ASU School of Earth & Space Exploration
ARIZONA STATE UNIVERSITY

Volume 1, Issue 3

SESE Source

.....the official newsletter of the School of Earth and Space Exploration

Artist's rendering of Lunar Reconnaissance Orbiter orbiting the Moon. Credit: NASA/Goddard Space Flight Center

Return to the Moon:

Lunar Reconnaissance Orbiter set to launch June 17

The Lunar Reconnaissance Orbiter (LRO) mission is part of NASA's Lunar Precursor Robotic Program (LPRP) and is the first spacecraft to be built as part of NASA's return to the Moon. The orbiter will be equipped with seven instruments: the Lunar Reconnaissance Orbiter Camera (LROC), Lunar Orbiter Laser Altimeter (LOLA), Lunar Exploration Neutron Detector (LEND), Diviner Lunar Radiometer Experiment (DLRE), Lyman-Alpha Mapping Project (LAMP), Cosmic Ray Telescope for the Effects of Radiation (CRaTER), and Mini-RF.

Professor Mark Robinson is the principal investigator of the LROC instrument, which consists of two Narrow Angle Cameras (NACs) to provide 0.5 meter-scale panchromatic images over a 5 km swath, a Wide Angle Camera (WAC) to provide images at a scale of 100 meters/pixel in seven color bands over a 60 km swath, and a Sequence and Compressor System (SCS) supporting data acquisition for both cameras. LROC is a modified version of the Mars Reconnaissance Orbiters ConTeXt Camera (CTX) and MARs Color Imager (MARCI).

LROC is designed to assess future landing sites on the Moon and acquire images of the poles every orbit to characterize the polar illumination environment. The planning, targeting, and data processing activities will take place at the Science Operations Center (SOC) located at ASU. The SOC will receive between 300 and 450 Gbits of raw image data per day during the year-long mapping phase of the mission. Production of calibrated images and mosaics will result in over 65 TBytes for archive with NASA's Planetary Data System (PDS). LROC image data will be disseminated to the public via a web interface.

For more information visit: *http://lroc.sese.asu.edu*

Upcoming Events:

LROC launch:	June 17
SCAP	June 14-28

Contents:

SESE in the News

AZ Business Magazine's April issue cover story "Destination Red Rock" prominently features SESE. Read the story at: *http://azbigmedia.com/ab/cover-story-destination-red-rock*.

Matthew Fouch is highlighted in Rachel Courtland's article "Listening to the Earth's deepest secrets" published in New Scientist. Fouch is part of a team of geologists working on the USArray project that is inspecting Earth's internal workings down to where the mantle touches the iron-rich core. "It is our version of the Hubble Space Telescope. With it, we'll be able to view Earth in a fundamentally different way," says Fouch.

Student Challenge Awards Program (SCAP)

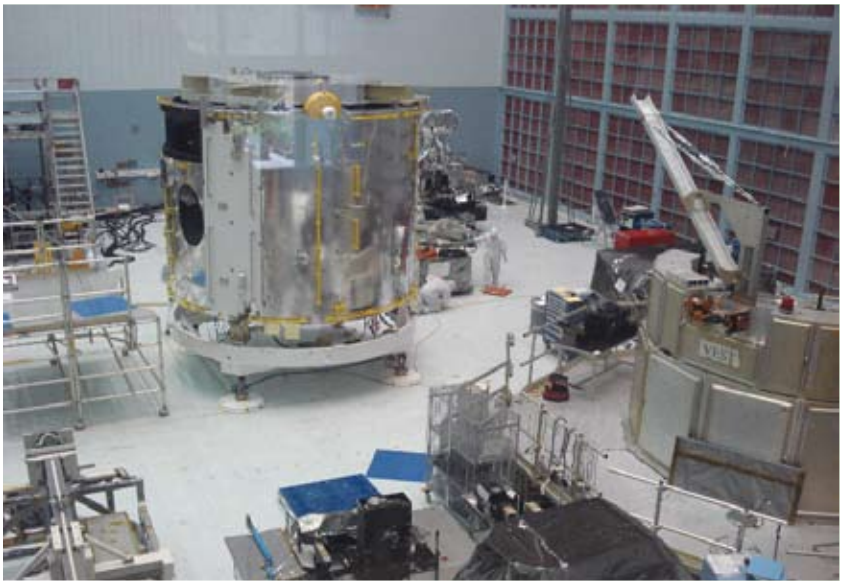
June 14-28, eight high school students will be part of a scientific research team at ASU targeting and analyzing images using the THEMIS visible light camera aboard the Mars Odyssey spacecraft and the Lunar Reconnaissance Orbiter Camera. The students will actively participate in spacecraft targeting, choosing localities of interest to image. The remote sensing program will be complemented by field trips to planetary geology analog sites in Northern Arizona, including sample collection near Sunset Crater Volcano. Sites of historical or archaeological significance accompany these geological sites, and the students will interact with a representative of the Navajo Nation to learn about multicultural perspectives on the changing Southwestern environment.

