



Lunar Surface Innovation

C O N S O R T I U M

LSIC Surface Power Focus Group August Meeting

August 27, 2020

We will start ~3 minutes after the hour

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Today's Agenda

- ISRU Workshop results
 - Discussion and implications for power
- Fall Meeting updates
 - SPFG guidance for break-out sessions
- Open Discussion
 - Topics you'd like to see discussed in more detail (Confluence?)
 - Year-one goal
- Lightning Talk
 - Dennis Wingo



LSIC Community

1. Harness the creativity, energy and resources of academia, industry and government in order for NASA to keep the United States at the forefront of lunar exploration
2. Identify lunar surface technology developments most in need of sponsor support and communicate those to NASA
3. Provide a central resource for gathering and disseminating information, results, and documentation



Confluence

- License provided -- 2000 available
- Contact Andrea Harman for “FREE” access
 - ams573@alumni.psu.edu
- Tutorial sessions posted
- Content can include
 - Wiki content, including a capabilities survey of LSIC members
 - Calendar of LSIC and related events
 - Information about telecons, etc.
 - Discussion area
 - Your ideas!
- LinkedIn LSIC group
<https://www.linkedin.com/groups/13861869/>





ISRU Supply & Demand Workshop

- More than 200 attendees at peak
- 6 presentations each on Supply and Demand
- Take-aways:
 - Real, near-term (less than a decade) potential for **commercial market for ISRU**. Demand ranges from 10's to 100's of metric tons for O₂
 - Demand for metals expected to follow quickly
 - Anchor Tenants such as NASA/DoD would be enabling for this marketplace
 - Major issues still remain: **timelines**, purity requirements, delivery locations, etc.
 - Desire from ISRU community for STMD to push for demo missions in CLPS allocations



- ASU as the virtual host/co-creators
- Theme is the interconnection between focus groups using power as the unifying context
 - Systems-engineering emphasis
 - Mix of high-level and technical talks
- Two days
 - Day 1 Plenary talks, virtual poster session
 - Day 2 Workshop/discussions
- Workshop topics/brainstorming
 - Many parallel topics for smaller group sizes



Fall Meeting/Open Discussion

Day 1 - October 14, 2020

NOTIONAL

- ASU
- There using
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PT	MT	CT	ET	Duration	Topic
8:00	9:00	10:00	11:00	2 hrs	Welcome and Introduction
					Artemis Update
					LSII Update
					LSIC Status
10:00	11:00	12:00	13:00	45 min	Lunch break
10:45	11:45	12:45	13:45	1 hr	ASU Overview and Feature
11:45	12:45	13:45	14:45	15 min	Systems Integration Concerns
12:00	13:00	14:00	15:00	10 min	Break
12:10	13:10	14:10	15:10	1 hr 20 min	Space Tech Opportunities: Panel Discussion including SBIR, STRG, NIAC, Centennial Challenges, Flight Opportunities
13:30	14:30	15:30	16:30	10 min	Break
13:40	14:40	15:40	16:40	1 hr 20 min	Mentoring, Networking and Posters

15:00 16:00 17:00 18:00

Adjourn

Fall Meeting/Open Discussion

- ASU as the
- Theme is using power
 - System
 - Mix of
- Two days
 - Day 1
 - Day 2
 - Abstracts
 - [https://www.nasa.gov/](#)
- Workshop
 - Many p

Day 2 - October 15, 2020

PT	MT	CT	ET	Duration	Topic	NOTIONAL
8:00	9:00	10:00	11:00	15	Envisioned Future Outbrief	
8:15	9:15	10:15	11:15	45	Power Panel: Systems level concerns & current status	
9:00	10:00	11:00	12:00	20	BREAK/TRANSITION	
9:20	10:20	11:20	12:20	60	Scenario sessions 1: 2028-2030 timeframe: establishing sustained presence	
10:20	11:20	12:20	13:20	20	BREAK/TRANSITION	
10:40	11:40	12:40	13:40	60	Scenario sessions 2: 2024-2026 timeframe: building towards a sustained presence	
11:40	12:40	13:40	14:40	20	BREAK/TRANSITION	
12:00	13:00	14:00	15:00	60	Scenario Outbrief preparation: discuss findings, prepare report for plenary	
13:00	14:00	15:00	16:00	10	BREAK/TRANSITION	
13:10	14:10	15:10	16:10	50	Scenario Report out; Discussion and Next Steps	
14:00	15:00	16:00	17:00		Adjourn	
Plenary Sessions						
Networking, Posters and Smaller Group Break-outs						
Panel Presentations with Q&A						



- Workshop topics/brainstorming
 - Session 1: Where do we want to be?
 - What is your envisioned future under different power constraints
 - “Unlimited” power (power is not a primary concern)
 - “Modest” power (limited duty cycle, modest ceiling)
 - Austere/limited, or “DIY” power
 - Session 2: How do we get there?
 - What are the technological linchpins to reach the envisioned future of session 1? What are the cross-cutting collaborations needed between focus areas?



- How quickly can we get to megawatt power on the lunar surface?
- What building blocks are available right now to start building towards the goal?
- Can mixed/hybrid power systems scale together?
- What are the immediate technology developments required to reach the goal more quickly?

- What is the trade space for power demand for O₂ from regolith and H₂O from PSR?
 - H₂O is easier to crack but lots of unknowns (distribution, transport)

- What is the minimum continuous power demand and how can we meet that?
 - E.g., what would it take to supply 50 kW non-solar for 50+hours? 5x fission reactors, large-scale FC, etc?

- What power-topics are NOT being discussed enough?
 - What system-level questions are not being addressed sufficiently?
 - What information do you need about the surface to refine technologies?
 - What information do we still need about dust mitigation, extreme environments, extreme access, excavation and construction
 - In what areas do we run the risk of stove-piping?



How do we install these systems on the surface

Focus Group Goal

Each focus group is charged to define a **single 1-year goal**.

NASA needs power systems which can survive the lunar night and enable lunar exploration. The first-year goal of the surface power focus group is to:

Provide specific recommendations and a staged road map to NASA for rapidly achieving sustainable, scalable power-related systems/capabilities needed to enable sustained presence, ISRU, excavation and construction, in the context of a polar lunar outpost.



- Dennis Wingo
 - CEO/President of Skycorp, Inc and has decades worth of experience in the computer and aerospace industries

