Lunar Surface Innovation CONSORTIUM

JOHNS HOPKINS APPLIED PHYSICS LABORATORY

Lunar Surface Innovation Consortium ISRU Capability Area Updates

Space Resources Roundtable (SRR) XXVI

June 2-5, 2026

Jodi Berdis, Karl Hibbitts, Anthony Coburger, Paul Burke, Richard Miller, Mallory Kinczyk, Yasin Abul-Huda, Nick Rotunda

Lunar Surface Innovation Initiative (LSII)

Technologies for a sustained lunar presence - working across industry, academia, and government

Space Technology Mission Directorate

Johns Hopkins Applied Physics Laboratory

Lunar Surface Innovation Initiative Systems Integrator

Lunar Surface Innovation Consortium

Lunar Technology Community

LSII

ELEVATE

Community Integration

- Voice for the community (feedback to NASA, info from NASA)
- Connections (people and organizations, leadership, collaboration opportunities)
- Information resource (lunar activity info, latest in tech, deeper dives, announcements, mission opportunities)
- Access to engineering and integration expertise and products/resources

ACCELERATE

Capability Integration

- Technical analysis for technology and operational needs
- Deep-dive engineering analysis
- Integration, interface, and environmental testing coordination and collaboration
- Environmental and engineering expertise

DELIVER

Infrastructure and Mission Integration

- Campaign reference designs
- Campaign/mission integration and interfaces planning and execution
- Tech development risk reduction and opportunity management
- Campaign/mission engineering expertise
- Use of flight opportunities to advance technologies

LSII'S MISSION-DRIVEN, OUTCOME-BASED APPROACH

LSII

ELEVATE

Community Integration

ACCELERATE

Capability Integration

DELIVER

Infrastructure and Mission Integration

Objectives

Engineering Products, Expertise, Integration

Needs, Feedback, and Collaboration

Systems Integration and Collaboration

NASA

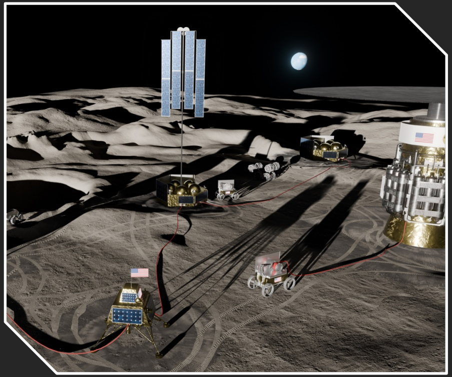
- Space tech for exploration and science
- National space direction

Objectives and Resources

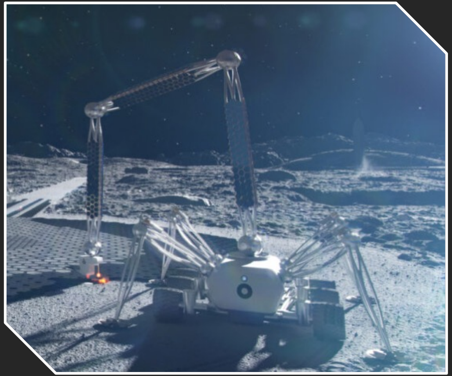
COMMUNITY

- Technology development
- Mission execution

MOON BASE



EXPLORATION TECHNOLOGY PIPELINE



Credit: ICON DARPA

LSIC | ISRU Capability Area

The In Situ Resource Utilization (ISRU) Capability Area (CA) will:

- Advance ISRU experiments, technologies, and demonstrations and their transition to operational capabilities for a Moon Base;
- Assess key lunar surface commodities, such as oxygen from regolith, water ice, and ^{3}He potential at the South Pole;
- Define implementation needs and strategies for ISRU systems.

Examples of topics to be explored include demonstrating systems for localizing water on the Moon and measuring its geophysical parameters, collecting and purifying water on the lunar surface, extracting oxygen and metals from lunar regolith, and the engineering / knowledge / integration challenges in achieving lunar ISRU at scale.

