# Lunar Librarian Newsletter September 2007

Vol. 2. Issue, 9

### LRO News

The Instrument Module was put through several tests in August. Two of the tests, imaged below, are sine-burst and acoustic tests. These tests simulating launch level vibrations in order to prove that the equipment can withstand the launch. For testing it is convenient to separate the acoustic regime from lower frequencies.



Instrument Module Sine-Burst Test
The sine burst test is done by putting the equipment (Flatsat) on a shake table and the equipment is shaken a specific frequencies and amplitudes. To cover all frequencies that the equipment will see during launch the frequency ramps through the range in a burst.



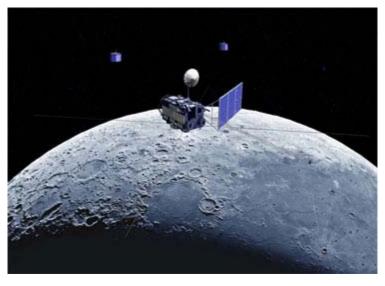
Instrument Module Acoustic Test

Instrument module is placed in a room with a large horn. The horn then blasts away while engineers take measurements of the effects on the module.

#### Lunar News

SELENE ~ First in a series of visitors

Before LRO makes its way to the Moon, the Moon will be visited by several other lunar efforts. The first to visit is the Japanese Space Agency (JAXA) SELENE (SELenological and ENgineering Explorer) or Kaguya, launched on September 14<sup>th</sup>. It will take SELENE approximately 5 days to reach the Moon. Similar to the other upcoming lunar missions, SELENE's primary objective is to survey the Moon, "obtaining data on elemental abundance, mineralogical composition, topography, geology, gravity,



and the lunar and solar-terrestrial plasma environments and to develop critical technologies for future lunar exploration, such as lunar polar orbit injection, three-axis attitude stabilization, and thermal control." (http://nssdc.gsfc.nasa.gov/database/MasterCatalog?sc=SELENE)

As seen in the artist rendition, above, SELENE consists of three satellites. The foreground satellite is an orbiter containing most of the scientific equipment. The other two satellites are a VLBI (Very Long Baseline Interferometry) Radio (VRAD) satellite (Vstar) make precise measurements of the position and precession of the Moon, and a relay satellite (Rstar) "designed to receive a Doppler ranging signal from the orbiter when it is around the far side out of direct contact with the Earth and transmit the signal to Earth to estimate the far-side gravitational field."

In use for over 25 years, very long baseline interferometry (VLBI) is a geometric technique that measures the time difference between the arrival of a radio wavefront emitted by a distant quasar to two Earth-based antennas. (<a href="http://lupus.gsfc.nasa.gov/files\_documents/vlbi\_brochure\_1990s/bintro.html">http://lupus.gsfc.nasa.gov/files\_documents/vlbi\_brochure\_1990s/bintro.html</a>) By measuring the time difference of a large number of quasars, the time difference measurements are accurate to a few picoseconds, the relative location of the antennas to a few millimeters, and the quasar positions to fractions of a milliarcsecond. With this type of accuracy in the measurements over time, scientists were able to conclude the existence of tectonic plate motion, regional deformation, and local uplift or subsidence. In the case for SELENE, both Vstar and Rstar will have VLBI onboard. They will be used to determine the Moon's gravity field.

For more information on SELENE, please visit: <a href="http://www.jaxa.jp/projects/sat/selene/index\_e.html">http://www.jaxa.jp/projects/sat/selene/index\_e.html</a>

#### NASA News

### STS-118 – An Educator in Space

What would it be like to lift off into space? Most Americans will never know only a select few become astronauts and make it into space. For many of us we just hope to inspire our children and students to view science and math as tools to get some where, not obstacles.

On this flight, Barbara Morgan became the first educator astronaut in space. Initially, Barbara was selected as the backup candidate for the NASA Teacher in Space Program in 1985. Though due to the unfortunate Challenger accident, Barbara Morgan assumed the duties of Teacher in Space Designee.

She returned to her teaching career, but continued to work with NASA's



Education Division. In January 1998, Barbara was selected to be the first Educator Astronaut. These individuals are teachers selected by NASA who have expertise in K-12 classrooms and are trained to become fully-qualified astronauts. As an astronaut, Barbara was one of the robotic operators controlling both the Shuttle's robotic arm and the International Space Stations' robotic are during spacewalks and other activities.

A few lucky Lunar Librarians and New Horizon Educators had an opportunity of a lifetime to attend a prelaunch conference of STS-118 and stay and watch the launch. I would like to share some of the comments that Stephanie Shauck (Librarian), Linda Gauthier (NH educator), and Pye Pajewski (Librarian) sent me.

