



Lunar Surface Innovation

C O N S O R T I U M

Extreme Environments Focus Group November Telecon

January 12, 2021

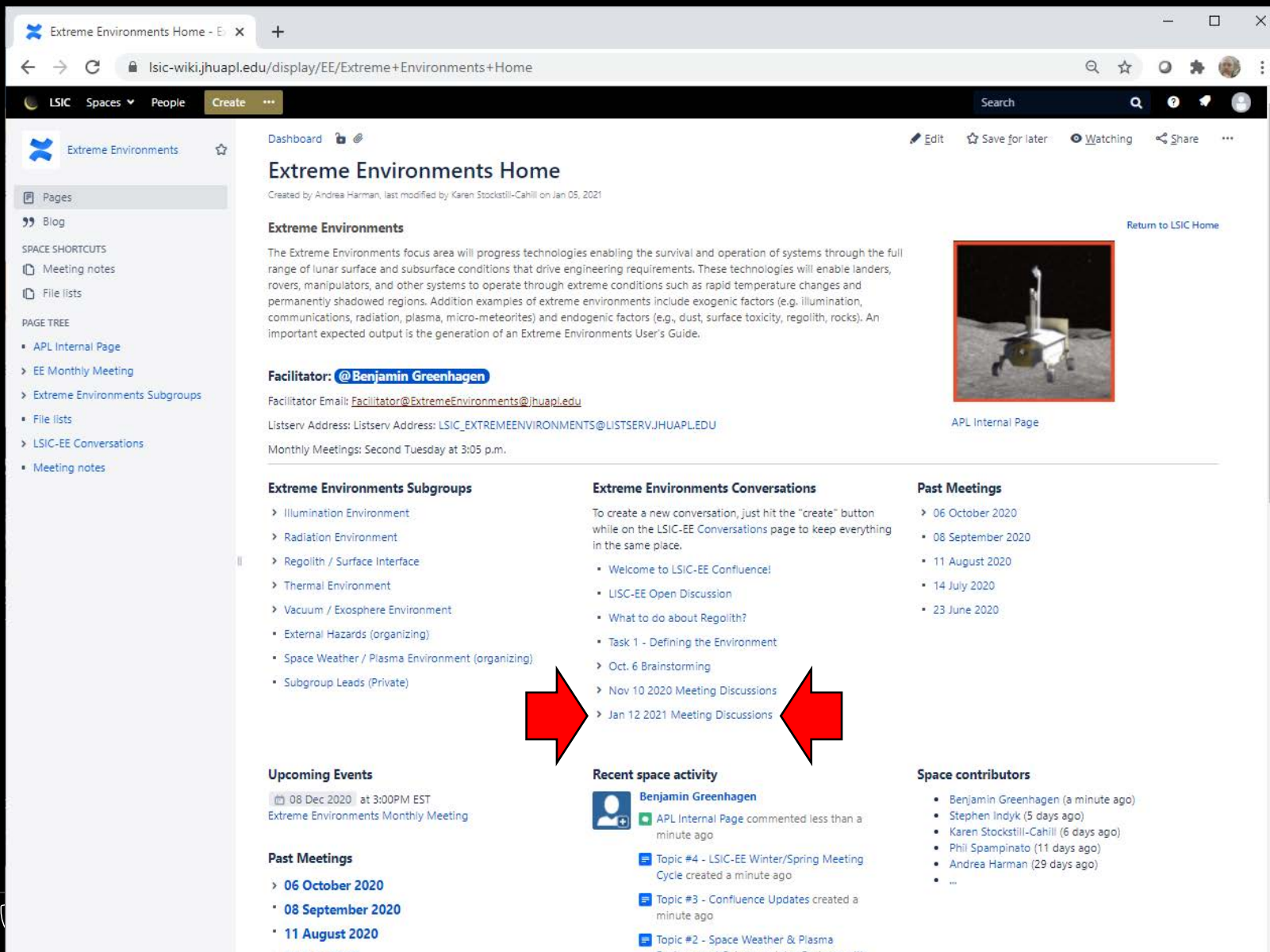
Dr. Benjamin Greenhagen
Planetary Spectroscopy Section Supervisor
Johns Hopkins Applied Physics Laboratory

