

# PISCES HAWAII

## Letter from Director



### *Moon Base Alpha: Could it be in mankind's future sooner than later?*

Last month was the 47<sup>th</sup> anniversary of Apollo 11's landing on the Moon, marking the first time we had set foot on another celestial body.

Since the end of the Apollo missions, man has not been back to the Moon.

However, the dream of heading back to our lunar neighbor may be closer than we think.

During the 1950's and 1960's, we saw an introduction of many science-fiction movies about space and lunar exploration, such as the 1950's "Destination Moon," 1953's "Project Moonbase," and later the movie from 1978 "Space 1999: Destination Moonbase Alpha."

I remember being 12 years old and being influenced by these movies. I instantly



*Major Matt Mason*

bought into being a space cadet, and by the 4<sup>th</sup> grade I knew I wanted to be a part of NASA's manned-space program. I followed every detail of NASA's Gemini and Apollo programs. I read everything written about those programs, built every spacecraft model, and sat in front of the TV watching every spaceflight.

Also in 1966, Mattel Toys introduced "Major Matt Mason and his Lunar Base Command Set." Major Matt Mason was an action figure and became Mattel's most popular boy's toy product for 3-years in a row.

Then, all of a sudden, it was gone after NASA and President Nixon had abandoned the Moon and thus any hope for a moonbase.

*Continue reading on pg. 5*

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## ISSUE 8 AUGUST 2016

Inside:

### PISCES' SUMMER STARS PROGRAM

This year PISCES had eight participants in the annual workshop for girls who want to learn about STEM careers.



pg. 3

### HELELANI DESIGN REFERENCE MISSION

Read about PISCES' recent rover field test and how our team conducted a real-life lunar mission!

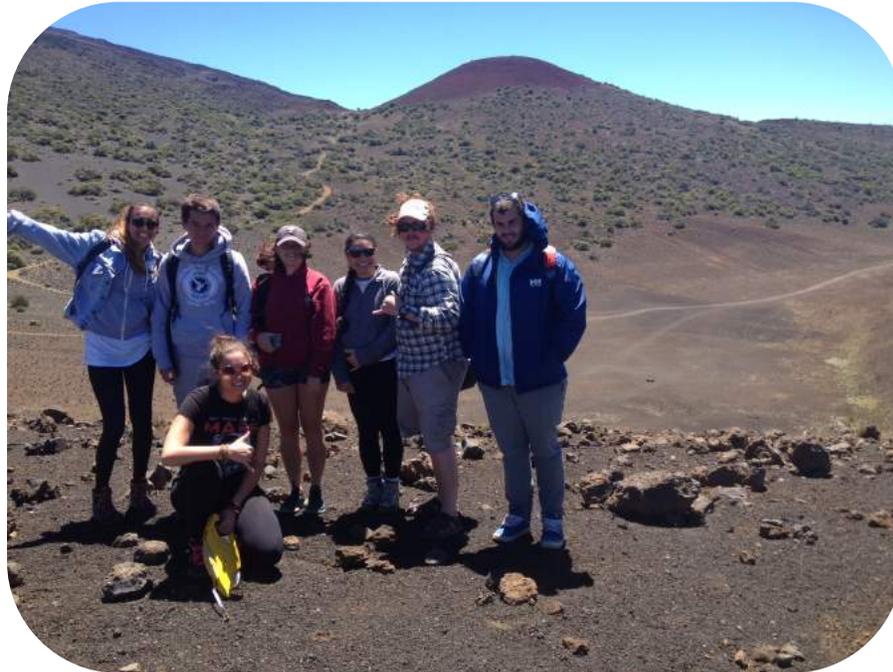


pg. 4

ALSO INSIDE...

Learn more about PISCES' two new analog interns on PG 2!

## PISCES ANALOG INTERNS



Kyla Defore (kneeling) and Ashley Garnett (third from the left) are pictured here during the PISCES' rover field test in July. They're joined with fellow students from the University of Hawai'i at Hilo.

This summer, PISCES welcomed two new analog interns to the team. Ashley Garnett and Kyla Defore (a previous PISCES intern) joined our staff to assist with some of our projects.

Ashley grew up on the Big Island and is a junior at the University of Hawai'i majoring in geology and studying Earth and Space science as a minor. She plans to use her degree to learn more about Earth.

