

LSIC Surface Power Telecon

September 23, 2021

Begins at 11:02



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Confluence Discussion:
<https://lsic-wiki.jhuapl.edu/pages/viewpage.action?pageId=19039547>

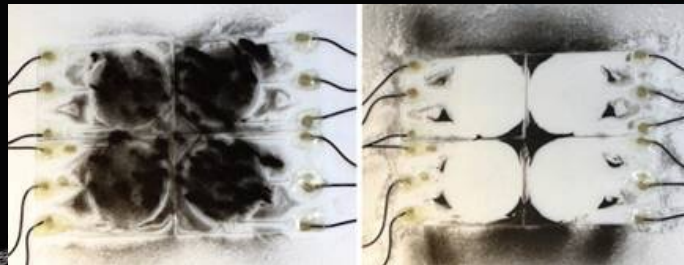
Overview

- Community updates
 - Other Focus Group activities
 - Funding opportunities
 - Fall meeting
- Off-cycle meetings:
 - Modularity and Standards Working Group:
 - kick-off meetings
 - Analysis groups
 - Expect these to be temporary as needed
 - Iterating the power beaming summary figure
- Value Chain Mapping: Presentation and discussion
 - “Power purchasing agreement” What does this look like?



Dust Mitigation

- **Dust Mitigation:** The Dust FG will have a special meeting on Monday at 1PM EDT to discuss aspects of the PRISM2 call related to the dust environment, which is a topic covered under the generic South Pole lander. I will send more details when available.



Excavation and Construction

Excavation and Construction: The EC FG will have presentations from three of the Break the Ice Challenge winners at their next monthly meeting, **this Friday at 3 pm**. Sign up on Confluence or email Athonu.Chatterjee@jhuapl.edu if you aren't yet a member of the EC Focus Group.

- **Elon Gordon (Redwire Space):** Redwire Space, Florida, won the first place for its proposed two-rover system designed for simplicity and robustness.
- **George Sowers (Colorado School of Mines):** Colorado School of Mines won the second place for its proposed Lunar Ice Digging System, or LIDS.
- **Curtis Purrington (Austere Engineering):** Austere Engineering, Colorado, won the third place for its Grading and Rotating for Water Located in Excavated Regolith (GROWLER) system.





ISRU FG August Meeting Summary

The ISRU working groups continue to be active:

- Water Ice Prospecting and Mining
- O2 Extraction
- ValueChain Analysis
- Facilities

Discussions on WaterIce prospecting and a presentation by Clive Neal, Notre Dame, on International Lunar Water-Ice Prospecting Campaign.

Discussions of opportunities and challenges associated with O2 extraction from regolith led by Michael Miller, SwRI

The ValueChain working group continues to be very active.

ISRU Facilities needs survey completed. <https://forms.gle/TxXbvb1LwN4XzQT47>. There will be a report out in the September ISRU FG meeting.

Join these discussions on Confluence at: <https://lsic-wiki.jhuapl.edu/display/ISRU>

LSIC Fall Meeting

LSIC Fall Meeting is confirmed for November 3-4, 2021

- Hosted at Bowie State University (Bowie, MD)
- Hybrid format with most content available virtually
- Theme: Autonomy and Robotics (EA and EE focus)
- Registration open! Abstracts submissions closed
- <http://lsic.jhuapl.edu/News-and-Events/Agenda/index.php?id=148>

