Lunar Surface Innovation
CONSORTIUM

Extreme Access Focus Group Telecon

June 10, 2021

We'll start around 3:03

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APPLIED PHYSICS LABORATORY

Lunar Surface Innovation CONSORTIUM

Today's Agenda

- LSIC Focus Group Updates
- Year 1 survey and feedback
- Upcoming Meetings/Opportunities
- Annual Goal and Subgroups
- Technology Spotlight
- Open floor and Discussion

Join the Discussion on Confluence

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10 June 2021

Created by Angela Stickle, last modified 9 minutes ago

Add a comment below to sign in and discuss.

Please add yourself to the Who's Who if you haven't had a chance. Feel free to add any info about what you're hoping to get out of the L

Today's hot topics:

Subgroup Formation and Details

Spring Meeting Debrief

Technology Spotlight

Ben Ashman: Lunar GNSS Receiver Experiment (LuGRE)

If you are interested in background on Ben Ashman's presentation, listen to (or read the transcript of) episode 9 of NASA's Invisible Network podcast, which describes the history of using GPS and GNSS sidelobe signals for satellite navigation.

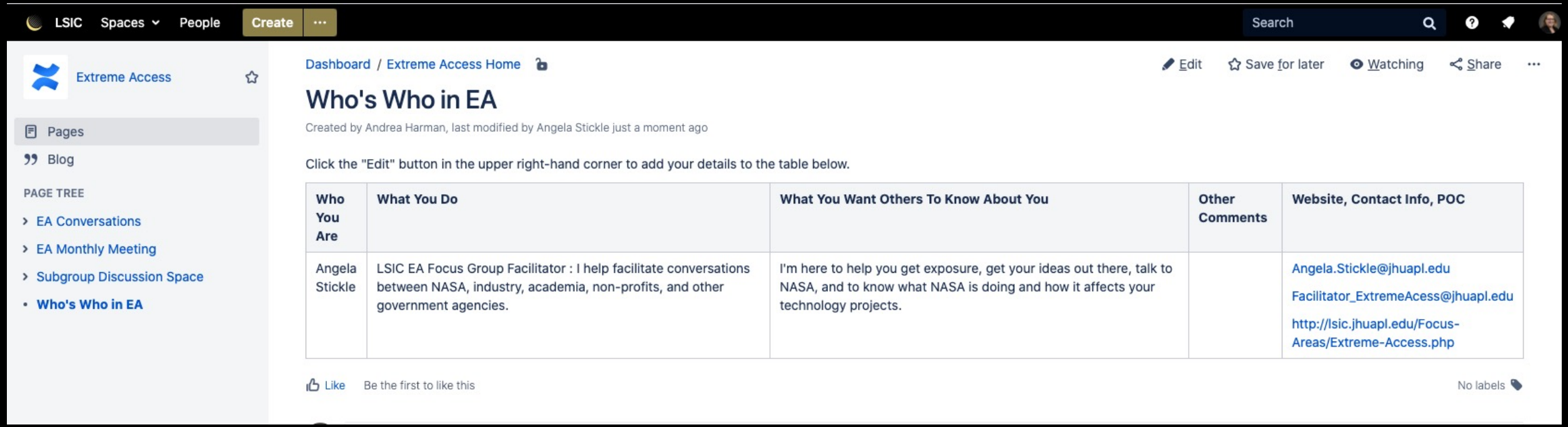
https://www.nasa.gov/mediacast/goddard/2019/the-invisible-network-podcast-episode-09-lobes

1. Add a comment to sign in
2. Selecta an agenda topic and comment your thoughts
3. Follow-up after the telecon to continue to discussion!

