



Lunar Surface Innovation

C O N S O R T I U M

LSIC Dust Mitigation Focus Group

Monthly Meeting

December 17, 2020



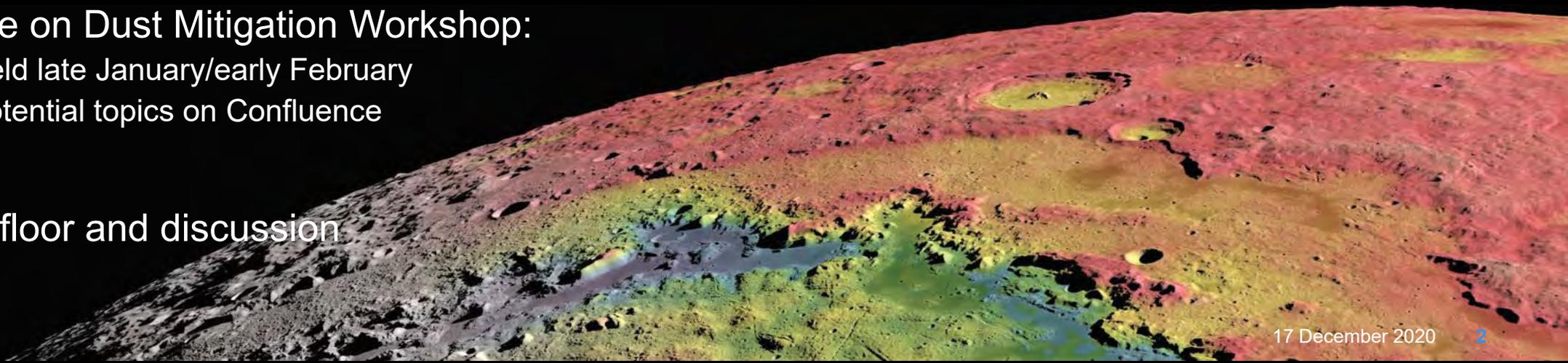
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Agenda

- Welcome, Updates, and Announcements
 - Upcoming Opportunities
- Brief overview of Confluence by Andrea Harman
 - We be using confluence for discussions, so contact Andrea (ams573@alumni.psu.edu) if you need access.
- Recap and look forward to 2021 for Dust Mitigation
 - What should the FG accomplish in 2021?
- Update on Dust Mitigation Workshop:
 - Held late January/early February
 - Potential topics on Confluence
- Open floor and discussion



Updates and Communications

- Monthly LSIC newsletter – New edition came out Dec 1
 - <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 lightning talk (10-15 mins)
 - Email me if you want to sign up: Facilitator_DustMitigation@jhuapl.edu

Follow the Code of Conduct for all Focus Group communications

NASA BIG Idea Challenge 2021

- Breakthrough, Innovative, Game-changing Idea Challenge
- Open to U.S. universities officially affiliated with their state's Space Grant Consortium
 - May collaborate with non-Space Grant universities and industry partners
- Awards ranging from \$50,000 - \$180,000
- Looking for active and passive technologies in one or more of the following areas
 - Landing dust mitigation
 - Spacesuit dust tolerance
 - Exterior dust clean up
 - Cabin clean up
- NOI Due September 25, 2020
- **Proposals Due December 13, 2020**
- <http://bigidea.nianet.org/>



2021 Theme Preview

Full competition details will be available on the BIG Idea Challenge website by August 3, 2020.
Some details may be subject to change.

Important Dates

Notice of Intent Deadline – September 25, 2020
 Proposal Deadline – December 13, 2020
 Selection Notifications – January 29, 2021
 Mid-Point Report Deadline – May 20, 2021
 Technical Paper Deadline – October 27, 2021
 2021 BIG Idea Forum – November 17–19, 2021

Eligibility

Participation is limited to teams of undergraduate and graduate students at accredited U.S.-based colleges and universities officially affiliated with their state's Space Grant Consortium. However, non-Space Grant affiliated colleges/universities may partner with a Space Grant-affiliated institution. (3-25 people/team)

Awards

A wide range of award sizes is expected in the range of \$50,000 - \$180,000 per team. Proposers are encouraged to request what is actually needed to conduct the proposed work.

