

# Lunar Librarian Newsletter

## March & April 2007

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### LRO News

#### LRO Assembly Progress

On its way to assembly, LRO has recently made an important pit stop to a place called FlatSat. Before any of the electrical components are assembled on the spacecraft bus, they must be checked and double-checked to assure that they can communicate with one another. That is where FlatSat comes in. The name "FlatSat" is a shortened version of just what it sounds like – flat satellite. All of the electronic components are laid out and hooked together on a long table and attached electrically like they will be on the satellite. FlatSat is operated and monitored using the Integrated Test and Operation System (ITOS). This is the same operating system that will be during the mission at the Mission Operations Center. During the integration process, FlatSat is used to write and integrate test procedures for the components onboard LRO. One by one, simulators of the individual spacecraft components and instruments for LRO are being attached. Currently, the engineering test unit (ETU) of the power system electronics (PSE) is attached to FlatSat. Also, the LAMP, Mini-RF, LEND, and Diviner instruments have a simulator at FlatSat. Soon the simulator for the Lunar Reconnaissance Orbiter Camera (LROC) will be added. Why bother with such an exercise? As part of the assembly process, each of the individual components involved with the spacecraft must be tested. FlatSat serves as a way to test procedures and reduce the risk of something going wrong with the electrical components once LRO is assembled. Once LRO is launched, mission operations will use FlatSat to test commands before sending them to the spacecraft.

In other news, assembly of LRO instruments has begun. Images of each of the instruments in their initial phases, along with LRO propulsion, attitude control system (ACS) components, and an LRO mock-up can be found on the LRO website: <http://lunar.gsfc.nasa.gov/gallery-hardware.html>



Dave Everett, LRO systems engineer, and others take a look at the LRO mock-up in Building 5.

## LRO Newsbytes

### LRO EPO Welcomes Arizona Librarians.

In early April, the LRO EPO team headed out to Tempe, Arizona to meet the next class of Lunar Librarians. This workshop took place at the Mars Education Program - Mars Space Flight Facility, Arizona State University, the home of Lunar Reconnaissance Orbiter Camera (LROC). Besides a tour of the LROC facility, the AZ librarians here two talks by Dr. Mark Robinson (PI, LROC). The first was about the three cameras that make up the LRO Camera system. He also discussed why NASA is returning to the Moon, and how LRO fits into the NASA Vision. The second was on the lunar environment, and what challenges need to be overcome in order to establish a lunar base. Dr. Robinson's presentations will become available on the Explore! website.

## NASA News

### First 3-D Images of the Sun

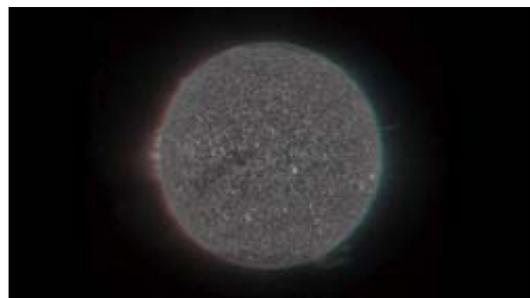
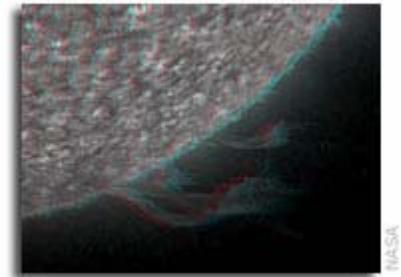
NASA just released the first images of the Sun in 3-D. Launched October 25, 2006, NASA's Solar TERrestrial RELations Observatory (STEREO) satellites will provide scientists the ability to better understand solar physics and improve space weather forecasting.

