



Pacific International Space Center for Exploration Systems NEWSLETTER



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WORKFORCE DEVELOPMENT

Message from the Director



Rodrigo Romo

Aloha Kakou,

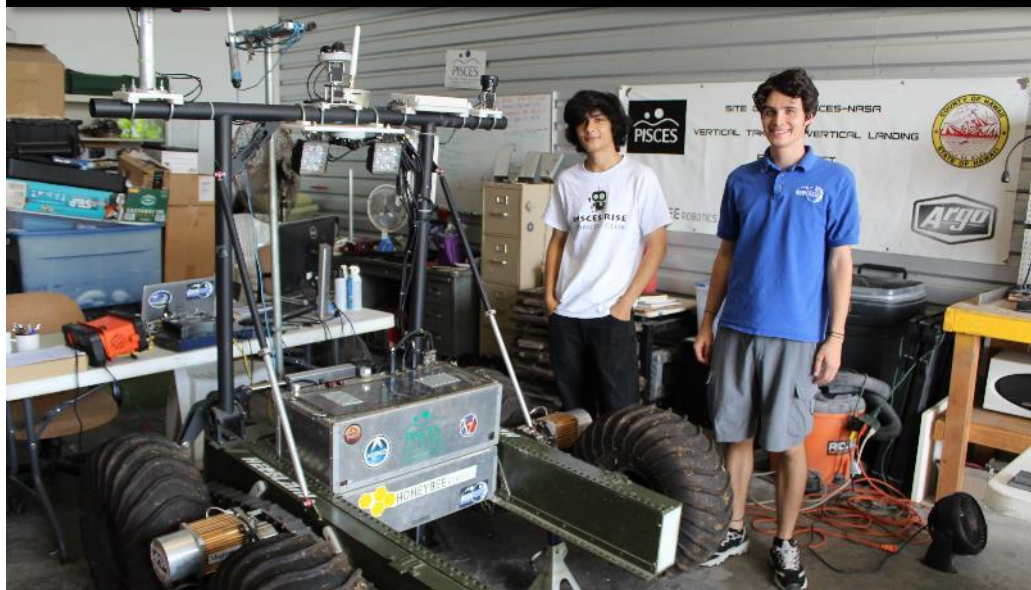
August was a busy month at PISCES, especially for our interns as they worked hard to complete their summer projects and final reports. Our group this year included two interns sponsored by Akamai, a fantastic program that provides Hawai'i students with unique, hands-on projects in STEM and related fields. Our Akamai interns worked on measuring physical and thermal properties of the sintered basalt materials we have developed and designed a tension reel for a tether-based UAV project. We also had two PISCES-funded interns working on our planetary rover, Helelani. One of the most consequential improvements they achieved was significantly increasing the battery life for the electronics power system. This will allow us to extend our field mission run times significantly.

(Continued on pg. 7...)

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Interns Wrap up Summer Science & Technology Projects

Above: Robotics Team interns Joel Paye (left) and Alec Goodson spent the summer validating and upgrading software systems and sensors aboard the Helelani planetary rover.

A cohort of four Hawaii-based students interning with PISCES wrapped up their projects in robotics, engineering and materials science last month.

Two University of Hawaii at Hilo students, Joel Paye and Alec Goodson, worked on the robotics team and recalibrated software systems aboard the Helelani planetary rover. Joel and Alec honed their coding skills, updating and validating the rover's software systems, calibrating existing sensors, and adding a game controller option to the operating software's graphic user interface. As a result, the battery life for the electronics power system was improved from an average of 90 minutes to eight hours.

Moving to a larger robotics projects was a natural step for both Joel and Alec. Joel has been a long-time mentor

with the PISCES-RISE Robotics Team for Keaukaha youth and will continue guiding students during Fall 2019. Alec is a Kealahou High School graduate who participated in the PISCES MoonRIDERS program, a project engaging local students with the design of a lunar flight experiment in partnership with NASA.

Joel and Alec are among dozens of students who sharpened their tech skills with Helelani. Since 2013, interns have built and configured a variety of sensors, software and imaging systems aboard the 700-pound robot. These include remote operating capability from any computer connected to the internet, stereoscopic imaging, and 3D mapping of the rover's surrounding environment using LiDAR (Light Detection and Ranging).

