CANDIDATE LANDING SITE FOR THE MARS SCIENCE LABORATORY: VERNAL CRATER, S.W. ARABIA TERRA. K. N. Paris[1], C. C. Allen[2], and D. Z. Oehler[2], [1]School of Earth and Space Exploration, Arizona State University Box 871404 Tempe AZ, 85287 (kparis@asu.edu), [2]NASA Johnson Space Center, Houston, TX 77058.

Introduction: In the fall of 2009, the Mars Science Laboratory (MSL) will be launched to Mars. The purpose of this mission is to assess biologic potential and geology and to investigate planetary processes of relevance to past habitability. MSL will be able to provide visual, chemical, radiation, and environmental data with its suite of instruments [1].

In order to be selected for the MSL landing site, certain engineering requirements must be met [1] and the area should contain geologic features suggestive of past habitability, so that the overriding science goal of the mission will be attained.

There are a total of 33 proposed landing sites as of the first MSL Landing Site Workshop held in Pasadena, CA from May 31st to June 2nd, 2006 [1]. There will be an opportunity to gather high resolution visual and hyperspectral data on all proposed landing sites from the now-orbiting Mars Reconnaissance Orbiter (MRO) which entered martian orbit and began its main science phase in November of 2006 [2]. The data being gathered are from: the high resolution imaging science experiment (HiRISE), the context (CTX) camera and the compact reconnaissance imaging spectrometer (CRISM) onboard the spacecraft. The footprints of these instruments are centered on a single point, and each proposer must submit these coordinates, along with the coordinates of the proposed landing ellipse. Data from these instruments, along with new MOC images and THEMIS mosaics, will be used to enhance our understanding of the geologic and engineering parameters of each site.

The purpose of this research is to recommend a landing site in Vernal crater (a name recently suggested by the authors [3]), Arabia Terra [4]. Located at 6ºN 355.5ºE (Figure 1), Vernal crater has a 1º slope stretching from the northwest rim to about halfway through the crater. There is an interesting section of the crater located in the south which is thermally bright in both day and night THEMIS infrared images (it shows up dark in Figure 1 because it is an inverted daytime IR mosaic of msl_24-dayir.jpg [5]).

Upon closer inspection using MOC Narrow Angle images and the new THEMIS IR mosaics, the geology of the crater appears intriguing, in that extensive layering and possible fluvial deposits and erosion suggest a history of fluid (aqueous?) conditions [6]. Between the northwestern and southern parts of the crater, approximately 750 meters of rock are exposed which lie stratigraphically below the section explored by the MER-B rover in Meridiani [7]. Much of the exposure may have been caused by wind erosion, which is particularly evident in the northern half of the crater. Work is continuing to determine the relative influence of fluvial erosion and/or original depositional features in the southern portion.

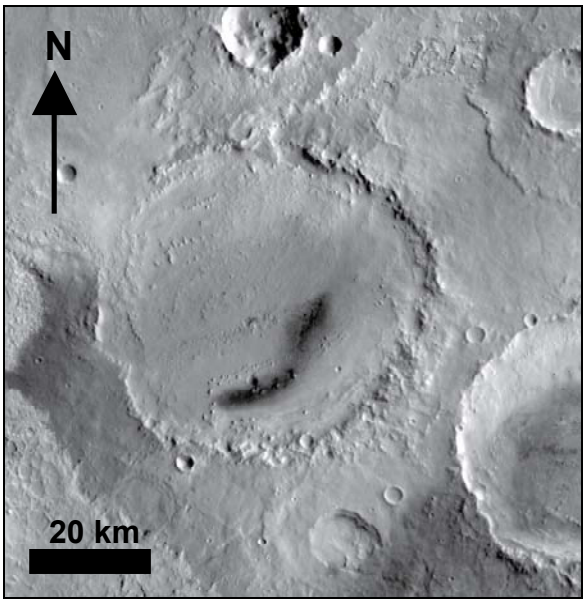

Figure 1: Inverted daytime IR mosaic [4] of Vernal crater.

Methods: MOC, THEMIS VIS and THEMIS IR images were used for distinguishing units. Using the Mars DVD for ArcGIS (provided by Trent Hare of USGS, Flagstaff AZ) in conjunction with the nighttime mosaic and visual images, relationships could be derived between visual and infrared data.

Visible Images. MOC and THEMIS VIS take images in several bands of the visible part of the spectrum at about 1.5-12 and 19 meters/pixel, respectively [7, 8].

Infrared Images. The IR subsystem on THEMIS takes images in the infrared wavelengths with a resolution of about 100 meters per pixel [8].

Results: Using the thermal and visual data available to date, Vernal crater has been divided into 7 geologic units, all of which would be accessible via rover (Figure 2).

Centerpoints for the proposed landing ellipse and MRO data (HiRISE, CRISM, and CTX) were submitted (Figure 3). The MRO footprints all share a common centerpoint, which was chosen to maximize information on the geology of the crater, rather than the landing ellipse.

