PISCES | Pacific International Space Center for Exploration Systems

University of Hawaii Hilo

The Role of the States in Space Exploration: PISCES

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LEAG Meeting, October 3, 2007, Houston, TX

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Rationale

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The Vision for Space Exploration

- Sustainable and Affordable
- Extend Human Presence
- Develop Innovative Technologies, Knowledge and Infrastructure
- Promote International and Commercial Participation

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The New Vision

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What's different about this one?

- This time we're going to stay – Apollo was "Columbus", this is "Jamestown."
- There is no crash program - no new money.
- Therefore, we must sustain the program by keeping the support of the public for many years.
- Therefore, we need to make it affordable.
- Therefore, it needs to benefit society.

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The Need

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NASA can't do this alone!

- Affordability demands State participation.
- Sustainability demands State participation.
- The public benefits more when States participate.
- Industry is critical, but it has to make money.
- The States can bring everything together.

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Ways to Play

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Possible State Roles

- Education
- Promotion
- Recruitment
- Incubation
- Infrastructure Development

Education

A Major Responsibility

- Promote STEM disciplines in K-12.
- Institute applied programs related to aerospace and space exploration in community colleges.
- Introduce relevant degree programs in the universities.
- Seed-fund research at the universities.
- Educate the public about space activities around the world and how the state can contribute and benefit.

Promotion

Some of the Ways

- Establish an Office of Aerospace Development.
- Join the Aerospace States Association.
- Sponsor local aerospace conferences.
- Develop attractive tax structures for space businesses.
- Minimize regulatory burdens.

Recruitment

For a "Place in Space"

- Attract space businesses.
- Attract faculty in space-related disciplines.
- Attract good students and excite them about space.
- Infuse state government with a space vision.
- Organize space business roundtables.

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Incubation

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Building the Start-Up Base

- Nurture space businesses.
- Create the next Silicon Valley, Rt. 128, Research Triangle.
- Promote industry/university/government partnerships.
- Enable tech transfer.
- Access venture capital.

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Infrastructure

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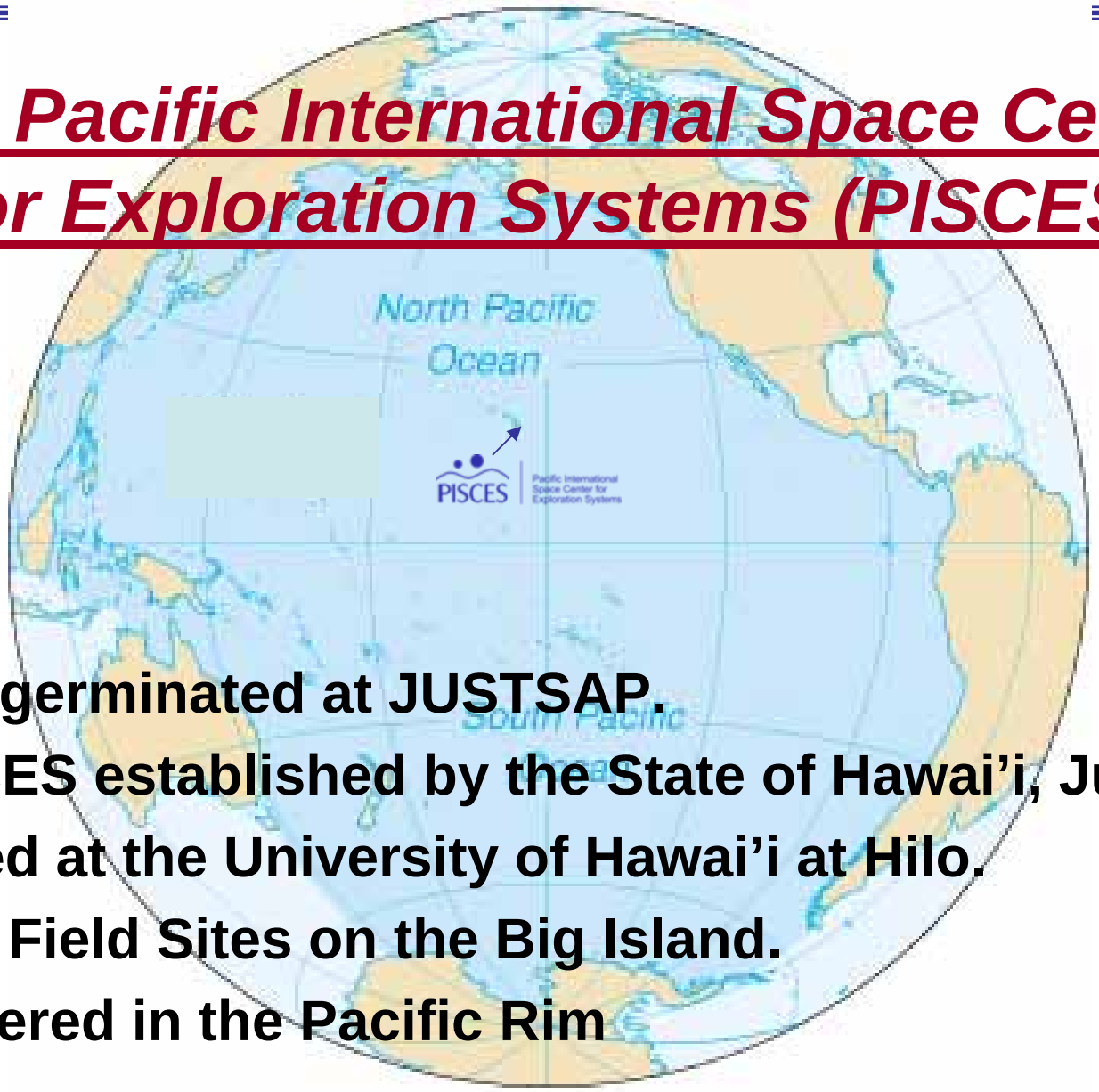
Beyond Cape Canaveral

