



# Pacific International Space Center for Exploration Systems NEWSLETTER



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## WORKFORCE DEVELOPMENT



### Applications Open for 2019 Women's STARS Program



We are excited to announce the sixth-annual Women's STARS (STEM Aerospace Research Scholars) Program for Hawaii high school girls! Young women in Hawaii, ages 14 and up are invited to apply for a week-long summer camp experience exploring the world of space exploration, science and engineering on Hawaii Island. This year we are offering an expanded variety of subjects including aerospace engineering, astronomy, space exploration research, planetary geology, volcanology, marine science and conservation.

Selected students will meet successful women in these fields, learn

what it's like to work in them (especially as a woman), and gain tools, resources and connections to succeed at their education and career goals. We're pleased to partner with HI-SEAS, NELHA, the Maunakea Observatories and Caterpillar, Ltd. this year to provide a memorable and valuable experience to our local youth.

To apply, students must live in the State of Hawaii and maintain a minimum GPA of 3.0. The program will run June 24-29. All meals, accommodations and on-island transportation will be provided at no cost to students. Applications are available [online](#) and the deadline to apply is Friday, May 17.

### Message from the Program Director



Aloha Kakou,

March is always an exciting month for schools here on Hawaii Island when educators and scientists visit classrooms for the annual Journey Through the Universe program. This year marks the program's 15<sup>th</sup> anniversary! I was pleased to be among the more than 70 scientists and educators who visited classrooms in North and East Hawaii. My own presentation explored the physics of flight with Waiakea Elementary School students. Our Geology Technician Kyla Edison visited DeSilva and Kaumana Elementary to talk about the geological history of Earth. She created and shared a 12-foot scroll that shows the time-scale of human existence compared with the planet they live on. The students were amazed. It's always a pleasure to be involved in this inspiring week-long outreach program that can impact so many students with the exciting world of STEM.

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# GUEST SPOTLIGHT

## The Latest Research at HI-SEAS

Dr. Michaela Musilova, HI-SEAS Director

*Astrobiologist Dr. Michaela Musilova is Director of the Hawaii Space Exploration Analog and Simulation (HI-SEAS) station, part of the International Moonbase Alliance (IMA). She has worked with NASA's Jet Propulsion Laboratory, University of London Observatory, on NASA's and UK Space Agency's MoonLite project, and served as an analog astronaut at HI-SEAS and the Mars Desert Research Station. Michaela is also involved as a visiting professor at the Slovak University of Technology, a researcher at UH Mānoa and as a lecturer for the International Space University.*

The HI-SEAS habitat is located at 8,200 feet (2,500 meters) elevation on Mauna Loa on the Big Island of Hawaii. It has been the home to five successful long-duration Mars simulation missions spanning four to 12 months since 2013. As of 2018, IMA—an organization dedicated to building sustainable settlements on the Moon—has been organizing regular simulated missions to the Moon and Mars at HI-SEAS. The research and technological experiments conducted at this facility will help build a prototype Moonbase in Hawaii to help build an actual Moonbase on the Moon (Mahina Lani).

From Feb. 20 to Mar. 6, I served as crew commander for a two-week simulated mission on the Moon at the HI-SEAS habitat. Our aim was to perform scientific experiments and test technological instruments needed for future exploration of the Moon. The mission was part of the EuroMoonMars initiative led by the [International Lunar Exploration Working Group](#) (ILEWG) of the European Space Agency (ESA), in collaboration with IMA, European Space Research and Technology Centre (ESTEC) and Vrije Universiteit (VU) Amsterdam.

Our crew came from all over the world and was able to complete all their mission targets. These included geological mapping of the Mauna Loa area for fresh pahoehoe lava flows and lava tubes by geology students Annelotte Weert and Sebastian Mulder. The study of the lava flows can help us understand how weathering processes affect this kind of geological material on Earth and what they would be like on other planetary bodies. Lava tubes could also be potentially used as shelters to build habitats on the Moon. The students used drone footage, imagery and 3D mapping to complement their research. Crew engineer and ESA systems engineer



*Five crewmembers stage an EVA to repair an antenna during a two-week mission at HI-SEAS in March 2019. Corner photo: Cmdr. Michaela Musilova. Credit: Musilova/HI-SEAS/EuroMoonMars.*

Nityaporn Sirikan completed work on enhancing the space suits and other technologies used at HI-SEAS. Her work will leave a new standard for future missions at the station and the feedback from the crew will allow for upgrades to be performed before another mission begins.

Other crew activities included several outreach and education projects by crew anthropology researcher [Benjamin Pothier](#) and crew journalist Josh Burstein, as well as myself. Last year, I organized a Mission to Mars competition in Slovakia which encouraged high school students to design a research experiment that could be performed during a simulated mission to the Moon or Mars. It involved collecting hair from crewmembers, dissolving it and using it as fertilizer to grow plants on the Moon. All crew members actively participated in all mission research projects and duties.

