LROC OBSERVATIONS IN THE LRO EXTENDED MISSION. B. L. Jolliff[1], M. S. Robinson[2], and T. R. Watters[3], [1]Washington University, St. Louis, MO 63130, blj@wustl.edu; [2]School of Earth & Space Exploration, ASU, Tempe, AZ; [3]National Air and Space Museum, Smithsonian Institution, Washington, DC.

Introduction: In the Lunar Reconnaissance Orbiter (LRO) extended science mission (ESM), the LRO Cameras (LROC) will continue exploring the Moon using targeted Narrow Angle Camera (NAC) observations that optimize opportunities afforded by the ESM orbit and Wide Angle Camera (WAC) coverage that will continue to improve knowledge of lunar photometry, surface composition, and mineralogy.

LROC ESM Themes: During the ESM, LROC will continue to fill in gaps in NAC coverage from the primary mission, and will focus on observations that improve coverage of (1) south polar targets, (2) tectonic features such as lobate scarps, graben, etc., (3) impact-related features, including impact melt deposits and processes, uplift structures, and degradation processes, and (4) volcanic features, including the identification and characterization of small, previously undetected structures. The 30×200 km elliptical orbit with south polar periselene will enable the NACs to obtain high spatial resolution observations of southern hemisphere and south polar targets while obtaining broad areal coverage of northern hemisphere targets.

Polar Illumination. Using LROC images, regions at the poles have been identified that are illuminated for nearly 95% of the year [1]. Lighting conditions vary from year to year as the lunar orbit precesses with an 18.6 year period. Further LROC WAC observations will improve illumination maps and the ability to predict lighting conditions for future polar missions. Increased NAC coverage will enable meter scale mapping of illuminated terrain, which will support planning and operations of future polar landers and rovers. Targeting LROC imaging of permanently shadowed regions (PSR) use Diviner models and LOLA topography to determine when secondary lighting is optimal in regions that receive no direct sunlight. The PSR images provide data on albedo and regolith properties.

Tectonic Features. The discovery of young, widely distributed tectonic features during from LROC images changed the existing view of the Moon as a geologically inactive body [2]. Our understanding of the current stress state of the crust and the age of the tectonic features, however, is incomplete because the total population of young structures is not yet known. A goal of the ESM is to determine the global distribution of the contractional lobate scarps and the extensional small-scale graben. Topographic data is critical in analyzing the tectonic landforms, characterizing morphometry in detail to constrain the geometry of faults, and modeling the kinematics and mechanics of faulting. Another goal of the ESM is to compare Apollo Pan photos and LROC images from throughout the mission to determine if any faults are currently active. The goal of these efforts is to better understand: (1) the spatial distribution, distribution of orientations, and morphometry of tectonic landforms; (2) the evolution of tectonic stresses with time; and (3) the origin of tectonic stresses and their relationship to the origin and thermal evolution of the Moon, and comparison to other terrestrial planets.

Impact craters and phenomena. New NAC stereo images, derived DEMs and the improved WAC-derived GLD100 [3] calibrate models for impact melt volume that is produced, ejected, and retained in crater formation, and test theoretical calculations against crater size, terrain, impact angle, and impactor properties. Properly calibrated cratering models are important to cratering studies on other planetary bodies, such as Vesta, Mercury, and Mars. The photometry and composition of impact products currently are not well characterized. Impact products may include flat-lying ponds and dark stringers that extend over the crater rim, but it is not clear if these materials were emplaced as melt or granular deposits. Impact products have a wide range in reflectance that may represent different degrees of melting and glass content. New photometric analysis using repeat NAC imaging in various lighting conditions will provide the needed phase function for high-priority targets. Repeat imaging will also be used to investigate the recent impact flux.

Volcanic Features. LROC images will be used to investigate emplacement mechanisms by characterizing composition, morphology, slope, flow features, and volumes. These data provide the basis for new investigations and discoveries of volcanic centers [e.g., 4], including unusual features such as the enigmatic volcanic caldera known as "Ina-D" [5], which is among the youngest volcanic features on the Moon. In the ESM, LROC will continue to search for and image similar young volcanic features, with NAC image resolution to better understand the distribution of the Moon's most recent volcanic activity. NAC observations of volcanic features, especially imaging to obtain geometric stereo pairs, will address the conditions of formation. Young volcanic features will be located and characterized to better understand the nature and distribution of the Moon's most recent volcanic activity.

References: [1] Speyerer & Robinson (2011) LPSC 42, #2540. [2] Watters, et al. (2012) Nat. Geosci. [3] Scholten et al. (2012) JGR Papers in Press. [4] Spudis et al. (2011) JGR 116. [5] Robinson et al. (2010) LPSC 41, #2592.