PRELIMINARY RESULTS FROM MARINER 10: HIGH RESOLUTION IMAGES OF THE MOON . Mark S. Robinson[1], B. Ray Hawke[1], Kay Edwards[2], Paul G. Lucey[1], Beth E. Clark[1], [1]*Planetary Geosciences, University of Hawaii, Honolulu, Hawaii, 96822.* [2]*U.S. Geological Survey, Flagstaff, Arizona, 86001.*

In November of 1973 the Mariner 10 spacecraft acquired high resolution images of both the Earth and the Moon as it began its voyage to Venus and then Mercury [1]. The best images had a resolution of ~1 km and were taken from an unusual viewpoint, above the lunar North Pole. At this time the Moon was illuminated such that the eastern limb, including ~30° of the farside, was visible. Two high resolution mosaics were acquired during this period which provide excellent views of regions of the Moon poorly seen from the Earth. These include the Frigoris, Humboldtianum, Marginis, and Smythii regions. These images also covered expanses of highlands not visible from the Earth. These data were unique in that they were the only useful robotic spacecraft images of the Moon; and they remained so until December of 1990 when the Galileo spacecraft made its first encounter with the Moon [2]. We have acquired these Mariner 10 lunar images and are currently using them in conjunction with Earth-based telescopic spectra as well as Apollo and Lunar Orbiter photographic data to investigate the nature of deposits comprising the Northeast Nearside of the Moon (NEN, [3]). These Mariner 10 frames have proved useful for photogeologic, photometric, and photoclinometric (R. Kirk) analyses; they have also been used in support of the second Galileo lunar encounter of December 1992 (see other abstracts this issue [4]).

Our initial work on these high resolution frames includes a sequence of 10 clear filter images that compose a mosaic centered at 70°N 95°E (see Fig. 1). To make these images useful for interpretation we first radiometrically and then geometrically calibrated each frame. During the actual lunar encounter an anomaly in the spacecraft resulted in a lower than expected vidicon temperature; -10° C [1]. Prelaunch calibration tests of the two vidicon imaging systems onboard the spacecraft revealed that one of the cameras (camera A, odd numbered frames) exhibited a sensitivity nonuniformity instability at the lunar encounter temperature [5]. Camera B (even numbered frames) was stable at this temperature. We currently are investigating the calibration of the A frames by comparing regions of overlap with the B frames. Our radiometric calibration includes dark current removal and a nonuniformity/nonlinearity correction based on a scheme we derived from examination of both prelaunch calibration frames and frames shuttered after launch. The details of this radiometric calibration closely follows the procedure outlined in [6].

Recalculation of both the Mariner 10 spacecraft position and camera pointing angles during the lunar encounter was recently performed at the Rand Corporation [7]. We used these new camera angles to determine the geometry of each image at the time of acquisition to calculate latitude and longitude for each pixel within a frame. We corrected for electronics induced geometric distortion in the images by accounting for reseau movement in the images relative to their measured nominal positions on the vidicon [8]. These steps are necessary to geometrically reproject the frames for mosaicking. To test the accuracy of the pointing geometry we compared a calculated limb position based on the new geometry with the actual limb in the images and found that the fit was best on the central nearside (~2 pixels) and worsened around the farside (~20 pixels). The source of this error is undetermined at this point

We have constructed a preliminary normalized albedo map of the NEN region from 4 frames (PICNOs 2660, 2661 ,2667, 2668). The calibrated images were

transformed to relative albedo using a Hapke function [9]. Based on the experience of Galileo Lunar images from 1990, the Hapke parameter Θ was adjusted from 20 to 5 to correct for over-brightening at high latitudes [10]. Examination of seam boundaries between frames indicate that the top left and right corners of the camera A frames are too bright; this being consistent with the prelaunch calibration. We found that selective masking of these areas results in a qualitatively acceptable match. Future work will quantify these results and determine if portions of the A frames are useful for photometric analysis. Our analysis of this preliminary map indicates: 1) Some portions of the "light plains" deposits [11] east and north of Mare Frigoris exhibit unusually low albedo, compatible with mare units. Mare volcanism in this region may have been more extensive than has previously been thought. 2) New albedo data confirm the existence of dark mantle deposits in the NEN region. 3) Localized pyroclastic deposits occur in the interior of Gauss crater; additional analysis may reveal the presence of dark mantling units.

REFERENCES: **[1]**Dunne, J.A. and Burgess, E. 1978. *NASA SP 424*. **[2]**Belton et al., 1991. *Science*,255, 570-576. **[3]**Hawke, B.R. 1992 *Bull AAS*, 24, 1027. **[4]**Belton, M.J.B. et al., this volume. **[5]**Benesh and Morrill, 1973 *JPL Doc* 615-148. **[6]**Robinson et al. 1992, *JGR*, 97, 18265-74. **[7]**M. Davies, personal comm., 1992. **[8]**PICS manual 1990. **[9]** Helfenstein, P. and Veverka, J., 1987, Icarus 72, 342-357. **[10]**Alfred McEwen, personal communication, 1992. **[11]**Luchitta, B.K., 1978, *USGS Map I-1062*.

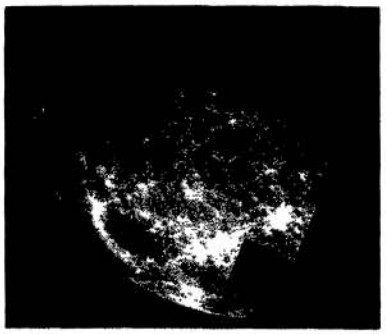

Figure 1. Mariner 10 digital mosaic of the lunar north pole region (orthographic projection, 1.1 km/pixel). The center of the mosaic is 70°N 95°E. This mosaic is very useful for comparison with the recently acquired Galileo SSI image data; LUNMOS04, 67°N 70°E [4]. Mare Humboldtianum is near the center of the disc, while Mare Crisium is the large circular feature near the lower left limb.

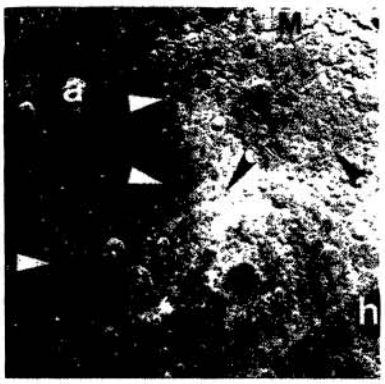

Figure 2. High resolution albedo map of the NEN region of the Moon. The Mariner 10 frames that comprise this mosaic were normalized with a Hapke photometric function [9] . Arrows indicate extensive light plains deposits [11], a = Aristoteles, h = Mare Humboldtianum, M = Meton. UL corner of mosaic 37.4° N 0.1° E; LL 19.1° N 38.1° E; UR 80.8° N 30.7° E; LR 47.2° N 82.8° E.

Acknowledgements: The U.S.G.S., Flagstaff, Arizona, provided PICS which was essential to this study. We thank R. Kirk for photoclinometric assistance.