Facilitator_ExtremeEnvironments@jhuapl.edu



Today's Agenda

- LSIC-EE Updates (5 min – Greenhagen, Stockstill-Cahill, Somervill)
 - Space Weather & Plasma Environment subgroup intro package with quad chart (10 min – Likar)
 - Confluence Updates (20 min – Stockstill-Cahill, Indyk, Choudhuri)
 - Vacuum & Exosphere Environment document “Vacuum Chamber Testing” request for feedback
 - Thermal Environment document “Summary Report on LSIC Extreme Thermal Environment” request for feedback
 - LSIC-EE Winter/Spring Meeting Cycle (10 min – Greenhagen)
 - Open floor (time permitting)
-
- Next month: February Meeting is scheduled for Tuesday 2/9/21 at 3:05pm EST



Extreme Environments Home - E

lsic-wiki.jhuapl.edu/display/EE/Extreme+Environments+Home

LSIC Spaces People Create

Extreme Environments

Dashboard

Extreme Environments Home

Created by Andrea Harman, last modified by Karen Stockstill-Cahill on Jan 05, 2021

Extreme Environments

The Extreme Environments focus area will progress technologies enabling the survival and operation of systems through the full range of lunar surface and subsurface conditions that drive engineering requirements. These technologies will enable landers, rovers, manipulators, and other systems to operate through extreme conditions such as rapid temperature changes and permanently shadowed regions. Addition examples of extreme environments include exogenic factors (e.g. illumination, communications, radiation, plasma, micro-meteorites) and endogenic factors (e.g., dust, surface toxicity, regolith, rocks). An important expected output is the generation of an Extreme Environments User's Guide.


Facilitator: @Benjamin Greenhagen

Facilitator Email: Facilitator@ExtremeEnvironments@jhuapl.edu

Listserv Address: Listserv Address: LSIC_EXTREMEENVIRONMENTS@LISTSERV.JHUAPL.EDU

Monthly Meetings: Second Tuesday at 3:05 p.m.

[Return to LSIC Home](#)



APL Internal Page

Extreme Environments Subgroups

- > Illumination Environment
- > Radiation Environment
- > Regolith / Surface Interface
- > Thermal Environment
- > Vacuum / Exosphere Environment
- External Hazards (organizing)
- Space Weather / Plasma Environment (organizing)
- Subgroup Leads (Private)

Extreme Environments Conversations

To create a new conversation, just hit the "create" button while on the LSIC-EE Conversations page to keep everything in the same place.

- Welcome to LSIC-EE Confluence!
- LSIC-EE Open Discussion
- What to do about Regolith?
- Task 1 - Defining the Environment
- > Oct. 6 Brainstorming
- > Nov 10 2020 Meeting Discussions
- > Jan 12 2021 Meeting Discussions

Past Meetings

- > 06 October 2020
- 08 September 2020
- 11 August 2020
- 14 July 2020
- 23 June 2020

