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Voyages in Education and Public Outreach An Office of Space Science Newsletter

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Voyage: A Journey Through Our Solar System

Jeff Goldstein, Challenger Center for Space Science Education

On October 17, 2001, a new long term space science exhibit *Voyage: A Journey Through Our Solar System* opened on the National Mall in Washington, DC. Created by Challenger Center for Space Science Education, the Smithsonian Institution, and NASA, *Voyage* is a one to 10-billion scale model of the solar system that provides visitors a dramatic understanding of Earth's place in space, and celebrates our ability to reach beyond our tiny world and uncover the breadth and majesty of the universe.

Comprised of 13 stations, *Voyage* is sited along a 600-meter path from the National Air and Space Museum to the Smithsonian's Castle building, in the shadow of the U.S. Capitol and the Washington Monument. Designed to fit the urban landscape of the National Mall, *Voyage's* 8.5 foot high stainless steel stations convey a sense of flight in both air and space. They are tall enough so that a visitor at any station can see adjacent stations, even with intervening crowds. The stations appear as stakes driven into the cosmic firmament to mark the location of the planets. Thus at each station the visitor has simultaneous access to the size of a world and a distance between worlds.

Each of the planets, their largest moons, and ring systems are seen as three-dimensional objects laser-sculpted inside solid glass. Precise orientations of the planetary systems are relative to a model celestial sphere, where the horizontal plane is the ecliptic and the model Sun is at the vernal equinox.

The porcelain enamel graphic panels place the visitor in a familiar context, such as standing on

a planetary surface looking up into the sky. But these are not common views: Earth in a starry field from the surface of Mercury, Jupiter from low Ionian orbit, and a Venusian landscape under a cloudy sky with Maxwell Montes in the distance,



Jeff Goldstein, Voyage project director, visits Uranus with a class of Washington, DC middle school students.

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these are meant to be voyages worth remembering.

In addition to the exhibit on the Mall, supplemental materials will be available at the *Voyage* website (www.voyageonline.org). *Voyage* K-12 educational materials are currently under development and will be free to download as pdf files. Visit the site for updates on all aspects of the *Voyage* project.

The *Voyage* exhibition was designed to be replicated and permanently placed at dozens of sites worldwide. Granted this is an idealistic view, perhaps naive, but our hope is that *Voyage* can change the way a significant percentage of the human race view a place called home.

Visitors can walk through the model solar system as if they were 'cosmic giants' walking through the real thing. Visitor reactions to date clearly show that regardless of age or schooling, they seem overwhelmed as Earth is reduced to just one of many tiny objects in a vast and seemingly endless space.

Updates

NASA Office of Space Science(OSS) Conference Rescheduled

The NASA OSS Education and Public Outreach Conference, hosted by DePaul University and originally scheduled for September 2001, has been rescheduled to June 12-14, 2002, in Chicago. Participants at the conference will include members of the NASA space science education and outreach community, scientists, educators in formal and informal science, and others interested in space science education and outreach.

The conference is limited to 270 participants. First priority is being given to those who were registered for the original conference dates. New registrants will be taken on a first come basis. Register on-line at

<http://analyzer.depaul.edu/ossconference>

Outcomes for the conference will include a set of proceedings and opportunities to guide the structure and focus of future OSS E/PO activities, as well as conferences intended to help set the overall direction of the OSS E/PO program.

Contact Victoria Simek at (773) 325-4790 vsimek@depaul.edu, or see the conference web site for information on program, accommodations and speakers.

NASA OSS E/PO Brokers Selected

NASA OSS recently selected seven recipients for grants to help space scientists become involved in educational activities, build partnerships between the space science and education communities, and serve as the regional points-of-contact for space scientists and educators seeking information on and involvement in NASA's Space Science education and outreach program. These institutions will continue and extend the work of the first set of Brokers selected in 1997.

"This new selection will deepen connections between NASA's Office of Space Science and educators across the country and improve our ability to search out productive opportunities for the space science community to participate in education and public outreach," said Dr. Jeffrey Rosendhal, Director of Education and Public Outreach for NASA's Office of Space Science. "We also expect this to provide an injection of fresh ideas and new capabilities to our educational and public outreach team."

