LUNAR ORBITER REVIVED: UPDATE ON FINAL STAGES OF SCANNING, ARCHIVING, AND CARTOGRAPHIC PROCESSING AT USGS. T. Becker, L. Weller, L. Gaddis, D. Soltesz, D. Cook, B. Archinal, A. Bennett, T. McDaniel, B. Redding, J. Richie, Astrogeology Team, U.S. Geological Survey, 2255 N. Gemini Drive, Flagstaff, AZ (tbecker@usgs.gov).

Introduction: In the late 1960's, five Lunar Orbiter (LO-I to -V) missions acquired high-spatial resolution photographic data of the lunar surface. A significant portion of this data, emphasizing global coverage of the Moon, has been digitized and processed by the U. S. Geological Survey Astrogeology Program [1-4]. Our focus has been on scanning and processing the LO film data to prepare for cartographic processing. The product will be a global, cartographically accurate, digital mosaic of the Moon containing combined LO III, IV and V medium- (MR) and high-resolution (HR) frames and it will be coregistered to the Clementine 750-nm global base mosaic [5]. As a concurrent effort, we have scanned and processed a selected subset of the very high resolution (VHR) data acquired by LO-III and -V [6]. This report provides an update on the status of both of these LO projects at USGS.

Global Project Products: Digital LO film strips for the global mosaic have been scanned and reconstructed into the familiar frames as viewed by the LO spacecraft [7]. After validation, the constructed LO frames are made available in 'raw' format at 100-micron resolution on the LO Web site at USGS (http://astrogeology.usgs.gov/Projects/LunarOrbiterDigitization/). Explanations and examples of frame processing methods are also available on this site. A LO-specific cosmetic processing capability is in development in preparation for global mosaic construction. The major cosmetic process is removal of the 'venetian blind' striping in each LO frame. These stripes result from mosaicking LO filmstrips with variable amounts of vignetting and different brightness levels. The diversity of scene content (e.g., amount of saturation, shadowing and spacecraft processing fault artifacts) within the frames has precluded a simple, 'catch-all' solution to removal of these stripes. Our solution is to develop a series of methods that work for the majority of frames, and to use these in an automated fashion prior to global mosaicking. When necessary, we will employ more interactive methods to both enhance and preserve scene fidelity. These routines and methods will be available on the LO website so that LO frames can be modified by users as needed.

Global Cartographic Control: Construction of a global mosaic using LO digital frames is currently in progress using ISIS [8-10] software and camera models for LO missions III, IV and V. Construction is nearly complete for all near-side LO frames. We are now systematically collecting tie-points between overlapping LO frames to link them together. Iterative triangulations of these point positions across regional areas to adjust LO camera pointing for each frame are in progress. We have completed a preliminary near side regional LO mosaic (***Figure 1***). The final stage of establishing geometric control will involve the collection of tie-points between LO and corresponding Clementine 750-nm image tiles. Subsequent triangulations will adjust pointing and coregister the LO data to the Clementine 750-nm 'truth' mosaic. Work in the next months will focus on cosmetic processing, geometric rectification, map projection of the LO frames, and global mosaic construction. Projected LO frames and the final global mosaic will be archived and made available on the LO website.

VHR Project Update: At low altitude, LO missions III and V collected hundreds of high-quality VHR frames of the lunar near side equatorial region [5]. Ground resolution of these data ranged from 1 to 5 m/pixel for the HR camera and 10 to 40 m/pixel for the MR camera. We have completed scanning a total of 164 LO VHR frames that fall within 10 areas photographed by LO III and 17 areas photographed by LO V. This total is ~25% of the VHR LO III and V data acquired. As with the global project, constructed VHR frames will be made available online following validation. Ultimately these frames will be geometrically controlled to the final MR III, IV and V frames that are processed for the global mosaic.

Summary: This project to digitize and cartographically process the LO film truly represents the revival of the historic LO photographic collection. This invaluable, high-quality dataset has previously been available as raw film strips, constructed frames on negatives, hardcopy prints, and as low-resolution reproductions in books and online. This cartographic task (funded by the NASA Planetary Geology and Geophysics Program) will result in a widely available digital archive at full resolution that we anticipate will be useful for planetary scientists and other 'lunatics' for many years into the future.

References: [1] Gaddis et al. (2001), *LPS XXXII*, #1892. [2] Lunar Orbiter Pilot Project: http://astrogeology.usgs.gov/Projects/LunarOrbiterDigitization/. [3] Gaddis et al. (2003), *LPS XXXIV*, #1459. [4] Becker et al. (2004), *LPS XXXV*, #1791. [5] Eliason et al. (1999), The Clementine UVVIS Global Mosaic, PDS CL_4001-4078. [6] Hansen (1970), Guide to Lunar Orbiter Photographs, NASA SP-242. [7] Bowker and Hughes, (1971), NASA SP-206. [8] Torson et al., (1997), *LPS XXVIII*, #1443. [9] Eliason, (1997), *LPS XXVIII*, #331. [10] Gaddis et al. (1997), *LPS XXVIII*, #387.