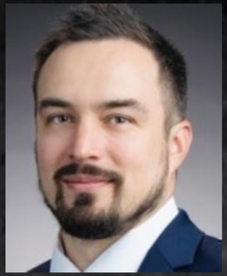
Meetings: 3rd Wednesday of the Month 11:00 am – 12:00 pm EST

Mailing List: LSIC_ISRU@listserv.jhuapl.edu

Facilitator Email: Facilitator_ISRU@jhuapl.edu

LSIC ISRU Webpage

LSIC Co-Leads



Anthony Coburger

Dr. Jodi Berdis

SI Lead

Dr. Karl Hibbitts

Dr. Rick Miller

Dr. Paul Burke

Dr. Mallory Kinczyk

Nick Rotunda

NASA Point of Contact

Dr. Julie Kleinhenz
ISRU Systems Capability Deputy

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LSIC | ISRU Testing, Interfacing, and Funding Workshop

Virtual Workshop, July 16, 2025: Updates on technology maturation, testing regimes, and success stories from various fields,

Presentations on systems for regolith processing, aluminum production, and oxygen extraction, standardizing interfaces for lunar infrastructure, exploring non-governmental funding opportunities.

UPSTREAM SUBSYSTEM | SUBSYSTEM | DOWNSTREAM SUBSYSTEM

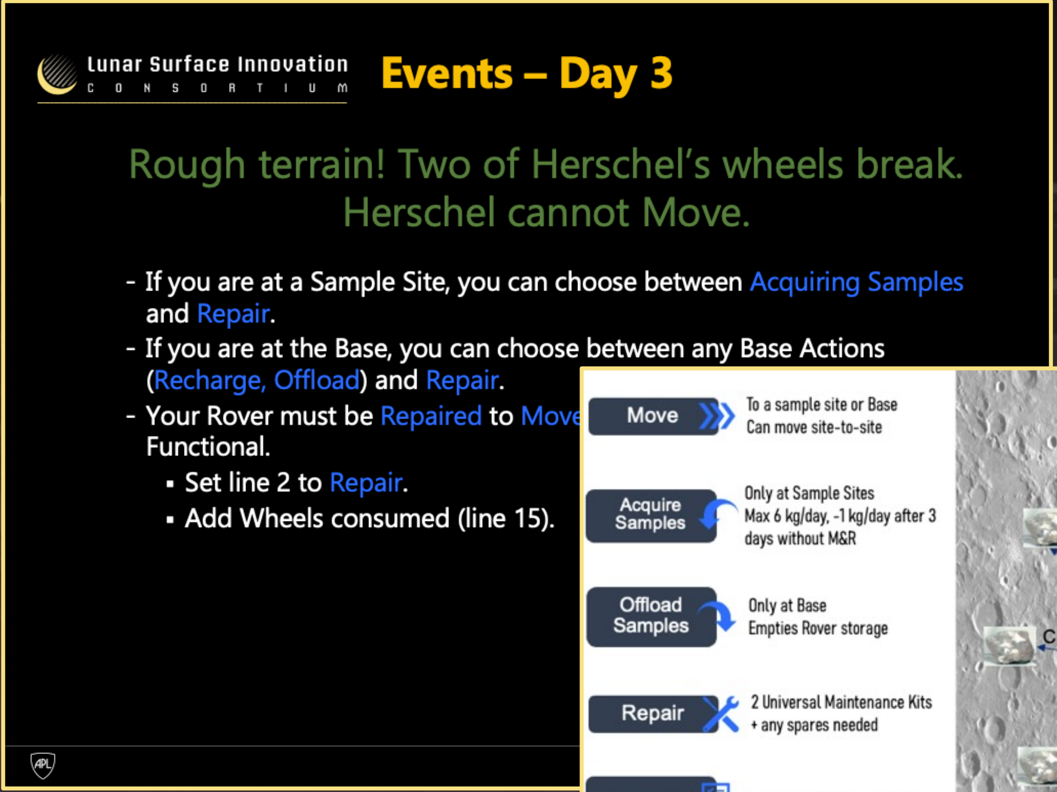
Provider	Interfacing Parameter	Provider Expectation	Receiver Expectation	Interfacing Parameter	Receiver
Regolith Processing & Handling	Regolith Processing Rate	150 kg/day+	100 kg/day	Regolith Processing Rate	ISRU Reactor System
Power	Electrical Power	15 kW+	<5kw	Power	ISRU Reactor System
ISRU Reactor System	O2 Production Rate	0.65 kg/hr		O2 Production Rate	O2 Processing and Storage
	O2 Liquefaction Rate		0.65 kg/hr	O2 Liquefaction Rate	
ISRU Reactor System	Max ISRU System Operating Temperature	2073 K		Max ISRU System Operating Temp.	Metal Processing O2 Storage Liquefaction System Regolith Processing and Handling
	Max ISRU System Surface Temperature	325 K		Max ISRU System Operating Temp.	Metal Processing O2 Storage Liquefaction System Regolith Processing and Handling

