



# Lunar Surface Innovation

C O N S O R T I U M

## LSIC Dust Mitigation Focus Group

Monthly Meeting  
January 19, 2022



JOHNS HOPKINS  
APPLIED PHYSICS LABORATORY

Dr. Jorge Núñez  
Senior Scientist  
Space Exploration Sector

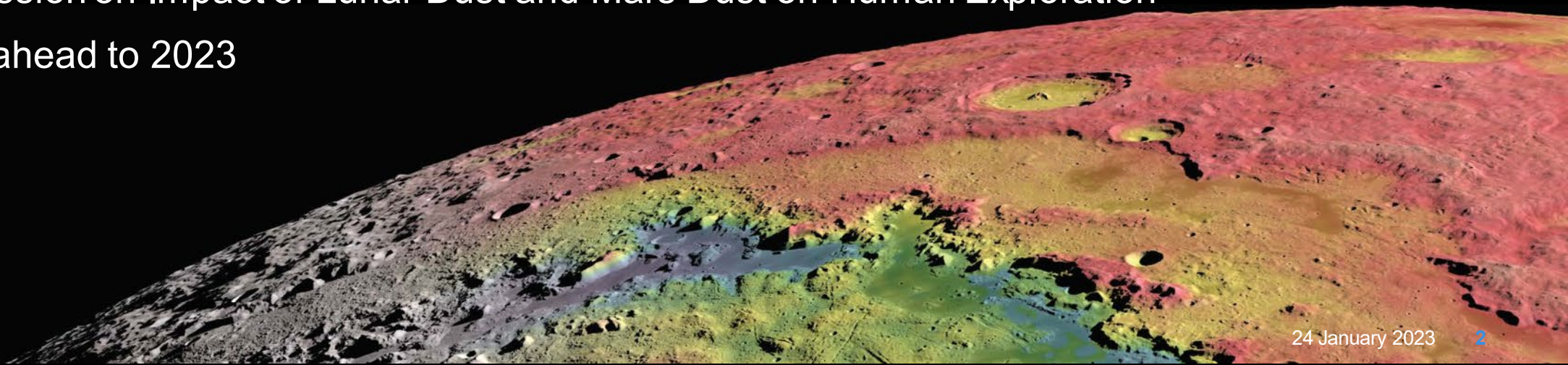
Facilitator: [DustMitigation@jhuapl.edu](mailto:DustMitigation@jhuapl.edu)

APL LSIC Dust Mitigation  
Team:

Lindsey Tolis  
Richard Miller  
Sarah Hasnain  
Stephen Izon  
Pegah Pashai  
Timothy Cole  
Mark Perry

