



Lunar Surface Innovation

C O N S O R T I U M

LSIC Dust Mitigation Focus Group

Monthly Meeting

November 18, 2021



JOHNS HOPKINS
APPLIED PHYSICS LABORATORY

Dr. Jorge Núñez
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Space Exploration Sector

Facilitator_ DustMitigation@jhuapl.edu

Agenda

- Welcome, LSIC and Focus Group Updates
 - Introduction of team member Andre Douglas
- Upcoming Opportunities and Meetings
- Quick DM Updates
 - Who's Who in Dust Mitigation
 - Dust Mitigation subgroups
 - What is next for Dust Mitigation FG
 - Dust Mitigation Resources page
- Featured Presentation by Dr. Wesley Chambers, NASA Marshall Space Flight Center
 - “Plume-Surface Interaction: Preliminary Observations from a Physics Focused Ground Test”
- Discussion on needs/gaps for Plume Surface Interactions

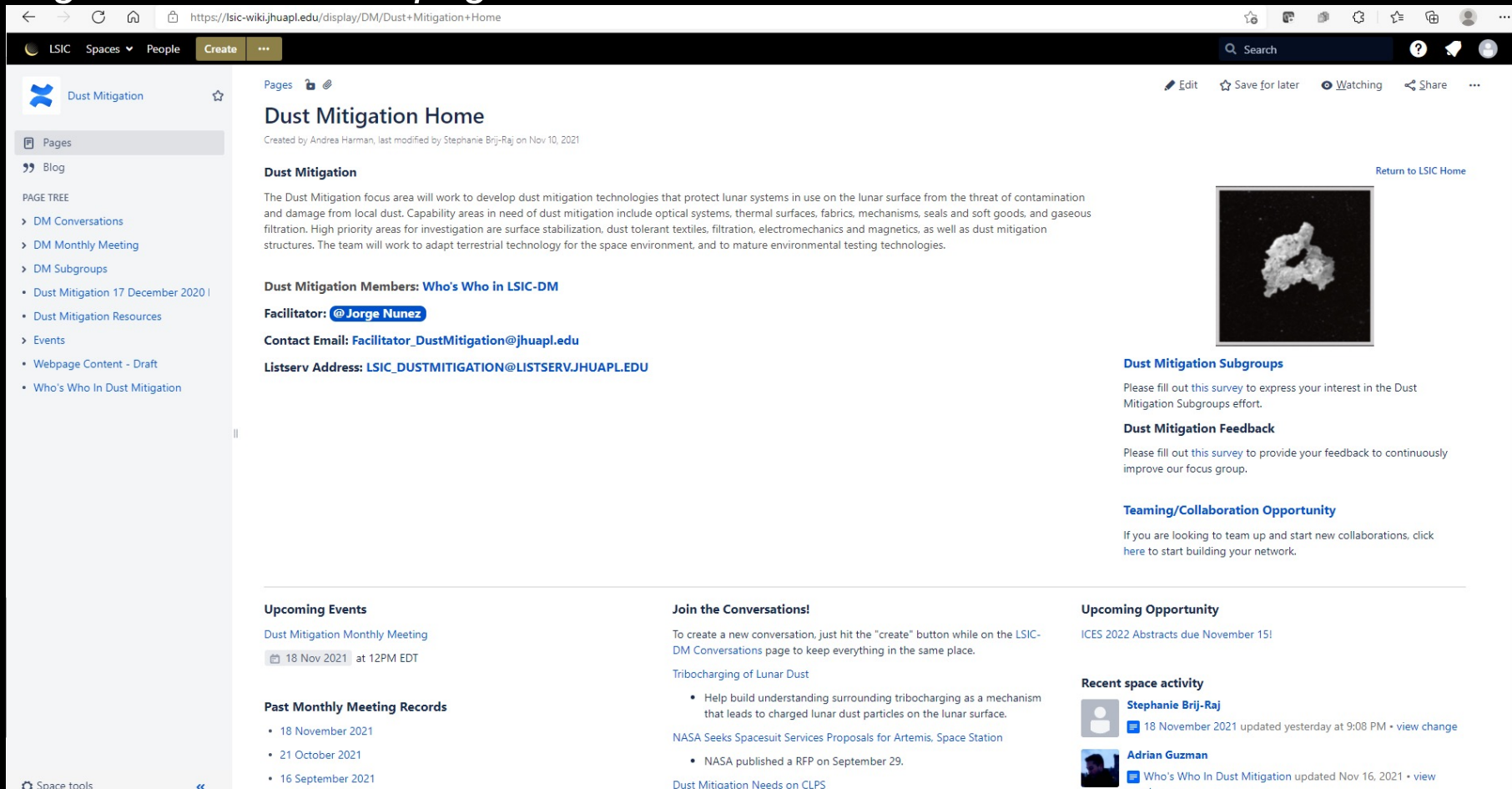
About Me

- Space Systems Engineer
 - Space Exploration Sector at APL
- B.S. in Mechanical Engineering
 - United States Coast Guard Academy
- M.S. in Mechanical Engineering
 - University of Michigan
- M.S. in Naval Architecture and Marine Engineering
 - University of Michigan
- M.S. in Electrical and Computer Engineering
 - Johns Hopkins University
- Ph.D. in Systems Engineering
 - George Washington University
- Interests in science and technology
 - Unmanned systems
 - System integration and development
 - Mechanical structures and mechanisms
 - Requirements, ICDs and V&V



