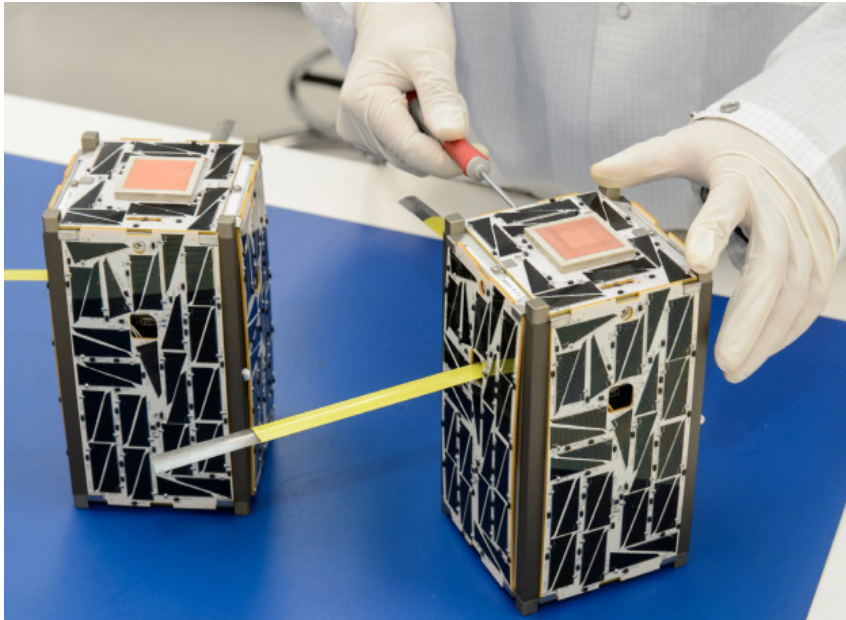


## UH Team Awarded \$500K by NASA to Develop CubeSat Kits for Students



**Above:** CubeSats, a class of nanosatellites, use a standardized size and form factor. They were developed as a cost-effective platform for education and space exploration. Image courtesy of NASA.

A team at University of Hawaii at Mānoa will receive \$500,000 from NASA to design and develop a fully functioning small satellite kit and course for undergraduate students as part of the Artemis Student Challenges. The project will develop a 1U cubesat and include a lesson plan with lectures, labs and hands-on hardware and software development.

“This topic is not typically taught and further, a spacecraft lab course is extremely rare,” Principal Investigator Dr. Frances Zhu wrote in the project proposal. “By reinforcing the theoretical curriculum with direct ties to hardware, students can truly engrain the subject matter learned from a conventional classroom setting, a feeling so often felt in classes solely based on lectures.”

The project will commence in two phases.

> Continued on [Page 3](#)

## Letter from the Director



*Rodrigo Romo*

Aloha kākou,

On May 30th, SpaceX made history by becoming the first commercial company to launch astronauts to the International Space Station. Millions of people around the world watched as two NASA astronauts were sent to space from the U.S. for the first time since 2011—and for the first time ever aboard a SpaceX vehicle. The SpaceX Falcon 9 booster that took NASA astronauts Robert Behnken and Douglas Hurley on a trajectory to meet the ISS returned to Earth with a perfect landing on a drone barge.

It is difficult to comprehend what SpaceX has accomplished in such a short period of time. The recovery of their reusable booster rockets almost seems routine now, though this feat of engineering seemed nearly impossible 18 years ago when the company was first founded.

Just a few days before the SpaceX launch, Virgin Galactic attempted to launch Launcher One, a small liquid fuel

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## SpaceX Successfully Launches Two NASA Astronauts to International Space Station

NASA and SpaceX are celebrating a historic launch completed May 30 that successfully brought two U.S. astronauts to the International Space Station aboard a commercial space craft. The mission, dubbed NASA's SpaceX Demo-2, was the first crewed commercial flight ever sent to space.

Astronauts Robert Behnken and Douglas Hurley launched inside a Crew Dragon spacecraft from Kennedy Space Center's iconic Launch Pad 39A aboard a SpaceX Falcon 9 rocket, taking to the skies after a previous launch attempt three days early was scrubbed due to weather concerns. About 19 hours later, the crew caught up with the ISS where they docked and were welcomed aboard after depressurizing their spacecraft, marking the successful completion of the first half of their journey.