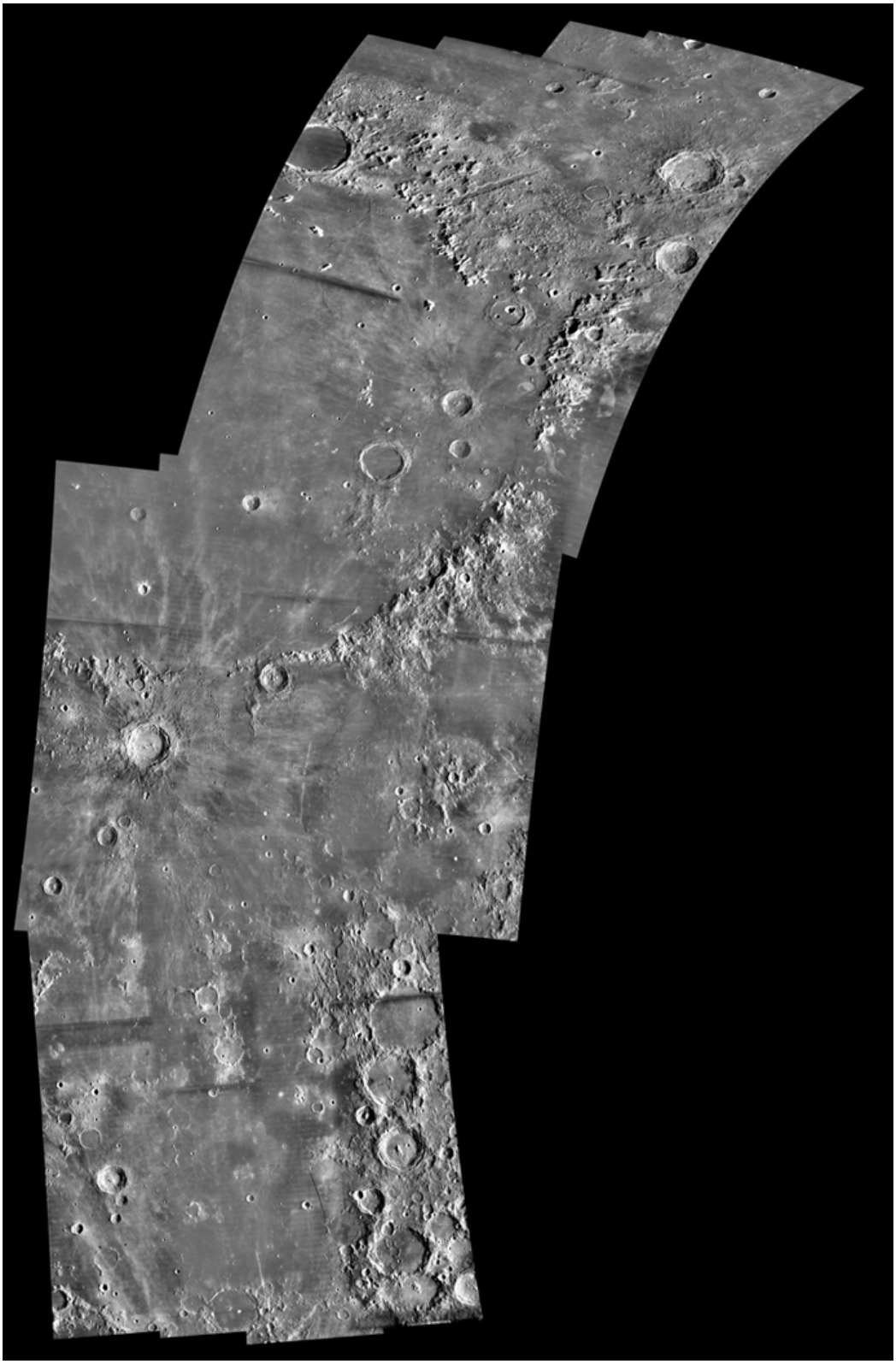

Figure 1. LO mosaic of the central lunar near side (62ºN-33ºS, 32ºE-30ºW) showing Copernicus crater, E Imbrium basin, Sinus Aestuum, Mare Nubium, etc.. Simple Cylindrical projection of 13 LO IV high-resolution frames 102, 103, 108, 109, 110, 113, 114, 115, 120, 121, 122, 125, and 126.