Lunar Surface Innovation CONSORTIUM

Get to know the community

https://lsic-wiki.jhuapl.edu/x/0IVf



Who's Who in ISRU: https://lsic-wiki.jhuapl.edu/display/ISRU/Who%27s+Who+in+ISRU
Who's Who in Surface Power: https://lsic-wiki.jhuapl.edu/display/SP/Who%27s+Who+in+LSIC-Surface+Power
Who's Who in E&C: https://lsic-wiki.jhuapl.edu/pages/viewpage.action?pageId=6260179
Who's Who in EE: https://lsic-wiki.jhuapl.edu/display/EE/Who%27s+Who+in+LSIC-EE

Year 1 Feedback

- So far, we hear:
  - You wanted to learn more about extreme access challenges and technologies, and feel that you have
  - You enjoy:
    - Collaboration opportunities
    - Learning about new technology
    - Interacting with NASA
  - You'd like to see:
    - Topical workshops
    - Cross focus group activities
    - Interactive brainstorming activities

- We'd love to hear your thoughts on how Year 1 of LSIC EA went!
  - https://forms.gle/77fszZB1BgmZdweW7

- Audience participation time!

Surface Power Activities

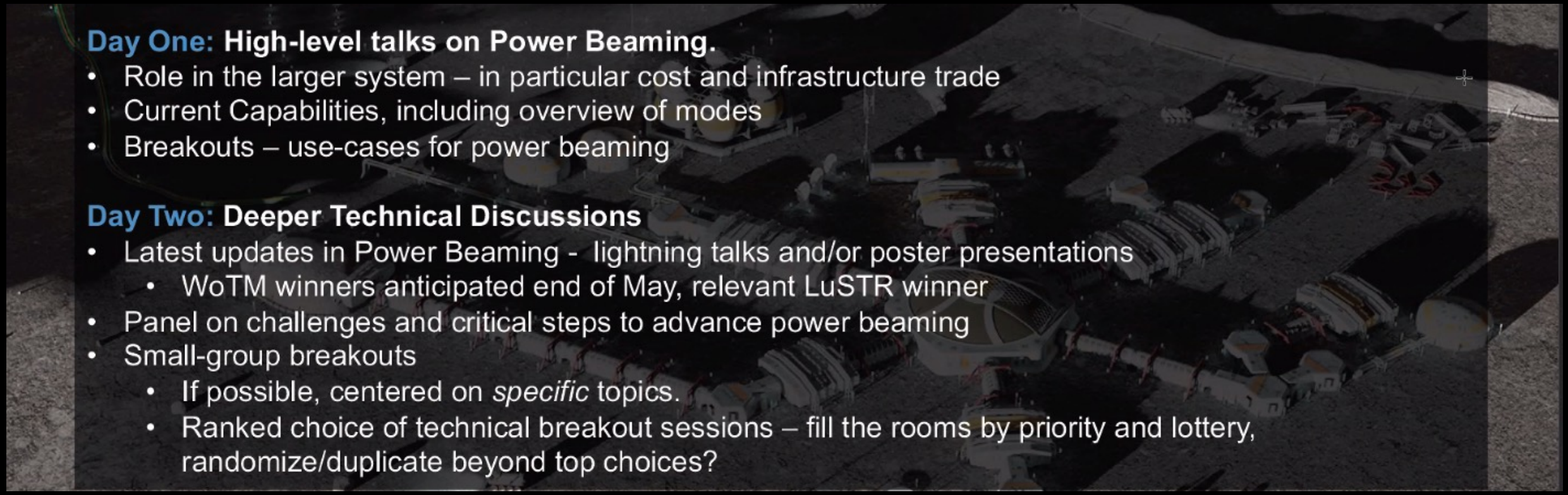
- Annual Goal:

  NASA needs power systems which can survive the lunar night and enable exploration. The over-arching goal of the surface power focus group is to provide specific recommendations to NASA for rapidly achieving appropriate-scale power-related technologies needed to enable sustained presence and exploration.

  To work towards this, over the next year we will focus on connecting power experts to their potential user base, framed by the economic and institutional drivers that set the scale of power demand. This will enable us to identify near-term needs for immediate prioritization and long-term goals that impact early architectural decisions.

