



# Lunar Surface Innovation

C O N S O R T I U M

## LSIC Dust Mitigation Focus Group

Monthly Meeting

February 16, 2022



JOHNS HOPKINS  
APPLIED PHYSICS LABORATORY

Dr. Jorge Núñez  
Senior Scientist  
Space Exploration Sector

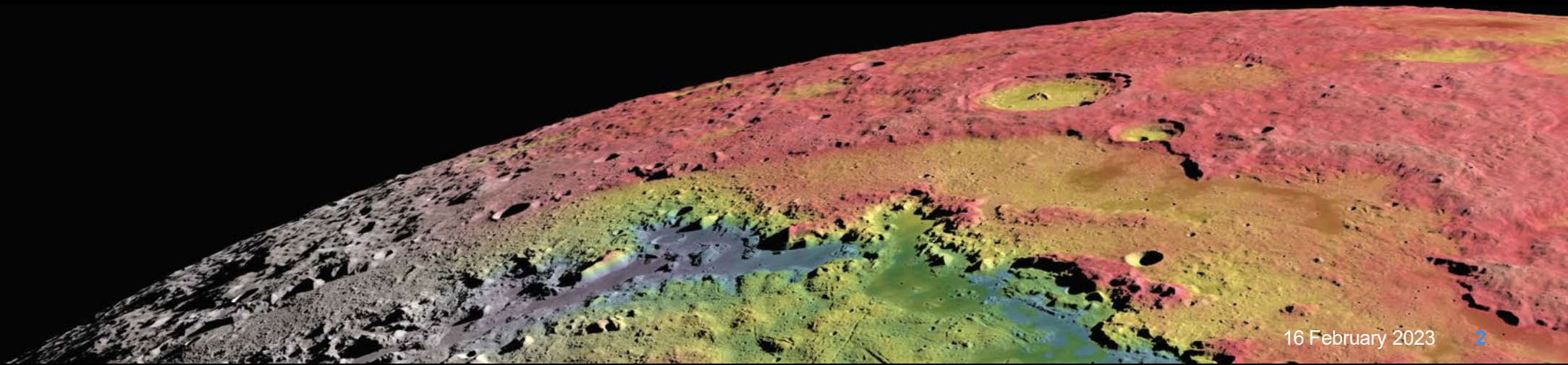
Facilitator: [DustMitigation@jhuapl.edu](mailto:DustMitigation@jhuapl.edu)

APL LSIC Dust Mitigation  
Team:

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

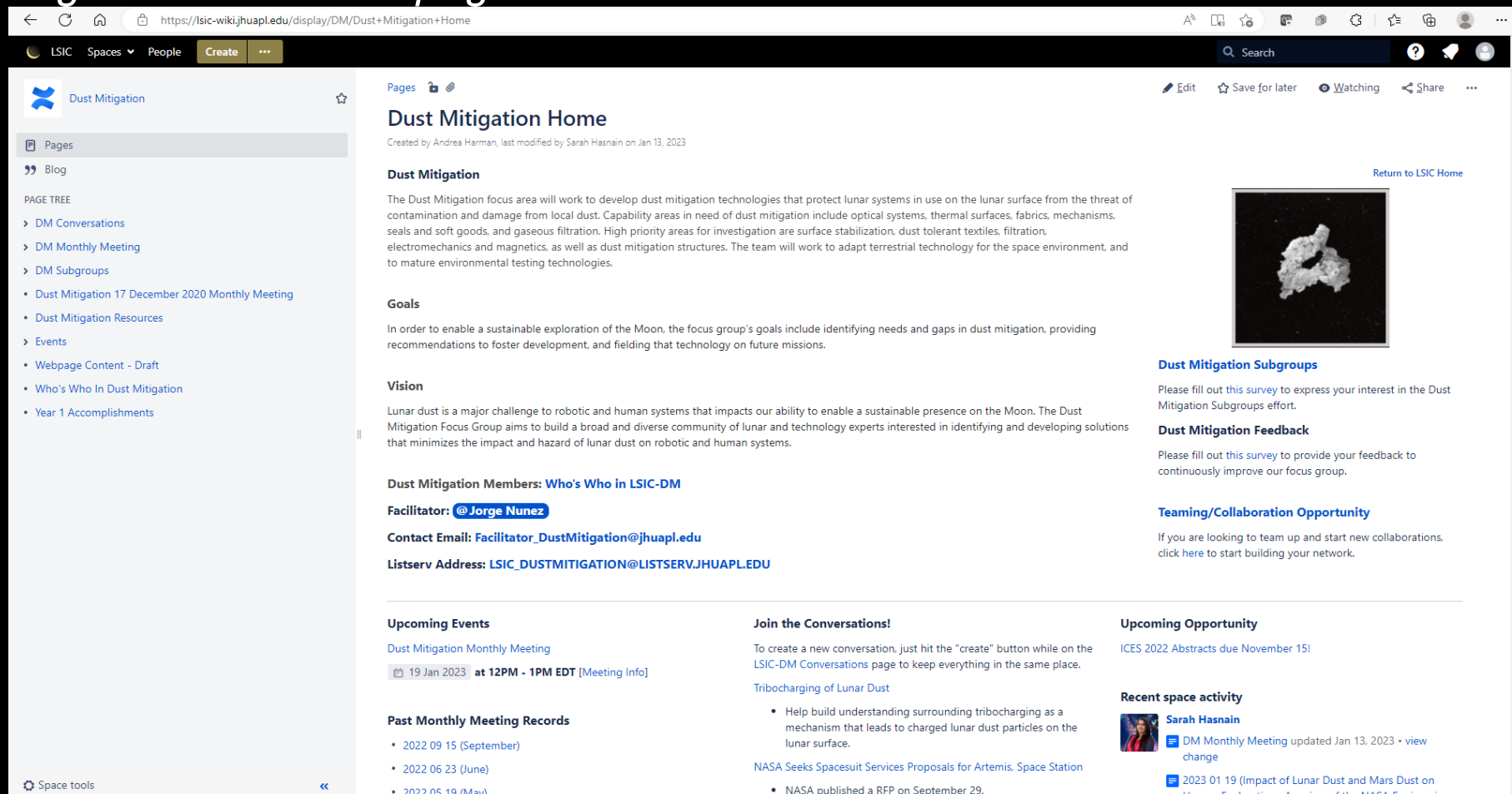
# Agenda

- Welcome, LSIC and Focus Group Updates
- Upcoming Opportunities and Meetings
- Featured Technology Presentation:
  - **“A Path to an Enduring Lunar Presence”**
    - Sarah Hasnain, LSIC Excavation & Construction Co-Facilitator + Autonomy & Site Planning Subgroup
- Discussion on dust mitigation gaps and opportunities for technologies needed for a sustained lunar presence



# 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 technologies to protect lunar systems from dust contamination and damage.
- Goals:** A paragraph stating the group's goals include identifying needs and gaps in dust mitigation, providing recommendations, and fielding technology on future missions.
- Vision:** A paragraph stating that lunar dust is a major challenge and the group aims to build a community of experts to develop solutions that minimize its impact.
- 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, there are several call-to-action sections:

- Dust Mitigation Subgroups:** A link to a survey to express interest in the subgroups.
- Dust Mitigation Feedback:** A link to a survey to provide feedback and improve the group.
- Teaming/Collaboration Opportunity:** A link to start building a network.

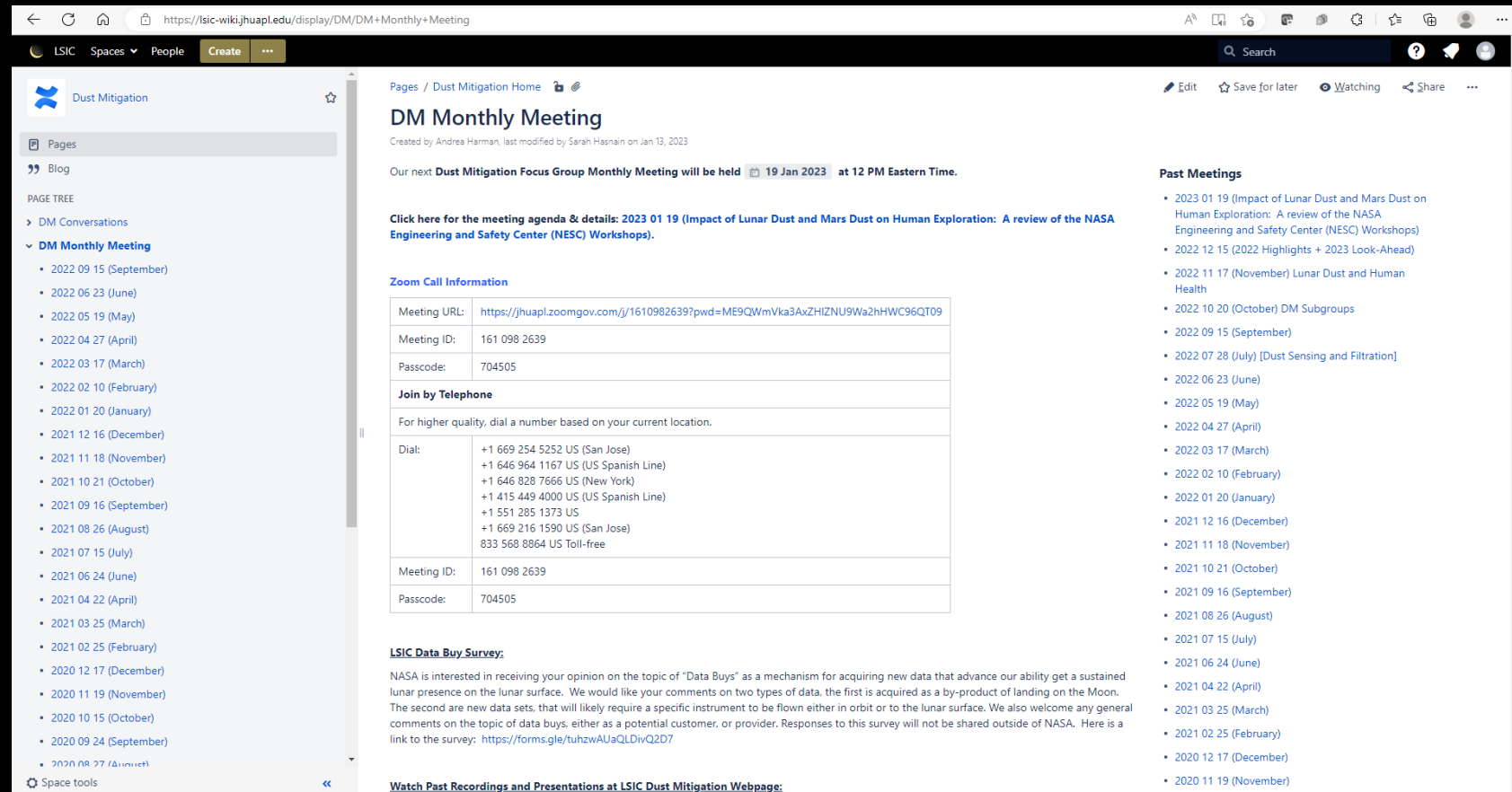
At the bottom, there are three columns of information:

- Upcoming Events:** Dust Mitigation Monthly Meeting on 19 Jan 2023 at 12PM - 1PM EDT.
- Join the Conversations!:** Instructions on how to create a new conversation and links to 'Tribocharging of Lunar Dust' and 'NASA Seeks Spacesuit Services Proposals for Artemis, Space Station'.
- 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 meeting title, creation/modification dates, and a notice about 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 on the right, and a 'LSIC Data Buy Survey' section is at the bottom.

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

# Updates and Communications

- Monthly LSIC newsletter – New edition came out early February 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 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.
- [Lunar Surface Technology Research \(LuSTR\) Opportunities »](#)
  - NOIs Due: March 22, 2023; Proposals Due: April 24, 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".

# NASA SBIR & STTR Solicitations 2023

- 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>



National Aeronautics and Space Administration




**NASA SBIR PROGRAM SOLICITATION 2023**

Join our diverse community of pioneers who are researching and developing technologies to change the world

NASA SBIR/STTR PROGRAM | [sbir.nasa.gov](https://sbir.nasa.gov)



# NASA LuSTR Solicitation 2023

- NASA's Space Technology Mission Directorate (STMD) has released "Lunar Surface Technology Research (LuSTR) Opportunities" as an appendix to the SpaceTech-REDDI-2023 solicitation.
- The LuSTR appendix is available at: <https://tinyurl.com/2023LuSTR>
- LuSTR solicits proposals in response to the following three topics:
  - **Active Dust Mitigation**
  - Lunar Extreme Access and Exploration via Cooperative Multi-Robot
  - Extraction of Metals from Lunar Regolith for Additive Manufacturing
- LuSTR23 NOIs Due                      March 22, 2023 @5:00 PM EDT
- LuSTR23 Proposals Due                April 24, 2023 @5:00 PM EDT

# LSIC Activities

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

- LSIC Dust Mitigation Focus Group Meeting (03/16)
- LSIC Spring Meeting (04/24 – 04/25, 2023) – New Date!
  - Abstracts due Feb 15!
  - Johns Hopkins Applied Physics Laboratory (Hybrid)
- LSIC Dust Mitigation Workshop (05/24 – 05/25)
  - Follow-up to DM Workshop from 2021
  - Information to be sent later

## *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/>
- Dust, Atmosphere, and Plasma Environment of the Moon and Small Bodies Workshop (06/05 – 06/07, 2023)
  - Boulder, CO
  - <http://impact.colorado.edu/dap/2023/index.html>



# LSIC Spring Meeting

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

Abstracts are due Feb. 15th. Registration is now open!