The individuals and institutions receiving the awards are:

- Dr. Kathleen Johnson, Lunar and Planetary Institute, Houston
- Dr. Julie H. Lutz, University of Washington, Seattle
- Dr. Cherilynn A. Morrow, Space Science Institute, Boulder, Colorado
- Dr. Nitin Naik, Wheeling Jesuit University, Wheeling, W. Va.
- Dr. Carolyn C. Narasimhan, DePaul University, Chicago
- Dr. Cassandra Runyon, College of Charleston, Charleston, S.C.
- Dr. Cary I. Sneider, Museum of Science, Boston

OSS E/PO Evaluation Report Released

NASA OSS has been working with the Program Evaluation and Research Group (PERG) at Lesley University in Cambridge, Massachusetts to conduct an evaluation of how effectively OSS is carrying out its E/PO program.

A report focusing on execution of the Education and Public Outreach (E/PO) Strategic and Implementation Plans has been completed and is available through the NASA OSS website

at http://spacescience.nasa.gov/education/resources/strategy/2001_Final_Report.PDF

Data were gathered between January 2000, and May 2001, both from members of the OSS E/PO community and from the communities it serves directly (educators, scientists, the rest of NASA). The report focuses on the actions that the OSS E/PO Program is taking to meet the goals outlined in the Implementation Plan, the successes of the Program, and the challenges that it faces.

The next phase of evaluation, dealing with the impact of the OSS E/PO program on the education community, is now getting underway.

Space Science Education Resource Directory (SSERD) Update

SSERD Version 2.0 was released October 1, 2001. Enhancements have been made over the course of the past year, including the addition of user-supplied product reviews, improved methods of search, and easier navigation. A new selection of products has been entered into the SSERD, markedly increasing the total number to nearly 200. Significant progress has also been made toward providing CD-ROMs through NASA CORE, and ultimately arriving at the "one stop shopping" goal where all OSS education products can be browsed and ordered through the SSERD (<http://teachspacescience.stsci.edu>)

Future Venues for Space Science Exhibits

Hubble Space Telescope - New Views of the Universe

Large Exhibit (<http://www.si.edu/sites/exhibit/hubble.htm>)

October 6, 2001 to April 28, 2002
Kennedy Space Center, FL

June 1, 2002 to August 25, 2002
Union Station Kansas City, MO

Small Exhibit (<http://www.si.edu/sites/exhibit/hubble2.htm>)

December 15, 2001 to February 24, 2002
Discovery Museum Bridgeport, CT

MarsQuest (<http://www.astc.org/exhibitions/mars/imars.htm>)

February 1, 2002 - April 30, 2002
Virginia Air & Space Center, Hampton, VA

June 1, 2002 - August 31, 2002

Peggy Notebaert Nature Museum, Chicago

October 1, 2002 - December 31, 2002

Natural History Museum, Lafayette, LA

Space Weather (http://www.spacescience.org/SWOP/Exhibits/Mini_Exhibit/1.html)

February 1, 2002 - April 30, 2002

Insights El Paso Science Museum, El Paso, TX

Information on exhibits and tour schedules may be obtained from these links.

Awards

Dr. Carol Jo Crannell of NASA Goddard Space Flight Center was honored with a NASA Exceptional Service Medal this fall. The award states - "In recognition of your pivotal role in creating and advancing the highly successful NASA SUNBEAMS program, which brings the excitement of NASA Space Science to the District of Columbia Public Schools." - signed Daniel S. Goldin, Administrator NASA, 8th August, 2001. An article on the SUNBEAMS program appears on page 8 of this newsletter.



Dr. Crannell with Alphonso V. Diaz, Director of GSFC and Dr. Ghassem Asrar, NASA Associate Administrator.

View Space Takes Award

The first annual Scala Worldwide Users Conference took place September 2001 in Minneapolis. Scala is an advanced multimedia authoring software. An awards banquet was held to recognize excellence in use of Scala in four areas: cable television, school networks, public/government and corporate/retail. *View Space*, a multimedia astronomy display for museums and planetariums, won the award in the Schools/Government category. (For more information on *View Space* see *Voyages*, September 2001, issue. <http://spacescience.nasa.gov/education/news>)

Exhibits & Planetarium Shows

Chabot Space & Science Center

Chabot Space & Science Center in Oakland, California offers a celebration of science at its state-of-the-art facility which includes a world-class planetarium, a dome-screen theater, hands-on exhibits and an observatory complex. NASA OSS funded two new interactive exhibits - *Shadow Dance*, which opened in June 2001, and *Touch the Sun*, which opens this winter. Other NASA funded exhibits include the newly restored 8" refractor telescope, the meridian transit telescope exhibit and the meteorite mural and exhibit. Through its partnership with NASA, Chabot was able to deliver a live satellite feed of the June 2001 solar eclipse to an audience of over 250 guests. NASA scientists are regularly featured in the Distinguished Lecturer series.

