

Dawn Virtual Vesta: Topographic Stereo Mapping Using Simulated FC Data

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The initial exploration of any planetary object requires a careful mission design guided by our knowledge of that object as gained by terrestrial observers. This process is very evident in the development of the Dawn mission to the minor planets 1 Ceres and 4 Vesta. This mission was designed to verify the basaltic nature of Vesta, to explore its geologic evolution and determine Vesta's size and shape. The estimation of Vesta's topography is crucial for understanding its surface processes and geological evolution and therefore photogrammetric stereo processing of simulated Dawn FC (Framing Camera) data (Virtual Vesta) has been performed to constrain topographic accuracies and to optimize the observation scenario as well. The stereo-photogrammetric derivation of a digital terrain model (DTM) followed algorithms and software realizations used extensively on previous planetary image data sets (Scholten et al., 2005; Gwinner et al., 2009). The Virtual Vesta dataset consists of simulated observations of Vesta for the Survey & High Altitude Mapping Orbits (HAMO), based on the current mission image acquisition strategy, including S/C trajectory and camera orientation. The simulated Vesta surface is based on the HST-derived global shape by Thomas 1997, 2005, with the addition of craters with diameter range of 0.4 - 100 km and surface perturbations at wavelengths from few 100 m to 10s of km. The resolution of the Vesta model is 10 m/pixel with a height accuracy of ~1 m, 1-sigma. The simulated trajectory and camera orientation data contain errors whose magnitude is consistent with what is expected at a post-processing stage; 1 FC pixel 1-sigma, random orientation error per image, and correlated position errors that range from a few km in Survey to few 100 m in HAMO. The Survey dataset consists of 507 images (250m/pxl mean resolution) and the HAMO dataset 2,005 images (60 m/pxl mean resolution) respectively. For both datasets, DTMs with sub-pixel accuracy can be derived with a grid spacing of 500m/pix for Survey and 125m/pxl for HAMO as well.