



# Lunar Surface Innovation

C O N S O R T I U M

## LSIC Dust Mitigation Focus Group

Monthly Meeting

September 15, 2022



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APPLIED PHYSICS LABORATORY

Dr. Jorge Núñez  
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APL LSIC Dust  
Mitigation Team:

Lindsey Tolis  
Mark Perry  
Richard Miller  
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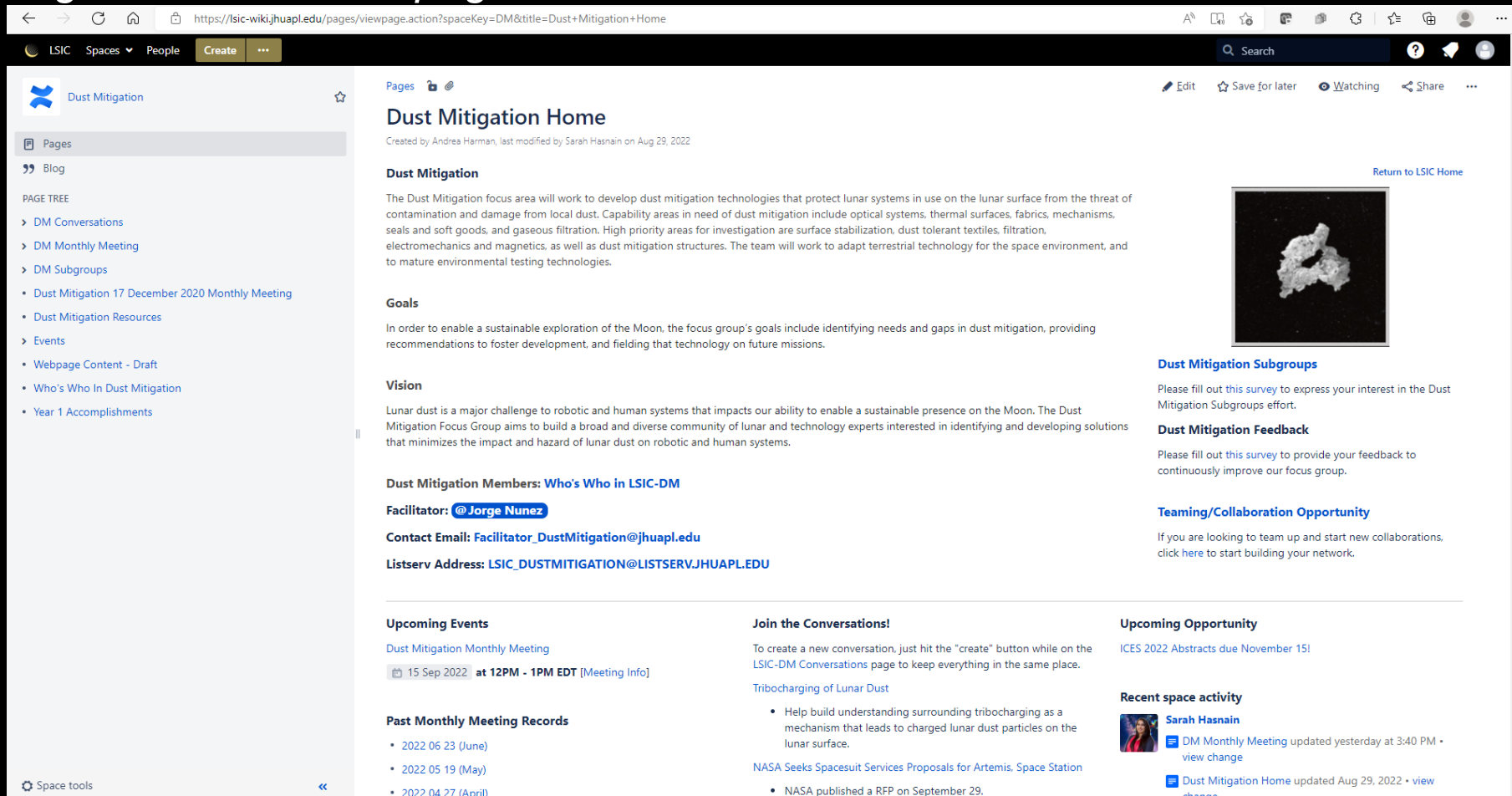
21 September 2022

