



# Lunar Surface Innovation

C O N S O R T I U M

## LSIC Dust Mitigation Focus Group

Monthly Meeting

April 20, 2023



JOHNS HOPKINS  
APPLIED PHYSICS LABORATORY

Dr. Jorge Núñez  
Senior Scientist  
Space Exploration Sector

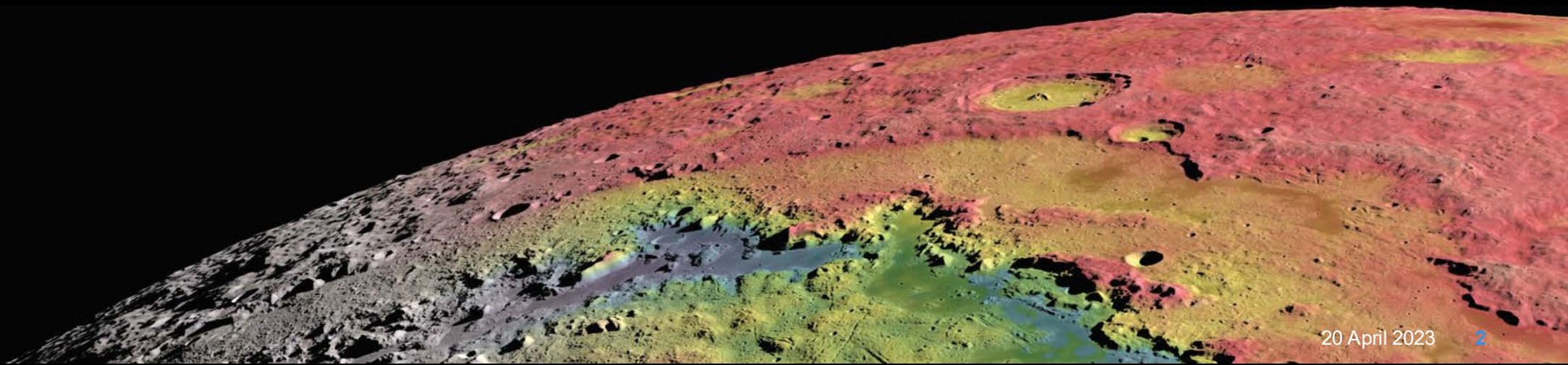
Facilitator\_[DustMitigation@jhuapl.edu](mailto:DustMitigation@jhuapl.edu)

APL LSIC Dust Mitigation  
Team:

