

# PISCES NEWSLETTER

PACIFIC INTERNATIONAL SPACE CENTER FOR EXPLORATION SYSTEMS \* HILO, HAWAII

APRIL, 2015

VOL #3 ISSUE #4



## *PISCES Launching Co-Op Program; Recruiting New Summer Interns*



*Image: Student interns and volunteers conducted stellar work with PISCES in 2014.*

As part of PISCES' workforce development initiative and promotion of STEM learning among students, the agency is now recruiting a new round of interns for the summer of 2015, as well as spearheading a cooperative work-study program with the University of Hawaii at Hilo.

The 10-week internship program is set to begin June 1 and will employ six to ten college-level students studying mechanical and electrical engineering, geology, physics, volcanology, computer science, and construction. Three projects will immerse the students in hands-on experience including robotics, planetary analogue test site surveys, and "space" construction – utilizing volcanic basalt to build a 10-meter lunar landing pad.

PISCES employed eight interns and volunteers last summer on two individual projects. Five students worked on the Planetary Analogue Test Site characterization team, conducting geological surveys of Hawaii's volcanic terrain to find suitable representatives for lunar and Martian landscapes. The additional three students worked on the Helelani planetary rover programming software and hardware systems to advance the robot's remote and sensory capabilities.

PISCES' cooperative education program with the University of Hawaii at Hilo will offer real-world work experience to supplement students' classroom learning. The initiative encompasses computer science, engineering, and physics and astronomy fields, and offers full-time paid work to participating students in an alternating semester-on/semester-off cycle. PISCES is currently in the process of finalizing and selecting a participant to launch the program beginning in the fall of 2015.

## MESSAGE FROM THE EXECUTIVE DIRECTOR THE 31<sup>ST</sup> SPACE SYMPOSIUM

Dear PISCES Friends and Family,

The few days between April 13-16, 2015, offered an incredible space event in Colorado not to be missed. The 31<sup>st</sup> Space Symposium was held in Colorado Springs in which space leaders from around the world got together to discuss, partner and strategize about the future of space exploration. The "Who's Who" of the space industry attended, including CEOs, Executive Directors, company presidents and more, meeting face-to-face to exchange ideas and get to know one another.

My good friend from Hawai'i, Elliott Pulham, and his wonderful staff at the Space Foundation, produced and managed the symposium.

As the Executive Director of PISCES, it was an amazing time of networking and business development for both the State of Hawai'i and PISCES. I even worked the Hawai'i Aerospace booth in the exhibit hall for several days and loved every minute.

This event was one of the top space conferences of the year. Mahalo to the Space Foundation for another fantastic event. I look forward to next year!

Until next time,

Res Gesta Per Excellentiam

(Achievement Through Excellence).

**-Rob Kelso, PISCES Executive Director**

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*Rob Kelso, PISCES Executive Director*

# PISCES AMONG PARTNERS AWARDED \$4.2 MILLION NASA GRANT

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## Moon RIDERS Visit NASA Ames



Moon RIDERS students from Kealakehe High School were invited to NASA's Ames Research Center in California for three days to conduct further testing of their lunar flight experiment hardware.

SSERVI, or Solar System Exploration Research Virtual Institute, which is headquartered at Ames, hosted the Moon RIDERS' test in a lunar regolith simulant test bed during their visit from March 30 – April 1. The 16 square-meter test bed room is filled with eight tons of JSC1A lunar dust simulant, and provided the students with the perfect opportunity to test their NASA-built electrodynamic dust shield (EDS) in lunar-like conditions.

The Moon RIDERS team also gave two technical briefings to SSERVI scientists about their initial test results following field work conducted with the EDS on the slopes of Hawaii's Mauna Kea volcano in mid-March. They also shared an in-depth look at Hawaii's viability as a spaceport, and the potential of lunar resources to serve in furthering space exploration and colonization.

Data collected during the additional testing at NASA Ames will help determine the best placement for the dust shield and accompanying cameras aboard a spacecraft for experimentation on the surface of the Moon, anticipated in late 2016. Their findings will be compiled in a report to NASA and teams from the Google Lunar XPRIZE at the end of May.

The Moon RIDERS' NASA Ames visit also coincided with the Silicon Valley Regional robotics competition held in San Jose. The high school robotics team competed in the bot challenge as Team 3880, the "Tiki Techs."