(Continued on pg. 3...)



GUEST SPOTLIGHT

Inspiring the Next Generation of Scientists and Engineers

By: Christian Wong – Executive Director, Hawai'i Science & Technology Museum



Above: A Lava Tubes Rocketry Team member practices her soldering skills on a Raspberry Pi. Credit: HSTM.

Let's get one thing out of the way. I am a Trekkie. And I don't mean I love Star Trek in a passing sort of way. I mean I loved Star Trek so much growing up that in many ways it helped make me who I am today. I was mesmerized by the tapestry Gene Roddenberry created where humanity explored far-off worlds in a galaxy where anything was possible and we as humans reached our true potential to exist at peace with one other as citizens of a much larger universe. Star Trek is science fiction to be sure, but as an art form it inspired millions of kids like me to remember that things are only impossible until they're not.

Here at the Hawaii Science and Technology Museum, we strive to continue that tradition of inspiring kids to reach for the stars through our mission to "Unleash the Innovator in Every Child." HSTM is a mobile museum and 501(c)(3) educational nonprofit that brings STEM education programs and exhibits directly to the schools. We offer science camps, after-school programs, tutoring and heavily support youth robotics. HSTM is also currently rolling out a community aerospace program which includes developing our CubeSat "Hiapo" for the maiden flight of the Firefly Aerospace Alpha Launch

Launch Vehicle; delivering aerospace curriculum to our local schools using functioning CubeSat prototypes for student research projects; and participation of our student-led Lava Tubes Rocketry Team in the NASA Student Launch Initiative and development of Hiapo. Students are learning fabrication techniques, electronics, payload development, teamwork and collaboration, meteorology, orbital dynamics, gaining proficiency using CAD software, and data collection and documentation. The opportunities for our Hawaii students to gain skills and knowledge through aerospace projects and curriculum are immeasurable; the inspiration for them to continue on into STEM careers is invaluable.

Thirty years ago, the opportunity for students to participate in a program like this would have made a great plot for a fun 80s movie. We now live in a day and age where what was once science fiction has become reality, where our Hawaii students can make a meaningful contribution to the development of an actual satellite. At HSTM we are truly honored to carry on the tradition of inspiring our young minds to boldly go where no one has gone before.



Interns Wrap-Up Science & Tech Projects *Continued* ...

Above: Akamai intern Joshua Tokunaga uses a wet saw to cut slabs of sintered basalt tile into smaller pieces for testing during his internship with PISCES.

Though not flight ready, Helelani offers a mobile platform for testing space exploration instruments and continues to serve as a valuable learning tool for students.

This summer's group also included two Akamai Workforce Initiative interns who worked on engineering and materials science projects: Jaynine Parico from Kapiolani Community College and Joshua Tokunaga from Arizona State University.

Jaynine designed and built a tethered reel system for PISCES' unmanned aerial vehicle (UAV). The UAV is outfitted with a bait dispersion system to kill little fire ants in tree canopies, a project PISCES took up with the County's Dept. of Research & Development. Jaynine's design involved a spool assembly, DC motor, water pump and control circuit to regulate the reel tension, providing slack or resistance as needed. A hose served as the tether, carrying insecticide to the UAV in flight, reducing the payload weight and increasing flight time. Jaynine's design identified several bugs in the system, as well potential fixes for future implementation of the project. The next

step in the project will be flight testing the UAV using the reel.

Joshua researched the structural properties of PISCES' latest sintered basalt tiles, designing and executing various tests to assess their structural integrity, porosity and thermal conductivity. PISCES makes sintered basalt tiles using only volcanic basalt sourced from commercial quarries on Hawai'i Island. Joshua's tests revealed that 1) sintered basalt is a good insulator among construction materials, nearing the properties of asbestos and concrete while exceeding those of brick; 2) higher sintering temperatures yield a stronger product while lower temperatures make a better insulator; 3) there is more work

