Lunar Surface Innovation
CONSORTIUM

LSIC Dust Mitigation Focus Group

Monthly Meeting
May 19, 2022

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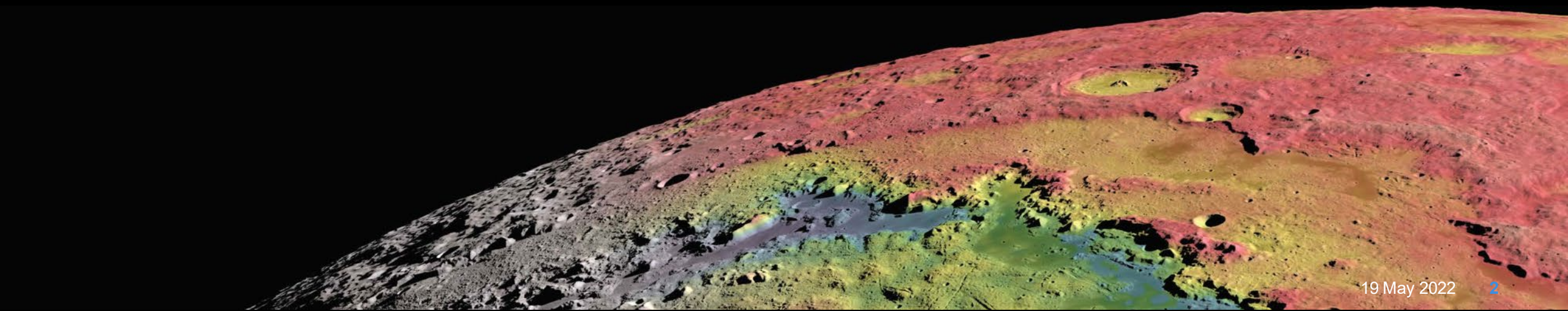
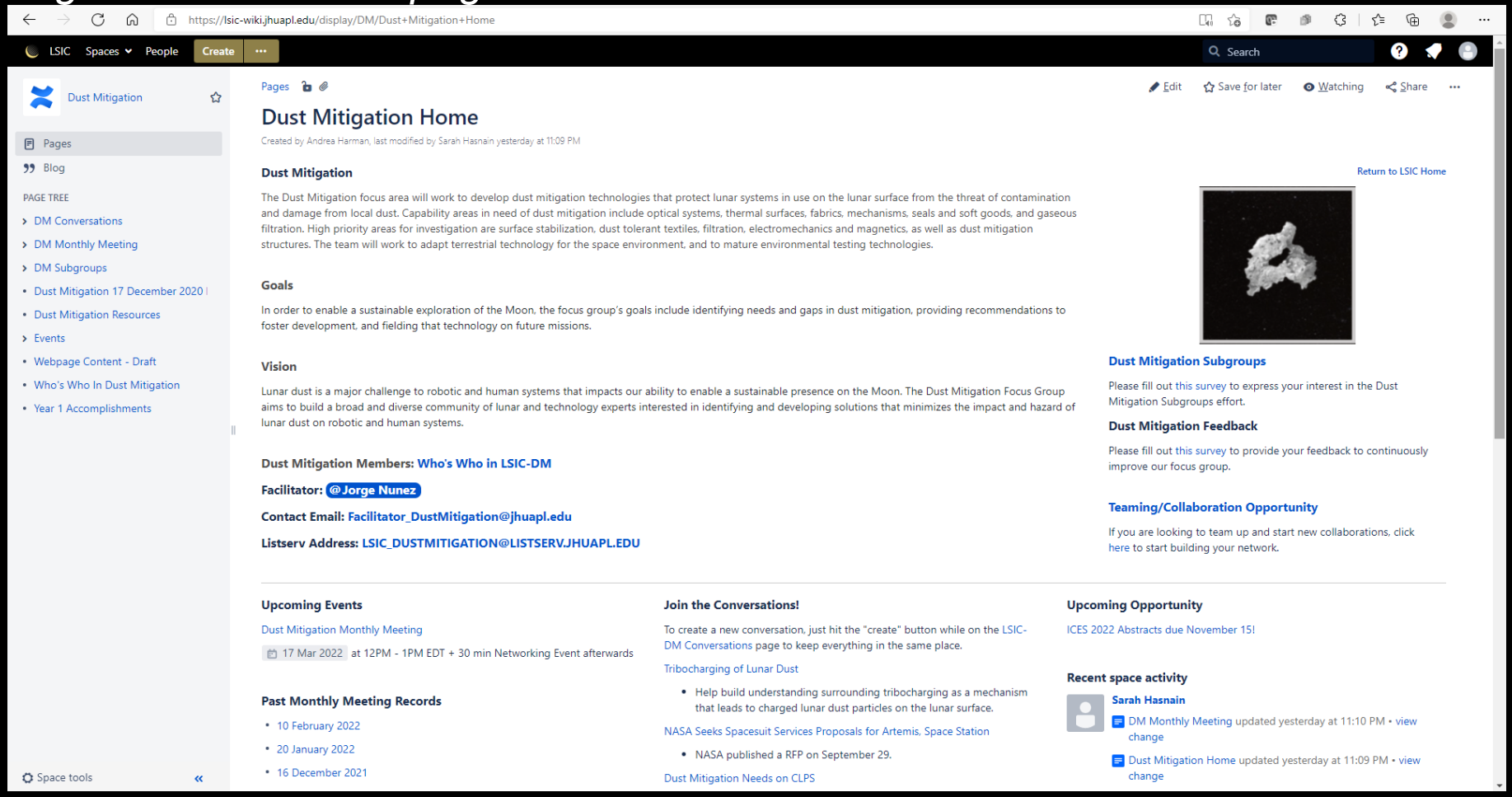
Agenda

