

# PISCES NEWSLETTER

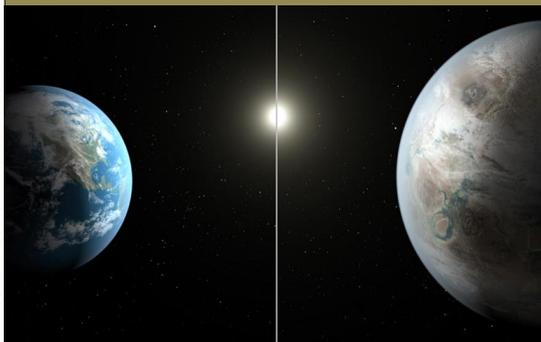
PACIFIC INTERNATIONAL SPACE CENTER FOR EXPLORATION SYSTEMS \* HILO, HAWAII

AUGUST, 2015

VOL #3 ISSUE #8



## NASA's Kepler Team Discovers Close 'Cousin' to Earth



An artist rendering compares Earth (left) to the newly discovered Kepler-452b, which inhabits the "goldilocks zone" where liquid water could be present. Credits: NASA/JPL-Caltech/T. Pyle

NASA's Kepler mission scientists have discovered and confirmed what is being called a "bigger cousin" to Earth some 1,400 light-years away. The new-found planet, dubbed Kepler-425b, orbits a sun similar to our own, and inhabits the "goldilocks zone" where liquid water could be present. Liquid water could potentially support life as we know it.

Kepler-425b is roughly 60% larger in diameter than Earth, but its annual orbit is only slightly longer in duration at 385 days. The Earth-cousin is estimated to be 6 billion years old – 1.5 billion years older than our solar system's sun.

"It's awe-inspiring to consider that this planet has spent 6 billion years in the habitable zone of its star; longer than Earth," said Jon Jenkins, Kepler data analysis lead at NASA's Ames Research Center. "That's substantial opportunity for life to arise, should all the necessary ingredients and conditions for life exist on this planet."

Hawaii's W.M. Keck Observatory atop Maunakea played a part in gathering key measurements to confirm the new-found Kepler. Other facilities included the University of Texas at Austin's McDonald Observatory, and the Fred Lawrence Whipple Observatory on Mt. Hopkins in Arizona.

The confirmation of Kepler-452b brings the total number of confirmed planets by the Kepler mission team to 1,030.

## MESSAGE FROM THE EXECUTIVE DIRECTOR Strategic Partnerships: Stoking the Fire of Space Research and Technology Development

Dear PISCES Friends and Family,

I recently returned to Hawaii from a multi-week trip to the mainland to meet with many of the strategic partners involved with PISCES. These face-to-face exchanges have proved extremely valuable and important in conveying the effective applied research within PISCES, as well as updating the community on aerospace development within the State of Hawaii.

I had the opportunity to meet with many senior leaders during these visits. A PISCES briefing was provided to update senior space leaders on the progress of PISCES projects and assess areas of future collaboration. This included senior managers from academia, the federal government, and the private sector. In each meeting, people were very impressed with the innovative work being done within PISCES and the State of Hawaii. They conveyed "amazement" and "awe" at the accomplishments. Often the comment was: "Gee, why can't we be doing that?" It is extremely evident that there is a strong and positive perspective of PISCES within these external communities outside of Hawaii.

Additionally, a Moon RIDERS project review was held at NASA KSC between PISCES and KSC SwampWorks. Moon RIDERS is a lunar surface flight experiment project between NASA, PISCES, two Hawaii High Schools and the private sector, Google Lunar X-Prize (GLXP).

Likewise, an ACME (Additive Construction for Mobile Emplacement) project review between PISCES and KSC SwampWorks was conducted at the Kennedy Space Center. This NASA Headquarters-sponsored project is designed to develop a robotically-constructed basalt launch/landing pad in Hawaii during FY 2015.

These face-to-face meetings continue to prove their vast worth for PISCES and the State of Hawaii.