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

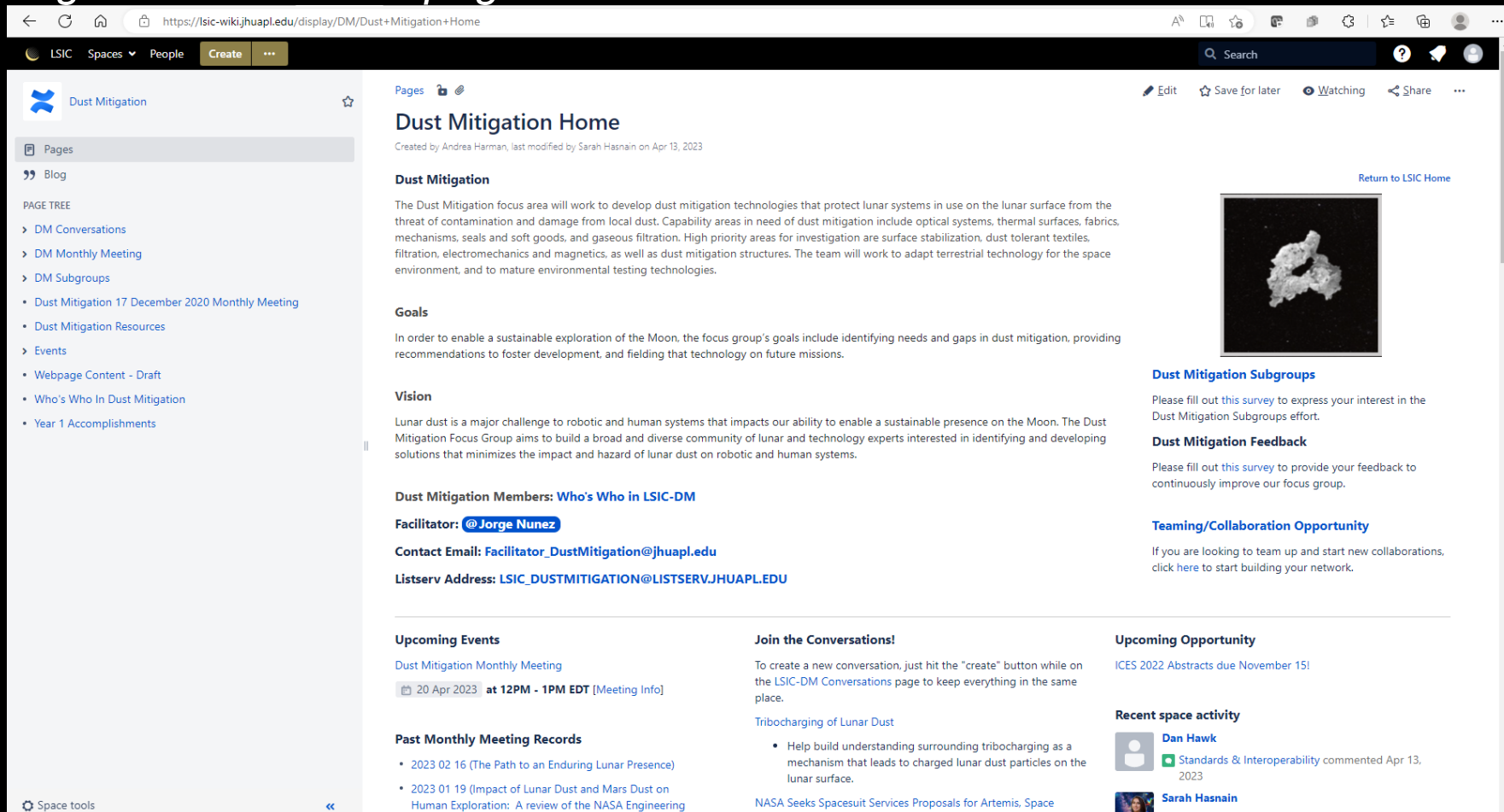
# Agenda

- Welcome, LSIC and Focus Group Updates
- Upcoming Opportunities and Meetings
- Featured Technology Presentations:
  - **“Dust and Particulate Mitigation for Flight Hardware in APL Cleanrooms”**
    - Morgan Steadham, Johns Hopkins Applied Physics Laboratory
  - **“Lunar Surface Environment Test Capabilities – JSC B351”**
    - Todd Peters, NASA Johnson Space Center
- Discussion on Dust Mitigation in Spacecraft and Testing Facilities