Solicitations

- <https://www.nasa.gov/directorates/spacetech/solicitations>

Open Solicitations and Opportunities

NASA TechRise Student Challenge

Student Registration Opens: August 18, 2021

Submission Deadline: November 3, 2021

Lunar Surface Technology Research (LuSTR) Opportunities

21LuSTR NOIs due: August 20, 2021

21LUSTRPro Proposals due: September 17, 2021

Lunar TORCH Challenge

Deadline: September 13, 2021

2022 Breakthrough, Innovative and Game-Changing (BIG) Idea Challenge: Extreme Terrain Mobility Challenge

Notice of Intent due: September 24, 2021

Proposal and Video deadline: January 18, 2022

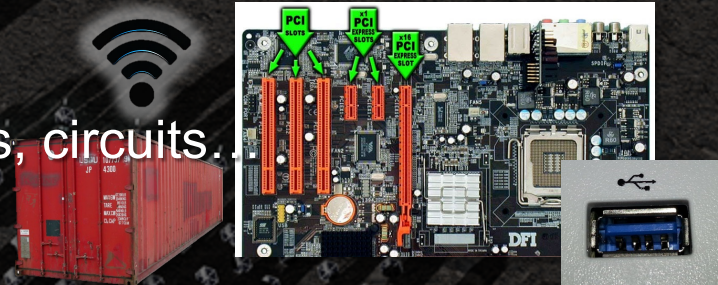
NASA Human-Autonomy Teaming Task Battery Challenge

Deadline: December 29, 2021

- Coming Soon: Watts on the Moon phase 2
- Gap/Closure plans will inform future solicitations

Modularity and Standards

- Overview and Brainstorming Sessions:
 - September 9th 2021, 11:00am – Noon EDT
 - <https://jhuapl.zoomgov.com/j/1616303523?pwd=SVVTNU03MWZNCnNLU3I4YlJBQTFpUT09>
 - September 14th 2021, 2:00pm – 3:00pm EDT
 - <https://jhuapl.zoomgov.com/j/1600847204?pwd=STZjWi9Oc2Y4WjdiUFZLR1dUcmpWUT09>
- Objective:
 - Discuss potential benefits of a Modular Open Systems Approach
 - Develop list of items that could be standardized or modularized on the lunar surface
- Examples:
 - Connectors, voltages, communications, data, message sets, controls, circuits.



Why is MOSA/M&S important? +1 +1 +1



What Modularity (and standards) efforts are underway in the community now? +1

Goddard/STMD
OSAM-1 mission

International External
Robotic Interface
Interoperability +1
Standards (IERIIS)