Shadow Dance is a multimedia exhibit where visitors learn about the Sun and the Moon, myths and rituals and celebrations relating to eclipses. They can step on floor sensors to create different types of solar and lunar eclipses and take a solar quiz. The Solar Telescope Exhibit, *Touch the Sun*, is a major addition to the Center's compliment of exhibits and public-access telescopes. The centerpiece is a world-class solar research telescope (formerly used by the Royal Swedish Academy of Sciences) which projects real-time images of the Sun. Visitors can make tracings of sunspots on the solar surface and capture their own digital images of the Sun to email as solar postcards. The exhibit explores the Sun's structure and atmosphere, the spectrum of its light, and the uses of solar power on Earth. Above the exhibit, a mural of solar icons and art from cultures around the world connect current scientific images of the Sun from the telescope with views of the Sun as seen through the eyes of different people across the reaches of history on Earth.

Additionally, funding from NASA enables students and visitors to interact with the Science Center by accessing Chabot's Virtual Science Center (VSC) online at www.chabotspace.org/vsc

The VSC includes in-depth information on the natural, scientific and technological content of select exhibits, a virtual planetarium and access to educational programs. These programs include teacher workshops and student classes that utilize many NASA materials.

Dr. Michael D. Reynolds, Executive Director/ CEO of Chabot, described the potential for shaping the future of science and technology:

"The beauty of the new Chabot Space & Science Center is that its emphasis — astronomy and space exploration — is something children and adults alike find fascinating. The universe does indeed touch our soul. To give students an opportunity to learn about space in a hands-on, discovery way will hopefully stimulate them to consider science. We don't expect to make an astronaut or astronomer out of every student who comes through here, we just want to let them know they can do it if they want to."



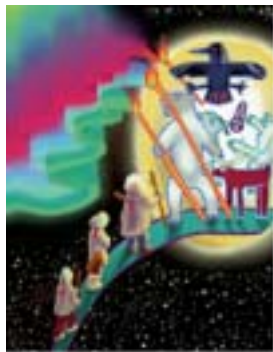
Historic 8" Alvan Clark refractor telescope is the original 1883 instrument donated by founder Anthony Chabot.

Northern Lights Planetarium Show

Lawrence Hall of Science

With support from NASA's Sun-Earth Connection Education Forum, the Lawrence Hall of Science (LHS) is about to release *Northern Lights* - a new addition to the audience participatory program series, *Planetarium Activities for Student Success* (PASS) - <http://www.lhs.berkeley.edu/pass/>. The show brings together images, video and activities that demonstrate the connectivity between our Sun and Earth. The show was field tested during the winter of 1999-2000, and will be available for general release to planetariums across the county in early 2002.

The first activity in this interactive show concerns seasons, sunrise, and sunsets. Each audience member uses a horizon pointer to predict where sunsets will be at their local latitude (e.g. 38° N in Berkeley) and at latitude 70° N (Tromso, Norway). They see an image of a midnight Sun from Tromso. In another activity the audience uses Earth globes to model a midnight Sun, with the Sun being a bare lamp in the middle of the planetarium. Then there is a video or series of slides depicting an auroral substorm as seen from the far north in Alaska or Norway, which is narrated by Franck Pettersen of Nordlys Planetariat in Tromso. Visitors use fluorescent chalk to sketch aurora which they have just seen and view the drawings under black lights to see the sketches glow. Other program elements include historical views of aurora; recent scientific views on the causes of aurora; including images and movie clips of the Sun, granules, corona, holes in UV, solar mass ejections.



An eskimo mythology for the Northern Lights show is illustrated in this work by Rose Craig, LHS artist. It shows aurora and spirits of people who died violent deaths feasting and playing football with a walrus skull.

For information on *Northern Lights* contact Alan Gould, Planetarium Director, University of California, Lawrence Hall of Science, Berkeley, CA. (agould@uclink4.berkeley.edu)

Smithsonian's National Air and Space Museum Opens *Explore the Universe* Exhibition

The Smithsonian Institution's National Air and Space Museum (NASM) opened *Explore the Universe* September 21, 2001. This permanent exhibition presents the major discoveries that have given us our current scientific view of the universe, illustrates how the universe is taking shape and probes the mysteries that remain.

Encompassing an unprecedented array of artifacts representing the state of the art over the past 400 years, the exhibition lays out the world's astronomical progress within its historical and technological context. *Explore the Universe* is made up of five major sections covering the evolution of man's tools for searching the heavens.