Dust Mitigation Technologies

Teams submit proposals for novel active and passive dust mitigation technologies that could be used for lunar applications, including but not limited to:

- Dust-free zones (i.e., landing pads, lunar surface modification, dust-free workspaces)
- Optical systems (i.e., viewports, camera lenses, solar panels, space suite visors, mass spectrometers, other sensitive optical instruments)
- Thermal systems (i.e., thermal radiators, painted surfaces, or connections)
- Dust-tolerant textiles and fabrics (i.e., space suit fabrics, soft wall habitats, mechanism covers)
- Dust-tolerant mechanisms (i.e., linear actuators, bearings, rotary joints, hinges, quick disconnects, valves, linkages)
- Seals and soft goods (i.e., space suit interfaces, harness, connectors, hoses)
- Gaseous filtration (i.e., atmosphere revitalization, In-Space Resource Utilization [ISRU] processes)

Breakthrough, Innovative & Game-changing (BIG) Idea Challenge

The BIG Idea Challenge is a university-level design competition sponsored by NASA and managed by the NIA. To participate, university teams of 3-25 students will submit proposals on concepts for a wide range of solutions for issues including reducing dust clouds upon landing, difficult dust removal from spacesuits and other surfaces, dust obstruction of optical systems, and in-cabin particulate levels, among others. Selected teams will receive up to \$180,000 to build and test their proposed dust mitigation solutions, then will present their test results to a panel of NASA and industry subject matter experts (SMEs) at the BIG Idea Forum in November 2021.

Background

Through the agency's Artemis lunar exploration program, NASA has its sights set on a place no humans have ever gone before: the lunar South Pole. The Moon's environment presents unique challenges, and lunar dust is one of the principal limiting factors in returning to the lunar surface for extended duration missions. Lunar dust is difficult to remove or mitigate as it is extremely abrasive, highly cohesive, electrically charged, and small in size.

For future lunar exploration missions, dust will inevitably be introduced into habitable spaces, where, under lunar gravity, fine lunar dust particles will be a health hazard to humans. In addition to threatening astronaut health, lunar dust issues have also resulted in incorrect instrument readings, vision/optical system obscuration, performance reduction, altered thermal properties, and equipment failure. High-velocity dust ejected by descent engine exhaust can cause damage to the lander, as well as nearby surface assets.

To enable sustainable human operation of the Moon in the coming decade, NASA is looking for near-term, innovative and viable solutions for dealing with the Moon's abrasive dust. Dust mitigation technologies can be categorized into active and passive technologies. Active technologies are those that are used to clean or protect a surface from dust deposition through external forces. Passive technologies do not require activation, such as chemically pretreated surfaces and dust tolerant coverings.

Basic Challenge

Develop active and passive dust mitigation (or dust tolerant) capabilities and technologies to be used in components of future lunar missions, in one or more of the following categories:

- Landing dust mitigation
- Spacesuit dust tolerance
- Exterior dust clean up
- Cabin clean up

Design Constraints

- Able to manage and mitigate abrasive dust
- Able to mitigate small particles (1-50 µm)
- Minimal barriers to NASA adoption (e.g. low mass, small size, low power, etc.)
- Cost-effective solution
- Non-flammable
- Able to work in harsh environments
- Tech should reach a minimum technology readiness level (TRL) of 4

<http://bigidea.nianet.org>

Lunar Vertical Solar Array Technology (Lunar VSAT) AO

- NASA Space Technology Mission Directorate (STMD) Game Changing Development (GCD) program is seeking proposals for **the design and prototype fabrication of autonomously deployable and relocatable lunar surface solar arrays** (Lunar VSAT) for future missions during the “Sustainment Period” of lunar South Pole exploration.
- “NASA plans to deploy the Lunar VSAT system near the lunar South Pole. Sunlight will be harvested from a very low grazing angle and terrain blockage will be an issue during some portion of the lunar year. The Lunar VSAT system may be taken to a strategic location on a ridge or similar topographic feature by a rover. The selected site will maximize sunlight, but will remove the system from immediate contact with other architecture assets.”
- **“Lunar dust is a ubiquitous concern of the mission. All designs shall incorporate a dust mitigation strategy.”**
- Proposals must be submitted through NSPIRES and are **due on December 14, 2020**
- NASA is hosting a Virtual Forum for Proposers on Thursday, Nov. 19, 2020 at 1:00 p.m. EST
- <https://nspires.nasaprs.com/external/solicitations/summary!init.do?solId={68A7EFE3-1B4F-5AA1-A169-119D97C8DB8F}&path=open>