We heard from an astronaut in training, took the back door tour to Kennedy Space Center with a guide who has 31 years of experience....were 200 yards from the Shuttle and 100 yards from the launch pad they are preparing for the Moon launches.

We sat with astronaut family members and about 100 turkey vultures. The difference between our view and other sites is that we had no tree obstruction so the first burst of light and sideways ignition clouds were very evident. The best way to describe the experience was like being in a movie only it was real! They announced that should a malfunction occur we would go to a our buses because of toxic vapors...right...the silver fish flipping from the water, egrets and blue herons seemed unphased from our distance.

We sat outside for about 2 hours that seemed to drag and then about 5 minutes until launch everything went in warp speed...sang national anthem which took 2 ½ minutes....then they announced ice on top of a rocket booster...but then decided to launch anyway....first burst of light about 3 seconds to launch...the frozen horizontal smoke...and then it sped skyward so fast.....it was already moving downsky before we heard any sound....like a long firework at a lower pitch...all were silent until we heard the "throttle up" and when we saw the rocket boosters fall to the sea everyone started to cheer and hug each other....

I think that not only did I stop breathing but my heart stopped beating ...those incredibly brave people sitting on top of controlled bombs! ~ Stephanie Shauck

Before the launch I was in line in the Saturn V building for 20 min. to buy stamps and talked to a lovely lady behind me. After talking to her for a while I realized she had a different type of identification badge on. When I asked her what group she was with she told me she is the widow of Mike Smith-one of the astronauts killed in the space shuttle Challenger accident in 1986. She was attending this launch for the first time since her husband was died over 21 years ago! She had her family with her. She was there to support Barbara Morgan whom she has known for over 24 years. I thanked her for her efforts in creating the Challenger Learning Centers...

I have registered to do the Engineering Design Challenge

(http://www.nasa.gov/audience/foreducators/plantgrowt h/home/index.html) with my students using the basil seeds that are being flown on STS-118. I will be talking to the local Observatory about providing Picture taken by Linda Gauthier

information to teachers concerning this outstanding opportunity to connect with space exploration. ~ Linda Gauthier

As a child during the Apollo era, I remember anything related to the space program was big news, even for those who weren't extremely interested in science. These days, shuttle missions don't seem to capture the attention of the general public in the same way. What can we do to bring back the excitement?

Almost every speaker at the conference, from educator to scientist to astronaut, indicated that they are where they are today because someone in their life believed in them and encouraged them to reach their potential. With our library programs we hope to come alongside our local schools to inspire the kids in our community to pursue STEM fields. It was exciting to learn about the resources that are available to make this happen.

Attending the conference and launch gave me a greater appreciation for not only this launch, but for the overall vision of NASA for the future. I hope that I can pass that appreciation on to our young library patrons and their families. ~ Pye Pajewski

#### **Science News**

NASA Science News has published several articles last month. Please follow the links to read the full stories. Check out our RSS feed at http://science.nasa.gov/rss.xml!



#### **Throttling Back to the Moon**

Accelerating from 0 to 60, then slowing down for a stop light is no problem for an ordinary automobile. But if you were piloting a rocketship, it wouldn't be so easy. Most rocket engines are designed to burn full-on (liftoff!) or full-off (coasting through space) with no in-between. And that can be a problem--namely, how do you land this thing? In today's story we learn how engineers are developing technology for throttling next-generation lunar landers. <a href="http://science.nasa.gov/headlines/y2007/16jul\_ceee.htm?list907815">http://science.nasa.gov/headlines/y2007/16jul\_ceee.htm?list907815</a>

#### Flying Into a Thunderstorm

This month in the skies above Costa Rica, scientists are flying into thunderclouds to learn more about the inner workings of furious storms. <a href="http://science.nasa.gov/headlines/y2007/18jul\_tc4.htm?list907815">http://science.nasa.gov/headlines/y2007/18jul\_tc4.htm?list907815</a>

#### **Mars Rovers Caught in Severe Dust Storm**

A severe dust storm is underway on Mars, causing an energy crisis for NASA's Mars rovers. Dust in the atmosphere over Opportunity has blocked 99 percent of direct sunlight, leaving only the limited diffuse sky light to power the rover. <a href="http://science.nasa.gov/headlines/y2007/20jul\_duststorm.htm?list907815">http://science.nasa.gov/headlines/y2007/20jul\_duststorm.htm?list907815</a>

