



Lunar Surface Innovation

C O N S O R T I U M

LSIC Dust Mitigation Focus Group

Monthly Meeting

March 17, 2022



JOHNS HOPKINS
APPLIED PHYSICS LABORATORY

Dr. Jorge Núñez
Senior Scientist
Space Exploration Sector

Facilitator_DustMitigation@jhuapl.edu

APL LSIC Dust
Mitigation Team:

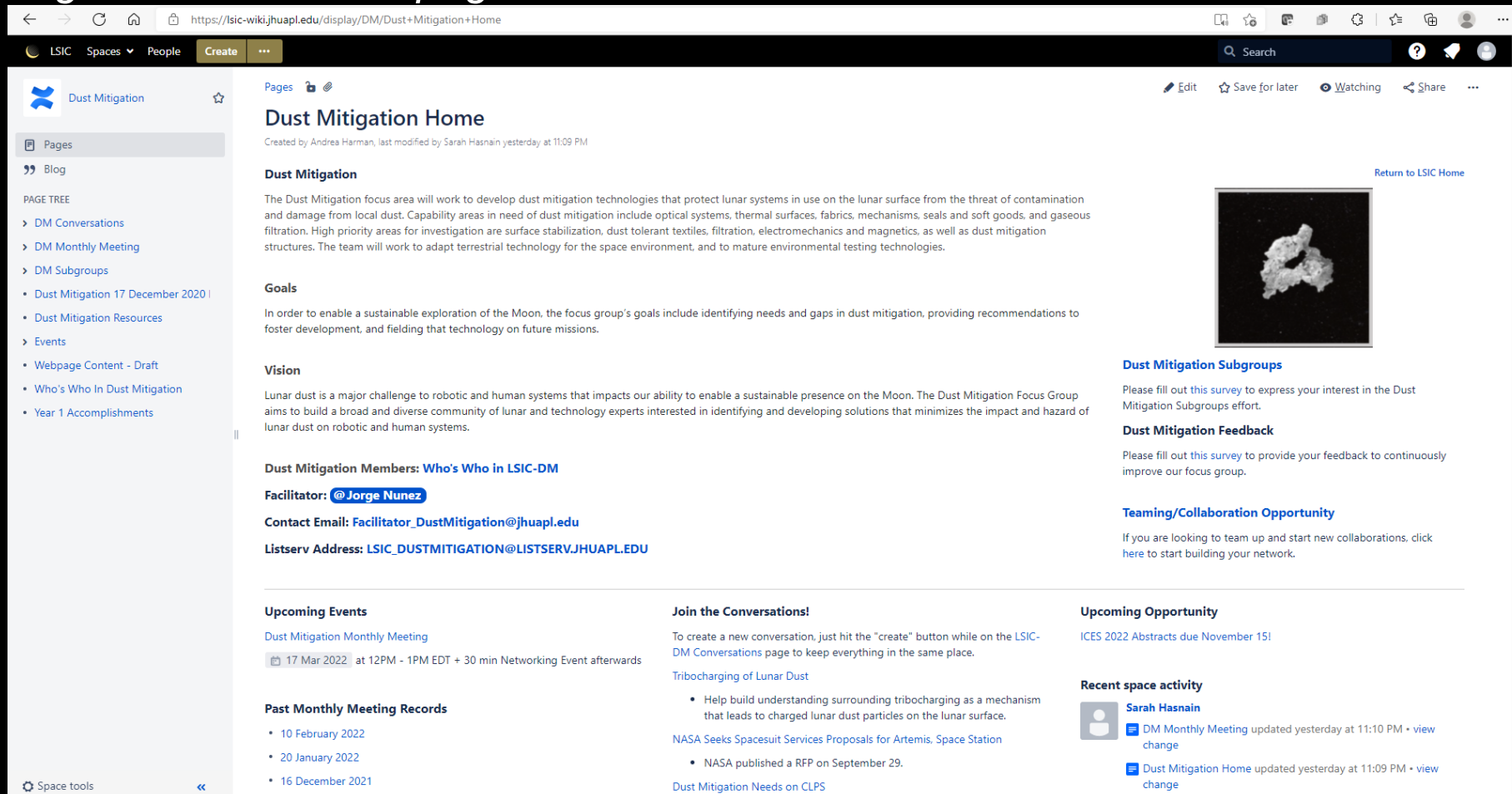
Lindsey Tolis
Mark Perry
Richard Miller
Sarah Hasnain

Agenda

- Welcome, LSIC and Focus Group Updates
- Upcoming Opportunities and Meetings
- Featured Presentations:
 - **Anthony (Drew) Hood, NASA Johnson Space Center**
 - “High Level Introduction on EVA Tool Development for Space Suit Dust Mitigation”
 - **Dr. Inseob Hahn, NASA Jet Propulsion Laboratory, California Institute of Technology**
 - “Lunar dust mitigation technology using electron beam”
- Discussion on Dust Mitigation for Space Suits/EVA
- Networking Subgroups

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 Dust Mitigation Home. The page includes a navigation sidebar on the left with sections for Pages, Blog, and a Page Tree containing links to DM Conversations, DM Monthly Meeting, DM Subgroups, Dust Mitigation 17 December 2020, Dust Mitigation Resources, Events, Webpage Content - Draft, Who's Who In Dust Mitigation, and Year 1 Accomplishments.