The crew's activities and research projects were monitored regularly by researchers and engineers at the mission control center based at Blue Planet Research's laboratory on the Big Island—a facility owned by IMA founder Henk Rogers. Bernard Foing of ESA and executive director of ILEWG, acted as the main space-crew communicator (CAPCOM) at the control center throughout the two-week mission.

Future missions at HI-SEAS are to continue in a similar format in terms of their length and the types of research being conducted. More EuroMoonMars missions are already being scheduled for later in 2019, as well as longer duration missions in collaboration with NASA's Johnson Space Center, University of South Florida and companies such as SIFT and Ketone Technologies.

We are accepting new crew applicants and scientific project proposals for these upcoming missions. To apply or submit a proposal, contact me at [musilova@moonbasealliance.com](mailto:musilova@moonbasealliance.com).

## GUEST SPOTLIGHT

### The 'EuroMoonMars' Initiative

Dr. Bernard Foing, ESA Senior Scientist

*Professor Bernard Foing is a French senior scientist at the European Space Agency (ESA), executive director of the International Lunar Exploration Working Group (ILEWG). He previously worked as the principal project scientist for SMART-1, the first European mission to the Moon. A professor at VU Amsterdam, Foing holds a doctorate in astrophysics and space techniques. He is the author of 16 books and has published some 800 research articles, including 221 peer-reviewed papers.*

The EuroMoonMars initiative is an evolving pilot research program with a series of instruments, investigations and facilities that are relevant to Moon/Mars science, astrobiology, technology, habitability, utilization, as well as inspiration and education for young professionals and the public.

Developed in 2008 by ILEWG, EuroMoonMars has organized field campaigns in specific locations of interest for science and technology in space exploration, including during the latest HI-SEAS mission in March. In addition to Hawaii, these locations have also included ESTEC, EAC at Utah's Mars Desert Research Station, Eifel, Rio Tinto, Iceland, La Reunion and LunAres base in Pila, Poland.



*Mission control at Blue Planet Research laboratory in Hawaii. Credit: EuroMoonMars/International Moonbase Alliance.*



*Above: Visitors from "Earth space station" including ISS astronaut Oleg Artemyev (far right) and IMA founder Henk Rogers (standing center) inside the HI-SEAS habitat with EMMIHS crewmembers. Corner photo: Dr. Bernard Foing. Credit: EuroMoonMars/International Moonbase Alliance.*

EuroMoonMars supported a precursor field campaign at the HI-SEAS habitat in May 2018 to test technologies and protocols with a crew commanded by Henk Rogers, CEO of Blue Planet Foundation and founder of the International Moonbase Alliance. ILEWG and IMA signed a collaboration agreement to further develop a campaign dubbed EMMIHS, which partnered EuroMoonMars, the International Moonbase Alliance and HI-SEAS from February 2018 through March 2019. Some preparation activities were conducted at ESA ESTEC beforehand. This latest two-week mission at HI-SEAS in March was a project under this partnership.

The EMMIHS crew's research included geological and drone surveys, lava flows and lava tube exploration and space technology testing. The mission control center at Blue Planet Research lab (pictured at right) was headed by me, serving as the mission's flight director and research coordinator. Students from VU Amsterdam, ILEWG and partners provided remote science and technical support throughout the two weeks.

The mission support team also went to HI-SEAS to train the crew prior to the recent EMMIHS mission, and to simulate a visit and delivery from Earth with a prestigious crew including ISS astronaut Oleg Artemyev and IMA founder Henk Rogers (both pictured above).

In 2018-2019, EuroMoonMars also supported activities at Eifel, the preparation of an ESA-Lab campaign to build a Moon habitat in ice (referred to as an "IgLuna") at Zermatt Swiss glacier in Iceland.



## OUTREACH & EDUCATION



### *Scientists, Educators Visit Classrooms During 15<sup>th</sup> 'Journey Through the Universe' Program*

*PISCES Geologist Kyla Edison explains the geological history of Earth to 3<sup>rd</sup> grade students at Kaumana Elementary School during the 2019 "Journey Through the Universe" Program organized by Gemini Observatory.*

More than 8,000 students in North and East Hawaii were visited by scientists and educators for hands-on science presentations during the 15<sup>th</sup> annual Journey Through the Universe (JTU) program held March 2 to 9. JTU is one of Hawaii's leading education and outreach programs and aims to promote science literacy and inclusivity in classrooms. The program brings about 80 astronomers, scientists, engineers and educators to local classrooms to present fun-filled activities and demonstrations.

The PISCES team was among the many classroom volunteers to engage students. Director Rodrigo Romo and Geology Tech Kyla Edison share their enthusiasm and knowledge behind the physics of flight and Earth's geological history, respectively, with grade schoolers in Kaumana and Waiakea.

