ABSTRACT

Yoon, Jong-suk Ph.D., Purdue University, December, 2004. Combined Mars Global Surveyor Data Processing for Precise Topographic Mapping. Major Professor: Jie Shan.

Mars control network and topographic mapping have been studied since 1960's to continuously support Mars exploration missions and scientific research. In this thesis, the high-resolution stereo images and laser altimetry data collected in the Mars Global Surveyor mission are combined and processed in a rigorous mathematical model to produce precise control network, digital elevation model and orthoimage. The comprehensive evaluation reveals a considerable registration offset between the laser altimetry data and the high-resolution images. To correct this mis-registration, a bundle adjustment combining the laser altimetry ranges and high resolution images as well as orbital trajectory data is implemented under a rigorous mathematical model. In this way, the image orientation is refined and can be used for precise topographic mapping. This study provides a comprehensive evaluation and estimation on the quality of the bundle adjustment. A sufficient number of corresponding points are collected through image matching and their precise 3-D ground locations are determined with the refined image orientation to generate digital elevation model and orthoimage. Presented in this thesis are results for three of the selected candidate landing sites for the 2003 Mars Exploration Rover missions.