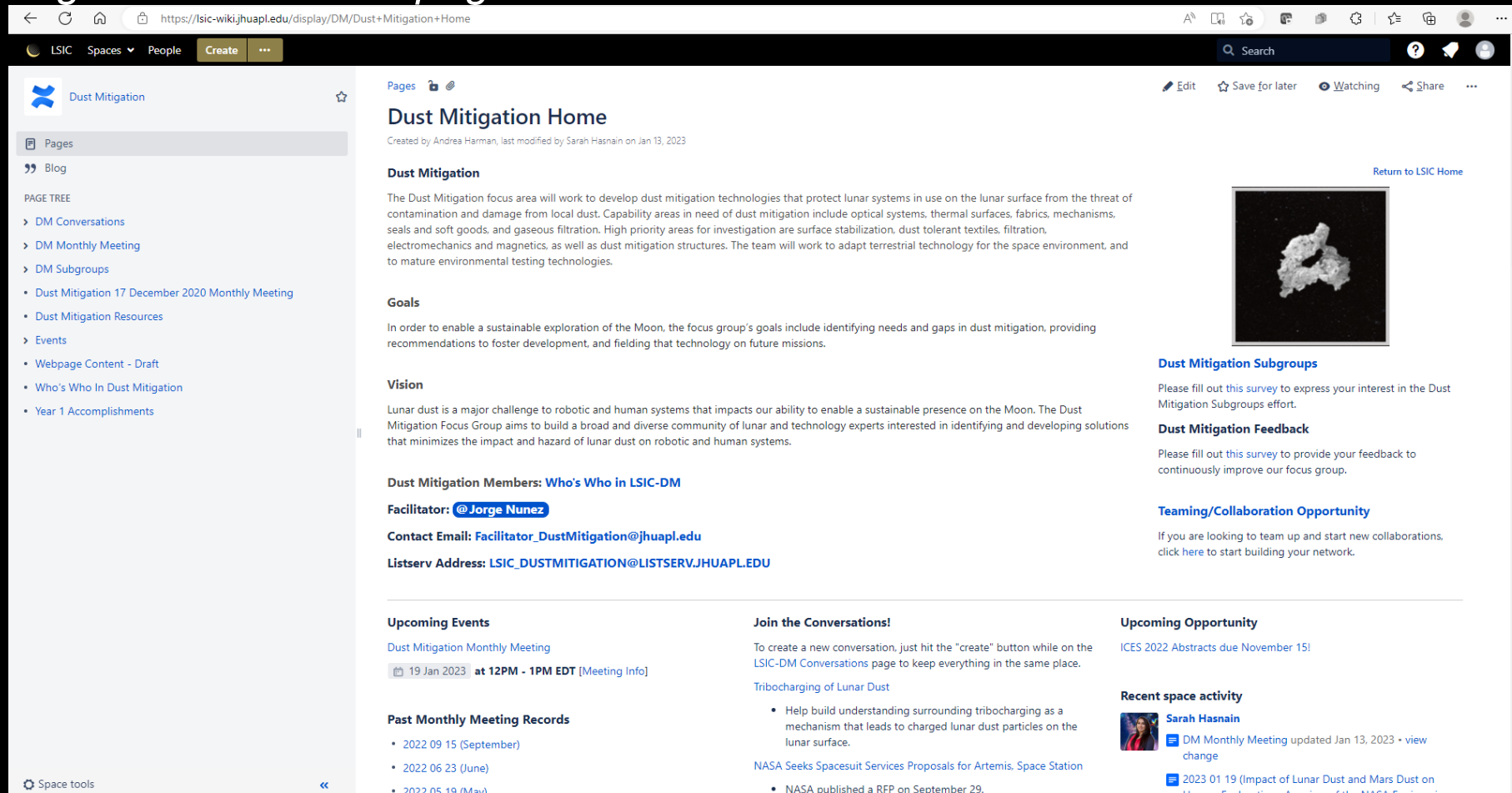
# Agenda

- Welcome, LSIC and Focus Group Updates
- Upcoming Opportunities and Meetings
- Featured Technology Presentation:
  - **“The Impact of Lunar Dust and Mars Dust on Human Exploration: A review of the NASA Engineering and Safety Center (NESC) Workshops”**
    - Dr. Joel S. Levine, Research Professor, Department of Applied Science, The College of William and Mary, Williamsburg, Virginia and Member, Space Environment Technical Discipline Team, NASA Engineering and Safety Center (NESC), NASA Langley Research Center, Hampton, Hampton, Virginia
- Discussion on Impact of Lunar Dust and Mars Dust on Human Exploration
- Look ahead to 2023



# LSIC Dust Mitigation Wiki Page

- To request access, please contact [lsic-wiki-admins@listserv.jhuapl.edu](mailto:lsic-wiki-admins@listserv.jhuapl.edu)
- *Dust Mitigation Discussion page and wiki*



The screenshot shows the 'Dust Mitigation Home' page on the LSIC wiki. The page is titled 'Dust Mitigation Home' and was created by Andrea Harman, last modified by Sarah Hasnain on Jan 13, 2023. The main content includes:

- Dust Mitigation:** A paragraph describing the focus area's goal to develop dust mitigation technologies for lunar systems, covering contamination and damage from local dust. It lists capability areas like optical systems, thermal surfaces, fabrics, mechanisms, seals, and soft goods, and high priority areas like surface stabilization, dust tolerant textiles, filtration, electromechanics, and magnetics.
- Goals:** A paragraph stating 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.
- Vision:** A paragraph stating that lunar dust is a major challenge to robotic and human systems, and the Dust Mitigation Focus Group aims to build a broad and diverse community of lunar and technology experts.
- Dust Mitigation Members:** A link to 'Who's Who in LSIC-DM'.
- Facilitator:** @Jorge Nunez
- Contact Email:** Facilitator\_DustMitigation@jhuapl.edu
- Listserv Address:** LSIC\_DUSTMITIGATION@LISTSERV.JHUAPL.EDU

On the right side of the page, there are several call-to-action sections:

- Dust Mitigation Subgroups:** A link to a survey to express interest in the Dust Mitigation Subgroups effort.
- Dust Mitigation Feedback:** A link to a survey to provide feedback to continuously improve the focus group.
- Teaming/Collaboration Opportunity:** A link to start building a network if looking to team up and start new collaborations.