Upcoming Events

08 Dec 2020 at 3:00PM EST
Extreme Environments Monthly Meeting

Past Meetings

- > 06 October 2020
- 08 September 2020
- 11 August 2020

Recent space activity

Benjamin Greenhagen

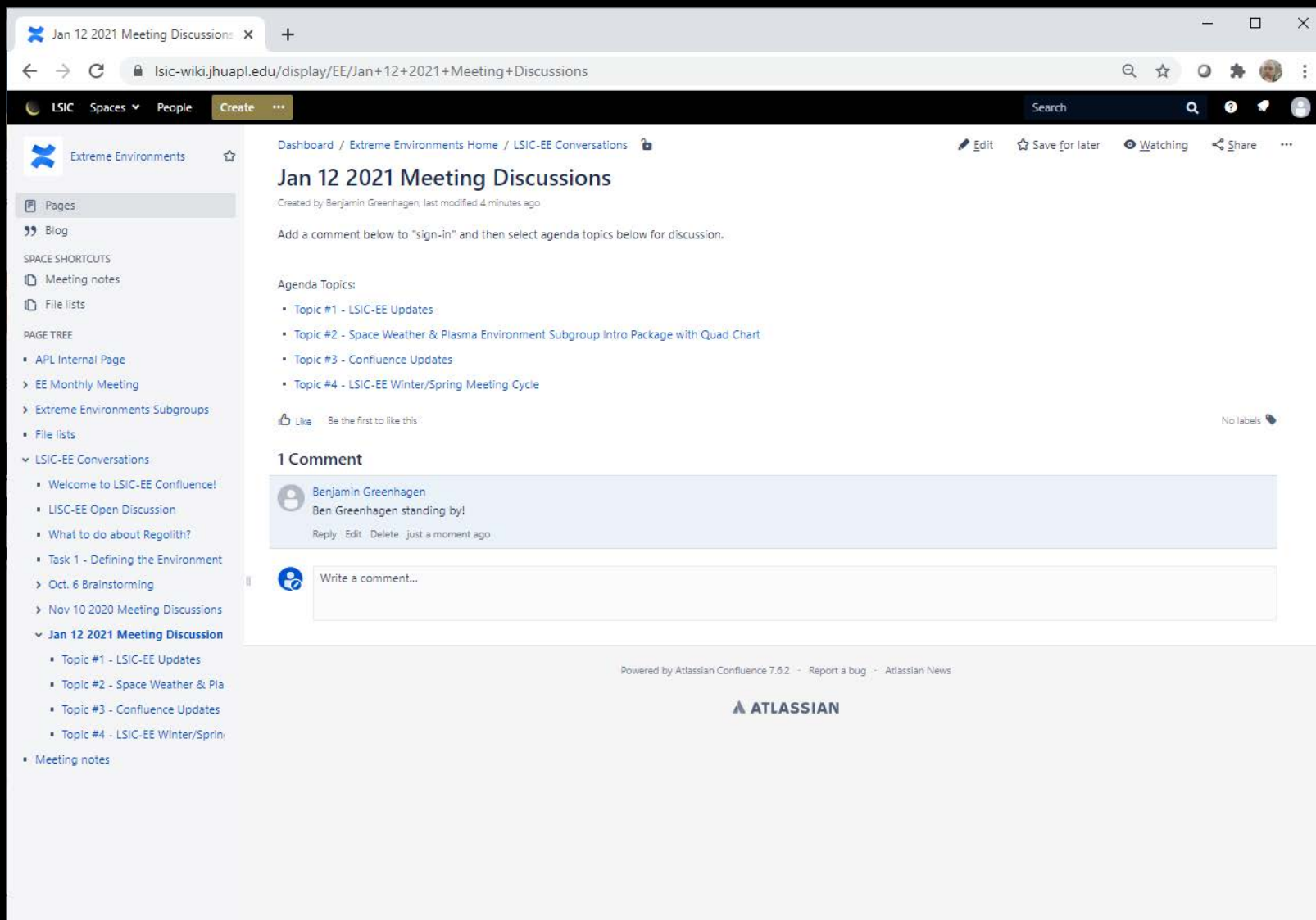
- APL Internal Page commented less than a minute ago
- Topic #4 - LSIC-EE Winter/Spring Meeting Cycle created a minute ago
- Topic #3 - Confluence Updates created a minute ago
- Topic #2 - Space Weather & Plasma

Space contributors

- Benjamin Greenhagen (a minute ago)
- Stephen Indyk (5 days ago)
- Karen Stockstill-Cahill (6 days ago)
- Phil Spampinato (11 days ago)
- Andrea Harman (29 days ago)
- ...

<https://lsic-wiki.jhuapl.edu/display/EE>

Join the Discussion on Confluence



1. Add a comment to “sign-in”
2. Select an agenda topic and comment your thoughts
3. You can comment before, during, or after the presentations
4. Check back later to see what others have commented!