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 the Confluence page for the LSIC Dust Mitigation Home. The page is titled "Dust Mitigation Home" and was created by Andrea Harman, last modified by Stephanie Brij-Raj on Nov 10, 2021. The main content area includes a description of the Dust Mitigation focus area, which aims to develop technologies to protect lunar systems from dust contamination and damage. It lists various capability areas such as optical systems, thermal surfaces, fabrics, mechanisms, seals, and soft goods. The page also identifies the Dust Mitigation Members as "Who's Who in LSIC-DM", with a facilitator, @Jorge Nunez, and a contact email: Facilitator_DustMitigation@jhuapl.edu. A listserv address is also provided: LSIC_DUSTMITIGATION@LISTSERV.JHUAPL.EDU.

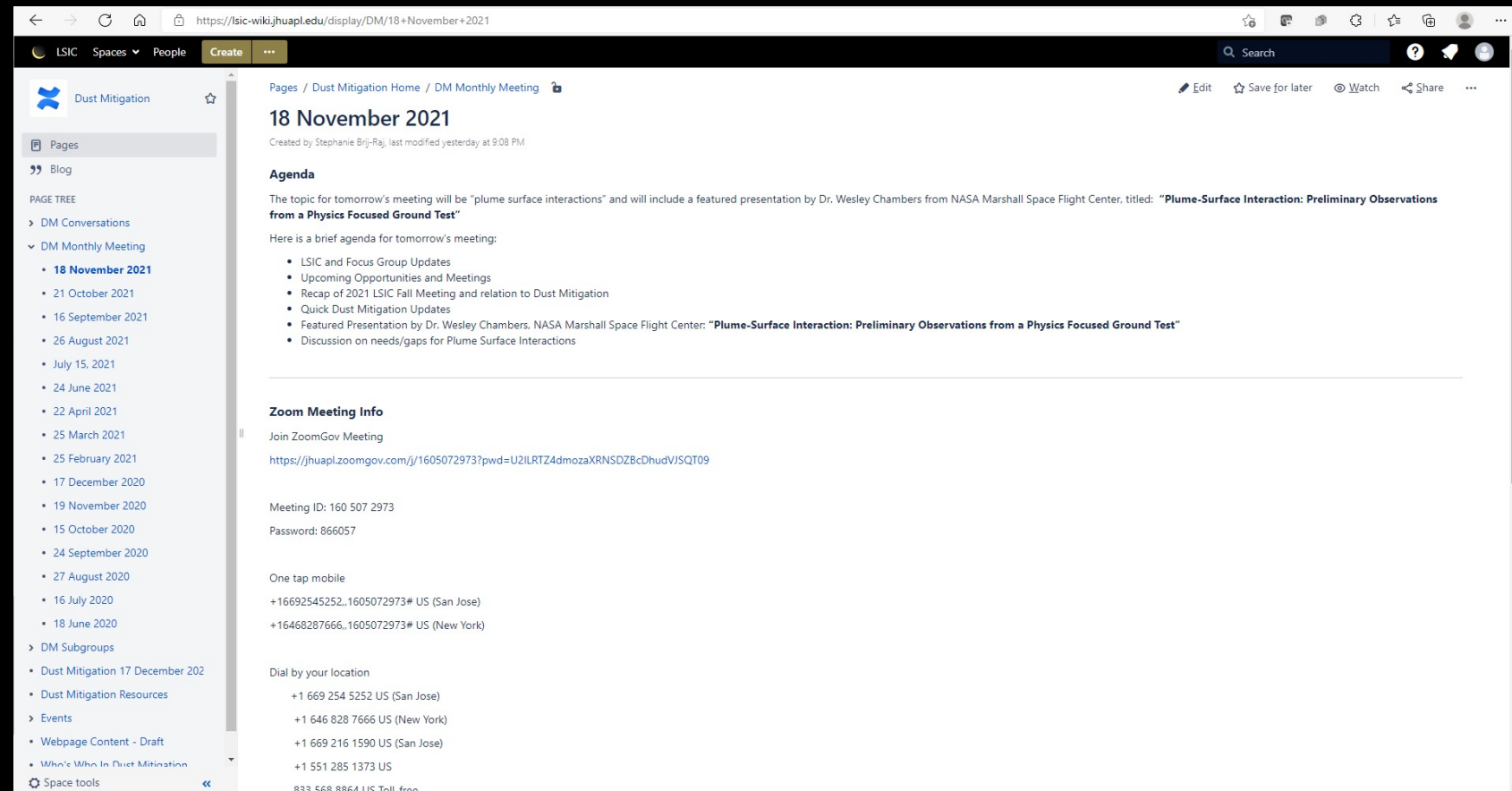
On the right side of the page, there are several sections: "Dust Mitigation Subgroups" with a link to a survey, "Dust Mitigation Feedback" with another survey link, and "Teaming/Collaboration Opportunity" with a link to start building a network. Below these are sections for "Upcoming Events" (Dust Mitigation Monthly Meeting on 18 Nov 2021 at 12PM EDT), "Past Monthly Meeting Records" (18 November 2021, 21 October 2021, 16 September 2021), "Join the Conversations!" (with instructions on how to create a new conversation), and "Upcoming Opportunity" (ICES 2022 Abstracts due November 15!).

