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

H.B. NO. 2152 H.D. 1 S.D. 1

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:

SECTION 1. The legislature finds that the Pacific international space center for exploration systems stimulates economic growth for the State, promoting the establishment and growth of new sustainable and green industries, associated jobs, workforce development, internships, and science, technology, engineering, and mathematics education programs. The Pacific international space center for exploration systems has generated significant interest in applied research and development for planetary surface systems technologies, with participation from the public and private sectors, as well as international organizations. The Pacific international space center for exploration systems is advancing these technologies using the world-class, basaltic planetary analog test sites uniquely found in the State.

The legislature further finds that 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 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 public and private research and development groups worldwide. Accordingly, the Pacific international space center for exploration systems will continue to explore and pursue research and development programs for planetary surface system technologies in five strategic areas.

The first area to be developed is the fabrication of basaltic-based construction materials as an alternative to cement. Three-dimensional printing is being developed and utilized to support a broad range of applications in architecture, civil engineering, robotics, and aerospace. The 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. Cement production is an

energy-intensive process that accounts for approximately five to seven per cent of global carbon dioxide. Production generates high environmental and economic costs, as the State pays a premium for cement and imports over three hundred thousand metric tons per year to meet demand.

The Pacific international space center for exploration systems can help reduce cement imports and costs by conducting applied research that can characterize and advance alternative binder technologies, using indigenous and "waste" byproducts of the State, to produce basalt-based construction materials for building homes, highways, and other structures statewide, in partnership with the University of Hawaii, National Aeronautics and Space Administration, and industry. Funding allocated through this Act will be used to perform applied research in three-dimensional printing of fabricated parts using the State's basalt fines, as well as researching the use of basalt material for construction.

The second area to be developed is in-situ resource use and integrated resource extraction technologies. A key requirement for space exploration is the ability to "live off the land" using indigenous resources found on planetary surfaces. The Pacific international space center for exploration systems has

acquired a planetary rover on long-term loan from Ontario Drive and Gear in Canada to 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 of extracting oxygen from Hawaii basalts, filtering the water, separating the water into hydrogen and oxygen, pumping gases into a hydrogen fueling station, and transferring gases from the refueling station into gas cylinders on the rover. This will expand the State's role as a premier site for the development, testing, and validation of planetary surface system technologies. Funding allocated through this Act will be used to design, develop, and test an integrated Pacific international space center for exploration systems in-situ resource utilization test facility with robotics, fuel cells, oxygen extraction, hydrogen storage, and aerial and hopper technologies. Funds will also support modification of equipment from the National Aeronautics and Space Administration, as well as the transportation of equipment and selected industry partners to the State for program integration.

The third area to be developed is the planetary analog test site. The island of Hawaii's unique geology enables the 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, this site 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. Funding allocated through this Act will be used to provide the 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, which in turn will secure the State's role as a global leader in the development of planetary surface system technologies.

The fourth area to be developed is the secondary school lunar surface flight experiment. 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 surfaces including solar arrays, radiators, viewports, and spacesuits. During the Apollo missions, three days of exposure to the lunar environment rendered some parts of the spacesuit unusable. There also is evidence suggesting this dust may be electrostatically charged.

The National Aeronautics and Space Administration Kennedy Space Center has made remarkable breakthroughs in technologies to counter the 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.

The Pacific international space center for exploration systems, in partnership with the National Aeronautics and Space Administration Kennedy Space Center, NanoRacks, and three Hawaii 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. The Pacific international space center for exploration systems has secured a grant from a Google Lunar X-Prize team to cover the transportation cost to the lunar surface, valued at $3,200,000. Funding allocated through this Act will be used to design, develop, test, and evaluate flight hardware.

The fifth and final area to be developed is the international robotics mining competition. The National Aeronautics and Space Administration lunabotics challenge has been among the most successful college robotics competitions.

Attracting the best and brightest from around the world, this event is held annually at the Kennedy Space Center and combines all the hallmarks of science, technology, education, and mathematics education, space exploration, and teamwork, embracing a "failure is not an option" attitude.

The National Aeronautics and Space Administration has refocused this event as a national competition for college teams targeting Mars. There is a demand for a global competition with college engineers and space science students. The 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 lunabotics challenge. Funding allocated through this Act will be used to facilitate and coordinate an international robotics competition in the State during the summer of 2014.

Pursuant to Act 169, Session Laws of Hawaii 2012, and Act 273, Session Laws of Hawaii 2013, the 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 goal is to establish an aerospace research and development park that will serve as an economic stimulus for the State, promoting the establishment and growth of new sustainable and green industries, with associated workforce development, high paying jobs, internships, and science, technology, education, and mathematics education programs.

The legislature additionally finds that 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 the State to accommodate the growing interest expressed by the National Aeronautics and Space Administration, international space agencies, and the commercial space sector in using the 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 the State.

The near-term objective 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 to uplink interfaces with spacecraft; and serve as a command and operations center for the laser optical communications ground station proposed for the island of Hawaii.

The purpose of this Act is to provide appropriate funds to enable the five planetary surface systems initiatives that will advance the State's leadership in aerospace, as well as to support development of the Pacific international space center for exploration systems' proposed research and development park, collectively fostering the development of technologies that will expand and diversify economic and workforce development opportunities throughout the State.

SECTION 2. There is appropriated out of the general revenues of the State of Hawaii the sum of $ or so much thereof as may be necessary for fiscal year 2014-2015 for the purpose of executing the Pacific international space center for exploration systems' five planetary surface systems initiatives described in section 1 of this Act and for the

center's general and administrative tasks. Of the funds appropriated, $730,738 shall be used to support the Pacific international space center for exploration systems' general and administrative tasks, and $645,000 shall be used to fund the five strategic Pacific international space center for exploration systems program initiatives.

The sum appropriated shall be expended by the Pacific international space center for exploration systems for the purposes of this Act.

SECTION 3. The director of finance is authorized to issue general obligation bonds in the sum of $10,000,000 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 purpose of supporting the development of the Pacific international space center for exploration systems' research and development park as follows:

Planning	$1,000,000
Design	$1,000,000
Construction	$8,000,000
Total funding	$10,000,000

The sum appropriated shall be expended by the Pacific international space center for exploration systems for the purposes of this Act.

SECTION 4. The appropriation made for the capital improvement project authorized by section 3 of this Act 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. This Act shall take effect on January 20, 2050.

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Report Title:
Pacific International Space Center for Exploration Systems; Appropriation; General Obligation Bonds

Description:
Appropriates funds to the Pacific international space center for exploration systems to support administrative and general tasks, strategic program initiatives, and the preliminary development of the Pacific international space center for exploration systems' research and development park. Effective January 20, 2050. (SD1)

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