"I'm really quite overcome with emotion on this day," SpaceX Founder Elon Musk said during a news conference following the launch. "It's hard to talk, frankly."

The Demo-2 mission is a critical final test to prove SpaceX's crewed systems for regular use by American astronauts. Since 2011,



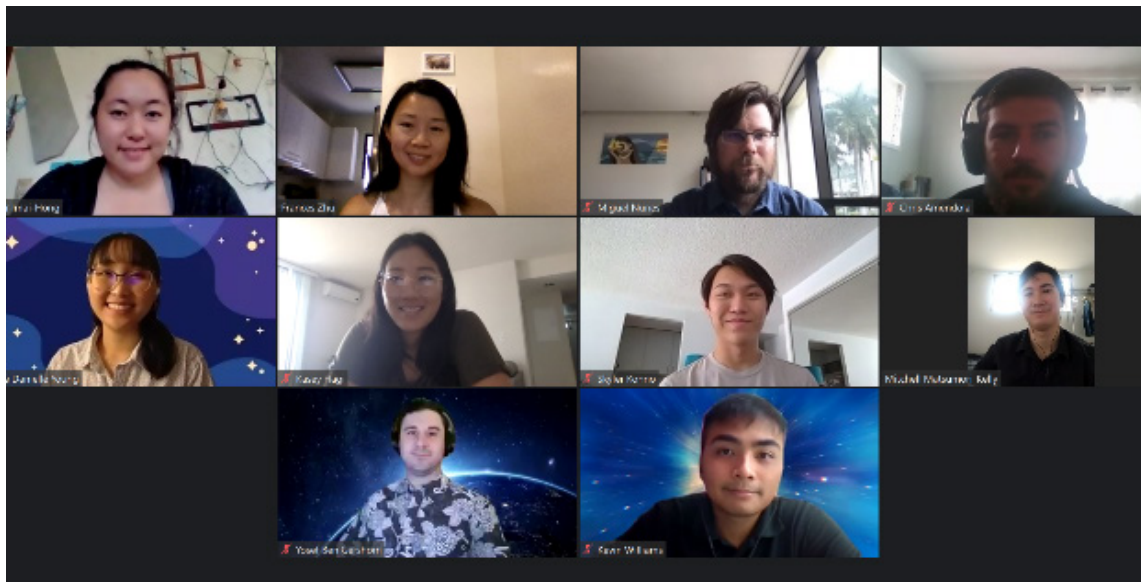
when the Space Shuttle program was retired, NASA has been relying on rides aboard Russian rockets to the tune of \$90 million per seat.

In about four months, Behnken and Hurley will depart the ISS to return to Earth, completing the final leg of their mission and proving whether Crew Dragon is ready for routine operations.

The next Crew Dragon mission is scheduled to be the first operational flight and will carry four astronauts including three from NASA and one from JAXA.

**Above:** A SpaceX Falcon 9 booster launches two astronauts aboard a Dragon crew capsule from Kennedy Space Center on May 30. **Left:** Astronauts Robert Behnken and Douglas Hurley inside Crew Dragon. Credit: NASA

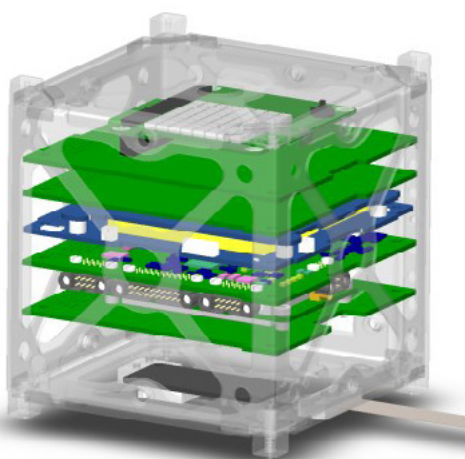
**Cont: UH Team Awarded \$500K by NASA for Satellite Kit ...**



**Left:** Students, faculty and staff for the Artemis CubeSat kit project attend a kick-off meeting via Zoom last month. (L-R): Amber Imai-Hong, Frances Zhu, Miguel Nunes, Chris Amendola, Danielle Young, Kasey Hagi, Skyler Konno, Mitchell Matsumori-Kelly, Yosef Gershom and Kevin Williams.