- Ensure good roads, communications, internet access.
- Dedicate public land for space launch and other space-related activities.
- Develop licensed spaceports (5 states already have).
- Take advantage of natural attributes (location, elevation, landforms, geological features) to develop ground analog facilities.
- Create space research and education centers.

An Example

The Pacific International Space Center for Exploration Systems (PISCES)



- **Idea germinated at JUSTSAP.**
- **PISCES established by the State of Hawai'i, June 2007.**
- **Based at the University of Hawai'i at Hilo.**
- **With Field Sites on the Big Island.**
- **Centered in the Pacific Rim**

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Vision

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A Comprehensive, International, Research and Education Center Dedicated to the Creation of Technologies to Sustain Human Presence on the Moon and Beyond

- **In-Situ Resource Utilization (ISRU)**
- **Intelligent Robotics**
- **Education and Outreach**
- **Habitat Design and Construction**
- **Solar Energy and Power Beaming**

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Featuring

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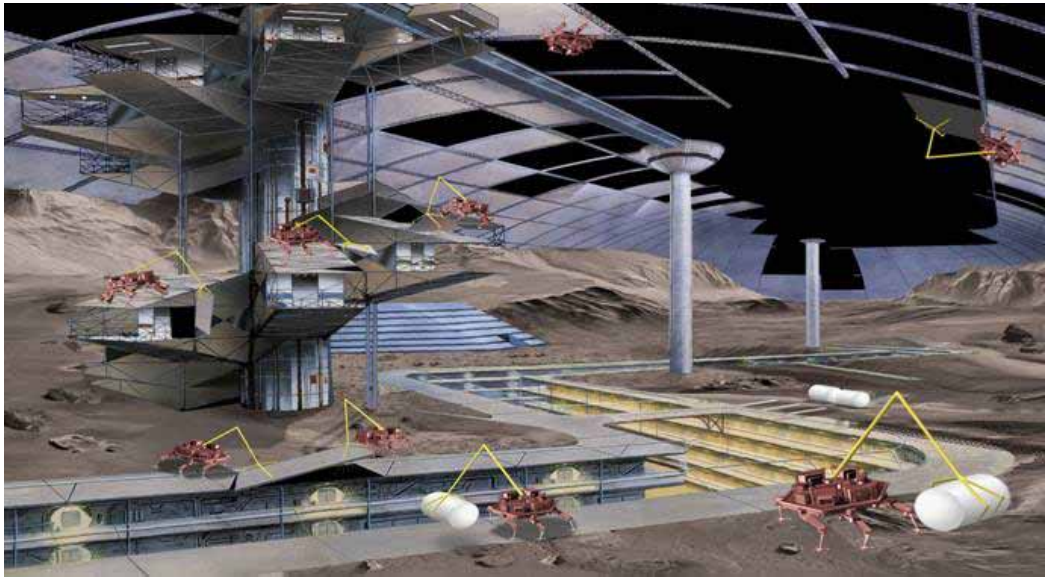
A Simulated Lunar Outpost on the Big Island of Hawai'i