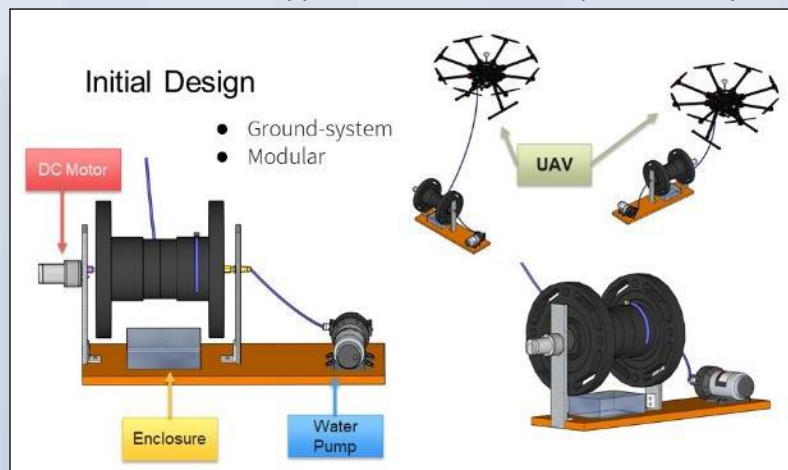
Right: Intern Jaynine Parico created this visual design of the reel system she built for PISCES' UAV octocopter. The reel is wound by a hose which carries insecticide to the UAV during flight, reducing its payload and improving flight time.

to do. To find out how sintered basalt will function in environments with little or no atmosphere, the samples need to be tested in a vacuum. PISCES is working to find other applications for sintered basalt, both on Earth and in space exploration.

Joshua's test results suggest that sintered basalt materials are ideal for launch and landing pad construction on places like the moon and Mars where surface dust poses a serious threat to ground infrastructure. Landing pads would mitigate the effects of sandblasting generating by rocket engines when spacecrafts launch and land.

"My internship with PISCES gave me a great opportunity to work in my field of interest and learn about the future of human space exploration," said Joshua following his seven-week internship with PISCES. "After this internship, I will take with me everything I learned about the project, and all of the connections I made with Akamai and PISCES to help carry my STEM career forward."

Now moving into its eighth year, the PISCES internship program has mentored 44 students in projects in robotics, engineering, geology and materials science. The program supports Hawai'i-based college students interested in aerospace-related fields, helping them hone their knowledge and skills through hands-on research and development projects. Interns also get networking opportunities in the aerospace industry.



WORKFORCE DEVELOPMENT



Akamai Symposium Highlights Student Work in Exciting STEM Projects

Above: Fifteen Akamai program students working in East Hawai'i finished their eight-week summer projects with a series of visual presentations at the 2019 Akamai Symposium on Aug. 14 in Hilo.

More than a dozen students presented the final results of their summer work with the Akamai internship program during the annual Akamai symposium last month in Hilo.

Fifteen students—including two working with PISCES—shared visual presentations on their work in STEM fields in science and technology, demonstrating what they learned and fielding questions from the audience. One student learned to write a computer program to help local astronomers pinpoint the faint light of dwarf stars; another tested and wrote network security protocols for Subaru Telescope. Working under PISCES, Akamai intern Jaynine Parico developed a tethered reel system to improve the flight time of an unmanned aerial vehicles (UAV) designed to kill little fire ants in tree canopies. Also working under PISCES through Akamai, intern Joshua Tokunaga researched the structural properties of PISCES' latest basalt sintering research, assessing the strength, porosity and thermal conductivity of sintered basalt bricks.

The event was opened with several speakers including an assistant professor of astronomy at University of Hawai'i at Hilo, Heather Kaluna. Kaluna noted that she was once an Akamai intern herself.