As part of NASA's contribution to this exhibit, NASA OSS arranged for the Hubble Space Telescope (HST) backup mirror to be turned over to the museum. As noted in *Voyages*, May 2001, (<http://spacescience.nasa.gov/education/news>), the mirror was delivered in January 2001, in addition to other HST hardware. Other pieces of NASA space astronomy hardware, such as the Hopkins Ultraviolet Telescope which twice flew on the Space Shuttle are also featured. The mirror and these other historic pieces of astronomy hardware will now be seen by millions of visitors each year.



Hubble Space Telescope backup mirror on display at the National Air and Space Museum's "Explore the Universe Gallery".

(photo - Eric Long, Smithsonian)

Educational Products

**SIRTF Releases First Education Module -
*Infrared: More Than Your Eyes Can See***
California Institute of Technology

Although launch of the Space Infrared Telescope (SIRTF) is not until December 2002, a host of educational materials are ready for students and educators now. The materials draw on the unique aspects of the mission and focus on what infrared light has to offer in revealing a unique perspective on the universe. The first educational module released, entitled *Infrared: More Than Your Eyes Can See*, addresses infrared light from many different perspectives. There is a classroom activity that recreates the original detection of non-visible light by William Herschel in 1800, a short video about infrared light and the many uses of infrared technology, and an introduction to multi-wavelength astronomy. You can also participate in a build-your-own space observatory interactive game, as well as explore Earth science (volcanoes and geysers) through the infrared. All of these resources can be accessed from the SIRTF educational page, http://sirtf.caltech.edu/SSC_EPO.html

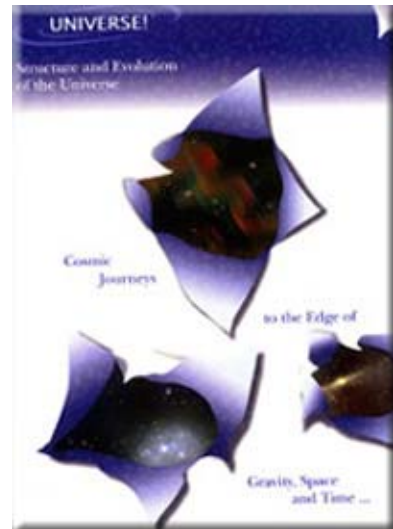
In addition, SIRTF is working closely with other infrared and astronomy missions to develop a well-rounded public education program that goes outside the primary mission of the observatory. Partnerships with groups that deal directly with standards-based curriculum development have also been formed. The CAPSI (Caltech Pre-College Science Initiative) has been funded by SIRTF to develop a series of basic physics activities to be included in *Whyville*, (<http://www.whyville.net>), their popular web-based science education site intended to support both home and classroom-based learning through scientific inquiry.



Explore the uses of visible and infrared images at the SIRTF Website.

E/PO materials highlight Cosmic Journeys
Sonoma State University (SSU)

At national science and mathematics teachers' conferences, affiliates of the Structure and Evolution of the Universe (SEU) Forum have been distributing a folder of educational flyers that highlight eleven SEU missions and their E/PO programs. The folders invite teachers and their students to take a *Cosmic Journey to the Edge of Gravity, Space and Time* by engaging in exciting and fun, science and math oriented activities that connect to each mission and are also aligned with national standards.



The folder features current missions such as Chandra, Microwave Anisotropy Probe (MAP), and XMM-Newton, as well as many in the pipeline, such as Gravity Probe B (GP-B), Swift, and the Gamma-Ray large Area Space Telescope (GLAST). Colorful flyers describe each mission, and also provide important URL links to the educational activities for each. Many of the flyers also highlight an activity connected to the *Cosmic Journeys* idea. For example, the MAP flyer features an activity that students can use to understand the geometry of space. A powerful math activity appearing on the Swift flyer uses gamma-ray bursts to teach the mathematics of scientific notation. What it takes to be a black hole and the gravitational effects of space-time are the focus of the activities on the GLAST and GP-B flyers. Rossi X-ray Timing Explorer (RXTE) data are used to teach coordinate systems and plotting skills by illustrating the distribution and time variability of a collection of galactic X-ray sources.

Flyers can be downloaded from <http://universe.sonoma.edu/flyers/>

Space Science Mission Discoveries Engage Teachers and Students

Center for Science Education @ Space Science Laboratory, UC Berkeley

The Science Education Gateway (SEGWay) brings together the expertise of NASA scientists, science museums, and K-12 educators to produce NASA Earth and space science-based curricula for access via the Internet. It captures seven years of innovation and advances in Education and Public Outreach (E/PO) from many Earth and space science missions. The SEGway website (<http://cse.ssl.berkeley.edu/segway>) provides resources for three target audiences: the general public, scientists, and educators.