Focus Group Updates

Reorganizing and improving support for our subgroups

- Karen Stockstill-Cahill (APL) has joined the LSIC-EE leadership as our Subgroup Coordinator
- Justin Likar (APL) will lead the Space Weather & Plasma Environment Subgroup
- Melissa Roth (Off Planet Research) will assume leadership of the Regolith Interface Subgroup
 - *Don Barker will continue to support the subgroup. Thank you, Don!*
- Standardizing subgroup monthly meetings to be in the 2.5 weeks after the FG meeting

Kevin is recruiting NASA SMEs for topical presentations and subgroup participation



- Dr. Karen Stockstill-Cahill, Johns Hopkins Applied Physics Laboratory
 - Interest: Combining modeling and lab experiments to constrain the geologic history of airless planetary bodies
 - I run LabSPEC and the Meteorite Laboratory in the SRE department at APL
- Educational background: Physics/Astronomy -> Terrestrial Volcanology
-> Planetary Geology (Spectroscopy)
- Moon Activities:
 - Fundamental research studying geologic materials in simulated vacuum environments
 - UHV Chamber that can be cooled (-100C) and heated (375C)
 - Aiding and abetting the LSII/LSIC endeavors
 - Participate in Lunar Cohort at APL
- My Role in LSIC-EE:
 - LSIC-EE Subgroup Coordinator (SC?)
 - Communicate with leads of subgroups, provide needed support, participate in subgroup meetings
 - Use the Confluence Page to support Subgroup efforts, foster communication on topics

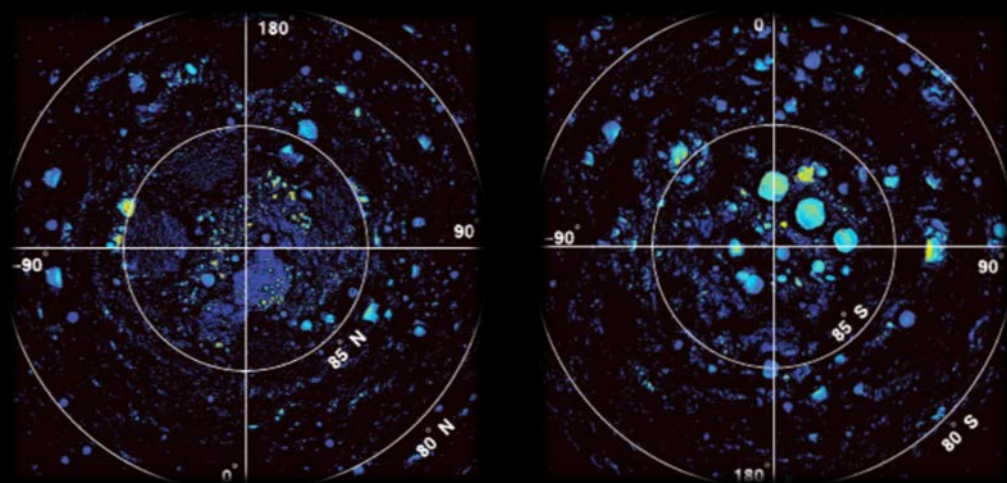
Focus Group Updates

Meeting Reminders

- LEAG/SSERVI New Frontiers Town Hall (1/14/21 12pm – 1:30pm EST)
 - <https://lunarscience.arc.nasa.gov/nf5-townhall/about/>
- LSSW Space Biology (1/20/21 9am – 3:10pm EST & 1/21/21 9am – 4:30pm EST)
 - <https://www.hou.usra.edu/meetings/lunarsurface2020/>
- LSIC Dust Mitigation Workshop (2/4/21 11am – 5pm EST)
 - <http://lsic.jhuapl.edu/Events/Agenda/index.php?id=118>



- *Lead: Justin Likar, Johns Hopkins University Applied Physics Laboratory (justin.likar@jhuapl.edu)*
 - *Sr. Professional Staff II & Acting Section Supervisor, Space Environmental Engineering Group (SEN)*
 - *Science Organizing Committee, Spacecraft Charging Technology Conference (SCTC)*
- *Supporters:*
 - *Don Barker, Space Initiatives*
 - *Marshall Eubanks, Space Initiatives*
 - *John Schaf, Moog*
- *Participants:*
 - *Ben Alterman (SWRI); Ben Greenhagen (JHU APL); Daoru (Frank) Han (MST); Lawrence Heilbronn (UTK); Angeliki Kapoglou (ESA); Michael Poston (SWRI); Leonardo Regoli (JHU APL); Melissa Roth (OPR); Karen Stockstill-Cahill (JHU APL); Michelle Donegan (JHU APL); Jamie Porter (JHU APL)*



Minimum discharging timescales at depth of 2 cm at lunar north pole (left panel) and lunar south pole (right panel) [doi: 10.1002/2014JE004710]

• Primary Characteristics

- Variability between “nominal” and “extreme” environments; range of characteristic timescales
- Surface & near-surface plasma
 - Magnetotail lobes, plasma sheet, magnetosheath, solar wind (including SEP events)
 - Regolith (dust)
 - Wake & deep wake
- Human generated – plumes, voltages (e.g. arrays), ...