In the past, images of the Sun have appeared in 2-D or flat. This has made it difficult to determine where matter and energy are flowing in the solar atmosphere. The 3-D imaging provides a better perspective on Coronal Mass Ejection (CME). "CMEs are eruptions of electrically charged gas, called plasma, from the sun's atmosphere. A CME cloud can contain billions of tons of plasma and move at a million miles per hour." When a CME interacts with the Earth's magnetic field, it causes magnetic storms that have caused overloads on power lines, disrupted satellite communications, and caused beautiful Auroras.

STEREO assist scientists in accurately locate the CME cloud front. "Knowing where the front of the CME cloud is will improve estimates of the arrival time from within a day or so to just a few hours," said Howard. "STEREO also will help forecasters estimate how severe the resulting magnetic storm will be."

For more information, please see:

<http://www.nasa.gov/centers/goddard/news/topstory/2007/stereo3DPassReleaseApril23.html> and [http://www.nasa.gov/mission\\_pages/stereo/news/stereo3D\\_press.html](http://www.nasa.gov/mission_pages/stereo/news/stereo3D_press.html)



**Images above:** Images of the full sun. On the left is the 2-D image and on the right is the 3-D image.

## 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>!

### **Mysteries of Rain and Snow**

People encounter rain and snow every day, and scientists have studied precipitation for centuries, yet it's amazing how much we still don't know about water that falls from the sky.

[http://science.nasa.gov/headlines/y2007/02mar\\_rainandsnow.htm?list907815](http://science.nasa.gov/headlines/y2007/02mar_rainandsnow.htm?list907815)

### **Double Satellites to Test Futuristic Technology**

Two satellites slated for launch this week are heading for an extraordinary rendezvous in Earth orbit. The name of the mission is Orbital Express and its goal is to test futuristic technologies key to the exploration of the moon and Mars. [http://science.nasa.gov/headlines/y2007/05mar\\_nohands.htm?list907815](http://science.nasa.gov/headlines/y2007/05mar_nohands.htm?list907815)

### **Alien Volcano**

When New Horizons flew past Jupiter on Feb. 28th, the spacecraft photographed a volcanic eruption on Io that amazed even longtime experts in the field. The must-see photo is featured in today's story from Science@NASA. [http://science.nasa.gov/headlines/y2007/09mar\\_alienvolcano.htm?list907815](http://science.nasa.gov/headlines/y2007/09mar_alienvolcano.htm?list907815)

### **Orbital Express Launches Successfully**

The Orbital Express mission to demonstrate cutting-edge automated rendezvous and docking technologies blasted off from Cape Canaveral last night. The successful launch marks the beginning of three months of intensive testing in low Earth orbit.

[http://science.nasa.gov/headlines/y2007/09mar\\_orbitalexpress.htm?list907815](http://science.nasa.gov/headlines/y2007/09mar_orbitalexpress.htm?list907815)

### **STEREO Eclipse**

No human has ever witnessed a solar eclipse quite like this: NASA's STEREO-B spacecraft was about a million miles from Earth last month when it photographed the Moon passing in front of the sun. The resulting movie looks like it came from an alien solar system.

[http://science.nasa.gov/headlines/y2007/12mar\\_stereoclipse.htm?list907815](http://science.nasa.gov/headlines/y2007/12mar_stereoclipse.htm?list907815)

### **Shooting Marbles at 16,000 mph**

NASA scientists are shooting marbles at 16,000 mph--and destroying them, splat!--to learn what happens when meteoroids hit the Moon. [http://science.nasa.gov/headlines/y2007/14mar\\_marbles.htm?list907815](http://science.nasa.gov/headlines/y2007/14mar_marbles.htm?list907815)

### **New Phenomena on the Sun**

NASA has just released never-before-seen movies of intense activity in an unexpected place on the sun. The images were captured by a space telescope onboard Japan's Hinode spacecraft.

[http://science.nasa.gov/headlines/y2007/21mar\\_chromosphere.htm?list907815](http://science.nasa.gov/headlines/y2007/21mar_chromosphere.htm?list907815)

### **First Steps to Mars**

The landing site is unknown, the rockets are still on the drawing board, and some of the astronauts haven't even been born yet. Nevertheless, NASA's journey to Mars has already begun. The first steps are being taken onboard the International Space Station.

