant sedimentation. Both sites offer the opportunity to sample materials associated with ephemeral water bodies of the type thought to have assisted in polymerization of simple organic compounds early in Earth history. Widespread sedimentation in the downstream fans assure that many samples 0f early chemistries are buried and well-preserved. “Site A” is notable as it offers the potential for recovering materials, including sediments, deposited during the formation of a long-lived highland valley network basin, as well as diverse materials of other geologic provenance and age. Site B is a significant regional, long-lived, and frequently renewed paleo-lake basin.

Evidence for Persistent Fluvial Activity /Geological History Of Site. Results of geologic mapping have been discussed previously [1]. Sites A and B are within a well-integrated high density valley network system that includes some intermittently closed basins (as adjudged from strand lines). Eight geologic units were mapped, related largely to fluvial deposition and associated incision within valley networks headed within the crater highlands surrounding Isidis Planitia. Identified surface materials span crater ages from middle Noachian to late Hesperian-early Amazonian [segment of map in **Figure 1**]: Nm, ancient highland massifs interpreted to be heavily eroded Isidis basin ejecta; Nf, fluvially dissected foothills and lower slopes of massifs and rolling intermontane plains; Hi, intermontane and crater-interior plains interpreted as sediments; Hd, plains bearing high density valley networks with meandering characteristics; Hv, Syrtis Major lava flows, Hk, knobby, Isidis-marginal plains; and Hr, plains with ridges and aligned-mounds of the Isidis basin interior.

Evidence for Exposed or Accessible Subsurface Material. Site A lies in the terminal fan of a large valley network (**Figure 2,** Site A). As a result of late incision over a broad area of the fan, a thick section of sediments may be examined with a horizontal traverse. Likely aqueously-altered crystalline highland rocks occur in adjacent hills. Samples of intermediate-age Syrtis lava flows are also possible as ejecta from the nearby, young 50-km crater *Syrtis Ee*.

Site B, (**Figure 2**, Site B) lies within the relatively flat floor of a large basin that has been a sink for fluvial sedimentation over much of the history of the regional valley network system. The basin floor is bordered by uniformly sloping surfaces of material shed from surrounding