At the bottom of the page, there are three columns of information:

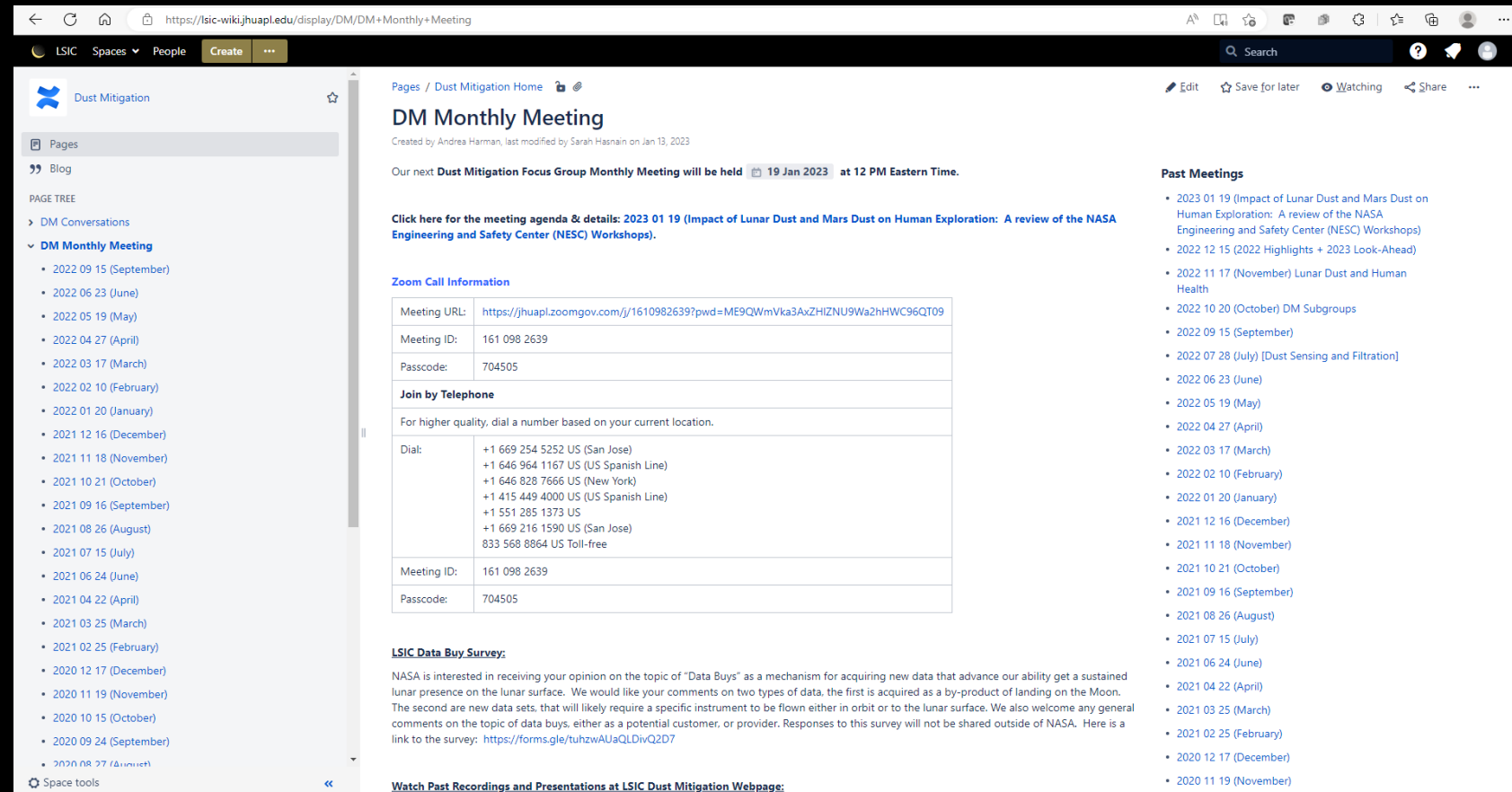
- Upcoming Events:** Dust Mitigation Monthly Meeting on 19 Jan 2023 at 12PM - 1PM EDT.
- Join the Conversations!:** A section for creating new conversations, with a link to 'Tribocharging of Lunar Dust' and a list of related topics.
- Upcoming Opportunity:** ICES 2022 Abstracts due November 15!
- Past Monthly Meeting Records:** A list of past meetings from September 2022 to May 2023.
- Recent space activity:** A list of recent news items, including 'DM Monthly Meeting updated Jan 13, 2023' and '2023 01 19 (Impact of Lunar Dust and Mars Dust on Human Exploration: A review of the NASA Engineering...)'.



# Join the Discussion on our Wiki Page

- To request access, please contact [lsic-wiki-admins@listserv.jhuapl.edu](mailto:lsic-wiki-admins@listserv.jhuapl.edu)
- *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 web browser displaying the 'DM Monthly Meeting' page on the LSIC Wiki. The page includes a navigation sidebar on the left with a 'Pages' section containing a list of past meetings from 2020 to 2023. The main content area features the title 'DM Monthly Meeting', a creation/modification date, and a notice for the next meeting on January 19, 2023. It also provides 'Zoom Call Information' with a table of meeting details and 'Join by Telephone' instructions. A 'Past Meetings' list is visible on the right side of the page.