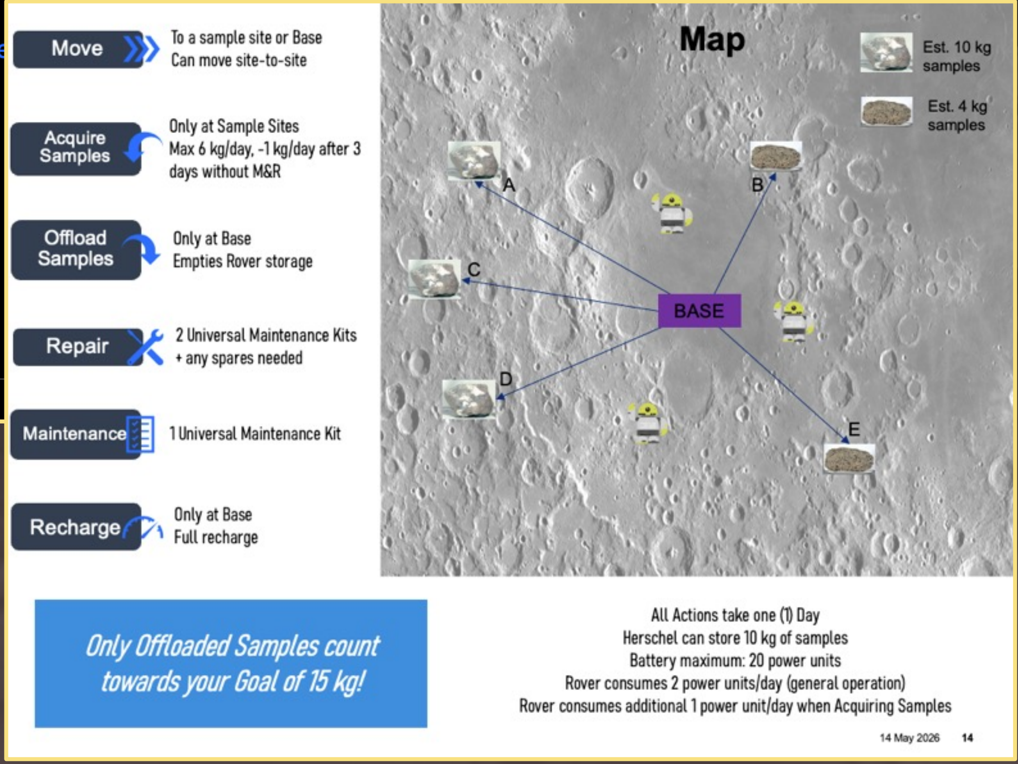
Key Findings:

- The O2fR Collaborative Systems Interface Database continues to be a valuable resource to the lunar ISRU community.
- The coordination of testing facilities and capabilities into a network can enhance research and testing efficiency, enable shared resources, and facilitate interdisciplinary collaboration.
- While technology development can benefit from 'small wins' of non-governmental funding to advance their capabilities, the future of lunar exploration will rely on government leadership and a 'whole-of-government' approach to drive large-scale lunar infrastructure development.
- Despite setbacks, multiple organizations in the lunar ISRU community voiced they are still hopeful that LIFT-1 will materialize, and several stated they will continue pushing their relevant technology forward.

LSIC | Maintenance & Repair for Sustainable Surface Infrastructure Workshop

Virtual Workshop, September 3, 2025: Explore the critical role of maintenance and repair (M&R) in sustaining lunar infrastructure, such as lunar landers and rovers, while drawing lessons from extreme terrestrial environments.





Key Findings:

- It is most impactful and cost-effective to start integrating maintainability & repairability in the design phase.
- Terrestrial applications offer valuable lessons for M&R, drawing on insights from the Right to Repair movement, repairability indexes, extreme environments such as mining, and the Industry 4.0 paradigm.
- Advancing M&R necessitates digital engineering approaches (collaborative virtual testbeds, digital twins), models (development, V&V, explainability, updates), resource management, and integrative testing.
- Surface demos must be intentionally designed to facilitate sensing, data collection, and data-sharing for the space tech community to develop critical systems that are maintainable, repairable, sustainable, and resilient.

LSIC | Power Applications at Varying Scales Workshop

Virtual Workshop, September 25, 2025: Examine applications on the lunar surface for power at low (~1 kW), medium (10s kW), and high (50+ kW) demands, and discuss power architectures/CONOPs for meeting the needs of such applications.

