



Lunar Librarian Newsletter

July & August 2008

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LRO News

The Orbiter completed its mechanical environments testing. After measuring the mass properties of the spacecraft, we completed 3 axes of sine vibration, acoustics testing, and shock testing. Check out the video of the environmental testing (http://www.nasa.gov/mission_pages/LRO/news/lrotesting_release.html) on the right hand side. Sine vibration shakes the spacecraft to simulate oscillations that may occur during launch. In the acoustics test, we blasted the Orbiter with the noise of launch. The noise couples in through large surfaces (like the solar array) and shakes the spacecraft. We completed the second of two shock tests today, where we released the clamp band that holds the Orbiter to the launch vehicle. The shock of this release gives the bottom of the spacecraft a hard bang.



This view of the Orbiter shows the solar array on the right and the Mini-RF antenna on the left with the other instruments in the background. The bolt catchers sticking out from the array catch the hardware that keeps the array attached to the spacecraft during launch.



Here the Orbiter is on the Miller table undergoing mass properties measurements. We measure the mass, center of mass in two axes, and the moment of inertia in one axis. You can see the instrument module on the right. The radiator panel is the surface coated in mirrors. These Optical Surface Reflectors reject most of the energy incident from the sun but still emit energy in the infrared, allowing the surface to run cold, even in direct sun. The high-gain antenna boom, shown here stowed across the radiator, will be deployed on the way to the Moon, rotating around the hinge at the bottom.



The mechanical team prepares for the final shock test. During the test, an electrically actuated pin puller released the band mechanism, dropping the separation system on the foam pads. The flight separation system is painted white so that it doesn't get too hot in the sun while it travels with LCROSS to the Moon.

July was a very busy month for LRO. We completed our comprehensive performance test, establishing a baseline against which we will compare after environmental testing. We finished nearly all of the



blanketing work, and we are now putting on the final touches for mass properties measurement, followed by mechanical environments.

On July 1st, we rotated the orbiter to place the +Z-axis down, so that we could test our optical instruments with minimal distortion due to gravity. This view shows the +X face, with the qualification battery in the upper left corner, CRaTER in the lower left, and the omni antenna boom on the right, with the omni antenna partially obscuring the view of the high-gain antenna

Follow LRO's assembly progress at: <http://lunar.gsfc.nasa.gov/hardware.html>

So When is LRO Going to Launch???

This is a question we have hear from several of the librarians. Here's the official press release as of July 31, 2008.

By the end of 2008, the Lunar Reconnaissance Orbiter will be transported to NASA's Kennedy Space Center in Florida for final launch preparations. The orbiter and the Lunar Crater Observation and Sensing Satellite, a mission to impact the moon in search of water ice, are scheduled to launch atop an Atlas V rocket from Cape Canaveral Air Force Station in Florida. The launch window opens Feb. 27, 2009, and continues through the end of March. (http://www.nasa.gov/mission_pages/LRO/news/lrotesting_release.html)

NASA News

Twitter. Facebook. Blogs. OH MY!

Keeping in touch with people by letters, aka snail-mail, is so out of date. Even email can be slow. The latest way of keeping in touch with people, and I mean a lot of people, is through the different electronic social media channels. Twitter, Facebook, and blogs allow users to disseminate information to a vast number of people who choose to follow what you have to say. You also have the choice of who can read what you post, for the most part.

Twitter can be best described as micro-blogging. Users 'twitter' what they are doing in 140 characters or less. Similar to instant messaging chat rooms, you can talk to a number of people at one time. People choose to follow you as you tweet about your day or what is going on in your life. You can in turn choose to follow them, or not. In order to preserve your privacy, you have the option to block people you do not want following you or you can allow people to follow you by permission only.

Personal web pages have been around for a while. The latest thing to have is a MySpace or Facebook page. MySpace has been utilized mainly by the youth. On the other hand, Facebook is geared to Generation X and Y. Generation X'ers were born between 1964 and 1980, while Gen Y'ers were born between 1981 and 1994.