At the bottom right, there is a "Recent space activity" section showing updates from Stephanie Brij-Raj and Adrian Guzman. The page also features a navigation menu on the left with options like "Pages", "Blog", and "PAGE TREE", and a search bar at the top right.

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



LSIC Spaces People Create

Dust Mitigation

Pages

Blog

PAGE TREE

- > DM Conversations
- > DM Monthly Meeting
 - 18 November 2021
 - 21 October 2021
 - 16 September 2021
 - 26 August 2021
 - July 15, 2021
 - 24 June 2021
 - 22 April 2021
 - 25 March 2021
 - 25 February 2021
 - 17 December 2020
 - 19 November 2020
 - 15 October 2020
 - 24 September 2020
 - 27 August 2020
 - 16 July 2020
 - 18 June 2020
- > DM Subgroups
 - Dust Mitigation 17 December 202
 - Dust Mitigation Resources
- > Events
 - Webpage Content - Draft
 - What's What In Dust Mitigation

Space tools

Pages / Dust Mitigation Home / DM Monthly Meeting

18 November 2021

Created by Stephanie Brij-Raj, last modified yesterday at 9:08 PM

Agenda

The topic for tomorrow's meeting will be "plume surface interactions" and will include a featured presentation by Dr. Wesley Chambers from NASA Marshall Space Flight Center, titled: "**Plume-Surface Interaction: Preliminary Observations from a Physics Focused Ground Test**"

Here is a brief agenda for tomorrow's meeting:

- LSIC and Focus Group Updates
- Upcoming Opportunities and Meetings
- Recap of 2021 LSIC Fall Meeting and relation to Dust Mitigation
- Quick Dust Mitigation Updates
- Featured Presentation by Dr. Wesley Chambers, NASA Marshall Space Flight Center: "**Plume-Surface Interaction: Preliminary Observations from a Physics Focused Ground Test**"
- Discussion on needs/gaps for Plume Surface Interactions

Zoom Meeting Info

Join ZoomGov Meeting

<https://jhuapl.zoomgov.com/j/1605072973?pwd=U2lRTZ4dmozaXRNSDZBcDhudVJSQT09>

Meeting ID: 160 507 2973

Password: 866057

One tap mobile

- +16692545252,,1605072973# US (San Jose)
- +16468287666,,1605072973# US (New York)

Dial by your location

- +1 669 254 5252 US (San Jose)
- +1 646 828 7666 US (New York)
- +1 669 216 1590 US (San Jose)
- +1 551 285 1373 US
- 833 568 8864 US Toll-free

Updates and Communications

- Monthly LSIC newsletter – New edition came out early November
 - <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 featured talk (~15 mins)
 - Email me if you want to sign up: 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

LSIC Activities

Recent and Upcoming LSIC Meetings and Workshops (<http://lsic.jhuapl.edu/News-and-Events/>)