NASA SBIR & STTR Solicitations 2021

- Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR)
- *Open to U.S. small businesses*
 - *May collaborate with universities and industry partners*
- Up to \$125 K for Phase I, \$750 K for Phase II
- Focus Area 24: Dust Mitigation
- Solicitations Opened November, 2020
- **Phase I Proposals Due January 8, 2021**
- <https://sbir.nasa.gov/solicit-detail/66886>



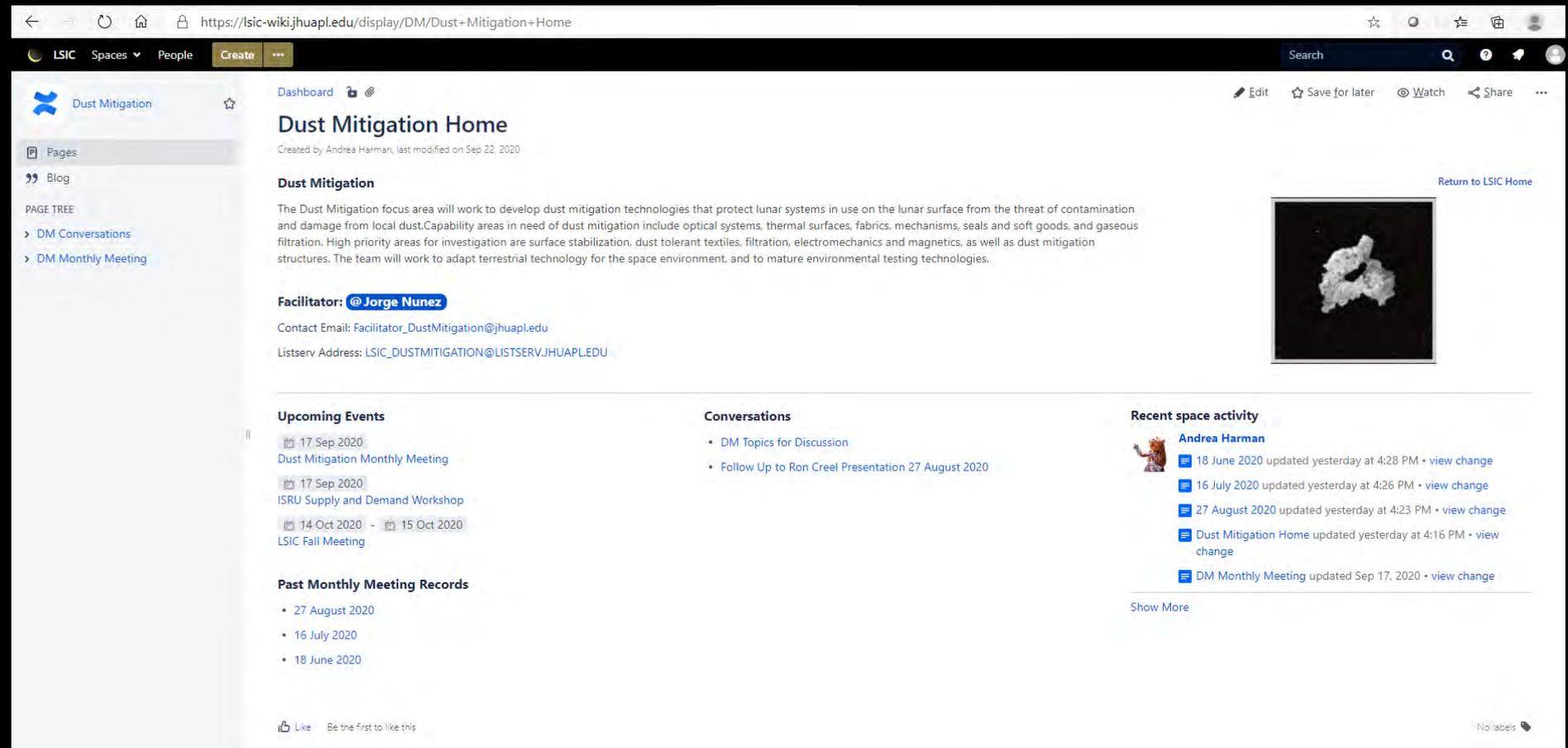
NASA SBIR & STTR Solicitations 2021

- Focus Area 24: Dust Mitigation
 - 3 Sub-topic areas
- 1. Active and Passive Dust Mitigation Surfaces (Z13.01)
 - Lead Center: KSC
 - Participating Center(s): JSC, LaRC
- 2. Dust-Tolerant Mechanisms (Z13.02)
 - Lead Center: KSC
 - Participating Center(s): GRC, JSC, LaRC
- 3. Lunar Dust Mitigation Technology for Spacesuits (Z13.03)
 - Lead Center: JSC
- <https://sbir.nasa.gov/solicit-detail/66886>



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*



The screenshot shows a Confluence page titled "Dust Mitigation Home" within the "LSIC" space. The page content includes:

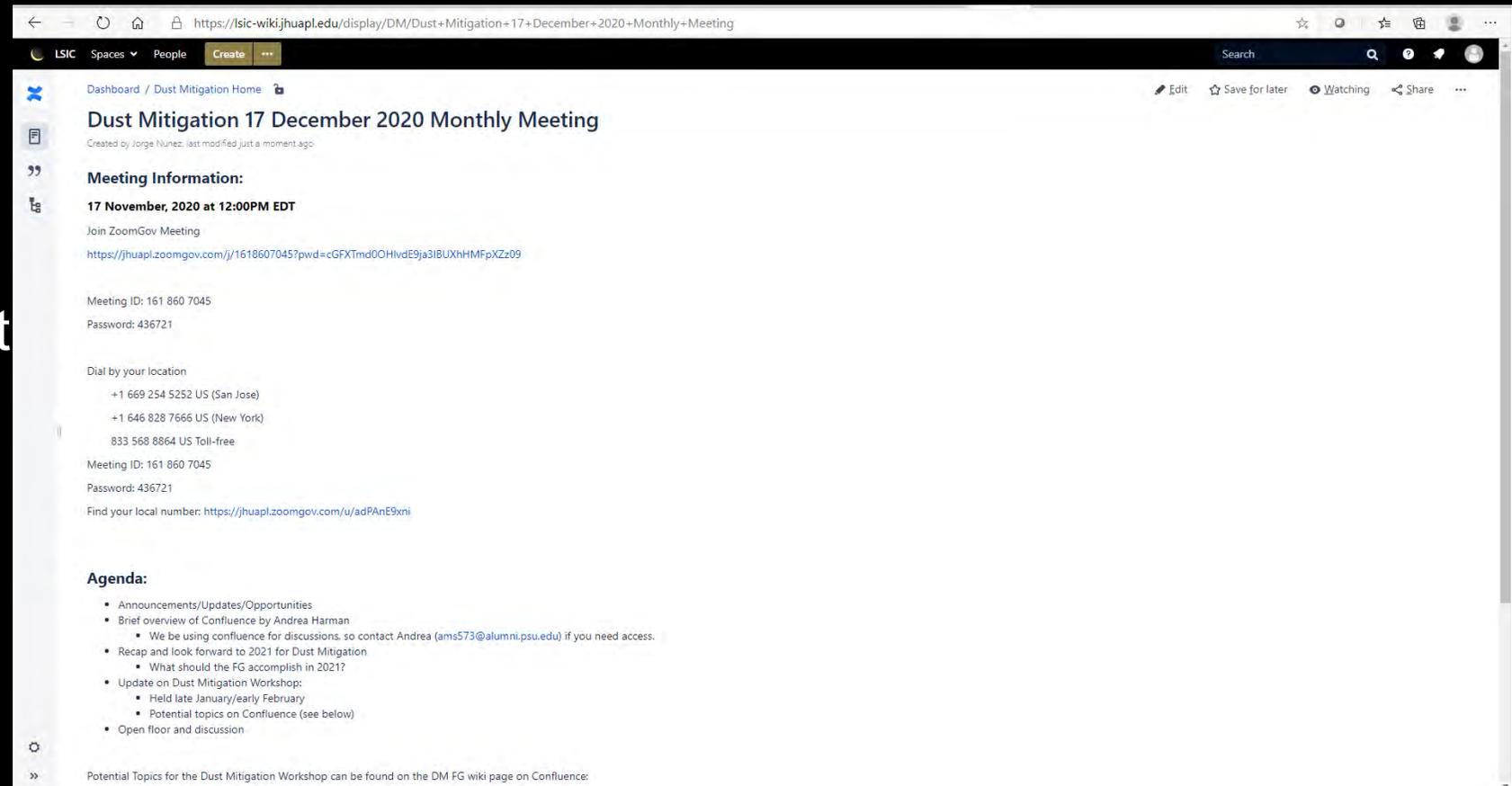
