

**PISCES Planetary Analog Site Current & Future Uses** . J. C. Hamilton<sup>1,2</sup>, C. Andersen<sup>1,2</sup>, R. M. Kelso<sup>1</sup> and R. Romo<sup>1</sup>, <sup>1</sup>Pacific International Space Center for Exploration Systems (PISCES), 99 Aupuni St, St 212-213, Hilo, HI 96720; [rkkelso54@gmail.com](mailto:rkkelso54@gmail.com), [rfrvromo@gmail.com](mailto:rfrvromo@gmail.com). <sup>2</sup>Dept. of Physics & Astronomy, University of Hawai'i - Hilo, 200 West Kawili St., Hilo Hawai'i 96720; [jch@hawaii.edu](mailto:jch@hawaii.edu), [canderse@hawaii.edu](mailto:canderse@hawaii.edu).

**Introduction:** The PISCES Lunar and Martian analog test site has been upgraded and repurposed for Google Lunar X-Prize (GLXP) teams and future government projects.

**Google Lunar X-Prize:** The GLXP Hungarian Team Puli Space[1] conducted a week long field test in December. This occurred at the PISCES Planetary Analog site at the 9,000 ft elevation level of Mauna Kea on the island of Hawaii. There are currently 18 teams competing for the \$30M prize.



Their test involved two rover prototypes and verified mission control scenarios. A newly installed portable wifi relay unit was deployed to increase bandwidth from the site to the internet hub at nearby Hale Pohaku one mile away. The team commanded the rover from a Mission Control in Budapest, Hungary. A complete mission scenario was performed, including a 600 meter remotely driven trek, and concluding "selfie" photo. [2] The rover's stereoscopic cameras imaged the test team at the 600m finish line, transmitting it back to Hungary. The team also simultaneously controlled 2 rovers from their remote control base. This was a demonstration of capabilities prior to the formal team selections for the Terrestrial Milestone prizes.

In order to spur activity, GLXP [3] announced the establishment of a series of Terrestrial Milestone Prizes. These prizes are for demonstrating (via actual testing and analysis) robust hardware and software to combat key technical risks in the areas of imaging, mobility and lander systems. In February of 2014, several leading teams were selected to compete for the \$6M purse [4]. PISCES has solicited these teams for consideration of our test site.

**Government Uses:** PISCES has embarked on a marketing campaign to advertise the availability of this test site (and others on island) to US and foreign governments. Potential customers include Indian Space

Research Organisation (ISRO) and the China National Space Administration (CNSA) for Lunar and Martian rover tests.

The successful 2008, 2010 and 2012 ISRU analog tests performed by NASA/CSA have resulted in the Regolith and Environment Science and Oxygen & Lunar Volatile Extraction (RESOLVE) being moved into a mission called the Resource Prospector Mission (RPM). This is being notionally targeted for launch in 2018. Once flown, RPM would be the US's first attempt to demonstrate in-situ resource utilization (ISRU) beyond Earth. More RPM mission profile tests are expected to develop for which the site would be prime.

In 2014, PISCES accepted loan of a Juno rover from Ontario Drive and Gear. This mobility platform is planned to be the basis for various payload and avionics testing, some of which could couple with the RPM needs.

Planning is also underway for lava tube entry and exploration technologies as analogs for the Lunar and Martian skylights recently imaged by Lunar Reconnaissance Orbiter (LRO) and the Mars Reconnaissance Orbiter (MRO)

**References:** [1] Google Lunar X-Prize - Team Puli <http://www.googlelunarxprize.org/teams/team-puli>  
[2] *Hungarian Rover takes 'panoramic selfie' to complete Google Lunar XPRIZE mission simulation in Hawaii*, January 15, 2014. [PHYS.org http://phys.org/news/2014-01-hungarian-rover-panoramic-selfie-google.html](http://phys.org/news/2014-01-hungarian-rover-panoramic-selfie-google.html) [3] Alex Hall, *Recognizing Giant Leaps: Google Lunar XPRIZE Establishes Milestone Prizes* (Op-Ed), Space.com Nov. 7, 2013. <http://www.space.com/23503-google-lunar-xprize-milestone-prizes.html>. [4] D. Werner, *Google Lunar X Prize Readies \$6 Million in Milestone Prizes for Moonbound Hopfuls*, SpaceNews Feb 19, 2014. <http://www.spacenews.com/article/features/39546google-lunar-x-prize-readies-6-million-in-milestone-prizes-for-moonbound> [5] D. Messier, *NASA, CSA Plan Lunar Water Extraction Mission*, Jan. 30, 2014 Parabolic Arc

**Additional Information:** More information about the PISCES field site can be obtained by email from the first author and Logistics Manager. A field users guide and project initiation form are also available. See also <http://www.pacificspacecenter.com/>