



OUTREACH & EDUCATION



TWELVE HAWAII HIGH SCHOOL WOMEN GRADUATE 2018 STARS PROGRAM

STARS students experienced insider tours at some of the world's most powerful telescopes on Maunakea during the STARS Program in early July.

Twelve young women from islands throughout the State of Hawaii attended and completed the 2018 STARS (STEM Aerospace Research Scholars) Program held by PISCES in early July.

Thanks to generous partner support by recognized science, technology and research organizations, as well as sponsorship awards from the Hawaii Technology Development Corporation and Women's Fund of Hawaii, the fifth annual workshop was a success and provided more opportunities and activities than previous years. This year STARS included overnight accommodations throughout the week, allowing students from Oahu, Maui, Kauai and Hawaii Island to attend. Many female scientists and engineers eagerly supported the program, engaging students with overviews of their

research, and personal stories relating their challenges and successes as women studying and working in STEM fields primarily dominated by men. Jessica Dempsey, an astrophysicist and deputy director at the James Clerk Maxwell Telescope (JCMT), returned to open the program with a frank (and funny) discussion of the trials she overcame to become a successful astrophysicist. Nagin Cox, a spacecraft engineer at NASA's Jet Propulsion Laboratory, presented remotely via videoconference from an isolated research facility in the Arctic Circle. Cox plays a leading role in NASA's Mars rover missions (including Curiosity and the upcoming Mars 2020 mission) and demonstrates a clear passion for outreach—especially young women. Kim Stratton, an aerospace engineer...

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MESSAGE FROM THE PROGRAM DIRECTOR



Rodrigo Romo

Aloha Kakou,

The month of July has continued to be a lesson in change for residents on Hawaii Island. Kilauea volcano is still erupting in full force, drastically altering the landscape and coastline of lower Puna with no signs of slowing. Thankfully, we are safe and continuing to work with promising progress here at PISCES.

July was an exciting month. We held the most successful STARS Program to-date, graduating a dozen local high school women. Including nightly accommodations in the program this year made it possible for students from other islands in the state to attend.

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APPLIED RESEARCH

AI SPACE FACTORY CLAIMS 2ND IN NASA CHALLENGE FOR MARTIAN HABITAT DESIGN



Above: "MARSHA" is a cylindrical 3D printed habitat designed to utilize space and energy as efficiently as possible. The multi-tiered structure is reinforced with basalt fiber—a material PISCES is researching for ISRU applications on Earth and in space. PC: AI Space Factory.

AI Space Factory—a New York-based additive manufacturing company receiving consulting support from PISCES—won second place in NASA's 3D Habitat Challenge for an innovative design that could one day support astronauts on Mars.

Designed as a cylinder reminiscent of a thimble, the 3D printed habitat is no yarn. Its vertical-standing shape is easier to print and provides optimal support for maintaining inside temperatures while efficiently routing air flow and energy. The habitat's inner space is divided into multiple floors connected by a winding staircase. Each tier provides a dedicated space including a lab, robotics garage, kitchen, personal quarters and recreational "sky room."

To construct the conceptual habitat (called "MARSHA"), the design calls for basalt-fiber reinforced polylactic acid (PLA)—a durable and recyclable thermal plastic that would comprise the shelter's main structure. PISCES provided consulting support on basalt construction to Space Factory, drawing

on several years of experience in basalt sintering research. PISCES also provided samples of Hawaiian volcanic basalt, which share strong similarities with the regolith found on Mars.

AI Space Factory is among five top teams selected to share a \$100,000 cash prize in the NASA Competition, which began in 2014. The next phase will challenge winning teams to construct a scaled-down version of their habitat for a \$2 million award.

The NASA 3D Habitat Challenge is an effort to cultivate and support innovative manufacturing technologies of the future. Engineers hope to one day see automated robots deployed into deep space to build ingenious biospheres like those designed by AI Space Factory, paving the way to human space settlement on other planets. The same technologies could also benefit people living on Earth by producing affordable housing, especially where access to conventional building materials is limited.

STARS ALUMNUS RECEIVES FIRST HOKUALA SCHOLARSHIP



Keilani Steele

Honoka'a High School senior Keilani Steele will receive the first-ever Hokuala Scholarship award to major in astronomy at a college of her choice.

Steele is a 2017 STARS Program alumnus and landed the scholarship through her leading-edge research in the Maunakea Scholars program. Last year she received observing time at Canada-France-Hawaii Telescope and recently completed another run of observing at W.M. Keck Observatory—research opportunities that professional astronomers compete for worldwide. She is now preparing for her first year in college to become an astronomer.

The Hokuala (or "rising star") Scholarship is a new addition to the Maunakea Scholars program and will be awarded once a year to one or more outstanding seniors in the program who plan to study astronomy in college. For University of Hawaii students, the scholarship award also includes mentorship from a leader involved in Maunakea astronomy for the duration of each recipient's undergraduate education.

Steele received news of the award during a presentation on her work at 'Imiloa Astronomy Center in July.

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2018 STARS PROGRAM CONTINUED...