- Dust Mitigation Home**: Created by Andrea Harman, last modified on Sep 22, 2020.
- Dust Mitigation**: A paragraph describing the focus area on developing dust mitigation technologies for the lunar surface, mentioning areas like optical systems, thermal surfaces, and filtration.
- Facilitator: @Jorge Nunez**: Contact Email: Facilitator_DustMitigation@jhuapl.edu; Listserv Address: LSIC_DUSTMITIGATION@LISTSERV.JHUAPL.EDU
- Upcoming Events**:
 - 17 Sep 2020: Dust Mitigation Monthly Meeting
 - 17 Sep 2020: ISRU Supply and Demand Workshop
 - 14 Oct 2020 - 15 Oct 2020: LSIC Fall Meeting
- Past Monthly Meeting Records**:
 - 27 August 2020
 - 16 July 2020
 - 18 June 2020
- Conversations**:
 - DM Topics for Discussion
 - Follow Up to Ron Creel Presentation 27 August 2020
- Recent space activity**:
 - Andrea Harman: 18 June 2020 updated yesterday at 4:28 PM - view change
 - 16 July 2020 updated yesterday at 4:26 PM - view change
 - 27 August 2020 updated yesterday at 4:23 PM - view change
 - Dust Mitigation Home updated yesterday at 4:16 PM - view change
 - DM Monthly Meeting updated Sep 17, 2020 - view change

