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Archive for the Lunar Explorers category

10-21-08

## [KAGUYA High Definition Movies Available to Public](#)

Posted by [dj](#)

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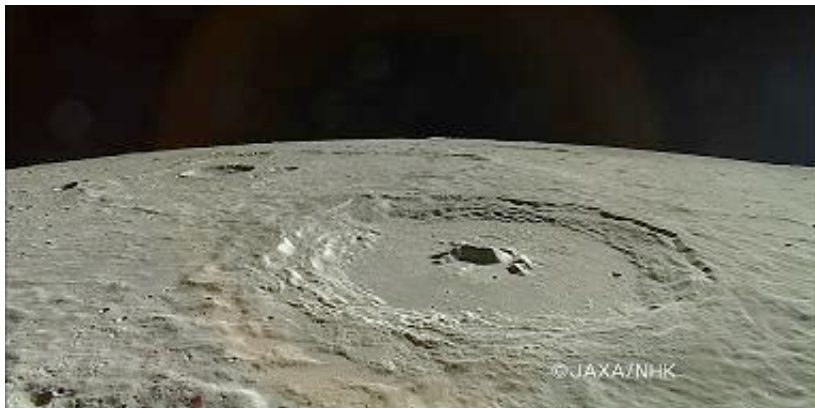
Courtesy of [JAXA/NHK](#)

On September 14th, 2007, the Japan Aerospace Exploration Agency (JAXA) launched the second Japanese lunar explorer, Kaguya. Kaguya was launched by an H-IIA Launch Vehicle from the Tanegashima Space Center (Mitsubishi Heavy Industries, Ltd. has a [special page](#) dedicated to the H-IIA No. 13, which was the rocket used for the Kaguya mission).

Kaguya shared the journey to the Moon with two smaller satellites, Okina and Okuna. Once in lunar orbit, Kaguya released the small satellites on elliptical orbits around the Moon. Okina and Okuna play the role of orbiting radio transmitters, relaying the data from Kaguya back to Earth in real time when Kaguya is above the far side of the Moon.

The instruments onboard the spacecraft have measured the composition and the topography of the lunar surface for more than one year.

Mapping of the lunar magnetic field was also performed.



Courtesy of [JAXA/NHK](#)

The NHK HDTV cameras on Kaguya recorded stunning movies of the Earth rising and setting over the lunar surface. The [movies are now available](#) on JAXA's web site.



[Lunar Explorers](#), [Space Exploration](#)

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10-15-08

### [Scouting the Moon \(III\)](#)

Posted by [dj](#)

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In the previous two posts in this series, we presented NASA's [Lunar Reconnaissance Orbiter \(LRO\)](#) and the [Chandrayaan-1 mission](#), which was designed and developed by ISRO. These two missions are typical lunar scouting missions: the spacecraft with onboard



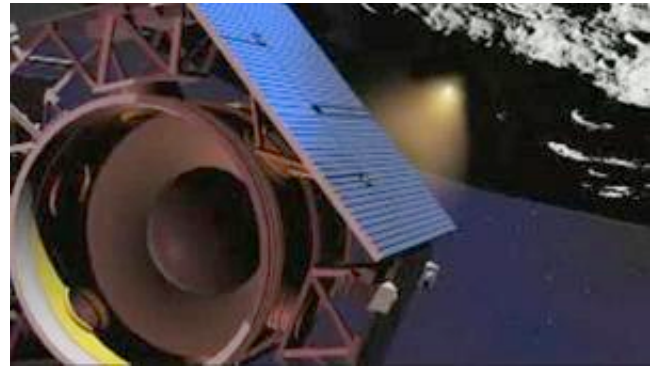
remote-sensing instruments will orbit the Moon, collect scientific data, and relay it back to Earth.

Credits: NASA

NASA will launch another lunar scouting spacecraft on the same Atlas V rocket with LRO: the Lunar Crater Observation and Sensing Satellite (LCROSS). This mission is not a typical scouting mission and we will see why in this post.

