PISCES HAWAII'S PORTAL TO SPACE NEWSLETTER

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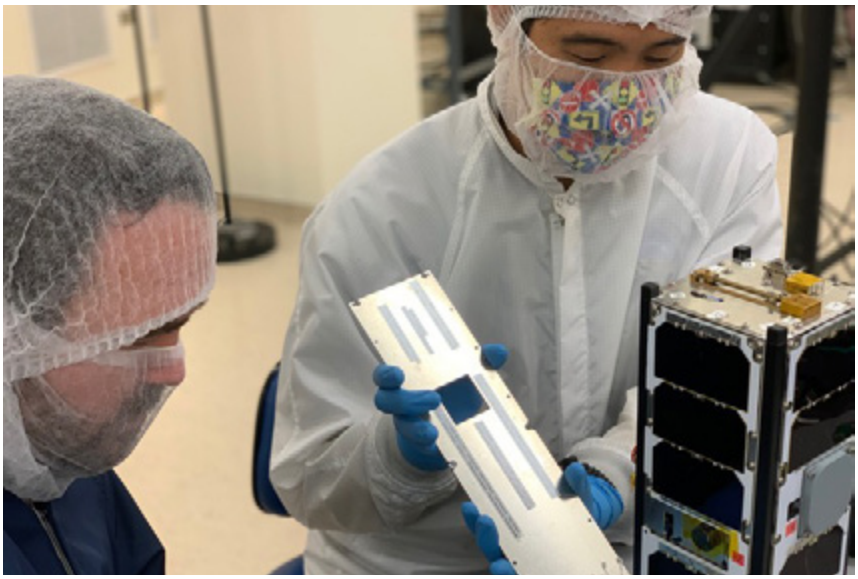
September 2020 - Issue 9 Volume 8



# CubeSat Developed by Hawai'i Space Flight Lab Set for Launch with NASA

***Above:*** *Students adding a solar panel to the Neutron-1 3U cubesat inside a cleanroom at HSFL. The inside panel contains labels with the names of all the students and faculty involved. Credit: HSFL.*

After six years in development, a small satellite built by the Hawai'i Space Flight Laboratory (HSFL) is set for launch. Neutron-1, a 3U cubesat outfitted with a neutron detector, will hitch a ride to the International Space Station on Sept. 30 aboard NASA's ELaNa 31 resupply mission from Wallops, Virginia. The launch is part of NASA's CubeSat Launch Initiative, which provides free rides to space for small satellites.

Neutron-1 is a joint project involving 32 University of Hawai'i at Mānoa students and 16 HSFL faculty members and engineers. A team at Arizona State University led by planetary scientist Craig Hardgrove provided the neutron detector. Names of the participating students and faculty will ride with Neutron-1 to space, printed on labels fixed on the back of a solar panel.

> *Continued on* ***Page 3***

@PISCES_HAWAII

## *Letter from the Director*

*Rodrigo Romo*

Aloha kākou,

The COVID-19 pandemic continues to wreak havoc across the world, and especially here in Hawai'i as of recent weeks. Though the number of cases remained low over the summer, easing of restrictions combined with summer events sent infection rates soaring in August. As a result, O'ahu is returning to stay-at-home orders while other islands are proceeding with caution and maintaining guidelines for wearing masks in public and social distancing. The Hawai'i Dept. of Education has also postponed in-person learning, extending distance learning protocols via internet through the first quarter of the school year.

In particular, this change has highlighted the need for better internet connectivity in remote locations across the islands where no coverage exists. Many students in rural areas have no access to wi-fi and cannot participate in distance learning measures at present.

> *Continued on* ***Page 5***

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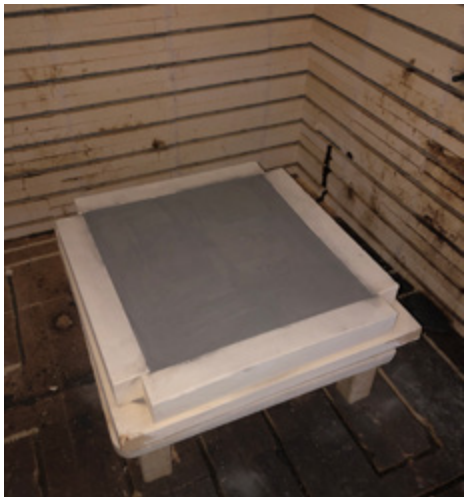


# Basalt Launchpad Tiles to Undergo Testing by NASA

PISCES completed a large batch of sintered basalt tiles last month for testing by NASA's Swamp Works at Kennedy Space Center. Thirty tiles will be assessed as a launch and landing pad material. The testing will be conducted by Masten Space Systems in Mojave, California.

Earlier this year, Masten tested a 12" x 12" x 1" tile made by PISCES, subjecting it to a two-second rocket burst fueled by liquid oxygen and liquid methane. The results of the test caught the interest of Swamp Works, who requested the latest batch of tiles. The next test will involve three one-square-meter launch pads (each containing nine tiles), subjecting them to a dynamic rocket blast that simulates launch and landing conditions. Once the results of the NASA test are published, PISCES will determine how to continue developing sintered basalt materials for commercial applications on Earth and infrastructure for space settlement.