The presenting students were among the largest Akamai cohort to-date, with 42 students involved in projects on Hawai'i and Maui island, and California in 2019. The larger group—nearly twice as many students as usual—was largely supported by the Thirty Meter Telescope, which provided roughly half of Akamai's funding this year. The program also received funding from Hawai'i Community Foundation's Career Connected Learning Program, W.M. Keck Observatory, Daniel K. Inouye Solar Telescope, University of Hawai'i at Hilo, Canada-France-

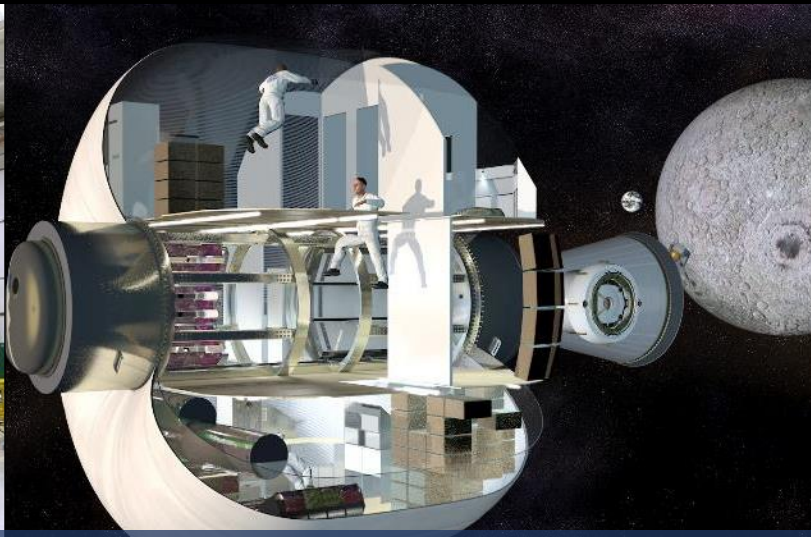
Hawai'i Telescope and the Air Force Office of Scientific Research.

Led by the Institute for Scientist & Engineer Educators at University of California, Santa Cruz, Akamai helps students develop skills and experience in Hawai'i's technical and scientific fields. The program received national recognition last year for its efforts to meet local workforce needs in astronomy, remote sensing and other related industries. Akamai partners with a range of organizations and companies to create projects that are both productive for the host sites and educational for students. In addition to science and engineering projects, Akamai students receive training in communication for formal and informal interactions. Results show 87% of students who participate in Akamai stay on a STEM-related pathway. More than 150 of the 427 interns who have worked with Akamai since 2003 are currently in STEM jobs; more than two-thirds of them work in Hawai'i.



Above: Intern Jaynine Parico answers questions about her project with PISCES during her presentation at the Akamai symposium.

AEROSPACE NEWS



Inflatable Lunar Gateway Undergoes Testing at NASA

Above left: A ground prototype of the LIFE inflatable habitat, fully pressurized. **Above right:** An artist rendering reveals the habitat's interior with various living and working stations for astronauts. Credits: Sierra Nevada Corporation.

An inflatable habitat designed for short and long-duration space missions was tested last month by astronauts at NASA's Johnson Space Center to assess its design and functionality for daily living and work.

Called LIFE (Large Inflatable Fabric Environment), the habitat was built by Sierra Nevada Corporation (SNC) for NASA's Lunar Gateway Project. It is designed to orbit the moon and support both crewed and robotic missions to the lunar surface, and eventually to deep-space destinations like Mars. Deflated, the habitat can fit inside an 18-foot rocket fairing, making it neatly compact for launch. Fully inflated, it measures 27 feet in diameter and length, providing up to 10,600 cubic feet of volume (about one third of the volume of the International Space Station).

The interior is partitioned into three decks incorporating a medical research and sick bay, a bathroom, galley, life support systems, crew workstations and sleeping quarters, and plenty of space for payloads and cargo storage. Additionally, the habitat is outfitted with a microgravity garden that offers both a source of fresh food and recreation. According to SNC principal scientist Robert Morrow, the 'Astro Garden' can grow leafy greens, tomatoes, radishes, peppers and green onions. Due to space limitations, the garden will only be a supplement for astronauts' dietary needs. But the garden can also offer a recreational activity and stress reliever for astronauts confined to a small space some 240,000 miles from Earth. It also provides an aesthetic appeal, making the habitat feel more inviting.

According to SNC engineers Mark Roberts and Jeff Valania,

NASA's testing evaluated the daily activities and routines that astronauts will perform in space while living inside LIFE and their ability to accomplish these goals within the space provided. Participating astronauts gave feedback on what worked and what they would want to change for future designs. The results of the tests have not yet been released.