## *PSTAR Selects BASALT Team to Conduct Mars Research in Hawaii and Idaho*



*Volcanic terrain in Hawaii and Idaho will be researched and compared with the Martian landscape (shown above) to determine the habitability of Mars. NASA photo.*

PISCES is one of several partners that has been selected to complete a four-year, \$4.2 million Mars research project designed to help prepare for future human and robotic missions to the Red Planet.

Called Biologic Analog Science Associated with Lava Terrains (BASALT), this project is spearheaded by the NASA Ames Research Center, with Dr. Darlene Lim as the Principal Investigator, in collaboration with NASA Goddard Space Flight Center, NASA Kennedy Space Center, BAER Institute, Wyle Engineering, Massachusetts Institute of Technology (MIT), Purdue University, Leiden Measurement Technology, Idaho State University (ISU), Cornell University, Arizona State University (ASU), and University of Hawaii at Hilo/PISCES.

Out of 47 proposals received nationwide, this elite team of researchers is one of only seven grant applicants chosen by NASA's highly competitive Planetary Science and Technology Through Analog Research (PSTAR) program.

BASALT crew comprised of scientists - both senior researchers and students - operations experts, and active astronauts, will investigate volcanic terrains and lava flows on the Big Island of Hawaii and in Idaho, both of which serve as Mars analogs.

Numerous studies show the Red Planet's past was filled with volcanic activity, with Hawaii's lava terrain having similarities to early Mars, and Idaho's flows resembling present-day Mars. Researchers will compare and contrast their geochemical properties to rocks on the Red Planet and evaluate microbial communities to understand the habitability potential of Mars.

"This project stresses the importance of Hawaii with regard to its valuable role in the future of space exploration, and expands our understanding of the universe around us," said PISCES Operations Manager Christian Andersen, a Co-Investigator on the BASALT team.

PISCES Test Logistics/Education and Public Outreach Manager John Hamilton, who is also a faculty member with the University of Hawaii at Hilo Department of Physics and Astronomy, will also serve on the BASALT Science Team.

"Connecting lands in Hawaii and Idaho via their physical similarity to Mars will broaden this relationship facilitating STEM learning in areas of astronomy, chemistry and geology," said Hamilton.

The BASALT team will conduct their research on Hawaii Island starting with a reconnaissance trip this Fall.

# LUNAR LAVA TUBES AND THE FUTURE OF SPACE HABITATION

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## The Big Picture

Check out this incredible series of photos released by NASA in honor of Earth Day on April 22.



Aurora captured from the ISS. Credit: NASA/ESA/Alexander Gerst



Windswept Valleys in Northern Africa captured from the ISS. Credit: Alexander Gerst/ESA/NASA

(See more on page 4!)

coming soon ...

**PRISM 2015**  
PISCES ROBOTIC INTERNATIONAL  
SPACE MINING COMPETITION

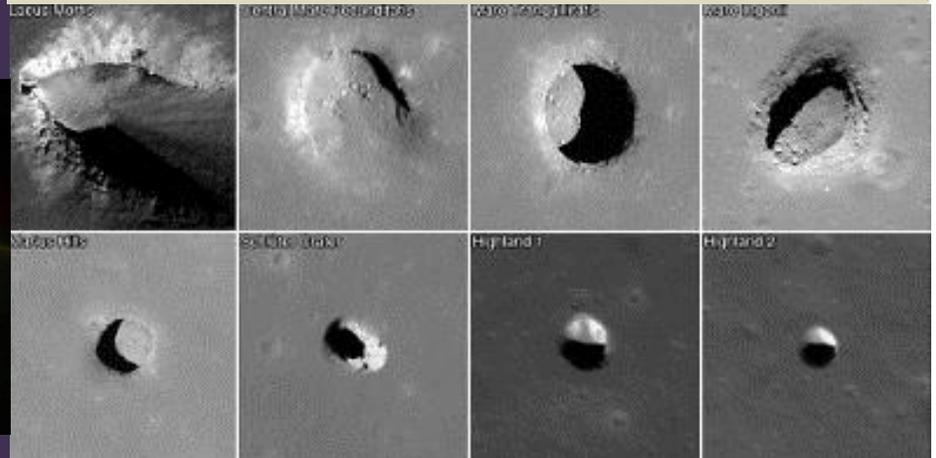
**JULY 25-29**



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## Moon Caverns Could Shelter Future Astronauts



Lunar skylights like the ones shown above could be potential portals to underground lava tubes on the Moon. Credit: NASA/GSFC/Arizona State University.

