Pacific International Space Center for Exploration Systems
PISCES
Newsletter
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Outreach & Education

National Contest Winner Trains like 'Mars Astronaut' in Hawaii

Top Left: #StudentAstronaut contest winner Julia Velasquez and Xploration Outerspace show host Emily Calandrelli strike a pose with PISCES' Helelani Rover outside the HI-SEAS habitat. Top Right: PISCES Intern Jack Andersen explains landscape hazards to Julia, Emily and the camera crew. Bottom Right: Helelani explores "Mars."

Hawaii's continuing role in space exploration efforts came to the spotlight in late September when a national contest brought an aspiring astronaut to the Mars-like terrain of the Big Island to train like a Martian astronaut.

Julia Velasquez, a U.C. San Diego student and two-time NASA intern, won Xploration Station's 2017 #StudentAstronaut contest, a national STEM TV show competition aimed at inspiring youth to pursue their science dreams. As winner, Julia claimed a three-part Hawaii training adventure with Emmy-nominated show host Emily Calandrelli.

With camera crews in tow, Julia and navigated a mock Mars mission with PISCES' Helelani Rover, spent a night on "Mars" at the HI-SEAS (Hawaii Space Exploration and Analog Simulation) Habitat and toured the Canada-France-Hawaii Telescope. The pair got a first-hand look at the exciting space-related projects happening here in Hawaii as part of the third-annual TV show contest, which focused on Mars this year.

"Mars is the next major frontier for crewed space exploration," Xploration Outerspace show host Emily Calandrelli said in a press release for the contest. "By centering this year's contest around such an ambitious mission, we hope to really inspire and encourage those young people who will actually make it happen!" *(Cont. on page 5…)*

Message from the Program Manager

Rodrigo Romo

Aloha Kakou!

On March 6, 1994, the second and last manned crew of Biosphere 2 entered a sealed, self-sustaining mini world to embark on a six-month mission. I had the privilege of being a member of that diverse crew. In my opinion, Biosphere 2 was ahead of its time. It aimed to prove that it was possible to create a self-contained facility capable of sustaining human life. Under a 3.5-acre space frame of glass, two crews successfully produced all of their own food and recycled all of their oxygen and waste.

Twenty-three years later, I'm writing these words from inside the HI-SEAS (Hawaii Space Exploration and Analog Simulation) habitat on the lower slopes of Mauna Loa. *(cont. on page 4)*

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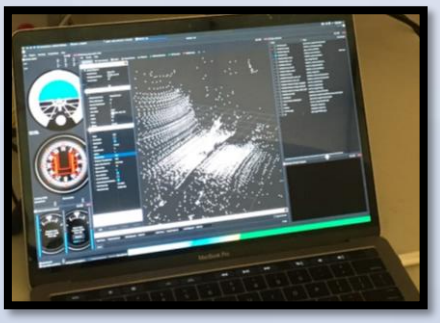
Applied Research

Helelani Gets LiDAR for Autopilot System

PISCES' Helelani Rover can how 3D map open terrain landscapes using a newly installed LiDAR system that will enable autonomous navigation.

PISCES' Planetary Rover "Helelani" (which translates to Heavenly Travels in Hawaiian) just got an exciting new hardware upgrade which will enable the rugged spacecraft to drive itself. Intern Jack Andersen—a Hawaii Community College student employed through PISCES' credit-based internship program—has successfully installed and configured a new LiDAR system that will allow the rover to autonomously drive itself over open terrain.

LiDAR—sometimes referred to as "Light Detecting And Ranging"—is a remote sensing technology that uses laser light pulses to measure spatial distances. LiDAR illuminates a given target and then analyzes the time lapse and wavelength of the light pulse that returns. Aboard Helelani, LiDAR allows the rover to scan its surrounding environment in three dimensions. As the rover drives forward, the shape and surrounding terrain is scanned. Combined with sensor information from the wheels and IMU (Inertial Measurement Unit) data, the LiDAR creates a 3D map of its surrounding environment.



Helelani's Graphic User Interface software displays a 3D spatial map created using the new LiDAR.

The new system works in all lighting conditions—even at night—and gives Helelani a definitive lay of the land to navigate obstacles and maneuver on her own. The LiDAR will enable autonomous navigation, allowing Helelani to steer and maneuver herself to a given destination based on "setting a course" with GPS coordinates. The PISCES Robotics Team intends to have the autonomous system up and running by the end of 2017.

PISCES Establishes Two New Partnerships

PISCES' Board of Directors approved two Memoranda of Understanding (MOU) in late September, forging new partnerships to further the agency's mission in planetary research and technology development.

The new MOUs were established with Hawaii-based construction company Bolton, Inc., and an innovative wheel design company called Shark Wheel headquartered in California.

