FINAL DIGITAL GLOBAL MAPS OF GANYMEDE, EUROPA, AND CALLISTO. T. Becker[1], B. Archinal[1], T. Colvin[2], M. Davies[2], A. Gitlin[1], R. L. Kirk[1], L. Weller[1], [1]USGS, Astrogeology Program, Flagstaff, AZ (tbecker@usgs.gov), [2]RAND, Santa Monica, CA.

Introduction: We report on the completion and availability of digital global maps for three of the four Galilean Satellites: Ganymede (Figure 1), Europa (Figure 2) and Callisto (Figure 3). The global maps make use of the best image quality and resolution coverage supplied by Galileo SSI and Voyager 1 and 2 missions. The maps were produced using the ISIS software ([1],[2],[3]) and updated geodetic and geometric parameters from RAND.

Image Processing: For each of the digital maps, the individual images were radiometrically calibrated and then were photometrically normalized using a Lunar-Lambert function with empirically derived values ([4], [5]). A linear correction based on the statistics of all overlapping areas was then applied to minimize image brightness variations. A final application of a filter seam-removal technique [6] further minimized image boundary seams. The image data were selected for each satellite on the basis of overall image quality, reasonable original input resolution (up to 500 meters and as low as 20 km/pixel for gap fill), and availability of moderate emission/incidence angles for topography (often extreme angles are included and chosen over poor resolution coverage). Although consistency was achieved where possible, different filters were included for global image coverage as necessary: Clear/Blue for Voyager 1 and 2, and Clear, 0.756nm and Green for Galileo SSI.

Geodetic Control: This map generation has been an iterative process, as Galileo supplied additional image coverage and image processing software was developed and improved ([7], [8]). Regarding the geodetic control of each satellite, the maps are built on updated radii, planet constant values (W_o), and adjusted C-matrices. The RAND calculations were based on a sphere, and so a single mean radius was used for mapping (Europa, r=1562.09 km; Callisto, r=2409.3 km, Ganymede, r=2632.345 km) ([9], [10]). The results for using an ellipsoid instead of a sphere indicated minimal differences except at high emission angles at the poles and near the equator at longitude 0 and 180. Given that the poles of all three satellites have very poor resolution coverage to no coverage at all, the sphere is considered sufficient. For the digital global maps, image data with lower emission angles were selected when available at the equator, thus reducing the effects of the shape chosen in these areas. However, it has been determined that digital mapping of the fourth Galilean satellite, Io, will benefit from using a triaxial ellipsoid as the reference surface.

Processing the fourth satellite, Io: We are currently still working on the digital maps for Io, in part because of the clear need for improving the geodetic data for this satellite. Current efforts on improving the geodetic control network for Io will be presented by Archinal *et al.* at this conference [11]. The digital image data for Io will be mapped using the resolved shape and adjusted geometric control. Two maps will be constructed, one of Galileo SSI data and a second of Voyager data. Rather than monochrome for each map, multi-filter images will be utilized for color from the Galileo SSI and Voyager missions ([12], [13]). Careful selection of images to be included in the maps will be required due to the sensitivity of the surface constrast to photometric variations (illumination and viewing geometry) [14]. The radiometric calibration and photometric normalization process will be similar to the processing of the other satellites, with additional sub-pixel coregistration between filters for the color. Final digital maps are anticipated to be completed in mid-FY01.

Available Products (present and near-future): The digital global maps are publicly available in many different forms. First, all three maps are available in a global format in the Simple Cylindrical map projection on the U.S. Geological Survey website for Astrogeology (http://wwwflag.wr.usgs.gov/Space). Tailor-made image maps of any area at a choice of map sizes and scales can be generated using Mapmaker at this same website ([15], [16]). Later in FY01, we will be printing I-Maps at 1:15M-scale of all four Galilean Satellites: Io will have a second 1:25M-scale I-Map (single sheet) of the Voyager-only map compared to the Galileo SSI-only map. The digital maps will also be available later this FY01 in a "daisy" projection suitable for the production of globes. Updated nomenclature overlayed on the final digital maps are available on *wwwflag.wr.usgs.gov/USGSFlag/Space/nomen/nomen.html*.