Key Findings:

- Ability to support high-power infrastructure depends on phased maturation; start with small demos, build up to interconnected nodes and eventually expand to a regional grid.
- Power grid design is highly dependent on site selection (size, shape, and layout).
- Power infrastructure success will rely on interoperability; standards for components like connectors, voltages, and interfaces must be defined early.
- Cleverly designed duty cycles and CONOPs can allow for flexibility in applications requiring high levels of power for short periods of time.
    - However, to maximize impact of some applications (for example, solar radar), high levels of power will be needed nearly continuously – this is likely only possible with the introduction of FSP.
- Fission Surface Power expects to be integrated with solar, batteries, and fuel cells into a mixed-source architecture.

ISRU Community: Let us know what we can do that would help your ISRU goals!

SIGN UP!

LSIC welcomes participation from throughout the world, with the goal of connecting those interested in participating in humanity's future in space to one another!

https://lsic.jhuapl.edu

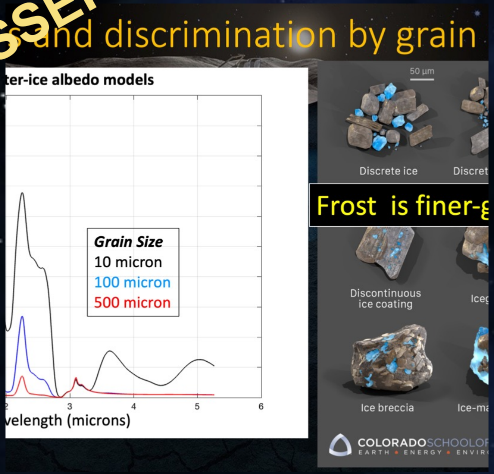
Products and Events

- Lunar Expertise for the Community
- Documents and Reports
- Notice Board for Employment and Internship Opportunities
- Facilities Directory
- News and Events Calendar
- Wiki Sites
- Community Whitepapers
- Simulant Reports
- Simulant Surveys
- Newsletters
- Specialized Workshops
- Annual Fall and Spring Meetings

Contact us @:
Jodi.Berdis@jhuapl.edu
Anthony.Coburger@jhuapl.edu
Karl.Hibbitts@jhuapl.edu

Check Out These Other APL ISRU Presentations!

SSERVI

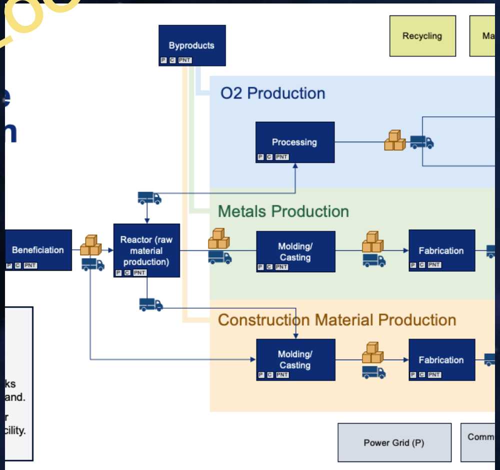


Karl Hibbitts

“Prospecting for Subsurface Lunar Water-Ice Using Infrared Reflectance Spectroscopy of the Moon’s Surface”

Tuesday @ 2:40pm

LOGIC

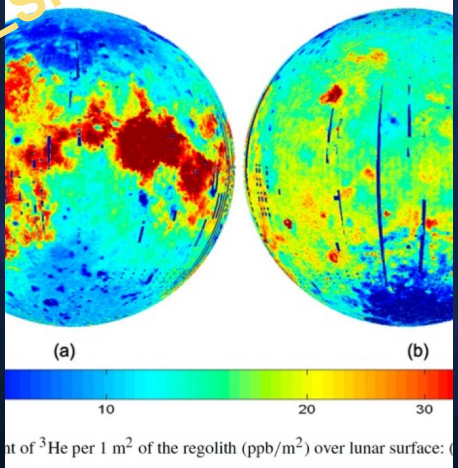


Paul Burke

”Lunar Operating Guidelines for Infrastructure Consortium (LOGIC) In-Situ Resource Utilization (ISRU) Working Group Overview and Update”

