



# **Developing Technologies for Space Resource Utilization – Concept for a Planetary Engineering Research Institute**

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# ***Planetary Engineering Research Institute: PERI***



## **What is it?**

- An independent engineering research & education institute
- Patterned on the Lunar & Planetary Institute (LPI)

### **LPI:**

- Supports research, development & education (RD&E) in **Planetary Science** - has emerged as the focus of that discipline
- Operated by a university consortium (USRA)
- Funded by NASA

# *PERI*



## **What is it?**

- Analogous to LPI, PERI would facilitate emergence of Planetary Engineering Science
- Serve as a focus for RD&E and communications among professionals in *in situ* resource development (ISRU)
- Support NASA ISRU RD&E
- Advocate space resource development and utilization to industry and the public

# *Planetary Engineering Science*

- **Civil/Mechanical/Materials** – e.g., planetary drilling and excavation, resource mining, surface trafficability, habitat construction & shielding, *in situ* structural materials production, thermal management systems, . . .
- **Chemical & Process** – e.g., in situ resource beneficiation, in situ chemical processing, life support systems, variable gravity effects, . . .
- **Energy** – e.g., nuclear power systems, in situ/renewable energy systems (solar, geothermal, hydro), . . .



**Robotics & Automation**

# *PERI*

## What is it?

- Small, permanent research staff (5-6)
- Small, limited-term staff of visiting engineers/scientists, Post Docs & students
- Limited in-house research facilities for bench-scale expts. & subsystem prototyping - mainly rely on regional universities, gov't labs & industry capabilities
- Conference/education facilities & staff

# ***REGIONAL LOCATION***

## ***SoCentral ROCKY MTS***

### **What are the Roles of Regional Universities, Gov't Labs & Industry?**

- *Primary source of visiting staff & students*
- *Support facilities:* Technical libraries, specialized labs, larger-scale facilities, field test sites, . . .
- *Technical consortia or teams to develop:* Mission proposals, critical competencies, technology demonstrations, . . .

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## Why is it needed?

- ISRU research has languished & is poorly focused, understood and supported
- Advocacy is limited to a small group of believers
- Emerging needs of the Mars program are strong, new drivers - the time is right!
- **PERI is the mechanism we need to focus, integrate, educate & advocate ISRU**

# *PERI*



## How can we implement it?

- *Build constituency* - regional universities & gov't labs, industry & NASA/DOE program managers, professional associations, . . .

### Seeking SRR support!

- *Identify sponsors* - NASA, DOE, industry, state gov't, . . .?
- *Identify managing entity* - e.g., USRA, . . .?
- *Build business plan*



# *PERI*

## *Estimated Costs*



### **Phase I**

- Start-up: \$1M
- Annual operating: \$5M
  - Technical staff - \$2M
  - Research facility support - \$2M
  - Education & support staff - \$1M

### **Phase II**

- Conference facilities: \$5M?

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*QUESTIONS & DISCUSSION*