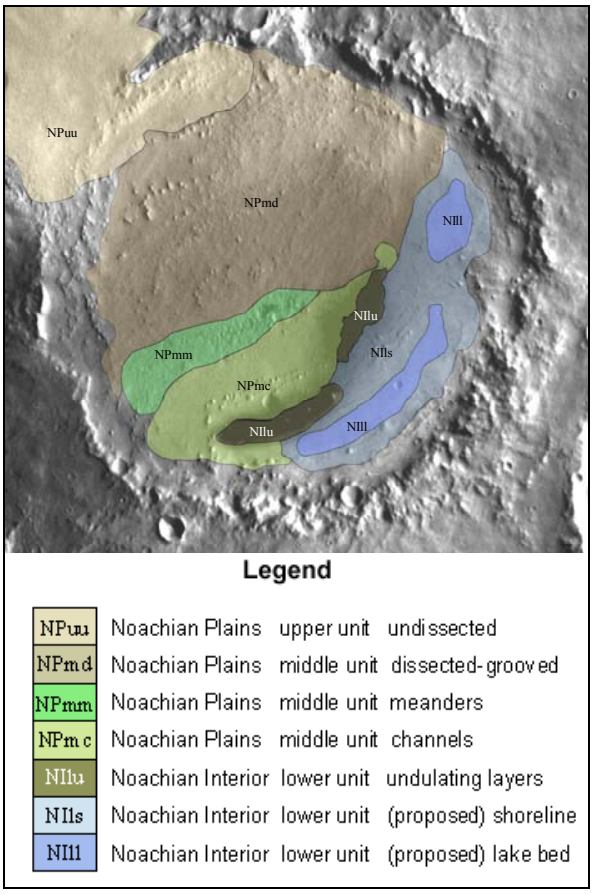

Figure 2: Geologic map and legend of Vernal crater.

Discussion: The geologic/geomorphic units of this crater were mapped using daytime and nighttime IR response, topography, and differences in erosional style. What makes Vernal crater different from other craters in SW Arabia Terra is a gentle slope extending from an elevation of about -1300 m in the northwest to about -2000 m in the southeast. This slope provides easy access to the exposed layers within the slope itself and to the layers that make up the walls of Vernal crater.

The geologic units of Vernal crater (Fig. 2) range from mainly aeolian features in the northwest (NPuu and NPmd) to an undulating, (possibly aqueous) layered unit near the center (NIlu), and possible remnants of lake deposits in the southeast (NIll). If there was once water present in the crater, the high southeast rim may have provided some protection and kept the water from evaporating/subliming [6]. The units in the southeast are believed to be the oldest exposed units within the crater, possibly representing extended periods of aqueous conditions [6, 7].

The new MRO data will provide additional insight into the geomorphology and chemistry of these units and thus should allow us to refine the geologic map and our understanding of the history of Vernal crater.

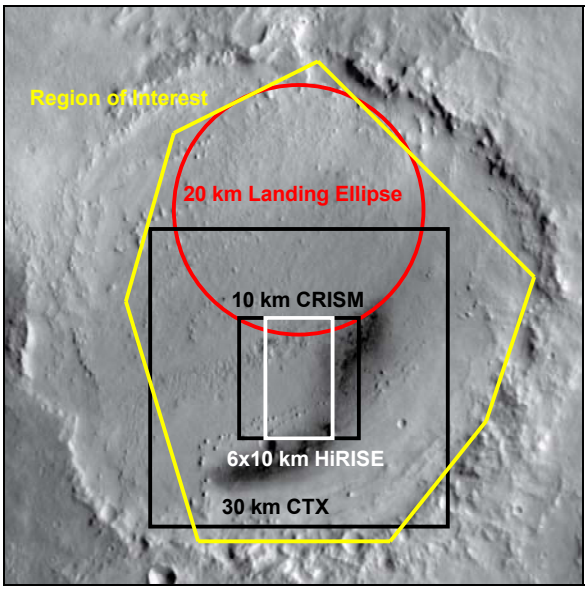

Figure 3: Inverted daytime IR image overlain with requested centerpoints for the landing ellipse and MRO instrument footprints, and a region of interest.

Conclusions: Vernal crater includes a variety of geologic features that can be studied in one general location; some of these features are suggestive of past aqueous activity [6], and these could provide new insights into questions of past habitability. The crater is unique in that it has a gentle slope from the northwestern rim to the topographic low in the south that would allow access to the MSL rover of all of the exposed, crater-filling units. Many craters in Arabia Terra have similar layered deposits [7], but the ease of accessibility to the layers in Vernal crater make it a prime choice for studying past habitability on Mars.

References: [1] Grant J. and Golombek M. (2006) *MSL Landing Site Workshop,* May 31st-June 2nd Pasadena, CA. [2] http://mars.jpl.nasa.gov/mro/mission. [3] The name, Vernal, has recently been approved by the IAU WGPSN. [4] Allen C.C. (2006) *Mars Landing Site Workshop,* May 31st-June 2nd Pasadena, CA. [5] Christensen, P.R. *et al.*. *THEMIS Public Data Releases*, Az. State Univ., http://themis-data.asu.edu. [6] Oehler, D.Z. *et al.* (2007) *LPSC XXXVIII* Abs. #1057. [7] Edgett K. (2005) *Mars* 1, 5-58. [8] Christensen P. (2004) *Space Science Reviews* 110, 85-130.