
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:

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

15 The legislature further finds that research and development
16 in areas of planetary sustainability and resource utilization
17 continue to demonstrate considerable potential for advancing



1 dual-use technologies that can assist the State in becoming
2 increasingly self-sufficient in renewable energy, broadband
3 communications, advanced manufacturing, and other critical areas
4 for development, as well as provide multiple opportunities for
5 economic and workforce development through strategic
6 partnerships with public and private research and development
7 groups worldwide. Accordingly, the Pacific international space
8 center for exploration systems will continue to explore and
9 pursue research and development programs for planetary surface
10 system technologies in five strategic areas.

11 The first area to be developed is the fabrication of
12 basaltic-based construction materials as an alternative to
13 cement. Three-dimensional printing is being developed and
14 utilized to support a broad range of applications in
15 architecture, civil engineering, robotics, and aerospace. The
16 Pacific international space center for exploration systems'
17 research in basaltic concrete and construction has the potential
18 for advancing multiple technologies in additive manufacturing
19 for rapid prototyping, parts production, and construction using
20 three-dimensional printing with novel materials.

21 For example, cement is the traditional "glue" that holds
22 aggregates together to form concrete. Cement production is an



1 energy-intensive process that accounts for approximately five to
2 seven per cent of global carbon dioxide. Production generates
3 high environmental and economic costs, as the State pays a
4 premium for cement and imports over 300,000 metric tons per year
5 to meet demand.

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

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



1 acquired a planetary rover on long-term loan from Ontario Drive
2 and Gear in Canada to enable the development, testing, and
3 validation of integrated resource extraction technologies. The
4 goal is to develop and demonstrate end-to-end technologies
5 associated with "dust to thrust" capabilities of extracting
6 oxygen from Hawaii basalts, filtering the water, separating the
7 water into hydrogen and oxygen, pumping gases into a hydrogen
8 fueling station, and transferring gases from the refueling
9 station into gas cylinders on the rover. This will expand the
10 State's role as a premier site for the development, testing, and
11 validation of planetary surface system technologies. Funding
12 allocated through this Act will be used to design, develop, and
13 test an integrated Pacific international space center for
14 exploration systems in-situ resource utilization test facility
15 with robotics, fuel cells, oxygen extraction, hydrogen storage,
16 and aerial and hopper technologies. Funds will also support
17 modification of equipment from the National Aeronautics and
18 Space Administration, as well as the transportation of equipment
19 and selected industry partners to the State for program
20 integration.

21 The third area to be developed is the planetary analog test
22 site. The island of Hawaii's unique geology enables the Pacific



1 international space center for exploration systems to provide a
2 world-class test site with terrain that closely simulates the
3 surface of the moon and Mars. Since 2007, this site has been
4 used to support robotic and other technology testing and
5 validation by the National Aeronautics and Space Administration,
6 private industry, and international space agencies. Funding
7 allocated through this Act will be used to provide the
8 additional power, mechanical systems, and communications
9 infrastructure required to enable technology testing and
10 validation requirements for future robotic and human missions to
11 the moon and Mars, which in turn will secure the State's role as
12 a global leader in the development of planetary surface system
13 technologies.

14 The fourth area to be developed is the secondary school
15 lunar surface flight experiment. The moon and Mars present
16 difficult challenges to exploration, chief among them being
17 dust. Surface dust consists mostly of a powder that is abrasive
18 and clings stubbornly to surfaces including solar arrays,
19 radiators, viewports, and spacesuits. During the Apollo
20 missions, three days of exposure to the lunar environment
21 rendered some parts of the spacesuit unusable. There also is
22 evidence suggesting this dust may be electrostatically charged.



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

8 The Pacific international space center for exploration
9 systems, in partnership with the National Aeronautics and Space
10 Administration Kennedy Space Center, NanoRacks, and three Hawaii
11 high schools, will plan, design, develop, and test a dust-
12 removal experiment to be flown on a 2015 Google Lunar X-Prize
13 mission to the lunar surface. The Pacific international space
14 center for exploration systems has secured a grant from a Google
15 Lunar X-Prize team to cover the transportation cost to the lunar
16 surface, valued at \$3,200,000. Funding allocated through this
17 Act will be used to design, develop, test, and evaluate flight
18 hardware.

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



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

6 The National Aeronautics and Space Administration has
7 refocused this event as a national competition for college teams
8 targeting Mars. There is a demand for a global competition with
9 college engineers and space science students. The Pacific
10 international space center for exploration systems is working
11 with international aerospace contacts to foster regional
12 competitions modeled on the National Aeronautics and Space
13 Administration lunabotics challenge. Funding allocated through
14 this Act will be used to facilitate and coordinate an
15 international robotics competition in the State during the
16 summer of 2014.