DoD is working to
standardize On Orbit
Servicing - Refueling

Operator Control
Units (DoD) +1

AMPS +1 +1 +1

Communications

SCaN LunaNet
Interoperability
Spec +1

outfitting in
construction

CLPS is working to
standardize Interfaces
for experiments +1 +1 +1

Payload user
guides available +1 +1

Voltages for
payloads, etc. +1 +1

IOP/JAUS +1

CONFERS

Gateway SORI
and LORI

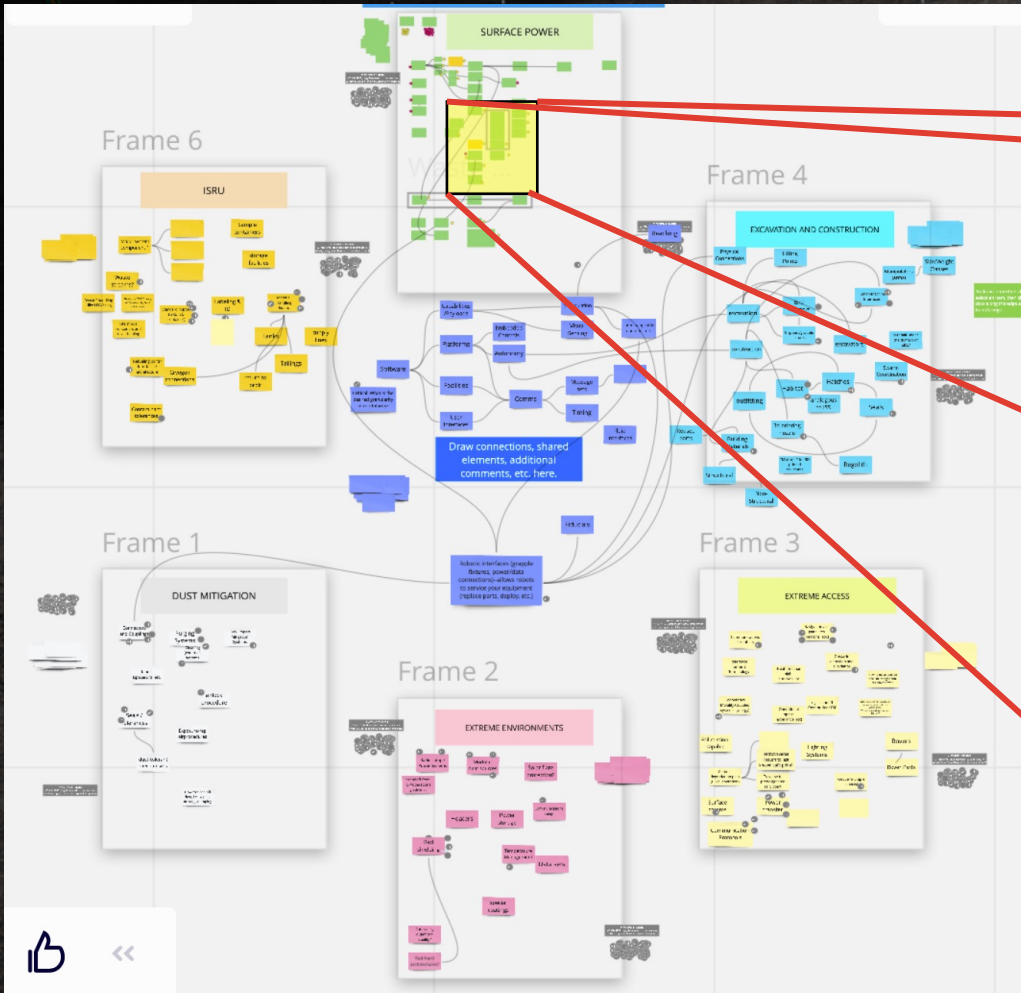
ISPSIS +1

ROS 2 /
Space ROS +1 +1 +1

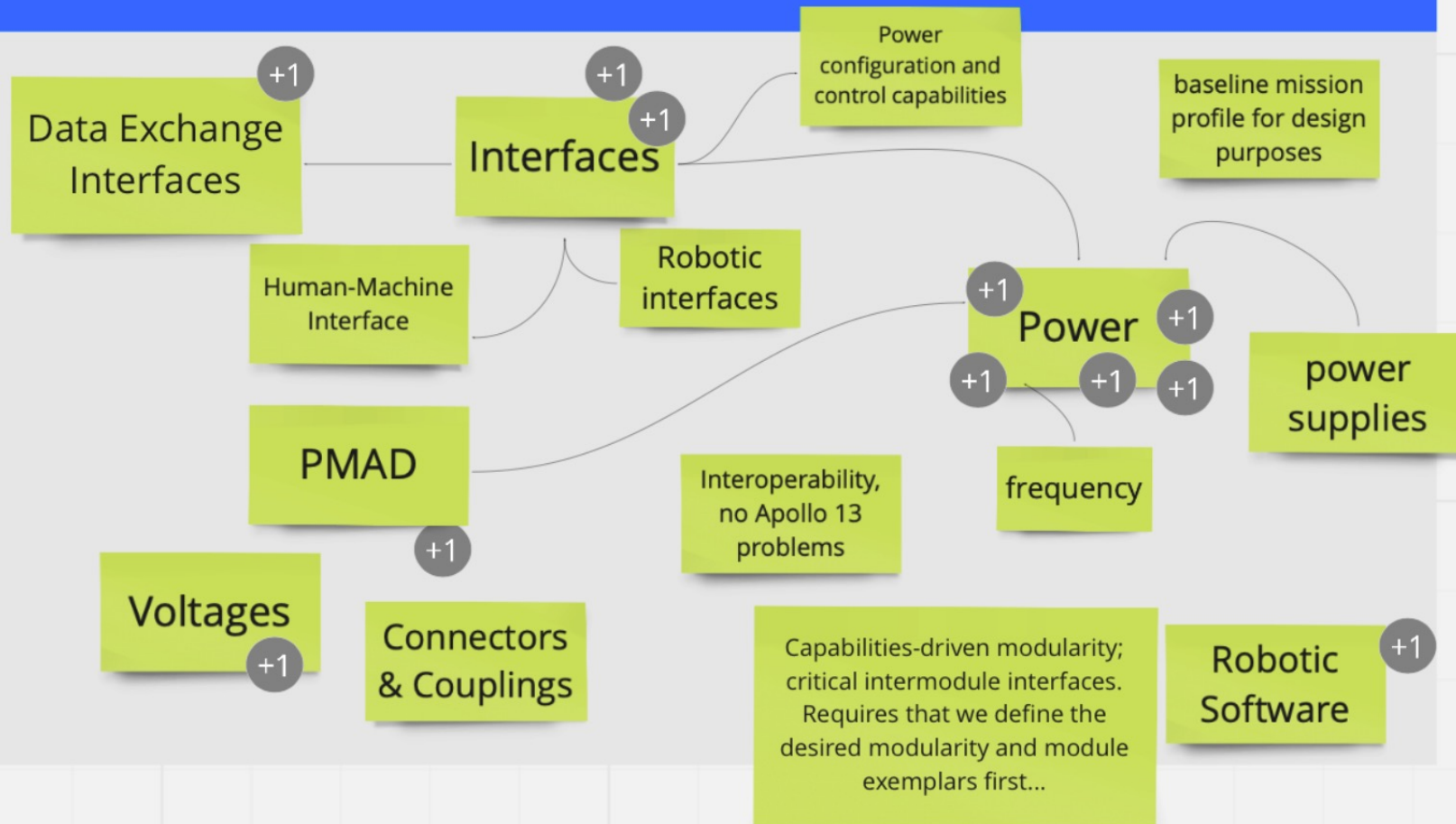
ESPA (secondary
payload
adapters)