- **Highlights of upcoming activities and discussion**
  - Upcoming and current workshops:
    - Space Power Workshop
    - Space Resources
    - Nuclear Emerging Technologies
  - **Survey of power users**– our FG will soon to be reaching out to other focus groups for information needed to analyze potential power systems
  - **Power Beaming Workshop – 2 days, anticipated June/July**
    - **Day 1: Context and Demand**
    - **Day 2: Deeper Technical Discussions**

Power Beaming Workshop, Late July



Day One: High-level talks on Power Beaming.

- Role in the larger system – in particular cost and infrastructure trade
- Current Capabilities, including overview of modes
- Breakouts – use-cases for power beaming

Day Two: Deeper Technical Discussions

- Latest updates in Power Beaming - lightning talks and/or poster presentations
  - WoTM winners anticipated end of May, relevant LuSTR winner
- Panel on challenges and critical steps to advance power beaming
- Small-group breakouts
  - If possible, centered on *specific* topics.
  - Ranked choice of technical breakout sessions – fill the rooms by priority and lottery, randomize/duplicate beyond top choices?

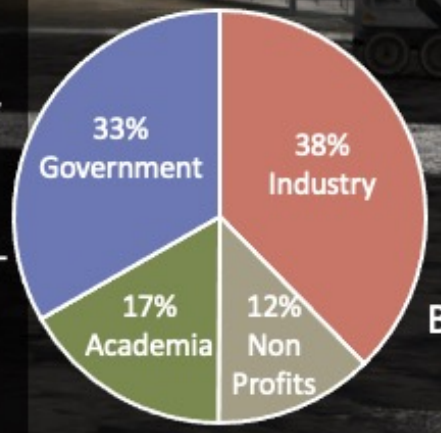
LSIC | Spring Meeting, May 11-12, 2021

The Lunar Surface Innovation Consortium (LSIC) Spring Meeting provided a forum for NASA and the space technology community to discuss technology development for establishing a sustained presence on the lunar surface.

546 attendees representing over 200 institutions joined the meeting over the course of two days. Roughly half of those registered for the meeting had not previously attended an LSIC meeting, and over half have never worked with NASA's Space Tech.

Videos of the event can be accessed at http://lsic.jhuapl.edu/News-and-Events/Agenda/index.php?id=124

- Featured presentations
  - Keynote address, Dr. Bhavya Lal, NASA Senior Advisor for Budget and Finance
  - Jim Reuter, NASA Associate Administrator for Space Technology
  - Joel Kearns, Deputy Associate Administrator for Exploration in NASA's Science Mission Directorate
- Moderated panel discussions
  - LSIC Executive Committee: engaging new members, focusing LSIC's mission, and developing the community
  - Space Tech Program Executives: funding opportunities and how to propose to them
  - NASA, DARPA, and Community Representatives: synergies and interactions between stakeholders
- Technical presentations
  - Invited talks by recent Space Tech funding recipients, contributed lightning talks and poster session
- Findings derived during breakout sessions
  - Triage is important with respect to technical readiness evaluation/testing. LSIC can help the community and NASA by coming to a consensus on where Earth and space-based testing facilities are adequate for testing lunar technology, then *determine which mission components absolutely have to be tested in-situ*.
  - While standardization is a concern to ensure interoperability, safety, and sustainability, there is a need to avoid a top-down direction which can stifle creativity. Yet, standardizing, or channelizing, development can save companies money and advance TRL more quickly. Thus, developing *community consensus on which key areas befit standardization* may benefit everyone involved.
  - For smaller businesses, proposal opportunities with low up-front burden to pitch an idea are more accessible. Techniques used by groups such as AFWERX should be considered when trying to stimulate commercial investment and engagement. LSIC should *leverage existing programs and tools to foster the lunar commercial industry*.