# 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*



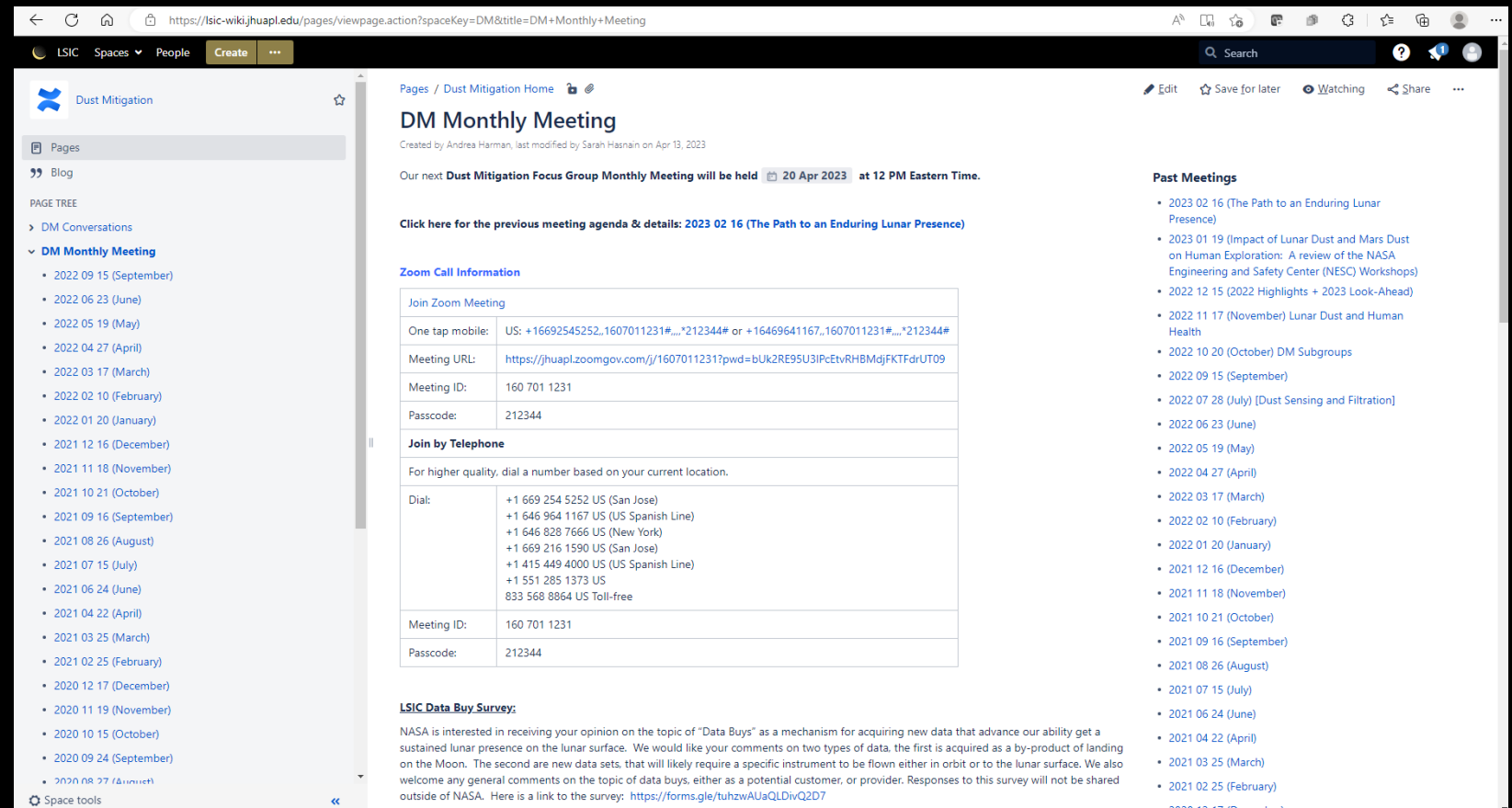
The screenshot shows the 'Dust Mitigation Home' page on the LSIC wiki. The page is titled 'Dust Mitigation Home' and was created by Andrea Harman, last modified by Sarah Hasnain on Apr 13, 2023. The main content includes a description of the Dust Mitigation focus area, which aims to develop technologies to protect lunar systems from local dust. It lists goals such as identifying needs and gaps, providing recommendations, and fielding technology on future missions. The vision is to build a community of experts to minimize the impact of lunar dust on robotic and human systems. The page also lists members, a facilitator (@Jorge Nunez), contact email (Facilitator\_DustMitigation@jhuapl.edu), and Listserv address (LSIC\_DUSTMITIGATION@LISTSERV.JHUAPL.EDU). There are sections for upcoming events (Dust Mitigation Monthly Meeting on Apr 20, 2023), past meeting records, and upcoming opportunities (ICES 2022 Abstracts due November 15). Recent space activity is also mentioned, including comments from Dan Hawk and Sarah Hasnain.



# 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 title is 'DM Monthly Meeting' and it was created by Andrea Harman, last modified by Sarah Hasnain on Apr 13, 2023. The page content includes:

- A notice: 'Our next: **Dust Mitigation Focus Group Monthly Meeting will be held** on **20 Apr 2023** at **12 PM Eastern Time**.' Below this is a link: 'Click here for the previous meeting agenda & details: **2023 02 16 (The Path to an Enduring Lunar Presence)**'.
- A section titled 'Zoom Call Information' with a table:
 

Join Zoom Meeting	
One tap mobile:	US: +16692545252,,1607011231# or +16469641167,,1607011231#
Meeting URL:	<a href="https://jhuapl.zoomgov.com/j/1607011231?pwd=bUk2RE95U3lPcEtvRHBMdjFKTFdUT09">https://jhuapl.zoomgov.com/j/1607011231?pwd=bUk2RE95U3lPcEtvRHBMdjFKTFdUT09</a>
Meeting ID:	160 701 1231
Passcode:	212344
- A section titled 'Join by Telephone' with a table:
 