# Agenda

- Welcome, LSIC and Focus Group Updates
- Upcoming Opportunities and Meetings
- Featured Technology Presentations:
  - Dr. Josh Cahill, APL and LSIC Deputy Director
    - “LSIC Facilities List”
  - Dr. Hossein Zare-Behtash and Andrea Cammarano, James Watt School of Engineering, University of Glasgow, UK
    - “Facility for Dust Mitigation Studies at the University of Glasgow”
  - Dr. Erin Hayward, NASA Marshall Space Flight Center (MSFC)
    - “Planetary, Lunar, and Asteroid Natural Environment Testbed & Other Dirty Facilities at NASA MSFC”
- Discussion on Dust Testing Facilities and LSIC Facilities List.

# LSIC Dust Mitigation Confluence Site

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



The screenshot shows the Confluence page for the Dust Mitigation Home. The page is titled "Dust Mitigation Home" and was created by Andrea Harman, last modified by Sarah Hasnain on Aug 29, 2022. The page content includes:

- Dust Mitigation:** The Dust Mitigation focus area will work to develop dust mitigation technologies that protect lunar systems in use on the lunar surface from the threat of contamination and damage from local dust. Capability areas in need of dust mitigation include optical systems, thermal surfaces, fabrics, mechanisms, seals and soft goods, and gaseous filtration. High priority areas for investigation are surface stabilization, dust tolerant textiles, filtration, electromechanics and magnetics, as well as dust mitigation structures. The team will work to adapt terrestrial technology for the space environment, and to mature environmental testing technologies.
- Goals:** 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.
- 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.
- Dust Mitigation Members:** [Who's Who in LSIC-DM](#)
- Facilitator:** [@Jorge Nunez](#)
- Contact Email:** [Facilitator\\_DustMitigation@jhuapl.edu](mailto:Facilitator_DustMitigation@jhuapl.edu)
- Listserv Address:** [LSIC\\_DUSTMITIGATION@LISTSERV.JHUAPL.EDU](mailto:LSIC_DUSTMITIGATION@LISTSERV.JHUAPL.EDU)