References: [1] Torson and Becker, (1997), *LPS XXVIII*, 1443. [2] Eliason, (1997), *LPS XXVIII*, 331. [3] Gaddis et al., (1997), *LPS XXVIII*, 387. [4] Kirk, (2000), *LPS XXXI*, 2025. [5] McEwen, (1991), *Icarus*, v. 92, 298. [6] Soderblom et al., (1978). [7] Becker et al., (1998), *LPS XXIX*, 1892. [8] Becker et al., (1999), *LPS XXX*, 1692. [9] Davies and Katayama, (1981), *JGR*, 8635. [10] Davies et al., (1998), *Icarus*, v. 135, 372. [11] Archinal et al., this conference. [12] Geissler et al., (1999), *Icarus*, v. 140, 265. [13] McEwen, (1988), *Icarus*, v. 73, 385., [14] Geissler et al.,

(1997), *LPS XXVIII*, 28. [15] Garcia et al., this conference.
[16] Garcia et al., (1997), *LPS XXVIII*, 1907.

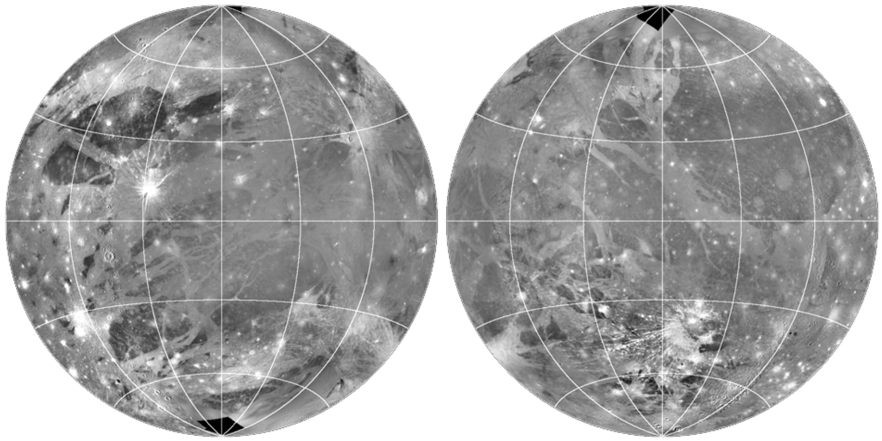

Figure 1. *Ganymede* - Lambert Azimuthal Equal-Area Projection (left: clon=0; right: clon=180.0).

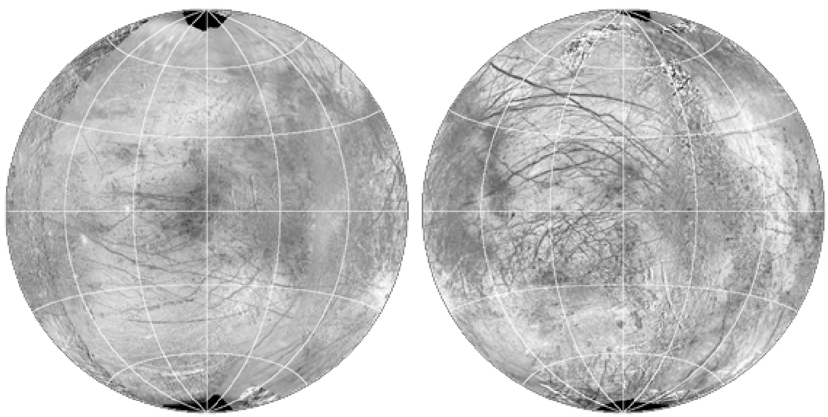

Figure 2. *Europa* - Lambert Azimuthal Equal-Area Projection (left: clon=0; right: clon=180.0).

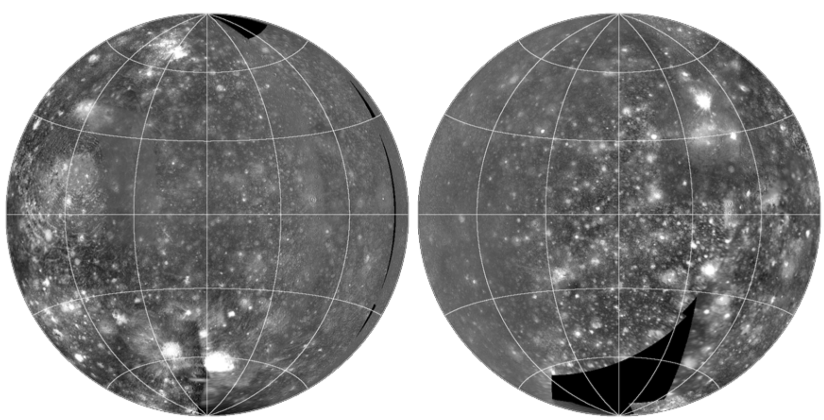

Figure 3. *Callisto* - Lambert Azimuthal Equal-Area Projection (left: clon=0; right: clon=180.0).