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

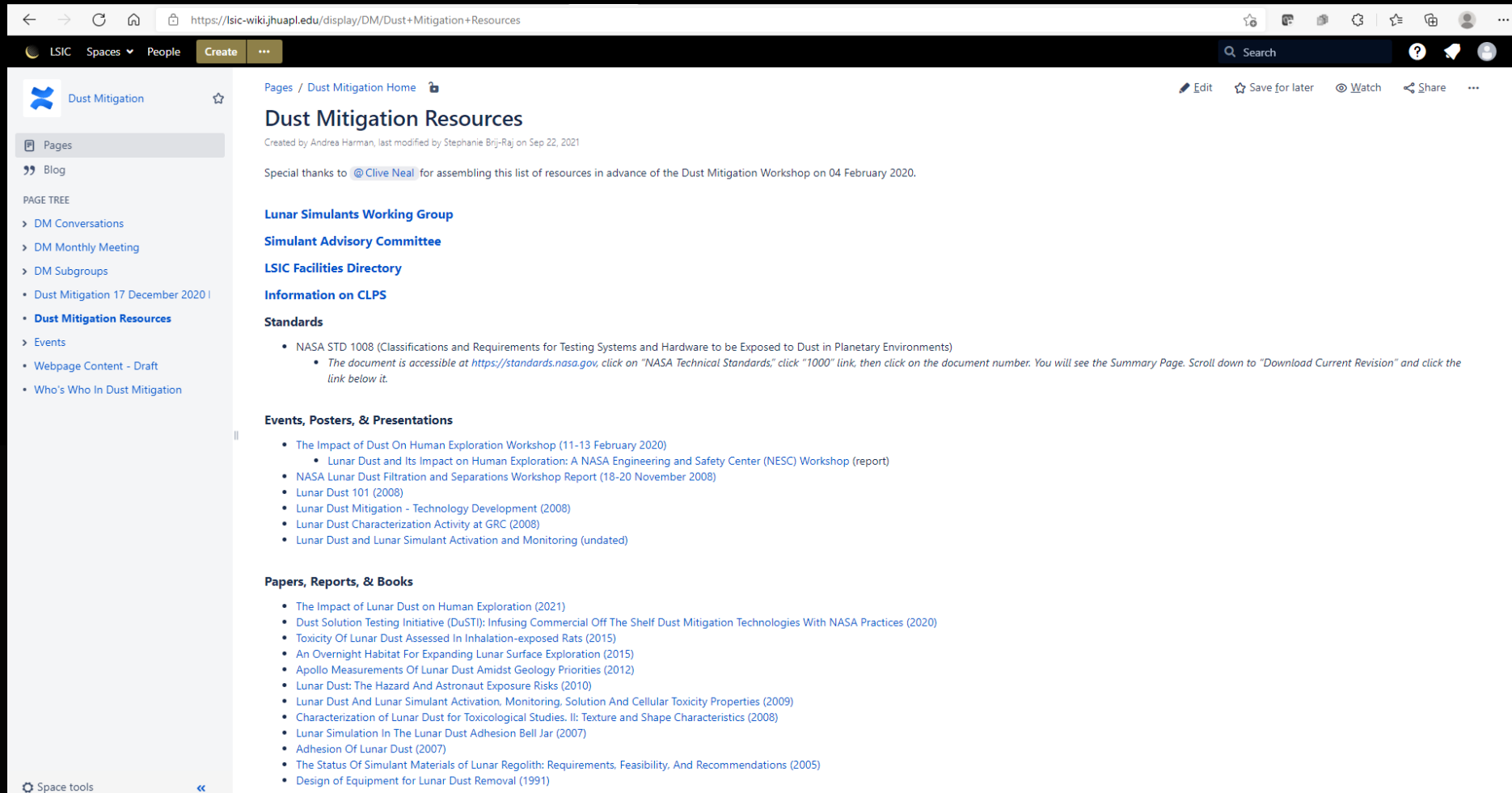
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# LSII | Data Buys Survey

- 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 Confluence site. 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 navigation options like Edit, Save for later, Watch, and Share. The background of the slide features a colorful, abstract image of a lunar surface.

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>

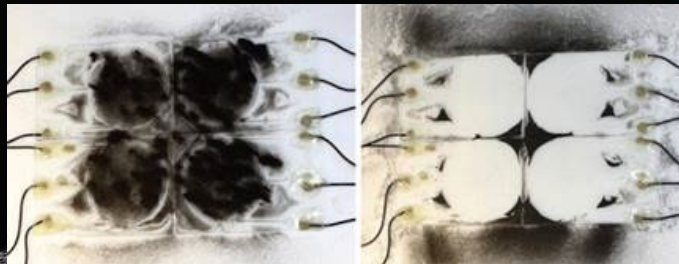
# Dust Mitigation FG Subgroups

- **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

## "A Path to an Enduring Lunar Presence"



**Sarah Hasnain**

**LSIC Excavation & Construction Co-Facilitator  
+ Autonomy & Site Planning Subgroup**

[Sarah.Hasnain@jhuapl.edu](mailto:Sarah.Hasnain@jhuapl.edu)





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