



Workforce Development



PISCES Receives \$4,000 Grant from HTDC for High School Women's STEM Program

We are pleased to announce that the Hawaii Technology Development Corporation (HTDC) has approved a \$4,000 sponsorship award to fund our 2018 Summer STARS (STem Aerospace Research Scholars) Program for Hawaii high school girls!

HTDC also sponsored our STARS Program in 2017, providing critical funding for meals, transportation and student supplies. We're grateful and excited to receive HTDC's support again this year, and to continue growing and building upon the success of previous STARS Programs.

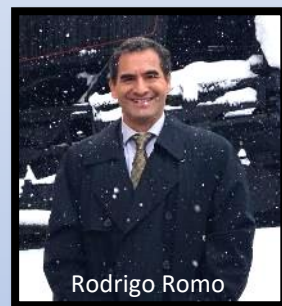
STARS is a free, week-long summer program designed to encourage young women to pursue careers in STEM. We accept up to 12 students based on interest and academic merit. Statistics show that young women need more encouragement and role models to succeed in STEM fields, and we hope to address this need while strengthening

the future of Hawaii's high-tech, skilled workforce.

This year, we intend to expand the program by providing overnight accommodations throughout the week and engaging students with more local organizations and female scientists. We are encouraged to see so much enthusiasm from local organizations in support of STARS, and we look forward to having our best program yet. By giving high school girls a behind-the-scenes look at STEM careers and the women who work in them, we hope to show young women that their dreams of becoming a scientist, researcher, or engineer are entirely possible—and that they have support and encouragement to pursue them!

If you are interested in sponsoring or supporting our STARS Program, please contact us. Learn more about the program by visiting bit.ly/2rvPXty.

Message from the Program Director



Rodrigo Romo

Aloha Kakou,

2018 is already proving to be an exciting year in the Aerospace Industry. Rocketlab's second launch successfully reached orbit and deployed three small satellites. This is truly commendable and brings the market for small satellite launch vehicles much closer to reality.

There is a high demand for small satellite launch capabilities—close to 3,500 small satellites (between 1 and 100 kg) are expected to go into space in the next 10 years. One of the current challenges facing this effort is the shortage of dedicated small launch vehicles. With the success of Rocket Lab's Electron rocket, the future for small satellite launch vehicles is looking bright.

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Economic Development



'Surfing Rocks': Making Surfboards Using Basalt

Romo and his new basalt-coated surfboard.

PISCES Director Rodrigo Romo recently had a one-of-kind, custom surfboard designed incorporating volcanic basalt as a coating material. Made by a local shaper, his new 7'6" longboard floats and performs like a traditional board with the added perk of a unique, multi-chromatic appearance that changes colors in varying light conditions.

An avid water sportsman, Rodrigo purchased several meters of basalt fabric for the custom board using his own money, intending to test the

versatility of the material. Rodrigo previously worked with another local surfboard shaper, as well as a canoe paddle maker to create similar products using basalt fabric.

He is now enjoying his new board out on the waves, while also using it as a talking point to raise interest and discussion around the potential applications for Continuous Basalt Fiber (CBF). Similar to S-glass and carbon fiber, CBF could be manufactured on Hawaii Island using raw, local materials.

PISCES has been investigating various methods for using basalt as a construction material on the Moon and Mars. Samples of concrete-like blocks made of sintered basalt have already generated interest in the ISRU community. CBF is made by melting and extruding basalt into a continuous filament, and can be used to create basalt rebar, chopped fiber, rope, mesh and fabric.

A local CBF plant could potentially create a new manufacturing industry in the state. PISCES issued an RFP in December seeking a firm to conduct a feasibility study on CBF manufacturing in Hawaii. The winning bidder will be selected later this month.

Ready for Flight!



Former PISCES Intern and Kea'au High School graduate Lily Leyva put the finishing touches on the agency's new unmanned aerial vehicle (UAV) in mid-January, calibrating its handheld controller and gyroscope to make it flight-ready. The eight-rotor DJI UAV is slated to be outfitted with a Little Fire Ant (LFA) bait dispersion system to mitigate populations in hard-to-reach tree canopies.

In addition to their painful sting, LFAs negatively affect the local nursery, agriculture, ranching and tourism industries in Hawaii. Current control methods mainly focus on ground nesting LFAs and largely neglect tree populations.

The project is being funded by the County of Hawaii Dept. of R&D to help mitigate LFA populations, which have grown exponentially in recent years.

The next step in the project will involve flight testing and developing a prototype design of the bait dispersion system which will mount to the carbon fiber frame of the UAV.

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Outreach & Education

*Program Director's
Message cont...*



Onizuka Day Brings Science to Public at UH Hilo

PISCES Director Rodrigo Romo mans the PISCES booth during UH Hilo's annual Onizuka Science Day event.

University of Hawaii at Hilo hosted its annual Onizuka Science Day on Saturday, Jan. 27, drawing some 400 students, grades 3 through 12. This year, the free public event honoring Hawaii Astronaut Ellison S. Onizuka featured NASA Astronaut Col. Jack Fischer. Fischer shared his stories of space travel during a morning assembly at UH Hilo's Performing Arts Center.

PISCES set up a booth at the event, promoting its Women's STARS Program and offering photos "with a spacecraft" using NASA JPL's augmented reality smart phone app. The event was supported by dozens of local science and technology organizations and institutions, engaging visitors with robots, educational programs, and astronomy and space-related workshops.

The annual science day honors Hawaii's first astronaut, Ellison Onizuka, who tragically perished aboard the Space Shuttle Challenger in 1986 when the craft exploded seconds after launch, killing its entire crew. To this day, Onizuka's memory continues to serve as a beacon of inspiration for Hawaii students who strive to reach for the stars.