Public users can access self-guided space science articles, obtain information on recent celestial events, and locate E/PO sites for missions such as the High Energy Solar Spectroscopic Imager (HESSI) and the Cosmic Hot Interstellar Plasma Spectrometer (CHIPS).

Scientists can find tools for developing E/PO proposals, sample E/PO plans, introductions to partner institutions, and easy ways to get involved in education.

The educators' section has been designed with teachers and improved by years of feedback from educators nationwide. Educators find tables of lessons organized by topic or grade level. Teacher resource pages offer lesson plans, assessment worksheets and answer keys, step-by-step procedures, and many other supporting materials.

SEGway's on-line activities give students and teachers an exciting look at research with access to recent NASA Space Science data. The *Sunspots* activity challenges students to determine if visible and x-ray Yohkoh images show evidence of correlation. In the newly released activity *X-ray Candles: Solar Flares on Your Birthday*, students use satellite data to graph the ups and downs of the solar cycle from the rate of solar x-ray flares.

A number of lessons have won awards, including PacBell's Blue Web'n and the Griffith Observatory Star. The *Sunspots* lesson is included in the National Science Teacher Association initiative, sciLINKS (<http://www.scilinks.org>), which links science textbooks to the Internet.

The PUMAS Connection

Solar System Exploration Forum



PUMAS is an on-line journal for teachers. It provides short examples of how math and science topics taught in K-12 classes can be used in interesting settings, including everyday life.

PUMAS, or Practical Uses of Math And Science, was founded and is edited by NASA JPL scientist Ralph Kahn. Dr. Kahn is Lead Scientist for the Earth and Planetary Atmospheres Research Element at JPL. Founding PUMAS was, for him, "the answer to the question of what most scientists can do to contribute to pre-college science and math education." PUMAS examples are submitted by scientists and engineers, and then peer-reviewed by at least one scientist with a relevant background and at least one teacher at an appropriate grade level. Submissions are evaluated on originality, accuracy, clarity, and grade-level appropriateness. The examples are identified by subject keywords, grade groupings, and curriculum topic benchmarks from McREL (Mid-continent Research for Education and Learning-<http://www.mcrel.org>). Examples have intriguing titles like

- Automatic Windshield Wipers
- Determining the Altitude of Iridium Flares
- Ice Sheets and Sea Level Rise
- Length of the Day
- Particle Man and the Photon
- The Shadow of the Dog

Nearly 50 authors have made one or more submissions to date. Several hundred people have served as reviewers, and many others have contributed comments on specific examples, assessments of the site and its contents, and suggestions. PUMAS receives about 3,000 visits per week from users all over the world.

As Kahn notes, "Teachers need nuggets of enrichment ideas that they can grab, understand, and apply to their lesson plans." Visit PUMAS at <http://pumas.jpl.nasa.gov>. To join the pool of reviewers, go to the Reviewers' page, and select the link to the Volunteer/Participant Update page.

Educational Programs

SUNBEAMS

NASA Goddard Space Flight Center

SUNBEAMS is beginning its fourth year as a partnership between NASA Goddard Space Flight Center and the District of Columbia Public Schools (DCPS). The program continues to evolve as a model urban intervention technique for sixth grade teachers and students by empowering the teachers and inspiring the students through participation in the process and excitement of science and technology. Each spring, fifteen teachers of 6th-grade math and science from the DCPS are invited to Goddard for a five-week paid internship. During the summer, each teacher is paired with a mentor from the scientific and technical staff. The teachers participate in the mentors' current scientific and technical research and partner with the mentors to develop lessons for middle school students which they subsequently pilot in their own schools and post on the *SUNBEAMS* web site.

During the school year, each teacher brings a class of up to 30 students to Goddard for a week of total immersion in math and science activities. The activities are standards-based and designed to give the students an understanding of the actual methods used by Goddard scientists, engineers, and technicians to do space science and technology. Following their week at Goddard,



Students in computer lab putting up web pages describing their week at NASA GSFC.

the teacher and students work together to plan a Family Night at their school to provide the school community and their Goddard partners an opportunity to share in the students' impressions and reactions to their experiences. *SUNBEAMS* is unique among the current crop of educational programs because it addresses issues in science education from a multitude of perspectives, involving all those who contribute to the students' education.

