



Pacific International Space Center for Exploration Systems



# NEWSLETTER

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@PISCES\_HAWAII

## Looking Ahead: How Next-Gen Unmanned Aerial Systems Can Benefit Hawaii



*Above: NASA's high-altitude, long endurance UAS called "Helios". Credit: NASA*

PISCES is working to bring new aircraft technology to Hawaii that could provide a variety of important services while aiding the state's economic recovery from COVID-19. Called High Altitude, Long Endurance Unmanned Aerial Systems (HALE-UAS), the aircraft are being developed for broadband internet access, remote sensing and natural disaster surveys.

HALE-UAS operate like geostationary satellites, hovering over a given region for weeks to months at a time at altitudes well above commercial jets. Hawaii is among only a few locations worldwide where these UAS could launch and land, and the aircraft could offer significant benefits to the islands.

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## Message from the Director

March was a busy month for us, putting the final touches on grant proposals and anticipating funding announcements. We received the exciting news that PISCES, in collaboration with Masten Space Systems, has been selected

for a NASA STTR Phase 1 grant to develop Low-Energy Additive Construction for the Moon and Mars. The proposal is based on our recent research and development of sintered basalt and a mineral binder.



*Rodrigo Romo*

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## Cont: How Next-Gen UAS Can Benefit Hawaii

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These include statewide broadband internet, storm and lava tracking, monitoring sea level rise, coastal erosion, coral reefs and invasive species, and recovery support following natural disasters.

AeroVironment is developing a UAS called the SunGlider that can serve as a communications platform providing 4G LTE cellular signals over large areas of land. This technology could significantly help rural areas lacking infrastructure for cellular and broadband internet.

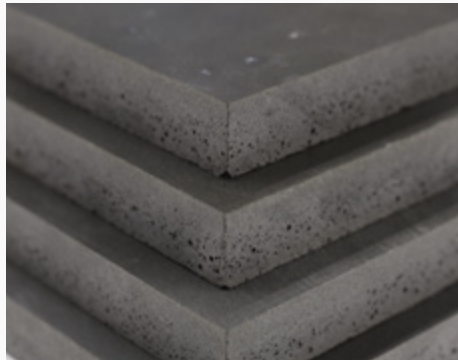
Bringing HALE-UAS to Hawaii could also support economic development by creating new jobs in information technology, engineering and aviation, as well as vocational programs to train prospective workers. The aircraft can also provide remote sensing capabilities at a much lower cost with greater accessibility than geostationary satellites.

In mid-March, PISCES, together with the Hawaii Space Flight Laboratory, hosted a webinar exploring the many uses of HALE-UAS, and how the State of Hawaii could leverage the new technology. Industry experts from the Alas-

ka Center for UAS Integration, USGS, NASA Ames, AeroVironment and the University of Hawaii at Hilo paneled the event which drew an audience of more than two-dozen lawmakers and state and county

officials. Moving forward, PISCES has plans to meet with these parties to discuss the first steps to lay groundwork for a UAS flight and operations center in Hawaii.

## Masten & PISCES to Receive NASA STTR Grant



*Sintered basalt tiles made by PISCES.*

**M**asten Space Systems together with PISCES has been awarded a NASA STTR Phase 1 grant of up to \$125,000 to develop a low-energy, additive construction method for the moon and Mars.

When humans go back to the moon, they will need materials to build shelter, infrastructure and crucial components for survival and operations. Not only that, but they will need an energy-efficient technique that takes raw materials and turns them into usable products—all in the vacuum of space.

PISCES has been researching such a technique using volcanic basalt and a novel binding agent. The STTR project proposes advancing and validating a novel binder-regolith composite for construction applications, and developing an effective extruder that can withstand the harsh lunar and Martian environments. The composite materials will undergo structural testing at PISCES and UH Manoa and be subjected to static rocket fire testing at Masten to assess their integrity as a launch and landing pad material.

Masten and PISCES will negotiate a 13-month contract with NASA before the award is granted and work begins. If selected for a Phase 2 award, the project would build and test the prototyped extruder (created in Phase 1) using the additive manufacturing method proposed.