• Environmental Variability

- Variability by solar zenith angle, terrain & surface features, surface potentials, photoelectron population, ...
- Dependent, also, on moon location within magnetosphere
- SEP occurrence & characteristics; also GCR
- Geometry modifications (e.g. docking, undocking, ...) drive threat / hazard

• Challenge to Technology Development

- Primary risks related to discharging – ESD, RE, ...
 - Consequences can be “nuisance” to “catastrophic”
- Range of potentials enveloped by +100 V to -1000 V; rapid fluctuations likely
- Nowcasting / forecasting of relevant environments (particle type, energies, fluxes, ...)
- Uncertainties in hazard modelling / predictions
- Importance of conops and planning

Confluence (Wiki) Updates

- *General Updates*
- *“Vacuum Chamber Testing” request for feedback*
- *“Summary Report on LSIC Extreme Thermal Environment” request for feedback*

Winter/Spring Meeting Cycle

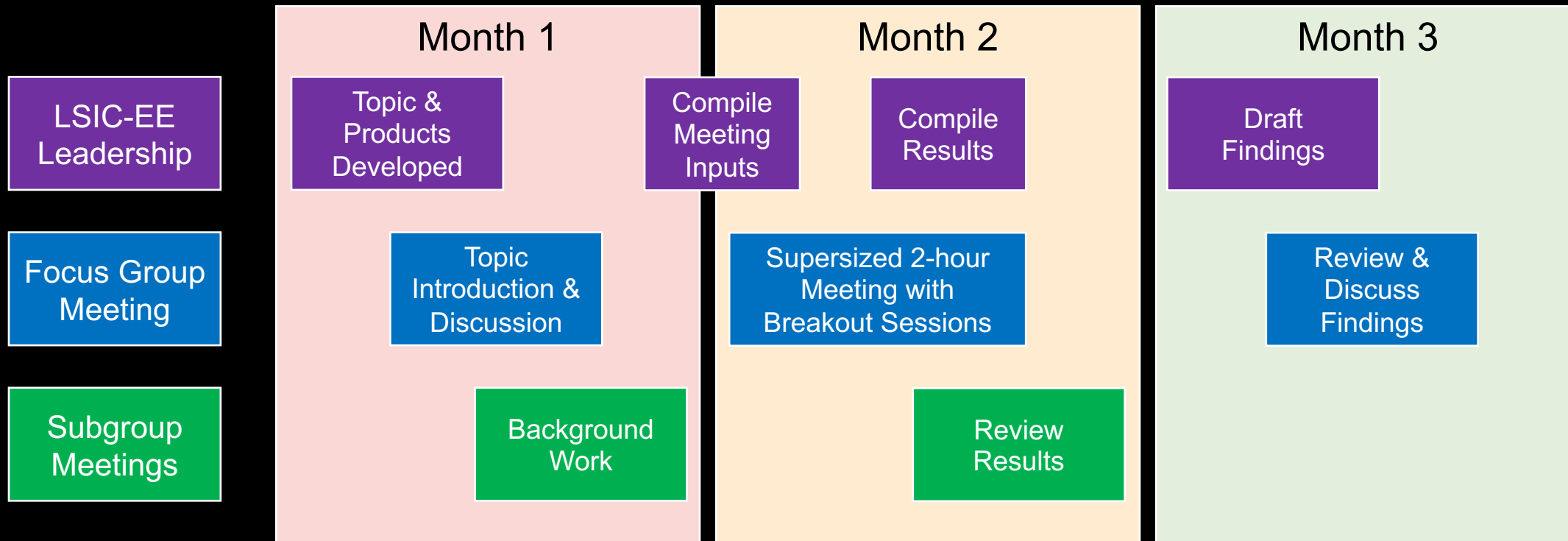
Each Focus Group is tasked with compiling community inputs on relevant topics