Facebook allows users to join networking groups centered on where one lives, where one went to school, and where one works. Users can post their interests, personal information such as political view, and even photos for people to see. It is easy to become a fan of a rock group or a cause, let alone challenge your friends to a game of Scramble. Just like Twitter, you can limit who can see what information you post.

So what does this have to do with NASA? Quite a bit. Many of NASA's missions, such as LRO, LCROSS, SDO, Mars Phoenix, and New Horizons, are tweeting and keeping Facebook pages about their mission. Twittering has allowed mission team members to keep the public up-to-date on the latest happenings with the mission.

Still not convinced? You heard about "Send your name to the Moon," (hopefully you sent your name). Currently there are 1.55 million names being sent to the Moon. How did we manage to get so many? Simple, the EPO Lead for LRO, Stephanie Stockman, tweeted on Twitter about it. Other Twitter users picked up the post and then 'retweeted' it to others. The use of social media does not stop there. Stephanie also created a Facebook page on LRO and a specific group called "Send your name to the Moon with LRO."

Check out the following links:

- **LRO:**
 - Twitter: http://twitter.com/LRO_NASA
 - Facebook: <http://www.facebook.com/profile.php?id=1349462143>
- **LCROSS:**
 - Twitter: http://twitter.com/LCROSS_NASA
 - Facebook: <http://www.facebook.com/profile.php?id=1381982749>
- **New Horizons:**
 - Twitter: <http://twitter.com/NewHorizons2015>
 - Facebook: <http://www.facebook.com/profile.php?id=1425866532>
- **MESSENGER:**
 - Twitter: <http://twitter.com/MESSENGER2011>
 - Facebook: <http://www.facebook.com/profile.php?id=1436758075>

NASA's Hubble Space Telescope completing its 100,000th orbit

On the morning of August 11, 2008, NASA's Hubble Space Telescope completed its 100,000th orbit around the Earth. Hubble has been orbiting the Earth and taking extraordinary pictures of the universe over the last 18 years. Visitors to <http://hubblesite.org/gallery/> can view the vast array of images including dazzling regions of celestial birth and renewal.



Red shows emission from sulfur atoms, green from glowing hydrogen, and blue from glowing oxygen.

The image to the right is a small portion of the Tarantula nebula near the star cluster NGC 2074. "The region is a firestorm of raw stellar creation, perhaps triggered by a nearby supernova explosion. It lies about 170,000 light-years away and is one of the most active star-forming regions in our local group of galaxies." (<http://www.nasa.gov/hubble>)

"This morning, the greatest scientific instrument since Galileo's telescope has reached another great milestone - its 100,000th orbit around the Earth," stated Senator Barbara A. Mikulski, D-Md., chairwoman of the Commerce, Justice and Science Appropriations Subcommittee that funds NASA. "Hubble has given us amazing insight into the origins of our universe, and I'm so proud of the men and women at Goddard and the Space Telescope Science Institute for their contributions and dedication to these great discoveries. The entire world is looking forward to the Hubble servicing mission in October 2008, when Hubble will get new scientific instruments, new batteries and new gyroscopes. The servicing mission will extend Hubble's life and give it a more powerful view of our universe. Hubble is the telescope that could, and its best years are ahead of it!" (http://www.nasa.gov/mission_pages/hubble/)

In October, NASA will be visiting Hubble for the fourth and last time. Shuttle astronauts will be replacing inoperable instruments, gyros, batteries and other components to allow the telescope to continue to operate through 2013. They will also add two new instruments to allow Hubble to see into the ultraviolet and infrared. This servicing mission will also improve Hubble's ability to see into new areas of the Universe. It is unknown what new discoveries Hubble will find. For more information on Hubble Servicing Mission 4, please visit: http://www.nasa.gov/mission_pages/hubble/servicing/SM4/main/index.html

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>!