[http://science.nasa.gov/headlines/y2007/28mar\\_firststeps.htm?list907815](http://science.nasa.gov/headlines/y2007/28mar_firststeps.htm?list907815)

## **Big Auroras on Jupiter**

NASA's Chandra X-ray Observatory has observed some spectacular Northern Lights on the planet Jupiter. The data may help researchers solve the mysteries of the biggest auroras in the solar system.

[http://science.nasa.gov/headlines/y2007/29mar\\_bigauroras.htm?list907815](http://science.nasa.gov/headlines/y2007/29mar_bigauroras.htm?list907815)

## **Lab-on-a-Chip Works!**

A miniature biological laboratory important to the future of space exploration has just passed an important test onboard the International Space Station.

[http://science.nasa.gov/headlines/y2007/06apr\\_locad2.htm?list907815](http://science.nasa.gov/headlines/y2007/06apr_locad2.htm?list907815)

## **Dusty Hurricanes**

What happens to a hurricane when it gets hit by a dust storm? This is an important question because Atlantic hurricanes are born not far from the Sahara desert. Recently NASA scientists gathered data that brings them closer to the answer. They did it by flying directly into a dusty hurricane.

[http://science.nasa.gov/headlines/y2007/13apr\\_dustyhurricanes.htm?list907815](http://science.nasa.gov/headlines/y2007/13apr_dustyhurricanes.htm?list907815)

## **Librarian News**

Here's what's going with some of the librarians who participated in the workshops

**Arizona:** I would like to welcome all of our new Arizona librarians.

### **Maryland:**

Jeanne Mayo, Carrolltowne Elementary School, is planning a "Space Week" for May where they will do lots of lunar activities that involve stories or finding information!

### **Pennsylvania:**

Diane Monnier, Montgomery County Library, held a space program the week of April 2<sup>nd</sup>.

## **What's going on at your library??**

Email Heather, [heather\\_weir@ssaihq.com](mailto:heather_weir@ssaihq.com), with your library's space program activities by February 10<sup>th</sup>, and it will be included in the next Lunar Librarian Newsletter. Feel free to send along pictures from your workshops.

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

### **Suggestions for our new librarians?**

"I would definitely suggest that the librarians check with their local schools to see at what grade the moon is taught. In one of our literature books there is a story about the moon and it offered a wonderful opportunity for me to collaborate with them. They all came down and we did the sky tellers Moon phases story. It fit in perfectly with what they were doing and gave me chance to highlight other lunar literature!" ~ Jeanne Mayo, Carrolltowne Elementary School



## Links of the Month...

- MESSENGER Education Modules: Comparative Planetology ~ <http://btc.montana.edu/messenger/ice> By studying Mercury, we look at the diversity of worlds and add to the knowledge base about the Solar System, its formation, and evolution. Modules include: *Voyage*, *The Voyage Continues*, and *Ice in the Solar System*.
- Planetary Photojournal ~ <http://photojournal.jpl.nasa.gov/index.html> An excellent source of NASA images taken by a variety of different spacecrafts. Users can browse the catalog to search for images on planets, moons, small bodies, spacecrafts, telescopes, and the Universe. The latest New Horizons images are also available.
- Explore! Fun with Science ~ <http://www.lpi.usra.edu/education/explore/> *Explore! Fun with Science* is designed to engage youth in space and planetary science in the library and other informal learning environments. Through video explorations, related hands-on activities, and supporting resources, children of all ages are immersed in the wonders of rockets, space colonies, our solar system, how our planets were shaped, and more!
- New Horizons Images of Jupiter and its moons: <http://pluto.jhuapl.edu/gallery/missionPhotos.html> & <http://pluto.jhuapl.edu/soc/> Images taken by New Horizons instruments: MVIC, LORRI, and LEISA show amazing detail of Jupiter and the Galilean moons.

