CHARACTERIZING THE LCROSS IMPACT SITE. G. D. Bart[1], A. Colaprete[2], [1]*Carl Sagan Center, SETI Institute, 515 N. Whisman Rd., Mountain View, CA 94043 (gbart@seti.org)*, [2]*NASA Ames Research Center, M/S 245-3, Moffett Field, CA 94035*.

Introduction: LCROSS, the Lunar CRater Observation and Sensing Satellite, will be launched on the same rocket as the Lunar Reconnaissance Orbiter (LRO) later this year (http://lcross.arc.nasa.gov). The LCROSS scientific objectives are: (1) Confirm the presence or absence of water ice in a permanently shadowed region on the Moon. (2) Identify the form/state of hydrogen observed by at the lunar poles. (3) Quantify, if present, the amount of water in the lunar regolith, with respect to hydrogen concentrations. (4) Characterize the lunar regolith within a permanently shadowed crater on the Moon. The presence of water ice is hypothesized based on evidence found by the Lunar Prospector neutron spectrometer for hydrogen in permanently shadowed regions at the poles [1].

The LCROSS spacecraft will set the rocket's Centaur Earth departure upper stage (EDUS) on an impact trajectory with the Moon. Once the trajectory is set, the spacecraft will release the EDUS, which will then impact the Moon in a permanently shadowed region characterized by high concentrations of hydrogen according to the Lunar Prospector neutron spectrometers. Following four minutes behind the EDUS, LCROSS will fly through the impact plume, using its 9 instruments (5 cameras (1 visible, 2 Near IR, 2 Mid IR), three spectrometers (1 visible, 2 NIR) and one photometer) to search for water ice.

Impact Site Candidates: Four south-pole regions are currently candidates for the LCROSS impact (Fig. 1): Shoemaker crater (88.1 S, 44.9 E, 50.9 km diameter), Shackleton crater (89.9 S, 0.0 E, 19 km diameter), Faustini crater (87.3 S, 77.0 E, 39 km diameter), and Cabaeus (85 S, 35 E). Due to the launch date swap, several north-pole areas are now candidates as well.

Target Selection Criteria:

Target selection will be key to the success of this mission. The constraints on the impact site selection are: (1) the ejecta plume must be observable by ground-based and orbital observatories. (2) the ejecta must be illuminated by sunlight, since the instruments primarily measure reflected light. (3) the target should have known surface properties (low roughness and slopes, deep regolith cover.) (4) the target should be in a region with an observed concentration of increased hydrogen, which could indicate presence of water [2].

Impact Site Characterization:

Characterizing the expected terrain within the crater will be difficult because the target impact site is required to be permanently shadowed. Because of lack of high resolution visible imaging at the poles, we use high resolution Earth-based radar data [3], which can directly observe some parts of the permanently shadowed regions. Once the tools and analysis methods are established, we will be ready to quickly assess new data provided by the instruments on LRO, which will begin taking data 2-3 months prior to the LCROSS impact.

Conclusion:

This study will be critical to providing the best scientific return from the LCROSS mission. Understanding the target as well as possible will both optimize the quality of data return and improve the analysis of the data.

Although this study is critical to the success of the LCROSS mission, it will also return scientific results relevant to:

- NASA lunar exploration initiatives
- Future landing site selection
- Understanding cratering processes
- Dry craters (Moon) vs. possibly wet craters (Mars)
- Ice deposits elsewhere, such as Mercury

References:

[1] Feldman W.C., Maurice S., Binder A.B., Barraclough B.L., et al. (1998) *Science*, *281* 1496–1500.

[2] Elphic R.C., Eke V.R., Teodoro L.F.A., Lawrence D.J., et al. (2007) *Geophys Res Lett*, *34* L13204.

[3] Campbell B.A. and Campbell D.B. (2006) *Icarus*, *180* 1–7.

[4] Margot J.L., Campbell D.B., Jurgens R.F., and Slade M.A. (1999) *Science*, *284* 1658–1660.

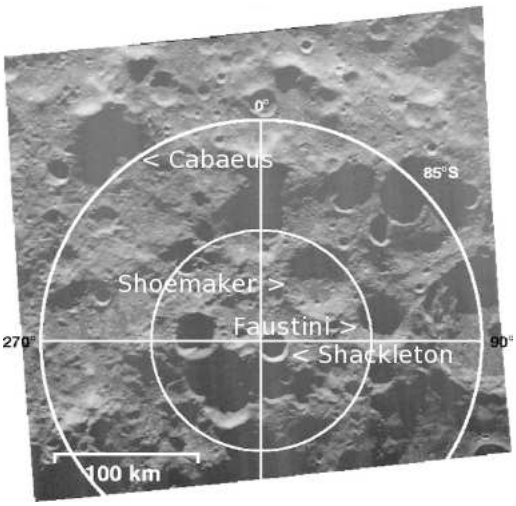

Figure 1: Illustration of the location of possible candidate impact locations for LCROSS, superimposed on a radar backscatter map of the lunar south pole from [4].