Geomorphology and Terrain Characterization of the 2007 Phoenix Mission Landing Sites in the Northern Plains of Mars. K. D. Seelos[1], R. E. Arvidson[1], T. Parker[2], M. Golombek[2], L. Tamppari[2], and P. Smith[3], [1]Washington University, St. Louis, MO 63130, deal@levee.wustl.edu, [2]Jet Propulsion Laboratory, Pasadena, CA 91109, [3]University of Arizona, Tucson, AZ 85721.

Introduction: Remote data coverage of the northern plains of Mars in support of the 2007 Phoenix mission has allowed detailed mapping and terrain analyses both to aid in landing site selection [1] and to provide insight into the surface processes at work at these high latitudes. Taking into account both scientific and engineering constraints [1, 2], three regions from 65 to 72 N were down-selected during the early stages of the landing site selection process: Region A (250 to 270 E), Region B (120 to 140 E), and Region C (65 to 85 E) (see Figure 1 in [1]). This abstract outlines the geomorphologic features in each of these regions, including results from a quantitative adirectional slope analysis, and discusses additional work and expected observations from the lander.

Methodology: Mars Orbiter Laser Altimeter (MOLA) topographic data, Thermal Imaging System (THEMIS) 36 and 18 m/pixel visible data and 100 m/pixel daytime infrared data, and Mars Orbiter Camera (MOC) narrow angle images were the primary datasets used in the terrain analyses presented here. Basemaps were created using MOLA together with THEMIS imagery, and geomorphic mapping was performed at the 36 m/pixel spatial scale. MOC data, including stereo and C-proto images [3], provide high resolution documentation at the lander scale.

Unit Descriptions: Seven units were identified and mapped across all three regions (Figure 1). These include Polygonal and Smooth/Mottled Plains units, Crater Interior and Ejecta units, Crater Cluster Terrain, Hills/Knobby Terrain, and Depression.

Plains. Region A is dominated by the Smooth/Mottled Plains unit. This unit is characterized by ubiquitous patterned ground (basketball terrain) at small spatial scales; sub-km craters appear highly degraded lending it overall smooth appearance. The Polygonal Plains unit dominates Regions B and C. Multiple kilometer-scale polygons similar to those described in Utopia Basin, e.g., [4], are overlain by widespread basketball terrain, frequently organized into stripes.

Crater Interior and Ejecta. The Crater Interior unit consists of the rim and basin structures produced through impact events. Ejected material surrounding the craters make up the Crater Ejecta unit. In general, craters and ejecta are highly degraded and few "fresh" craters are present. Rampart ejecta and other ejecta patterns thought to be due to fluidization of subsurface volatiles are common.

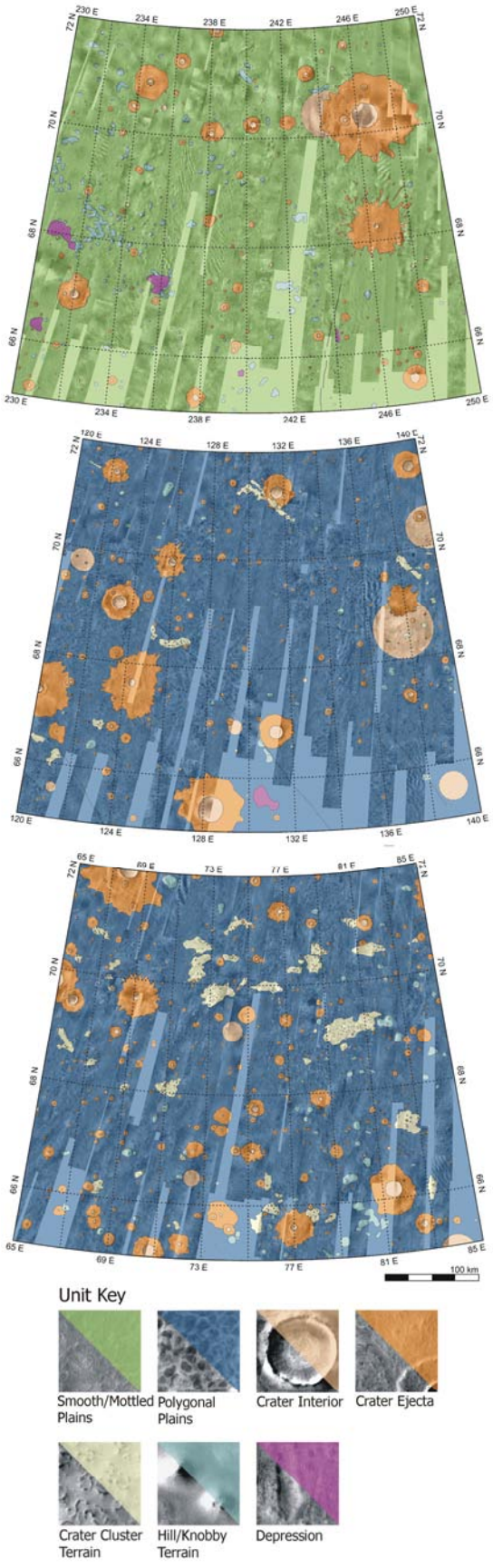
Crater Cluster Terrain. Isolated concentrations of overlapping craters with little or no discernable ejecta appear predominantly in Regions B and C. The origin of this terrain remains unclear, but may be associated with secondary ejecta, volcanic, or explosive subsurface volatile release processes.