"Your vision is not limited by what your eye can see, but what your mind can imagine." – Ellison S. Onizuka, 1946 – 1986.

In Memory of Dr. Paul Coleman

We were shocked and saddened to learn of the passing of Dr. Paul Coleman in January. Dr. Coleman was an astrophysicist with the University of Hawaii's Institute for Astronomy and a passionate supporter of science outreach and education in the Hawaii Island community.

As both a Native Hawaiian and accomplished astronomer, he served as an advocate for astronomy efforts in the Islands, as well a champion for youth education efforts in his field of work.

The PISCES 'ohana extends its deepest sympathies and condolences to Dr. Coleman's friends and family. He will be remembered and missed by his colleagues and the many students whose lives he touched.



The late Dr. Paul Coleman, photo courtesy of UH Institute for Astronomy.

In other news, this month the State of Hawaii legislative session commenced, and we are working with lawmakers to submit bills benefiting PISCES, the state economy and the aerospace industry.

In Applied Research, we are looking at participating in two research grant proposals this year. PISCES will be collaborating with various organizations including universities and private companies involves in various areas of research, including surface mobility and in-situ resource utilization (ISRU).

In Workforce Development, we are currently planning our upcoming summer programs providing unique STEM opportunities for Hawaii youth: The Summer Internship Program for college-level students, and the Women's STARS Program for high school girls. We hope to grow the number of partners and sponsors supporting our fifth annual STARS Program this year, providing even more opportunities for local young women to find inspiration and motivation from mentors and role-models in Hawaii.

Lastly, in Economic Development projects we have received several proposals in response to our RFP for a feasibility study on a Continuous Basalt Fiber (CBF) manufacturing operation in Hawaii. Later this month we will select the winning bidder and expect to start the contract in March. The results from this study will determine whether Hawaii can sustain and profit from a CBF plant while benefiting the local economy. We look forward to seeing what the future holds in this exciting effort!

A hui hou,

Rodrigo Romo
PISCES Program Director

Guest Spotlight

Palm Trees, Lunar Rovers and Space Settlement

Peter Visscher

Mobility Systems Engineer, Canadensys Aerospace Corp.

I first experienced Hawaii 10 years ago as part of an analog field test on the slopes of Maunakea. At the time, I was working as a mechanical engineer, designing and building extreme terrain off-road vehicles in Canada. Through a series of fortunate events, I was asked to participate in a lunar rover design for the Canadian Space Agency (CSA). Task one: Travel to Hawaii and spend three weeks working with the CSA, NASA and a few other companies to collect data. Tough job, but somebody's got to do it, right? I imagined sunny days on the beach, palm trees, maybe a couple of coconut-based libations. Instead, I experienced long days on the lunar-like slopes of Maunakea in harsh conditions. At 9,000 feet, the thin air conditions ranged from below freezing to hot, dusty and windy (I was cleaning out red iron dust from special places for a long time). Still, I was hooked. The scenery was breath-taking, and the work was fascinating.

During the next five years, we continued to work with both the CSA and NASA to develop a family of next-generation lunar rover platforms (including PISCES' Helelani rover) designed to search for water on the surface of the Moon. I was fortunate to return to Hawaii on several more occasions to conduct field tests with a program called RESOLVE (which is a long acronym for something). This program (now known as Resource Prospector) is a NASA-led initiative to land a 600-pound robotic rover on the Moon and collect data using various sensors to determine where water might be hidden beneath the

surface. Once water is detected, a drill will be deployed to collect a sample and determine how much water is present and in what form.

This would be a remarkable discovery that goes far beyond satisfying scientific curiosity. Harvestable water on the Moon is the first step towards utilizing off-Earth resources to enable space exploration. Currently, the cost to land a kilogram of water on the Moon is between \$100,000 and \$1,000,000. This seriously limits what can be accomplished on the lunar surface. Producing water on-site would provide cost-effective water and air supplies for astronauts, as well as propellant for rockets and even surface rovers. Ultimately, this is a key strategy to allow mankind to explore and even settle on Mars.

In 2017, I began working for Canadensys Aerospace Corporation, an engineering company with expertise across all aspects of space hardware design. We continue to work with the CSA to develop lunar rover technology (among other things). My specific area of interest lies in the mobility system, ensuring that the vehicles on the lunar surface are robust and capable. The terrain on the

Peter (self-described as "hair-free") and his colleagues pose with the Canadian Space Agency's Juno Rover loaded with NASA's RESOLVE payload during an analog field test on Hawaii Island in 2010.



The Artemis Jr. Rover (shown above) carried NASA's Resource Prospector payload during an analog mission on Hawaii Island in 2012.

Moon ranges from relatively flat and smooth, to steep and rocky, and the entire lunar surface is coated with an abrasive dust (regolith) that wreaks havoc on mechanical, electrical and thermal systems.

While we can simulate and replicate some of the characteristics of the Moon (such as the extreme vacuum and temperature range), real world testing is the only way to properly validate the performance of wheels, suspensions, motors and batteries as we operate the robotic vehicles on slopes, rocks, soft sand, etc. Analog sites, such as the slopes of Maunakea, provide an environment that enables critical testing on our path to explore our solar system.

It has truly been a pleasure working with everyone at PISCES. I will certainly be looking for an opportunity to visit the Big Island again soon and pay a visit to Helelani—and to fill up on some of the local delicacies like Big Island Pizza's "Widowmaker" or Ken's House of Pancakes' "Sumo Grinder."

