Optical Depth Retrievals with the HRSC on Mars Express

N. M. Hoekzema, *(hoekzema@linmpi.mpg.de)*, **W. J. Markiewicz, H. U. Keller**, *Max-Planck-Institute for Aeronomy, Katlenburg-Lindau, Germany.*

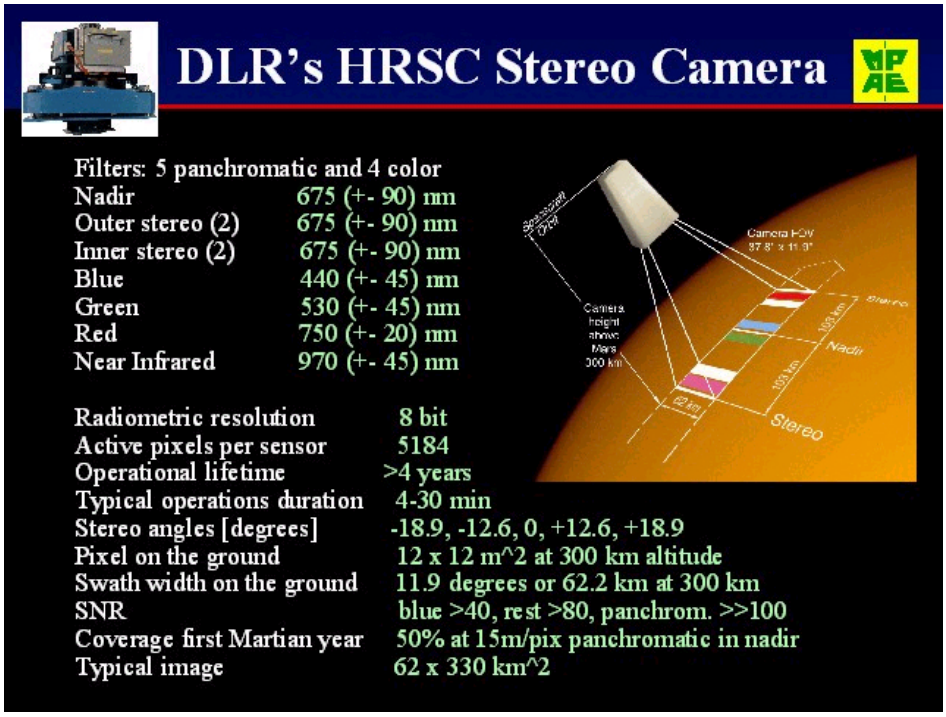

Figure 1: Basic information on the High Resolution Stereo Camera

Introduction:

The European satellite Mars Express is scheduled for launch in June 2003. If all goes well it will enter Martian orbit around Christmas that year and start its actual mission during the next month. One of the instruments onboard of the orbiter is HRSC: the High Resolution Stereo Camera.

HRSC is a scanning camera build by DLR in Berlin. It has nine line CCDs of 5184 pixels each, which are mounted in parallel in the focal plane of a telescope with a focal length of 1.75 meter. It can almost simultaneously observe in five-angle stereo and in five colors between blue and near-infrared. Figure 1 offers more details. The camera must map most of Mars, in stereo, with a horizontal and a vertical resolution of 10—30 meters.

HRSC images can be used to map the optical depth of the Martian atmosphere. We present two methods to retrieve optical depths from the images: the *shadow-method* and the *stereo-method*.

Shadow-Method:

The shadow-method estimates optical depths from the differences in intensity between sunlit and shaded regions in an image. Such differences offer information about the ratio between direct and diffuse illumination onto the surface. This ratio is a measure for the optical depth of the atmosphere.

We tested the shadow-method on images taken by the Viking Orbiters of regions close to the Viking Lander sites; for these sites almost co-temporal in-situ measurements by the Viking Landers were available. Comparison with Lander data indicates that the shadow-method retrievals typically have an accuracy of 10% or better.

Stereo-Method:

The stereo-method uses the stereo capabilities of HRSC. The distance through the atmosphere from the surface to the camera is smaller for the nadir image than for the forward and backward looking images. Therefore, the nadir image will show the smallest optical depth. Presuming that the surface displays a much higher contrast than the atmosphere above it, the nadir image will have a larger contrast than the forward and backward looking images. The differences in contrast between the various images allow retrieval of the optical depth.

This method will enable optical depth retrievals with an accuracy of better than 0.05, but only if the camera will prove to be optimally calibrated. At this moment there are no data available that allow for testing the accuracy of the HRSC flight model; this will be done once real HRSC images of Mars become available.