# Monthly Lunar Activity

Solar System Distance Activity ~ <http://mars.jpl.nasa.gov/classroom/pdfs/solarsystembeaddistance.pdf>

## Goal:

The students will understand the distances between the Sun, planets, and small objects in the Solar System.

## Objective:

To create a model demonstrating the scale distances of the Solar System using astronomical units that have been converted into a 10 centimeter scale.

## National Science Education Standards:

Standard D: Earth in the Solar System

## Materials:

- Planet beads (large craft pony beads in 11 colors):

Sun	yellow
Mercury	solid red
Venus	cream
Earth	clear blue
Mars	clear red
Asteroid belt	black
Jupiter	orange
Saturn	clear gold
Uranus	dark blue
Neptune	light blue
Pluto	brown
- 4.5 meters of string for each student
- Small piece of cardboard to wrap Solar System string around (10 cm x 10 cm)
- Meter sticks or measuring device
- Student handout

## Background:

- To speed up the activity for younger students, the string may be pre-cut and a set of Solar System beads may be put into a plastic ziplock bag for each student. Also, for younger students, a measured marking grid can be put on a table top so the students can mark their measured distances and then tie off the beads. If the pre-marking method is used, extra distance must be added to each planet distance to accommodate the string within each knot (approximately 4 cm for a double knot around the bead). Tape newspapers to the surface where the students will be marking their strings, so they do not mark up the counter or floor.
- For older students, measurements are made each time from the Sun to the planet and tied on after each measurement.

## Student Procedure:

- Convert the various AU distances to centimeters and complete the chart on the student hand-out sheet.
- Measure and cut a piece of string 4.5 m long.
- Using the calculated cm distances, tie the bead onto the string using a double knot.
- When finished with the activity wrap the Solar System string (with beads) around the cardboard holder

# Solar System Distance Activity

## Introduction:

Our Solar System is immense in size by normal standards. We think of the planets as revolving around the Sun, but rarely consider how far each planet is from the Sun. Furthermore, we fail to appreciate the even greater distances to the other stars. Astronomers use the distance from the Sun to the Earth as one "astronomical unit". This unit provides an easy way to calculate the distances of the other planets from the Sun.

## Vocabulary:

Astronomical Unit - 1 AU = approximately 150 million kilometers (93 million miles)

## Activity:

We will construct a distance model of the Solar System to scale, using colored beads as planets. The chart below shows the planets and asteroid belt in order along with their distance from the Sun in astronomical units. First, complete the chart by multiplying each AU distance by our scale factor of 10 cm per astronomical unit. Next, use the new distance to construct a scale model of our Solar System. Start your model by cutting a 4.5 m piece of string. Use the distances in cm that you have calculated in the chart below to measure the distance from the Sun on the string to the appropriate planet and tie the colored bead in place. When you are finished, wrap your string Solar System around the cardboard holder.

Planet	AU	Scale value (cm)	Color
Sun	0.0 AU	_____cm	yellow
Mercury	0.4 AU	_____cm	solid red
Venus	0.7 AU	_____cm	cream
Earth	1.0 AU	_____cm	clear blue
Mars	1.5 AU	_____cm	clear red
Asteroid belt	2.8 AU	_____cm	black
Jupiter	5.0 AU	_____cm	orange
Saturn	10.0 AU	_____cm	clear gold
Uranus	19.0 AU	_____cm	dark blue
Neptune	30.0 AU	_____cm	light blue
Pluto	39.0 AU	_____cm	brown

Consider that if you were traveling at the speed of light, it would take 8 minutes to travel from the Sun to the Earth (1 AU). It would take 4.3 years (traveling at the speed of light - 300,000 kilometers per second) to reach the next nearest star, Alpha Centauri! Show the model to your teacher for a grade. You may keep the model!