LIFE is among a handful of design concepts being considered by NASA. The agency has hired private companies to develop lunar gateway designs under its Next Space Technologies for Exploration Partnerships-2 (NextSTEP-2) Habitat Systems program. The gateways are a key element in NASA's new lunar program, Artemis, which intends to return humans to the moon and build a permanent settlement. The scheduled target date to place the first gateway module in lunar orbit is 2024.



Above: The 'Astro Garden' prototype shown inside the LIFE habitat. Credit: Sierra Nevada Corporation.

OUTREACH & EDUCATION



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August Events: Educational Talks, Public Forums and Youth Science Nights



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1) PISCES Geology & Materials Science Tech Kyla Edison presents an overview on PISCES and her volcanic basalt research to a group of visiting Japanese students on Aug. 27 at 'Imiloa Astronomy Center.

2 - 4) Hundreds of students and parents turned out for science night at DeSilva Elementary School on Aug. 27 in East Hawai'i. Organized by Hawai'i Science & Technology Museum, the event featured smoke canons, robots, building blocks and astronomy activities, creating a lively, interactive and fun learning environment for kids.

5) PISCES Tech Kyla Edison presents the latest results of her sintered basalt research during the International Lunar Observatory Association's 2019 Galaxy Forum at 'Imiloa. Open to the public, the event featured speakers from the business, education and astronomy communities, and began with an opening welcome and pule by Hawaiian cultural practitioners Kimo Pihana and Leilehua Yuen.

Director's Message *Continued* ...

In the coming months we are excited to be working with both NASA and SpaceFactory on grant proposals, and independently submitting grants for various research projects including rover-mounted instrumentation for surface analysis, landing pad construction and low energy basalt additive manufacturing.

In the latest aerospace industry events of note, SpaceX successfully completed a test flight about 500 feet above ground with its Starhopper spacecraft. The advances that companies like SpaceX are achieving open an incredibly attractive future for space exploration. We are working hard to keep Hawai'i involved in these exciting aerospace developments and look forward to the challenges and rewards ahead.

Finally, we are happy to again partner with Hawai'i Science and Technology Museum in support of two exciting aerospace projects it has launched for local students. One will engage intermediate students in building a cubesat for launch through Firefly Aerospace's DREAM Payload Program. The other project will task students with the construction and launch of a rocket for NASA's Student Launch Initiative which is slated for next spring in Alabama.

It's exciting and rewarding for us to see Hawai'i's youth actively participating in these exciting projects and we are honored to support them.

A hui hou,

R. Romo

Rodrigo Romo
Program Manager



STEM Exploration

NexTech Students, Grade 7-12

Saturday, September 21, 9:00 am – 1:30 pm

Geologic Solutions

Utilize critical thinking and collaboration
Understand the process of solving problems

Presented by Kyla Edison

Geology and Material Science Technician at
PISCES

Pacific International Space Center for Exploration Systems



LOCATION

Engineering Partners, Inc.
455 E. Lanikaula St., Hilo

REGISTER before Sep 15

Limited Seating / Lunch Included

Call/Text 430-5898

for more information

SPECIAL MEETING

Advance 3-Day Camp

ORIENTATION

1:45 – 2:15 pm

Students, Student Mentors
& Camp Team



PISCES is a Hawai'i
State Government
Aerospace Agency



A multi-disciplinary
engineering & design
firm with global reach



PISCES Technician's Story Highlighted by Alma Mater



Kyla shows off the latest sintered basalt tiles she has been working on at PISCES.

Kyla Edison's successful journey from community college freshman to a working technician and scientist at PISCES was recognized last month in a feature article published by McLennan Community College (MCC) in Waco, Texas. Kyla earned two degrees at MCC—an Associate of Arts and Associate of Science in 2012 and 2013, respectively—before returning to Hawai'i to receive a Bachelor's in Geology from the University of Hawai'i at Hilo.

"Kyla represents the perfect example of what a Highlander can do when she/he possesses curiosity, courage and commitment," Brad Turner, MCC environmental science professor, said in the article. "She has advanced far beyond her beginning at McLennan and it humbles me to think I was fortunate enough to play a little part in her amazing journey."