

## Analog Astronauts Explore 'Moon' During Two-Week Simulation in Hawai'i



*Above: PISCES geologist Kyla Edison descends into a lava tube on the lower slope of Mauna Loa during an EVA (Extra Vehicular Activity) as part of a simulated lunar mission led by the European Space Agency last month. Credit: EMMIHS-III/HI-SEAS.*

Six analog astronauts wrapped up a two-week lunar simulation mission at the Hawai'i Space Exploration and Analog Simulation (HI-SEAS) habitat on Mauna Loa volcano last weekend, conducting research and exercises to inform the future of human settlements beyond Earth.

The crew included HI-SEAS director and mission commander Michaela Musilova; head of rover operations Robert Heemskerck; geologist and lead scientist Marc Heemskerck; aerospace engineer, artist and commander-in-training Priyanka Das Rajkakati; aerospace engineer, PhD student and chief engineer Lucas Brasileiro; and PISCES geologist and communications and science officer, Kyla Edison.

The mission began Jan. 18 with training on the ins and outs of the dome-shaped habitat, highlighting energy and water conservation as

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### *Letter from the Director*



Aloha kākou,

The Hawai'i legislative session is entering full swing and there are a couple of bills on the table that will help define the future structure of PISCES. To ensure a smooth transition for our staff programs, I am working closely on these bills with state legislators in both the Senate and House, as well as leadership at the State Department of Business, Economic Development & Tourism (DBEDT) of which PISCES is an attached agency.

2020 will be an exciting year for our research, and we intend to collaborate on at least five grant proposals involving a variety of topics that include: utilizing plastics (that are no longer recycled by Hawai'i County) as a binder to produce construction-grade basalt materials; 3D printing using basalt as a feedstock; and robotics testing at local analog sites for planetary research projects.

As our sintered basalt products move

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## Kea'au Robotics Team Receives Top Honors at State VEX Competition, Qualifies for Worlds



*Left: The Kea'au High School Cougar Techs team took home the Excellence Award, the highest honor presented during the VEX Robotics State Championship held Jan. 11. Credit: Hawaiian Electric*

Two Hawai'i Island robotics teams will compete in the 2020 VEX World Championship after qualifying in the state championship on Jan. 11 at University of Hawai'i at Hilo. Students from Kea'au High School and Waiākea Intermediate will be among 1,200 of the top students from around the world to participate in the championship event slated for April 22 to 25 in Louisville, Kentucky.

PISCES staff were among the many judges at the day-long event that included 37 teams from Hawai'i Island, Maui and O'ahu. Seven high school and three middle school teams earned top honors and will go on to the world championship in April.

In addition to qualifying for Worlds, the Kea'au High Cougar Techs (Team 5968A) claimed the Excellence Award—the highest honor in the high school category—for overall

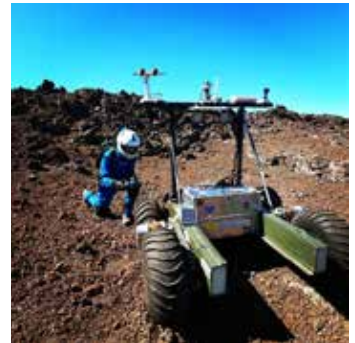
excellence in their robotics program. The team members include Crystal Simeon, Jessary Subia and Everett Ayap, led by coaches John Bonewitz and Jared Hay. Team 394A from Highlands Intermediate School of Pearl City, O'ahu, was honored with the same award in the middle school category.

*Right: Students of the Waiākea Intermediate School robotics team will compete in the VEX Robotics World Competition in April. Credit: Hawaiian Electric*

Another Kea'au High School team (5968Y) claimed the "Innovate Award" during the state competition. The team includes students Jessica Doan, Teagan Carter and Skyler Padamada.

See the full rankings for the 2019 Hawai'i State VEX Championship [online](#).





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a top priority. HI-SEAS is a solar-powered facility with battery storage, but stores can quickly be depleted during overcast or stormy weather. To ration water, each crew member was allotted only eight minutes of shower use per week.