Bolton, Inc. is a family-owned and operated construction company operating out of Kailua-Kona. Their services in excavation, quarries and aggregate materials align with PISCES' Materials Science research efforts to develop a Basalt Manufacturing industry in Hawaii. Together, PISCES and Bolton will investigate methods for commercializing basalt-derived feedstock, basalt fiber technology and other basalt-based products.

Shark Wheel is an Orange County skateboard wheel company specializing in innovative designs. Its square-shaped polyurethane wheels provide better traction and speed for boardriders. PISCES has partnered with the pioneering company to investigate new wheel designs that could improve rover performance on the rugged, barren landscapes of places like the Moon and Mars.

PISCES now has 22 MOUs established with individuals and technology companies around the world to collaboratively work on innovative space-based research and development projects.

Follow us online!

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Workforce Development

Summer 2017 Interns: Lessons Learned

PISCES 2017 Summer Internship *employed five college-level students from local schools in two learning tracks: Materials Science and Robotics. The 10-week program provides full-time salary and real-world work experience to participating students. Internships align with PISCES' Workforce Development initiative to prepare Hawaii's youth for competitive, high-tech industry careers. Here is what the team of 2017 interns learned…*

Materials Science Team

Kyla Defore
University of Hawaii at Hilo Geology graduate

My PISCES internship has given me invaluable skills that I will always use in my career. These include site characterization, data analysis and an active knowledge of materials science. More importantly, I developed my leadership skills this year by mentoring other interns. Everything I have done now applies in my new position at PISCES, continuing research in materials science. I am forever grateful for receiving such a great opportunity.

Lily Leyva
Keaau High School Graduate, University of Colorado at Boulder student

My first two weeks, I got a crash-course in geology including mineral formation, classification and materials science applications. These fast-paced studies help me to narrow research on past experiments and applications of basalt processes that could apply to our research over the summer. I also created new designs for interlocking tiles and built a 3D printer. Collaborating with team members, I applied pervious designs and what I learned from geology into a final tile design and printed a prototype model using the 3D printer I configured.

Robotics Team

Jack Andersen
Hawaii Community College student

My summer internship gave me a chance to apply skills from the Electronics Technology program at Hawaii CC. I also became a more effective electronics troubleshooter by analyzing the ODG circuit schematics aboard the rover, using them to design a new method of acquiring data from the rover's motors. I also gained practical experience with the ROS robotics software platform, a popular industrial robotics application.

Andrew Hasegawa
Hawaii Community College student

My internship was a rewarding learning experience. I worked on integrating various types of sensors on the rover such as the, EMU, GPS and also new types of control protocols such as CAN and I2C. This internship pushed me beyond my comfort zone with what I felt I could do, and challenged me to use what I learned in the classroom in a practical situation.

Aaron Roth
Waiakea High School graduate, Arizona State University student

Since my internship, I can confidently say I know how to use Python effectively, design and print a 3D model, calibrate stereo cameras with OpenCV to get intrinsic and extrinsic camera parameters, and use the extrinsic camera parameters to produce 3D anaglyph images. My experience with PISCES holds so much value to me because of the things I learned and because of the real work experience I gained.

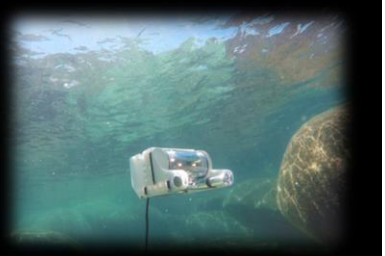
PUEO Nā Kilo Culture & Science Fair

Join us! Saturday, Oct. 21, at Radio Bay in Hilo

This free family event merges traditional Hawaiian culture and modern science to inspire youth curiosity in STEM and culture.

- *Demonstrations & activities*
- *Robotic Planetary Rover & Underwater Rover*
- *Hōkūalaka'i Double-Hulled Voyaging Canoe*

Learn more at **alohapueo.org**



Guest Spotlight

Julia Velasquez

#StudentAstronaut Contest Winner, Aspiring Astronaut

Julia spent two days on Hawaii Island in late September training like a "Martian Astronaut." She holds a B.S. in Biology and has interned in two NASA programs.

For as long as I can remember, I've always wanted to be an astronaut. Winning the 2017 Xploration Station contest and becoming the first Deaf #StudentAstronaut has been an absolute dream. I am so thankful to Xploration Station for the opportunity to travel with show host Emily Calandrelli to the HI-SEAS Habitat, where we stayed overnight to experience what life would be like on Mars. We were lucky enough to have been accompanied by two of the HI-SEAS crew members during our visit, Laura and Brian, who had just completed their eight-month mission. Laura and Brian graciously extended their time at HI-SEAS to host all of us. They both went out of their way to make us feel right at home. I discovered that Laura had been learning American Sign Language a few years prior and was teaching Brian ASL during their mission. They understood the value of using sign language, especially in situations where there is a loss of signal, like during Extra-Vehicular Activity. It was awesome that we could communicate directly with one another. I loved listening to their stories on the reality of life in isolation and how they each coped with living in such a tiny space with finite resources. They're total rock stars in my book.