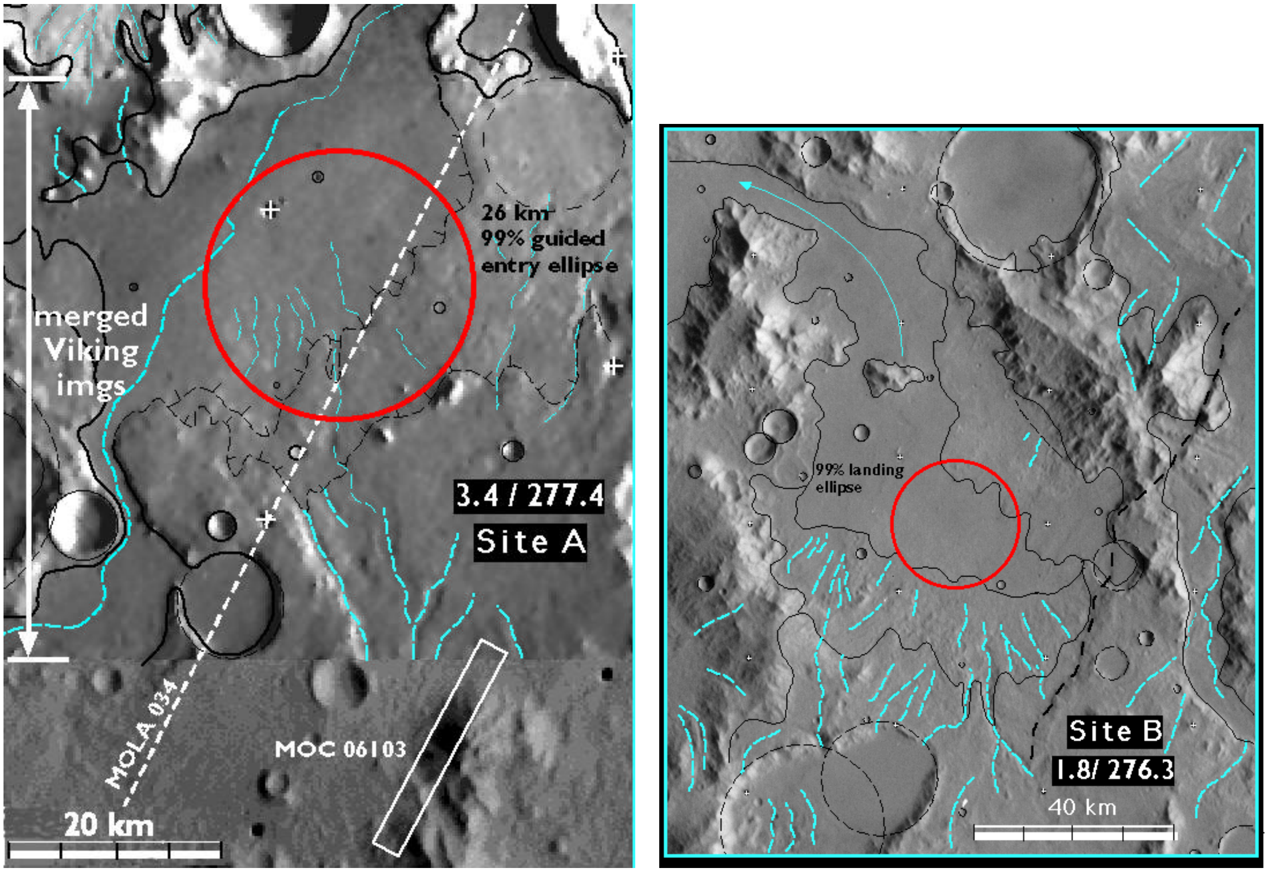

Figure 2. Site A and B with guided 99% landing circle (26 km diameter) indicated. Lines are from geologic mapping and outline differing surface materials. Small dashed lines indicate representative sample of small valley networks.

highlands. These sloping surfaces contain abundant valley networks as well.

Engineering Surface Criteria. Engineering evaluation data were collected (**Table 1**) for this site along the lines established previously in the evaluation of possible Pathfinder sites [2]. As of this writing, the 99% landing error at this latitude is represented by a 26 km diameter circle centered on the target coordinates. When fitted to site A, this encompasses a relatively smooth terminal deposit fed by long-lived outflow of several valley networks draining the interior highlands of Libya Montes. The drainage density within this region is among the highest on Mars and constitutes a prime example of early surface runoff, ephemeral basins, and multiple phases of discharge. Rock abundances, estimated from Viking IRTM [3] imply less than 2 percent of the area is covered by rocks larger than 35 cm. Phobos ISM data [4] suggest ferric iron concentrations typical of highland materials, whereas TES data [5] are indicative of moderate pyroxene abundances. High resolution (16 m) Viking image data are restricted, but include areas to the north and east of Site A in similar borderland terrains potentially suitable for local interpolation.

MOLA Track. The track from Orbit 34 crosses directly over the primary Site A and provides additional high resolution information. Although there is currently a mismatch between inertial coordinates for surface tracks and Viking image mosaic surface coordinates, the location of MOLA profile track for orbit 034 [6] can be precisely located with respect to surface images landforms using several prominent landforms and small impact craters as tie points (**Figure 3**). The results enable a controlled geotraverse down a significant ancient highland valley network. Inflections of 30 to 50 m are detectable where the track crosses significant drainage trunk lines, providing the first estimates of the detailed relief across valley networks and corresponding potential for estimates of probable discharges. As anticipated by the sediment fan environment, the relief across the nominal Site A target is among the most benign (**Figure 3**) along the track and characterized by 20 to 40m swales with several kilometer wavelengths.

MOC Image. A single MOC image has been acquired near Site A. The image includes a geological surface of high valley network density similar to that within and bordering the proposed site. (MOC_06103). The distance between interfluves of valley networks dissecting local fluvial fan sediments is estimated at 80 m. which agrees with observed undulations in regional topography from MOLA results. These valleys are likely to have exposed local sedimentary macrostructures preserving materials deposited late in the drainage basin history. There are likely to be physical and chemical materials deposited, preserved , and exposed within the local sediments representing a wide age range in the history of the drainage system.

Additional details will be provided in a formal summary report in progress. This work was funded by the Mars Surveyor Landing Site Mapping Program, NASA.

