A NEW VIKING-BASED PRECISE GLOBAL MAP OF MARS. W. Zeitler, G. Niedermaier, J. Oberst, E. Hauber, R. Jaumann, DLR-Institute of Space Sensor Technology and Planetary Exploration, Rudower Chaussee 5, 12489 Berlin, Germany, Wolfgang.Zeitler@dlr.de.

Introduction: We present a new global map of Mars based on images taken by the Viking Orbiters. Precise image position information and camera pointing data, needed to produce this map, were derived from a recent analysis of the Viking control point network [1]. The resulting cartographic product is precisely tied to the Mars-fixed coordinate system with an accuracyof approx. 1-2 km, on average – and does not suffer from the severe geometric offsets of previous planetary cartographic products.

Method: This map was compiled from originally 1138 Viking Orbiter images with resolutions between 900 and 1100 m/pixel. Each of these images was part of the control network analysis which involved the simultaneous determination of Mars-fixed 3-dimensional coordinates for 3739 control points and determination of pointing data for the images using 16711 line/sample measurements of the control points. This new control point network benefitted from recently restored Viking Orbiter trajectories as well as from new rotational parameters of Mars and lander coordinates, derived from Pathfinder tracking data (see [1] for details). As a result of this effort, parameters of the exterior orientation for all the images involved were exactly tied to the Mars-fixed coordinate system.

The raw images were transformed into orthophotos using several processing steps: First, the camera distortion of the Viking image was removed; general image processing techniques were then applied to remove single pixel errors and image noise. Next, images were orthoprojected to a sinusoidal map with a pixel size of 1/64° (925 m near the equator) to match the format of the available USGS cartographic products. The center of the projection was chosen to be at 0° latitude whereas the center longitudes were at 45°, 135°, 225°, and 315° to form four sheets, each covering a range of 90° of longitude, respectively. As the image position and pointing data for each were taken from the results of the global point determination, the resulting map is exactly tied to the accuracy of the control network [1]. The Digital Elevation Model (DEM), needed to compute the orthoimages, was interpolated from the control point coordinates and thus has a grid spacing of 50 km [2]. The fourth step was to process each image by highpass filters to remove large scale variations in image brightness. All projected orthophotos were mosaicked to form the four sheets of the global map. Following visual inspection, some images were manually edited to remove image artifacts (broad stripes of pixel errors, etc.); some others were not included in the mosaik because of severe artifacts. A few remaining gaps in the global coverage (less than approx. 2 % of the surface) were filled with appropriate MDIM images. Finally, latitude/longitude grids were added. In separate versions of the map, the color-coded DEM was used as a background.

Summary and Conclusion: The map is available in a digital- as well as a hardcopy version. It consists of four single sheets, each showing Mars from the north to the south pole and with a range of 90° in longitude. For the hardcopy version (which will be shown at the meeting), a scale of 1:6,500,000 was choosen to fit the format A0. This new map is geometrically precise to within 1-2 km and, in particular, does not suffer from the previously noted severe offsets between Mars-fixed coordinates and cartographic products. One typical application for this improved map would be, e.g. to plot surface reflection tracks of the Mars Orbiter Laser Altimeter (MOLA) onboard Mars Global Surveyor (MGS) for comparison with the image data [3]. This map also should be of great importance for spacecraft navigation in future missions to Mars.

References: [1] Zeitler W. and Oberst J. (1999) *JGR, 104*, 8935-8942. [2] Zeitler W. and Oberst J. (1999) *JGR, in press*. [3] Oberst J. et al. (1999) companion abstract, this meeting.