- Some FGs have conducted ~6-hour topic-specific workshops (e.g. ISRU Supply and Demand, upcoming Dust Mitigation) but there are other possible approaches
- Desirable to leverage unique structure of LSIC-EE and broad-based expertise
- Conceptualizing multi-month approach including a “supersized” monthly tag-up

Winter/Spring Meeting Cycle

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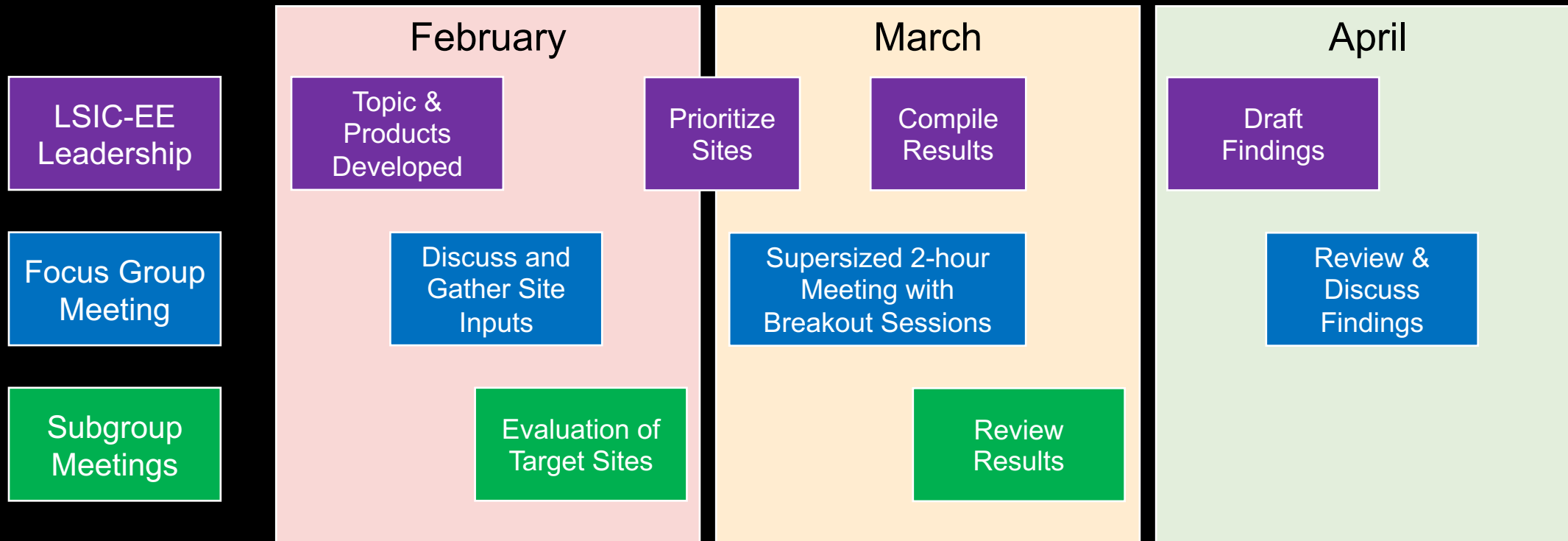
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Winter/Spring Meeting Cycle

Potential Topic: Breaking the “lunar environment” into actionable target site environments

- Identify and evaluate site-specific environments for likely lunar surface use cases [February]
- Identify site-specific technology capabilities and gaps (for variety of architectures) [March]
- Identify relevant observation, experiment, and model capabilities and gaps [March]



Winter/Spring Meeting Cycle

Pros and Cons for this Approach

- Pro: Ensures all areas of LSIC-EE are engaged in the process
- Pro: Provides multiple opportunities to be involved at FG and subgroup level
- Con: Longer timeframe potentially makes it harder to stay engaged
- Con: Unclear if one 2-hour supersized meeting is sufficient. Two supersized meetings? One longer meeting?

Thoughts? Discussion?



JOHNS HOPKINS
APPLIED PHYSICS LABORATORY