PISCES NEWSLETTER

PACIFIC INTERNATIONAL SPACE CENTER FOR EXPLORATION SYSTEMS * HILO, HAWAII

JULY, 2015 VOL #3 ISSUE #7

'Mars' Explorers Return to Earth in Freefall

HI-SEAS crewmembers and researchers pose with the U.S. Army's Golden Knights parachute team in front of a Chinook helicopter that brought the crew 'back to Earth.'

Reentering Earth's atmosphere from space can take around 60 minutes in a spacecraft plunging at supersonic speed. For a crew of simulated Mars explorers who just completed an eight-month mission in isolation, reentry to the planet took about 60 seconds at 100 mph.

After the longest Mars-mission simulation ever conducted in the U.S. on the slopes of Hawai'i's Mauna Loa volcano, six crewmembers participating in a NASA-funded study called HI-SEAS (Hawai'i Space Exploration and Analog Simulation) returned to everyday life on June 13 with a free fall from 12,000 feet. Their dive was facilitated by the U.S. Army's Golden Knights parachute team over the Kona side of Hawai'i Island.

Though it wasn't an identical recreation of a real Earth reentry in a spacecraft, eight months of sensory deprivation from the sounds, sights, and smells of the outside world made the experience one for the books.

"I couldn't think of a better way to come out of a dome than like this," said Allen Mirkadyrov, a HI-SEAS crewmember and aspiring astronaut. "It was pure joy."

Sophie Milam, a former PISCES worker and chief engineer on the HI-SEAS mission, has skydived twice but said this plunge was "by far the best."

(Continued on next page…)

MESSAGE FROM THE EXECUTIVE DIRECTOR

PISCES Welcomes Student Interns and Volunteers for the Summer of 2015

Dear PISCES Friends and Family,

Summer is a special time for PISCES. Each year the Center not only looks forward to one of its large, semi-annual robotics field tests, but it also welcomes a highly capable team of college-level interns and volunteers to work within the organization. Students work alongside senior PISCES engineers on some incredible planetary research and engineering projects.

This year, PISCES has welcomed eight interns and volunteers. Over the last two summers, the Center has hosted 17 interns involved in research projects spanning planetary surface research, robotics, and more. Of that number, 88% of the participants were students from universities in the State of Hawai'i.

At PISCES, our goal is to: "create economic development and hi-tech workforce by providing research and development in planetary surface systems for maturing technologies for sustainable operations on the Moon, Mars and asteroids." To this end, PISCES is committed to workforce development in the State of Hawai'i through hands-on education and experience. We strongly believe in university students working alongside senior engineers on compelling aerospace projects that will give them real world application to complement their on-going academic curricula.

PISCES' team of interns are tackling two main project areas this summer: (1) planetary robotics and (2) planetary analogue test sites. Interns working with PISCES' chief roboticist, Rodrigo Romo, are developing and testing critical new subsystems on the PISCES Helelani rover. These include the development of mechanical systems for an upcoming project to robotically construct a launch and landing pad from basalt using the Helelani.

The robotics team is also developing a new mission control center architecture for the command and control of robotics at PISCES planetary analogue test sites. The robotics team of interns and volunteers consists of: Teddy DeRego Karlin Yeh, Amy Lowe and Ernesto Esparza. They are led by PISCES' Robotics Technician Casey Pearring under the direction of Romo.

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Rob Kelso, PISCES Executive Director

PISCES STARS COMPLETE JOURNEY THROUGH "SPACE"

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'Mars' Explorers cont…

The volunteer crew endured living in a 36-foot diameter, dome-shaped habitat for eight months to assess the long-term psychological and physiological effects of isolation on a group of people. The mission was the third and longest yet conducted at the HI-SEAS habitat nestled at over 9000 feet on the slopes of Mauna Loa.

Throughout the mission, crewmembers worked on individual research projects, teamed up for a daily dose of P90X (a trademark, vigorous exercise routine), and explored the creative possibilities of cooking with freeze-dried, shelf-stable foods. Occasionally, they exited the dome to the otherworldly terrain of Mauna Loa's rugged lava, but within the cloak of modified hazmat suits to simulate being on Mars.

Allen says the crew also had access to media uploaded to a local server, enabling the group to watch the full season of "Game of Thrones." Despite being cut-off from the outside world, there was plenty to do beyond workouts, meal preparation, and entertainment.

Allen, an aerospace engineer at NASA who originally hails from Russia, spent his time finding the most energy and time efficient roundtrip route to Mars. He also studied an Earth-transit occurring from Mars in 2084, when the Earth will pass directly through the Sun from the perspective of the Red Planet.

Sophie completed her Master's degree in Mechanical Engineering during the mission, becoming the first "Martian graduate." Her research involved tensegrity robots, which are exceptionally robust and versatile bots that could pave the way for future mechanics.