- LSIC EE Regolith/Surface Interface subgroup meeting (10/26) at 1 PM ET
 - Presentation by Dr. Ryan Zeigler, NASA's Apollo Sample Curator
- LSIC Fall Meeting (11/3-4), Bowie State University, MD
 - Recordings and slides will be posted soon!
 - <https://lsic.jhuapl.edu/News-and-Events/Agenda/index.php?id=148>
- LSIC Dust Mitigation Focus Group Meeting (11/18) – Today!
- LSIC Dust Mitigation Focus Group Meeting (12/16)
 - Topic: BIG Idea Challenge Finalists: Dust Mitigation Technologies
 - Special 2 hr Meeting

Other Recent and Upcoming Dust Mitigation Related Workshop and Meetings

- LSSW #12: Future Landing Sites and Capabilities for Future CLPS Deliveries (11/18)
 - <https://www.hou.usra.edu/meetings/lunarsurface2020/>
- AIAA ASCEND 2021 Meeting in Las Vegas, NV (11/15-17)
 - “Who Did It Best? Seven Unique Lunar Dust Mitigation Technologies, and NASA Update on Lunar Dust Mitigation Strategies” – 11/16

LSIC Fall Meeting

- Dates: November 3-4, 2021
- Venue: Hybrid, Virtual and In-Person, Bowie State University, Bowie Maryland
- The technical focus of the meeting was Autonomy and Robotics
- The meeting also included updates from NASA, networking opportunities, and contributed technical content from the community

- Recordings and slides will be posted on the Fall Meeting webpage
- Any feedback and impressions are welcomed!
- Fall Meeting Website:
- <https://lsic.jhuapl.edu/News-and-Events/Agenda/index.php?id=148>

LSIC | ISRU Facilities Survey Results

- ISRU Facilities subgroup conducted short survey to identify facility needs for testing lunar ISRU technology
 - Follow-up survey after LSIC Facilities Directory release received no responses: could be a sign for the lack of use of the LSIC Facilities Directory. Directory use could be tracked to evaluate this possibility, especially as it continues to evolve.
- 12/16 of ISRU technology developers indicate their needs are **not currently being met** (either facilities do not exist, or survey participants are not aware of facilities' existence)
- 13/16 indicated they **do not have access to the facilities they require** to perform their tech testing
- 11/15 would be willing to pay a small user fee **if they could budget facility use** into proposals
- 12/16 would require someone to either run or assist with their testing
- **Considerations:**
 1. Develop a more **centralized, singular location to query facility testing resources and schedule time** on/in these facilities.
 2. **Broaden access to facilities**, and explore why organizations don't have, or think they don't have, access to facilities.
 3. Proposal solicitations could allow, and advertise the fact that they allow, **budgeting for testing and facility use**.
 4. Facilities could make expertise knowingly available to technology testers, and proposal solicitations should **allow the proposers to budget compensation for these facility experts**.
- Additional participant-suggested facility needs: variable gravity test; larger thermal vacuum chambers; end-to-end testbed evaluation facility; long-term testing; very hard vacuum; cryogenic temperatures; microwave transmission test chamber, etc.

SpaceTech-REDDI-2022: NIAC Phase II

- Space Technology Research, Development, Demonstration, and Infusion-2022 (SpaceTech-REDDI-2022): NASA Innovative Advanced Concepts (NIAC) Phase II
- Not to exceed \$600K for 2yrs (\$300K per year)
- Notice of Intent were Due October 21, 2021
- Proposal Due December 15, 2021
- Selection Date February 9, 2022
- Award Date March 31, 2022
- <https://nspires.nasaprs.com/external/solicitations/summary!init.do?sollId={05B1A3ED-79C4-C9DE-8167-1CE2403016E4}&path=open>



