



# Lunar Surface Innovation

C O N S O R T I U M

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## LSIC ISRU Focus Group Monthly

<http://lsic.jhuapl.edu/>

<http://lsic-wiki.jhuapl.edu/> (sign-up required)

**May 19, 2021**

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# Agenda

- General Updates – 10min
  - SBIR awards - [https://sbir.nasa.gov/award\\_topic\\_list/selection\\_nid/66870](https://sbir.nasa.gov/award_topic_list/selection_nid/66870)
  - Other FG updates; expect a new monthly meeting announcement
- Take-aways from the LSIC Spring meeting – 15 min
  - Open discussion – enter questions in Chat or ‘raise hands’ so we can keep track and everyone gets a chance to participate.
- ISRU major subject area discussions – permanent themes of the ISRU FG - 20 min
  - Identifying and connecting technology needs between industry and NASA
  - Funding approaches and needs for technology development
  - Positively impacting the ISRU community
- Networking breakout focus areas – goal: Identify needs, solutions, and provide input to NASA 10 min + (and next month)
  1. Facilities for ISRU – availability, needs, etc.
  2. Technology needs/approaches for finding H<sub>2</sub>O reserves
  3. Technology needs for O<sub>2</sub> from regolith processing system
  4. Inter-focus group collaborations
  5. Extracted resource purity – needs, approaches, challenges
  6. Outreach and inclusiveness; meeting FG member needs
  7. Figure of Merits for ISRU system technologies

Considered but not included:

  1. Technology needs for H<sub>2</sub>O processing system (well supported by previous fundings)
  2. How to improve contributions/access for small and new companies (may be covered under current networking efforts)
  3. Waste not, want not; other ISRU resources such as metals, etc. (of great interest but benefits from maturing O<sub>2</sub> from regolith technologies)

# SBR awards

## Focus Area 8 In-Situ Resource Utilization (3)

### Advanced Cooling Technologies, Inc.

1046 New Holland Avenue  
Lancaster, PA 17601  
William Anderson (717) 205-0602  
20-2-Z12.01-4941 JSC  
[Thermal Management System for Lunar Ice Miners](#)

### Lunar Resources, Inc.

5000 Gulf Freeway, Exploration Research Park, Building 4  
Houston, TX 77023  
Elliot Carol (646) 455-8382  
20-2-Z12.01-4634 KSC  
[Prototype Development of a Molten Regolith Electrolysis Oxygen Capturing, Filtering and Storage System](#)

### Paragon Space Development Corporation

3481 East Michigan Street  
Tucson, AZ 85714  
Joel Johnson (520) 382-4854  
20-2-Z12.01-5262 JSC  
[ISRU Collector of Ice in a Cold Lunar Environment \(ICICLE\)](#)

## Focus Area 24 Dust Mitigation (3)

### Astrobotic Technology, Inc.

1016 North Lincoln Avenue  
Pittsburgh, PA 15233  
Michael Provenzano (845) 399-0843  
20-2-Z13.02-6350 GRC  
[High Power Near-Field Wireless Transfer for Dust Intensive Applications](#)

### Hedgefog Research, Inc.

1891 North Gaffey Street, Suite 224  
San Pedro, CA 90731  
Alex Kolessov (310) 935-2206  
20-2-Z13.01-6503 KSC  
[Bendable Electrodynamic Dust Shields](#)

### Mainstream Engineering Corporation

200 Yellow Place  
Rockledge, FL 32955  
Michael Rizzo (321) 631-3550  
20-2-H3.03-5980 GRC  
[Cyclone Precipitator Sub-Micron Particulate Separator](#)

## From Focus Area 4 – Robotic Systems

### Blueshift, LLC

575 Burbank Street, Unit G  
Broomfield, CO 80020  
Ryan Garvey (850) 445-3431  
20-2-Z5.05-6062 JSC  
[Modeling Rover Interactions with Lunar Regolith in Permanently Shadowed Regions](#)

### Creare, LLC

16 Great Hollow Road  
Hanover, NH 3755  
Robert Kline-Schoder (603) 640-2487  
20-2-S4.02-5011 JPL  
[Compact, Robust Pump for Deep Subsurface Ice Penetration](#)