The crew also included Commander Martha Lenio, Neil Scheibelhut (also a former PISCES worker), Jocelyn Dunn, and Zak Wilson. They were supported by an experienced team of researchers at the University of Hawai`i at Manoa, but the simulated astronauts had no contact with the outside world beyond e-mail.

In spite of the confinement and isolation, the crew agreed that everything worked out well. No signs of third-quarter syndrome appeared – the anticipated period of isolation when people can start losing their mental and emotional stability.

"It's unusual to live in these circumstances, but everyone found a way to cope with it," said Allen. "At the end of the day, we completed the mission."

The research conducted at HI-SEAS is paving the way for a potential manned colony on the Red Planet within the coming decades. In August, the study will continue with a 12-month mission in the habitat.

Welcome back to Earth HI-SEAS crew!! Congratulations on completing your mission!!

Hawaii High School Students Spend Night on "Mars"

STARS students suited up for space in front of the HI-SEAS Mars-simulation habitat on the slopes of Hawaii's Mauna Loa volcano.

Stargazing, spacecraft missions, and visiting Mars? It sounds like the life of an astronaut, but this was the life of 10 Hawai'i high school women who participated in the 2015 PISCES STARS (STem Aerospace Research Scholars) Workshop in late June.

The group of youngsters included: 'Aulani Oka of Kamehameha School's Kapalama campus; Celine Laranang of Waiakea High School; Kiana Lum of WHEA (West Hawaii Exploration Academy); Luika Eckman of WHEA; Ellie Furneisen of WHEA; Anuhea Kahikina of WHEA; Gabriella Haines of WHEA; Tanya Adams of Kohala High School; Gabrielle Bartolome of Kohala High School; and Schelin Ireland of Konawaena High School.

The teenaged STARS spent five days immersed in the world of aerospace science with hands-on activities and presentations that proved to be both educational and fun. Their activities included a mock robotic moon mission, a lesson in ISRU (in-situ resource utilization) – which could enable sustainable living on other planets – a test drive of PISCES' Helelani planetary rover, and a visit to the lunar-like terrain of a planetary analogue test site. The students also convened for a night of stargazing on the slopes of Mauna Kea, and dined in at the astronomer lodging quarters of the Ellison S. Onizuka Center for International Astronomy.

Their space-centric adventure came to a close with an overnight stay on "Mars," courtesy of the HI-SEAS (Hawaii Space Exploration and Analogue Simulation) habitat on Mauna Loa. The geodesic dome was recently home to six simulated astronauts who completed an eight-month mission in isolation in preparation for a potential Mars colony in the decades ahead. Former HI-SEAS mission commander Martha Lenio hosted the STARS, who got a taste of off-planet life by trying on space suits, cooking "space" food, and hiking the rugged terrain of Mauna Loa.

STARS participant 'Aulani Oka of Kamehameha School's Kapalama campus said it was much more hands-on than she expected. "It's been really fun," she said. "I really enjoyed stargazing."

Another student, Ellie Furneisen of West Hawaii Exploration Academy, who hopes to be an observatory operator one day, commented "You get to kind of experience hands-on, like, the industry of astronomy and aerospace and all that kind of stuff to see if it's really something you're interested in, and if you're willing to pursue a career in it in the future."

The 2015 STARS program is the second-annual workshop conducted by PISCES. The program, led by Program Director Mari-Ela David Chock, aims to inspire young women in STEM (science, technology, engineering and math) by demonstrating how a career in aerospace is not a farfetched science-fiction dream, but an achievable, fun, and engaging reality within reach.

PAVING THE WAY TO SPACE CONSTRUCTION: ACME PROJECT UPDATE

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Letter from the Executive Director *Cont…*

A second set of interns are working on categorizing and defining new planetary analogue test sites under PISCES Logistics/EPO Manager John Hamilton. They are: Colin Milovsoroff, Valerie Wasser, Niki Thomas and Eric Bucher. These interns are building a database of the Center's test sites to assist current and new customers in the planning and use of planetary analogue testing areas. They will also be characterizing new sites for lava tube and skylight operations and testing.

The office is buzzing with activity! We at PISCES are very excited to have these bright-minded students working for the Center, giving them the opportunity to reach for the stars!

WELCOME ALL PISCES INTERNS!

Until next time,

Res Gesta Per Excellentiam
(Achievement Through Excellence)

-Rob Kelso, PISCES Executive Director

Construction Site Selected and Rover Readied for Work

PISCES' Helelani rover is being readied for robotic construction using basalt.

PISCES is making steady progress in its Hawaii space construction project known as ACME (Additive Construction for Mobile Emplacement). The joint initiative with NASA Kennedy Space Center's SwampWorks aims to robotically build a lunar landing pad using Hawaii's volcanic basalt.