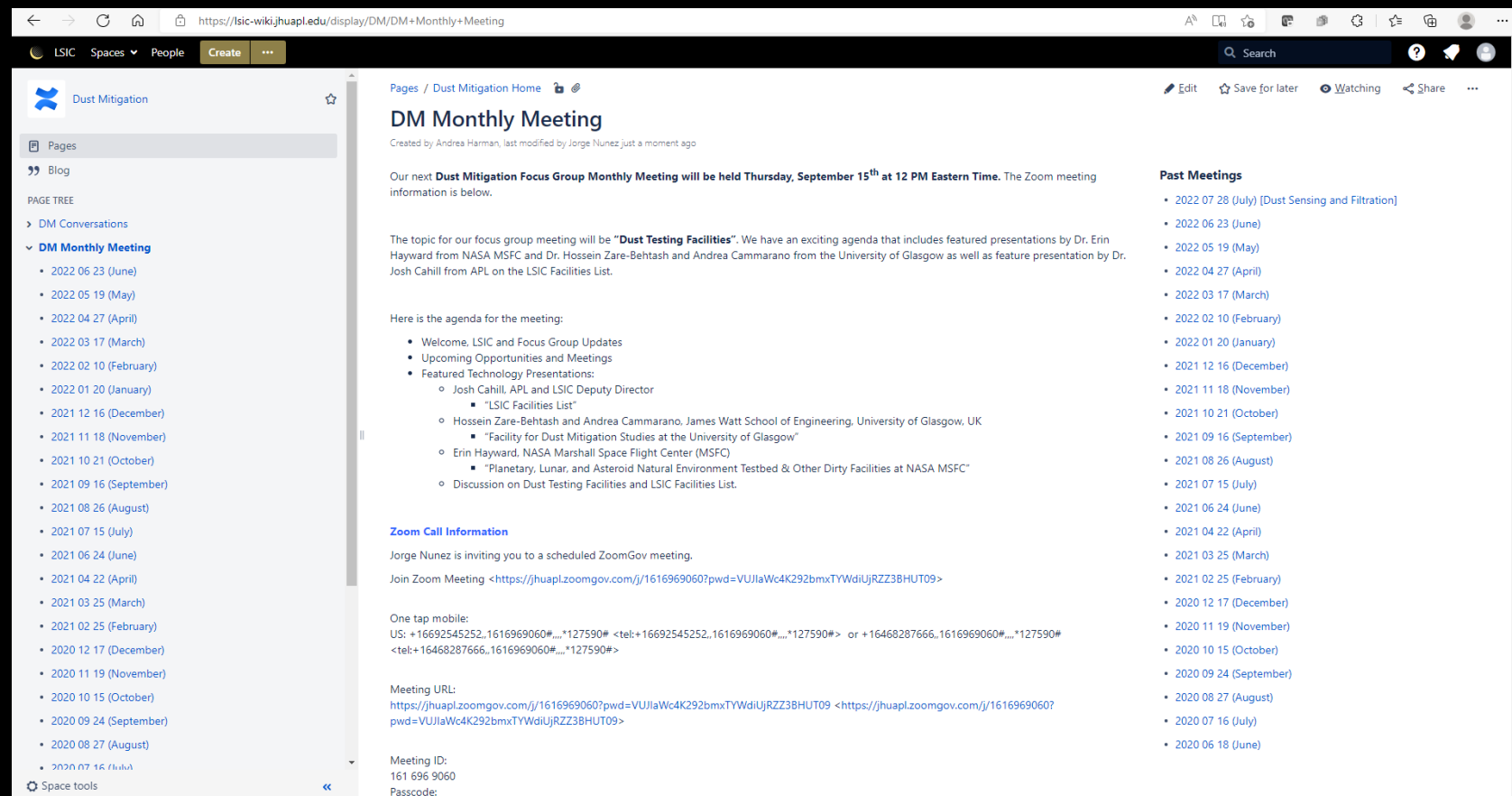
The page also features several sidebars and sections:

- Left Sidebar:** Includes navigation for "Dust Mitigation", "Pages", "Blog", and a "PAGE TREE" with links to "DM Conversations", "DM Monthly Meeting", "DM Subgroups", "Dust Mitigation 17 December 2020 Monthly Meeting", "Dust Mitigation Resources", "Events", "Webpage Content - Draft", "Who's Who In Dust Mitigation", and "Year 1 Accomplishments".
- Right Sidebar:** Includes "Dust Mitigation Subgroups" (with a survey link), "Dust Mitigation Feedback" (with a survey link), and "Teaming/Collaboration Opportunity" (with a link to start building a network).
- Bottom Section:** Contains "Upcoming Events" (Dust Mitigation Monthly Meeting on 15 Sep 2022 at 12PM - 1PM EDT), "Join the Conversations!" (with a link to create a new conversation), "Upcoming Opportunity" (ICES 2022 Abstracts due November 15!), "Past Monthly Meeting Records" (listing meetings from June 2022 to April 2022), "Recent space activity" (listing updates from Sarah Hasnain), and "NASA Seeks Spacesuit Services Proposals for Artemis, Space Station" (with a link to the RFP).

