Lunar Surface Innovation
CONSORTIUM

LSIC Excavation and Construction Focus Group

http://lsic.jhuapl.edu/

March 5, 2021 (February Meeting)

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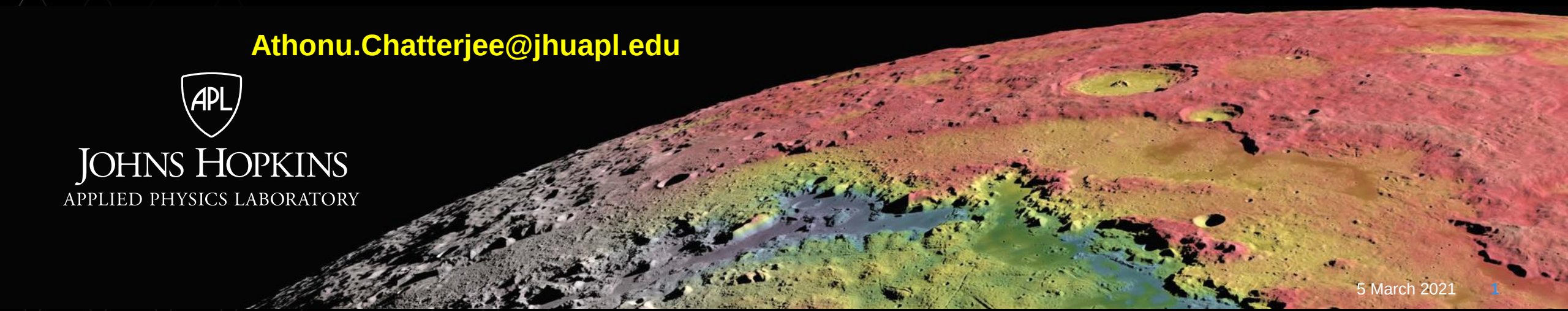


Friendly Reminders

- Slides, chat and recording will be posted in our website in 2-3 days. (http://lsic.jhuapl.edu/Focus-Areas/Excavation-and-Construction.php)

- Feel free to post your questions/suggestions in ‘chat’.
  - We can move the discussion to Confluence.

- Please mute yourself if you are not speaking.

Lunar Surface Innovation CONSORTIUM

Focus Group Update

- *Add your information in "E&C Who's Who".*
  - *Yellow pages for E&C community.*

- *Use Confluence for technical discussions, sharing resources, seeking feedback, etc.*
  - http://lsic-wiki.jhuapl.edu/ (sign-up required)
  - Contact Andrea Herman for access: ams573@alumni.psu.edu

Break the Ice Lunar Challenge (NASA Centennial Challenge)

Excavate icy regolith and deliver acquired resources in extreme lunar conditions.

- https://breaktheicechallenge.com/

Timeline

1. **NOVEMBER 18, 2020**
   Phase 1 opens

2. **DECEMBER 2020 – JANUARY 2021**
   - Webinars to support registered Teams and potential Teams in developing their system architectures
   - Promotional activities and/or other support for registered Teams
   - Judging Panel Summit (virtual) to brief judges on roles/responsibilities and Challenge rules

3. **JUNE 18, 2021**
   Deadline for registration and for Teams to submit their system architectures

4. **JUNE – JULY, 2021**
   - Administrative review of the system architectures to verify compliance with rules
   - Judging Panel may conduct virtual interviews with Teams

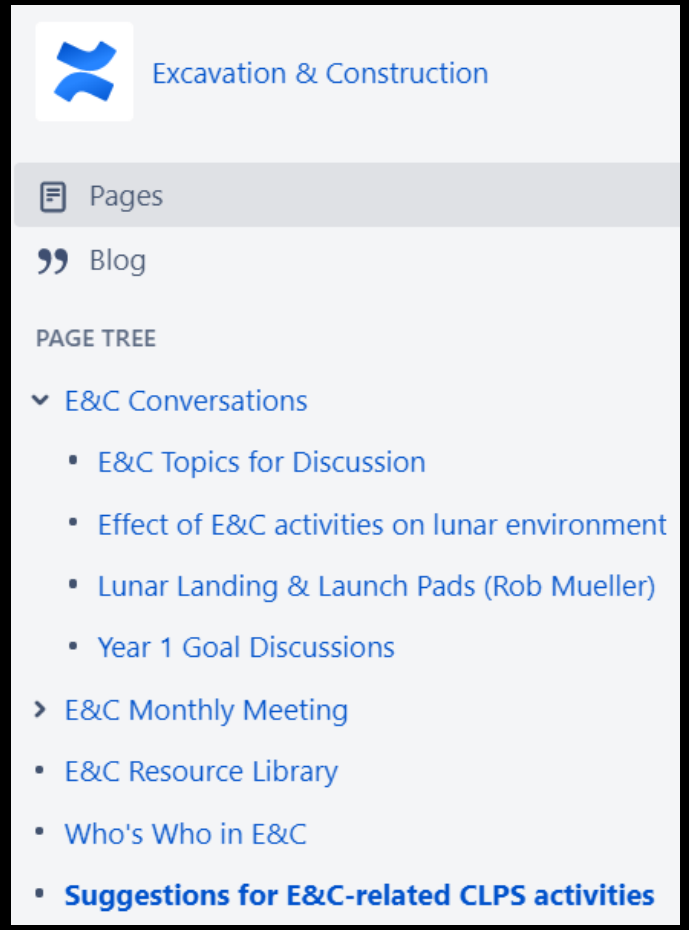
5. **JULY – AUGUST, 2021**
   - Judging Panel reviews and scores the system architectures
   - Judging Panel Summit (virtual) to determine Phase 1 winners

6. **AUGUST 13, 2021**
   Phase 1 winners announced

Focus Group Goal

Overarching Goal: Help NASA set the stage for a big RFP for 2030 lunar base development.