Zoom Call Information	
Meeting URL:	<a href="https://jhuapl.zoomgov.com/j/1610982639?pwd=ME9QWmVka3AxZHlZNU9Wa2hHWC96QT09">https://jhuapl.zoomgov.com/j/1610982639?pwd=ME9QWmVka3AxZHlZNU9Wa2hHWC96QT09</a>
Meeting ID:	161 098 2639
Passcode:	704505

Join by Telephone	
For higher quality, dial a number based on your current location.	
Dial:	+1 669 254 5252 US (San Jose) +1 646 964 1167 US (US Spanish Line) +1 646 828 7666 US (New York) +1 415 449 4000 US (US Spanish Line) +1 551 285 1373 US +1 669 216 1590 US (San Jose) 833 568 8864 US Toll-free
Meeting ID:	161 098 2639
Passcode:	704505

# Updates and Communications

- Monthly LSIC newsletter – New edition came out early January 2023
  - POC: Josh Cahill
  - <https://lsic.jhuapl.edu/Resources/LSIC-Resources.php>
- 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](mailto:LSIC_DUSTMITIGATION@LISTSERV.JHUAPL.EDU) to safe senders list.
  - If we need smaller, focused lists we can set those up
- Updates to the webpage - <https://lsic.jhuapl.edu/Our-Work/Focus-Areas/index.php?fg=Dust-Mitigation>
  - Notes, slides, recordings from telecons posted here
- Keep up on the Wiki!
  - Confluence is free to you and available to all registered LSIC members
  - **To request access, please contact [lsic-wiki-admins@listserv.jhuapl.edu](mailto:lsic-wiki-admins@listserv.jhuapl.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](mailto:Facilitator_DustMitigation@jhuapl.edu)

**Follow the Code of Conduct for all Focus Group communications**

<https://lsic.jhuapl.edu/Resources/LSIC-Resources.php>

# Space Technology Funding Opportunities

## Current Tech Development Opportunities

- [NASA Innovative Advanced Concepts \(NIAC\) 2022 Phase II Call for Proposals »](#)
  - Proposals Due January 18, 2023
- [FY 2023 Phase II SBIR and STTR Solicitations \(2022 Phase I awardees only\) »](#)
  - Phase II solicitations are not released publicly; the solicitations are sent directly to Phase I awardees as they are the only ones eligible to apply.
  - SBIR and STTR Phase II contracts last for 24 months and have a maximum funding amount of \$850,000. Proposals are due 60 days before the Phase I period of performance ends.
  - The 2022 SBIR Phase II Solicitation (2022 SBIR Phase I awardees only) opens on December 13, 2022 and closes on January 25, 2023. Post Phase II funding opportunities are only open to small businesses with Phase I or II awards. See the NASA SBIR/STTR program website for more information.
- [FY 2023 Phase I SBIR and STTR Solicitations »](#)
  - Phase I opportunity opened on Jan. 10, 2023 and closes on March 13, 2023.
  - The NASA SBIR and STTR Phase I Solicitations are open to small businesses with 500 or fewer employees. To apply for an STTR, a small business must partner with a non-profit research institution such as a university or a research laboratory. SBIR Phase I contracts last for six months and STTR Phase I contracts last for 13 months, both with a maximum funding of \$150,000.
  - Selections scheduled to be announced on June 5, 2023.

## Future Solicitation and Opportunities

- [NASA Innovation Corps Pilot »](#)
  - Proposals may be submitted at any time through March 29, 2023, but applications will be reviewed in intervals on the following dates: July 22, 2022; Sept. 16, 2022; Nov. 17, 2022; and Jan 20, 2023



# NASA SBIR & STTR Solicitations 2023

- Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR)
- *Open to U.S. small businesses*
  - *May collaborate with universities and industry partners*
- Phase I: Up to **\$150 K** for 6 Mo
- Phase II: Up to \$850 K for 24 Mo
- **Focus Area 24: “Dust Mitigation and Extreme Lunar Environment Mitigation Technologies”**
- **Phase I Solicitation Closes March 13, 2023**
- **Phase II Solicitations Due by last day of Phase I contract**
- **Phase I Selections expected June 5, 2023**
- <https://sbir.nasa.gov/solicit-detail/97360>



The poster features the NASA logo at the top right and the text "National Aeronautics and Space Administration" at the top left. The central image shows an astronaut on a space station with Earth in the background. A diamond-shaped inset shows a group of four people in NASA attire. The text "NASA SBIR PROGRAM SOLICITATION 2023" is prominently displayed in blue, with the tagline "Join our diverse community of pioneers who are researching and developing technologies to change the world" below it. At the bottom, it says "NASA SBIR/STTR PROGRAM | sbir.nasa.gov".