- Welcome, LSIC and Focus Group Updates
- Upcoming Opportunities and Meetings
- Follow-up on LSIC Spring Meeting
- Discussion on STMD Envisioned Futures and relation to Dust Mitigation



LSIC Dust Mitigation Confluence Site

- Please contact Andrea Harman (ams573@alumni.psu.edu) to get set up with an account!
- *Dust Mitigation Discussion page and wiki*

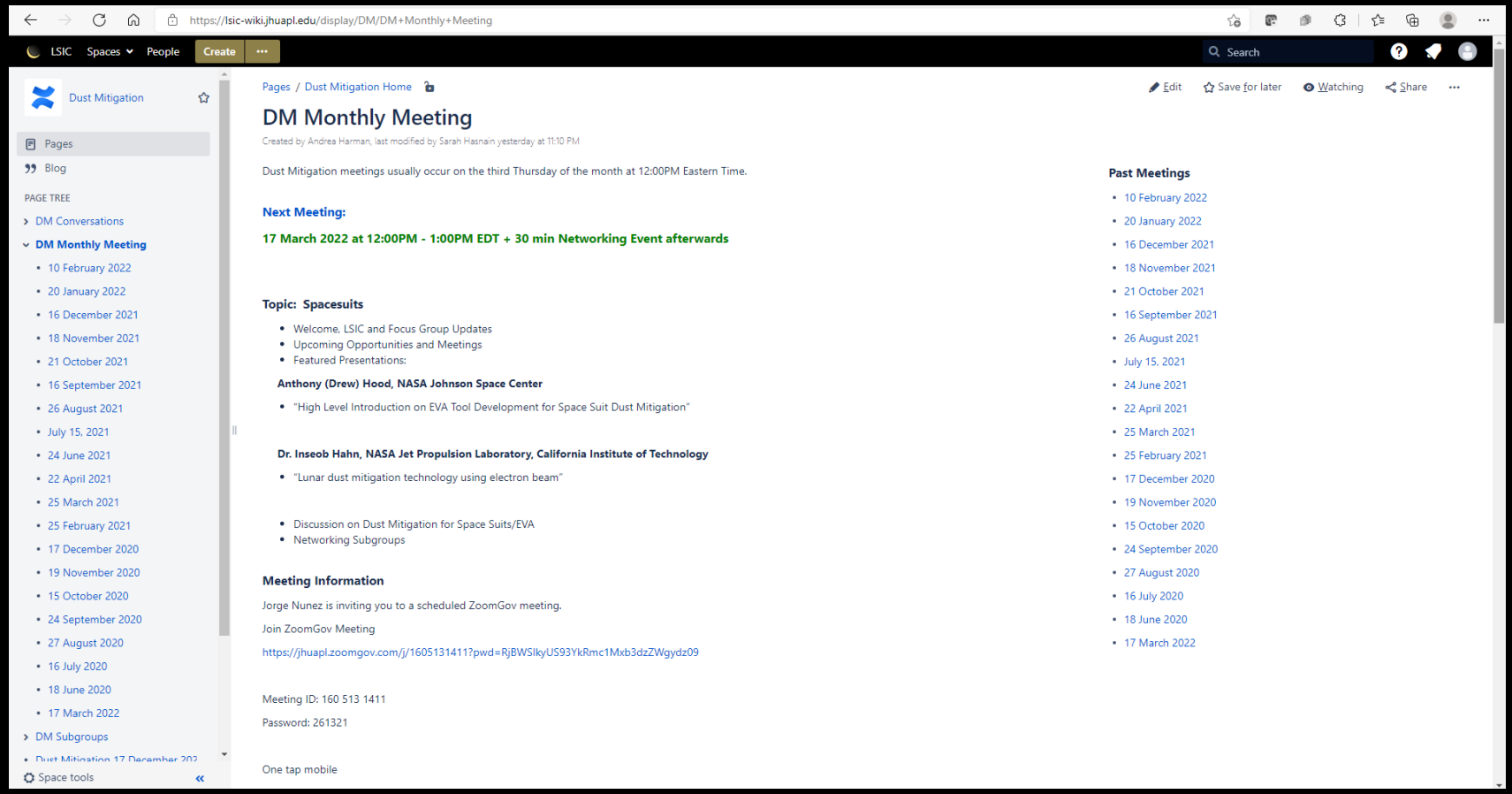


https://lsic-wiki.jhuapl.edu/display/DM/Dust+Mitigation+Home

Join the Discussion on Confluence Site

- Please contact Andrea Harman (ams573@alumni.psu.edu) to get set up with an account!
- *Dust Mitigation Discussion page and wiki*

- 1. Sign-in to add a comment
- 2. Add comment at bottom of page
- 3. You can comment before, during, or after today's meeting



https://lsic-wiki.jhuapl.edu/x/GoAZ

Updates and Communications

- Monthly LSIC newsletter – New edition came out early May 2022
  - http://lsic.jhuapl.edu/Resources/
- Mailing list
  - The listserv goes to all participants. Use with caution. But feel free to use!
  - Please make sure to add LSIC_DUSTMITIGATION@LISTSERV.JHUAPL.EDU to safe senders list.
  - If we need smaller, focused lists we can set those up
- Updates to the webpage - http://lsic.jhuapl.edu/Focus-Areas/Dust-Mitigation.php
  - Notes, slides, recordings from telecons posted here
- Wiki is ready!
  - Confluence is free to you and available to all registered LSIC members
  - To request an account, please email Andrea Harman: ams573@alumni.psu.edu