IEEE

Modularity and Standards



Pick ONE thing that you think needs to be modularized or standardized FIRST.



Lunar Surface Innovation Consortium (LSIC)



Nationwide alliance of universities, commercial companies, non-profit research institutions, NASA, and Other Government Agencies with a vested interest in our nation's campaign to establish a sustained presence on the Moon.

LSIC Objectives include:

- 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.



Focus Groups (FG) are the primary means for consistent interaction with the LSIC Community. This includes:

- Establishing collaborative relationships among members via virtual monthly forums, quarterly virtual workshops, and LSIC member site visits
- Building community and developing talent
- Compiling member input and reporting outcomes and recommendations



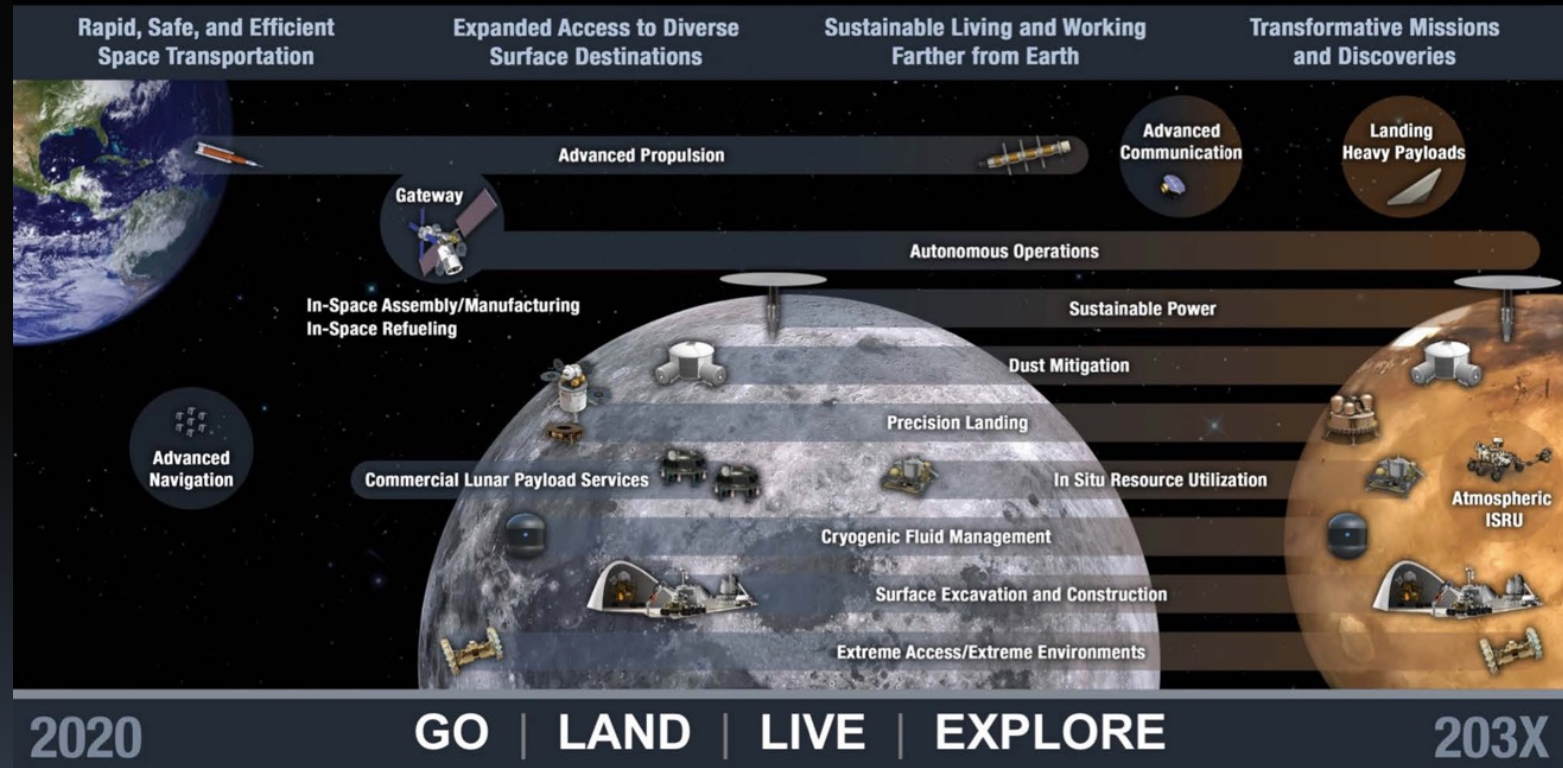
If interested in further information, please visit lsic.jhuapl.edu

NASA **DRAFT** GAP/CLOSURE SUMMARIES



- Gaps arranged around Thrusts
- Closure plans will inform funding opportunities
- LSIC Community core to assessment, including technology maturation level, acquisition options, funding structures, etc.