- Provide recommendations for upcoming E&C–specific CLPS activities.
- Enhance and smoothen interaction between industry and NASA.
  - Help develop RFI and RFP that are easily understood by all.
  - Recommendations for funding through various avenues such as SBRI, STRG, ---.
  - Community building.
- Help NASA in some technical areas.



Possible 21-22 Annual Goal Topics

(1) Lunar Servicing, Assembly and Manufacturing (LSAM)

Identify and recommend LSAM capabilities needed for habitat and landing pad construction and provide recommendations for CLPS activities.

- What kind of spare parts manufactured on Moon, supplier/demand sides, industry-academia-government ecosystem

(2) Optimal Lunar Habitats

Critical analysis of pros and cons of over-ground and under-ground habitat and provide recommendations for CLPS missions.

- available technologies, effect on lunar environment, optimal architecture

Express your views or suggest any other topic in Confluence

Today's Talks

Two ~20-minute presentations :

- **Kari Abromitis** is a Product Strategist for ***Redwire***, a new leader in mission critical space solutions and high reliability components for next generation space systems and infrastructure. Kari will give a presentation on Redwire's technologies that are applicable to lunar excavation and construction .

- **Dr. Bibhrajit Halder** is the founder and CEO of ***SafeAI***. SafeAI's autonomous technology enables equipment owners to transform existing machines into self-operating robotic assets. Their autonomous platform brings advanced AI and autonomous vehicle technology to mining and construction industries.

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APPLIED PHYSICS LABORATORY

Possible 21-22 Annual Goal Topics

Lunar Servicing, Assembly and Manufacturing (LSAM)

Identify and recommend LSAM capabilities needed for habitat and landing pad construction and provide recommendations for CLPS activities.

- What kind of parts are beneficial to be manufactured on lunar surface as opposed to sending from earth?
- What are some possible demands for metal manufacturing on the moon in the short term ?
- What kind of metal-based spare parts are needed / maybe needed to be made?
- Where can the suppliers / technology developers know about lunar surface construction demands? Identify supply and demand sides.
- How can industry and academia be brought into this eco-system.

Express your views or suggest any other topic in Confluence

Possible 21-22 Annual Goal Topics

Optimal Lunar Habitats

Perform a critical analysis of pros and cons of over-ground and under-ground habitat and provide recommendations for CLPS missions.

- Explore and compare available technologies.
- Analyze the two options from cost, safety and sustainability points of view.
- Effect on lunar environment and how to mitigate.
- Recommend an optimal architecture for habitats; maybe a combination of two.
- How can industry and academia be brought into this eco-system?

Express your views or suggest any other topic in Confluence

E&C Technical Areas Google Survey Results

Habitat construction in lunar conditions. (Inflatable habitat, underground habitat, radiation shielding, multi-functional materials/structures)	**70.5%**
Manufacturing processes for lunar construction. (Additive manufacturing, sintering, regolith fiber pulling)	63.6%
Excavation technology for hard regolith/icy material. (Drilling, mining, lightweight construction equipment)	61.4%
Autonomous vehicles and robots for E&C on lunar surface.	59.1%
Lunar surface structure development. (Landing pads, berms, roads)	54.5%
Increased autonomy of operations.	34.1%
Virtual lunar terrain simulation.	29.5%
Beyond additive technology.	22.7%
Long duration robust , easily maintainable robot design for industrial scale use (not science)	2.3%
Subsurface and interior imaging and composition analysis	2.3%
Compressed, sifted regolith as a building material	2.3%
Spacecraft refueling station development	2.3%

LSII System Integrator - APL

A key tenet of LSII is to implement a multitude of novel collaborations across industry, academia, and government in order to successfully develop the transformative capabilities for lunar surface exploration.

Origin of the APL Task

- NASA was investigating using a University Affiliated Research Center (UARC) to bring efficiencies to development
- LSII initiated a tasked APL, to assess system integration role for the Lunar Surface Innovation Initiative
- APL established a Lunar Surface Consortium with academia and industry representatives, as well as NASA experts, that span a broad range of capabilities to execute timely studies, tasks, and/or acquisitions

The Consortium will assist NASA in

- Identifying lunar surface technology needs and assessing the readiness of relative systems and components
- Making recommendations for a cohesive, executable strategy for development and deployment of the technologies required for successful lunar surface exploration
- Providing a central resource for gathering information, analytical integration of lunar surface technology demonstration interfaces, and sharing of results