> Continued from **Page 1**

**Below:** Anatomy of the Hiapo 1U, the first community-built satellite assembled by students working with Hawaii Space Grant Consortium (HSGC) and the Hawaii Space Flight Lab (HSFL). Courtesy photo.



Phase 1 will see the hardware and software development of the kit including onboard computing, RF communications, sensors, a basic infrared camera and an electrical power system. The cubesat will include software for telemetry, software visualization and development—and all for less than \$5,000. Phase 1 will also focus on developing an online lab course for the kit. Students around the country will have access to a standardized aerospace design program with online support—a rare opportunity for undergraduates. Phase 2 will include the development of a classroom and online spacecraft mission design course using the kits. An additional component of the project will focus on outreach, bringing extensive workshops to commu-

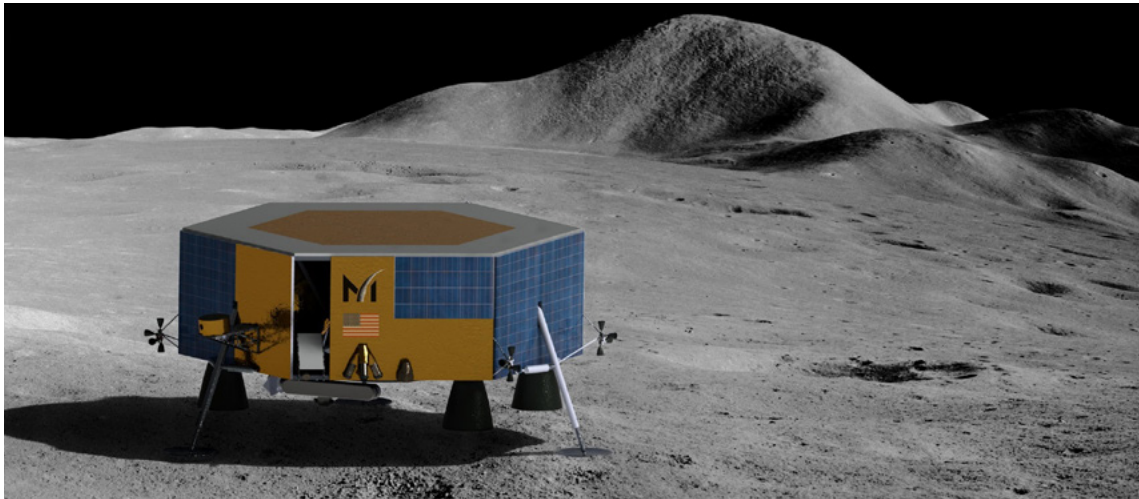
nity colleges throughout Hawaii that place emphasis on Native Hawaiians and other underserved groups.

The project’s team includes Dr. Zhu, Amber Imai-Hong, Yosef Ben Gershom, Kasey Hagi, Dr. Miguel Nunes and Dr. Trevor Sorensen. Phase 1 of the project began May 1 and will continue through the end of 2020. A group of three students are being recruited to assist in the project and will present their research findings at the Undergraduate Fellowship and Traineeship Symposium.

Several institutions are partnered in the project including multiple colleges in the UH system and in Washington state, PISCES and the Native Hawaiian Science and Engineering Mentorship Program.

NASA has awarded a total of nearly \$2.4 million to universities as part of the Artemis Student Challenges, a new initiative to inspire the next generation of astronauts who will explore the moon and beyond.

## Preparing for a Long-Term Human Presence on the Moon



*Left: An artist rendering of Masten Space Systems' XL-1 lunar lander which is slated for a Moon landing in 2022 carrying cargo for NASA. Courtesy image.*

**By: Matthew Kuhns, Chief Engineer - Masten Space Systems**

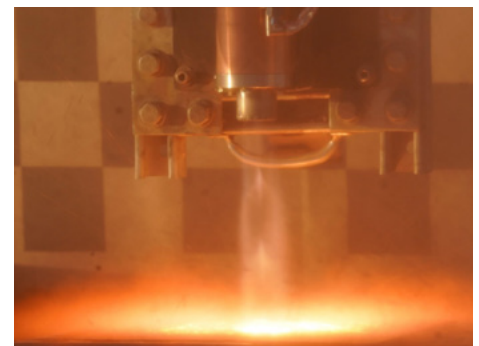
In December 2022, Masten's XL-1 lander is scheduled to land on the Moon, carrying payloads for NASA and other commercial customers to the lunar South Pole. As part of NASA's Artemis program, the purpose of these experiments is to collate localized, concurrent data sets from the lunar polar region in advance of human missions to the Moon. This mission is one of the first steps toward building a foundation for public/private partnerships that will establish a sustainable and long-term human presence on the lunar surface.