Until next time,

*Res Gesta Per Excellentiam*  
(Achievement Through Excellence)

**-Rob Kelso, PISCES Executive Director**

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Rob Kelso, PISCES Executive  
Director

# UNIVERSITY OF HAWAII AT HILO ROBOTICS TEAM PUTS ROVER TO THE TEST

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## *PISCES Moon RIDERS Program Gets \$35K in Grants*



PISCES' Moon RIDERS (Research Investigating Dust Expulsion Removal Systems) program recently got a boost with two generous grant awards totaling \$35K.

The Hawai'i County Department of Research and Development awarded the program \$25K as part of an economic develop initiative to create high-tech jobs. An additional \$10K was awarded by the Hawai'i Community Foundation's THINK Fund, which was established to promote STEM education and 21<sup>st</sup> century job skills.

"The County of Hawai'i supports many initiatives around building a 21<sup>st</sup>-century workforce so that our children can participate in the groundbreaking science happening right here," commented Jane Horike, Economic Development Specialist for the Department of Research and Development. "Moon RIDERS offered a unique opportunity to work on a real NASA project. Beyond all the benefits of supporting STEM in our schools, the excitement of this project will change the lives of these students forever."

Moon RIDERS, a joint partnership between PISCES, NASA, and two Hawai'i high schools, aims to put a student-built lunar experiment on the surface of the Moon in early 2017. The funding will enable the students to configure and integrate NASA-built hardware into a lunar lander as part of the experiment. Preparations are being made to fly the experiment to the surface of the Moon aboard a Google Lunar XPRIZE team's spacecraft in early 2017.

"PISCES greatly appreciates the recently awarded grants from both the County of Hawai'i and Hawai'i Community Foundation," said PISCES Executive Director, Rob Kelso. "The award supports an unprecedented opportunity for Hawai'i's students, the state, and the greater endeavor of space exploration."

Roughly 70 Hawai'i students from 'Iolani School in Honolulu and Kealakehe High School in Kailua-Kona are involved in Moon RIDERS, which began last fall.

## **Student-built Mining Robot Doesn't Disappoint**



*Above: "Spock" is UH-Hilo's very first planetary rover and has proved its worth as an effective mining robot.*

The University of Hawaii at Hilo's Space Robotics Team has successfully built from scratch the school's very first planetary mining rover. And by competition standards, it's a contender.

Ethan Paguirigan, Carli Hand, and Daryl Albano comprise the core team that designed and built the rover - appropriately named "Spock" after UH-Hilo's mascot, "The Vulcans" - from scratch over the course of a semester. They intended to enter NASA's annual Robotic Mining Competition (RMC) at Kennedy Space Center, which challenges college teams to build a space-worthy mining rover that can effectively mine and haul regolith, or dirt.

Though they ran short on time, the students were able to test Spock's prowess on July 28 for the very first time at a PISCES Martian-simulation site as part of the 2015 PRISM (PISCES Robotic International Space Mining) event.

"It went spectacular," said Ethan Paguirigan, UH student and team leader of the robotics group who tackled the mechanical design of the rover. "The entire system was untested... it was all a big mystery."

Operating the robot remotely from Gemini Observatory Headquarters in Hilo some 30 miles away, students initially faced some challenges. But any uncertainty about Spock's capabilities were soon put to rest after the rover hauled 2.5 pounds of dirt and gravel, qualifying it by NASA competition standards as a contender.

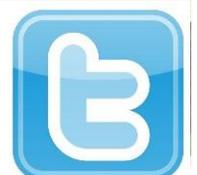
Following their first successful field test, Ethan, Carli, and Daryl are looking at an ambitious upgrade for Spock - autonomous operation. Their goal is to integrate sensors into the rover that will allow it to know where it is and what it is doing without a driver. With this in mind, the team intends to enter Spock in NASA's 2016 RMC - boldly going where no UH students have gone before.



Left - UH Hilo's space robotics team (L-R): Ethan Paguirigan, Carli Hand, and Daryl Albano are the brainchildren behind "Spock," the school's very first planetary mining rover.