# Join the Discussion on Confluence Site

- Please contact Andrea Harman ([ams573@alumni.psu.edu](mailto: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 web browser displaying the 'Dust Mitigation' Confluence page. The page title is 'DM Monthly Meeting'. The content includes:

- DM Monthly Meeting**: Created by Andrea Harman, last modified by Jorge Nunez just a moment ago.
- Our next Dust Mitigation Focus Group Monthly Meeting will be held Thursday, September 15<sup>th</sup> at 12 PM Eastern Time.** The Zoom meeting information is below.
- The topic for our focus group meeting will be "Dust Testing Facilities".** We have an exciting agenda that includes featured presentations by Dr. Erin Hayward from NASA MSFC and Dr. Hossein Zare-Behtash and Andrea Cammarano from the University of Glasgow as well as feature presentation by Dr. Josh Cahill from APL on the LSIC Facilities List.
- Here is the agenda for the meeting:**
  - Welcome, LSIC and Focus Group Updates
  - Upcoming Opportunities and Meetings
  - Featured Technology Presentations:
    - Josh Cahill, APL and LSIC Deputy Director
      - "LSIC Facilities List"
    - Hossein Zare-Behtash and Andrea Cammarano, James Watt School of Engineering, University of Glasgow, UK
      - "Facility for Dust Mitigation Studies at the University of Glasgow"
    - Erin Hayward, NASA Marshall Space Flight Center (MSFC)
      - "Planetary, Lunar, and Asteroid Natural Environment Testbed & Other Dirty Facilities at NASA MSFC"
    - Discussion on Dust Testing Facilities and LSIC Facilities List.
- Zoom Call Information**: Jorge Nunez is inviting you to a scheduled ZoomGov meeting. Join Zoom Meeting <<https://jhuapl.zoomgov.com/j/1616969060?pwd=VUJlaWc4K292bmxTYWdiUjRZ3BHU09>>
- One tap mobile:** US: +16692545252.1616969060#...\*127590# <tel:+16692545252.1616969060#...\*127590#> or +16468287666.1616969060#...\*127590# <tel:+16468287666.1616969060#...\*127590#>
- Meeting URL:** <https://jhuapl.zoomgov.com/j/1616969060?pwd=VUJlaWc4K292bmxTYWdiUjRZ3BHU09> <<https://jhuapl.zoomgov.com/j/1616969060?pwd=VUJlaWc4K292bmxTYWdiUjRZ3BHU09>>
- Meeting ID:** 161 696 9060
- Passcode:**

On the right side, there is a 'Past Meetings' section with a list of dates from 2020 to 2022, including months like July, June, May, April, March, February, January, December, November, October, August, and September.

# Updates and Communications

- Monthly LSIC newsletter – New edition came out early September 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](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 - <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](mailto: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](mailto: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](http://lsic.jhuapl.edu/Resources/files/Code%20of%20Conduct_05222020.pdf)

# Space Technology Funding Opportunities

## Current Tech Development Opportunities

- [Break the Ice Lunar Challenge - Phase 2 »](#)
  - Registration Closes: 30 September 2022
- [Space Technology Research Institutes \(STRI\) Solicitation »](#)
  - Preliminary Proposals Due: 03 August 2022 - Invited Full Proposals Due 03 November 2022
- [Announcement for Partnership Proposals \(AFPP\) to Advance Tipping Point Technologies »](#)
  - Final Proposals Due 11/22/2022
- [NASA Space Technology Graduate Research Opportunities – Fall 2023 \(NSTGRO23\) »](#)
  - Proposals Due 11/2/2022

## 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 STMD RFI: NASA's Strategic Technology Framework "EXPLORE & LAND Thrusts"

- The Space Technology Mission Directorate (STMD) Strategic Technology Framework “EXPLORE&LAND Thrusts” Request for Information (Solicitation 80HQTR22ZOA2L\_EXP\_LND).
- 
- For NASA to meet the objective of this RFI, the following information is requested in addition to other information that the responder considers necessary for a complete evaluation of the provided responses.
  - Are the Envisioned Futures charts (see below) 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?
- 
- **EXPLORE&LAND Thrusts Envisioned Futures charts:** charts, along with the Strategic Outcomes, can be downloaded from NASA TechPort: <https://techport.nasa.gov/framework>
- 
- **Responses to this RFI are due October 06, 2022 at 5:00 p.m. ET** in NSPIRES. STMD is seeking responses not to exceed 10 pages
- 
- **To view the RFI and instructions on how to submit a response, visit:**
- <https://nspires.nasaprs.com/external/solicitations/summary.do?solid={1B6EF822-99AE-AECA-6440-6F68C4A3FD31}&path=&method=init>

