An Overview of the Lunar Crater Observation and Sensing Satellite (LCROSS) Mission Results from Swing-by and Impact. A. Colaprete[1], G. Briggs[1], K. Ennico[1], D. Wooden[1], J. Heldmann[1], L. Sollitt[2], E. Asphaug[3], D. Korycansky[3], P. Schultz[4], A. Christensen[2], K. Galal[1], G. D. Bart[5] and the LCROSS Team, [1]NASA Ames Research Center, Moffett Field, CA, Anthony.Colaprete-1@nasa.gov, [2] Northrop Grumman Corporation, Redondo Beach, CA, [3]University of California Santa Cruz, [4]Brown University, [5]University of Idaho.

Introduction: Interest in the possible presence of water ice on the Moon has both scientific and operational foundations. It is thought that water has been delivered to the Moon over its history from multiple impacts of comets, meteorites and other objects. The water molecules migrate in the Moon's exospheric type atmosphere though ballistic trajectories and can be caught in permanently shadowed polar cold traps that are cold enough to hold the water for billions of years. Verification of its actual existence would help science constrain models of the impact history of the lunar surface and the effects of meteorite gardening, photo-dissociation, and solar wind sputtering. Measurements of the ice distribution and concentrations would provide a quantitative basis for studies of the Moon's history and a test of current theories on the form and distribution of lunar hydrogen.

The LCROSS Mission: The primary objective of the Lunar Crater Observation and Sensing Satellite (LCROSS) is to confirm the presence or absence of water ice at the Moon's South Pole. This mission uses a 2300 kg kinetic impactor with more than 200 times the energy of the Lunar Prospector (LP) impact to excavate more than 250 metric tons of lunar regolith. The resulting ejecta cloud will be observed from a number of Lunar-orbital and Earth-based assets. The impact is achieved by steering the launch vehicle's spent Centaur upper stage into a permanently shadowed polar region. The Centaur is guided to its target by a Shepherding Spacecraft (S-S/C), which after release of the Centaur, flies toward the impact plume, sending real-time data and characterizing the morphology, evolution and composition of the plume with a suite of cameras and spectrometers (Figure 1). The S-S/C then becomes a 700 kg impactor itself, to provide a second opportunity to study the nature of the Lunar Regolith.

Impact Target: The specific impact site for LCROSS depends on the exact launch date for LRO. The launch date of June 18, 2009 resulted in a 4 month cruise and an impact in at the south pole on October 9. The impact site is selected based on a number of requirements including solar illumination of ejecta, visibility to earth (specifically observatories in Hawaii), and target properties (e.g., slopes and roughness). The targeting capability of the LCROSS S-S/C, ~1 km (3σ), allows for a fairly precise selection of impact point. Inter-crater impact targeting could be adjusted up until Trajectory Correction Maneuver #7 which occurred on September 25. Intra-crater targeting refinement occurred up until October 6 allowing for the maximum use of LRO observations in LCROSS target selection.

LCROSS provides a critical ground-truth for Lunar Prospector and LRO neutron and radar maps, making it possible to assess the total lunar water inventory, as well as provide significant insight into the processes that delivered the hydrogen to the lunar poles in the first place. Also, during swing-by, LCROS made measurements of the farside northern hemisphere, including unique near ultraviolet observations. This talk will summarize the results from LCROSS lunar swing-by and impact, including observations from the S-SC, ground and earth orbiting observations.

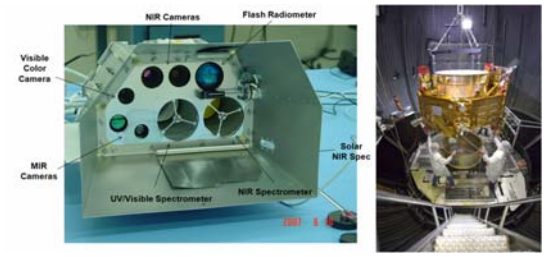

Figure 1. Left: The LCROSS Payload Observation Deck and its eight nadir viewing instruments (an additional solar occultation spectrometer is to the side). Right: The LCROSS spacecraft entering thermal vacuum testing at Northrop Grumman.