ASPECTS OF VOYAGER PHOTOGRAMMETRY

In January 1986, Voyager 2 took a series of pictures of Uranus and its satellites with the Imaging Science System (ISS) on board the spacecraft (Smith et al., 1986). Based on six stereo-images from the ISS narrow-angle camera, a topographic map was compiled of the southern hemisphere of Miranda, one of Uranus' moons (Fig. 1). Assuming a spherical figure, a 20-km surface relief is shown on the map. The images used were FSC268-4611, -4614, -1617, -4626, and -4629. With three additional images (FSC268-4409, -4413, and -4630) from the ISS wide-angle camera, a control network of Miranda's southern hemisphere was established by analytical photogrammetry, producing 88 ground points for the control of multiple-model compilation on the AS-11AM analytical stereoplottter.

The calibrated focal lengths of the wide-angle and narrow-angle cameras on board the spacecraft are, respectively, 200.77 mm and 1,503.49 mm (Davies et al., 1979). Each frame of the two cameras consists of 800 x 800 image elements with a pixel size of 14 µm. Both cameras have a grid of 202 reseau marks. Calibration of reseau coordinates has an accuracy of better than 2 µm (Benesh and Jepsen, 1978). Residuals of images produced from the Optronics Photowrite range from 8 to 17 µm. Decalibration was made by the U.S. Geological Survey image-processing facility in Flagstaff, using reseau calibration data. For the control network, coordinate measurements were further corrected by a second-degree polynomial. Residuals of measurements were then reduced to 6 to 8 µm, about half an image element. Images used for map compilation were obtained at altitudes ranging from 30,000 to 42,000 km. Control-network adjustment has a precision of about 375 m.

Digital terrain data from the topographic map of Miranda have also been produced. By combining these data and the image data from the Voyager 2 mission, perspective views or even a movie of the mapped area can be made.

The application of these newly developed techniques to Voyager 1 imagery, which includes a few overlapping pictures of Io and Ganymede, enables the compilation of contour maps or topographic profiles of these bodies on the analytical stereoplotters.

References
Figure 1. Topographic map of the southern hemisphere of Miranda, one of Uranus' satellites. Compilation scale is 1:1 million and contour interval is 1,000 m. The projection is Polar Stereographic.