# THE HIGH RESOLUTION STEREO CAMERA (HRSC): A TOOL FOR LANDING SITE SELECTION.

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**Introduction:** The High Resolution Stereo Camera (HRSC) [1] onboard ESA`s Mars Express (MEX) mission is a multiple line scanner which acquires 5 stereo channels and 4 colors. One of its goals is to map Mars globally. Until March 2006, 30% of the surface have been covered with a resolution of better than 20 m. HRSC data are unique since a single image covers very large areas (typically in the order of $10^4$ km$^2$; sometimes up to $10^5$ km$^2$) in high resolution (Tab. 1), and they provide quantitative 3D information about the surface. We will demonstrate these properties, which allow for a straightforward combination of HRSC with any other imaging or topographic data set, for a proposed landing site in Valles Marineris.

**Topography:** The biggest asset that HRSC provides to landing site selection is the stereo capability [2,3]. The resolution of the stereo channels is 10-40 m/pixel, and derived Digital Elevation Models (DEM) have a grid spacing of 50-100 m (Fig. 1). In comparison, the distance between single Mars Orbiter Laser Altimeter (MOLA) shots, which have very high vertical accuracy, is 330 m along track and up to several kilometres across track at lower latitudes. The combination of the global MOLA geodetic reference frame with laterally higher-resolution HRSC images and DEM yields excellent results. HRSC DEM provide very good information about slopes over long (2-5 km) baselengths, and will also be useful to assess slopes over intermediate (20-40 m) baselengths. Since the swath width of HRSC is ~60 km, the entire size of a landing site ellipse (20 km diameter) can be easily covered by one HRSC image and DEM. This could be of enormous help, since no mosaicking is required, which is usually affected by different illumination and atmospheric conditions such as dust or clouds).

**Table 1.** Comparison between HRSC and other imaging instruments with high spatial resolution. Grey shading: Mars Reconnaissance Orbiter (MRO).

| Instrument | Spatial resolution | Swath width |
|---|---|---|
| HRSC | ~11-20 m/pixel | ~60 km (@periapsis) |
| MOC | ~few meters/px (*cPROTO* <1m/px) | typically 3 km |
| THEMIS-VIS | 19 m/px or 38 m/px | 20 km |
| (THEMIS-IR) | ~100 m/px | 32 km |
| HiRISE | 30 cm/px | >6 km (red) >1.2 km (b/g/near-IR) |
| Context Imager | 6-8 m/px | 40 km |
| CRISM | 18 m/px | ~20 km |

**HRSC as a "Bridge":** Very high-resolution Mars Orbiter Camera (MOC) images (few meters/pixel) can easily be combined with HRSC images and DEM. It will equally be possible to combine HRSC with the upcoming HiRISE images (~30 cm/pixel) as well as with data from the Context Imager, both on NASA`s MRO mission. In contrast, the very large difference in spatial resolution between the MOC and MOLA data makes their combination much more problematic. It will be particularly useful to combine HiRISE images and HRSC DEM (HiRISE will also produce DEM, but the spatial coverage will be limited). Therefore, HRSC images and DEM can serve as a bridge between lower- and higher-resolution data. Mineralogical information from spectrometers like OMEGA (MEX) and CRISM (MRO) might be crucial for the MSL landing site selection. HRSC images are already used in close cooperation between the HRSC and OMEGA teams to provide morphologic context for geological interpretation. While other images (Viking, MOC, and THEMIS-VIS) can also be used, HRSC images are particularly useful as a bridge to mineralogy due to their large areal extent and color information. Finally, HRSC data can be processed into spectacular perspective 3D-views that proved to be very appealing to non-scientists and media: HRSC is a bridge to the public.

**Outlook:** HRSC data might be a very useful component among the various data sets that will constitute the basis for landing site selection. We propose that HRSC be involved in MSL landing site selection from the beginning, which would enable us to cover as many proposed landing sites as possible with single HRSC images during the MEX Extended Mission(s).

**References:** [1] Neukum et al., ESA SP-1240, 17-35, 2004. [2] Scholten et al., *PE&RS* **71**(10), 1143-1152, 2005. [3] Gwinner et al., *PFG* **5**, 387-394, 2005.

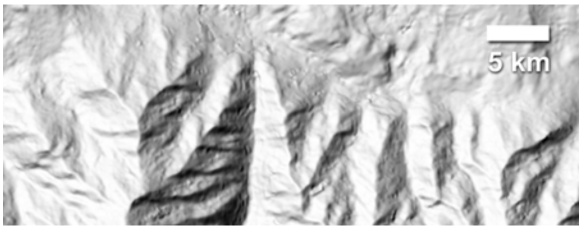


**Figure 1.** Shaded HRSC DEM (part of Valles Marineris at 1.5°S/284.5°E). Note the high accuracy in this near-equatorial area, where MOLA across-track spacing may be several kilometres (North is up).