PISCES began researching basalt-based launchpad tiles in 2014 and sent raw Hawai'i basalt fines to a team at NASA for sintering. Between the fall of 2015 and 2016, PISCES created a series of interlocking basalt tiles for the Additive Construction with Mobile Emplacement (ACME) project, which staged a robotically built, full-scale launch pad. The tiles were designed at NASA and sintered by PISCES using Hawai'i basalt. After being placed by a planetary rover with a robotic arm provided by Honeybee Robotics, the tiles underwent a static fire test to assess their durability under the heat and pressure of a rocket blast.

The experience of these previous projects and tests led to refinements and further experimentation to improve the tiles' strength and durability. The chemical composition of raw basalt is a key factor in producing quality sintered products. Basalt sampled from varying locations can produce significantly different materials when sintering, some better than others. The latest generation of tiles is much stronger than those built during the ACME project. The PISCES team is looking forward to the test results and will continue researching basalt for ISRU applications.

***Above (L-R):***

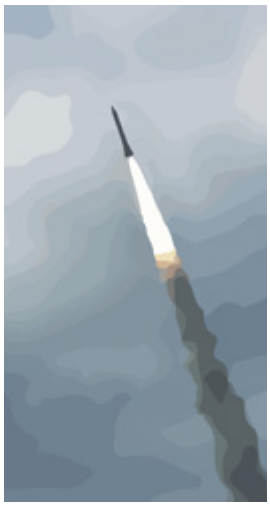
*Geology Tech Kyla Edison removes basalt tiles from their molds after being sintered.*

*Raw basalt fines are carefully placed and packed into a mold for the sintering process.*

*Director Rodrigo Romo delivers the tiles for shipping to Kennedy Space Center.*

# UH Mānoa Aerospace Engineering Program Launches Website

The University of Hawai'i at Mānoa College of Engineering Aerospace Engineering Program (AEP) now has a dedicated website with a variety of resources for students interested in spaceflight studies and careers. Launched in Spring 2020 under the Department of Mechanic Engineering, AEP offers new courses in emerging fields of aerospace engineering and exposes students to technologies that integrate air and space missions. The program is designed to invite and engage students in various internship, scholarship and fellowship opportunities offered by federal agencies, and private and industrial organizations including NASA and Lockheed Martin. Students also work in exciting research projects as part of intramural and extramural funded projects in partnership with other organizations like NASA, the Air Force Research Lab, Air Force Office of Scientific Research, National Science Foundation, Office of Naval Research and other federal and state entities. For more information, visit manoa.hawaii.edu/aeroeng.



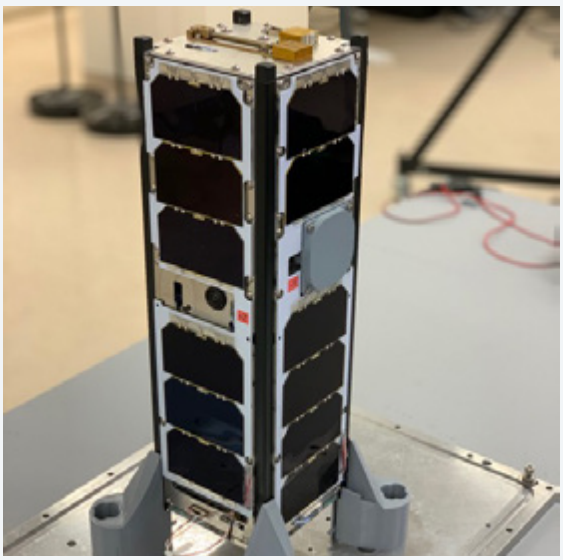
## *HSFL CubeSat Set for Launch ...* > *Continued from* **Page 1**

Dr. Migues Nunes, systems engineer for Neutron-1 and deputy director of HSFL, called the project's completion "a great testament to the determination of the HSFL team to deliver a satellite during challenging times." Due to disruptions created by the pandemic, many satellite teams were unable to deliver their planned projects in time for the mission.

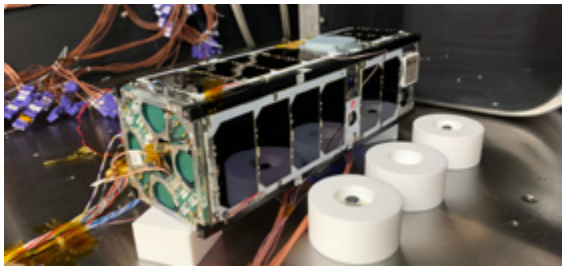
On Aug. 20, the cubesat was delivered for final flight integration to Nanoracks—a company providing commercial access to space for small research payloads. Nanoracks has successfully brought more than 1,000 research payloads and small satellites to the ISS, according to the company's website.

Neutron-1 is expected to be operational in space in mid-November, once astronauts aboard the ISS configure the satellite's deployment system. The mission will investigate global neutron counts while serving as a hardware and software flight verification and validation.

