Lunar CRater Observation and Sensing Satellite

VisCam Camera Pixel Resolution

The LCROSS Shepherding Spacecraft (S-S/C) separates from the Centaur about 7 hours before impact & follows it to the surface of the Moon 4 minutes behind. The S-S/C actually flies through the Centaur impact plume, while its VisCam and other instruments make high resolution spatial measurements of the impact, plume and fresh Centaur crater.
Photo courtesy NASA

The VisCam is the only LCROSS camera which will image the Centaur rocket's impact on the Moon in the part of the electromagnetic spectrum that we can see. The smallest object that can be seen in a picture taken by the VisCam is called the camera's pixel resolution[1]. The VisCam's pixel resolution will change with its distance from the Moon, as it follows the Centaur to the surface, taking important images until it is finally destroyed. A student can demonstrate what is meant by pixel resolution in pictures taken by a CCD[2] camera.

A student's closed fist held at arm's length is about 10 degrees. That is about 1/3rd the size of the VisCam's Field of View[3]. Three fists side by side would approximate the VisCam Field of View.

If a student holds up his closed fist at arm's length, covering up as much of an object in the distance as possible with his closed fist, the student can use his fist as a measuring device and pretend to take a picture with the VisCam at that distance.

If the student moves closer to the same object, the student can then find out what part of the object he can cover by holding up his closed fist at arm's length now. He can envision what would be in a VisCam picture taken of the object at this closer distance.

At this distance, the student's fist or Field of View of his VisCam Fist Camera might cover the entire backboard of the outdoor basket.

At this closer distance, the student's fist or Field of View of his VisCam Fist Camera might cover only the small white sign on the base of the basket's pole. If there is writing on this small sign, it would probably be able to be seen or resolved in the picture.

Which of the two pictures above showing the student simulating the VisCam Field of View would have the higher resolution? When the student was farther from the basket, his picture contained the entire backboard. An object the size of the small white sign on the basket post would be too small in the picture to read anything that might have been written on the sign. However, when the student moved closer to the basket, the small white sign on the basket post filled the entire picture. Something written on the sign would likely show up in the picture.

The picture displaying the most detail and therefore has from the object caused the student closer to the target would have the the higher resolution. The distance he was change in camera pixel resolution, which determines the smallest object that could be seen in the picture, when using the same camera.

What would prevent an object from showing up or being imaged by the camera? If the object is below the pixel resolution of the camera, it will not be seen by the camera; it would not be even one dot or pixel[4] in the picture.

How large would an object have to be on the Moon's surface to be seen with the VisCam? As the Centaur rocket impacts the Moon the pixel resolution of the VisCam is 0.4 kilometers per pixel. The large plume created by the impact will be able to be captured in VisCam images. Three minutes and 45 seconds later, only 15 seconds before its own impact with the surface, pictures taken by the VisCam will reveal much more detail of the plume and impact crater, at 0.02 kilometers per pixel. An oversized tennis court on the Moon at that distance would show up as one dot or one pixel in the VisCam picture. The characteristics of the VisCam and all the LCROSS instruments were considered by mission scientists and engineers in order to meet their research goal of finding the water content in permanently shadowed regions at the Moon's pole.

1: Pixel resolution - the number of kilometers on the surface of the Moon imaged by each pixel or picture unit in a VisCam picture. 2: CCD - Charged Coupled Device detector like those in digital cameras. 3: Field of View - the area or solid angle which can be viewed through an optical instrument. 4: Pixel - the basic unit of composition of a display like a computer monitor or a picture.