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ABSTRACT SUBMISSION FORM

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Title of the Paper One-meter DTMs of the Mars Science Laboratory candidate landing sites: A major topographic dataset and a unique opportunity for quality assessment
Author(s) [1] R.L. Kirk[1] (WG IV/7 Planetary Mapping and Databases), E. Howington-Kraus[1], D. Galuszka[1], B. Redding[1], J. Antonsen[1], K. Coker[1], E. Foster[1], M. Hopkins[1], A. Licht[1], A. Fennema[2], F. Calef III[3], S. Nuti[3], T.J. Parker[3], and M.P. Golombek[3]. [1]Astrogeology Science Center, U.S. Geological Survey, 2255 N. Gemini Dr., Flagstaff AZ 86001, [2]Lunar and Planetary Lab., Univ. of Arizona, Tucson, AZ 85721, [3]Jet Propulsion Lab., Pasadena, CA 91109.
Corresponding Author [2] Randolph L. Kirk, rkirk@usgs.gov, Ph. +1-928-556-7020, Fax +1-928-556-7014.
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ABSTRACT(more than 300 words) [5]

The Astrogeology Science Center of the USGS has been tasked with conducting topographic mapping to assess the safety of candidate landing sites for every successful Mars surface mission (and none of the unsuccessful ones). The volume of data analyzed for this purpose has grown exponentially with each new mission, from $3x10^4$ posts (interpolated from ~1000 actual contour points) for Mars Pathfinder to $3x10^9$ posts for the Mars Science Laboratory (MSL, to be launched in late 2011). To support MSL site selection, we have used the methods described by Kirk et al. (*JGR, 113*, E00A24, 2008) to produce 1 m/post DTMs of the candidate sites from ~25 cm/pixel Mars Reconnaissance Orbiter HiRISE stereopairs. A total of 26 such DTMs provide 75-96% complete coverage of the 20x25 km landing ellipses for the final four candidate sites (Eberswalde, Gale, and Holden craters and Mawrth Vallis) plus partial coverage of the nearby science targets to which MSL might drive if these landing sites were selected. The number of data points in these DTMs, produced over the past three years, is more than 4 times that of the Mars Orbiter Laser Altimeter (MOLA) global dataset. Our mapping shows that rover-scale slopes at the sites range from slightly to 2x rougher than the Mars Exploration Rover "Spirit" site in Gusev crater, but fall well within the safety criteria for MSL to land.

The large set of partly overlapping HiRISE stereo DTMs in the MSL sites also provides a unique opportunity to evaluate the accuracy and precision of our stereo mapping (most scientific applications of HiRISE topography require only a single, isolated stereopair). Our DTMs were individually controlled to the MOLA global dataset by manual tiepointing as they were produced. Once all DTMs were completed, they were adjusted horizontally by manual tiepointing to one another and to Mars Express HRSC orthoimages (themselves controlled to MOLA), then adjusted vertically by least-squares fitting to one another and to the HRSC-derived DTM for each site. From these *post hoc* adjustments we conclude that our original adjustments to MOLA had an accuracy of 50-100 m horizontally, ≤20 m vertically, and ~1 mRad (0.05°) in tilt. Comparison of overlapping HiRISE DTMs indicates that their vertical precision is ~ 0.1–0.4 m, varying somewhat with image texture. These accuracy and precision values are entirely consistent with the early estimates published by Kirk et al. (2008). We also compared the HRSC DTM data with smoothed HiRISE data to assess the resolution and precision of the former. A 50 m/post HRSC DTM was best matched by HiRISE data smoothed with a 750 m boxcar filter, with a RMS residual of 12.5 m (1 pixel) in areas with strong image texture. In areas with less texture, the RMS residuals are larger but the best-fit smoothing is the same even though the HRSC DTM appears to have been filled by interpolation over distances as large as several kilometers.

Please refer to overleaf for details.

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