Attendee Breakdown

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Upcoming Meetings

- Focus Group Telecons (2nd Thursday each month, 3-4 pm EST)
  - June 10, 2021
  - July 8, 2021

- Lunar Surface Science Workshop
  - Fundamental and Applied Lunar Surface Research in Physical Sciences (August 18-19, 2021)
  - Abstract deadline June 18, 2021
  - Free, but registration is required
  - https://www.hou.usra.edu/meetings/lunarsurface2020/

This physical sciences workshop will focus on:

- Lunar dust and its properties, behavior, and mitigation
- Life support and thermal management
- Materials flammability and habitat fire safety
- Extraction of water-ice from regolith research, including separation, purification, electrolysis, and liquefaction
- Lunar environment and its effects on materials
- Lunar research in extraction, processing, and handling
- Lunar research for advanced manufacturing
- Fundamental physics research on the lunar surface

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- Workshop on Terrestrial Analogs for Planetary Exploration
  - June 16-18, 2021
  - https://www.hou.usra.edu/meetings/terrestrialanalogs2021/
- Planetary Data Workshop and Planetary Science Informatics and Data Analytics Meeting
  - June 28-July 2, 2021
  - https://www.hou.usra.edu/meetings/planetdata2021/

Other Notes of Interest

- PNT subgroup meeting, 17 June 3 pm ET
- TRN subgroup kickoff, early-mid July

- Current Funding Opportunities:
  - Break the Ice Lunar Challenge
    - https://breaktheicechallenge.com/
    - Registration and System Architecture Submission Deadline: 18 June 2021

- http://lsic.jhuapl.edu/Resources/Funding-Opportunities.php

LSIC Extreme Access Year 2 Goals

Vision: Build a community specializing in technology required to access, navigate, and explore surface and subsurface areas on the Moon. Identify areas of interest in technology development, evaluate readiness, and provide a resource for members to gain & share information, network, and discuss technology needs for lunar exploration.

Year 2 Goals:

Identify mission/system elements needed to provide access in challenging lunar environments, including identifying specific technology needs and gaps, prioritizing development timelines, and providing a general roadmap and recommendations for needed technology, testing, and demonstrations.

- *PSRs and lunar pits/lava tubes were chosen as high priority environments*
- *We will work with the EE group to identify environment requirements and challenges*
- *Conduct at least 1 technical interchange meeting*

Build a community and develop collaborative relationships among members

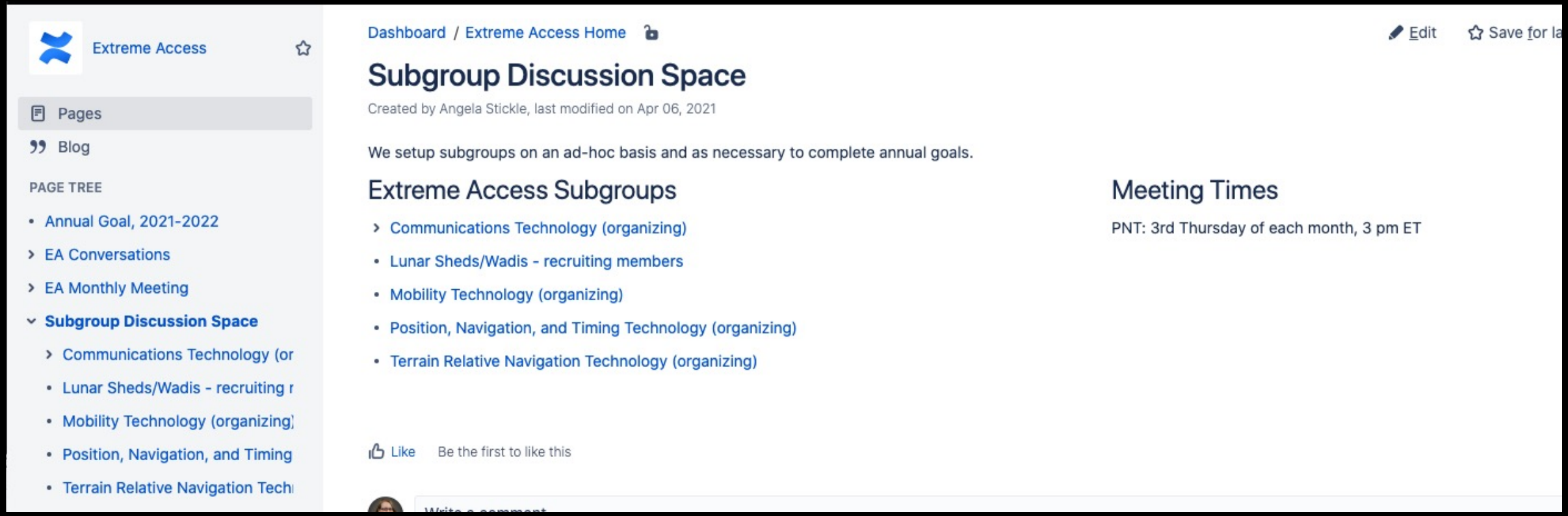
- Inclusive monthly telecons with member technology spotlights
- Provide networking opportunities at large LSIC meetings, mentoring through LSIC channels
- Community-led subgroups for in depth discussions and networking