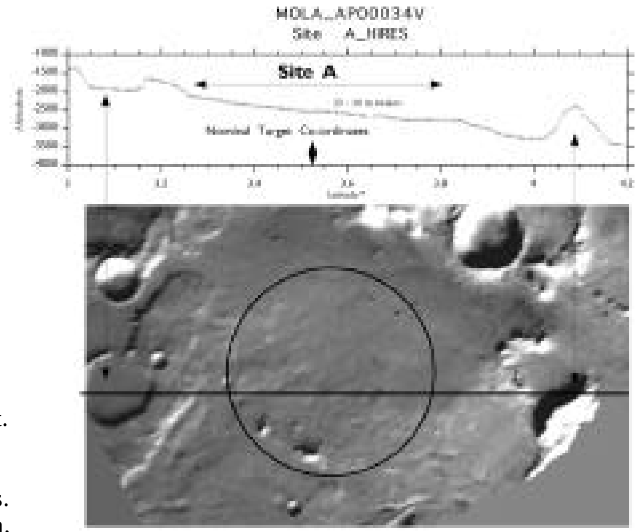

Figure 3. Detail of MOLA altimetry across Site A. Viking image base. 26 km landing circle, here shown slightly SE of its location in Figures 1 and 2.

References. [1] Crumpler, L. S., Lunar Planet. Sci. XXIX, Abstract #1946, Lunar and Planetary Institute, Houston, (CD-ROM), 1998; [2] Golombek, M. and D. Rapp, Jour. Geophys. Res. 102, 4117-4129 1997; [3] based on Christensen, P.R. , Icarus 68, 217-238, 1986; [4] Mustard , J. F.et al., Jour. Geophys. Res., 98, 3387-3400, 1993, calibrated Phobos ISM spectral band minimum, band area, slope avaialble; [5] . Christensen et al., Science; (orbit 034 results), 1998; [6] D. E. Smith et al. , Science,279, 1686 - 1692 ; Fig. 2, orbit 34, 1998; [7] Haldeman, A. et al., Jour. Geophys. Res., 102, 4097-4106., 1997; Goldstone, 1975, G. Downs in Schaber, 1982; [8] Palluconi, F.D. and H.H. Kieffer, Icarus, 45, 415-426, 1981; [9] 16 m resolution data within one degree.

Table 1. Surface engineering evaluation for Sites A, B, and C, Isidis Planitia, Syrtis Major Planum, and Libya Montes.

	measurement	**Site A**	**Site B**	**Site C**	**Ares Vallis**
Site Environment		highland/ valley networks	highland/ valley networks/ lake bed	lowland/spring?	fluvial ouflow
Location	Center Latitude °N	3.37	1.758	15.3	19.5
	Center Longitude °W	277.539	276.288	281.3	32.8
Region of Interest	NW Corner Lat/Long	4/278	2.5/277		
	NE Corner Lat/Long	04/277	2.5/275.5		
	SW Corner Lat/Long	03/278	1/277		
	SE Corner Lat/Long	03/277	1/275.5		
Elevation	MOLA, km [6]	-2.2 ± 0.04 MOLAAP00034V	nd/similat to A	nd	nd
	Viking DTM, km	0.55±0.5	0.88±0.5	-0.10±0.5	0.8±0.5
	Radar, km	available [7]	available?	~-1.6 [7]	1.3 - 1.7m
Surface Properties	Bulk thermal inertia [9]	8.2	9.6	9.6	10.2
	Fine-component thermal inertia ave ± s.d.	7.2	8.0	9.6	8.2±0.4
	Fine-component thermal inertia range				7.7 - 8.8
	albedo[8]	0.1780	0.1940	0.2020	0.19 - 0.23
	TES Data [5]	Mod to hi px?	nd	nd	nd
	Phobos ISM Data[4]	High Fe^{3+}	High Fe^{3+}	available [4]	nd
Rock Abundance %area	est. from Thermal Inertia [3]	15	15	5	20.4 ± 2.1 [ob.=16]
	est. from [2] %area covered by >35 cm high rocks	1.8	1.8	.02	6.0 [ob.= 2]
MOC Images	SE of proposed ellipse				
Viking image res and coverage (m/px)		227m (100%)[9]	227m (100%)[9]	~27m (?%)	38 - 51 (~80%)