In 1999, a precursor of LRO and LCROSS called the Lunar Prospector detected traces of concentrated hydrogen at the lunar poles. As a result, the LCROSS mission's main goal is to confirm the presence or absence of water in a permanently shadowed crater near a lunar polar region. At the present time, landing a probe on the lunar surface and performing excavations or drilling would be very expensive. A less expensive solution for the LCROSS mission is to use a kinetic impactor to excavate a crater on the surface of the Moon.

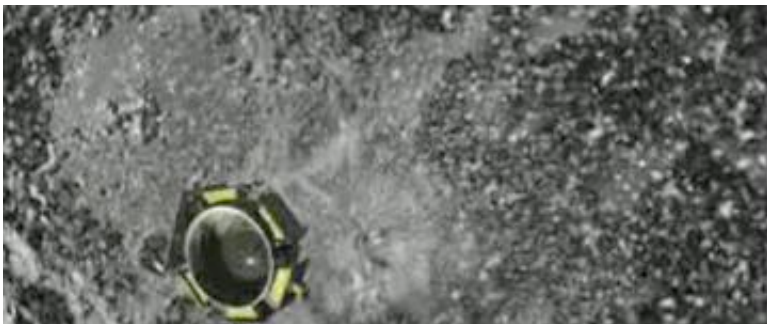
After the launch, LRO will separate from LCROSS, and continue on a solo journey to the Moon. LCROSS will remain attached to the Centaur upper stage of the Atlas V launch system.



Credits: NASA

While LRO will follow a trajectory that will place it in a polar lunar orbit, LCROSS will execute a flyby of the Moon, and use an elongated Earth orbit to position itself on an impact trajectory. During this time, the LCROSS mission team will perform instrument calibration and corrections for the impact trajectory. The target of the impact will be the lunar south pole.

Seven minutes before the impact, LCROSS will separate from Centaur. The Centaur will be used as a kinetic impactor. Having a mass of approximately 2,200 kg, on impact, it will excavate a crater 20 meters wide and 3 meters deep. According to NASA scientists, more than 250 tons of lunar material will be propelled into space.



LCROSS will then fly through the debris of the previous impact. The instruments onboard LCROSS will collect scientific data and the spacecraft will relay it back to Earth. LCROSS will end its mission four minutes after the Centaur impact by creating its own impact crater on the lunar surface. The last S in



LCROSS should stand for Smasher instead of Satellite considering the final act of the mission!

Credits: NASA

The scientific instruments onboard LCROSS cover a wide spectrum: two near-infrared spectrometers, a visible light spectrometer, two mid-infrared cameras, two near-infrared cameras, a visible camera, and a visible radiometer. The instruments can detect traces of organics, hydrocarbons, hydrated minerals, water ice, and water vapor. More details about the LCROSS scientific payload can be found on [LCROSS mission page](#).

I wonder to what extent the debris caused by the impact of Centaur and LCROSS will interfere with the scientific instruments onboard LRO and Chandrayaan-1. Both LRO and Chandrayaan-1 will be orbiting the Moon on polar orbits at that time.



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10-8-08

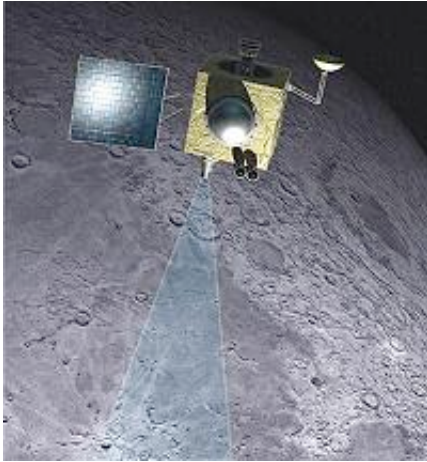
## [Scouting the Moon \(II\)](#)

Posted by [dj](#)

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We presented in a [previous post](#) the Lunar Reconnaissance Orbiter (LRO) mission. The goals of the LRO mission are to map the lunar resources and to create a detailed 3D map of the lunar surface in preparation for future NASA missions to the Moon. However, NASA is not the only space agency that has high hopes regarding the exploration of the Moon. The Indian Space Research Organization (ISRO) is another agency heavily involved in space activities.