- Focus Area 24: Dust Mitigation and Extreme Lunar Environment Mitigation Technologies
  - 2 Sub-topic areas
- 1. Lunar Dust Filtration and Monitoring (Z13.04)
  - Lead Center: GRC
  - Participating Center(s): JSC, KSC
- 2. Components for Extreme Environments (Z13.05)
  - Lead Center: KSC
  - Participating Center(s): GRC, JSC, LaRC
- <https://sbir.nasa.gov/solicit-detail/79614>





# LSIC Activities

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

- LSIC SP Focus Group Meeting (01/26)
- LSIC Dust Mitigation Focus Group Meeting (02/16)
- LSIC Spring Meeting (04/24 – 04/25, 2023) – New Date!
  - Abstracts due Feb 3!
  - Johns Hopkins Applied Physics Laboratory (Hybrid)
- LSIC Dust Mitigation Workshop (Spring 2023)
  - Follow-up to DM Workshop from 2021
  - Dates TBD

## *Other Recent and Upcoming Dust Mitigation Related Workshop and Meetings*

- Lunar and Planetary Science Conference - LPSC (03/13 – 03/17, 2023)
  - The Woodlands, TX
  - <https://www.hou.usra.edu/meetings/lpsc2023/index.shtml>
- Space Resources Week 2023 (04/19 – 04/21, 2023)
  - Luxembourg
  - <https://www.spaceresourcesweek.lu/>

# LSIC | Surface Power Focus Group January Telecon

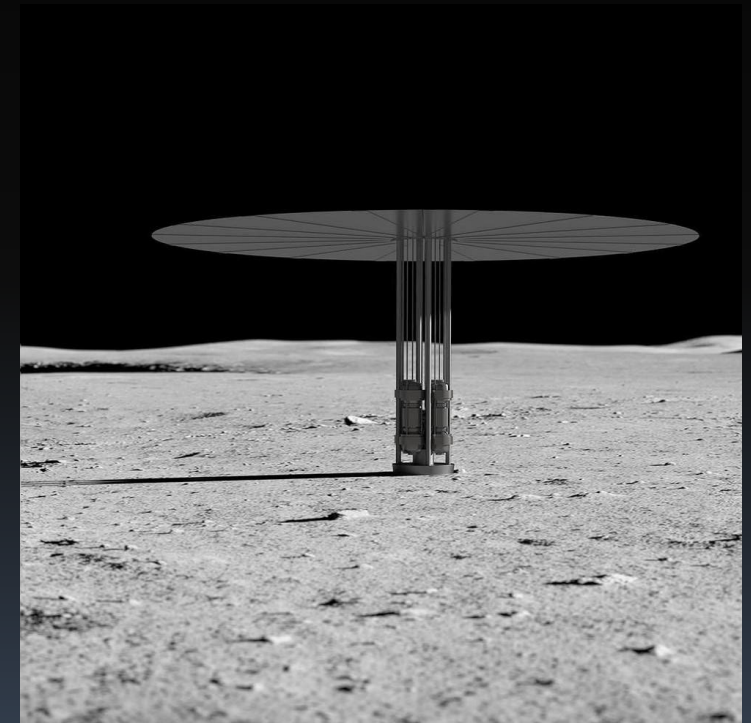
Surface Power Telecon: January 26<sup>th</sup> 11:00 ET

**Speakers:** Peter McGrath (FSP Project Manager for Intuitive Machines and X-Energy)  
Joe Halackna (Deputy Director for Reactor Engineering for Westinghouse)  
Mikaela Blood (FSP Reactor Lead at Lockheed Martin)  
Lee Mason (Power Division Associate Chief at NASA GRC)

**Topic:** NASA Fission Surface Power Phase I

**Agenda:**

- Community Updates
- Intuitive Machines/X-Energy presentation
- Westinghouse presentation
- Lockheed Martin presentation
- Panel Discussion Q&A



**Zoom Link for Jan 26<sup>th</sup> 11:00 ET:**

<https://jhuapl.zoomgov.com/j/1617206812?pwd=ZWhtaW5XRURsRmxJcWd4b1ZoeFFwUT09>





# LSIC Spring Meeting

**\*\*NOW\*\*** April 24<sup>th</sup> – 25<sup>th</sup> at Johns Hopkins Applied Physics Lab

Abstracts are due Feb. 3<sup>rd</sup>. Registration will open in Feb.!