# NASA STMD RFI: On Enabling Industry Efforts for Space Nuclear Systems and Capabilities (80HQTR22ZOA3L\_SNPP)

- The Space Technology Mission Directorate (STMD) Request for Information “On Enabling Industry Efforts for Space Nuclear Systems and Capabilities” is available via the NASA Solicitation and Proposal Integrated Review and Evaluation System (NSPIRES) at <https://nspires.nasaprs.com> by searching on solicitation number **80HQTR22ZOA3L\_SNPP** or via the link provided below. This STMD RFI does not constitute a commitment, implied or otherwise, that the National Aeronautics and Space Administration (NASA) will take action in this matter.
- NASA invites industry to submit responses to this RFI to assist the Agency in analyzing the feasibility of paths to facilitate private sector investment in space nuclear systems and capabilities development for potential use on future government and commercial space missions. Private sector investment may include, but may not be limited to, nuclear systems and capabilities in direct support of human missions and exploration activities. NASA also invites responses that identify other important areas of private-sector interests associated with space nuclear technology developments or applications that may be outside programmed investment, otherwise not directly addressed in the RFI, or considered important to private-sector alignment.
- **Respondents are requested to focus on and provide responses to some or all the questions presented in Section 5.0 of the RFI.**
- **Responses to this RFI are due October 15, 2022 at 5:00 p.m. ET.** Responses to this RFI must be submitted electronically using NSPIRES at <https://nspires.nasaprs.com/>. Any questions to this RFI may be submitted to [STMDRFI@nasaprs.com](mailto:STMDRFI@nasaprs.com) at any time before the due date for responses.
- STMD is seeking responses not to exceed 20 pages, and should be uploaded as a single PDF file attachment not to exceed 10MB at the NSPIRES website (<https://nspires.nasaprs.com>).
- **To view the RFI and instructions on how to submit a response, visit:**
- <https://nspires.nasaprs.com/external/solicitations/summary.do?solId={3EB0D5BE-0468-3426-A3CA-29585FE5BA38}&path=&method=init>



# LSIC Activities

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

- LSIC Dust Mitigation Focus Group Meeting (09/15)
  - Topic: Dust Testing Facilities
- LSIC Fall Meeting (11/02 – 11/03)
  - University of Texas – El Paso
  - Call for abstracts and registration posted on LSIC website
  - <https://lsic.jhuapl.edu/Events/Agenda/index.php?id=350>

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

- Annual LEAG Meeting (08/23-25; at APL, Laurel, MD)
  - <https://www.hou.usra.edu/meetings/leag2022/#nav>
- 73rd International Astronautical Congress (09/18-22)
  - <https://www.iafastro.org/events/iac/iac-2022/>
- AIAA ASCEND Conference (10/24-26)
  - <https://www.ascend.events/>
- Commercial Lunar Payload Services Survive the Night Technology Workshop (12/06-08)
  - Cleveland, OH/Virtual; Abstracts Due 09/22
  - <https://www.hou.usra.edu/meetings/clps2022/>

# LSIC Fall Meeting

- Dates: November 2-3, 2022
- Venue: Virtual and In-Person, University of Texas at El Paso (UTEP),
- The LSIC 2022 Fall Meeting will concentrate on understanding NASA's plans and technology investments relevant to building a sustained presence on the lunar surface. The event will feature interrelationships between the six focus areas identified by the Consortium, with a specific focus on how they relate to excavation and construction.
- The fall meeting will feature individual invited talks, group and panel discussions, as well as poster sessions, breakout groups, and networking opportunities.

