HOUSE OF REPRESENTATIVES
TWENTY-SEVENTH LEGISLATURE, 2014
STATE OF HAWAII

# H.B. NO. 2472

# A BILL FOR AN ACT

RELATING TO THE PACIFIC INTERNATIONAL SPACE CENTER FOR EXPLORATION SYSTEMS.

**BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF HAWAII:**

PART I

SECTION 1. Pursuant to Act 169, Session Laws of Hawaii 2012, and Act 273, Session Laws of Hawaii 2013, Pacific international space center for exploration systems was established to support the development of a world-class center of excellence in Hawaii to facilitate the design, testing and validation of new technologies to support both robotic and human missions to space. The ultimate goal of Pacific international space center for exploration systems is to establish an aerospace research and development park that will serve as an economic driver for the State, promoting the establishment and growth of new sustainable and green industries; associated jobs; workforce development; internships; and science, technology, engineering, and math education programs.

In concert with this goal, Pacific international space center for exploration systems has been working with the department of accounting and general services, along with

Ferraro Choi and Associates, to design a state-of-the-art facility in Hawaii that can accommodate the growing interest expressed by the National Aeronautics and Space Administration, international space agencies, and the commercial space sector in using our State's unique lunar and Mars analog sites to develop, test and validate communications, renewable energy, advanced manufacturing, and other technologies that can support planetary exploration, as well as innovative applications of these technologies to enhance the qualities of life in Hawaii (such as the development of three dimensional printing that can utilize local basaltic materials, as an alternative to imported concrete, for construction).

The near-term objective of the Pacific international space center for exploration systems is to develop a testing and checkout facility to accommodate the assembly of space hardware, software loading, interface verification, electro-mechanical analysis, and other critical analyses prior to demonstrating and evaluating these technologies and integrated systems at the Pacific international space center for exploration systems field sites on the island of Hawaii. An operations control room would also be outfitted to support data processing, command and control, and uplink interfaces with spacecraft, as well as to



serve as a command and operations center for the laser optical communications ground station proposed for the island of Hawaii.

The Pacific international space center for exploration systems has also generated significant interest in applied research and development for planetary surface systems technologies, with participation from the federal, public, and private sectors, as well as universities and international organizations. Furthermore, the Pacific international space center for exploration systems has demonstrated considerable progress toward advancing these technologies using the world-class, basaltic planetary analog test sites uniquely found in the Hawaiian Islands.

Research and development in areas of planetary sustainability and resource utilization continue to demonstrate considerable potential for advancing dual-use technologies that can assist the State of Hawaii in becoming increasingly self-sufficient in renewable energy, broadband communications, advanced manufacturing, and other critical areas for development, as well as provide multiple opportunities for economic and workforce development through strategic partnerships with both public and private research and development entities nationwide and overseas.



As such, the Pacific international space center for exploration systems should continue to explore and pursue research and development programs for planetary surface system technologies in five strategic areas. These five strategic areas include:

(1) Basaltic construction and fabrication. Three dimensional printing is being developed and utilized to support a broad range of applications in architecture, civil engineering, robotics, and aerospace. Pacific international space center for exploration systems research in basaltic concrete and construction has the potential for advancing multiple technologies in additive manufacturing for rapid prototyping, parts production, and construction using three dimensional printing with novel materials.

For example, cement is the traditional "glue" that holds aggregates together to form concrete. Producing cement is an energy-intensive process that is estimated to account for five to seven per cent of global carbon dioxide emissions. Hawaii pays a premium for cement and imports over three hundred thousand metric tons per year to meet demand. This

represents large economic and environmental costs to the State.

Pacific international space center for exploration systems can help reduce these imports (and associated costs) by partnering with the University of Hawaii, the National Aeronautics and Space Administration, and other industry experts to perform applied research that can characterize and mature alternative binder technologies (using indigenous and "waste" by-products in Hawaii) to produce basalt-based construction materials for building homes, highways, and other structures statewide.

(2) In-situ resource utilization. A key requirement for space exploration is the ability to "live off the land" using indigenous resources found on planetary surfaces. Pacific international space center for exploration systems has acquired a planetary rover on long-term loan from Ontario Drive and Gear in Canada that will enable the development, testing, and validation of integrated resource extraction technologies. The goal is to develop and demonstrate end-to-end technologies associated with "dust to

thrust" capabilities - that is, extracting oxygen from Hawaii basalts, filtering water, separating the water into hydrogen/oxygen gases, pumping the gases into a hydrogen fueling station, and transferring gases from the refueling station into gas cylinders on the rover - which in turn will expand Hawaii's role as a premier site for the development, testing, and validation of planetary surface system technologies.