The page also features a sidebar with navigation options like "Pages", "Blog", and "PAGE TREE", and a top navigation bar with "LSIC", "Spaces", "People", and "Create" buttons.

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*

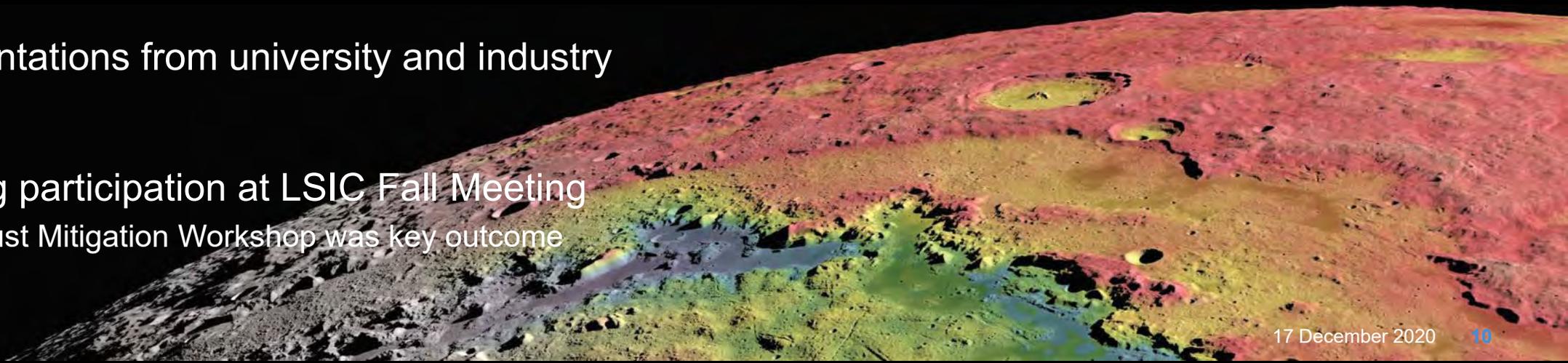
- 1. Sign-in to add a comment
- 2. Add comment at bottom of page
- 3. You can comment before, during, or after today's meeting



The screenshot shows a Confluence page for a meeting. The page title is "Dust Mitigation 17 December 2020 Monthly Meeting". It includes meeting information such as the date and time (17 November, 2020 at 12:00PM EDT), a Zoom link, and meeting ID (161 860 7045) and password (436721). There is also a section for dialing by location with phone numbers for San Jose, New York, and a toll-free number. An agenda is listed below, including announcements, a recap, and an update on the Dust Mitigation Workshop. The page footer mentions that potential topics for the workshop can be found on the DM FG wiki page on Confluence.