SUNBEAMS provides teachers with the time and resources to develop curriculum materials based on NASA research and national education standards, fosters a positive attitude towards math and science in participating students, and establishes meaningful, long-term partnerships between NASA Goddard technical personnel and local teachers. For additional information about *SUNBEAMS* contact Dr. Carol Jo Crannell, at crannell@gssc.nasa.gov or Ms. Sarah E. Brown at sbrown@stars.gsfc.nasa.gov.



SUNBEAMS students touring the thermal blanket assembly room at NASA GSFC.

The *SUNBEAMS* webpage is <http://space.gsfc.nasa.gov/sunbeams/>

Stars on Earth

Southwestern Indian Polytechnic Institute

Southwestern Indian Polytechnic Institute (SIPI), located in Albuquerque, New Mexico is a national Indian community college. Its geographical location, in the heart of Indian country, as well as the center of New Mexico's technology corridor, affords its students a myriad of cultural and scientific resources. Last winter SIPI was one of 15 institutions selected by NASA OSS to participate in a major effort to develop space science capabilities at minority universities. (For in-depth coverage see *Voyages*, May 2001, <http://spacescience.nasa.gov/education/news>) SIPI President Dr. Carolyn Elgin notes that "*Stars on Earth* has definitely impacted the SIPI academic program through the development and implementation of the geology and astronomy courses, which are transferable to a four-year institution."

Stars on Earth is a year-round academic and research based program opportunity for underrepresented students to build a solid foundation in Earth and planetary sciences, mathematics, technology and communications. The multifaceted program addresses the needs of both high school and community college student participants. Area high school students, SIPI students and graduate students at the University of New Mexico work cooperatively to expand their knowledge of earth and planetary sciences under the auspices of the NASA Space Science grant. The program is under the direction of Principal Investigator, Ms. Catherine L. Abeita, Special Programs Coordinator at SIPI, and Co-Principal Investigator, Dr. Horton Newsom, Institute of Meteoritics and Earth and Planetary Sciences, University of New Mexico Research Professor

Significant accomplishments during 2001 include:

- Saturday Academies during which high school students were actively engaged in projects that integrate Earth and space science, mathematics and English. Students participated in NASA's Student Involvement Program.

- A six-week residential program during which students attended Earth and space, life, and environmental science classes and labs, developed research projects, and interacted with professionals in the field.

- Development and implementation of physical geology 101 and 101 lab courses for students attending SIPI.

- Development of an introductory astronomy course in collaboration with the University of New Mexico. The course will be offered at SIPI during the Spring 2002 trimester.

- In collaboration with the Institute of Meteoritics at University of New Mexico (UNM), the establishment of a meteorite identification laboratory at SIPI that provides internship/research experience for college and high school students.

The establishment of the SIPI Meteorite Identification laboratory has given high school and college students a chance to learn more about Earth and planetary sciences, to participate in meaningful research, and to interact with professionals in the field. UNM's Institute of Meteoritics receives some 200 rock samples a year from the public who send them in thinking that they might be meteorites. According to Dr. Newsom, one or two meteorites are identified at the Institute annually. SIPI students now help in identification based upon characteristics of density, mineral content, shape, and texture. The relationships established through the collaborative may well influence the career choices of the participants. Meteorite Lab interns are very excited because within the last month, a meteorite may have been identified here at SIPI!

Contact Cathy Abeita (cabeita@sipi.bia.edu) for more information about *Stars on Earth*.



NASA OSS program provides hands-on field experience for SIPI geology students.

Exceptional Space Science Materials for Exceptional Students

Southeast Regional Clearing House (SERCH)

This past June, SERCH hosted a workshop for special needs teachers and NASA personnel who develop educational materials and exhibit resources. The purpose of the workshop was to (1) familiarize developers of NASA OSS education materials with the diversity of exceptional classroom and audience needs; (2) familiarize educators of exceptional students with the wide variety of standards-based space science educational support materials available from NASA; (3) evaluate several popular classroom materials from the different OSS themes for use in exceptional classrooms; and (4) build a communication and support network of exceptional teachers and NASA mission-related personnel.

The workshop included training by special needs teachers to expose participants to what it is like to be blind, deaf, and/or physically challenged.

Workshop participants experienced visual impairment by donning goggles and blindfolds that simulated impairments



ranging from total blindness to cataract growth and hearing impairment through a variety of earplugs that caused partial to total hearing loss. To better understand the learning environment of special needs students, each member of the audience was asked to assume a different impairment and/or disability for each of the E/PO activities presented.