NASA to Attempt Historic Solar Sail Deployment

This summer, NASA engineers will try to realize a dream older than the Space Age itself: the deployment of a working solar sail in Earth orbit. The name of the sail is NanoSail-D and it is scheduled for launch onboard a SpaceX Falcon 1 rocket as early as July 29, 2008.

http://science.nasa.gov/headlines/y2008/26jun_nanosaild.htm?list907815



The Tunguska Impact--100 Years Later

One hundred years after the Tunguska event in Siberia, scientists review what they've learned about the mysterious blast from the heavens.

http://science.nasa.gov/headlines/y2008/30jun_tunguska.htm?list907815

Planets Align for the 4th of July

Look beyond the fireworks on 4th of July weekend. A trio of worlds is converging for a pretty sunset sky show. http://science.nasa.gov/headlines/y2008/01jul_4thofjuly.htm?list907815

New Discoveries at Mercury

Mercury's magnetic field is "alive." Volcanic vents ring the planet's giant Caloris basin while the planet itself is surrounded by a plasma nebula of surprising complexity. These are just a few of the new discoveries made by NASA's MESSENGER spacecraft and reported in a special July 4th issue of Science magazine. http://science.nasa.gov/headlines/y2008/03jul_mercuryupdate.htm?list907815

A Telescope Made of Moondust

Mix moondust with epoxy, add a dash of carbon nanotubes, and spin. The result? A parabolic mirror perfectly suited for a giant lunar observatory. A NASA-supported scientist has discovered this new recipe for making telescopes out of moondust, and to prove it works he has spun a "moondust mirror" here on Earth. http://science.nasa.gov/headlines/y2008/09jul_moonscope.htm?list907815

What's Wrong with the Sun?

The sun is entering its third year of eerie calm. Sunspots are rare and solar flares simply aren't happening. Is this "solar minimum" lasting longer than it should? A NASA scientist has examined centuries of sunspot data to find the answer at:

http://science.nasa.gov/headlines/y2008/11jul_solarcycleupdate.htm?list907815

NASA Works to Improve Short-term Weather Forecasts

NASA scientists are using an infra-red sounder in space to improve short-term weather forecasting.

http://science.nasa.gov/headlines/y2008/18jul_airs.htm?list907815

The 2008 Perseid Meteor Shower

The 2008 Perseid meteor shower peaks during the dark hours before dawn on Tuesday, August 12th, and forecasters say it should be a good show.

http://science.nasa.gov/headlines/y2008/22jul_perseiddawn.htm?list907815

Plasma Bullets Trigger Northern Lights

Researchers have discovered what causes brilliant outbursts of Northern Lights: Gigantic plasma bullets launched toward Earth by explosions 1/3rd of the way to the Moon.

http://science.nasa.gov/headlines/y2008/24jul_plasmabullets.htm?list907815

Partial Eclipse, Total Fun

Friday, August 1st, millions of people in China witnessed a well-publicized total eclipse of the sun. Less widely reported is the partial eclipse, which *billions* of people across a quarter of the globe can observe and enjoy. Today's story from Science@NASA explores the delights of partiality.

http://science.nasa.gov/headlines/y2008/29jul_solareclipse.htm?list907815

A Brief History of Solar Sails

Have you ever stared up at the night sky, felt a gentle breeze, and wished you could set sail for the stars? Get in line. Many great thinkers from history have had the same idea. This long-held fancy could soon become reality with one solar sail mission on the drawing board and another already on the launching pad, slated to blast off this summer. http://science.nasa.gov/headlines/y2008/31jul_solarsails.htm?list907815

Lunar Impact Mission Update

Today's story from Science@NASA tells of NASA's plans to find water on the Moon by crashing a spacecraft into the lunar surface. The Lunar CRater Observation and Sensing Satellite (LCROSS for short) is on track for a 2009 launch and subsequent plunge into a crater near one of the Moon's poles. Amateur astronomers may be able to observe the impact through backyard telescopes.