## Taking Flight: The Development of HALE-UAS Aircraft



**Above:** Swift Engineering's SULE HALE-UAS takes flight. The craft is capable of carrying up to 22 pounds of payload for more than a month at a time. Courtesy image.

**By: Matthew Fladeland, Airborne Science Manager at NASA Ames**

The advent of lightweight, high-power batteries, efficient solar cells, and miniaturized autopilots and sensors has led to the development of a new generation of aircraft known as High Altitude Long Endurance (HALE) Unmanned Aerial Systems (UAS)—also known as High Altitude Pseudo-satellites (HAPS). These aircraft can loiter over a region of land for weeks to months at a time like a geostationary satellite.

NASA first explored the utility of these vehicles during a program in the 1990s that resulted in a flight demonstration of the Helios HALE-UAS over Kauai island. Today, there is significant commercial and government interest in turning these vehicles into an important new asset to forecast weather conditions, monitor fisheries and coastlines, and many

other applications. The NASA Airborne Science Program is partnering with the USGS National Innovation Center to explore how innovative new UAS can improve science observations and decision-making related to resource management and emergency response.

Several foreign and domestic HALE-UAS aircraft are currently in various stages of development. As these platforms mature, NASA, USGS and other agencies are exploring concepts-of-operations that can best utilize them. NASA Ames Research Center recently partnered with the USFS to conduct more than 10 demonstrations of Swift Engineering's SULE HALE UAS. This aircraft is capable of carrying up to 22 pounds of payload for more than 30 days at a time. Both NASA and USGS are also in discussions with other aircraft manufacturers including AeroVironment, Prismatic/BAE Systems, Northrup Grumman and SCEYE.

Hawaii can play an important role in the development and maturation of this new sector of aviation. The islands' advantageous geographic position, need for improved monitoring of geologic, coastal and oceanic resources, and relatively benign airspace make them an ideal place to position HALE-UAS as a driver for research, jobs and industry development.



**Matthew Fladeland.**  
 Courtesy photo.

### Cont: Message from the Director

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PISCES and MSS will enter contract negotiations for the award this month.

The HALE-UAS (High Altitude Long-Endurance Unmanned Aerial Systems) webinar we organized in March was quite successful. We had a knowledgeable panel of experts including Dr. Cathy Cahill of the Alaska UAS Integration center, Matt Fladeland of NASA Ames Research Center, John Stock of USGS, Peter De Baets of AeroVironment and Tim Ward of UH Hilo's Aeronautical Sciences program. The attendees included state and federal lawmakers, county official, members of state

and federal agencies, academia and private parties. I am hopeful that this event has set the stage to begin developing HALE UAS operations in Hawaii.

We had another fantastic lineup of women speak during the 2nd Women in Space Exploration (WiSE) Talks series held during spring break, March 15 to 19. The event is aimed toward young women interested in space careers and features daily talks and Q&A sessions with leading women working at places like NASA and other space organizations, private and public. Watching these talks, even

as an adult, is truly inspiring. Mahalo to all our wonderful speakers, and to our sponsors Hawaii Science and Technology Museum and Microsoft for helping make WiSE Talks possible.

Many conferences—this year virtual—are on the horizon. Last month, we were invited to present our research at the 3rd International AIAA Space Architecture. We are also preparing to presentations for the Earth and Space Conference organized by ASCE next month. Later this summer, we will share the testing work done on our sintered basalt tiles at the PTMSS conference.

In the legislature, we are still closely monitoring two bills that will define the future of PISES as well as the state budget. While nothing is certain yet, the situation appears favorable for continuation of our projects and programs. We have been working closely with key senators and representatives in the Hawaii legislature who have provided strong support for us. Mahalo to all our supporters who are working to continue funding for PISCES.

A hui hou,

Rodrigo Romo  
Program Director

MAUNAKEA OBSERVATORIES  
**ASTRODAY**  
PRINCE KUHIO PLAZA  
FRIDAY  
**April 30**  
↓  
SUNDAY  
**May 2**  
Learn about science in Hawai'i through our **contactless activities!**  
PICK UP KITS & OTHER INFO  
go to participating shops and restaurants while supplies last  
VIEW DEMOS & PRESENTATIONS  
scan our QR codes throughout the mall