- Lightning Talks at monthly focus group meetings
  - Anyone can volunteer to give a featured talk (~15 mins)
  - Email me if you want to sign up: Facilitator_DustMitigation@jhuapl.edu

Follow the Code of Conduct for all Focus Group communications

http://lsic.jhuapl.edu/Resources/files/Code%20of%20Conduct_05222020.pdf

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Space Technology Funding Opportunities

Current Tech Development Opportunities

- Space Technology Announcement of Collaboration Opportunity (ACO) »
  - Mini proposals due: March 31, 2022; Final proposals due: July 28, 2022
- Announcement of Collaboration Opportunity (ACO) Synopsis »
- Technology Advancement Utilizing Suborbital and Orbital Flight Opportunities "TechFlights" »
  - Proposals Due 6/2/2022
- Early Stage Innovations Solicitation »
  - NOI's Due 5/25/2022
- Announcement for Partnership Proposals (AFPP) to Advance Tipping Point Technologies »
  - Mini proposals due: March 31, 2022l Final proposals due: July 28, 2022

Future Solicitation and Opportunities

- Space Technology Research Institutes (STRI) Solicitation »
  - June 2022
- NASA Innovative Advanced Concepts (NIAC) 2023 Phase I Call for Proposals »
  - June 2022

LSIC Activities

Recent and Upcoming LSIC Meetings and Workshops (https://lsic.jhuapl.edu/Events/)

- LSIC Dust Mitigation Focus Group Meeting (06/16)
  - Topic: Dust Tolerant Mechanisms
- Low Temperature Power and Energy Storage for the Lunar Surface (07/27-07/28)
  - Replaces DM FG Meeting on 04/21

