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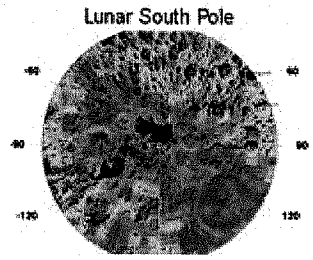

Lunar South Pole.

11 April 2006

NASA Chooses New Spacecraft To Search for Water on Moon, April 10, 2006

(Satellite will launch with Lunar Reconnaissance Orbiter in 2008)

By Cheryl Pellerin
Washington File Staff Writer

Internet Resources

Radioactive Moon (NASA webpage)

Lunar Reconnaissance Orbiter (NASA webpage)

LCROSS (NASA webpage)

NASA

Washington -- NASA officials have announced that the agency will send a small "secondary payload" spacecraft to the moon with the launch of the Lunar Reconnaissance Orbiter (LRO), scheduled for October 2008.

During an April 10 press briefing at NASA headquarters, Scott Horowitz, associate administrator for the Exploration Systems Mission Directorate, said the Lunar Crater Observation and Sensing Satellite (LCROSS) will travel independently of the orbiter to search for water ice.

The LCROSS spacecraft, proposed by NASA's Ames Research Center in California and to be built by Northrop Grumman Corporation, will fly on the same expendable launch vehicle that will launch the orbiter from NASA's Kennedy Space Center in Florida.

"The LCROSS mission gives the agency an excellent opportunity to answer the question about water ice on the moon," said Daniel Andrews of NASA Ames, whose team proposed LCROSS.

LRO and LCROSS are the first of many robotic missions NASA will conduct between 2008 and 2016 to study, map and learn about the lunar surface to prepare for the return of astronauts to the moon.

LUNAR RECONNAISSANCE ORBITER

According to NASA's Vision for Space Exploration, the agency plans to send astronauts back to the moon by 2020 and, eventually, to set up an outpost there as a step toward Mars and beyond.

The LRO is designed to help make this possible. After a four-day trip to the moon, it will map the moon's surface and characterize future landing sites in terms of terrain roughness, usable resources and radiation environment, with the ultimate goal of helping return people to the moon.

During its yearlong initial mission, some of LRO's most important measurements will involve characterizing deep-space radiation in lunar orbit, determining the global topography, mapping sources of hydrogen, mapping temperatures in shadowed regions near the poles and imaging the surface in permanently shadowed regions.

LRO also will try to identify deposits of near-surface water in polar cold traps, assess features for potential future landing sites – the largest unknown in present knowledge of lunar resources – and characterize the availability of sunlight in the polar region (for constant solar power).

MAPPING THE MOON

"We really need to know more about the radiation environment on the moon, especially if people will be staying there for more than just a few days," said Harlan Spence, a Boston University astronomy professor, in a September 2005 NASA **fact sheet**.

LRO will help measure and map the moon's radiation environment using an instrument called the Cosmic Ray Telescope for the Effects of Radiation (CRaTER).

By placing the radiation detectors in CRaTER behind various thicknesses of a special plastic that has similar density and composition to human tissue, Spence and colleagues will obtain much-needed data.

LRO's other radiation-sensing instrument, the Lunar Exploration Neutron Detector (LEND), is partially funded by Roscosmos, the Russian Federal Space Agency. LEND will detect radiation from particles called neutrons that emanate from the lunar surface to measure how energetic – and therefore damaging to people – the neutrons are.

LRO also has a laser that can shine pulses of light into dark craters. The main purpose of this Lunar Orbiter Laser Altimeter (LOLA) is to produce an accurate contour map of the entire moon.

It also will measure the brightness of each laser reflection. If the soil contains ice crystals, as little as 4 percent, the returning pulse will be noticeably brighter. LOLA by itself cannot prove there is ice, but brighter pulses in the permanent shadows would be a good clue, NASA said.

WATER ON THE MOON?

Determining whether there is ice, and therefore water, on the moon is important to future space travel.

Whether establishing a moon base will be feasible depends largely on the question of water, as colonists would need water to drink and grow plants. In addition, water -- two parts hydrogen and one part oxygen -- can be broken apart to make air (oxygen) and rocket fuel (oxygen plus hydrogen). Water is also very good at blocking space radiation. Surrounding a moon base with a meter or so of water would help protect explorers from solar flares and cosmic rays.

To help find out if the moon has water, another LRO instrument, Diviner, will map the temperature of the moon's surface so scientists can search for places where ice could exist. Even in the permanent shadows of polar craters, temperatures must be very low for ice to resist evaporating.

Diviner will provide back-up data for LRO's other ice-sensitive instruments, identifying areas where positive signs of ice would not make sense because the temperature is too high.

Another instrument, the Lyman-Alpha Mapping Project (LAMP), will look into the darkness of permanently shadowed craters at the moon's poles for signs of hidden ice, by sensing a special range of ultraviolet-light wavelengths.

Water ice has a characteristic "fingerprint" in the same range of ultraviolet light, so this evidence will help determine whether the craters hold ice.

SECONDARY PAYLOAD

LCROSS will launch in October 2008 on the same expendable launch vehicle as LRO. On the way to the moon, LRO will be released. LCROSS and LRO will then be two separate missions, said NASA Ames's Andrews.

The LRO will begin orbiting the moon, and LCROSS and the upper stage of the expendable rocket will continue their journey, traveling around the Earth twice, taking about 90 days.

At the end of that journey, as the LCROSS/upper stage approach the moon's south pole, Andrews said, "we go ahead and drop the upper stage in toward [a crater at] the south pole, hitting at a very high impact angle" and generating a huge, 1000-metric-ton plume of the constituents of the crater.

Above the crash site, LCROSS sensors directly will measure water ice, water vapor and other compounds.

Then, Andrews said, "we fly right through that plume, so we have an excellent opportunity to measure what is going on and what is there, all the way down into some mineralogical angles. We're going to learn a lot from this."

After it captures data from the plume and sends it back to Earth, the LCROSS satellite also will crash into the moon, creating a second plume visible to lunar-orbiting spacecraft and Earth-based observatories.

"One of the side benefits of this mission," Andrews said, "is that we will have the opportunity for amateur astronomers back on Earth with reasonable-grade telescopes to be able to witness ... the plume that develops."

It is a great way, he added, "to engage the public in this very interesting mission."

Information and images of the **Lunar Reconnaissance Orbiter** and the **LCROSS** mission are available at the NASA Web site.

More information about NASA's plans to explore the moon, Mars and beyond is available at the NASA Web site.