Interest in undertaking a lunar scientific mission was sparked at a meeting of the Indian Academy of Sciences in 1999. One year later, the Astronautical Society of India made a recommendation supporting the idea.

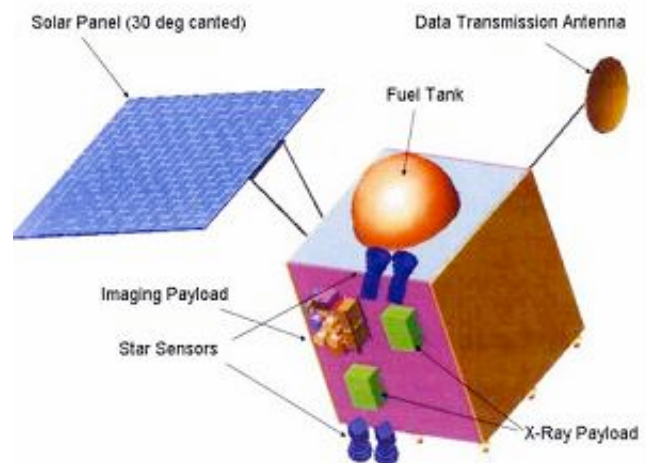
The ISRO formed a National Lunar Mission Task Force that involved leading Indian scientists. The Task Force provided an assessment on the feasibility of such a mission. The mission, called Chandrayaan-1, was approved in November 2003 for an estimated cost of \$83 million USD.

Credits: ISRO

The Chandrayaan-1 spacecraft is a 1.5 meter cube with a ~~weight~~ mass of approximately 523 kg. The spacecraft bus is based on an already developed meteorological satellite. Chandrayaan-1 will carry a 30 kg probe that will be released to penetrate the lunar surface. The power for the onboard systems is generated by a solar panel. The 750 watts generated by the solar panel will be stored by the rechargeable batteries onboard the spacecraft. Maneuvering in the lunar orbit is done using a bipropellant propulsion system.

The scientific payload contains a diverse collection of instruments. The instruments were designed and developed by ISRO, ESA, NASA, and the Bulgarian Space Agency.

There are two instruments that will map the surface of the Moon: the Terrain Mapping Camera (TMC) will produce a 5 meter resolution map of the surface, and the Lunar Laser Ranging Instrument (LLRI) will scan the lunar surface and determine the surface topography.



Credits: ISRO

The X-ray spectrometer onboard the spacecraft has three components: the Imaging X-ray Spectrometer (CIXS), the High Energy X-ray/gamma ray spectrometer (HEX), and the Solar X-ray Monitor (SXM). The X-ray spectrometer will measure the concentration of certain elements on the lunar surface as well as monitor the solar flux in order to normalize the results of the measurements taken.

The mineralogical configuration of the surface will be mapped by four instruments: the Hyper Spectral Imager (HySI), the Sub-keV Atom Reflecting Analyzer (SARA), the Moon Mineralogy Mapper (M3), and the Near-Infrared Spectrometer (SIR-2).

The Radiation Dose Monitor (RADOM-7) will record the radiation levels in the lunar orbit.



ISRO has two operational launch vehicles: the Polar Satellite Launch Vehicle (PSLV) and the Geosynchronous Satellite Launch Vehicle (GSLV). For Chandrayaan-1, ISRO has chosen to use PSLV as a launch vehicle. The PSLV developmental flights were completed in 1996 and the rocket has had 12 successful missions since then. PSLV is 44.43 meters tall and ~~has a weight of~~ 294 tonnes at launch. It can inject a payload of 1,000 kg – 1,200 kg into a polar orbit.

The launch of the Chandrayaan-1 mission is scheduled for the end of October 2008. The PSLV rocket will take off from the Satish Dhawan Space Center in Sriharikota on the southeast coast of India. The transfer to the lunar orbit will take approximately five days and after additional maneuvers the spacecraft will reach its final polar orbit, 100 km above the surface. The spacecraft will be operational for two years.