The Big Island is one of 10

locations in the country that are designated JTU sites. Throughout the year, JTU puts on the StarLab Portable Planetarium show for K through 1<sup>st</sup> graders, as well as career panel presentations for high school students. It also includes educator workshops, family science events and public presentations.

"The Journey Through the Universe STEM initiative is a stellar partnership between the Department of Education, business organizations, and community," said Chad Farias, Hilo-Waiakea and Ka'u-Kea'au-Pahoa complex area superintendent. "Our complex areas appreciate and acknowledge the enthusiasm and energy this initiative has generated for our schools, students, teachers, administrators and families. This concerted effort has made this grassroots program a sustaining reality."

### *Director's Message Continued...*

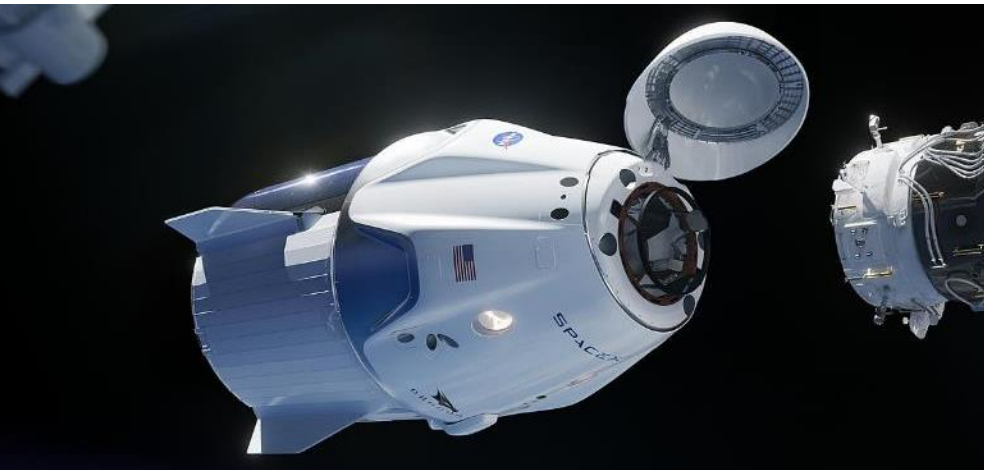
In other news last month, SpaceX achieved a major victory for the human endeavor of spaceflight after successfully launching its Crewed Dragon capsule on a two-stage Falcon 9 rocket on March 2. The spacecraft spent a total of six days in flight, docking with the International Space Station (ISS) and gathering flight data using a dummy outfitted with sensors named "Ellen Ripley." Though no actual humans were on this flight, the maiden voyage will open the way to actual crewed missions aboard the Dragon, which can carry up to seven passengers. With this milestone, SpaceX is a great step closer to shuttling U.S. astronauts to the ISS. I look forward to seeing this become a reality—and seeing the possibilities for manned missions into deep space grow!

With summer quickly approaching, we are also planning our sixth-annual Women's STARS (STEM Aerospace Research Scholars) Program for Hawaii high school girls. This year's program will offer an expanded curriculum, including space exploration, astronomy and engineering, as well as marine science and conservation. Students from across the state will explore Hawaii Island's world-class research facilities and experience a "night on Mars" at the HI-SEAS simulation habitat on Mauna Loa. They will also meet and engage with successful women working in STEM to give them a taste of what these careers are like while providing encouragement and support. I appreciate the generous support from the many science, education and private organizations who are participating in this year's program including the Maunakea Observatories, HI-SEAS, Caterpillar Inc., University of Hawaii, USGS, NELHA and the State of Hawaii. Without their support and engagement, this program would not be possible.

*(Continued on next page)*



## Director's Message Continued...



Left: SpaceX's Falcon 9 rocket and Crew Dragon capsule gear up for launch at Kennedy Space Center on March 2. Credit: NASA TV. Above: An artist rendering of the Crew Dragon spacecraft docking with the International Space Station. Credit: NASA/SpaceX.

In Economic Development, the market feasibility study we contracted for a Continuous Basalt Fiber (CBF) manufacturing plant on Hawaii Island is continuing to generate interest. We have been receiving requests for the study results from around the world since the results were released in December. PISCES is now seeking a facility that can conduct validation testing for Hawaiian basalt to determine the quality of fiber that it can produce. We hope to attract investors to look into developing this unique material. I will be presenting the specifics of the study and our basalt research at the Bridge Engineering Institute conference in Honolulu in late July. PISCES will also be presenting the results of its basalt research at the Space Resources Roundtable conference in Colorado, the International Astronautical Congress in Washington D.C. and the International Space Development Conference in Virginia.

On a personal note, I wish to congratulate our Geology Tech Kyla Edison on her wedding last month. The PISCES 'ohana are lucky to have her on our team and we wish her happiness going forward!

A hui hou,

*R. Romo*

Rodrigo Romo  
Program Director



# ASTRODAY!

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