OVERVIEW OF MARS EXPLORATION PROGRAM 2007 PHOENIX MISSION LANDING SITE SELECTION.

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Introduction: The 2007 Phoenix Lander is designed to touch down on the high northern latitudes of Mars to characterize the surface, acquire and analyze samples of soil and ice, and monitor atmospheric conditions. Entry, descent, and landing (EDL) are critical phases of the mission and require knowledge of specific atmospheric and surface characteristics for success. This abstract focuses on site selection work, including EDL-based requirements, analyses of candidate sites, and a summary of what has been accomplished to date.

Landing Site Requirements: The science objectives associated with the Phoenix Mission require access to sites that are predicted to have relatively thin soil covers over ice or icy soils. This requirement is to maximize the probability, using the robotic arm, of accessing soils, ice, and icy soils for characterization of textures and other physical properties, volatile phase mineralogy and isotopic composition, aqueous chemistry, and the overall biologic potential. In addition, the site should exhibit morphologic patterns indicative of interactions between volatiles and soils (e.g., patterned ground), and be located in a region where meteorologic observations can facilitate a mesoscale understanding of atmospheric dynamics.

In addition to science objectives there are key engineering requirements that must be met to ensure successful EDL phases of the mission:

a. Location between 65 and 72 degrees north latitude
b. Altitude below -3.5 km relative to MOLA-defined geoid
c. Slopes less than 16 degrees at all scales
d. Rock areal abundances less than or equal to the 18% found at the Viking Lander 2 site (~48 degrees north and an analog site for higher latitudes)
e. Wind velocities (<20 m/s below 40 km) and gusts that are relatively benign

Site Selection Work: Initial work on site selection focused on use of Odyssey GRS data to infer the depth of dry soil covering ice or icy soil within the latitude range of interest, coupled with geomorphic, slope, and rock abundance analyses. Three broad regions were chosen for further detailed study largely based on the predicted depth of dry soil cover over ice or icy soil (Fig. 1). Odyssey THEMIS, Mars Global Surveyor MOC, Mars Express HRSC, and OMEGA data were requested and analyzed over the regions. Additional constraints on dry layer soil thicknesses were provided by modeling the depth to stable ice, and tracking short and long term surface temperature trends by using Mars Global Surveyor TES data. The results show that local winds are dominated by storm systems that travel with the westerly polar jet. Mesoscale atmospheric modeling was also carried out for each region. The strength of these storms may vary somewhat between regions, but winds from these storms were found to be acceptable for EDL in all regions.

Down Selection to Region B: Region B was chosen as the prime landing area because detailed analyses of slopes from MOLA-based topography, coupled with elevation maps derived from MOC stereo analyses and photoclinometric solutions, showed acceptable slopes. Further, boulder abundance estimates from MOC high-resolution data, detailed mapping of hazards, and consideration of albedo, thermal inertia, and radar scattering characteristics all show that Region B meets landing safety requirements. It has intermediate predicted depth to ice (soil cover several to ~20 cm thickness), and areally extensive smooth plains. Importantly, it also has the lowest altitudes of the three Regions and thus provides considerable EDL safety margin.

Three (150 km by 75 km) boxes within Region B have been chosen for new orbital coverage and detailed site characterization and certification work. The box locations were selected to minimize large-scale hazards and to cover a wide latitudinal range for landing (southerly box maximizes estimated soil cover whereas northerly box maximizes orbital telecommunication coverage during the mission. Middle box provides an intermediate and third location). Because the azimuthal orientation of the landing ellipse shifts with launch date and the length of the long axis changes with latitude, the box size was chosen to encompass all possible ellipse sizes and orientations.

Additional Work: The intent is to continue analyses of data within the three boxes in Region B and to request additional THEMIS, MOC, HRSC, and OMEGA instrument coverage. There are also plans to acquire Mars Reconnaissance Orbiter HiRISE, CTX, and CRISM observations as soon as possible after the spacecraft enters Mars orbit and begins its mapping mission. Analysis of HiRISE data, in particular, will provide the highest spatial resolution coverage of the proposed landing sites and allow us to downselect to one box. The intent is to decide on a final ellipse location by June 2007, to be ready for an August launch.

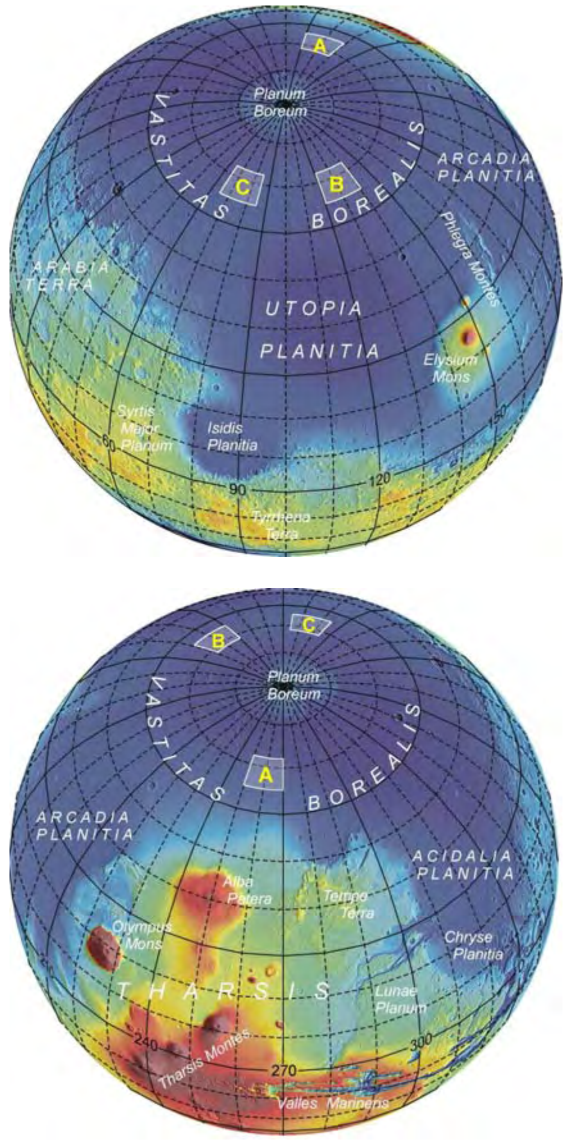

Figure 1. Polar perspective views of MOLA color coded elevations with Regions A, B, C shown. Each Region covers the latitude range from 65 to 72 N. Region A covers 250 to 270, B 120 to 140, and C 65 to 85 degrees E longitude.