AN IMAGE MAP OF THE MARS PATHFINDER LANDING SITE. M. Kuschel, J. Oberst, E. Hauber, and R. Jaumann, DLR-Institute of Space Sensor Technology and Planetary Exploration, Rudower Chaussee 5; D-12489 Berlin, Germany, Juergen.Oberst@dlr.de.

Introduction: On 4 July 1997, the Pathfinder spacecraft landed on Mars near the mouth of the outflow channel Ares Vallis, located in the southern part of Chryse Planitia [1,2]. Between July 4 and September 27, 1997, the Imager for Mars Pathfinder (IMP) returned more than 16,000 single images including five panorama data sets [1,2,3]. Depending on the degree of overlap, approximately 150 images of one filter form a complete monoscopic panorama. Here, we present the results of our efforts to compute a geometrically precise panoramic color image map and an orthoimage map of the landing site from these individual raw images. Printed versions of these maps will be presented at the meeting.

Image Data Processing: 123 images of the *Super Panorama* were used to produce an initial geometrically precise base map; the *Super Panorama* data were used because of their lower data compression and, consequently, more visible image detail. Then, color images from the *Gallery Panorama* were registered to this base map (this was the only panorama without gaps, see [3] for description of the data base).

Unfortunately, the nominal pointing (azimuth and elevation) of the images had systematic errors so that mosaics compiled with these data often suffered from considerable offsets between adjacent images. Also, the exact absolute orientation of the camera system was unknown. Therefore, a sophisticated procedure for pointing data adjustment had to be carried out. Tiepoints were collected between 33 red filter *Super Panorama* images which showed the horizon. Using block adjustment techniques, relative pointing was computed for these images. Subsequently, the images were transformed into a cylindrical map projection with a resolution of 18 pixels per degree, and then mosaicked. Sunrise and sunset images made it possible to obtain the absolute orientation of this horizon mosaic. The precise azimuth and elevation angles of the sun at the Pathfinder landing site were determined using ephemeris data. Horizon markings seen in both the sun images and the panorama helped to find a precise match between the two (see [4] for details).

The absolutely oriented horizon mosaic served as a reference for the adjustment of all remaining panorama images. They were cylindrically map projected one–by–one using their original pointing data and registered to the reference mosaic using manual tiepoint measurements. The full panorama mosaic served as a geometrical basis for all further operations. All red, green and blue filter images of the *Gallery Panorama* were registered to this reference mosaic.

Orthoimage Map: Because of the fixed base length of the IMP camera the stereo interpretation is limited. Distances can be measured reliably within a range of only 2 – 10 m.

49 red filter stereo image pairs of the *Super Panorama* (see above) served as the data basis for the ortho mosaic. 11 stereo pairs of the *Monster Panorama* were added because of gaps.

Right eye images of the *Monster Panorama* were registered to the reference mosaic (*Super Panorama*, see above). Afterwards, all corrected values of azimuth and elevation were copied into the image labels of the second (left) eye of the *Super* and *Monster Panorama*. Digital image correlation methods were used to find large numbers of conjugate points for each stereo image pair. The information of the measured parallaxes was stored in image-formatted files. Great differences of depth, as occurring between relatively near objects and their background, often produced mismatched points. These were removed by manual editing, as far as possible.

Based on the improved pointing data, object points were calculated from the conjugate points, which were stored in image-formatted separate files for X-, Y- and Z-coordinates as well. Range-weighted interpolation between these object points lead to contiguous Digital Elevation Models (DEMs) for each of the stereo image pairs. Combining the X- and Y-coordinates in plan-view with the original image information resulted in the corresponding orthoimages, which then were combined to an orthoimage mosaic.

Due to rounding effects, the transformation of floating point X- and Y-coordinates to integer values (rows and columns) of the ortho-view produced gaps between the pixels, which were filled by interpolation. Thus, hidden areas of the original panorama (e.g. behind rocks) were artificially replaced by grey values as well.

Equal-elevation contour lines in steps of 10 cm were derived from the DEM and superposed on the orthoimage mosaic. The coordinate system used in the map is the *Mars Local Level* (LL) frame. X points to north, Y to east and Z to nadir (downward); the given elevations represent the negative Z-values. The origin of the system is located in the center of the lander base plate.

References: [1] Golombek et al. (1997) Science 278, 1743-1748. [2] Golombek et al. (1999) JGR 104, 8523-8554. [3] Gaddis et al. (1999) JGR 104, 8853-8868. [4] Oberst et al. (1999) JGR 104, 8927-8934.