#### Piranha Black Holes

Astronomers using NASA's Chandra X-ray Observatory have caught some supermassive black holes engaged in a piranha-like feeding frenzy.

http://science.nasa.gov/headlines/y2007/27jul\_piranha.htm?list907815

#### **Dreamy Lunar Eclipse**

Mark your calendar: On Tuesday, August 28th, there's going to be a dreamy, colorful, total eclipse of the Moon. http://science.nasa.gov/headlines/y2007/03aug\_dreamyeclipse.htm?list907815

#### **Strange Lights: The 2007 Aurigid Meteor Shower**

On Sept. 1st, a flurry of bright and oddly-colored meteors could spill across the skies of western North America--or not. Forecasters are divided about what will happen next month when Earth runs into an ancient stream of debris from mysterious Comet Kiess.

http://science.nasa.gov/headlines/y2007/08aug\_aurigids.htm?list907815

#### Of Skunks and Telescopes

This human interest story describes a night in the life of scientists and engineers working 'round the clock to test NASA's next great space telescope. http://science.nasa.gov/headlines/y2007/10aug\_xrcf.htm?list907815

#### Surprise! A Star with a Comet-like Tail

Astronomers have discovered something they've never seen before: a star with a tail like a comet. Even more amazing is the fact that the newfound tail is attached to one of the most popular stars in the sky, a red giant named Mira. Amateur and professional astronomers have been watching Mira for 400 years and only recently has a NASA space telescope spotted its massive tail.

http://science.nasa.gov/headlines/y2007/15aug\_mira.htm?list907815

#### **Space Seeds Orbit Earth**

When she blasted off onboard the space shuttle Endeavour last week, teacher-turned-astronaut Barbara Morgan carried millions of basil seeds to the International Space Station. Soon she'll return millions more "space seeds" for students on Earth to study. Educators, read today's story to learn how to participate. http://science.nasa.gov/headlines/y2007/16aug basil.htm?list907815

#### The Exploding Lunar Eclipse

On Tuesday morning, Aug. 28th, a team of astronomers and engineers at the Marshall Space Flight Center will attempt something never done before--to observe meteoroids hitting the Moon and exploding during a lunar eclipse. This will allow them to explore an elusive and mysterious population of "Helion" meteoroids coming from the direction of the sun.

http://science.nasa.gov/headlines/y2007/27aug\_explodingeclipse.htm?list907815

#### **Cosmic Cockroaches**

A tough, pesky molecule possibly key to the origins of life on Earth has been spotted in deep space surviving the ferocious blastwave of a supernova explosion.

http://science.nasa.gov/headlines/y2007/31aug\_cockroaches.htm?list907815

#### The Universe Through the Looking Glass

Astronomers at NASA's Marshall Space Flight Center are testing a strangely-shaped mirror that will allow them to explore the Universe using super-energetic X-rays.

http://science.nasa.gov/headlines/y2007/07sep\_lookingglass.htm?list907815

#### **Fasten Your Seat Belts**

NASA's adventurous Discovery program--responsible for the first rover on another planet, the first landing on an asteroid, the first samples of a comet returned to Earth and much more--is about to get even better. http://science.nasa.gov/headlines/y2007/14sep\_seatbelts.htm?list907815

#### A Giant Trilobite on the Sun

Last week in Boulder, Colorado, scientists converged on the "Living With A Star" workshop to share the latest research in solar physics. At one point, nearly 200 participants sat slack-jawed as they watched a new movie recorded by Japan's Hinode spacecraft showing a sunspot emerging from the depths of the sun. The newborn spot resembled nothing less than a swimming planet-sized trilobite. See for yourself--and find out what it means--in today's Science@NASA story.

http://science.nasa.gov/headlines/y2007/18sep\_trilobite.htm?list907815

### Librarian News



# Welcome to Fall! What programs are you planning for the fall? Drop us an email and let us know!

# Did you know?? Where can I find??

So you want to borrow the Lunar Sample disks...

If you're NASA center is Goddard Space Flight Center, go to the following link <a href="http://www.nasa.gov/centers/goddard/visitor/loan/lunar.html">http://www.nasa.gov/centers/goddard/visitor/loan/lunar.html</a>. You will find the directions and the required paperwork that needs to be filled out.

If your NASA center is Dryden Research Center, please go to <a href="http://www1.dfrc.nasa.gov/Education/Educator/SupportMaterials/lunar.html">http://www1.dfrc.nasa.gov/Education/Educator/SupportMaterials/lunar.html</a> for directions and required paperwork.