Hills/Knobby Terrain. This unit is typified by topographically elevated hills or a localized series of hills that appear unrelated to a cratering origin. Semi-linear or circumferential structures with boulder fields are commonly observed.

Depression. Enclosed, irregular-shaped topographically lowered areas are mainly observed and typically associated with the Hill/Knobby Terrain .

Slopes: Adirectional slopes at ~460m baselines were calculated using MOLA 256 pixel/degree topographic data within each region and per geomorphic unit. Figure 2 summarizes the results for Region B, as an example. Overall, slopes are extremely low, averaging well below 4 degrees in all regions. Higher slope values are observed in the Hill and Crater Interior units. The plains units that dominate all regions have a mean slope below 1 degree at this baseline. In summary, slopes are benign at this scale and pose a negligible threat to landing site safety during touchdown.

Conclusions and Future Work: Patterned ground is ubiquitous in the regions considered for Phoenix landing site selection, suggestive of the widespread and long-term influence of subsurface ice. Upcoming observations by the Mars Reconnaissance Orbiter (MRO) instruments will provide additional high resolution spectral and spatial information, which will be analyzed for both compositional variability and potential hazards to the lander, such as areas with high rock abundance. Current efforts are also underway to establish a resurfacing history based on crater counts. Results thus far verify an Amazonian age [5] and suggest that modification processes have acted on only the top few meters of surface materials. Finally, measurements made by the Phoenix lander itself will provide invaluable *in situ* knowledge of the mineralogic and volatile components of northern plains materials, while at the same time making observations of the surrounding morphology and obtaining meteorologic data. The Phoenix landing site is a ground truth point for high latitude climatic and surface process models, adding to our understanding of the evolution of Mars.



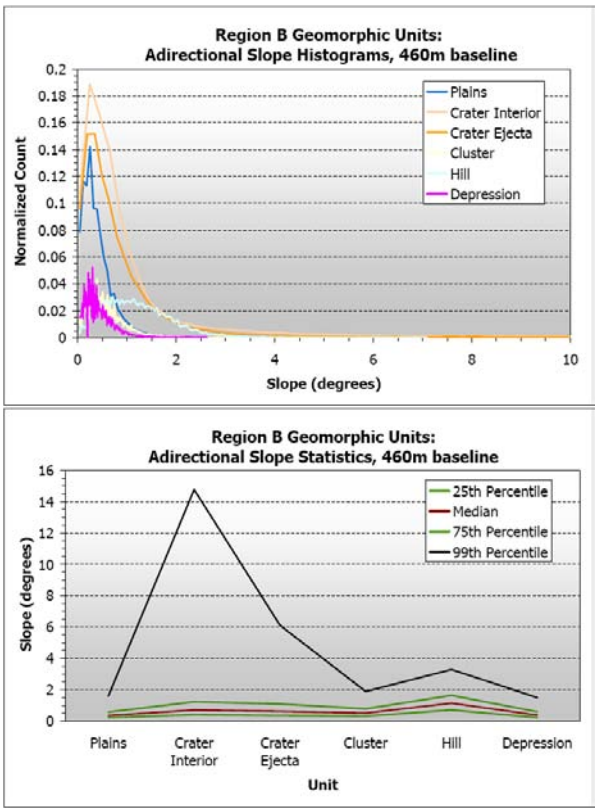


Figure 1. (left) Geomorphologic maps for Regions A (top), B (middle), and C (bottom). Unit color shading is overlain at 60% opacity on a basemap mosaic of THEMIS 36 m/pixel images, courtesy of our collegues at ASU. Unit key is located below. See text for unit descriptions.

Figure 2. (above) Slope statistics for Region B geomorphic units based on MOLA 256 pixel/degree topographic data. The slope baseline is ~460 m. Overall, the mean slope is well below 2 degrees for all units, indicating a very flat landscape at this scale.

References: [1] Arvidson et al. (2006) this conference. [2] Guinn et al. (2006) this conference. [3] Kirk et al. (2006) this conference. [4] McGill (1989) *JGR*, 94, 2753-2759. [5] Tanaka et al., (2003) *JGR*, 108, 8043.

Additional Information: The author would like to make note her former surname, Deal, for reference to previous publications or abstracts.