(3) Planetary analog test site development. The island of Hawaii's unique geology enables Pacific international space center for exploration systems to provide a world-class test site with terrain that closely simulates the surface of the moon and Mars. Since 2007, the island of Hawaii has been used to support robotic and other technology testing and validation by the National Aeronautics and Space Administration, private industry, and international space agencies. The provision of additional power, mechanical systems, and communications infrastructure required to enable technology testing and validation requirements for future robotic and human missions to the moon and Mars on the island of Hawaii will secure Hawaii's role as a



global leader in the development of planetary surface system technologies.

(4) Secondary school lunar surface flight experimentation. The moon and Mars present difficult challenges to exploration, chief among them being dust. Surface dust consists mostly of a powder that is abrasive and clings stubbornly to such surfaces as solar arrays, radiators, viewports, and spacesuits. During the Apollo missions, three days of exposure to the lunar environment rendered some parts of spacesuits unusable. There also is evidence suggesting this dust may be electrostatically charged.

The National Aeronautics and Space Administration's Kennedy Space Center has made some remarkable breakthroughs in technologies to counter this dust issue. The technique employed, through an electric grid, has been shown to lift and transport particles using electrostatic forces. This technology, while working well in the laboratory, has never been applied to space applications on the moon.

Pacific international space center for exploration systems, in partnership with the National

Aeronautics and Space Administration's Kennedy Space Center, NanoRacks, and three Hawaii-based high schools will plan, design, develop and test a dust-removal experiment to be flown on a 2015 Google lunar x-prize mission to the lunar surface. Pacific international space center for exploration systems has already secured a grant valued at $3,200,000 from the Google lunar x-prize team to cover the transportation cost to the lunar surface.

(5) International robotics mining competition development. The National Aeronautics and Space Administration's Lunabotics Challenge has been among the most successful college-level robotics competitions. Attracting the best and brightest from around the world (involving fifty teams, one-third of which are international), this event is held annually at the National Aeronautics and Space Administration's Kennedy Space Center and combines all the hallmarks of science, technology, engineering, and math education, space exploration, and teamwork, embracing a "failure is not an option" attitude.

The National Aeronautics and Space Administration has now refocused this event as a national competition for college teams targeting Mars. There is also a demand for a global competition with college engineers and space science students, and Pacific international space center for exploration systems is working with international aerospace contacts to foster regional competitions modeled on the National Aeronautics and Space Administration's Lunabotics Challenge.

The purpose of this Act is to foster the development of technologies that will expand and diversify economic and workforce development opportunities statewide and advance Hawaii's leadership in the aerospace field by:

(1) Appropriating funds for the Pacific international space center for exploration systems to explore and pursue research and development programs for planetary surface system technologies in five strategic areas; and

(2) Authorize the issuance of general obligation bonds to support development of the Pacific international space center for exploration systems testing facility and

operations control room for a proposed research and development park.

PART II

SECTION 2. There is appropriated out of the general revenues of the State of Hawaii the sum of $1,375,738 or so much thereof as may be necessary for fiscal year 2014-2015 for Pacific international space center for exploration systems for the exploration and pursuit of research and development programs for planetary surface system technologies in five strategic areas including basaltic construction and fabrication; in-situ resource utilization; planetary analog test site development; secondary school lunar surface flight experiments; and international robotics mining competition development; provided that the sum of $730,738 shall be used for personnel costs, operational expenses, and general and administrative expenses of the Pacific international space center for exploration systems to carry out the purposes of this part and the sum of $645,000 shall be used for the research and development programs for planetary surface system technologies.

The sum appropriated shall be expended by the department of business, economic development, and tourism for the purposes of this part.



PART III

SECTION 3. The director of finance is authorized to issue general obligation bonds in the sum of $1,500,000 or so much thereof as may be necessary and the same sum or so much thereof as may be necessary is appropriated for fiscal year 2014-2015 for the development of a Pacific international space center for exploration systems research and development park; provided that of the appropriation authorized under this section, $1,300,000 shall be used for land acquisition and $200,000 shall be used for costs associated with the land acquisition including but not limited to subdivision approval process costs; property valuation appraisal report costs; land title search report costs; site environmental assessments; and pre-design tasks such as traffic studies, soil borings, and topographic surveys.

SECTION 4. The appropriation made for the capital improvement project authorized by this part shall not lapse at the end of the fiscal biennium for which the appropriation is made; provided that all moneys from the appropriation unencumbered as of June 30, 2016, shall lapse as of that date.

SECTION 5. The sum appropriated under this part shall be expended by the department of business, economic development, and tourism for the purposes of this part.



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PART IV

SECTION 6. This Act shall take effect on July 1, 2014.

INTRODUCED BY: _____

JAN 2 2 2014

# H.B. NO. 2412

**Report Title:**
Pacific International Space Center for Exploration Systems; Program Development; Appropriation

**Description:**
Appropriates funds for the exploration and pursuit of research and development programs for planetary surface system technologies in specified areas. Authorizes the issuance of general obligation bonds for the development of a research and development park. Appropriation. Effective July 1, 2014.

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