http://science.nasa.gov/headlines/y2008/11aug_lcross.htm?list907815

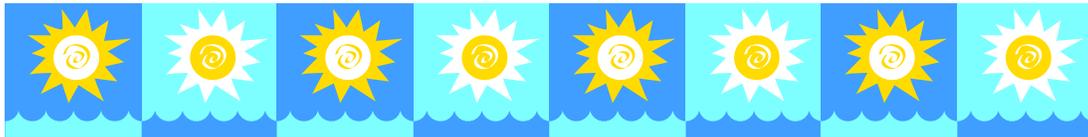
The Realm of Earthworms: NASA Gets Down to the Nitty-Gritty

NASA scientists are preparing to launch a "flying tractor" with microwave sensors to explore the nitty-gritty realm beneath your feet. http://science.nasa.gov/headlines/y2008/15aug_omega.htm?list907815

Living with a Star

What if you woke up one morning and found your whole planet had been swallowed by the atmosphere of a star? Don't laugh, it could happen to you, and NASA has a special program to deal with it.

http://science.nasa.gov/headlines/y2008/19aug_lws.htm?list907815



Librarian News

What activities do you have planned dealing with space and the Moon at your library this summer? Please feel free to share ideas, comments, and pictures.

- Space will be the theme for the 2009 Massachusetts Summer Reading Program - specifically, we will be using the "Starship Adventure" program currently running in Tennessee. We thought it would be especially timely since the 40th anniversary of the Moon landing falls right in the middle of summer reading!
- Rebecca Stashower and Jean Nei (from Los Altos Library, Los Altos, CA) did "Back to the Moon and beyond" programs at six different community libraries during the last two weeks of May. There were 102 school aged children ranging from 1st grade through 6th grade attended the programs.
- Vickie Beene from the Southeast Region (Massachusetts) is going to start a blog that would tie in with last March's workshop and with plans for next year's summer reading.



Links of the Month...

- ORBITER is a free flight simulator that goes beyond the confines of Earth's atmosphere. Launch the Space Shuttle from Kennedy Space Center to deploy a satellite, rendezvous with the International Space Station or take the futuristic Delta-glider for a tour through the solar system - the choice is yours. <http://orbit.medphys.ucl.ac.uk/>
- ALL KNOWN BODIES IN THE SOLAR SYSTEM LARGER THAN 200 MILES IN DIAMETER, Alan Taylor, find a useful diagram placing solar system bodies in size perspective. The site is useful in showing students why Pluto was demoted. <http://www.kokogiak.com/gedankengang/2007/03/all-known-bodies-in-solar-system.html>
- "Learning with Data," a new CDROM that provides all of the data, tools, activities, and background learning materials needed to implement data rich investigations into the theory of Plate Tectonics. Students select and plot earthquake, elevation, seafloor age, volcano, island age, and heat flow data, then assemble and annotate the plots for their interpretations. Inquiry activities and a wealth of animations and background material are included. Video Demo at: <http://learningwithdata.org/info/index.html>
The main site is at: <http://learningwithdata.org/>
- ASPP's Best Practices for Locating Copyright Owners of Photographic and Visual Art. http://www.aspp.com/users/ASPPSite4390/ASPP_Best_Practises_v2_7-8-08.pdf
- Identify the birds in your neighborhood: <http://rightbird.com>

• Monthly Activity

Ice Floats

The activity enables students to experience the buoyancy of ice in water. The activity works best when a variety of see-through containers are selected in order to observe below the waterline.

For all activities, to record reflections, observations, calculations, etc.

- Science Notebooks: writing and drawing utensils
- Drawing materials

MATERIALS:

- Several see-through containers, clear plastic cups to place water and an ice cube
- 12-gallon or larger plastic or Plexiglas aquarium tank(s)
- Several 10, 20 or 25-lb blocks of ice
- Varied large blocks of ice, as well as ice cubes
- Plastic trays large enough to hold water and let ice float without touching the bottom of the container.
- Food coloring & eyedropper
- Thermometer sensitive at the freezing point of water
- Water
- Collection of objects that float or sink
- Select items such as: bathtub toys, wood, coins, rocks, foil opened flat, foil balled up, foil folded like a boat

PART 1.

