Want good topography? Consider HRSC!

High Resolution Stereo Camera: A tool for landing site selection

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Overview

HRSC: overview and data products

HRSC: a “bridge” to landing sites

Examples and outlook
How does HRSC work?
## Comparison to other surface data

<table>
<thead>
<tr>
<th>Camera</th>
<th>Resolution</th>
<th>Swath width</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HRSC</strong></td>
<td>~11-12 m/pixel</td>
<td>~60 km [complete landing ellipse plus “to go“ area]</td>
</tr>
<tr>
<td><strong>MOC</strong></td>
<td>~few meters/pixel</td>
<td>~3 km</td>
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<tr>
<td></td>
<td><em>cPROTO</em> (&quot;compensated Pitch and Roll Targeted Observation,)&lt;1m/pixel</td>
<td></td>
</tr>
<tr>
<td><strong>THEMIS-VIS</strong></td>
<td>19 m/pixel or 38 m/pixel</td>
<td>~20 km</td>
</tr>
<tr>
<td><strong>HiRISE</strong></td>
<td>30 cm/pixel</td>
<td>&gt;6 km <em>(red)</em></td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt;1.2 km <em>(b/g/ near-IR)</em></td>
</tr>
<tr>
<td><strong>Context Imager MRO</strong></td>
<td>8 m/pixel</td>
<td>40 km</td>
</tr>
<tr>
<td><strong>CRISM</strong></td>
<td>18 m/pixel</td>
<td>~25 km</td>
</tr>
</tbody>
</table>
Topographic profiles

[Image of Martian terrain with labeled scarps and graphs showing elevation profiles]

- HRSC
- MOLA

Distance [km]

Elevation [m]

- -10000
- -9000
- -8000
- -7000
- -6000
- -5000
- -4000

slope

scarp

slope
Comparison HRSC - MOLA
Valles Marineris/Hebes Chasma

MOLA shaded DEM (cell size 463 m/px)
Valles Marineris/Hebes Chasma

HRSC shaded DEM (cell size 50 m/px)
Valles Marineris/Hebes Chasma

shaded & colour-coded DEM
Valles Marineris/Hebes Chasma

application: layer geometry (strike and dip)

Valles Marineris/Hebes Chasma

slope map (e.g., landing sites)
Melas Chasma

slope map > 15°
Melas Chasma

slope map > 15° over shaded DEM

50 km
Melas Chasma

slope map > 15° over shaded DEM

20 km

50 km

N
Surface roughness by HRSC photometry

- USE OF LEVEL 4 HRSC products (orthorectification, DTMs, registration procedures)
- Orbital information reveals significant variations of the surface physical properties, consistent with the in situ observations (Gusev floor / Columbia Hills) → Johnson et al., 2006; Arvidson et al., 2006; Squyres et al., 2006):

courtesy of Patrick Pinet (Toulouse)
MOLA pulse width

**slope correction with HRSC DEM**

- MOLA pulse width correlates with surface roughness
- analysis requires correction for slopes
- MOLA footprint diameter is ~150 m → correction with smaller-scale slopes from HRSC DEM might provide more accurate results
Coverage and Former Landing Sites
Constraints on Landing Sites

±60° latitude and < 2 km (MOLA)
HRSC Coverage up to orbit 2841
Combination HRSC elevation – MOC images

• a bridge to higher-resolution data
Combination MOLA elevation – HRSC images

- MOLA
Combination MOLA elevation – HRSC images

- MOLA
- HRSC

*a bridge to lower-resolution data*
HRSC: a useful base map

Combination MOLA – HRSC - MOC
Detection of sulfate minerals by OMEGA spectrometer
(Gendrin et al., Science, 2005)
OMEGA mineral classification on HRSC 3D-view

• bridge to mineralogy

spectral data analysis by Aline Gendrin
Again: HRSC is a good data set for a base map.
The „show“ factor (public relations)

- a bridge to the public

shown at ESA Press conference for context of OMEGA findings (sulfates); Nov. 2005
Examples: Crater paleolakes and fans or deltas

from Hauber et al., LPSC (2005)
Drive down the stratigraphic sequence!

- have gravity on your side!
- avoid topographic steps associated with layer outcrops

MOC

1 km
Specific HRSC Data Products for Landing Site Selection and Characterization

- By request:
  - specially processed high-resolution DTMs
  - Map-projected photometric and color data
  - Anaglyphs
  - ........
Distribution of MEX periapsis positions

planned coverage for Becquerel crater

there is often no second chance!
Summary

• HRSC has very good local to regional topography, high-res color orthoimages, and large coverage (full MSL landing ellipse in one HRSC image!), and it can also be

• a bridge to lower-resolution data
• a bridge to higher-resolution imaging data
• a bridge to the public

Outlook

• HRSC should actively take part in MSL landing site selection process from the beginning
• We are ready for suggestions to observe possible MSL and ExoMars sites – just let us know!
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