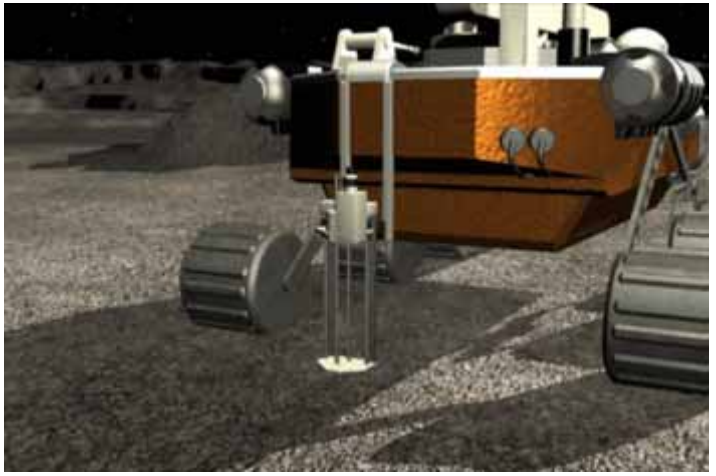


- **Habitats Constructed from Local Materials**
- **ISRU Pilot Plants**
- **Robotic Field Operations**
- **Self-Sustaining**
- **Infrastructure Including Power, Communications, Shops, Storage, Accommodations**

ISRU

Planned ISRU Systems

- Regolith Excavation and Transport
- Resource Extraction, Refining and Finishing
- Final Product Manufacturing

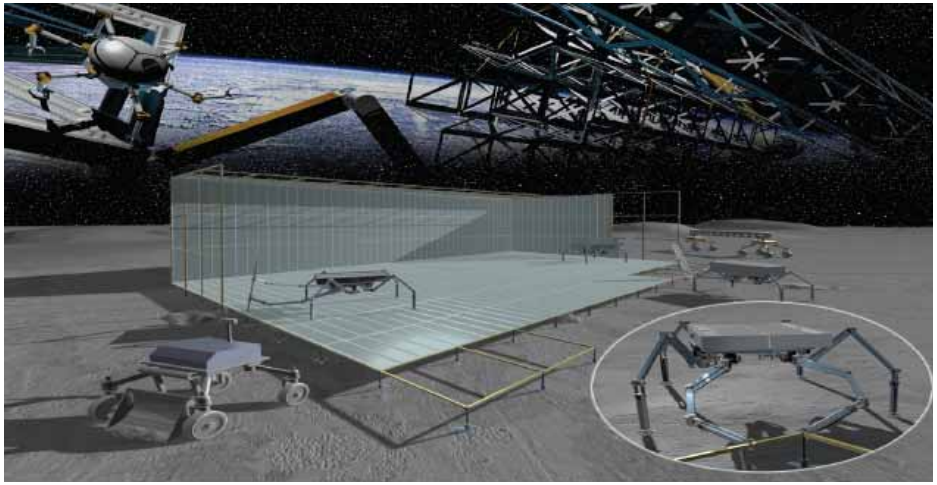


Planned Extraction Systems

- Oxygen Extraction from the Hawaiian Regolith (Hydrogen Reduction, Carbon Reduction, or Electrolysis)
- Extraction of Volatiles by Heating
- High Temperature Processing, Including SHS, for Production of Glasses, Ceramics and Glass-Ceramics
- Metals and Silicon Production

Robotics

Human and Robotic



- **Advanced Perception and Planning**
- **Tactical and Cooperative Behaviors**
- **Scalable Man-Machine Interfaces**
- **Command, Control and Communication Systems**
- **Systems Architecture that Integrates these Capabilities into a Robotic System that Can Look, Plan, Move, Operate Collaboratively, and Perform on Command**

Education

A Major PISCES Thrust

- **Undergraduate and Graduate Student Research Programs**
- **PISCES Internships in Public Relations/Communications at The University of Hawai'i at Hilo, where Coursework in these Areas Already Exists**

SpaceClass™ Class 2006

- **PISCES Internships from Tokyo Institute Of Technology, One of Our Partner Institutions, as a Model for Future Internships from Other Universities**
- **PISCES Student Internships in Cultural Studies, Emphasizing the Importance of Science and Voyaging in the Hawaiian Culture**
- **A SpaceClass ™ Lesson About Living on The Moon, Reaching Classrooms Around The Globe, a Valuable Resource to Science Teachers**