Reaching The Moon And Mars Faster With NASA Technology



NASA **DRAFT** GAP/CLOSURE Analysis Teams



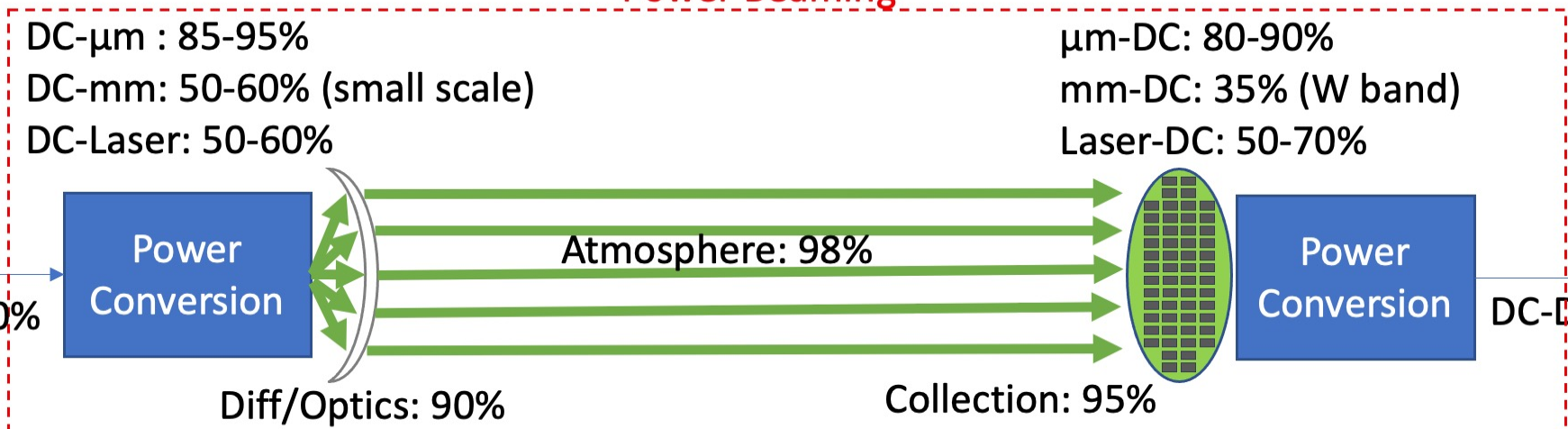
- Teams convene to discuss draft topics and final gaps when released
 - **Reaching out for community members to help lead these sessions**
1. Nuclear topics
 2. Durable PV Blankets
 3. Low Temperature Batteries
 4. Fuel Cells: Long-life RFC Storage, Mini RFCs, LO₂/LCH₄ Primary FCs
 5. Rad-Hard Power Electronics
 6. Transmission: Power Beaming, Low-Mass Cable
 7. Roadmap Analysis / additional gaps



Challenges for Power Beaming

Power Beaming

μm: 170-216 W
mm: 700-840* W
Laser: 350-590 W



- | | | |
|---|---|---|
| <p>Emitter</p> <ul style="list-style-type: none"> • Coherence vs. Incoherence • Optics and Beam Quality • Continuous vs. Pulsed • Emitted Spectrum • Heat Dissipation | <p>Transmit</p> <ul style="list-style-type: none"> • Atmosphere <ul style="list-style-type: none"> • Noble gases • Dust • Distance • Safety? (eyes, burns, etc.) | <p>Receiver</p> <ul style="list-style-type: none"> • Aperture Size • Collection Efficiency • Conversion Efficiency <ul style="list-style-type: none"> • Heat Dissipation • Dual-purpose? |
|---|---|---|

	Wavelength	DC-Efficiency	Coherence	Atmosphere	Aperture Size	Receiver Efficiency	TRL
μm	5 - 12 cm	85-95%	Optics	??	140 m	80-90%	
mm	0.3 - 3 cm	50-60% (TRL)	??	??	10 m	35% (TRL)	
Laser	500 - 1550 nm	50-60%	Diffraction	Dust?	.025 m	50-70%	