The participants were paired with a colleague with a different 'condition' to facilitate lesson completion and to share their thoughts as they executed the exercises. OSS activities presented included posters, CD ROMs, web sites, music, hands-on activities from each of the four OSS education themes and the contents of the Multisensory Space Science Kit (See *Voyages*, January 2001, <http://spacescience.nasa.gov/education/news/> for information on the Multisensory Kit.) In instances where the participant could not manipulate a keyboard, or



Blindfolds make glider flying a challenge!

hear or see the presenter, their partner did their best to communicate the lesson and instructions to them. Partners helped to record comments. As most did not

know sign language and were not used to having a hearing or vision loss, there was much confusion, laughter and some frustration at the beginning. In the end however, there was a much more complete awareness of the environment in which both the special needs student learns and the conditions for which the exceptional needs teachers must plan and design their lesson plans and activities.

By the end of the workshop, all had learned a great deal about their own learning styles and how to better prepare teaching materials. They had also developed a much deeper appreciation for the truly exceptional students and educators. Summary recommendations for those creating E/PO Outreach materials are available from SERCH. Contact Dr. Cassandra Runyon or Kathryn Guimond at 1-888-873-9475.

Watch the SERCH website (<http://serch.cofc.edu/serch>) for information regarding the next workshop *Exceptional Technology for Exceptional Space Science Materials* planned for late Spring 2002.

Live From Mars 2001

Passport To Knowledge

On October 23, 2001, Mars Odyssey entered Mars orbit. One week later, *LIVE FROM MARS 2001*, a TV special created and distributed by PASSPORT TO KNOWLEDGE (P2K), originated from the Jet Propulsion Laboratory (JPL), to take students and teachers behind the scenes to interact directly with the men and women who wrote this latest chapter in solar system exploration. (<http://passporttoknowledge.com>)

The broadcast was carried live by over 130 participating PBS stations and NASA-TV, and was webcast by JPL and NASA's "Classroom of the Future." Guests at JPL included Odyssey deputy

project manager, Roger Gibbs, updating the status of the spacecraft from the Mission Support Area (MSA), surrounded by the navigators and other team members who had gotten Odyssey to Mars. On-camera were Dr. Vicky Hamilton, a member of Dr. Phil Christensen's team from Arizona State and Dr. John Callas, Mars 2003 Exploration Rover science manager. Video questions came in from schools in Maryland, Michigan, Idaho and Montreal, Canada. Through P2K's unique web-based resource "ON-AIR", more than 200 e-mail questions poured in. Some were literally answered "on-air," but all received personal replies from teams of volunteers at the JPL MSA



Roger Gibbs chats with student from Michigan.

and the Mars Imaging Facility at Arizona State. In addition to the latest Mars Odyssey information, background reports covered past "Mysteries and Marvels, Water and Life", "Missions to Mars", and "Odyssey's Long Journey"—including assembly scenes at Lockheed Martin Astronautics in Denver, and pre-launch activities at NASA Kennedy Space Center.

Wrote one teacher from Michigan, "I know my seventh graders were thrilled with the opportunity to participate in this broadcast. We are in the middle of a unit about the solar system, and this was a fantastic way to expose them to the absolute latest developments in science. I know that providing the opportunity for the students to e-mail their questions really got them involved in the entire process, and they were really amazed to get replies back so soon."

A follow-up broadcast, *Live From Mars 2002* on March 19, 2002, will update viewers on new results "just in" from Mars Odyssey. Students will see how Odyssey's instruments use parts of the electromagnetic spectrum beyond visible light to discover otherwise hidden aspects of Mars' mysterious surface. *Live From Mars 2002* will explain how "virtual observations" are open to any teams of students, anywhere, via the Internet, through the Mars Student Imaging Project. (See details in the following article).

Mars Student Imaging Project (MSIP)

Arizona State University

Arizona State University, NASA, and the Jet Propulsion Laboratory (JPL) have partnered to create the Mars Student Imaging Project (MSIP). MSIP offers students the ability to be involved in authentic Mars research - teams in grades 5 through the junior college level can image a site using ASU's Thermal Emission Imaging System (THEMIS) camera onboard the Mars Odyssey spacecraft and conduct image analysis research that will contribute to exploring Mars. Student teams will be able to participate in four different types of MSIP missions: 5-day and 3-day on-site missions at ASU, distance-learning missions, and archived data missions. A downloadable educator guide will be available on-line to help educators incorporate these standards-aligned activities into their existing curriculum. MSIP will provide educators with an engaging, innovative, exciting educational activity that is fun for students and also addresses national science educational standards. For additional information, please check the MSIP website at <http://msip.asu.edu/>

New on the Web: Enhanced Space Science Access for Museums and Planetariums

Structure and Evolution of the Universe Forum

Every year millions of students, teachers, and family groups get their astronomy education at science centers, museums and planetariums. These are vital venues for astronomy and space science education. To help make the rich resources of NASA's Space Science research efforts more available to these institutions, *Space Science Access* (<http://mo-www.harvard.edu/spacescienceaccess>) has been created. *Space Science Access* has three main sections:

- *NASA's Space Science Resources* provides a single portal with annotated links to access images, data, education programs and human resources of particular interest to planetariums and science centers. The growing list of exhibits developed in partnership with NASA OSS E/PO projects appears here, along with links to the best sources of high-resolution space science images.