One of the risks posed by lunar landings is the plume cratering and ejecta kicked up by vehicle engines during descent. Large engines can dig deep craters and throw ejecta up that can damage the vehicle or even make it to the reaches of lunar orbit. With the Artemis program using larger landers than the Apollo missions, this is a problem worth studying as humans head back to the moon in 2024. One way to make landings safer is by using landing pads, which

minimize the amount of regolith and dust displaced during launch and landing.

PISCES has been working to mitigate this risk by developing landing pad pavers made with sintered Hawaiian basalt. Hawaii's basalt is similar to lunar regolith and can be used as a regolith simulant. PISCES teamed up with Masten earlier this year to test one of its designs using a Masten rocket engine. This work was done in support of a NASA Phase I SBIR and the Plume Surface Interaction group. The results were extremely encouraging, demonstrating good resistance to plume effects and erosion durability for high velocity and high temperature plume impingement at approximately 25% of the surface heat flux value experienced during the Apollo landings. This test data will help PISCES and NASA develop improved designs which one day may be used on the Moon.

*Below: A static rocket fire test by Masten using a PISCES-built sintered basalt tile for launch and landing pads. Courtesy photo.*



## 2020 AstroDay in East Hawaii Goes Virtual

The 19th annual AstroDay event in Hilo was postponed last month due to lockdowns to prevent the spread of COVID-19. But like many people adapting to the new normal, organizers created a modified event online using Facebook, Twitter and Youtube.

Virtual AstroDay featured three weeks of activities, presentations and lessons by volunteers who posted videos shot from home where many are working remotely. The presenters included astronomers, engineers, tech workers, scientists and educators from organizations like UH Institute for Astronomy, PISCES, Canada-France-Hawaii Telescope, Gemini Observatory, Subaru Telescope, East Asian Observatory, UKIRT and 'Imiloa Astronomy Center.

More than 2,000 viewers tuned in for the event activities, which ran April 27 through May 12. [Winners of the 2020 Maunakea Coin Contest](#)—an annual graphic design competition sponsored by AstroDay for K-12 Hawaii Island students—were announced. Every year, the contest promotes awareness of the relation between modern science and traditional Hawaiian culture. The winners received prizes and the top design will be minted as a novelty coin for distribution.

AstroDay is sponsored by the [Maunakea Astronomy Outreach Committee](#) (MKA-OC), a partnership of scientists, administrators and educators working in Hawaii's astronomy and related sectors.

## Letter from the Director

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rocket that takes off from the underside of a modified Boeing 747. Unfortunately, there was a problem with the rocket's motor and the launch was not successful. Nevertheless, it is encouraging to see private companies continuing to advance impressive technologies that will send payloads into Earth orbit and beyond.

Another commercial space company based in Mojave, California called Masten Space Systems—which we have partnered with to test launch and landing pad materials—has secured a NASA Commercial Lunar Payload Services Contract. Masten intends to send their lunar lander to the Moon by 2022. This is exciting news and I send congratulations to the Masten team!

Just recently, Rocket Lab did a successful test capturing one of their spent boosters with a helicopter. Rocket Lab now joins SpaceX and Blue Origin in successfully reusing rockets. Rocket Lab's recovery technique is different (catching it in mid-air) but it is still a breakthrough for the small launch vehicle industry.

As Hawaii, other states and nations move forward with plans to safely reopen their economies, PISCES has been working closely with lawmakers to find opportunities in aerospace projects that will help our local economy recover. Now is the time to start thinking outside of the box and look for new development opportunities that will help the State diversify its economy beyond tourism. We look forward to working closely with state lawmakers and leadership at the Dept. of Business, Economic Development and Tourism to find solutions to the challenging times we collectively face.

A hui hou,  
Rodrigo Romo  
Program Director