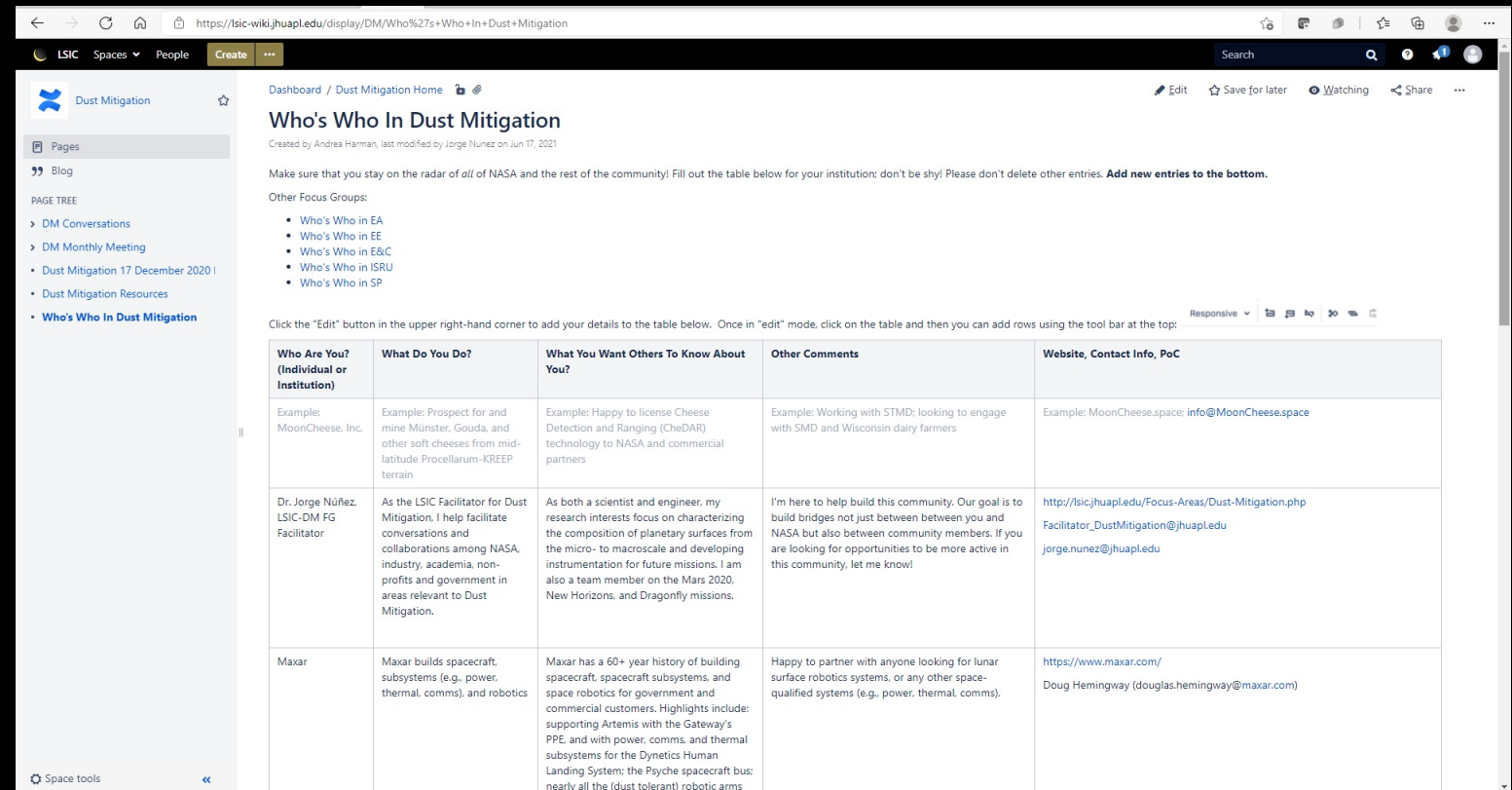
Over the Dusty Moon Challenge

- Design and Build a Regolith Transport Solution for the Moon
- 1. September 24, 2021 - Webinar
 - Q&A session
- 2. November 29, 2021 - Deadline for entries
 - Must be submitted by 11:59 pm Mountain Time
- 3. December 20, 2021 - Notification to invitees
 - Teams notified if they are invited to compete in the in-person challenge
- 4. June, 2022 - In-person challenge
 - Hosted by Colorado School of mines
- <https://www.overthedustymoon.com/>



Who's Who in Dust Mitigation

- We have setup a Who's Who in Dust Mitigation page on Confluence
 - Great opportunity stay on the radar of *all* of NASA and the rest of the community
 - Please contact Andrea Harman (ams573@alumni.psu.edu) to get set up with an account!
1. Sign-in to add your and your organization's information
 2. Click the "Edit" button in the upper right-hand corner to add your details to the table
 3. You can add your information before, during, or after today's meeting



Dashboard / Dust Mitigation Home

Who's Who In Dust Mitigation

Created by Andrea Harman, last modified by Jorge Nunez on Jun 17, 2021

Make sure that you stay on the radar of *all* of NASA and the rest of the community! Fill out the table below for your institution: don't be shy! Please don't delete other entries. **Add new entries to the bottom.**

Other Focus Groups:

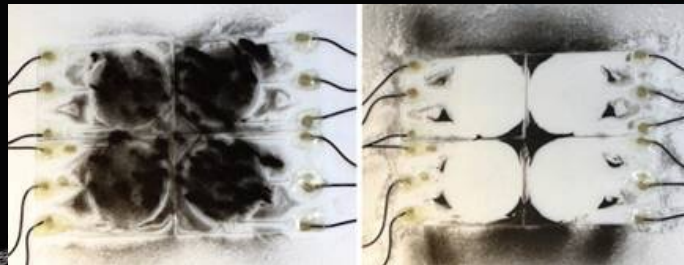
- Who's Who in EA
- Who's Who in EE
- Who's Who in E&C
- Who's Who in ISRU
- Who's Who in SP