- *Project Sharing* supports ongoing communication by providing a bulletin board where those working on developing informal

astronomy education projects can post descriptions and photos of projects "in the works."

- *Best Practices* contains education research, lessons learned in past space science education and public outreach projects, and other information meant to contribute to improving the quality of future programs and products.

The site debuted at the October 2001, meeting of the Association of Science -Technology Centers in Phoenix, Arizona and will be evolving as users provide feedback and new resources are added. The site has an on-line evaluation form. Everyone with suggestions for new links or site improvements is encouraged to fill it out, or email spacescienceaccess@cfa.harvard.edu. Don't forget to use the Project Sharing bulletin board to post information about your informal science education and public outreach projects!

SEU Missions Bring High Energy Astronomy to Educators

NASA Goddard Space Flight Center (GSFC)

Several SEU missions participated in a day-long teachers' workshop in April 2001, organized by Dr. James Lochner (GSFC) and sponsored by the Gamma-Ray large Area Space Telescope (GLAST) mission and NASA GSFC. Local teachers attended and heard content-rich talks on gamma-ray bursts and other exciting topics in gamma-ray astronomy from experts such as Dr. Steve Ritz (GSFC) and Dr. Chryssa Kouveliotou of NASA Marshall Space Flight Center. There were also two hands-on presentations to engage the teachers. The first presentation, developed by Dr. Laura Whitlock of Sonoma State University (SSU) as part of the Swift E/PO program, and presented by Dr. Philip Plait (SSU), encouraged the teachers to study wave motion by playing with slinkies, and develop math skills by using a special deck of cards featuring 13 astronomical or Earth-objects, in the four "suits" of Mass, Distance, Energy and Time. A second workshop, conducted by Dr. Padi Boyd (GSFC) and Dr. Alan and Karen Smale (GSFC) showed ways to use gamma-ray bursts to engage student learning. The gamma-ray burst teachers' activity book and posters used during this workshop are on-line and available at <http://imagine.gsfc.nasa.gov/docs/teachers/gammaraybursts/gammaraybursts.html>

On the Horizon

Space Day will blast off on May 2, 2002. The goal of *Space Day* is to advance science, math and technology education and to inspire children to realize the vision of our space pioneers. Co-chaired by former Senator John Glenn, this award-winning global celebration is dedicated to the extraordinary achievements, benefits and opportunities in the exploration of space.

Space Day 2002 - Adventure to Mars! will focus children's attention on expanding our scientific frontiers to one of Earth's nearest planetary neighbors. Three new Design Challenges created by *Challenger Center for Space Science Education* will provide teachers with the right stuff to lift students' interest. Visit the *Space Day* website (<http://www.spaceday.com>) for more information on the Design Challenges.

Sun Earth Day - Celebrate the Equinox

NASA's Sun Earth Connection Education Forum (SECEF) is developing and supporting the 2nd annual Sun Earth Day, an education and public outreach event that will be held on March 20, 2002, to celebrate the Equinox and share *The Real Reasons for the Seasons*, a new GEMS Teacher Guide featured in *Voyages*, January 2001, issue. Participant kits will be distributed in January 2002, and a new web cast is being developed. New activities with projects such as *Telescopes in Education* (<http://tie.jpl.nasa.gov/tie/>) and *Astronomy With a Stick* (daytime astronomy for elementary and middle school - <http://www.nsta.org/programs/sst/aws/>) will be featured. The web cast will include a celebration of the Equinox through a Native American collaboration, and student interactions through activities selected to enhance student knowledge about the Sun and seasons. Updates, participation opportunities, and ideas can be found on the Sun-Earth Day website:

<http://sunearth.gsfc.nasa.gov/sunearthday>

To receive an electronic copy of future newsletters, contribute an article or have questions about getting involved with the NASA OSS Education and Public Outreach Program, contact Larry Cooper, Editor. (larrycooper@oai.org)

Back issues of *Voyages* are online at <http://spacescience.nasa.gov/education/news/>