



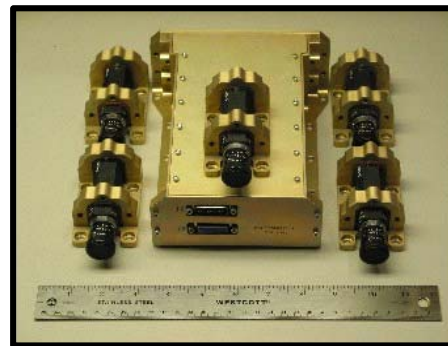
Lunar CRater Observation and Sensing Satellite

The LCROSS VisCam

Instruments onboard numerous Earth and Moon-orbiting spacecraft and Earth-based instruments in many parts of the world will be watching for evidence of water when the LCROSS mission sends the upper stage of a Centaur rocket to impact the Moon. The Shepherdling Spacecraft (S-S/C) is equipped with nine instruments to observe and “sense” the impact.

There are five cameras onboard the LCROSS S-S/C. The S-S/C also has three spectrometers¹ which break down light into its component parts, and one photometer² to measure the brightness of the impact flash³. Of the five S-S/C cameras, one operates in the visible region of the electromagnetic spectrum, while four others take pictures in either the Mid- or Near-Infrared⁴ region of the electromagnetic spectrum. Visible imaging will identify the location of the impact to within 500 meters, monitor the changing appearance of the cloud from which the velocity of the material and total mass can be determined, and determine the visible properties of the grains in the plume, including the particle sizes and the reflective properties.

The VisCam is a high-end broadcast-quality CCD⁵ video camera. It will place the readings of all other instruments on the LCROSS spacecraft in the context of what is visually happening on the Moon during the impact. The VisCam will observe the impact location, the impact itself, and the characteristics of the resulting cloud.



LCROSS Shepherdling Spacecraft
Visual & Infrared Cameras
Photo courtesy NASA/Ames



The LCROSS S-S/C attached to the Centaur rocket. The S-S/C will follow the Centaur to the surface after their separation. Photo courtesy NASA

A CCD, or Charged Coupled Device, converts light into electrical energy. A CCD consists of a two-dimensional matrix⁶ made up of thousands of individual photosensitive elements. The camera optics focus the scene onto this matrix and each element generates a charge that varies with the intensity of the light that it receives.

The VisCam has a detector of 752 horizontal pixels or picture units and 582 vertical pixels. The Field of View⁷ of the VisCam is 25 degrees by 28 degrees. That means that an entire picture taken by the camera spans approximately 28 degrees horizontally and vertically. These specifications of the camera have implications to what the camera can see in pictures according to its distance from the Moon.

What is meant by camera pixel resolution⁸? The more clearly small objects can be seen in a picture taken by a camera, the higher the resolution. Higher resolution shows more detail in a picture.

VisCam operation will begin approximately 55 minutes prior to the Centaur impact, taking pictures at one frame per second, with some variation, until the VisCam and the entire S-S/C join the Centaur on the Moon! Goldstone Apple Valley Radio Telescope (GAVRT) Program students play a key role in the LCROSS mission, listening for a distress signal from the spacecraft during its cruise phase, so that LCROSS can be delivered safely to the Moon.

1: Spectrometers - an instrument designed to separate electromagnetic radiation into its component frequencies. 2: Photometer - an instrument for measuring a property of light, especially luminous intensity or brightness. 3: Flash - to give off light or be lighted in a sudden burst. 4: Infrared - the wavelengths of electromagnetic radiation between visible light and the far infrared, which is closest to the microwave region. 5: CCD - an electronic detector like those in digital cameras. 6: Matrix - something organized in columns and rows. 7: Field of View - the area or solid angle which can be viewed through an optical instrument. 8: resolution - the number of kilometers on the surface of the Moon imaged in each pixel of a particular VisCam picture.

