NEW HIGH-RESOLUTION 70-CM WAVELENGTH RADAR IMAGES OF THE MOON. B.A. Campbell[1], D.B. Campbell[2], and M. Nolan[3], [1]Center for Earth and Planetary Studies, Smithsonian Institution, Washington, DC 20560-0315, campbellb@nasm.si.edu; [2]Cornell University, Ithaca, NY 14853; [3]Arecibo Observatory, Arecibo, PR.

Introduction: Radar maps of the lunar nearside at 70-cm wavelength currently have a spatial resolution of 3-5 km, and have been used to identify differences in regolith physical and chemical properties [e.g., 1-3]. Data at such long wavelengths are of particular interest due to their penetration depth of 5-10 m in even lossy lunar materials. Using the Arecibo Observatory 430 MHz radar system, we are collecting new images of the lunar surface with spatial resolution of ~300 m. These data will be used to study age and chemistry-related differences among the mare deposits, regional differences in scattering properties in the highlands, and areas of possible permanent shadow at the lunar poles.

Data Collection. In November, 2000, we collected high-resolution images of five sites, surrounding Posidonius crater, the Aristarchus Plateau, Central Mare Imbrium, the North Pole, and a region of the highlands near Nicolai crater. We also collected data for the sub-Earth region for analysis of the near-nadir radar echo.

These data were collected over 12-minute looks, using a 13-element Barker code to achieve a 2 □s effective pulse length. The radar system tracked the center of each target region, permitting an area of ~500 km diameter to be mapped with limited frequency smearing. The radar measurements are collected in the cross-polarized circular sense (e.g., LR), often termed "polarized" in planetary radar studies. North-south ambiguities are limited by the narrow beamwidth of the antenna, and by not mapping regions very near the Doppler equator.

A total of 4-5 looks for each target were obtained during these runs. Each look was processed by standard techniques, and re-projected to a selenographic coordinate system. For summations of multiple looks, each image is weighted by the level of off-planet noise.

Preliminary Data Analysis. To date, we have processed data for the area surrounding Posidonius crater (Figures 1 and 2). This radar image comprises only two looks, but illustrates the level of detail that can be obtained. There are systematic offsets between features in our re-projected data and the Clementine control grid (Figure 2), and we are investigating these projection issues prior to processing the remaining data.

Note the very low radar-return mare deposit northwest of Posidonius. In areas like this, and in central Mare Imbrium, we will search for evidence of subregolith scattering features such as small craters or tectonic structures. At present, the basal structure of the lunar regolith has not been well characterized, and the new 70-cm data have adequate resolution to determine whether such buried features are detectable.

Ongoing Work. We plan to complete the reduction of the remaining sites, with a particular emphasis on the lunar north pole. We also plan to collect new 70-cm images in 2003 using the Arecibo and Greenbank telescopes to obtain dual-polarization (LL and LR) data. These data will allow deeper probing of the lunar polar deposits than has been achieved by previous radar experiments [4] and the Lunar Prospector gamma-ray sensor. The two polarizations will permit a search for high values of the LL/LR ratio, which have been associated with ice deposits on Mercury, Mars, and the Galilean satellites.

References: [1] Thompson, T.W. (1987) *Earth, Moon, Planets, 37,* 59-70. [2] Schaber, G.G., et al. (1975) *Moon., 13,* 395-423. [3] Campbell, B.A., et al., (1997), *JGR, 102*, 19,307-19,320. [4] Stacy, N.J.S., et al. (1997), *Science, 276*, 1527.

Figure 1. 70-cm radar image of the region surrounding Posidonius crater (25-40 N, -22.5 to –37.5 E).

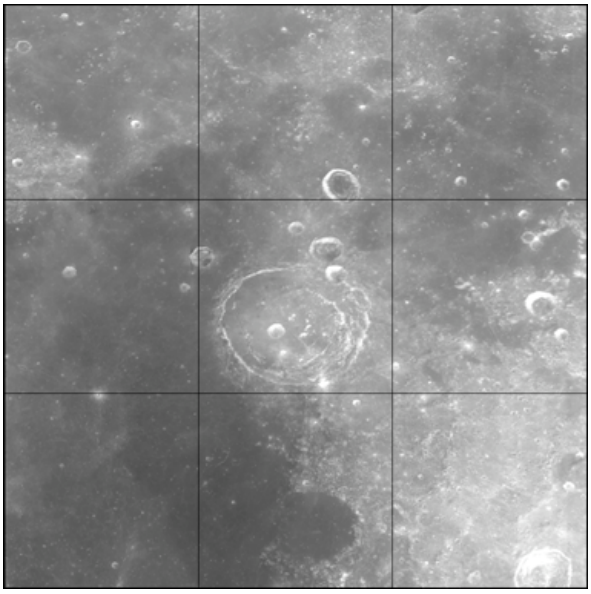

Figure 2. Clementine visible image of the Posidonius region (25-40 N, -22.5 to -37.5 E).