Click the "Edit" button in the upper right-hand corner to add your details to the table below. Once in "edit" mode, click on the table and then you can add rows using the tool bar at the top:

| Who Are You? (Individual or Institution) | What Do You Do? | What You Want Others To Know About You? | Other Comments | Website, Contact Info, PoC |
|--|--|--|--|--|
| Example: MoonCheese, Inc. | Example: Prospect for and mine Münster, Gouda, and other soft cheeses from mid-latitude Procellarum-KREEP terrain | Example: Happy to license Cheese Detection and Ranging (CheDAR) technology to NASA and commercial partners | Example: Working with STMD; looking to engage with SMD and Wisconsin dairy farmers | Example: MoonCheese.space; info@MoonCheese.space |
| Dr. Jorge Núñez, LSIC-DM FG Facilitator | As the LSIC Facilitator for Dust Mitigation, I help facilitate conversations and collaborations among NASA, industry, academia, non-profits and government in areas relevant to Dust Mitigation. | As both a scientist and engineer, my research interests focus on characterizing the composition of planetary surfaces from the micro- to macroscale and developing instrumentation for future missions. I am also a team member on the Mars 2020, New Horizons, and Dragonfly missions. | I'm here to help build this community. Our goal is to build bridges not just between between you and NASA but also between community members. If you are looking for opportunities to be more active in this community, let me know! | http://lsic.jhuapl.edu/Focus-Areas/Dust-Mitigation.php Facilitator_DustMitigation@jhuapl.edu jorge.nunez@jhuapl.edu |
| Maxar | Maxar builds spacecraft, subsystems (e.g., power, thermal, comms), and robotics | Maxar has a 60+ year history of building spacecraft, spacecraft subsystems, and space robotics for government and commercial customers. Highlights include: supporting Artemis with the Gateway's PPE, and with power, comms, and thermal subsystems for the Dynetics Human Landing System; the Psyche spacecraft bus; nearly all the (dust tolerant) robotic arms | Happy to partner with anyone looking for lunar surface robotics systems, or any other space-qualified systems (e.g., power, thermal, comms). | https://www.maxar.com/ Doug Hemingway (douglas.hemingway@maxar.com) |

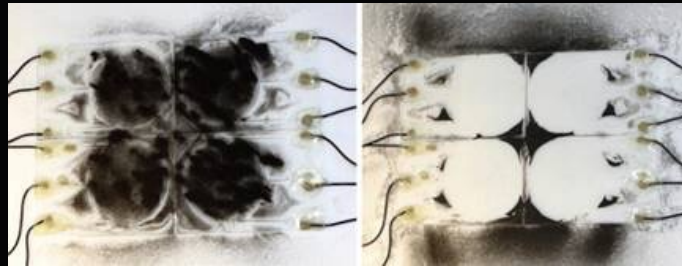
Dust Mitigation FG Subgroups

- **Materials and Surface 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
- **Seals, Soft Goods, and Fabrics:**
 - *Fabrics* – Space suit fabrics, soft wall habitats, mechanism covers
 - *Seals and Soft Goods* – Space suit interfaces, hatches, connectors, hoses
- **Mechanisms:**
 - *Mechanisms* – Linear actuators, bearings, rotary joints, hinges, quick disconnects, valves, linkages
- **Monitoring and Filtration:**
 - *Gaseous Filtration* – Atmosphere revitalization, ISRU processes
 - *Dust monitoring* – Cabin and external dust monitoring
- **Modeling:** – *Dust plume modeling*
- **Lunar Surface Modification** – Lunar landing pads, dust free zones and workspaces
- **Isolation Technologies** – Technologies that keep dust out



Dust Mitigation FG Subgroups

- Please fill out the short survey below if interested or would like to sign-up:
- <https://docs.google.com/forms/d/e/1FAIpQLScB6iT2fgPqj2zIaP0s-rwWQDQ04TPfgVyiC5zn0AQPAT5CZA/viewform>
- Anyone is welcome to join! Thank you to those who have already filled out the survey.