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# NEW HORIZONS SPACECRAFT MEETS PLUTO

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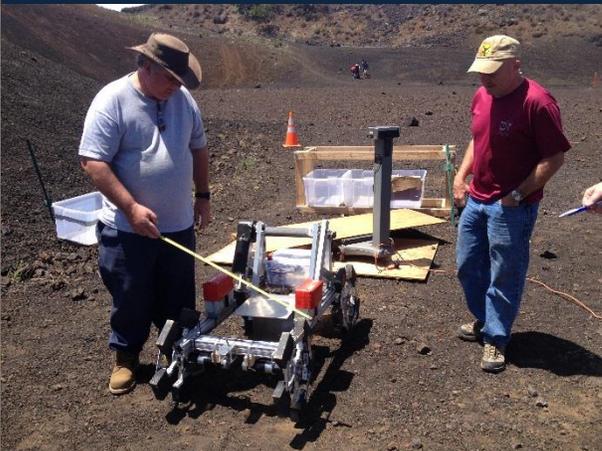
## UH-Hilo Robotics Team *cont...*

Ethan, a mechanical engineering major, says he got into robots after seeing Marvel's first installment of Ironman on the big screen. Carli is double-majoring in math and electrical engineering; Daryl is the programming wiz behind Spock with his studies directed in computer science.

Spock's simple design and unique features speak for its performance. The battery-operated, 125-pound rover is about the size of a large lawn mower, but would eat any yard maintenance device alive with its rugged four-wheel-drive design. Using "wlegs," or spoked "wheel legs" made of wooden pegs, the rover has superior traction and mobility on rugged, rocky surfaces. The frame is made of light-weight aluminum and houses a cleanly-welded shovel to scoop dirt and gravel using an actuator from an electric wheel chair.

Besides innovating the design and build of a really cool robot, UH-Hilo's space robotics team is also advancing the technology of ISRU – *in-situ resource utilization*. ISRU involves "living off the land" by utilizing local materials like regolith for creating usable resources and infrastructure. On other planets, this might look like space shelters, breathable oxygen, and rocket fuel. All from dirt you ask? Yes. And it's becoming more of a potential reality thanks to the hard work of scientists and students alike.

Congrats to the UH-Hilo space robotics team on their hard work and success!



Above: Judges assess Spock during its very first field test mining dirt and gravel at a PISCES martian simulation test site during PRISM. The UH-Hilo space robotics team was happy with the rover's results, which proved its capacity as a NASA RMC contender.

## PISCES Commends New Horizons Team on Mission Success!



*New Horizons captured this detailed view of Pluto some 476,000 miles away. The photo took 4.5 hours to transmit 3 billion miles back to Earth. Credits: NASA/APL/SwRI*

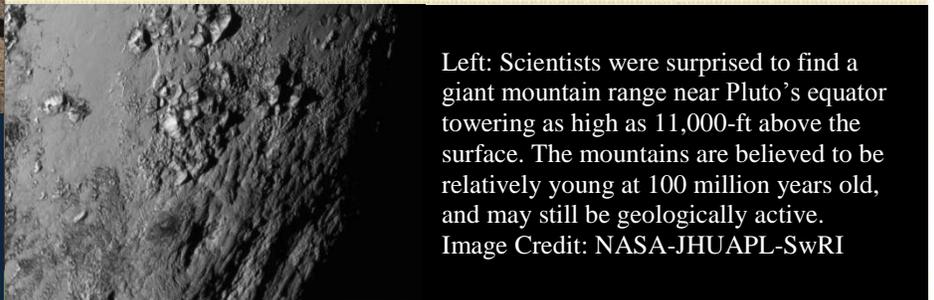
Eighty-five years ago, astronomer Clyde W. Tombaugh discovered Pluto at the Lowell Observatory in Flagstaff, Arizona. On July 14, NASA's New Horizons spacecraft completed a close encounter with the distant dwarf planet for the first time in history.

"With the successful flyby of Pluto we are celebrating the capstone event in a golden age of planetary exploration," said Dr. John Grunsfeld, associate administrator for NASA's Science Mission Directorate. "While this historic event is still unfolding, with the most exciting Pluto science still ahead of us, a new era of solar system exploration is just beginning."