\*Please remember to utilize the abstract template provided on webpage

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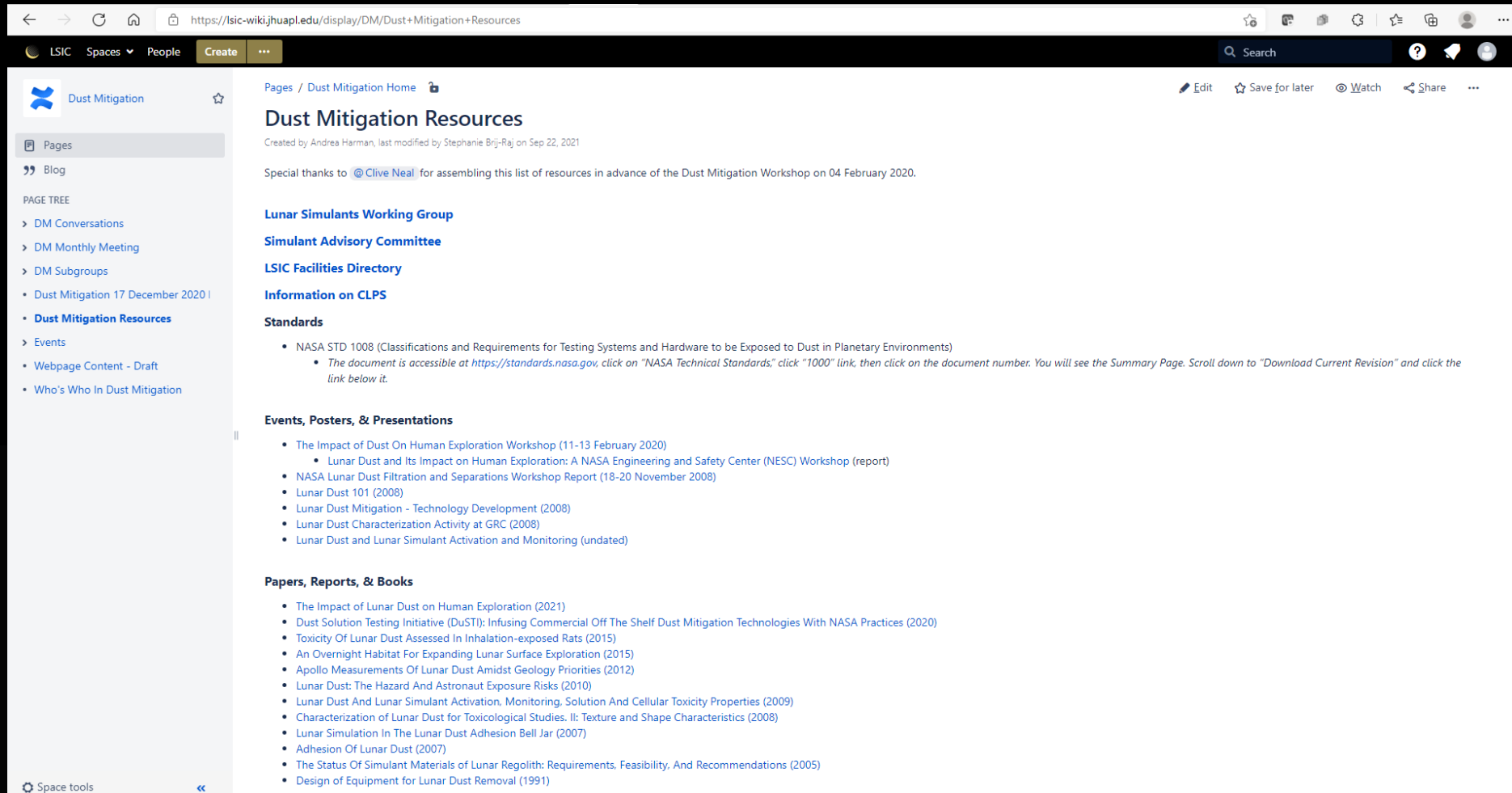


# LSII | Data Buys Survey

- NASA is interested to learn more about the interest in the LSIC community of NASA conducting data buys from commercial providers
- There are two types of data to consider
  - Data acquired as a by product of landing on the Moon
  - Dedicated data that require a specific instrument to be flown
- What kind of data access is required?
  - Does NASA buy an entire data set and put it in PDS?
  - Do users buy data directly from the providers?
- Survey Link:  
<https://forms.gle/tuhzwAUaQLDivQ2D7>

# Dust Mitigation Resources

- 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>



The screenshot shows a web browser displaying the 'Dust Mitigation Resources' page on the LSIC Wiki. The page title is 'Dust Mitigation Resources' and it was created by Andrea Harman, last modified by Stephanie Brij-Raj on Sep 22, 2021. The page content includes a list of resources categorized into Standards, Events, Posters, & Presentations, and Papers, Reports, & Books. The left sidebar shows the page tree with 'Dust Mitigation Resources' highlighted. The right sidebar shows options to edit, save for later, watch, and share the page.

Pages / Dust Mitigation Home

## Dust Mitigation Resources

Created by Andrea Harman, last modified by Stephanie Brij-Raj on Sep 22, 2021

Special thanks to @Clive Neal for assembling this list of resources in advance of the Dust Mitigation Workshop on 04 February 2020.

**Lunar Simulants Working Group**

**Simulant Advisory Committee**

**LSIC Facilities Directory**

**Information on CLPS**

**Standards**

- NASA STD 1008 (Classifications and Requirements for Testing Systems and Hardware to be Exposed to Dust in Planetary Environments)
  - The document is accessible at <https://standards.nasa.gov>. click on "NASA Technical Standards," click "1000" link, then click on the document number. You will see the Summary Page. Scroll down to "Download Current Revision" and click the link below it.