Credits: ISRO

The Chandrayaan-1 mission opens the door to future lunar missions. ISRO has already committed to a second Chandrayaan mission that will land a rover on the surface of the Moon. The rover will perform a number of experiments on the lunar surface and the results will be relayed to Earth by the Chandrayaan-2 orbiter.

We will come back with more details about the Chandrayaan-1 mission as the events unfold. Please stay tuned on the OrbitalHub frequency.

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09-24-08

## [Scouting the Moon](#)

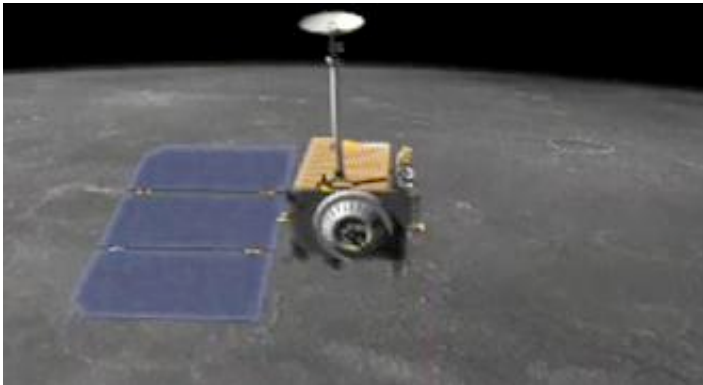
Posted by [dj](#)

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NASA's return to the Moon requires careful preparation. Finding safe landing sites, locating potential resources, and taking measurements of the radiation environment are some of the tasks the Lunar Reconnaissance Orbiter (LRO) spacecraft will perform while in lunar orbit. LRO is an unmanned mission that will create a comprehensive atlas of the moon's surface and resources.

The data gathered by LRO will be crucial in designing and building a permanent lunar outpost. The data will also be used to reduce the risk and increase the productivity of the future manned missions to the Moon.

The launch of LRO is scheduled for February 2009. An Atlas V rocket launched from the Kennedy Space Center will place the LRO on a transfer trajectory. After 4 days, the spacecraft will reach the Moon and after performing additional orbital maneuvers, it will move into its final orbit. The LRO's final orbit will be a circular polar orbit 50 kilometers above the lunar surface.



The mission is designed to last for one year, with a possible extension. The total mass of the spacecraft is around 1,000 kilograms, of which 500 to 700 kilograms will be the fuel. The power is supplied by articulated solar arrays, and for the peak and eclipse periods a Li-Ion battery is used. The bandwidth of the communication link will be approximately 100-300 Mbps.

Credits: NASA

The LRO payload is comprised of six scientific instruments and one technology demonstration.

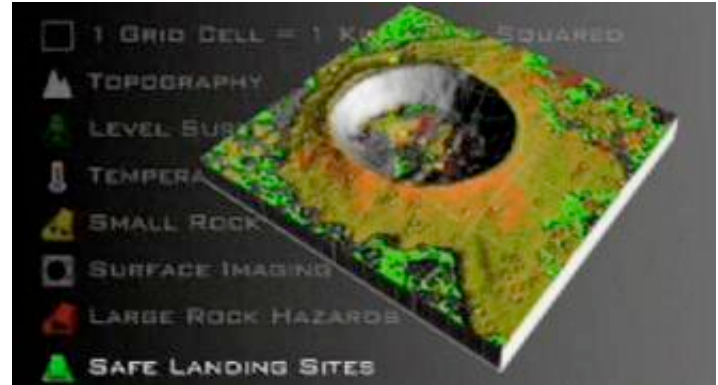
The Cosmic Ray Telescope for the Effects of Radiation (CRaTER) was built and developed by Boston University and the Massachusetts Institute of Technology in Boston. CRaTER will help explore the lunar radiation environment. The data gathered by measurements will help in the development of protective technologies that will keep future lunar crews safe.

The Diviner Lunar Radiometer Experiment (DLRE) was built and developed by the University of California, Los Angeles and the Jet Propulsion Laboratory in Pasadena, California. DLRE is capable

of measuring surface and subsurface temperatures from orbit.