Before Apollo astronauts set foot on the Moon, scientists theorized the existence of lava tube tunnels snaking underneath the dusty, barren lunar surface. The idea emerged from early orbital photographs capturing surface phenomena that indicated an intricate underground network of channels. Researchers believed these channels had been formed by lava flows on the Moon billions of years ago.

After NASA's Lunar Reconnaissance Orbiter (LRO) space craft launched into lunar orbit in mid-2009, these theories started to be confirmed as reality. The LRO's moon-investigating cameras captured images of enormous caverns hundreds of feet deep, which were later proved to be skylights leading to lava tubes. Hundreds of these skylights were found after further analyzing imagery from the LRO ranging in size from 5 meters in diameter to 900 meters.

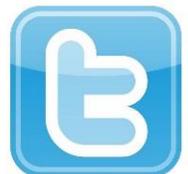
The discovery of these extraterrestrial lava tubes not only gives an exciting look into the Moon's geological past life, but also offers potential prebuilt shelters for future astronauts. Inhabiting underground tunnels like these could be crucial for living on the Moon, warding off hazards like meteoroids, extreme temperatures, and solar radiation. According to scientists, the temperature remains fairly constant at just two meters below the lunar surface, compared with the extremes that occur above ground.

However, the idea still remains somewhat of a science fiction dream until the skylights can be further explored. Because remote instruments can only provide so much data at this time, it may likely require a manned visit to the Moon's surface to delve into some lunar spelunking.

Meanwhile, scientists are exploring technologies to investigate lava tubes on Earth. On Hawaii Island, PISCES is working to map out terrestrial lava tube analogues that could serve as ideal testing grounds for these types of technologies. By testing robotics in similar environments, researchers could one day execute a successful lunar lava tube exploration mission using robots to safely scout the Moon's unknown network of hidden caverns.

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Retreat of Yakutat Glacier in Alaska.  
Credit: NASA Earth Observatory image  
by Robert Simmon



The March 20, 2015 solar eclipse's shadow  
over clouds in the Arctic Ocean. Credit: NASA  
Goddard MODIS Rapid Response Team



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Sea around the Pribilof Islands. Credit:  
NASA/Landsat 8



Egmont National Park in New Zealand.  
Credit: NASA/USGS

### ABOUT US

PISCES is a Hawaii State Government Aerospace Agency located in beautiful Hilo, Hawaii. The research and education/training center is part of the State Department of Business, Economic Development, and Tourism (DBEDT), and conducts environmentally safe field demonstrations to test and validate innovative space technologies on Hawaii's volcanic terrain under the jurisdiction of the Hawaii State Department of Land and Natural Resources (DLNR).

### *NASA Testing New Flight Vehicle off Hawai'i Shores*

How did NASA land a 2,000 pound, car-sized robotic rover on the surface of Mars? Part of their success lay in using a gigantic, 51-foot parachute to slow-down the rover after entering the Red Planet's atmosphere.

NASA is now further developing chute technology to land even larger robotic crafts on other planets using even larger parachutes. The agency will be testing its Low-Density, Supersonic Decelerator (LDSD), a saucer-shaped, rocket-powered test vehicle, off the shores of Kauai Island in Hawaii to test the largest parachute yet.

During the trial flight slated for June, the LDSD will be carried to an altitude of 120,000 feet by a balloon, then engage its rocket booster to soar to 180,000 feet. Two drag technologies will be tested in an automated sequence: the first is a doughnut-shaped inflatable tube designed to slow its supersonic travel from Mach 4 to Mach 2.5; the second is the largest supersonic parachute ever deployed. Following the massive chute's release, the craft is expected to splash down in the Pacific for retrieval.

The concept of using atmospheric drag as a way to slow down supersonic spacecrafts upon atmospheric entry is intended to spare valuable rocket fuel for final maneuvers, allow for larger payloads, and to enable landings at higher altitude locations. The LDSD's findings will test these technologies' usefulness for future missions to the Red Planet, and others. The mission is being led by NASA's Jet Propulsion Laboratory in Pasadena, California.



The press get an up-close look at the LDSD flight-test vehicle at NASA-JPL on March 31. Photo: NASA/JPL-Caltech.