**Events, Posters, & Presentations**

- The Impact of Dust On Human Exploration Workshop (11-13 February 2020)
  - Lunar Dust and Its Impact on Human Exploration: A NASA Engineering and Safety Center (NESC) Workshop (report)
- NASA Lunar Dust Filtration and Separations Workshop Report (18-20 November 2008)
- Lunar Dust 101 (2008)
- Lunar Dust Mitigation - Technology Development (2008)
- Lunar Dust Characterization Activity at GRC (2008)
- Lunar Dust and Lunar Simulant Activation and Monitoring (undated)

**Papers, Reports, & Books**

- The Impact of Lunar Dust on Human Exploration (2021)
- Dust Solution Testing Initiative (DuSTI): Infusing Commercial Off The Shelf Dust Mitigation Technologies With NASA Practices (2020)
- Toxicity Of Lunar Dust Assessed In Inhalation-exposed Rats (2015)
- An Overnight Habitat For Expanding Lunar Surface Exploration (2015)
- Apollo Measurements Of Lunar Dust Amidst Geology Priorities (2012)
- Lunar Dust: The Hazard And Astronaut Exposure Risks (2010)
- Lunar Dust And Lunar Simulant Activation, Monitoring, Solution And Cellular Toxicity Properties (2009)
- Characterization of Lunar Dust for Toxicological Studies. II: Texture and Shape Characteristics (2008)
- Lunar Simulation In The Lunar Dust Adhesion Bell Jar (2007)
- Adhesion Of Lunar Dust (2007)
- The Status Of Simulant Materials of Lunar Regolith: Requirements, Feasibility, And Recommendations (2005)
- Design of Equipment for Lunar Dust Removal (1991)

# Get Involved with Dust Mitigation

- 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](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://forms.gle/AGpyJcNZBd6ihdaq7>
  - Still looking for subgroup leads!
- 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>



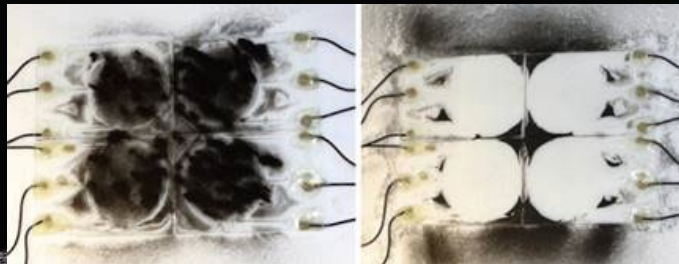
# Dust Mitigation FG Subgroups

- **Standards & Interoperability [Subgroup Lead: Dan Hawk]**
  - Standards and interoperability across testing and operational use cases
- **Isolation Technologies [Subgroup Lead: Ron Creel]**
  - Technologies that keep dust out
- **Materials & 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
  - Fabrics – Space suit fabrics, soft wall habitats, mechanism covers
  - Seals and Soft Goods – Space suit interfaces, hatches, connectors, hoses
- **Mechanisms & Connectors**
  - Mechanisms – Linear actuators, bearings, rotary joints, hinges, quick disconnects, valves, linkages
  - Dust-tolerant connectors
- **Modeling & Monitoring**
  - Gaseous Filtration – Atmosphere revitalization, ISRU processes
  - Dust monitoring – Cabin and external dust monitoring
  - Dust plume modeling

Interested in leading a  
Dust Mitigation Subgroup?

Fill out our survey!

<https://forms.gle/AGpyJcNZBd6ihdaq7>



## Today's Technology Presentation

“The Impact of Lunar Dust and Mars Dust on Human Exploration: A review of the NASA Engineering and Safety Center (NESC) Workshops”



### Dr. Joel S. Levine

Research Professor, Department of Applied Science  
The College of William and Mary, Williamsburg,  
Virginia

Member, Space Environment Technical Discipline  
Team, NASA Engineering and Safety Center (NESC)