"I believe if we have a better understanding of Earth's geological processes we can better understand exoplanets," she says.

Space has interested her since she first saw a shooting star. Ever since then she's been fascinated with the universe and hopes to one day go to space and visit another planet.

"I know there's so much more out in the universe just waiting for us to find it and explore it," she says.

Kyla is also majoring in geology at the University

of Hawai'i at Hilo. Kyla is from Kaua'i but moved to the Middle East where she grew up as a child. After some traveling, she moved back to Hawai'i to study geology and learn more about her native culture.

*"I know there's so much more out in the universe just waiting for us to find it and explore it..."*

*-Ashley Garnett  
PISCES analog intern*

"I probably became interested in geology because I grew up traveling around the world and experiencing many different environments. I have always been interested in space exploration, and it is something I am very passionate about. I am particularly interested in Martian geology and morphological processes involving surface water," she says.

Kyla also assisted with our summer STARS workshop this year.

Both Kyla and Ashley played a pivotal role in our recent Helelani field test at the PISCES' planetary analog site on Mauna Kea.



Kyla Defore



*Some of PISCES' summer STARS participants are seen here at the Canada-France-Hawai'i Telescope on Mauna Kea.*

## High School Females Reach for the STARS!

Another successful year for PISCES' summer workshop for high school girls

This year the Pacific International Space Center for Exploration Systems (PISCES) had another successful four-day workshop for high school females interested in science, technology, engineering, and mathematics (STEM).

Starting July 19<sup>th</sup>, PISCES and the Canada-France-Hawai'i Telescope teamed up to give eight very bright and talented high school females the opportunity to learn more about science on the Big Island. The program lasted for four days until July 22<sup>nd</sup>.



Ara Uhr from Hilo High School, Stephanie Lewis and Tanya Adams from Kohala High School, Lily Bailey from Kona, Emma Hon from Waiakea High School, Lily Leyva from Kea'au High School, Allison Dupre from

Colony High School in Alaska, and Cappi Winters from Kea'au High School, all participated in the program this year.

On the first day of the workshop, the girls kicked things off with a geode rock activity. Each participant broke up their own geode and learned about the different types of rocks that form here on Earth. PISCES' intern Kyla Defore, a geology major from the University of Hawai'i at Hilo, led the discussion. She later presented her NASA-funded research on Martian gullies to the curious students.

Our Operations Manager Christian Andersen also gave a presentation on our Vertical Take-off/Vertical Landing (VTVL) pad project and answered questions about space science.

Later that afternoon the students went to the PISCES' high bay *Continued on pg. 6*

# PISCES/NASA HELELANI DESIGN REFERENCE MISSION

For the third consecutive year, PISCES conducted an extended Design Reference Mission with its planetary rover Helelani. Each summer PISCES takes Helelani to the field to conduct missions where new systems are tested and characterized and different test objectives are set. This year's reference mission had *three primary objectives*:



*Helelani at night.*

1. Test of the new command and control upgraded system and graphic user interface stations, and characterization of the new power subsystems installed for the electronics and payload systems.
2. Test of a remote Mission Control Center at the PISCES headquarters and evaluate the first actual teleoperations mission of the rover.
3. Allow NASA scientists to get a "hands-on" experience on remotely operating a rover under a simulated lunar time delay in preparation for the Resource Prospector Lunar Mission.

There were three full days of testing. On the first day, Program Manager Rodrigo Romo, along with Robotics Technician Teddy DeRego and summer interns Aaron Roth and Ara Uhr, performed multiple day runs to characterize the power subsystems and test the new navigation and command-control system.

A night test drive was also conducted to test the new night driving mode of the rover.

On the second day of testing, PISCES Executive Director Rob Kelso served as Mission Director for the PISCES MCC/Geology Survey test.

The objective of the mission was to demonstrate the command and control of the PISCES rover and to successfully demonstrate a telerobotic geology mission of a simulated planetary site using remote operations.

PISCES' intern and University of Hawai'i at Hilo student Kyla Defore selected various test sites in the volcanic valley on Mauna Kea using Google EARTH orbital imagery. PISCES staff then navigated the rover to these selected sites from a command center in Hilo to perform remote geologic analysis through the rover imaging cameras.