Dial:	+1 669 254 5252 US (San Jose) +1 646 964 1167 US (Spanish Line) +1 646 828 7666 US (New York) +1 669 216 1590 US (San Jose) +1 415 449 4000 US (Spanish Line) +1 551 285 1373 US 833 568 8864 US Toll-free
Meeting ID:	160 701 1231
Passcode:	212344
- A section titled 'LSIC Data Buy Survey:' with text: 'NASA is interested in receiving your opinion on the topic of "Data Buys" as a mechanism for acquiring new data that advance our ability get a sustained lunar presence on the lunar surface. We would like your comments on two types of data. The first is acquired as a by-product of landing on the Moon. The second are new data sets, that will likely require a specific instrument to be flown either in orbit or to the lunar surface. We also welcome any general comments on the topic of data buys, either as a potential customer, or provider. Responses to this survey will not be shared outside of NASA. Here is a link to the survey: <https://forms.gle/tuhzwAUaQLDivQ2D7>'.
- A 'Past Meetings' list on the right side of the page, including dates and titles like '2023 02 16 (The Path to an Enduring Lunar Presence)', '2023 01 19 (Impact of Lunar Dust and Mars Dust on Human Exploration: A review of the NASA Engineering and Safety Center (NESC) Workshops)', etc.

# Updates and Communications

- Monthly LSIC newsletter – New edition came out early April 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

- [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

- [NASA Innovative Advanced Concepts \(NIAC\) Phase III »](#)

- Mandatory Preliminary Proposals Due: March 8, 2023 Final Proposals Due: May 17, 2023

## Future Solicitation and Opportunities

- [NSF SBIR and STTR »](#)

- NSF recommends treating the submission window like a deadline, but you can submit anytime within a year of receiving an official invitation from NSF. (NSF uses submission windows to help gather and review proposals, but sometimes proposals are reviewed as they are received.)  
Windows: November 22, 2022 - March 1, 2023 March 2, 2023 - July 5, 2023 July 6, 2023 - November 1, 2023

- [Early Stage Innovations Solicitation »](#)

- The goal of Early Stage Innovations (ESI) is to accelerate the development of groundbreaking, high-risk/high-payoff space technologies to support the future space science and exploration needs of NASA, other government agencies, and the commercial space sector. Accredited U.S. universities are eligible to submit proposals. Data TBD



# 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>



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 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




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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

# Human Lander Challenge

- Through the 2024 HuLC competition, NASA's Human Landing System (HLS) Program provides college students the opportunity to explore innovations and potential solutions to lunar Plume-Surface Interaction (PSI) risks and challenges.
- NASA's HLS Program is responsible for the transportation in deep space to carry humans to and from the surface of the Moon for NASA's Artemis lunar exploration program. Crews will board the HLS in lunar orbit and descend to the surface where they will collect samples, perform science experiments, and observe the lunar environment before returning to orbit in the HLS.
- Teams are invited to submit proposals for **innovative, systems-level solutions to understand, mitigate, and manage the impacts of lunar PSI that can be implemented within 3-5 years**. The potential solutions teams can propose to could include, but are not limited to, the following categories:
  - Trade Studies on Landing Trajectories that Minimize PSI
  - Reduction / Mitigation of Erosion (Cratering) and Ejecta during Descent, Landing, and Ascent
  - Development of PSI Flight Instrumentation / Measurement Methods and Concepts
  - Tracking Dust During Descent, Landing, and Ascent
  - Instrumentation Performance Through the Dust Cloud During Landing
  - HLS Asset Safety (ejecta damage, excessive lander heating, etc.)
  - PSI Modeling and Validation
- Notice of Intent (NOI) Deadline: October 22, 2023
- [https://hulc.nianet.org/challenge\\_details/](https://hulc.nianet.org/challenge_details/)

# LSIC Activities

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

- LSIC Dust Mitigation Focus Group Meeting (04/20)
- LSIC Spring Meeting (04/24 – 04/25, 2023)
  - Johns Hopkins Applied Physics Laboratory (Hybrid)
- LSIC Dust Mitigation Workshop (Moved to Fall 2023)
  - Follow-up to DM Workshop from 2021
  - Information to be sent later

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

- 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
  - Contributed abstracts Submission Still Open!
  - <http://impact.colorado.edu/dap/2023/index.html>





# LSIC Spring Meeting

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

Registration is closed!