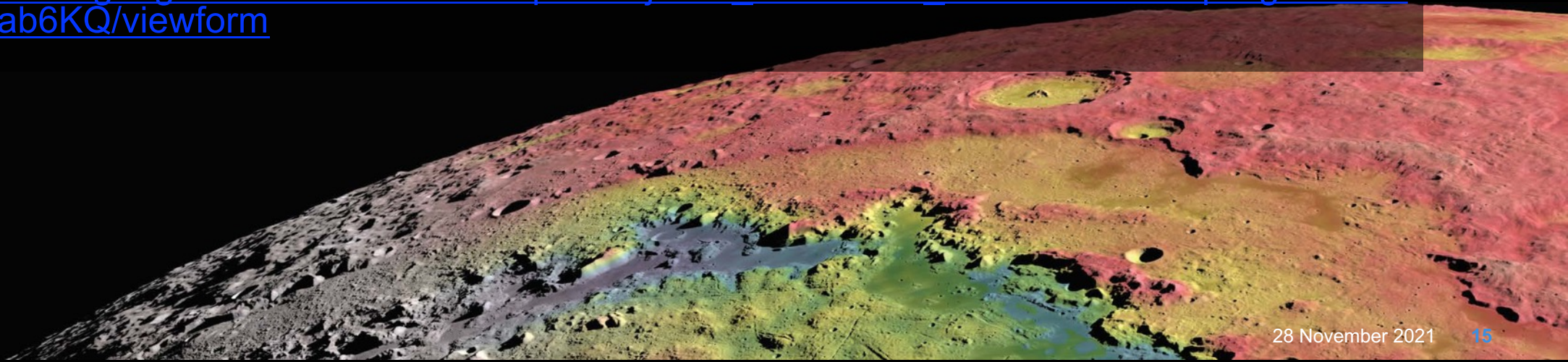


What is next for Dust Mitigation FG?

Help us improve the Dust Mitigation Focus Group!

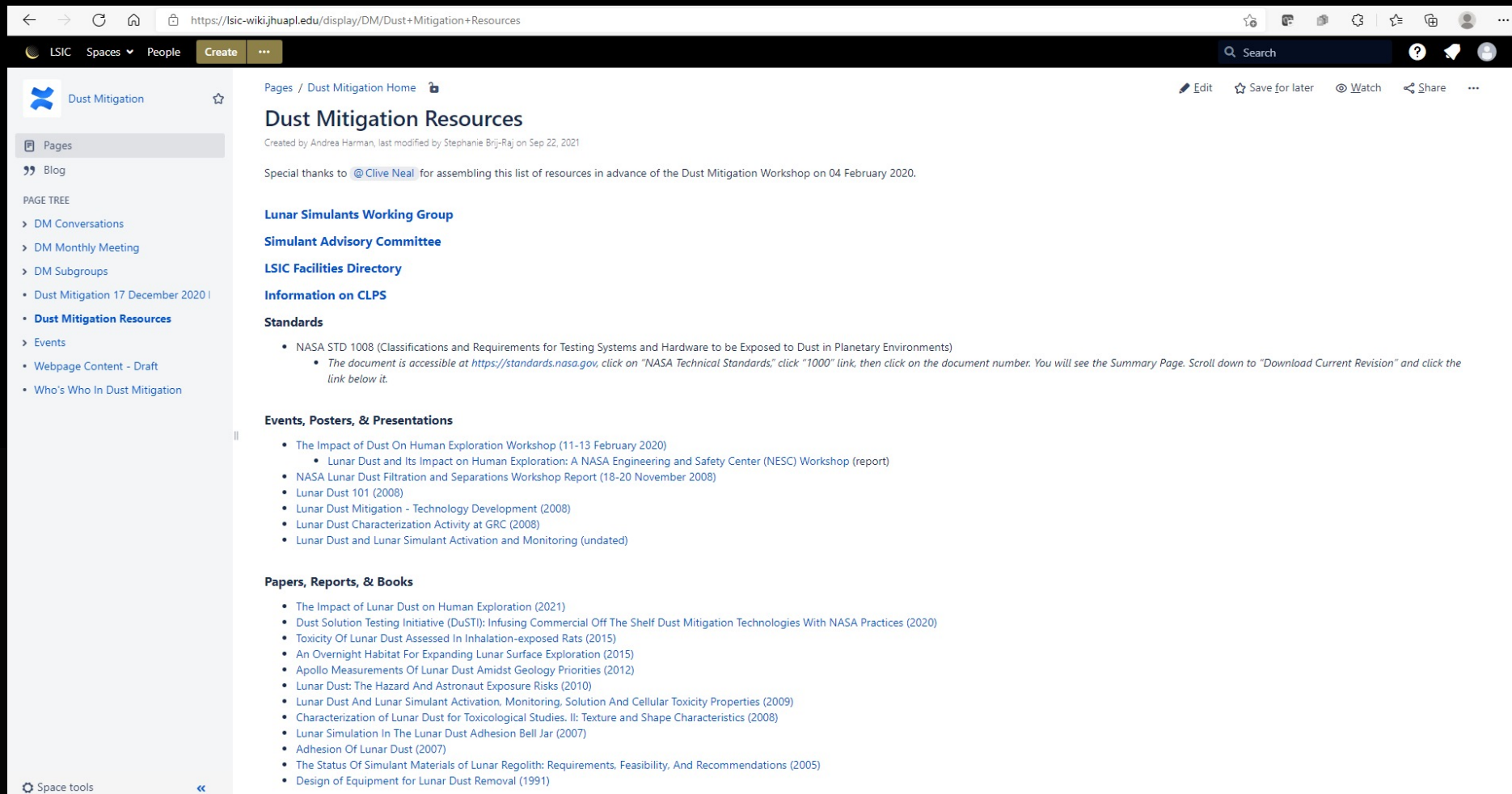
- What benefits have you gained from being part of the LSIC Dust Mitigation Focus group?
- Is there anything else you enjoy about monthly meetings? Anything you'd like to see us change?
- Is there anything you liked about this past year that you'd like to see continue?
- Is there anything about this past year that you'd change going forward?
- Are there other activities you would like to see us organize?