## From Focus Area 6 – Life Support

### Bettergy Corporation

8 John Walsh Boulevard, Suite 321  
Peekskill, NY 10566  
Lin-Feng Li (914) 290-6293  
20-2-H3.01-5695 MSFC  
[High Efficiency Hydrogen Separation Membrane Module for Space Oxygen Recovery Systems](#)

### PH Matter, LLC

6655 Singletree Drive  
Columbus, OH 43229  
Christopher Holt (614) 783-2396  
20-2-H3.01-4569 MSFC  
[Automated Carbon Formation Reactor](#)



# LSIC | Other Focus Group Updates

## Power FG

Vertical Solar Array Technology (VSAT) Super-Telecon, May 27<sup>th</sup>, 11:00-1:00 ET. Attended by 4/5 of the companies.  
Power Beaming Workshop, July 15-16, 2021

## Extreme Environment FG

Extended Telecon held in April on technology concerns for polar and non-polar environments. “Breaking down the Lunar Environment Monolith”

Polar Environments: <https://lsic-wiki.jhuapl.edu/display/EE/Polar+Environments+Breakout>

Non-Polar Environments: <https://lsic-wiki.jhuapl.edu/display/EE/Non-Polar+Environments+Breakout>

## Extreme Access FG

Major take-aways from the TRN workshop in March: **Precision landing and hazard avoidance systems are necessary to enable access across the lunar surface. Communication between lunar data providers and data users is necessary and, to date, has been inefficient.**



# Spring Workshop Take-aways

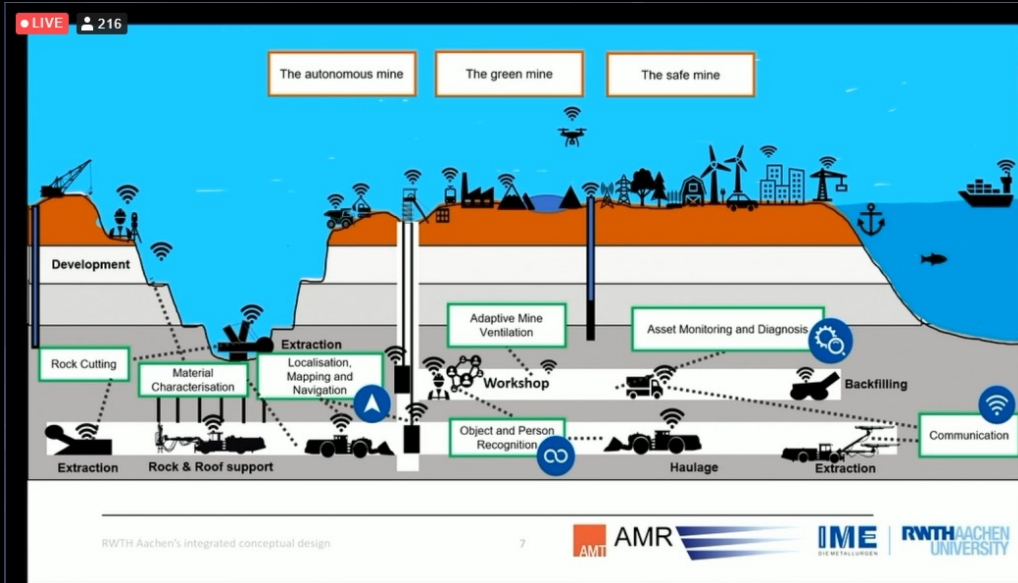
- NASA will be a user of technology – focus is continuing to shift from NASA building to industry providing. What should NASA be doing for funding? What tech should NASA demonstrate feasibility of and then enable industry and how? (*What ISRU tech does the FG think is needed?*)
- Need for standardizing interfaces...and a need for setting standards (requirements) – (*this gets to the next point*)
- Infrastructure is needed...autonomous excavation and construction. Huge system challenge. (*ISRU has these same challenges, different scale – need to approach from a system perspective*)
- Roadmapping, gaps, and dependencies. (*Our FG should think beyond roadmapping for NASA*)
- PPP and new acquisition models. (*The FG can weigh in on this*)
- Others?

