Lunar CRater Observation and Sensing Satellite

Crater Impact

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The primary goal of the LCROSS mission is to determine if there is water ice on the Moon. The presence of water ice will greatly influence future human activities on the Moon. The water ice could serve as a source of oxygen and hydrogen. In order to confirm the presence of water ice on the Moon the Atlas V Centaur Earth departure upper stage, also known as the EDUS, is the vehicle which will be used as the impactor. The impact will create a plume and the content of the plume will be observed by another shepherding spacecraft known as the Shepherd Spacecraft, S-S/C. This instrument will determine the presence or absence of water ice on the Moon.

The use of the impact of the EDUS to excavate and eject lunar material from permanently shadowed regions on the Moon will allow for the ejected material or ejecta to be imaged and spectroscopically studied. The LCROSS S-S/C will study it at wavelengths between visible and mid-IR (mid-Infrared) and also from UV (Ultraviolet) through radio regions of the spectrum. Models of the impact have been created to ensure effective execution of the observational campaign. These models for the LCROSS mission are based on numerical hydrodynamic codes, impact experiments performed with the NASA Ames Research Center vertical gun, and analytical models using semi-empirical scaling relations. The purpose of all these approaches is to contribute information to the task of guiding the LCROSS mission. Creating many models and performing many experiments will prove to be very useful in determining the expected outcome. A compilation of all the results from the models has been made which summarizes the current best estimate for the impact event. This summary is known as the CBEIM, or the Current Best Estimate Impact Model. It contains high and low values for a variety of physical quantities such as crater dimensions and ejecta velocities. Taking into consideration the information included in the CBEIM, it has been indicated that the impact flash will evolve in tens of milliseconds and the ejecta will rise and fall in about 2 minutes. This reveals the importance of rapid measurement techniques needed by ground and space based telescopes. The only measurement needed that will last for a greater length of time is the temporal evolution of the OH- exosphere, which is expected to last for tens of minutes.

The purpose of the EDUS impact is to determine whether or not there is water ice in the permanently shadowed regions of the Moon. To determine this, the plume and ejecta created by the impact will be studied by the S-S/C. Many models have been created of the impact and the results of these models have been studied. This helps determine expected results of the actual mission and ensures the execution of the mission will be effective.