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# LSIC Spring Meeting 2023



## Lunar Surface Innovation Consortium Spring Meeting

Monday, April 24, 2023 -Tuesday, April 25, 2023

Venue: Johns Hopkins Applied Physics Lab

### FEATURED SPEAKERS



**Pam Melroy**  
Deputy  
Administrator, NASA  
[read bio](#)



**Stefanie  
Tompkins**  
Director, DARPA  
[read bio](#)



**Matt Daniels**  
Assistant Director,  
White House OSTP  
[read bio](#)



**Kurt "Spuds"  
Vogel**  
Director of Space  
Architecture, NASA  
[read bio](#)



**James Reuter**  
Associate  
Administrator, NASA  
STMD  
[read bio](#)



**Walt  
Engelund**  
Deputy Associate  
Administrator for  
Programs, NASA  
STMD  
[read bio](#)

### EVENT DETAILS

**Date:** Monday, April 24, 2023 -  
Tuesday, April 25, 2023

**Time:** All times are Eastern.

**Location:** Johns Hopkins Applied  
Physics Lab

### LIVESTREAM

Check back on April 24, 10:30  
a.m.-12 p.m. EST, to view the public  
livestream of Spring Meeting's  
morning sessions.



# LSIC Spring Meeting 2023

## DAY 1 (Monday 24 April)

Time	Topic	Speaker(s)
9:00AM	Coffee & Networking (In Person and in GatherTown)	
10:30AM	In-Person Welcome & Logistics	Rachel Klima, LSIC Director Robert Braun, Sector Head, Space Exploration Johns Hopkins Applied Physics Laboratory (APL)
10:35AM	NASA's Blueprint Objectives	Kurt "Spuds" Vogel, Director of Space Architecture, NASA
11:00AM	NASA Space Tech Update	Jim Reuter, Associate Administrator for Space Technology, NASA MODERATOR: Niki Werkheiser, NASA
11:25AM	Fireside Chat	Kurt "Spuds" Vogel, Director of Space Architecture, NASA Jim Reuter, Associate Administrator for Space Technology, NASA
11:50AM	BREAK	
12:10PM	LSII and LSIC Updates	Wes Fuhrman, APL LSII Lead Rachel Klima, LSIC Director LSII Team, APL
1:00PM	Lunch Break & Community White Paper Discussions	MODERATOR: Harri Vanhala, NASA
2:40PM	PANEL: LuSTR Project Results	Paul van Susante, Michigan Technological University (ISRU) Ahsan Choudhuri, University of Texas at El Paso (ISRU) Philip Lubin, University of California, Santa Barbara (Power)
4:00PM	BREAK	
4:20PM	Lightning Talks	Community Members
5:00PM	Poster Session & Networking	
6:00PM	Adjourn for the Day	

## Day 2 (Tuesday 25 April)

Time	Topic	Speaker(s)
9:00AM	Coffee & Networking in Person and in GatherTown	
10:30AM	Welcome and Introduction	Robert Braun, Sector Head, Space Exploration, APL MODERATOR: Walt Englund, NASA Pam Melroy, Deputy Administrator, NASA Stefanie Tompkins, Director, DARPA
10:35AM	PANEL: Government Collaboration to Meet Long-term Goals for a Lunar Ecosystem	Matt Daniels, Assistant Director for Space Security and Special Projects, White House OSTP Kurt "Spuds" Vogel, Director of Space Architecture, NASA
12:00PM	BREAK	
12:20PM	CLPS Program Updates	
12:35PM	PANEL: CLPS Program	
1:10PM	Lunch Break and Small Group Discussions: National Strategy	
2:40PM	PANEL: How Do Long-term Use Cases Drive Technology Development	
3:40PM	BREAK	
4:00PM	GROUP DISCUSSION: Findings and Recommendations	
5:00PM	Adjourn Meeting	

