GALILEO GLOBAL COLOR MOSAICS OF IO. T. Becker, P. Geissler, Astrogeology Team, U.S. Geological Survey, 2255 N. Gemini Drive, Flagstaff, AZ (tbecker@usgs.gov).

Introduction: A major goal of the Galileo Solid-State Imaging experiment (SSI) at Io was accomplished late in the mission by acquiring color coverage of the entire satellite surface at a consistent phase angle. Consistent phase angle coverage is critical to understanding Io's surface coloration because of the marked photometric variations exhibited by the satellite [1, 2, 3]. Io's appearance alters drastically with phase angle due to the distinct scattering behavior of diverse surface units such as coarse-grained ices and fine-grained frosts. The GLOCOL01 sequence recorded during orbit I31 completed longitudinal coverage at an optimum phase angle near 4 degrees, low enough to reveal subtle color variations with minimal topographic influences but high enough to exclude the opposition surge. To date, these data have yet to be incorporated into a global mosaic that shows the full range and complexity of Io's coloration. An accurate color mosaic of Io will be put to a number of immediate applications for both scientific and education/outreach purposes. U. S. Geological Survey Astrogeology Program plans to construct three global color mosaic products of Io.

Background: The previous best effort at creating a global color mosaic of Io [4] was forced to make several compromises due to inadequacies of the then-available data. First and foremost, this work had to include a mixture of phase angles ranging from 4 to 14 degrees, adjusting the brightness and contrast of images taken at some phase angles to fit the others. This procedure introduced uncertainties into the results that were difficult to quantify. Second, the highest resolution color data (acquired later, during orbit C21) was not yet available at the time that study was undertaken. Third, the geometry of the color images was corrected only approximately, since a global Galileo control net had not yet been established.

Global Cartographic Control: Geodetic control efforts of Io were performed by USGS [5] resulting in updated radii and camera pointing for a large number of Galileo SSI, Voyager I and II images. The generation of a monochrome global mosaic based on the final solution is complete. This product was constructed using the global coverage of the best moderate resolution data acquired by Galileo SSI and high-resolution data from the Voyager II mission.

Products: Processing of the color data will be performed using ISIS software [6, 7, 8] and will follow procedures established by Geissler et al. [4] and others during the Galileo mission. The Galileo SSI 756 nm, GRN and VIO images from orbits G2, C9, C21 and I31 will be used initially. These images were all acquired at phase angles ranging from 3.5 to 4.5 degrees, ensuring consistent colors across the globe (in contrast to previous efforts that had to settle for mixtures of 4 and 14 degree phase data). This data set includes the high-resolution (1.3 km/pixel) color data from orbit C21 that was not included in the mosaic of Geissler et al. (1999). The data set includes two areas of poor coverage: longitudes 250º W to 270º W, which appear near the limb in these images and are therefore highly foreshortened, and the Jupiter-facing hemisphere that is covered by relatively low resolution (19.6 km/pixel) images from orbit I31. This product will provide a sound scientific basis for understanding Io's global color variations and for making comparisons of hemispheric color differences. However, it will be subject to the spatial resolution limitations and geometric distortions. Nonetheless, this product will provide our best estimate of Io's global color properties and will form the scientific basis for additional higher quality products.

We can improve the detail and aesthetics of the mosaic by incorporating higher resolution data, using the uniform phase angle product as a basis to perform brightness and contrast corrections. Our next task will be to produce a second color mosaic made up of the best quality Galileo color image data, cosmetically corrected and normalized to 4 degrees phase. Color and brightness corrections will be computed by least-squares regression in the areas of overlap between the individual higher resolution images and the uniform phase angle mosaic constructed during step one. This second mosaic will represent our best understanding of Io's appearance as pictured during the Galileo Mission.

Finally, we will merge this best-quality color mosaic with the existing monochrome mosaic. The monochrome mosaic highlights topographic and morphological information and will be greatly enhanced by adding the dimension of color.

Summary: An accurate color mosaic of Io will be put to a number of immediate applications for both scientific and education/outreach purposes. Color information is essential for geologic mapping [9, 10] to delimit compositional boundaries and to identify diffuse volcanic plume deposits which are frequently more evident in one Galileo SSI filter than in others. Color data are needed for volcanology, to distinguish silicate lava flows from suspected sulfur flows, for example, and to tell fresh (black) lava flows from altered or partially buried flows. Color information will assist ongoing efforts to catalog specific features on Io such as paterae [11] and mountains [12, 13] helping to clarify whether observed brightness variations are caused by topography or composition. A high-quality color mosaic will benefit efforts to define Io's nomenclature by allowing us to pin down the precise locations of features.

The final products will be made available on a USGS website and be distributed via the Planetary Data System archive.

References: [1] Simonelli et al. (1997), *Geophysical Research Letters* 24, 2475-2478. [2] Simonelli et al. (2001), *JGR*, 106, 33241-33252. [3] Geissler et al. (2001), *JGR*, 106, 33253-33266. [4] Geissler et al. (1999), *Icarus* 140, 265-282. [5] Archinal et al. (2001), *LPS XXXII*, Abstract #1746. [6] Torson et al. (1997), *LPS XXVIII*, Abstract #1443. [7] Eliason, (1997), *LPS XXVIII*, Abstract #331. [8] Gaddis et al. (1997), *LPS XXVIII*, Abstract #387. [9] Williams et al. (2002), *JGR*, 107, 6-1. [10] Williams et al. (2004), *Icarus* 169, 80-97. [11] Radebaugh et al. (2001), *JGR*, 106, 33005-33020. [12] Schenk et al. (2001), *JGR*, 106, 33201-33222. [13] Turtle et al. (2001) *JGR*, 331750-33200.