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Development

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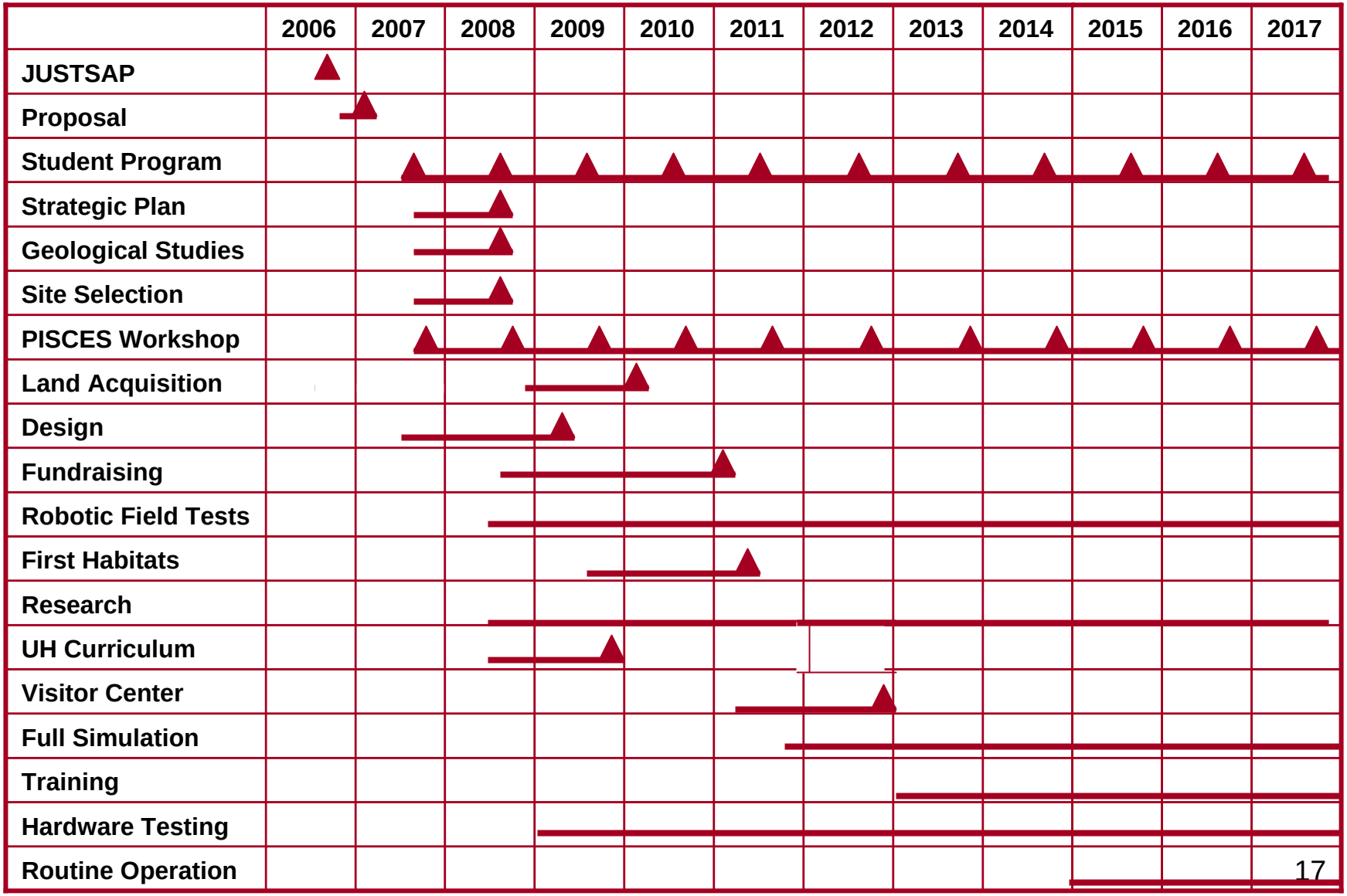

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Summary

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The States have Important Roles to Play in Space Exploration

A Voyaging Culture

- Education
- Promotion
- Recruitment
- Incubation
- Infrastructure Development

A Diverse Culture

PISCES will Contribute in all of these Roles