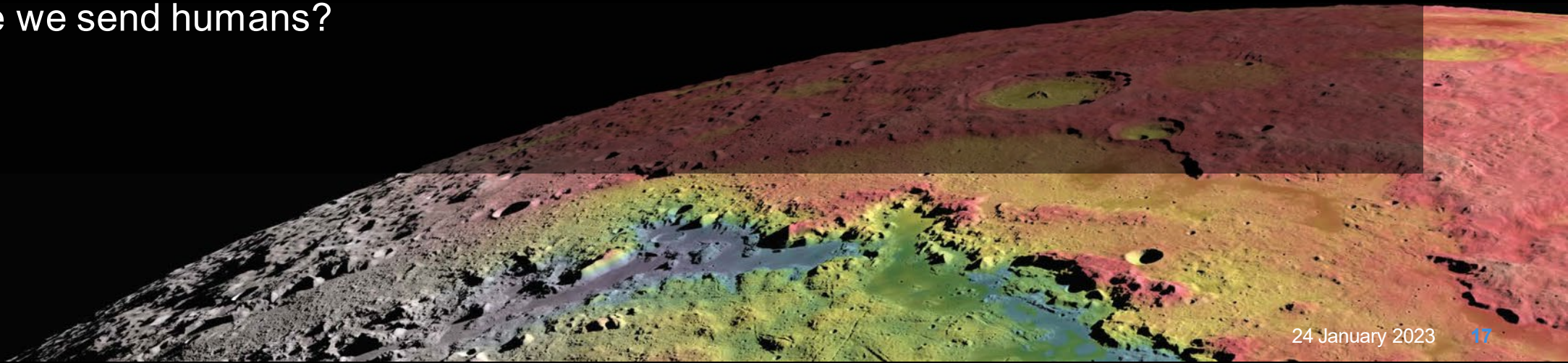
NASA Langley Research Center, Hampton,  
Hampton, Virginia

[joelslevine@gmail.com](mailto:joelslevine@gmail.com)



# Discussion on Impact of Lunar Dust and Mars Dust on Human Exploration

- What gaps exist in our understanding of lunar and martian dust and dust environment?
- What data do we still need to help improve our understanding of risks to hardware and future astronaut crews?
- What plans are in place to ensure we get the data we need to close those gaps?
- Do upcoming CLPS missions help get the data we need?
- Are current testing facilities and simulants sufficient for testing that needs to be done?
- What experiments and technology demonstrations need to be flown on CLPS missions before we send humans?





# What is next for Dust Mitigation FG?

## What would you like to see for Dust Mitigation Focus Group in 2023

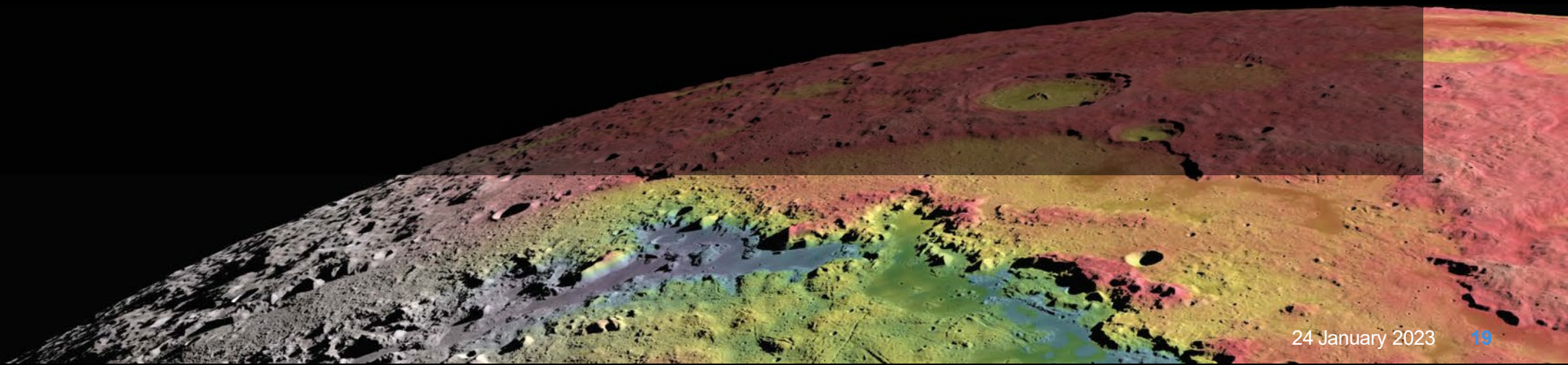
- What benefits have you gained from being part of the LSIC Dust Mitigation Focus group?
- Is there anything else you enjoy about monthly meetings? Anything you'd like to see us change?
- Is there anything you liked about this past year that you'd like to see continue?
- Is there anything about this past year that you'd change going forward?
- Are there any topics we have not covered you would like to see covered (or see more)?
- Are there other activities you would like to see us organize?

- **Please fill out the feedback survey:**

- [https://docs.google.com/forms/d/e/1FAIpQLSdjuTIK\\_TLMnCM4\\_aSMLAzLS762qtzbgmcOd2fgizICsab6KQ/viewform](https://docs.google.com/forms/d/e/1FAIpQLSdjuTIK_TLMnCM4_aSMLAzLS762qtzbgmcOd2fgizICsab6KQ/viewform)

# Looking forward to 2023

- LSIC Spring Meeting (April 24-25, 2023)
- LSIC “White Paper”
- LSIC Dust Mitigation Workshop (Spring 2023)





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