1) Students build smart robots with UH Hilo Robotics Team lead Marc Roberts. 2) STARS students, PISCES staff and Helelani outside the HI-SEAS habitat. 3) Mary Beth Laychak leads a tour inside CFH Telescope on Maunakea. 4) Students build spaghetti bridges during an engineering challenge at CFH headquarters in Waimea.

—at Caterpillar's Automated Division, returned for her second year supporting STARS to chaperone and present on the possibilities for creative expression and fun that engineering can offer. Miriam Fuchs of the Smithsonian Submillimeter Array also provided staff support and a lively presentation on the origins of the universe.

These and other talks were alternated with activities to keep students engaged including a robotics workshop, planetary geology expedition and mock-Mars rover mission. Students also stayed overnight at

the HI-SEAS habitat, experiencing what it might be like to live on Mars. Rep. Tulsi Gabbard provided a closing video message for the program, urging students to pursue their dreams and be exemplary leaders for their peers to follow.

Besides being a lot of fun for the students, feedback surveys indicate the program succeeded in its intended goal. Eleven students rated their STARS experience as "excellent." All 12 reported they are more likely to pursue a career in STEM after completing the program.

PROGRAM DIRECTOR'S MESSAGE CONTINUED...

Among the twelve participants, we had four students from Oahu, one each from Maui and Kauai, and six from Hawaii Island. The diversity added more value to the experience of the students, and the program. But of course, this program would not be possible without the support of all the STARS sponsors and participating organizations. I send a big Mahalo to all those who made STARS possible this year.

Meanwhile, our AKAMAI intern Kylie Higaki is receiving high praises for her work in our Materials Science project involving Hawaii volcanic basalt for ISRU manufacturing. With guidance and mentorship from Geology Technician Kyla Defore, Kylie has done excellent work. She will present the results of her 7-week project at an upcoming interns presentation scheduled in August. It has been a pleasure working with her!

Lastly, I would like to congratulate AI Space Factory on winning second place in NASA's 3D Habitat Challenge. We've been providing consulting support to their team on basalt sintering. Their design for a Martian 3D printed habitat won second place in the NASA competition and a cash prize. Excellent work!

A hui hou,

R. Romo

Rodrigo Romo
PISCES Program Director

SPECIAL THANKS TO OUR 2018 STARS PROGRAM SUPPORTERS:

- Hawaii Technology Development Corp.
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- Yuko Kakazu, Subaru Telescope
- Mary Beth Laychak, CFH Telescope
- Kalepa Baybayan, 'Imiloa Astronomy Center
- Kim Binsted, HI-SEAS
- Jonathan Humphries, HI-SEAS
- Maunakea Astronomy Outreach Committee (MKAOC)
- Geneva San Miguel, Resonate Hawaii
- Darrin "DC" Carlson, KWXX

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GUEST SPOTLIGHT



HI-SEAS: EXPLORING BIG IN SMALL SPACES

Kim Binsted, Principal Investigator

Kim Binsted is a UH Mānoa Professor of Computer Science and the Principal Investigator for the HI-SEAS Habitat on Hawaii Island. She earned her PhD in Artificial Intelligence from the University of Edinburgh. Outside of creating intelligent computer software capable of coining puns, she enjoys flying, cooking, kayaking, diving and improvisational comedy.



HI-SEAS (Hawaii Space Exploration Analog and Simulation) is a dome-shaped habitat situated on an isolated Mars-like site on the lower slope of Hawaii Island's Mauna Loa volcano. Here, we conduct NASA-funded research with the goal of reducing or removing some of the barriers to long-duration human space exploration.

What makes HI-SEAS special? Well, for one thing, the Mars-like terrain in the area. Like Olympus Mons on Mars—which happens to be the largest volcano in our solar system—Mauna Loa is a shield volcano, and the two mountains share many geological features like lava tubes and flows. The terrestrial Mauna Loa maintains a dry climate with little variation throughout the year, enabling long-duration missions of up to 12 months. Also, it is visually isolated with no signs of plants, animal life, or human activity in the surrounding area.

The crew members selected for HI-SEAS missions are close to real-life astronauts in their education, professional background and psychology. To participate in one of our studies, they need to be mentally and physically tough to withstand the challenging conditions of living in the habitat.

Resources are in short supply. For example, each crew member gets only eight minutes of shower time per week, and there is no fresh food (all food items must be shelf-stable).

Furthermore, communication is slow, impeded by a 20-minute delay each way—just like it would be on Mars. This means if you click on a link to a web page, you won't see the results for at least 40 minutes! Space is also limited. With only about 1,000 square feet of indoor space between six people, living quarters are cramped. And a crew member can't just step outside to get away from it all. They are only allowed to exit the habitat wearing simulated space suits, and with pre-approval and a plan.

Over the past five years at HI-SEAS, we have conducted two four-month missions, two eight-month missions, and one 12-month mission. A journey to Mars and back would take 2.5 to 3 years, so we need to understand what issues can arise in the long-term, and how to prevent or respond to them.

In between missions, there are no crews at the habitat and we welcome visits by community groups (by special arrangement). It's a great way to get a feel for what life would really be like on Mars!

Below: At 8,200 feet in elevation, the HI-SEAS habitat sits on an isolated, barren plain of eroded lava rock that is both visually and chemically like the surface of the Red Planet. Photo courtesy of HI-SEAS.