"We had some epic challenges during this process but at the end we came through and we could not be happier with the results," Dr. Nunes wrote in an email lauding the team's efforts. "Neutron-1 went through a rigorous environmental testing process and at the Nanoracks delivery we demonstrated that the whole system was working nominally and it's all set to operate in orbit."



***Above:*** *Neutron-1.Credit: HSFL.*



# Students get Hands-on Aerospace Work through HSFL

***By: Luke Flynn, Director of Hawai'i Space Flight Laboratory***

In 2007, the Hawai'i Space Flight Laboratory (HSFL) was created to design, build, test, launch and operate small satellites (<100 kg) from the Hawaiian Islands. Similar to PISCES, the goal of HSFL and its parent organization, the Hawai'i Space Grant Consortium (HSGC), is to promote an aerospace economy in Hawai'i and train a home-grown aerospace workforce. HSFL and HSGC support roughly 120 to 135 undergraduate student internships annually of which 55% are underrepresented students (mostly Native Hawaiian) and 30% are women.

HSFL is currently working on a number of small satellites. Delivered in 2015, the 50 kilogram HiakaSat was HSFL's first remote sensing satellite built by State of Hawai'i staff and students. Unfortunately, due to a launch failure, HiakaSat did not reach orbit. HSFL has just delivered the four-kilogram Neutron-1 satellite (see article in this newsletter) to NASA for launch from the International Space Station later this fall. Neutron-1 also features a communication system that can be used by HAM radio operators for testing and will be operated using a ground station installed at and operated by Kaua'i Community College. Hyperspectral Thermal Imager represents the third HSFL satellite that will feature a highly-sensitive infrared detector from NASA JPL and will be delivered for launch in 2021. Finally, HSFL is involved in three projects to economically build small 1-U satellites (roughly one kilogram) for educational and testing purposes, including a satellite-building project assisting students and staff from the Hawai'i Science and Technology Museum on the Big Island.

While small satellites can provide global coverage, very high altitude Unmanned Aerial Systems (UAS) can use the same small satellite technology much closer to Earth. Flying at above 60,000 feet, the latest solar-powered UAS, such as the HAPSMobile Hawk30, can continuously fly for six to 12 months and provide important data for disaster research of wildfires, volcanoes and hurricanes.

HSFL will continue to provide hands-on aerospace research opportunities for Hawai'i students. Using the 1-U CubeSat satellite kit that is now being developed by Dr. Frances Zhu as part of NASA's Artemis Program, HSFL will partner with PISCES to offer Big Island students the opportunity to build, test and operate their own small satellites in space. Space-rated components remain very expensive, and Hawai'i has an opportunity to offer high-paying and high-technology jobs in aerospace.

***Photos (L-R):***

*HSFL students who worked on the Neutron-1 satellite.*

*Neutron-1 inside a thermal vacuum chamber.*

*Credits: HSFL.*

## Virtual Space Talks for Young Women Slated for October

Young women of all ages are invited to peer inside the exciting world of space exploration during the Women in Space Exploration (WiSE) Talk series coming in October. Organized by PISCES in partnership with Microsoft, the virtual program will feature five prominent women working in space careers giving talks and answering questions about their work and research projects. The event will be held Oct. 5 to 9, and will be open to anyone who wishes to participate. Young women and girls will get priority in the Q&A portion of each talk.

Through the event, PISCES hopes to inspire more young women in space and related STEM careers. Due to the ongoing pandemic, the 2020 Women's STARS Program for high school girls was cancelled this summer. PISCES hopes to provide an inspirational event for the many students learning from home during their Fall Break period in October.

## *Cont: Letter from the Director...*

> *Continued from* ***Page 1***

There is a need for greater connectivity, so all students have equal access to education under the current circumstances.

We are looking into a project that may solve this challenge, one that could provide services to areas without internet access. In the months ahead, we will be working with community leaders and state lawmakers to find the best approach for this initiative, one that could boost Hawai'i's crippled economy.

In other news, we were contacted by the Smithsonian's Air and Space Museum in Washington, D.C. last month to provide sintered basalt material for an exhibit about In-Situ Resource Utilization (ISRU). We intend to provide samples of our planetary LEGOs—a project we did in 2018 with a NASA STTR Phase 1 grant in partnership with Honeybee Robotics—as well as launchpad tiles from our Robotic VT/VL Construction project. We are excited to display our work with basalt at a national level and share the possibilities of how ISRU can create the literal building blocks for developing infrastructure beyond Earth.

In a major push, we wrapped up a large-scale production of basalt tiles last month to undergo testing by NASA. We shipped 30 tiles to Kennedy Space Center, and Masten Space Systems will be conducting a rocket engine test. We're looking forward to seeing the results of this test, and to continue refining our basalt sintering process for improved products for Earth and Space.

The "new normal" created by this pandemic has required a lot of adjustments in the way we live, work and interact with one another. Here at PISCES, we are working hard to find opportunities to aid Hawai'i's economic recovery through aerospace and reduce our state's heavy reliance on tourism. Stay safe and take care.

A hui hou,
Rodrigo Romo
Program Director