- Please fill out the feedback survey:
- https://docs.google.com/forms/d/e/1FAIpQLSdjuTIK_TLMnCM4_aSMLAzLS762qtzbgmcOd2fgizlCsab6KQ/viewform



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 is titled 'Dust Mitigation Resources' and was created by Andrea Harman, last modified by Stephanie Brij-Raj on Sep 22, 2021. It includes a 'Special thanks' section for Clive Neal and a list of resources categorized into: Lunar Simulants Working Group, Simulant Advisory Committee, LSIC Facilities Directory, Information on CLPS, Standards (including NASA STD 1008), Events, Posters, & Presentations, and Papers, Reports, & Books. The page also features a sidebar with navigation options like 'Pages', 'Blog', and 'PAGE TREE'.

Today's Presentation

“Plume-Surface Interaction: Preliminary Observations from a Physics Focused Ground Test”



Dr. Wesley Chambers

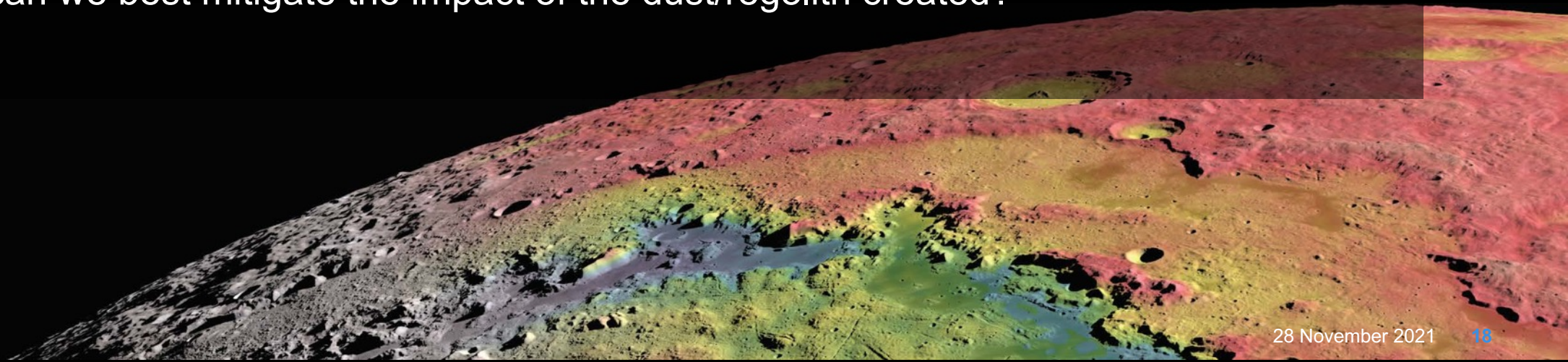
Natural Environments Branch

NASA Marshall Space Flight Center

wesley.chambers@nasa.gov

PSI Discussion

- What gaps exist in our understanding of plume surface interaction/what data do we still need?
- What plans are in place to ensure we get the data we need to close those gaps?
- Are current investigations on CLPS missions
- Once we have that data, will it be made publically available for the community to use?
- How will plume surface interaction impact early lunar operations (things like machinery and equipment, but also environmental concerns like human health)/will its impact change over time?
- How can we best mitigate the impact of the dust/regolith created?





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