17 Pursuant to Act 169, Session Laws of Hawaii 2012, and Act
18 273, Session Laws of Hawaii 2013, the Pacific international
19 space center for exploration systems was established to support
20 the development of a world-class center of excellence in Hawaii
21 to facilitate the design, testing, and validation of new
22 technologies to support both robotic and human missions to



1 space. The goal is to establish an aerospace research and
2 development park that will serve as an economic stimulus for the
3 State, promoting the establishment and growth of new sustainable
4 and green industries, with associated workforce development,
5 high paying jobs, internships, and science, technology,
6 education, and mathematics education programs.

7 The legislature additionally finds that Pacific
8 international space center for exploration systems has been
9 working with the department of accounting and general services,
10 along with Ferraro Choi and Associates, to design a state-of-
11 the-art facility in the State to accommodate the growing
12 interest expressed by the National Aeronautics and Space
13 Administration, international space agencies, and the commercial
14 space sector in using the State's unique lunar and Mars analog
15 sites to develop, test, and validate communications, renewable
16 energy, advanced manufacturing, and other technologies that can
17 support planetary exploration, as well as innovative
18 applications of these technologies to enhance the qualities of
19 life in the State.

20 The near-term objective is to develop a testing and
21 checkout facility to accommodate the assembly of space hardware,
22 software loading, interface verification, electro-mechanical



1 analysis, and other critical analyses prior to demonstrating and
2 evaluating these technologies and integrated systems at the
3 Pacific international space center for exploration systems field
4 sites on the island of Hawaii. An operations control room would
5 also be outfitted to support data processing, command, and
6 control, and to uplink interfaces with spacecraft; and serve as
7 a command and operations center for the laser optical
8 communications ground station proposed for the island of Hawaii.

9 The purpose of this Act is to provide appropriate funds to
10 enable the five planetary surface systems initiatives that will
11 advance the State's leadership in aerospace, as well as to
12 support development of the Pacific international space center
13 for exploration systems' testing facility and operations control
14 room for the proposed research and development park,
15 collectively fostering the development of technologies that will
16 expand and diversify economic and workforce development
17 opportunities throughout the State.

18 SECTION 2. There is appropriated out of the general
19 revenues of the State of Hawaii the sum of \$1,375,738, or so
20 much thereof as may be necessary for fiscal year 2014-2015 for
21 the purpose of executing the Pacific international space center
22 for exploration systems' five planetary surface systems



1 initiatives described in section 1 of this Act. Of the funds
2 appropriated, \$730,738 shall be used to support the Pacific
3 international space center for exploration systems' general and
4 administrative tasks, and \$645,000 shall be used to fund the
5 five strategic Pacific international space center for
6 exploration systems program initiatives.

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

10 SECTION 3. The director of finance is authorized to issue
11 general obligation bonds in the sum of \$1,500,000 or so much
12 thereof as may be necessary and the same sum or so much thereof
13 as may be necessary is appropriated for fiscal year 2014-2015
14 for the purpose of supporting the development of the Pacific
15 international space center for exploration systems' research and
16 development park as follows:

17	Land acquisition	\$1,300,000	
18	Acquisition-related tasks	\$200,000	
19	Total funding		\$1,500,000

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



H.B. NO. 2152

1 SECTION 4. The appropriation made for the capital
 2 improvement project authorized by section 3 of this Act shall
 3 not lapse at the end of the fiscal biennium for which the
 4 appropriation is made; provided that all moneys from the
 5 appropriation unencumbered as of June 30, 2016, shall lapse as
 6 of that date.

7 SECTION 5. This Act shall take effect on July 1, 2014.

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INTRODUCED BY:

<p><u>[Signature]</u></p> <p><u>[Signature]</u></p> <p><u>[Signature]</u></p> <p><u>Calvin K. Jay</u></p> <p><u>[Signature]</u></p>	<p><u>[Signature]</u></p> <p><u>Nicole E. Sauer</u></p> <p><u>[Signature]</u></p> <p><u>[Signature]</u></p> <p><u>[Signature]</u></p> <p><u>[Signature]</u></p> <p><u>[Signature]</u></p> <p><u>[Signature]</u></p>
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H.B. NO. 2152

Report Title:

Pacific International Space Center for Exploration Systems;
Appropriation

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.

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