Kelso says the test was similar to a real-life lunar mission where first a rover would go to a place such as the Moon and scientists (such as Kyla) would remotely investigate its geology from Earth.

He says PISCES' ability to conduct the simulation will interest private companies investigating future lunar missions.

The third day was dedicated to a team of NASA researchers from AMES working on the lunar rover for the Resource Prospector Lunar Mission. Through this experience, NASA scientists received real-life training of what to expect when they attempt to navigate their lunar rover. Using Helelani's Time Delay Emulation capabilities, and its multiple imaging systems, the NASA

scientists maneuvered Helelani across the test valley from their Mission Control Center in California. Later that night, they conducted a second test under complete nighttime conditions. Feedback from NASA was positive and many lessons were learned during the exercise. NASA is already requesting more tests for the future.



NASA Engineers Mark Shirley, Robert Carvalho and Sarah G. Hobart are seen here conducting teleoperations of PISCES' planetary rover Helelani from AMES in California.

*Letter from Director Continued...*

NASA now has its attention on sending humans to Mars, but others are criticizing them for providing no content or schedule on how and when humans will get there. Under President Obama's administration, the Moon was abandoned again and in its place was NASA's Asteroid Retrieval Mission (ARM). ARM, in reality, has received little interest from anyone and may be cancelled after the next presidential election.

But all hope is not lost for the Moon. There has been a growing interest in restarting surface exploration on the Moon by groups other than the U. S. and NASA. China announced planned missions to the lunar surface in the coming years to include human missions. Japan will be sending a small lander to the Moon in 2017. Russia has released information of a planned moonbase. Most prominently, the European Space Agencies (ESA) Director General Johann Wörner has been advocating for an international Moon village and setting up a permanent human outpost on the Moon.

Many a scientist and engineer outside of NASA have advocated for a path of "Mars *by Way of the Moon.*" As lunar scientist Paul Spudis says, "The Moon has VALUE!"

Indeed, the Moon has many strategic advantages in preparing for later missions to Mars:

1. **It's close.** The Moon is *only* 3-days away and offers a close location (as compared with Mars) for testing critical technologies that will later be needed for human journeys to Mars.
2. **It's useful.** The further discovery of resources and most importantly water make the Moon a potential "game-changer." Water can be used for drinking and also can be broken down into hydrogen and oxygen gases for powering fuel cells and for making rocket propellant.
3. **It has much more interesting science waiting for us.** The Apollo astronauts only made brief visits to six places on the Moon.

The Moon is *STILL* exciting, if only to the internationals, the private sector and lunar advocates. Sadly, the recent Republican and Democratic platforms have said only a few words about space and nothing about the Moon.

Whether or not the U.S. and NASA will focus on a more direct Moon-path will be interesting to watch in the new presidential administration. Some surmise that the Moon will be put back on the table.

So, perhaps we might see MOON BASE ALPHA in the not too far future. Major Matt Mason is standing by....

Until next time,



Rob Kelso, PISCES Executive Director

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An image of the popular 1950's classic  
"Project Moonbase."

## STARS Continued...

and had a chance to drive our robotic rover Helelani with PISCES Program Manager Rodrigo Romo.

The following two days consisted of presentations from the staff at the Canada-France-Hawai'i Telescope.

CFH Executive Director Doug Simons provided an introduction to the students while CFH's Outreach Program Manager Mary Beth Laycheck spoke to them about the science performed at the institution.

Later that day the students participated in a cardboard chair challenge. They were separated into two groups and attempted to create a chair out of cardboard that would hold the weight of an adult for at least 15 seconds.

The chairs were tested the next day after a series of lectures that included topics about engineering and astrobiology. Both groups successfully completed the challenge.

The students finished the workshop with a wonderful visit to the summit of Mauna Kea for a sunset tour.

Overall, the students really enjoyed their experience.

"The STARS program was an amazing opportunity to talk one-on-one with experts in STEM fields, make valuable references and have fun while being exposed to the sciences," says Lily Leyva, a STARS participant from Kea'au High School.



PISCES' John Hamilton and CFH's Mary Beth Laycheck are seen here at the summit of Mauna Kea at sunset.



The 2016 Summer STARS crew at PISCES' high bay with our Program Manager Rodrigo Romo.