Other Recent and Upcoming Dust Mitigation Related Workshop and Meetings

- Lunar Exploration and Analysis Group (LEAG) virtual town hall regarding the Planetary Science and Astrobiology Decadal Survey (2023-2032) (May 19, 1-3 PM EDT)
  - The Town Hall can be viewed live on YouTube using the link https://youtu.be/U1odBPj7g2E. The transcript will be available after the Town Hall.
- AIAA ASCEND Conference (10/24-26)
  - Call for Content now open! Propose a session or submit an abstract (Deadline: March 31, 2022)
  - https://www.ascend.events/call-for-content

LSIC Spring Meeting

- Dates: May 4-5, 2022
- Venue: Virtual and In-Person, Johns Hopkins Applied Physics Laboratory, Laurel, MD
- The LSIC 2022 Spring Meeting concentrated on understanding NASA's plans and technology investments relevant to building a sustained presence on the lunar surface. The meeting will include invited speakers, panels, posters, and breakout discussions.

Call for Feedback

- Spring Meeting Website: https://lsic.jhuapl.edu/Events/Agenda/index.php?id=200
- Post-meeting Survey: https://app.sli.do/event/byj1TuQZAwZEQZJi62PFzG/embed/polls/42c182d5-501e-4d66-b588-fbd61b92b073

Dust Mitigation Focus Group Goal 2021

Vision

Lunar dust is a major challenge to robotic and human systems that impacts our ability to enable a sustainable presence on the Moon. The Dust Mitigation Focus Group aims to build a broad and diverse community of lunar and technology experts interested in identifying and developing solutions that minimizes the impact and hazard of lunar dust on robotic and human systems.

Goal

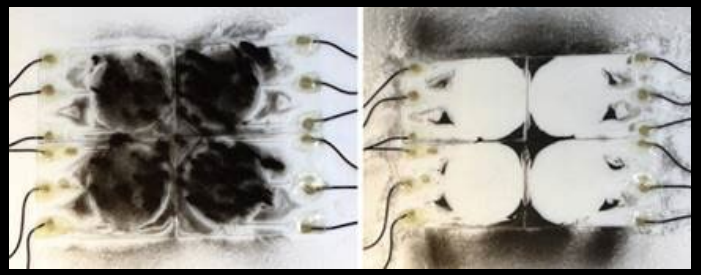
In order to enable a sustainable exploration of the Moon, the focus group's goals include identifying needs and gaps in dust mitigation, providing recommendations to foster development, and fielding that technology on future missions.

Objectives

- Build a diverse community specializing in dust mitigation, including creation of subgroups focused on specific dust mitigation technology areas
- Evaluate specific dust mitigation technology areas for dust mitigation development, testing/maturation capabilities, and gaps
- Provide community recommendations and guides to NASA and broader community to encourage technology investments and how it can be included in future missions

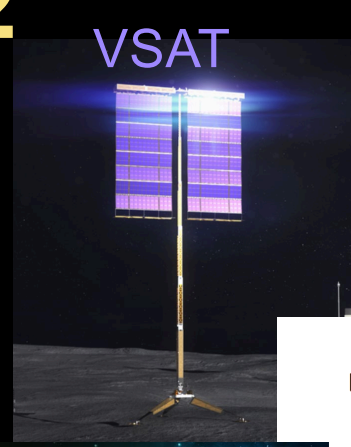
Dust Mitigation Subgroups

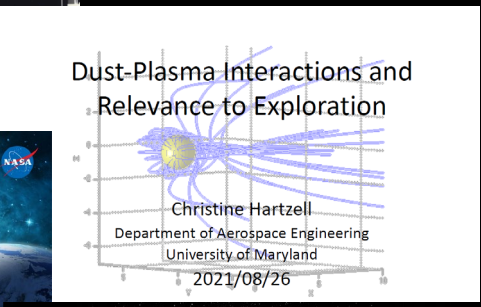
- Materials and Surface Coatings:
  - *Optical Systems* – Viewports, camera lenses, solar panels, space suit visors, mass spectrometers, other sensitive optical instruments
  - *Thermal Surfaces* – Thermal radiators, thermal painted surfaces, thermal connections
- Seals, Soft Goods, and Fabrics:
  - *Fabrics* – Space suit fabrics, soft wall habitats, mechanism covers
  - *Seals and Soft Goods* – Space suit interfaces, hatches, connectors, hoses
- Mechanisms:
  - *Mechanisms* – Linear actuators, bearings, rotary joints, hinges, quick disconnects, valves, linkages
- Monitoring and Filtration:
  - *Gaseous Filtration* – Atmosphere revitalization, ISRU processes
  - *Dust monitoring* – Cabin and external dust monitoring
- *Modeling: – Dust plume modeling*
- *Lunar Surface Modification* – Lunar landing pads, dust free zones and workspaces
- Isolation Technologies – Technologies that keep dust out

