GEOMETRICALLY PRECISE MAPS AND THEIR APPLICATIONS J. Oberst, W. Zeitler, M. Kuschel, and R. Jaumann, DLR-Institute of Space Sensor Technology and Planetary Exploration, Rudower Chaussee 5, 12489 Berlin, Germany, Juergen.Oberst@dlr.de

Introduction: We re-analyzed the Viking Mars control point network [1], an effort, which resulted in accurate pointing data for a list of 1138 Viking Orbiter images. From these images, which have resolutions between 900-1100 m, we derived maps at local, regional, and global scale tied to the Mars coordinate system with an accuracy of approx. 1-2 km. These maps exceed the geometric precision of previous cartographic products by an order of magnitude (see companion abstract [2]) and therefore constitute important bases for a variety of further geoscientific studies.

Viking Landing Sites: *Viking Lander 1.* Planet-fixed coordinates of landers on the surface of the planet are typically known from tracking of the spacecraft's radio signals. As our map is precisely tied to the Mars-fixed coordinate system, this gives us the chance to predict the line/sample coordinates in images of the landing sites for Viking Lander 1 and 2 (VL1 and VL2). As we reported previously [1], we predicted that VL1 was offset to the east by 4-5 km from the location that was previously adopted after the landing [3], a prediction which was later confirmed when VL1 panoramas were re-analyzed [4].

Viking Lander 2. The spacecraft landed in a vast desert plain which lacked prominent topographic features in the neighborhood. Its location in images was therefore never undisputedly established. Work on the identification of this site in the geometrically precise images is currently under way, using the known Mars-fixed coordinates of this lander as a basis. We expect that recovery of the Viking landing site coordinates in images will be possible to 1-2 km.

MOLA tracks and image data: Our maps are of immediate practical use for geologists. The Mars Orbiter Laser Altimeter (MOLA) onboard Mars Global Surveyor (MGS) has begun collecting altimeter data [5]. The locations of laser reflection points are believed to be accurate to within only meters with respect to the Mars-fixed coordinate system. Unfortunately, present maps of Mars suffer from severe offsets between latitude/longitude grids and the Mars-fixed coordinate system of up to 10-20 km. The location of MOLA tracks with respect to image data is therefore often uncertain (except in the obvious cases that the MOLA track intersects e.g. a crater). Our new map fimly ties MOLA and image data (see Fig. 1) which enables geologists to directly recover heights, slopes, and topographic profiles for features seen in images.

Mars Polar Lander Area Map: Availability of geometrically precise maps is required to direct a spacecraft to some desired landing site seen in images. In order to support the site selection process for the Mars Polar Lander, scheduled to arrive in december 1999, we compiled a basemap of the lander target area near the South Pole. As the images in our network with their limited resolutions do not resolve sufficient detail of the landing area, higher-resolution images were selected and added to our control point network. The resulting regional image map covers an area from 73-78°S, 170-230°W, showing details of 200 m/pixel. This map will be presented at the meeting.

References: [1] Zeitler W. and Oberst J. (1999) JGR, 104, 8935-8942. [2] Zeitler W. et al. (1999) companion abstract, this meeting. [3] Morris, E.C. (1980) Icarus 44, 217-222. [4] Parker, T. (1999) Lunar Planetary Science XXX. [5] Smith et al. (1999) Science 279, 1686-1692.
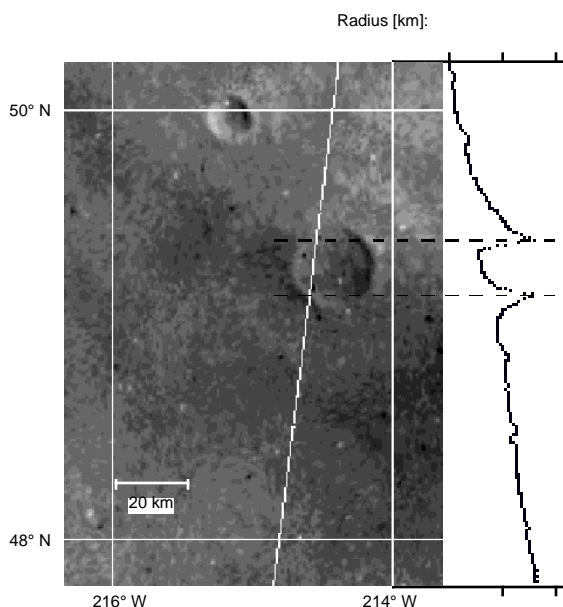

Figure Caption: Prototype map for a small area on the northern hemisphere of Mars (left) computed on the basis of the updated "Viking control point network". A laser altimeter profile across a crater obtained by MOLA (Mars Orbiter Laser Altimeter) from board the Mars Global Surveyor is used to verify the geometric accuracy of this map. The topographic data acquired by MOLA are shown on the right, while the corresponding laser surface reflection points, as given in MOLA experiment ancillary data sets, are plotted on the map. The precise match between instrument and map data, as the MOLA surface track intersects a crater, indicate that the Mars-fixed coordinate system and the map are correctly tied to within the spatial resolution of the map of 1 km.