This competitive fellowship program is funded by an outside donor and implemented by Earthwatch.

Return to the Moon. The journey begins now.

"The Moon is just a stepping stone, a place to gain experience for the exploration goal that lies ahead: human missions to Mars." - **Mark Robinson**

History with Hubble:
Heavens are closer thanks to Hester and Windhorst



Artist's rendering of Lunar Reconnaissance Orbiter orbiting the Moon. Credit: NASA/ Goddard Space Flight Center

Hester was on the science teams that built the first Wide Field and Planetary Camera and the WFPC2, which was responsible for saving the HST mission in 1993. On the evening the WFPC2 was installed, Hester was in HST in the missions operations center as one of two members of the science team tasked with verifying the on-orbit performance of the instrument. He was also one of about a dozen people in the control room when the first WFPC2 images came down. Hester's image of the Eagle Nebula is generally considered the iconic image from Hubble.

Windhorst's list is nearly as impressive. As a member of the WFC3 Science Oversight Committee, he helped define the science goals of the new camera and ensure that Goddard Space Flight Center built the camera to specification.

The instrument's key feature is its ability to span the electromagnetic spectrum from the near ultraviolet through the optical, and into the near infrared. WFC3 is the only Hubble instrument with this "panchromatic" capability. The near infrared detector will improve the discovery efficiency of the current instrument 30 times.

For nearly twenty years the Hubble Space Telescope has brought the beauty and brilliance of the heavens to us on Earth along with unprecedented discoveries - and with its recent upgrade and installation of a new camera, Hubble will be an even more powerful facility for astronomical research.

The launch of the Hubble Space Telescope in 1990 initiated an era of unprecedented discoveries. Jeff Hester and Rogier Windhorst have contributed significantly to our understanding of the universe through their work on countless HST projects.

Those awe-inspiring Hubble images such as that of the Eagle Nebula or the Omega Nebula were generated by the Wide Field Planetary Cameras (1 and 2), cameras that are now more than fifteen years old. Fifteen years ago digital cameras were unheard of and now nearly all cell phones have one. Imagine how impressive the next Hubble images will be when the new WFC3 replaces the dated WFPC2.

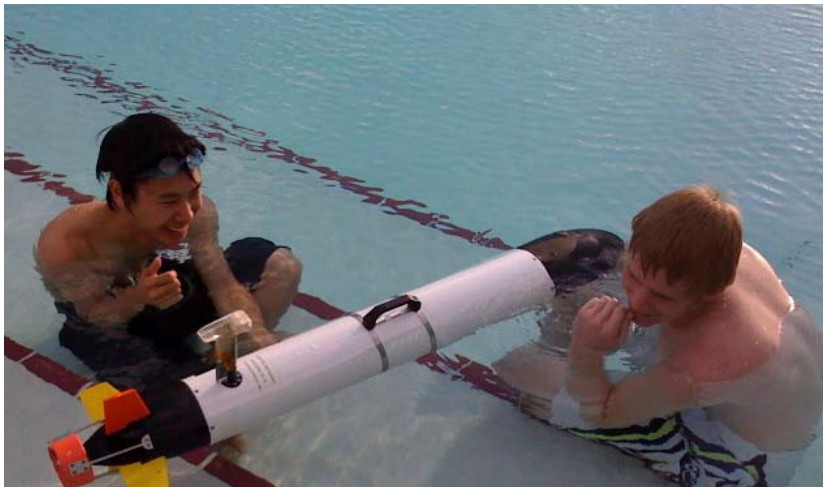
"The images we have to look forward to will be even more spectacular," said Windhorst. "Imagine taking a beautiful Ultra-Deep Field Hubble image and pouring a bucket of 10,000 small diamonds over the top of it. With the ultra-violet capabilities, now you will see all these young sparkling star clusters shining like diamonds where we couldn't see them before."