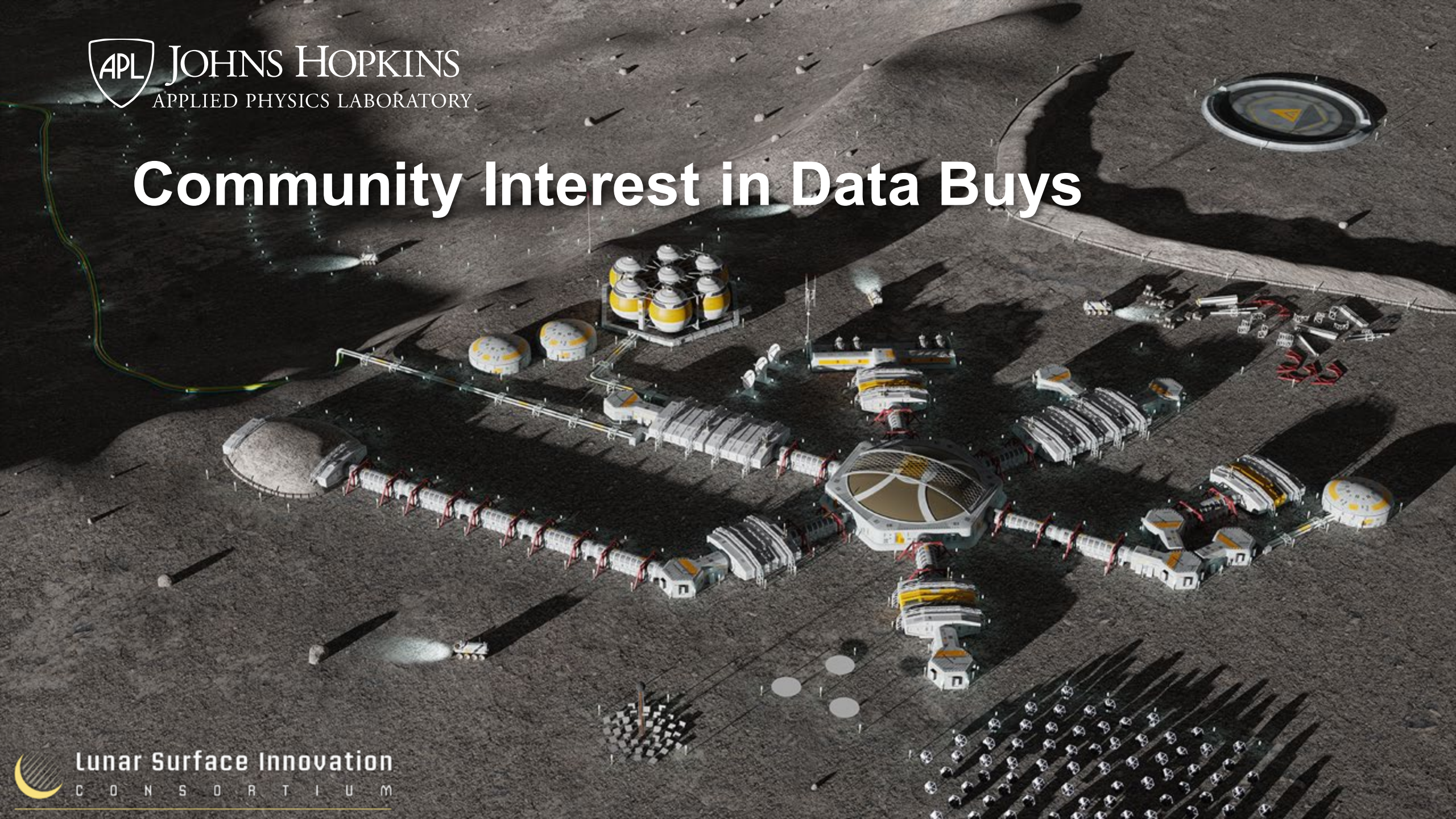
## Call for Abstracts

- We invite abstracts from the community describing technical capabilities within the six LSIC focus areas, as well as those that identify lunar surface technology needs and assess the readiness of relative systems
- Other topics of interest include defining the parameters and constraints of the architecture required to support a sustained presence on the lunar surface, as well as economic and policy considerations.
- **All abstracts are due by 11:59PM ET on September 16<sup>th</sup>**
- **Registration NOW OPEN!**
- **Fall Meeting Website:** <https://lsic.jhuapl.edu/Events/Agenda/index.php?id=200>