Wednesday @ 4:20pm

LSIC

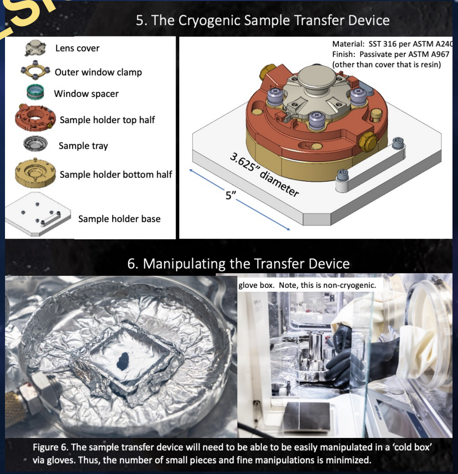


Rick Miller

“3He Prospecting Challenges”

Poster on Tuesday

LSIC

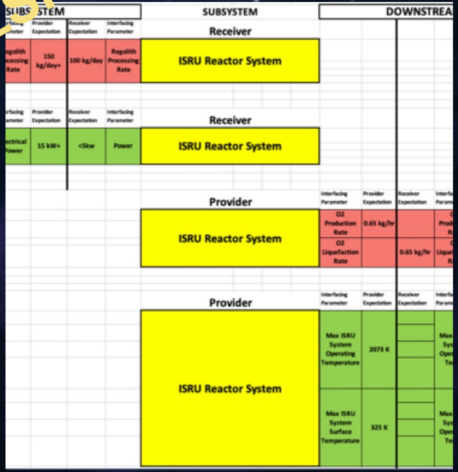


Karl Hibbitts

“Preparing for Lunar Volatile-Rich Cryogenic Sample Return and Analysis”

Poster on Tuesday

LSIC



Anthony Coburger

“Oxygen from Regolith (O2fR) Collaborative Systems Interface Study: Updates and Path Forward”

Poster on Thursday

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BACKUP

LSIC Work and Products

LSIC bi-annual meetings increased in attendee count by 400% since LSII/C was established in 2020.

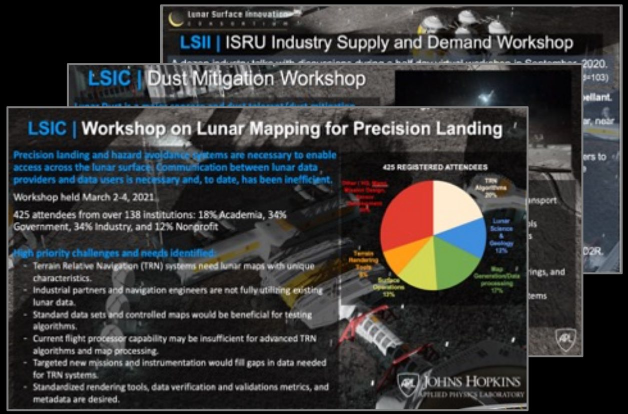
54% at kickoff had not previously worked with Space Tech

4,000+ participants from over 1,200 organizations across 50 states, PR and 70 countries

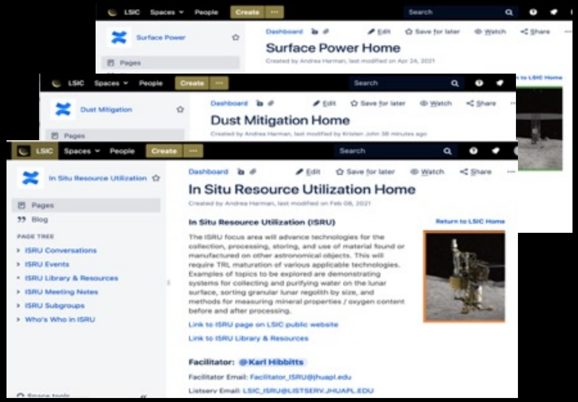
10 **Bi-annual Meetings**
(Spring at APL and Fall at Participant Site)

LSIC Website

(Access to space opportunities, funding opportunities, lunar simulant portal, facilities database, and more)



18 **Thematic Workshops attended** by over **4,000 participants**
(Outcome reports with key recommendations; topics driven by member interest)



4 **Capability Areas, Monthly Telecons**
(Presentations, Collaborative Discussions, Who's Who, Wiki Sites)