The first day of my training, I had the honor of being the first person to operate the PISCES rover Helelani at HI-SEAS! I had so much fun maneuvering the rover—it was actually easier than I thought it would be! Thank you, Rodrigo, Jack and Kyla for teaching me the tricks!

The next afternoon, we visited the Canada-France-Hawaii Telescope on the summit of Maunakea. We arrived in time to catch the sunset, and it was absolutely breathtaking! What an incredible and exhilarating trip! The main highlights of my trip were connecting with everyone and learning about the important work being done on the Big Island of Hawaii. I am excited to share my experience with the Deaf/DeafBlind/DeafDisabled/HardofHearing/LateDeafened (DDBDDHHLD) communities all over the world, and I look forward to more opportunities for collaborative work towards making space accessible to everyone, especially to DDBDDHHLD youth.

Program Manager Message *cont...*

I am one of six crewmembers participating in a 48-hour exercise to evaluate the dome-shaped habitat and its equipment to make upgrade recommendations.

My fellow crewmates include my wife Charlotte (a middle school science teacher who was also a member of Biosphere 2), PISCES Board Chair Henk Rogers, educator Juli Rogers, educator Samantha Smith who is our mission chef, and Gaetan Petit, a member of the European Space Agency sponsored by Luxembourg.

We shared long hours of insightful conversations exploring how to upgrade the EVA suits for the habitat, what our visions of the future look like, and how we can grow food on another planet *(see photos on page 5).*

In other talks of future space endeavors, Elon Musk spoke at the International Astronautic Conference (IAC) in Australia, sharing his plans to send two cargo ships to Mars by 2022, followed by four more ships in 2024 to establish a city on Mars. An ambitious plan? Perhaps. But without ambitious goals, mankind runs the risk of slowing progress, and we need more ambitious goal setters for today's world.

In this spirit, I will be participating in the International MoonBase Summit this month in Waikoloa, Hawaii, where a diverse group of people will meet for three days to brainstorm the creation of a permanent lunar settlement.

These are exciting times in Space Exploration, and PISCES is set to be in the middle of it.

A hui hou,

R. Romo

Rodrigo Romo
PISCES Program Manager

Contest Winner Trains in Hawaii *Cont…*

Left: Helelani poses for a cameraman outside HI-SEAS. Right: PISCES Geology Tech Kyla Defore discusses Mauna Loa's similarity to Mars with Julia and host Emily.

Julia was the first deaf contestant to win the national contest. She was also the first individual to pilot the Helelani Rover at the HI-SEAS Habitat. With Emily as co-pilot, Julia remotely controlled Helelani from within the space dome, driving the 700-pound spacecraft over rugged lava terrain and capturing image data from the surrounding environment. PISCES Geology Technician Kyla Defore designed the rover-based site characterization mission. PISCES Intern Jack Andersen explained the controls and landscape hazards after configuring the software and hardware systems.

Later, Julia and Emily stayed the night at HI-SEAS accompanied by two Mission V crewmembers, Laura Lark and Brian Ramos. Laura and Brian, who knew a bit of sign language themselves and could communicate directly with Julia, recently emerged from an eight-month mission living in isolation within the confines of the dome.

The HI-SEAS habitat functions as a testbed for a continuing NASA-funded social and psychological study conducted by the University of Hawaii at Manoa. Researchers want to know the long-term effects of isolation on a group of humans in preparation for a future settlement on Mars, and how to make that ambitious effort a success. The next mission is scheduled to begin in early 2018.

During their adventure, Julia, Emily and the Xploration Station crew also ventured to the Canada-France-Hawaii Telescope at sunset, situated at one of the world's best places for astronomy.

We at PISCES were honored to support Julia's dreams of becoming one of the future humans to boldly explore the new frontiers of space. Congratulations Julia! We wish you the best in your continuing space adventures!

Xploration Station production crew, PISCES staff and contest winner Julia 'take five' for a group photo.

IN PHOTOS: Preparing for the Real Thing

Photos above: 1: HI-SEAS Mission 5.1 (9/29/17—10/1/17) Clockwise from Top Left: Charlotte Romo, Julie Rogers, Rodrigo Romo, Samantha Smith, Gaetan Petit and Henk Rogers. 2: Outside view of the HI-SEAS habitat. The dome-shaped structure sits at roughly 9,000 feet in elevation on the Martian-like slopes of Hawaii's Mauna Loa volcano. 3: Biosphere 2 Mission 2 (3/6/94—9/17/94) Left to Right: Tilak Mahato, Matt Finn, Norberto Alvarez-Romo, Pascale Maslin, John "Rubio" Druitt, Rodrigo Romo, Charlotte Godfrey.