# 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://docs.google.com/forms/d/e/1FAIpQLScB6iT2fgPqj2zlaP0s-rwWQDQ04TPfgVyiC5zn0AQPAT5CZA/viewform>
  - Still looking for subgroup lead for Monitoring and Filtration Subgroup!
- 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>

# Community Interest in Data Buys



# LSII | Data Buys

- 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>

# LSII | By-Product Data

- Data acquired as a by product of landing on the Moon
  - Environmental Data
    - Radiation, thermal, illumination, dust, volatiles
  - Descent & Landing Imagery
    - Images of terrain during descent, surface panorama after landing
  - Landing & Post-landing effects
    - Plume/surface interactions
  - Technology/System Performance
    - Navigation performance, comm performance, landing precision, hazard detection and avoidance
- Are there additional data sets you would want?
- Are there data sets the lander will naturally acquire, but perhaps you need a variation of those data, e.g. a certain data set to be acquired at a higher cadence?

# LSII | New Data Sets

- What data would enhance your ability to plan lunar surface operations?
- Data sets that require a dedicated instrument to be flown
  - E.g. New topography, or mineral map data sets
  - Could be either an orbital or surface data set
- Monitoring Data for Situational Awareness
  - Rover locations and movement
  - Charging operations
  - Search and Rescue for lost rovers
  - Comm quality/performance

# LSIC | Joint MOSA & Surface Power September Telecon



## Joint MOSA & Surface Power Telecon: Sept 22<sup>nd</sup> 11:00 ET

**Speakers:** Nicolas Carbone & David Sadey, NASA Power Systems Engineers for Gateway L2

**Topic:** International Space Power System Interoperability Standards (ISPSIS) Overview

### **Abstract:**

- The International Deep Space Interoperability Standards are a collection of collaboratively prepared regulations geared towards the earliest phases of spacecraft design and exploration planning. Signees include NASA, ESA, CSA, JAXA and Roscosmos.
- The presentation will provide an overview of the ISPSIS agreement. These electrical power quality standards exist to provide “commonality, reliability, interchangeability, and interoperability” for space electrical systems.
- Following the presentation, the speakers will participate in a question-and-answer session

