

Pacific International Space Center for Exploration Systems (PISCES):



Robotics Strategic Program Plan

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Success Factors

• Robotics and Automation are expected to play a critical role in the establishment of a permanent presence on the Moon and beyond.

• NASA current plans call for hybrid approaches involving rover-mounted mobile habitats combined with robot-assisted construction and other surface operations

- Rovers such as the Jet Propulsion Laboratory's (JPL's) All-Terrain Hex-Legged Extra-Terrestrial Explorer (ATHLETE), JSC's "Chariot" and Carnegie Mellon University's "Scarab" are early prototype of the kinds of vehicles that will be used at a lunar outpost.

- Another NASA system is the Lunar Surface Access and Mobility Module "LSAMM" for the lunar outpost to conduct drilling, scooping, construction and assembly for power and life support installations.



Justification and Benefits

- ***Robots will enhance human safety and be teammates with people in the harsh space environment, on almost any terrain, and in almost any task, while under continuous human supervision and control***

- *Such vehicles could result in savings of thousands of hour work by humans for construction, assembly, drilling, material, and human transport, repair, maintenance and scientific research, and diagnostics.*
- *Humans will have command and control from Space or Earth locations.*
- *Humans will use the robots to take over high risk or repetitive functions*
- *Educational/ commercial/industrial benefits for ground applications for the State of Hawai'i with jobs creation and tax base generation*
- *Utilize PISCES facilities to hold conferences, symposia, workshops in an exciting setting*



PISCES Role

PISCES will provide field test robotic systems like these in terrain similar to that found on the Moon and Mars



- The Scarab rover has already been scheduled for tests at the PISCES site during JUSTSAP meeting, November '08
- Ultimately of far greater value to the citizen's of Hawai'i and residents of the Big Island, PISCES will develop its own robotics and automation research and programs involving faculty, and students of UH-Hilo and its partner institutions, faculty and students from International Universities, researchers from US-Japanese companies, and international space agencies including NASA, and JAXA.
- The robotics research at PISCES will concentrate on developing the technologies needed for future lunar outpost, but will also actively pursue spin-off technologies that will provide incentive for Earth-based companies to join PISCES and thereby benefiting the local business base and the local economy
- Robust education program at UH-Hilo that will be a catalyst for moving the campus more rapidly into engineering and science education.

PISCES GOALS

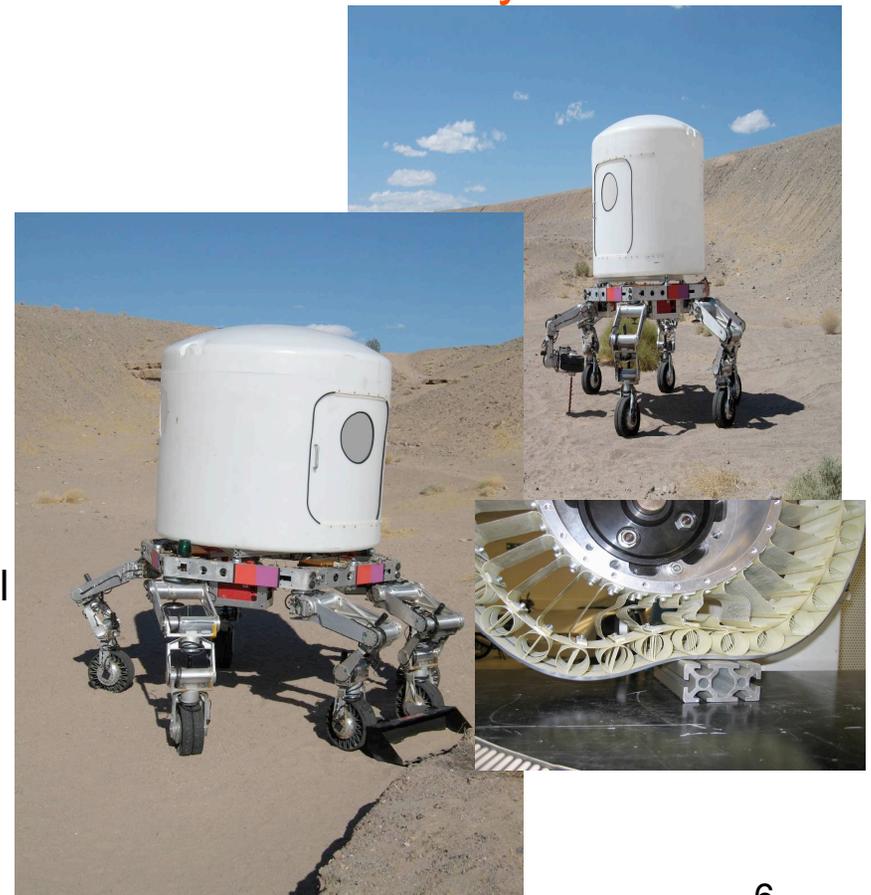
- The goals of the program include development of technology, infrastructure and human skills to accelerate the economical growth of the State of Hawai'i economy, while preserving its culture and values.
 - Technology Development: Build a comprehensive capability to design and test low-cost, efficient autonomous and/or human-supervised robotic system to assist explorers in space operations, and to spin off the technologies into terrestrial applications in the State of Hawai'i
 - Infrastructure Development: Build Laboratories and Shop Facilities for research, assembly and bench-scale testing; high-bay areas for larger assembly and transport; and field areas for realistic test and validation of systems. The field areas will include communications, mobile platforms, teleoperation, remote wireless networking, safety, and emergency provisions
 - Human Capability Development: For PISCES to function and grow, a strong collaboration must develop between the faculties of UH-Hilo and various partner institutions by developing robotics curriculum which can attract researchers, faculty, and funding.

Implementation Plan

PISCES will develop the capability to create robotic technology for space applications, some of which will have near-term terrestrial use by industry, such as in manufacturing, assembly, mining, agriculture, energy, construction, health-care and safety.

-Technology Development: Advanced perception and planning; tactical and cooperative behavior; scalable human-robotic interfaces; command, control and communications, and system architecture that can integrate these capabilities in a robotic system that can look, plan, move, operate collaboratively and perform on command.

-Human Capabilities: Develop the infrastructures for a human-robotics educational component to cultivate partnerships involving nationally and internationally know researchers and users of PISCES facilities.



Near-Term Opportunities

- Automate agriculture processes and equipment
- Automate roads constructions
- Automate man-machine interface in customers and tourist business support
- Automate rescue and emergency operations through an all terrain navigation and guidance system
- Robotic assisted Elderly and Nursing care and Physical Therapy
- New technology for smart power grid management and alternative energy generation
- Test bed for NASA and DoD mobile systems, wireless power transmission, etc.

Outreach and Education

- Create value to the local communities and industries in jobs, profit and opportunities
- University and High School students as Interns leading to BS. MS.
- Math, Science and Engineering Camps to students and their parents
- Visitor briefings and demonstrations, a new attraction for visitors and tourists
- Hawaiian community cultural interactions by supporting and preserving their Heritage of Explorers and Exploration.