<https://lsic.jhuapl.edu/Events/Agenda/index.php?id=380>

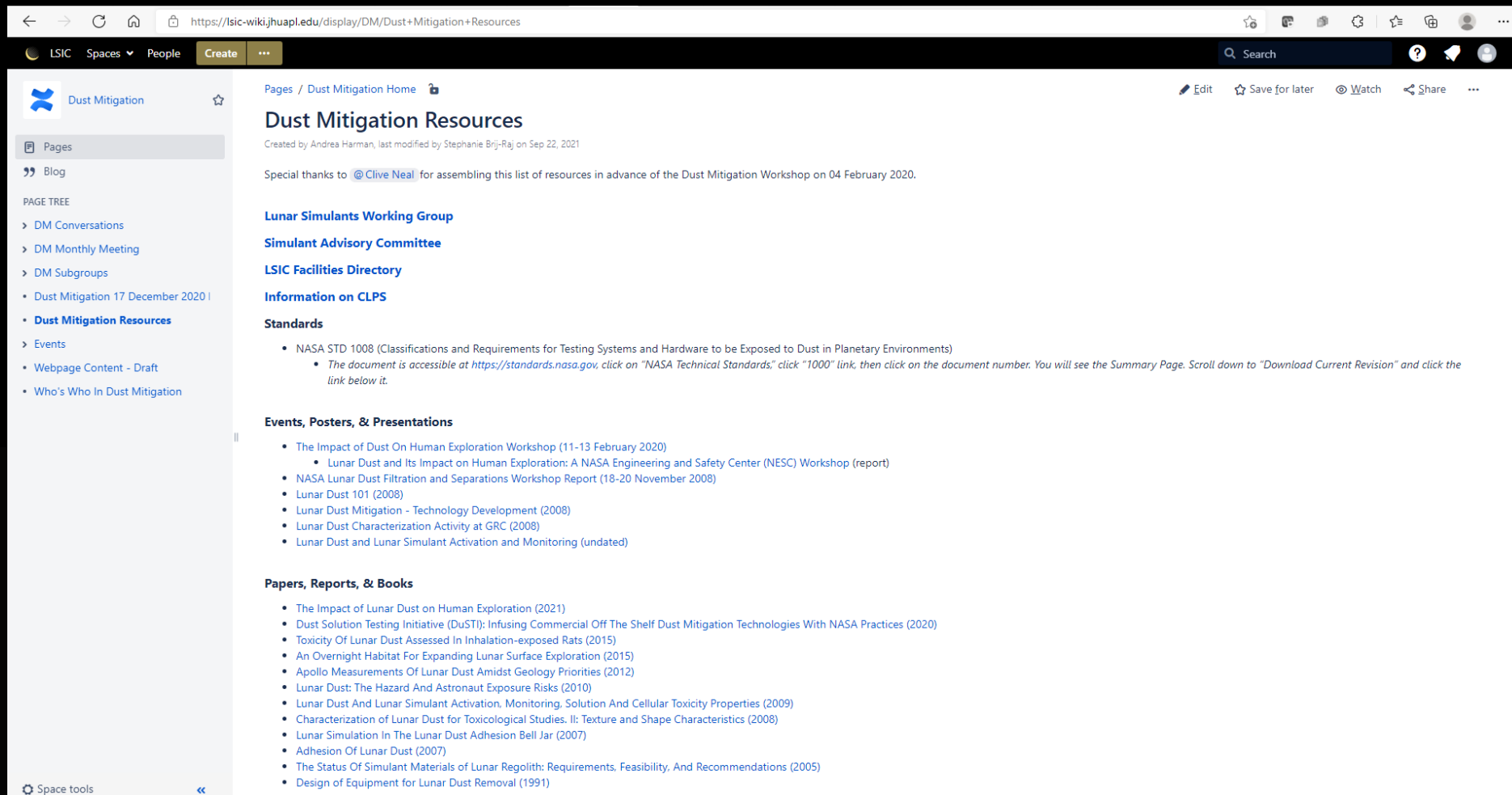


# LSII | Data Buys Survey

- 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 special thanks to @Clive Neal for assembling the list of resources in advance of the Dust Mitigation Workshop on 04 February 2020. The resources are categorized into several sections: Lunar Simulants Working Group, Simulant Advisory Committee, LSIC Facilities Directory, Information on CLPS, Standards, Events, Posters, & Presentations, and Papers, Reports, & Books. The Standards section lists NASA STD 1008 (Classifications and Requirements for Testing Systems and Hardware to be Exposed to Dust in Planetary Environments). The Events, Posters, & Presentations section lists several workshops and reports, including 'The Impact of Dust On Human Exploration Workshop (11-13 February 2020)' and 'NASA Lunar Dust Filtration and Separations Workshop Report (18-20 November 2008)'. The Papers, Reports, & Books section lists various scientific papers and reports, including 'The Impact of Lunar Dust on Human Exploration (2021)' and 'Dust Solution Testing Initiative (DuSTI): Infusing Commercial Off The Shelf Dust Mitigation Technologies With NASA Practices (2020)'. The page also features a sidebar with navigation options like 'Pages', 'Blog', and 'PAGE TREE', and a search bar at the top right.