## **Zoom Link for Sept 22<sup>nd</sup> 11:00 ET:**

<https://jhuapl.zoomgov.com/j/1617206812?pwd=ZWVhlaW5XRURsRmxJcWd4b1ZoeFFwUT09>

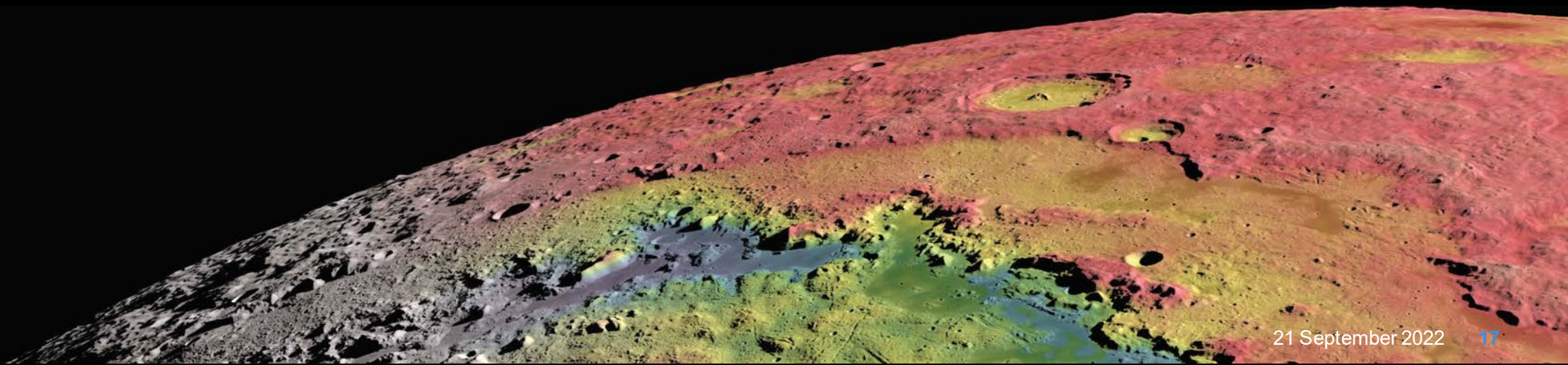


# Today's Technology Presentation “LSIC Facilities List”

**Dr. Josh Cahill**

**APL and LSIC Deputy Director**

[Joshua.Cahill@jhuapl.edu](mailto:Joshua.Cahill@jhuapl.edu)



# Today's Technology Presentation

## “Facility for Dust Mitigation Studies at the University of Glasgow”

**Dr. Hossein Zare-Behtash and  
Andrea Cammarano**

**James Watt School of Engineering,  
University of Glasgow, UK**

[Hossein.Zare-Behtash@glasgow.ac.uk](mailto:Hossein.Zare-Behtash@glasgow.ac.uk)

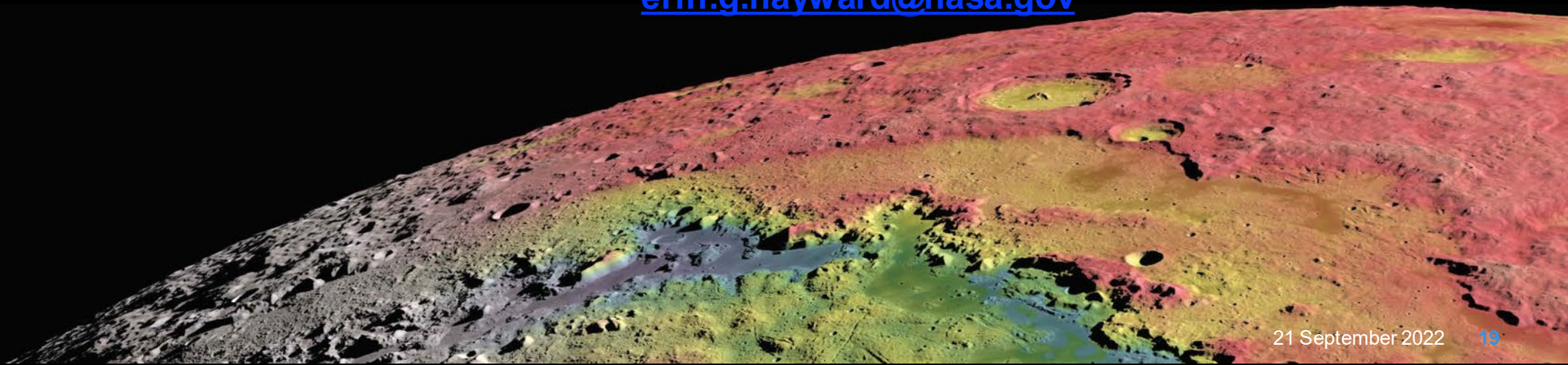
# Today's Technology Presentation

## “Planetary, Lunar, and Asteroid Natural Environment Testbed & Other Dirty Facilities at NASA MSFC”

**Dr. Erin Hayward**

**NASA Marshall Space Flight  
Center (MSFC)**

[erin.g.hayward@nasa.gov](mailto:erin.g.hayward@nasa.gov)



# Dust Testing Facilities Discussion

- What gaps exist in our understanding of lunar dust and dust environment, and what data do we still need to help improve testing in terrestrial facilities?
- 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 sufficient for testing that needs to be done?
- Achieving ultra-high vacuum with dust is very challenging, with limited number of facilities available
  - Are some tests that can only be accomplished with UHV, or can lower vacuum suffice?
  - Do existing facilities suffice or more needed?
- How would you improve the LSIC facilities list? What would you like to see?
- Do you have a facility that you would like to be added to the list? – Let us know!



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