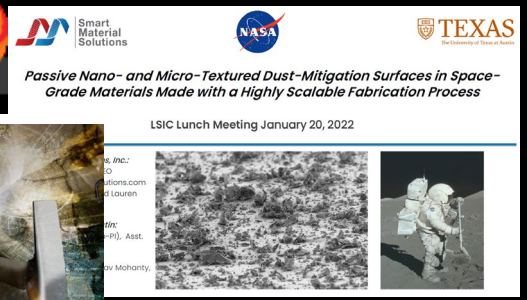



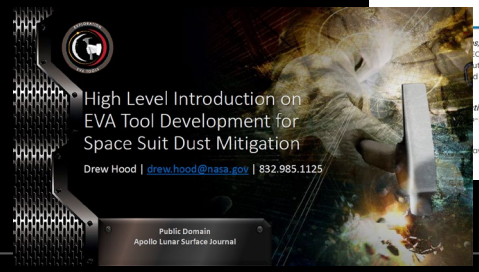
Dust Mitigation Highlights, 2021-2022

- Themed Monthly FG Meetings on Key Technology Areas
  - *Dust Tolerant Connectors*
  - *Dust/ Plasma Environment*
  - *Plume/ Surface Interactions*
  - Passive/ Active Dust Removal
  - Space Suits/Fabrics
- Joint Extended Meetings with other Focus Groups
  - *Vertical Solar Array Technology – VSAT (Joint with EE & SP)*
  - *Plasma Interaction with Lunar Regolith/Dust (Joint with EE)*
  - *Designing Dust-Tolerant Systems (Joint with E&C)*
- Special Dust Mitigation Events
  - *NASA Standards Document 1008: Dust Testing Standards*
  - *CLPS/PRISM Overview and Opportunities*
  - *BIG Idea Challenge Finalist Presentations: Dust Mitigation Technologies*
- Networking Events
  - CLPS/PRISM Teaming and Networking Event
  - Subgroups Kickoff and Networking Event









Dust Mitigation Findings, 2021-2022

- Focus groups and FG meetings are valuable for sharing information between NASA, industry, academia, and non-profit.
  - FG members are able to present their latest research and provide insights into the lunar dust environment and development of technologies for mitigating lunar dust
  - FG meetings provide opportunities to network and foster collaborations
  - NASA is able to disseminate information to community about new announcements and opportunities, and is able to get feedback quickly
- Lunar Dust is a major concern and dust tolerant/dust mitigation solutions are critical for enabling sustained surface operations.
- Bringing Dust Mitigation technology developers and system developers together (including ESDMD) is important for incorporating new dust mitigation technologies into systems/architectures in time.
  - Commercial providers are in good position to infuse new dust mitigation technologies into their systems
- High priority challenges and needs:
  - Establishing set of tolerances allowing systems to operate “dirty”
  - Acquisition of ground truth dust properties and plume/ejecta data from precursor missions to validate modeling tools and designs
  - Develop and standardize simulants and testing conditions to better capture real dust problems instead of approximations
  - Pathways and mechanism for integrating dust tolerant/mitigation technologies into lunar systems and architecture
  - Technology demonstrations on CLPS landers to test in real-world conditions

2022-2023 Dust Mitigation Draft Goals

- Build on our current goal and objectives:

> In order to enable a sustainable exploration of the Moon, the focus group's goals include identifying needs and gaps in dust mitigation, providing recommendations to foster development, and fielding that technology on future missions.

Next Steps:

- Continue to hold focus group meetings focused on key technology areas of interest
  - Examples: Mechanisms, filtering and dust sensing, surface modification, etc.
- Expand networking and collaboration opportunities
  - Expand Who's Who page and dedicate portions of FG meetings to networking opportunities
- Expand joint focus group meetings with other focus groups
  - Hold future joint meetings with ISRU and E&A
- Build on Dust Mitigation subgroups
  - Expand participation in DM subgroup and work on specific subgroup goals

