

## THEMIS characterization of the MER Gusev crater landing site

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[1] Gusev crater, previously interpreted as the depocenter for the Gusev-Ma'adim Vallis fluvio-lacustrine system, is a proposed landing site for one of the Mars Exploration Rovers (MER). Here we use new remote-sensing data from the Thermal Emission Imaging System (THEMIS) supplemented by data from the Thermal Emission Spectrometer (TES), Mars Orbiter Camera (MOC), and Mars Orbiter Laser Altimeter (MOLA) to characterize the geology of Gusev crater. Thermal infrared data from THEMIS and TES were used to map thermophysical units on the basis of relative albedos and diurnal temperature variations. THEMIS and MOC visible images were used to map unit morphologies and to estimate crater density ages. MOLA data were used to identify unit contacts and stratigraphic relationships. Various data were then combined to construct a new surface unit map and stratigraphy for units on the floor of Gusev. Seven surface units were identified in Gusev, mostly Hesperian in age, but with two showing evidence of later modification and redistribution. Five or more surface units and layering are present within the MER-A landing ellipse, attesting to the geologic diversity of this site. Surface units show features that could be consistent with fluvio-lacustrine, aeolian, and/or volcanoclastic deposition, but the spatial resolution of visible/infrared data does not allow for the identification of unambiguous volcanic or fluvio-lacustrine textures. However, a MER landing in Gusev may provide the opportunity to analyze multiple units, distinguish rock types, examine stratigraphic relationships, and shed light on the ancient depositional environment.

*INDEX TERMS:* 5464 Planetology: Solid Surface Planets: Remote sensing; 5470 Planetology: Solid Surface Planets: Surface materials and properties; 5494 Planetology: Solid Surface Planets: Instruments and techniques; 5415 Planetology: Solid Surface Planets: Erosion and weathering; 5460 Planetology: Solid Surface Planets: Physical properties of materials; *KEYWORDS:* THEMIS, Gusev crater, thermal infrared, MER, Mars Exploration Rover, landing site

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### 1. Introduction

[2] The focus of the Mars Exploration Program is the search for water, with the goal of identifying regions having the highest probability of capturing and preserving biomarkers. As a part of this program, two rovers are set to launch toward Mars in 2003 with early 2004 landings. Each Mars Exploration Rover (MER) will carry the Athena science package [see *Squyres et al.*, 2003] with instruments suitable for gathering evidence of ancient water on Mars. Each MER site has been evaluated for evidence of past water and the relatively low probability of hazards posed during landing. Prior to final landing site selection and mission operations, it is crucial that all available data sets

from Mars orbiting spacecraft be analyzed to ascertain the potential scientific return of each site.

[3] Gusev crater is a ~160 km-diameter complex impact structure (Figure 1), centered at 14.64°S 175.36°E, within the Aeolis Quadrangle of Mars (USGS M 5M-15/202 RN, 1984). The location of Gusev at the terminus of the 900 km-long Ma'adim Vallis and geomorphic features within both landforms have led several researchers [*Schneeberger*, 1989; *Cabrol et al.*, 1993, 1998; *Grin et al.*, 1994; *Grin and Cabrol*, 1997a] to propose Gusev as a lacustrine depocenter for the Ma'adim Vallis drainage system. Interpretations by previous authors that are consistent with this hypothesis include: multiple terrace levels within Ma'adim Vallis [*Cabrol et al.*, 1994], evidence of stream migration [*Cabrol et al.*, 1997], debris lobes or "deltaic" deposits at the mouth of Ma'adim [*Schneeberger*, 1989; *Grin et al.*, 1997a; *Grin and Cabrol*, 1997b], and curvilinear ridges