"We find them smaller and fainter, in constantly increasing numbers, and we know that we are reaching into space, farther and farther, until, with the faintest nebulae that can be detected with the greatest telescopes, we arrive at the frontier of the known universe." - Edwin Powell Hubble

Exploration Below the Surface

Developing an underwater vehicle was the task at hand for Assistant Professor Srikanth Saripalli's students. This initial test, serves as a basis on which future students can build in next year's SES 410/411 (Senior Exploration I & II). Students commanded the underwater vehicle from one GPS way-point to another and developed algorithms to go to various depths at specific way-points with a maximum depth rating for the vehicle at 300 ft.

"Currently, we can go at 2.5 knots for about five hours in shallow water. In the next few months we will increase it to 10 hours and 5 knots," said Saripalli, a roboticist with research interests in unmanned system. "We are working on algorithms for adaptive sampling (based on an estimated gradient), autonomous navigation and mapping."



Students test their underwater vehicle for the first time. Saripalli hopes there will be interest in using the vehicle for sampling and mapping applications in oceans, rivers and lakes. Watch the video at: http://robotics.asu.edu/auv-3.mov

The Right Stuff?

Researcher Jim Rice soon to be Astronaut Rice?

At Arizona's Meteor Crater, Jim Rice helps NASA test future lunar spacesuits and equipment. Credit: Andrew Feustel

Interview by Robert Burnham (RB)

RB: When did you decide to become an astronaut?
I was about seven years old - that was in 1965 or 66.

RB: And when did you first make a serious effort toward the goal?
My 8th grade text book had a section on space with the characteristics needed by astronauts at the time. I studied that list very carefully, and I worried a lot over the height requirement. NASA said the upper limit was 5 feet 11 inches, and I knew I'd grow taller than that. Luckily, they relaxed the height requirement somewhat after Apollo.

The first time I actually applied to become an astronaut was in the summer of 1999. I got as far as being interviewed.

RB: How often have you applied before?
This is my third time.

RB: What will you do if not selected?
I'll try again — all they can do is say No! But realistically, everyone applying knows that the odds are very slim. For this latest group, NASA got about 3,500 applications, and from that they will pick about a dozen or so.

RB: What is your current job?
Right now, I'm an astrogeologist. I work on the science team for the Spirit and Opportunity Mars rovers. I'm doing fieldwork at sites around the world that are analogs for places on the Moon or Mars. These include Iceland and Hawaii.

I'm also involved in field tests of a new electric lunar rover, and checking out procedures with lunar equipment. We're doing these in northern Arizona, at the Black Point Lava Flow, about 40 miles northeast of Flagstaff, near Cameron, along the Little Colorado River.

RB: Do you want to go to the Moon?
I'd love to! My suitcase and toothbrush are always packed and ready to go. But this class NASA is selecting is an ISS class.

RB: What would you say to anyone considering an astronaut career?
You need is stubbornness, perseverance, and doggedness. Also, be realistic about your chances.

Student Focus: Erin DiMaggio
Geology graduate student

Erin conducts her research in the Afar Depression of Ethiopia, adjacent to prominent anthropological sites of Hadar, Gona, and Dikika. In the past three years she has visited Ethiopia on three occasions with her advisors Dr. Ramon Arrowsmith, Dr. Kaye Reed and Dr. Chris Campisano.

My postdoctoral research project is focused on investigating the tectonics, stratigraphy, and volcanic deposits in the region called 'Geraru' located in the west-central region of the Afar Depression in Ethiopia. This region is significant for its exposures of fossiliferous sedimentary deposits from the Pleistocene to Pliocene (5.3 – 0.01 Ma) that are well-known because they yield abundant fossils and artifacts of early humans including the famous Australopithecus afarensis specimens "Lucy" and "Selam". This region is also important because it lies in a triple rift junction between oceanic spreading centers and continental rifting, and is volcanically active.