Get Involved

- Sign-up to Receive LSIC and Dust Mitigation FG Updates:
  - Fill out the LSIC Survey and indicate interest in Dust Mitigation to receive news and event invitations:
  - https://lsic.jhuapl.edu/News/Sign-Up.php
- Help us improve the Dust Mitigation Focus Group!
  - Feedback survey: https://docs.google.com/forms/d/e/1FAIpQLSdjuTIK_TLMnCM4_aSMLAzLS762qtzbgmcOd2fgizlCsab6KQ/viewform
- Join one of the Dust Mitigation Subgroups!
  - Dust Mitigation Subgroup Membership/Leaders survey: https://docs.google.com/forms/d/e/1FAIpQLScB6iT2fgPqj2zlaP0s-rwWQDQ04TPfgVyiC5zn0AQPAT5CZA/viewform
- Interested in Teaming/Collaborating with Others?
  - Add yourself to our Who's Who page: https://lsic-wiki.jhuapl.edu/display/DM/Who%27s+Who+In+Dust+Mitigation
- Looking for info on lunar dust or dust mitigation resources?
  - Checkout our resources page on the Dust Mitigation Wiki page on Confluence: https://lsic-wiki.jhuapl.edu/x/94Rf

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Today's Discussion

"NASA's Strategic Technology Framework "LIVE Thrust" 80HQTR22ZOA2L_LIVE"

Sarah Hasnain

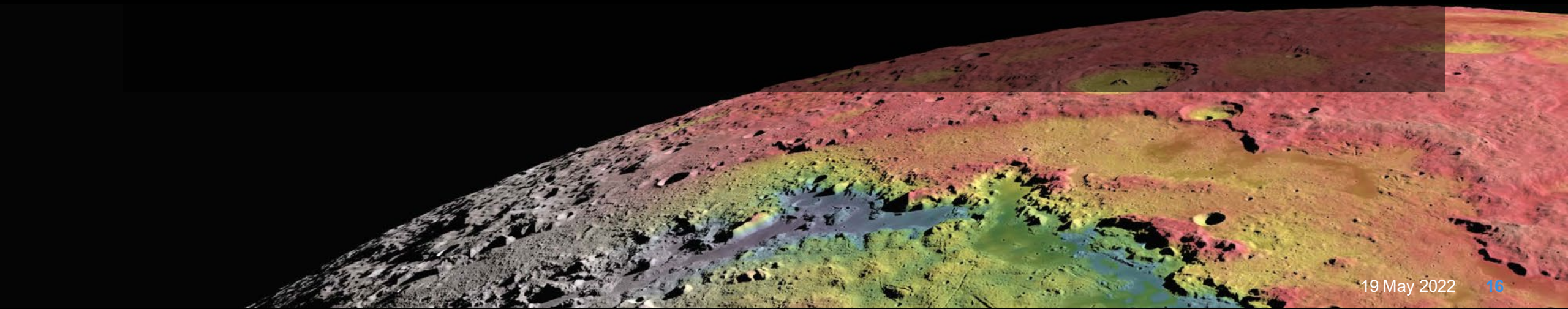
LSIC Dust Mitigation Facilitator

Johns Hopkins University Applied Physics Laboratory

Sarah.Hasnain@jhuapl.edu

NASA SMTD RFI Envisioned Futures Feedback Questions

- Are the Envisioned Futures charts inclusive of space community needs? Please provide specific recommendations for improving the provided Envisioned Future charts.
- Are the State-of-the-Art summaries complete and accurate or are there technologies that exist that we may not be aware of that satisfy these needs?
- Are the technology gaps stated in the Envisioned Futures charts inclusive of the work needed to reach these Envisioned Futures? What technology advances are not included that would be necessary to reach these goals?



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Community Discussion

- Few mins to review Envisioned Futures: LIVE - Sustainable Living and Working Farther from Earth
  - Think: "How might lunar dust play a role in this?"
  - Use Miro sticky notes to annotate the 1-slide summaries that were presented at LSIC Spring Meeting

- Discussion prompts about the Envisioned Futures presented + ideation about how LSIC can support the community in making such solutions possible

Miro Link: https://tinyurl.com/ef-dust-miro

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- Establishing norms for this session:
  - Raise "Zoom Hand" to queue for hopping on the mic to share your idea
    - Keep questions/comments on the mic to under 1min – we want to hear what everyone has to say!
  - If you agree with a note that someone else has written, add a +1 sticker to it
  - Fellow Dust Mitigation Facilitators – hop on the mic to let me know if there's a chat message to respond to!

JOHNS HOPKINS

APPLIED PHYSICS LABORATORY