# 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>



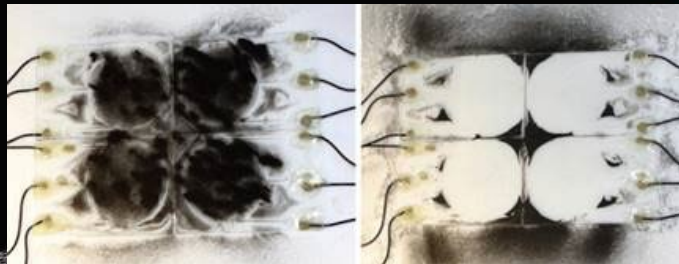
# Dust Mitigation FG Subgroups

- **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 (1 of 2)

## “Dust and Particulate Mitigation for Flight Hardware in APL Cleanrooms”



**Morgan Steadham**

**Contamination Control Engineer**

**Johns Hopkins Applied Physics Laboratory**

[Morgan.Steadham@jhuapl.edu](mailto:Morgan.Steadham@jhuapl.edu)



# Today's Technology Presentation (2 of 2)

## “Dust and Particulate Mitigation for Flight Hardware in APL Cleanrooms”



**Todd Peters**

Facility Engineer

Energy Systems Test Area

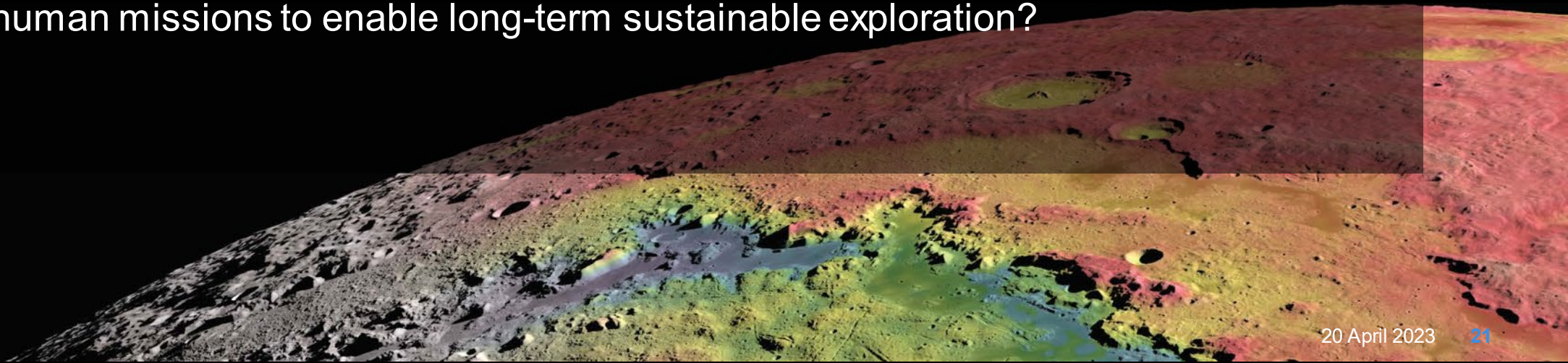
NASA Johnson Space Center

[todd.a.peters@nasa.gov](mailto:todd.a.peters@nasa.gov)



# Discussion on Dust Mitigation in Spacecraft and Testing Facilities

- What gaps exist in our understanding of lunar dust and dust contamination control?
- What data do we still need to help improve our understanding of risks to 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 or early human missions to enable long-term sustainable exploration?





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