If your NASA center is Johnson Space Flight Center, please go to: <a href="http://curator.jsc.nasa.gov/lunar/sampreq/index.cfm">http://curator.jsc.nasa.gov/lunar/sampreq/index.cfm</a> for directions and required paperwork.

### Links of the Month...

- Google Moon, http://www.google.com/moon/, higher resolution images provided by LPI.
- New images from Cassini <a href="http://saturn.jpl.nasa.gov/news/events/iapetus/showAll.cfm">http://saturn.jpl.nasa.gov/news/events/iapetus/showAll.cfm</a>, new images of Iapetus.
- Astronomy Picture of the Day <a href="http://antwrp.gsfc.nasa.gov/apod/astropix.html">http://antwrp.gsfc.nasa.gov/apod/astropix.html</a>
- Earth Science Picture of the Day, <a href="http://epod.usra.edu/">http://epod.usra.edu/</a>
- NASA's Educational Resource Centers <a href="http://www.nasa.gov/audience/foreducators/k-4/contacts/ERCN\_State\_Listing.html">http://www.nasa.gov/audience/foreducators/k-4/contacts/ERCN\_State\_Listing.html</a> Find out where your closest ERC is.
- Good Astronomy Activities on the World Wide Web <a href="http://www.astrosociety.org/education/activities/astroacts.html">http://www.astrosociety.org/education/activities/astroacts.html</a>

## Monthly Lunar Activity

# Making a Comet in the Classroom

by Dennis Schatz Pacific Science Center http://www.noao.edu/education/crecipe.html

A dramatic and effective way to begin a unit on comets is to make your own comet right in front of the class. The ingredients for a comet are not difficult to find and watching a comet being "constructed" is something the students will remember for a long time.

The "ingredients" for a six-inch comet are:

- 2 cups of water
- 2 cups dry ice (frozen carbon dioxide)
- 2 spoonfuls of sand or dirt
- a dash of ammonia
- a dash of organic material (dark corn syrup works well)

Other materials you should have on hand include:

- an ice chest
- a large mixing bowl (plastic if possible)
- 4 medium-sized plastic garbage bags
- work gloves
- a hammer, meat pounder, or rubber mallet
- a large mixing spoon
- paper towels

Dry ice is available from ice companies in most cities (look under "ice" in the Yellow Pages for a local source). Day-old dry ice works best, so you might want to buy it the afternoon before the day you do the activity. Keep the dry ice in an ice chest when transporting it and in your refrigerator's freezer compartment overnight. Most ice companies have a minimum on the amount of ice they will sell (usually 5 pounds). But having extra dry ice on hand will be useful because some will evaporate and also because it is advisable to practice this activity at least once before doing it with the class.

Here are the steps for making a 6-inch comet (students make good baker's assistants for this exercise!):

- 1. Cut open one garbage bag and use it to line your mixing bowl.
- 2. Have all ingredients and utensils arranged in front of you.
- 3. Place water in mixing bowl.
- 4. Add sand or dirt, stirring well.
- 5. Add dash of ammonia
- 6. Add dash of organic material (e.g. corn syrup), stirring until well mixed.
- 7. Place dry ice in 3 garbage bags that have been placed inside each other. Be sure to wear gloves while handling dry ice to keep from being burned.
- 8. Crush dry ice by pounding it with hammer.
- 9. Add the dry ice to the rest of the ingredients in the mixing bowl while stirring vigorously.
- 10. Continue stirring until mixture is almost totally frozen.

- 11. Lift the comet out of the bowl using the plastic liner and shape it as you would a snowball.
- 12. Unwrap the comet as soon as it is frozen sufficiently to hold its shape.

Now you can place the comet on display for the students to watch during the day as it begins to melt and sublimate (turn directly from a solid to a gas - which is what carbon dioxide does at room temperature and comets do under the conditions of interplanetary space when they are heated by the Sun).

The comet is reasonably safe to touch without getting burned by the dry ice, but it is still best to have a spoon or a stick for the students to use while examining it. As the comet begins to melt, the class may notice small jets of gas coming from it. These are locations where the gaseous carbon dioxide is escaping through small holes in the still frozen water. This type of activity is also detected on real comets, where the jets can sometimes expel sufficient quantities of gas to make small changes in the orbit of the comet.

After several hours, the comet will become a crater-filled ice ball as the more volatile carbon dioxide sublimates before the water ice melts. Real comets are also depleted by sublimation each time they come near the Sun. Ultimately; old comets may break into several pieces or even completely disintegrate. In some cases, the comet may have a solid, rocky core that is then left to travel around the comet's orbit as a dark barren asteroid.