Observe the dynamics of ice floating.

This can be done in several ways, depending on the dynamics of the class, whichever allows students the most direct experience, while also remaining as orderly as a scientific laboratory. (Be prepared: water is likely to spill at any rate.)

Whole Group Activity or as a Small Group Exploratory Zone

1. Fill a 12-gallon aquarium tank about 3/4 full.
2. Draw a line to mark the water level.
3. Place a 10, 20, or 25-lb block of ice in the water.
4. Notice that the water level rises. Mark the level.
5. Push the ice to the point that the top of the ice is even with the top of the water. Mark that level.
6. Observe and record what happens.
7. Pose questions about what happened.
8. Measure how much of the ice floats and how much is submerged.

Small groups, in pairs, or as individuals

1. Fill a small clear container about 3/4 full.
2. Draw a line to mark the water level.
3. Place a chunk of ice or an ice cube into the water.
4. Notice that the water level rises. Mark the level.
5. Push the ice to the point that the top of the ice is even with the top of the water. Mark that level.
6. Observe and record what happens.
7. Pose questions about what happened.
8. Describe how much of the ice floats and how much is submerged. (Precise measurement may be difficult with smaller containers and smaller pieces of ice.)

This table is a guide to the range of observations in this activity.

Phenomenon	Measurement/Description
a. Ice floats (observable directly)	<ul style="list-style-type: none"> ■ Measure how much ice is above and below surface ■ Notice/measure change in water level
b. Ice displaces water and floats	<ul style="list-style-type: none"> ■ Capture overflow of displaced water
c. If you push on the ice, the water level rises again, and then it pops back up	<ul style="list-style-type: none"> ■ Describe what happens as the water pushes up on the ice ■ Describe/measure how much of the ice is above and below the water line
d. Icebergs float in the ocean (observable via video and imagery)	<ul style="list-style-type: none"> ■ Make inferences about how much more of the iceberg is under water
e. Test ice floating in salty water (salt water is denser than fresh water)	<ul style="list-style-type: none"> ■ Describe/measure differences in the way ice floats in salty water

PART 2.

Observe the dynamics of near-freezing water sinking.

Lead off a discussion with questions such as:

Have you ever noticed that when you put cold ice cubes into a warm soft drink, a moment later the liquid at the bottom is colder than the liquid at the top? You can get to that refreshing coldness with your straw.

Or when you go swimming, have you ever noticed that the water down below is cooler than near the surface?

What's going on?

Pick out two different colors of food coloring. Keep one at room temperature or warmer (perhaps have someone hold the food coloring bottle in their hands). Place the other color near the ice to get close to freezing.

Obtain two see-through containers large enough to hold sufficient water to enable a 10-pound block of ice to float. Fill each container with water at room temperature.

Test out how the warm food coloring behaves when a small droplet is placed in the water at room temperature. Then test out how the cold food coloring behaves. Do they behave differently?

Now, place a 10-pound block of ice in the other container. Notice that it floats. Notice also that this is like a big ice cube in a soft drink. Now place a droplet of each food coloring (warm and cold) near the big ice block. What happens?

Proposed explanations may emerge from discussion. Here's the scoop:

The cold liquid next to the ice cube cools down to close to the freezing point and then sinks to the bottom. As water gets colder, the molecules get closer together. Just above the freezing point 0° to 4°C, the water is at its MOST DENSE—and THAT NEAR FREEZING WATER actually SINKS (that's why you see the food-coloring sink in next to the ice. The warm food coloring might take just a moment longer to first cool and then sink. Near-freezing water will SINK. Frozen water (ice) will float.

Activity from *Exploring Ice in the Solar System* <http://btc.montana.edu/messenger/ice>