# Focus Group Activities for the next year

- Identifying and connecting technology needs between industry and NASA
  - Roadmapping tech development. Clear plan for private industry that is not fully dependent on NASA. As part of this, Sustained Presence must be defined. (Explicit statement of human presence and durations on the Moon). The ISRU FG can provide input to NASA on which technologies should be developed and flown for developing workable ISRU systems. System-level considerations. Cross-collaborations with other FG (Dust, Power, Extreme Environment, Extreme Access, Excavation and Construction).

# ROADMAPPING activity by the ISRU FG

## Mine of the Future



Our goal is to develop and communicate an architectural roadmap to advance the TRL of necessary ISRU technologies (to create an ISRU system) capable of supporting sustained lunar surface operations. To propose a strategy where we make hard choices and prioritize the right things. The roadmap is simply a reflection of this.

“A roadmap is a strategic plan that defines a goal or desired outcome and includes the major steps or milestones needed to reach it. It also serves as a communication tool, a high-level document that helps articulate strategic thinking—the why—behind both the goal and the plan for getting there”

3. Develop a business model and plan
4. Propose a roadmap, demonstrating how the service/product

“A vast majority of roadmaps miss the why behind what they are building and just focus on features — they are disconnected from the product strategy and have no clear goals or themes. Instead, excellent roadmaps should be a product of collaboration and include the input of many stakeholders and cross-functional teams.”

“...delivery-focused roadmaps, ...with granular timelines for development teams that want to know the details. Communicate objectives, status/stage of development, areas of your product, and account for other work they need to support. Leverage dependencies and capture risks.” – Product Board

# Focus Group Activities for the next year

- Funding approaches and funding needs for technology development
  - Include terrestrial spin-offs and developing cis-lunar economy (Space Resources week) – tech needs?
  - How well does current funding structure result in the development of functional systems?
- Positively impacting the ISRU community
  - Keep providing feedback on Confluence or by email; start Confluence conversations, etc. Change will happen.



# Networking

- Today: We have 10+ minutes for Networking.
  - Breakout sessions. Feel free to jump between them.
  - How it works today.

The break out sessions

  1. Figure of Merits for ISRU system technologies
  2. Facilities for ISRU – availability, needs, etc.
  3. Technology needs/approaches for finding H2O reserves
  4. Technology needs for O2 from regolith processing system
  5. Inter-focus group collaborations
  6. Extracted resource purity – needs, approaches, challenges
  7. Outreach and inclusiveness; meeting FG member needs
- Next Month focus group meeting
  - Devoted to Networking
  - Opportunity to record 1min video about you/your company/messaging ( and please make sure the Who's who is filled out so others can follow up with you)
  - Then break into extended breakout rooms. (today is a scalable demonstration of this technology)



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Vision Statement	Goal	Objective	Implementation
<p style="text-align: center;">Enable the identification and maturation of technology needs for ISRU systems that can produce up to 10s to 100s MT/yr of O2</p>	<p style="text-align: center;">Connect FG technology ideas with NASA</p>	<p>The FG provides recommendations and rationales to NASA on which technologies that members would like to see NASA fly as risk mitigation.</p>	<p>Increasing the number of ISRU components selected to be flown on future CLPS missions.</p>
		<p>The FG makes recommendations to NASA on which ISRU technologies and interfaces need maturing.</p>	<p>Future NASA AO's and selections reflect recommendations for ISRU technology development.</p>
	<p>Provide NASA an assessment of the effectiveness of current funding approach to ISRU technology</p>	<p>The FG will assess the strengths and weaknesses of the current funding approach by NASA and make recommendations on how to improve.</p>	<p>Better alignment of NASA funding opportunities, and possibly new funding options, with ISRU technology NASA and the community believes needs maturing.</p>
	<p>Affect a positive impact on community collaborations</p>	<p>The FG will develop and demonstrate effective metrics for determining how well it is meeting the needs of the community: industry, NASA, academia, non-profits.</p>	<p>New line of funding or new business opportunity obtained by FG members attributable to participation in the LSIC ISRU FG.</p>
			<p>A report based upon input by the ISRU FG members on how well the ISRU FG is meeting their needs.</p>
	<p>Continual population of the Who's Who database for improved networking by the ISRU community.</p>		