1. Fuel-DC
2. DC-DC
3. DC-EM
4. Shape Beam
5. Atmosphere
6. Hit Receiver
7. EM-DC
8. DC-DC
9. DC-Work

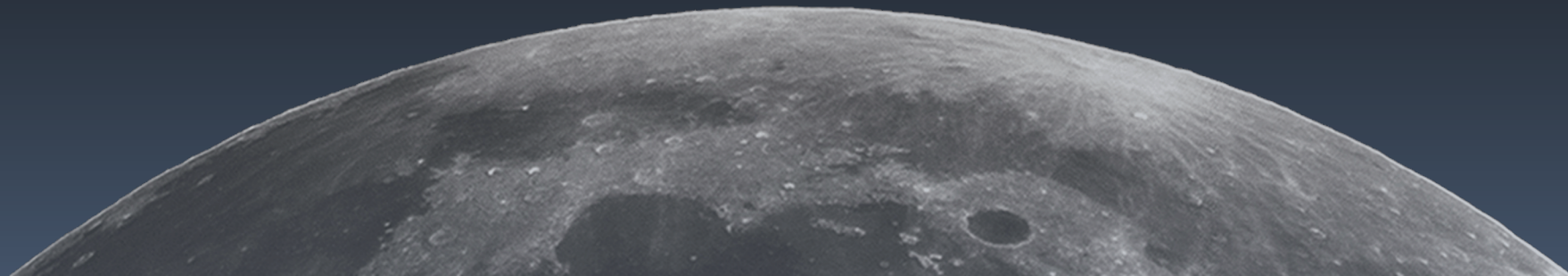
Approximate

Don Jenket, NREL

Value Chain Mapping

Kartik Kumar, SatSearch

David Kornuta, Blue Origin



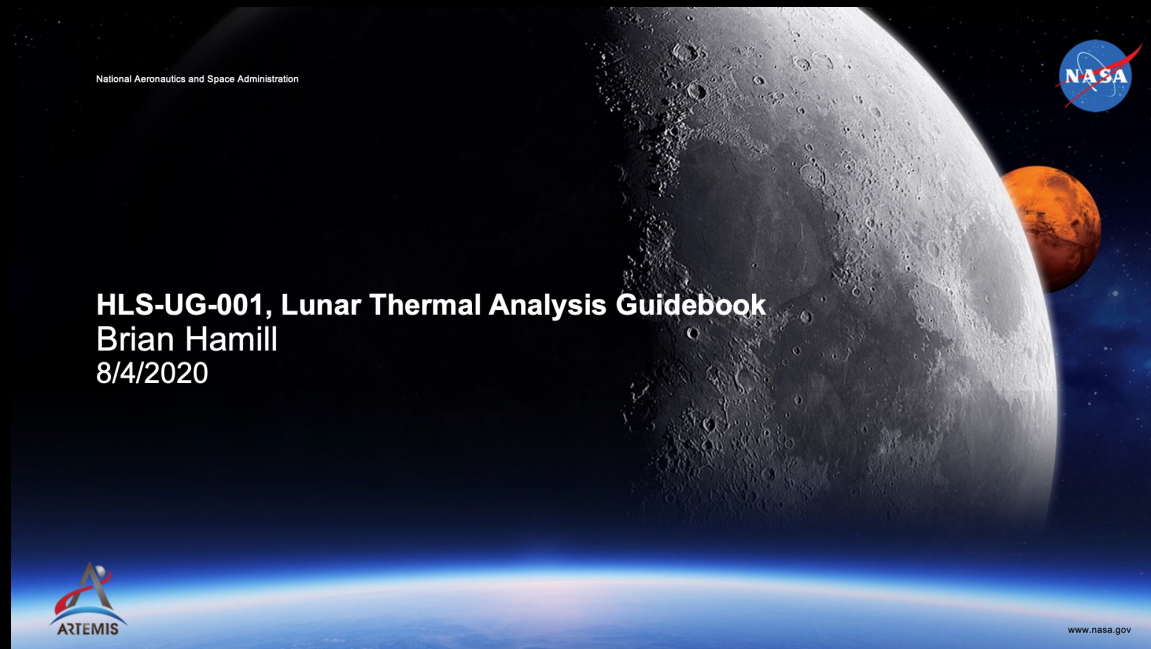


JOHNS HOPKINS
APPLIED PHYSICS LABORATORY



Extreme Environments

- New FG Facilitator, Dr. Jaime Porter
 - *Radiation Effects engineer specializing in radiation transport and charging effects for planetary missions*
- Featured Presentation, Brian Hamill
 - “Overview of the Lunar Thermal Analysis Guidebook - LTAG - HLS-UG-001”



Extreme Access FG Plan

- ✓ Identify areas and/or environments of interest
- ✓ Pick 1-2. –PSRs and Lunar pits/lava tubes
- 3. Identify specific architectures to enable exploration of these areas. What are the environments like? What are the needs for mobility, PNT, comms, autonomy?
- 4. Evaluate current technology availability, compare to what is needed for (3). This will likely involve standing up several smaller subgroups.
- 5. Identify gaps, prioritize which are more important to close first
- 6. Roadmap, determine recommendations for specific tech development and/or demos
- 7. Throughout: keep in mind where will need input or tech crossover from other focus groups. Where does technology development require multiple inputs?
- 8. Write a report of some sort