In June, the construction site for the VTVL (Vertical Takeoff/Vertical Landing) platform was cleared, graded and leveled (shown below). A 20-meter diameter area was set using 8" pavers, and the next step will involve filling the area with basalt fines to recreate a lunar landscape. NASA is providing detailed information from the Apollo lunar missions to create an accurate rendering of a lunar landscape at the landing pad site.

Development of PISCES' Helelani planetary rover continues, which will operate as a key system in the robotic construction process. The avionics and payload power subsystems are being improved to execute the landing pad construction more efficiently. The rover has been outfitted with a rolling compactor and leveling blade to execute the task.

PISCES expects to receive a kiln in early July, which will be used to make the basalt pavers. Once the oven is inspected and tested, a NASA engineer will join the ACME team and calibrate the kiln's thermal profile.

Construction is slated to begin late this year after the first pavers are successfully built. Helelani will robotically deploy the basalt-composed pavers to construct the main landing pad area.

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Independence Day: Honoring the American Flag…..*on the Moon!*

Every July 4th, we celebrate the U.S.A.'s independence as a nation. It is a time of patriotic celebration when the American flag can be seen everywhere, lining streets and flying overhead in household yards. But the stars and stripes reach well beyond the borders of the U.S. as a nation. Firmly grounded in the dusty surface of the Moon lie American flags planted at every Apollo landing site over 40 years ago. Are they still standing upright, withstanding decades of the harsh lunar environment?

Through the incredible imagery captured by NASA's Lunar Reconnaissance Orbiter (LRO) spacecraft, scientists have been able to confirm that all the American flags planted during the Apollo missions are still "flying" on the Moon, with the exception of Apollo 11. Legendary Astronaut Buzz Aldrin recounted seeing the flag blown-over during lift-off from the lunar surface.

Even so, we don't know much about the present condition of the flags. They are likely bleached from the relentless bombardment of solar radiation and thin atmosphere, losing their hues of red, white and blue. It's also possible these symbols of the U.S. nation and values have been pelted countless times by a steady barrage of micro-meteorites. But until a future Moon mission revisits these historic sites, we can only speculate, and wonder at the incredible achievement of human space exploration.

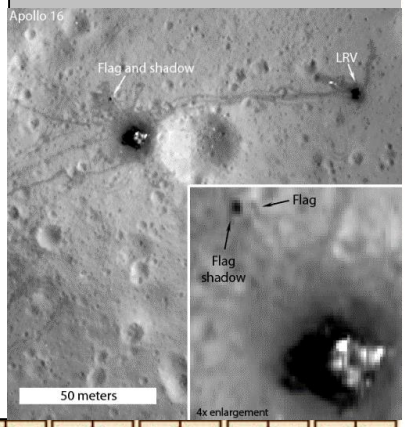
On this Independence Day, glance up at the Moon and pause for a few seconds to think about these flags, still "flying" the stars and stripes on the surface of Earth's faithful neighbor. Happy 4th of July!

Image a right: Snapshots by NASA's LRO reveal former Apollo landing sites where U.S. flags lie planted in the lunar dust. Credit: NASA.

WE ARE LIVE!!!

Check Out PISCES on the Web!

PISCES.HAWAII.GOV



ABOUT US

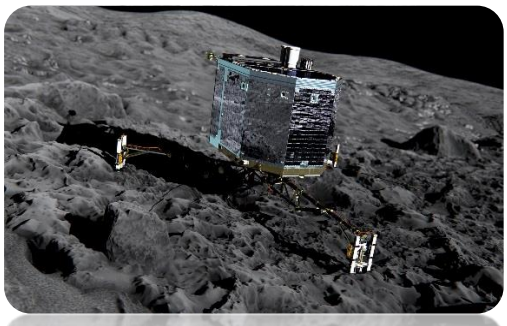
PISCES is a Hawaii State Government Aerospace Agency located in beautiful Hilo, Hawaii. The research and education/training center is part of the State Department of Business, Economic Development, and Tourism (DBEDT), and conducts environmentally safe field demonstrations to test and validate innovative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

Philae Lander Reawakens After 7 Months of Hibernation on Comet

After the European Space Agency's Philae lander fell silent some 7 months ago following a historic landing on Comet 67P/Churyumov-Gerasimenko, scientists were left in the dark. But on June 13, the pioneering probe reawakened from "sleep mode," drawing enough energy from the approaching Sun's energy to recharge its drained batteries. During touchdown last November, the craft strayed into the shadow of a cliff face, rendering its solar panels useless and ultimately running out of power.

After notifying headquarters of its awakening, the craft began sending invaluable data back to Earth about its surrounding environment, giving scientists an unprecedented look at the surface of a comet.

Philae deployed from its parent space craft, Rosetta, which journeyed four billion miles over 10 years to reach its destination. Rosetta still orbits the peanut-shaped comet, relaying data transmissions from Philae and other data.



Philae became the first space craft to rendezvous with a comet last November. ESA photo.