Community Findings

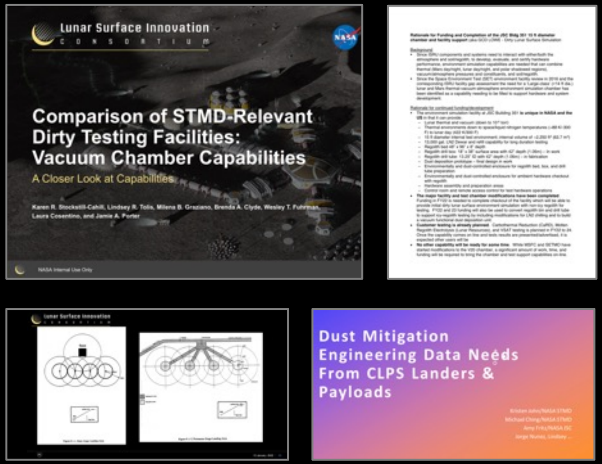
Bi-Monthly Newsletters

(Solicitations and opportunity announcements, events, features, member spotlights)

LSII Systems Integration Work

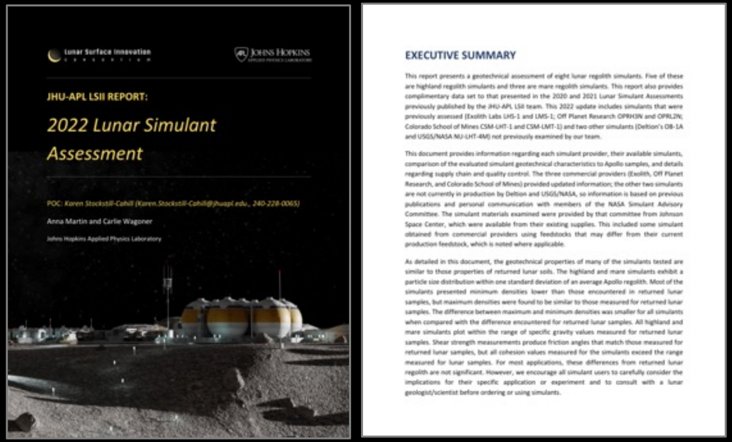
Capability Integration

(LIT Campaign Study, LIT Industry Working Session, LIFT-1 Study, Power Distribution, etc.)



Studies

(Eagle Studies, O2fR, Dirty Testing Facilities, Lunar Solar Array Towers, etc.)



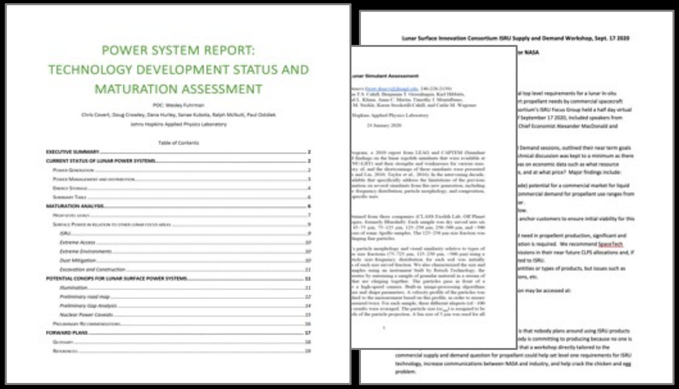
Survey and Assessments

(Simulant Survey, Data Buy Survey)

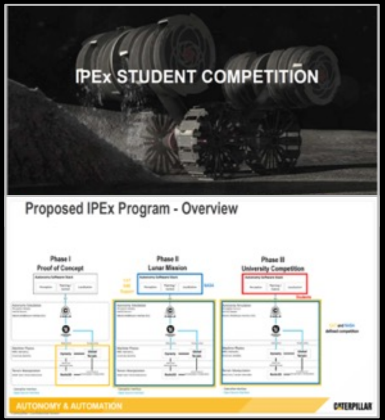
Lunar Environment Expertise

(Lighting Assessments, Landing Sites, Payload Integration, [Lunar Engineering 101])

Site Visits



Technology and Gap Assessments



Challenge Support

(Lunar Autonomy Challenge, BIG Idea Challenge)

LSII Capability Areas

Crosscutting Capabilities

Multi-faceted CA cover areas impacting technology implementation and use on an array of topics which feed into goals across LSIC and promote collaboration amongst internal and external stakeholders.

In Situ Resource Utilization

Technologies for the collection, processing, storing, and use of space-based resources.

Excavation & Construction

Technologies that enable affordable, robust, autonomous manufacturing and construction supporting surface operations.

Surface Power

Technologies that provide continuous power in extreme environments including power generation, power management and distribution, and energy storage.