We are now on Step-3!

- ✅ 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

Subgroup Formation Information



Subgroup formation to facilitate more in-depth discussions of technology and gaps

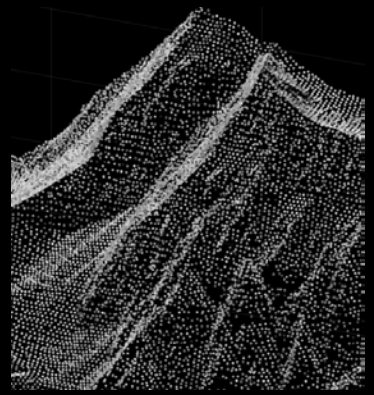
- Recruiting leads and participants.
- Expectation: 1 subgroup meeting (outside EA monthly telecon) to discuss ongoing tasks
- We will have occasional report-outs at regular monthly telecons
- Confluence can be used for discussion and resource compilation

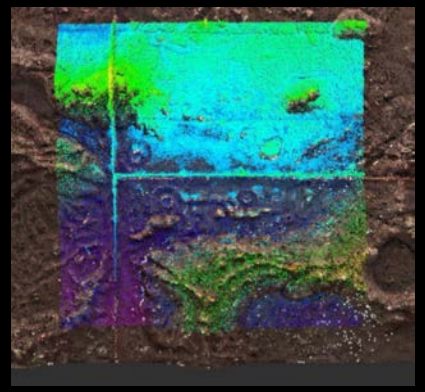
Subgroup Formation and Progress

- Please fill out the subgroup interest survey: https://forms.gle/fhQgngyXQ4KLniEZA

- PNT Technology – Lead: Sarah Withee
- TRN Technology – Lead: Carolina Restrepo
- Mobility Technology –
- Communications Technology –
- Lunar Sheds/Wadis –

Lunar PNT





- *Subgroup Goal*
  - *Determine what technologies for extreme access exploration of the lunar surface*
    - *already exist*
    - *need to be modified for lunar surface work (dust mitigation, dealing with electrostatic discharge, etc.)*
    - *need to be developed*

- *First meeting Thursday May 18 2021*
  - *Began discussion of PNT issues in lunar lava tubes*
    - *Identified challenges, earth analogue environments, and existing technologies that can be used for navigation sensing*
    - *Detailed notes are in Confluence https://lsic-wiki.jhuapl.edu/x/FYjL*

- *Next meeting Thursday June 17 2021 at 3 pm ET*
  - *Continuing lava tube discussion, focusing on limitations/issues current sensor technologies may face in lava tube environment*
  - *Contact Sarah Withee sarah.withee@jhuapl.edu for more info*
  - *https://lsic-wiki.jhuapl.edu/x/-4DL*

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Technology Spotlight

Dr. Ben Ashman – Lunar GNSS Received Experiment (LuGRE)

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Communications

- Confluence is our record of discussions and a good repository
  - Confluence is free to you and available to all registered LSIC members
  - We will be using Confluence to document discussions and provide resources to LSIC members. All focus groups have a separate page so it's a good collaboration space.
  - To request an account, please email Andrea Harman: ams573@alumni.psu.edu

- Technology Spotlights/Lightning Talks at monthly telecons
  - Anyone can volunteer to give a lightning talk (10-20 mins)
  - Email Angela or Sarah, or comment on Confluence, to sign up!

