AOGS 2005

USGS Topomapping with Mars Express HRSC and SRC Images

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Since the beginning of Mars Express operations in January, 2004 the role of the U.S. Geological Survey (USGS), Flagstaff, in the HRSC experiment has broadened from providing guidance on Mars cartographic standards and control nets to developing an independent approach to photogrammetric processing of the image data. The approach chosen was to write software to ingest Level 2 (radiometrically calibrated, geometrically raw) HRSC and SRC images into the USGS in-house planetary cartography software system (ISIS) and from there into the commercial photogrammetric software SOCET SET (© BAE Systems) used by the USGS, as well as sensor models for the two cameras in the ISIS system. The techniques used were previously developed by the USGS for photogrammetry and cartography with images from the Mars Global Surveyor Mars Orbiter Camera (MOC) [1] and other cameras. This approach to HRSC/SRC processing offers numerous benefits.

1) It provides a check on the VICAR processing used at the DLR and elsewhere.
2) It prepares the USGS to undertake systematic processing of the images, if desired.
3) It allows the many researchers who use ISIS to work with HRSC data. A subset of these users also has SOCET SET and can perform stereo processing as well.
4) It permits the unique ISIS capabilities for photometric modeling/correction and refinement of DTMs to 1-pixel resolution by photoclinometry [2] to be applied.
5) It allows for production of high-quality DTMs even from images containing areas of low texture by using SOCET SET tools for interactive DTM editing.
6) It allows very high resolution DTMs to be produced by combining SRC frames with scanner images of comparable resolution from MOC, because SOCET SET allows images from multiple sensors to be combined at all stages of processing.

The capabilities for ISIS cartographic processing and SOCET SET DTM production with HRSC and SRC-MOC stereopairs have been demonstrated, and photometric/photoclinometric modeling using the stereo as a constraint [2] is currently underway.

Keywords: Mars; Mars Express; topography; photogrammetry; cartography; stereo; photoclinometry; shape-from-shading

References

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