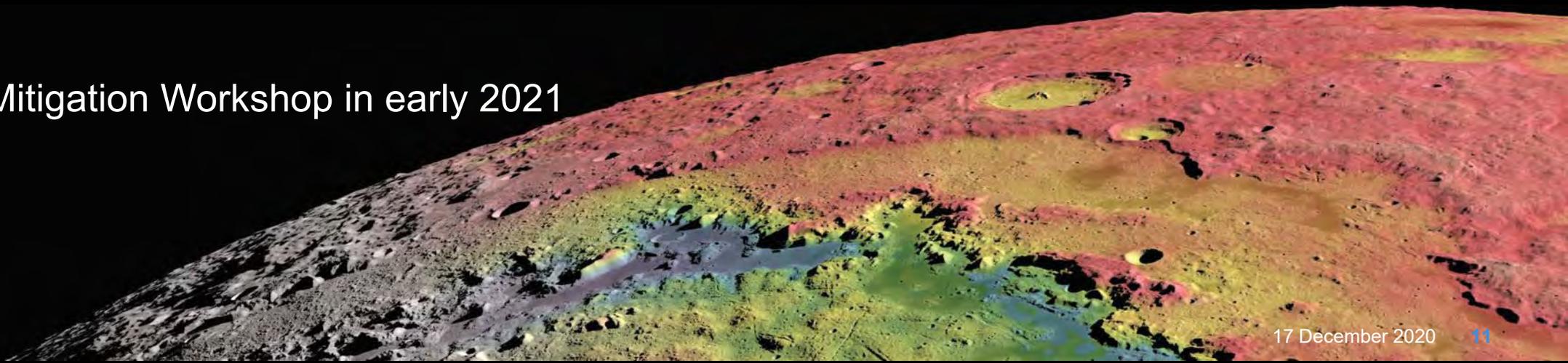
DM FG Recap

- Over 360 members signed up on Dust Mitigation Listserv
- 50-70 participants in monthly meetings
- Monthly discussions about different Dust Mitigation topics
 - Technology areas
 - Simulants
- Presentations from university and industry
- Strong participation at LSIC Fall Meeting
 - Dust Mitigation Workshop was key outcome



DM FG Looking Forward to 2021

- What Items/topics did you like the most?
- What do you wish could be different for 2021?
- What are the next steps for Dust Mitigation? What do you think are the priorities?
- What can Dust Mitigation Focus Group move forward?
- Dust Mitigation Workshop in early 2021



Dust Mitigation Workshop

- Dates: January 28 or February 4 (Date to be finalized)
- Format? Half-day workshop, 11 AM to 5 PM
 - Presentations in first ½ followed by breakout discussions in second ½
- Workshop OBJECTIVES:
 - Bring together key stake holders:
 - Government, Industry, Academia, and Non-profit
 - Architecture developers, dust mitigation technology developers, and scientists
 - Identify what technologies are already available
 - Identify what are the current challenges and gaps in Dust Mitigation
 - Identify areas in need of key investments
- Add topics to Wiki page:
- <https://lsic-wiki.jhuapl.edu/display/DM/Dust+Mitigation+Workshop+Topics>

Dust Mitigation Workshop

- Add topics to Wiki page:
- <https://lsic-wiki.jhuapl.edu/display/DM/Dust+Mitigation+Workshop+Topics>
- Rocket plume - dust interaction: What's the latest and greatest in analysis and modeling efforts?
- How does gravity affect leading dust mitigation strategies?
- Are special testing conditions (i.e. simulated lunar-G) needed to adequately test dust mitigation strategies?
- What gaps in dust mitigation technologies remain? Are there technologies that have been overlooked?
- What is needed to facilitate the integration of dust mitigation technologies into the larger lunar architecture?
- What are the most pressing challenges in dust mitigation?
- How can upcoming Commercial Lunar Payload Services (CLPS) missions advance dust mitigation solutions?
- How do we keep dust out (ex. keep suits outside of habitat)?



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