- Updates to the webpage - http://lsic.jhuapl.edu/Focus-Areas/Extreme-Access.php
  - Notes, slides, recordings from telecons posted here

Follow the Code of Conduct for all Focus Group communications

Contact information

LSIC Director: Rachel Klima, SES-LSIC-Director@jhuapl.edu
http://lsic.jhuapl.edu

Focus Group Area	Listserv address	Facilitator
In-Situ Resource Utilization	LSIC_ISRU@listserv.jhuapl.edu	Karl Hibbitts
Surface Power	LSIC_Power@listserv.jhuapl.edu	Wes Fuhrman
Extreme Environments	LSIC_ExtremeEnvironment@listserv.jhuapl.edu	Ben Greenhagen
Extreme Access	LSIC_ExtremeAccess@listserv.jhuapl.edu	Angela Stickle
Excavation and Construction	LSIC_ExcavationConstruction@listserv.jhuapl.edu	Athonu Chatterjee
Dust Mitigation	LSIC_DustMitigation@listserv.jhuapl.edu	Jorge Núñez

LSIC Meeting Cadence

- **Bi-Annual Meetings** (Spring and Fall)
  - May 11-12 Spring Meeting (accepting Abstracts now)
- **Monthly Focus Group Meetings**
  - 2nd Tuesday of the Month 3:00-4:00 pm – Extreme Environment
  - 2nd Thursday of the Month 3:00-4:00 pm – Extreme Access
  - 3rd Wednesday of the Month 3:00-4:00 pm – ISRU
  - 3rd Thursday of the Month 12:00-1:00 pm – Dust Mitigation
  - 4th Thursday of the Month 11:00 am-12:00 pm – Surface Power
  - Last Friday of the Month 3:00-4:00 – Excavation and Construction
- **Thematic Workshops** (as identified by FGs and NASA POCs)
  - Workshops In development Funding, CLPS Provider, and Power Beaming

STMD Opportunities for Academia and Industry

STMD anticipates awarding ~$600M to academia and industry supporting 2020 solicitations & awards

- **STMD Tipping Point Multiple Awards:** ***Jan – Mar 2020*** — $250M
- **Small Business Innovation Research (SBIR)/Small Business Technology Transfer (STTR) Phases I, II, II-E, Civilian Commercialization Readiness Pilot Program (CCRPP), Sequential:** ***Phase I Solicitation Jan – Apr 2020*** — $212M
- **Announcement of Collaborative Opportunity (ACO):** ***Jan – Mar 2020*** — $10M
- **Flight Opportunities Tech Flights:** ***Feb – May 2020*** — $10M
- **Early Career Faculty (ECF):** ***Feb – Apr 2020*** — $6M
- **Early Stage Innovations (ESI):** ***Apr – Jun 2020*** — $9M
- **NASA Innovative Advanced Concepts (NIAC) Phases I, II, III:** ***Phase I Solicitation Jun – Jul 2020*** — $4M
- **Space Technology Research Institutes (STRI):** ***Jun – Aug 2020*** — $30M
- **NASA Space Technology Graduate Research Opportunities (NSTGRO):** ***Sep – Nov 2020*** — $19M
- **SmallSat Technology Partnerships (STP):** ***Sep – Nov 2021*** — $3M
- **Centennial Challenges:** ***Varied release dates*** — $8M
- **NextSTEP Broad Agency Announcements (BAAs):** ***Varied release dates*** — *Varies*
- **Lunar Surface Technology Research (LuSTR) Opportunities:** ***Coming soon!!!*** — $30M

Note: Funding awards are approximate and subject to change

- Open Solicitations as of June 5, 2020
- Solicitations were/will be open *in the timeframe specified in italics*