Several discoveries have been revealed since the spacecraft's approach, including a heart-shaped surface feature, confirmation of a polar ice cap, and an exact determination of the dwarf planet's size – larger than previously thought at 1,473 miles wide. Since the flyby, scientists say Pluto's surface is one of the youngest ever seen in the solar system, and may call into question current theories of planetary geology.

High-resolution imagery of Pluto captured by New Horizons has revealed an icy mountain range climbing to 11,000 feet above the distant planet's surface. Pluto's largest moon, Charon, also came into crystal-clear focus for the first time, showing a "youthful and varied" terrain.

While these initial findings have been exhilarating for the mission team, there is still much more to come. The complete set of data will take about 16 months to transmit back to Earth. *(Continued on next page...)*



Left: Scientists were surprised to find a giant mountain range near Pluto's equator towering as high as 11,000-ft above the surface. The mountains are believed to be relatively young at 100 million years old, and may still be geologically active. Image Credit: NASA-JHUAPL-SwRI

## NEW HORIZONS SPACECRAFT MEETS PLUTO *cont...*

New Horizons traveled 3 billion miles over the last 10 years to encounter Pluto and its moons. The far-flung mission was first conceived in 1989 when Stern posed the question at NASA Headquarters, "Why aren't we starting a mission to Pluto?" His question led to an inspired, determined effort to make the dream a reality.

Even with 2.5 million pounds of rocket thrust aboard the U.S.A.'s largest rocket, Atlas 5, New Horizons still needed an extra boost to reach Pluto in a timely manner. Through painstaking calculations, mission scientists used a fortuitous flyby of Jupiter to give the spacecraft a gravity-assisted boost, shortening travel time by a full three years.

New Horizons is now poised to answer some fundamental questions about the Pluto system: What does Pluto and its largest moon, Charon, look like? What are they made of? How do their atmospheres behave?

With seven of the most powerful instruments ever sent on a first fly-by to another planet (and all powered by less energy than a 60-watt light bulb), the spacecraft is well-prepared to answer these questions.

Though July 14 marks the culmination of the New Horizons mission at its closest approach, it also heralds a new chapter in planetary science. After its historic pass, the spacecraft will continue its groundbreaking exploration by visiting other bodies in the Kuiper Belt – an outer region of icy objects ranging from boulders to Pluto-sized dwarf planets – and if all goes to plan, shed further light on the

*Left: A composite image captures Pluto and its largest moon, Charon, just hours before New Horizons' closest approach. Charon (shown right), nearly half the size of Pluto, surprised scientists with its lack of surface craters. The moon is thought to be geologically very young. Image Credits: NASA/JHUAPL/SwRI*



## WE ARE LIVE!!!

Check Out PISCES on the Web!



[PISCES.HAWAII.GOV](http://PISCES.HAWAII.GOV)



## ABOUT US

PISCES is a Hawaii State Government Aerospace Agency located in beautiful Hilo, Hawaii. The research and education/training center is part of the State Department of Business, Economic Development, and Tourism (DBEDT), and conducts environmentally safe field demonstrations to test and validate innovative space technologies on Hawaii's volcanic terrain under the jurisdiction of the Hawaii State Department of Land and Natural Resources (DLNR).

### *NASA Selects Astronauts for First U.S. Commercial Spaceflights*

Four American commercial space astronauts have been selected by NASA as part of an initiative to strengthen the U.S.' role in space exploration and expand deep-space travel.

Robert Behnken, Sunita Williams, Eric Boe, and Douglas Hurley have been chosen to begin spaceflight training in preparation for a launch in 2017. They will be the first American astronauts to fly aboard a U.S. commercial spaceflight.

The selection takes a big step towards NASA's goal of manned spaceflight to Mars, as well as other deep space exploration missions. NASA Administrator Charles Bolden says commercial partnerships have enabled the organization to dream big:

"By working with American companies to get our astronauts to the ISS, NASA is able to focus on game-changing technologies, the Orion spacecraft and the Space Launch System (SLS) rocket that are geared toward getting astronauts to deep space."



NASA's new commercial crew (from left to right, top to bottom): Bob Behnken, Eric Boe, Doug Hurley and Sunita Williams. Credit: NASA