With little time to enjoy modern conveniences, the crew focused on their research. They conducted a series of EVAs (Extra Vehicular Activities, or expeditions outside a spacecraft or habitat) wearing space suits and prepared with various tools and instruments. One EVA involved setting up a relay antenna to operate the 700-pound planetary rover provided by PISCES. The rover, named Helelani, served as a robotic crew member, relaying information via sensors and cameras while bolstering the realism of the mission. Several smaller rovers accompanied the mission including one provided by Zebro, which was remotely controlled from the Netherlands.

On foot, crew members explored a series of massive lava tubes, mapping their terrain and taking small samples in a responsible manner. PISCES geologist Edison collected three rock samples from the surface to test basalt sintering at high-altitude. Using a muffle furnace, she heated the samples in search of a thermal profile that would



produce a durable product. On the moon, the process could be used to make structures like landing pads, shelters and berms.

Overall, the mission went smoothly and the crew developed a good rapport.

“The mission was very successful,” said Commander Musilova. “The whole crew managed to perform most of the research that they desired to do during the mission and we all had a great time. This crew bonded very well and they were also the most efficient crew in terms of low water usage on record at HI-SEAS.”

The two-week simulation was the third EuroMoonMars mission in a collaborative series led by the European Space Agency (ESA), the [International Moonbase Alliance](#) (IMA) and HI-SEAS. Since 2018, IMA has been organizing lunar and Mars simulations at HI-SEAS to help build a moon base prototype in Hawai'i as a proof-of-concept for the real thing.

*Top left: The HI-SEAS habitat glows in the volcanic terrain of Mauna Loa beneath a starry sky. Top middle: Crew members suit up for their first EVA on mission day three. Top right: Edison maneuvers Helelani over rugged volcanic terrain. Bottom left: Edison holds a small tile of sintered basalt fired in a mini-kiln. Bottom right: Brasileiro monitors HI-SEAS habitat systems from a computer terminal. Photo: EMMIHS-III/HI-SEAS.*

## PISCES STARS Program Recognized in National STEM Mentoring Report



*Above: Students of the 2019 STARS Program show their graduation certificates on the last day of the week-long space and science camp at the HI-SEAS habitat on Mauna Loa.*

The Women's STARS (STEM Aerospace Research Scholars) program coordinated by PISCES has been recognized in the [2019-2020 State of the States](#) report issued by Million Women Mentors, an initiative of STEMconnector.

MWM is a national initiative launched in 2014 to support young women in STEM through mentorship, community awareness and nonprofit partnerships. The report highlights mentoring efforts and programs for each of the 43 states currently involved with MWM, including Hawai'i.

PISCES launched STARS in 2014 to encourage more girls in Hawai'i to pursue higher education and careers in STEM-related fields. Despite half of Hawai'i's total population being female, women fill only 25% of STEM jobs in the state.

To date, STARS has mentored nearly 50 young women in Hawai'i. Graduates have gone on to major in STEM fields in college and intern with organizations like PISCES and NASA's Jet Propulsion Laboratory.



### Letter from the Director

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closer to potentially being commercialized, we will be testing our basalt tiles for both commercial and space applications. I am excited to share the results of this assessment once it is completed.

Our geologist Kyla Edison just completed a two-week mission in January at the Hawai'i Space Exploration and Analog Simulation (HI-SEAS) on Mauna Loa where she and a group of European scientists simulated a human lunar surface mission. During her stay, Kyla studied the effects of high altitude on the basalt sintering process she has been researching. We also sent the Helelani analog rover to accompany the crew on their lunar adventure. This mission establishes the first direct collaboration between PISCES and HI-SEAS on an analog astronaut mission, and I expect we will be partnering on more projects in the future.

Finally, I want to congratulate the Kea'au High School Cougar Techs robotics teams who won two prestigious awards at the Hawai'i State Vex Robotics Championships last month in Hilo, and qualified for the VEX World Championship in Kentucky later this year. Great job, Cougars!

A hui hou,

Rodrigo Romo  
Program Director  
PISCES