The Lyman-Alpha Mapping Project (LAMP) was built and developed at the Southwest Research Institute in San Antonio. LAMP will be used to map the entire lunar surface in the far ultraviolet spectrum.

The Lunar Exploration Neutron Detector (LEND) was developed at the Institute for Space Research in Moscow. This detector will create high-resolution maps of the hydrogen distribution and gather data about the neutron component of the lunar radiation.



Credits: NASA

The Lunar Orbiter Laser Altimeter (LOLA) was conceived and built at NASA's Goddard Space Flight Center. LOLA will generate high-resolution three-dimensional maps of the moon's surface.

The Lunar Reconnaissance Orbiter Camera (LROC), developed at Arizona State University at Tempe, will image the lunar surface in color and ultraviolet. LROC will be able to capture 1 m resolution images of the lunar poles.

The technology demonstration is called Mini-RF Technology Demonstration. The primary goal of this demonstration is to locate subsurface water ice deposits. The advanced single aperture radar (SAR) that will be used is capable of taking high-resolution imagery of the permanently shadowed regions on the lunar surface.

The data gathered by LRO will help us develop a better understanding of the lunar environment. This understanding is essential for a safe human return to the Moon and for the future exploration of our solar system.



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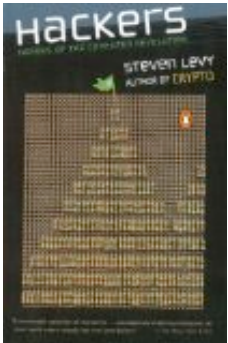
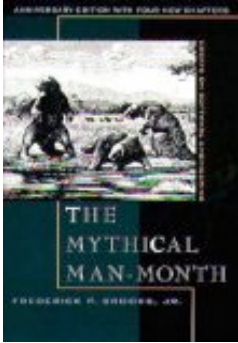
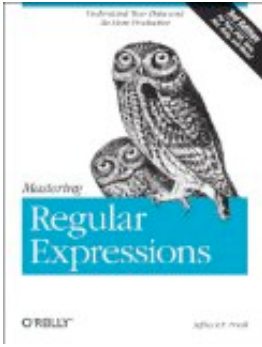
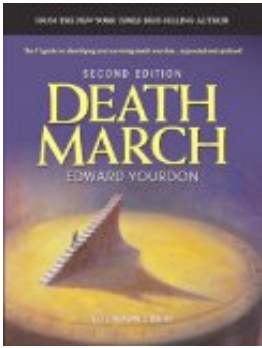
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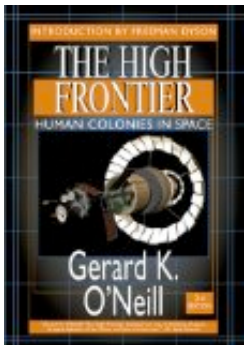
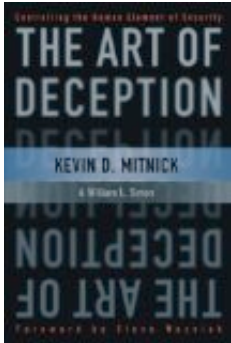
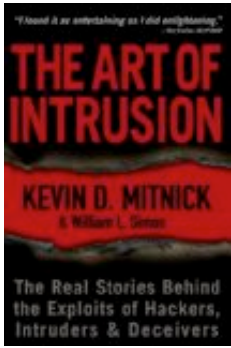
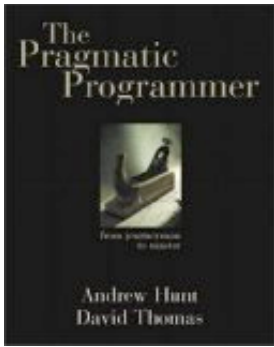
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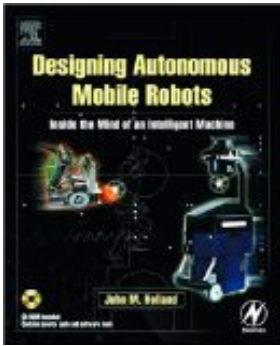
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