The area I work in is extremely hot, dry, and there are tribal conflicts that often limit my access to the field. In addition to field work, I have to manage the local tribal people (Afar) that we hire to guard us and to work on their land. Its is extremely important that I am cognizant of cultural differences so that I am respectful and courteous, as my safety and ability to work on this land depends on my relationship with the Afar. The Afar Depression is an exciting place and extremely important to many research fields making it the focus of truly transdisciplinary research projects that include paleoanthropology, archaeology, geology, volcanology, etc.

My project targets a time period (ca. 2.9-2.7 Ma) that corresponds to important biologic, climatic, and tectonic events. The methods

In the Geraru field area in the Afar Depression, Ethiopia along the Mille River, sediments and interbedded tephra deposits (thin, white, horizontal beds) are exposed along the right bank and dated to ca. 2.8 Ma. Sediments are also exposed in the background against faulted basaltic flows shown along the horizon. Credit: Erin DiMaggio

I employ include geologic mapping, stratigraphic analysis, tephrochronology (40Ar/39Ar dating technique using minerals from volcanic ash), and tephrostratigraphy (the geochemical correlation of volcanic ash in a stratigraphy section). This research will contribute to understanding past environments in East Africa and how they varied with time – variations that may have significantly influenced faunal populations, including early humans. This work also provides insight into the timing of tectonic, climatic, and volcanic processes controlling the development of the area, within an active region of the Afar Depression where continental crust is heavily stretched.

President Barack Obama addresses graduates at ASU's May 13 commencement.

Awards and Recognition

Students:

Rebecca Jarnagin is a student in the BAE Secondary Earth and Space Science Education program, soon to graduate. She was accepted for a prestigious summer internship with the National Air and Space Museum. "I will be working in the space history department and in particular I will be working with various astronomy based exhibits and educational resources to go along with the displays," says Jarnagin.

Postdoctoral student **Chunpeng Zhao** is a recipient of one of the American Geophysical Union's "Outstanding Student Paper Award" for the "Study of the Earth's Deep Interior" research area. Chunpeng earned the award from his poster presentation titled "Investigating the edges of the large low shear velocity province in the lowermost mantle beneath the Pacific Ocean" at the December 2008 AGU meeting.

David Haddad, a graduate student studying Active Tectonics, Quantitative Structural Geology and Geomorphology, received an AGU Outstanding Student Paper Award for his poster titled, "Investigation of the geologic setting and geomorphic processes that control the formation and preservation of precarious rock zones."

Faculty promotions:

Ariel Anbar, promoted to professor
Amanda Clarke, promoted to associate professor
Steven Desch, promoted to associate professor
Steven Semken, promoted to associate professor

Congratulation to our 2009 graduates:

- Jeff Havig (Geological Sciences PHD)
- Michael Kraft (Geological Sciences PHD)
- Lynn Neakrase (Geological Sciences PHD)
- Shawn Wright (Geological Sciences PHD)
- Kevin Goldman (Geological Sciences MS)
- Jill Lockard (Geological Sciences MS)
- Megan Muretta (Geological Sciences MS)
- Ramses Ramirez (Geological Sciences MS)
- Kelli Wakefield (Geological Sciences MS)
- Alexandra Dunsdon (SES BS)
- Josh Florie (Geology BS)
- Rhiannon Howard (Geology BS)
- Joe Walsh (Geology BS)

Live from Mars:
News from Mars Space Flight Facility

Mars Student Imaging Project (MSIP):
- Eleven schools brought a total of 200 students for MSIP on-site visits in April.

- MSIP on-site has now served a total of 5,225 students.

- 107 students from six high schools in the Peoria Unified School District visited ASU to present their MSIP projects. All ninth graders in PUSD complete an MSIP project in their science class.

Mars Space Flight Facility Tours:
- 467 students visited MSFF for a tour in April.

- 68 adults visited MSFF with an additional 15 VIPs.

Teacher Workshop
Searching for Life on Mars and Beyond, a full-day workshop on the astrobiology of Mars and beyond, was held Saturday, April 25. Five teachers and two researchers attended the event and enjoyed a series of hands-on activities and a lectures on stars and the formation of elements and an astrobiology introduction.

For more information visit:
http://marsed.asu.edu/

Mars Education Program participated in the monthly International Year of Astronomy program at the Arizona Science Center on April 11. Three large floor puzzles were featured along with an interactive exhibit featuring specimens and coloring sheets. More than 2,000 people attended this all-day event. Credit: Michael Fancher