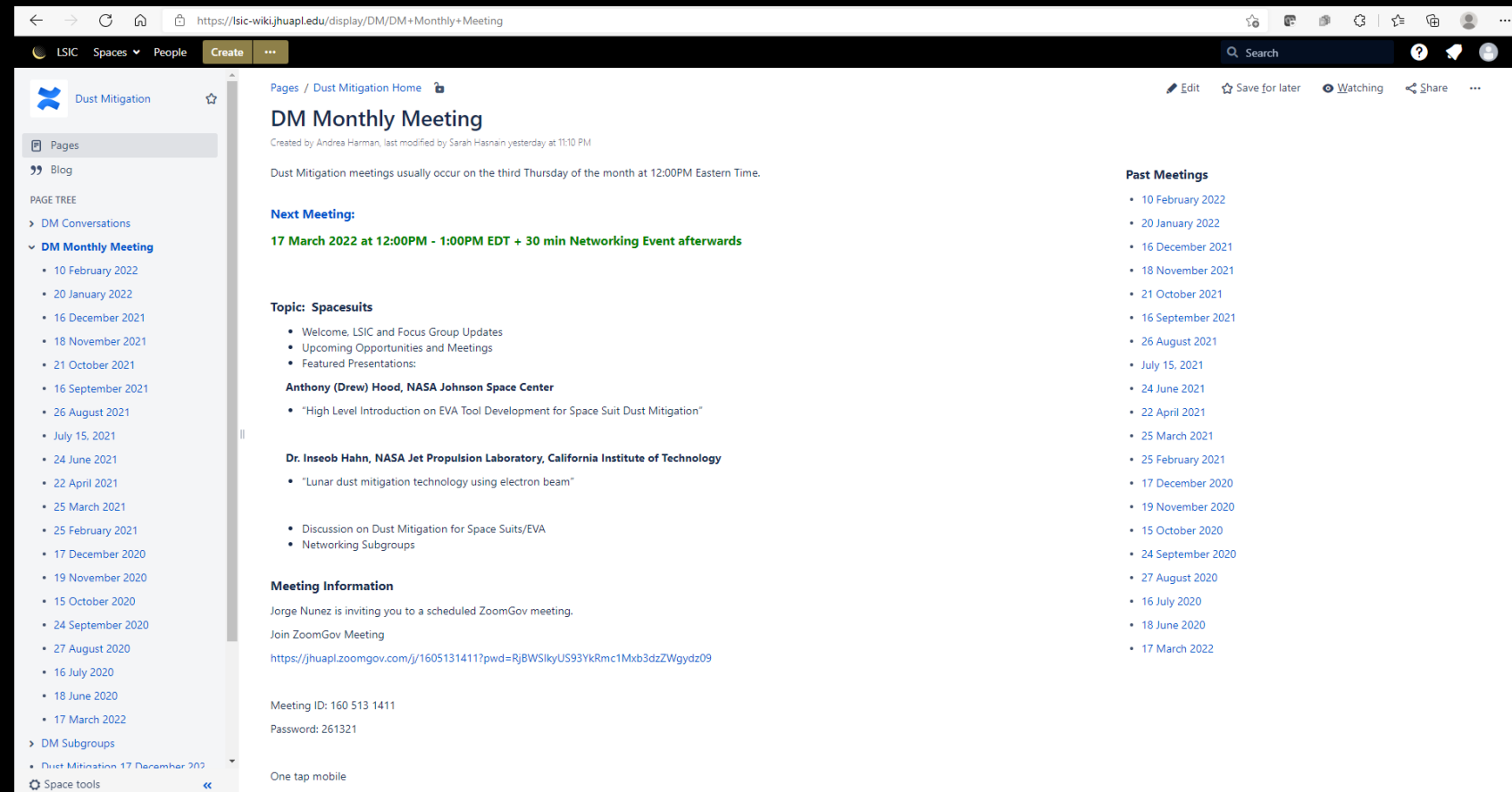
The main content area features the following sections:

- Dust Mitigation Home**: Created by Andrea Harman, last modified by Sarah Hasnain yesterday at 11:09 PM.
- Dust Mitigation**: A paragraph describing the focus area's goal to develop technologies for lunar surface protection.
- Goals**: A paragraph stating the group's goals for sustainable lunar exploration.
- Vision**: A paragraph discussing the challenges of lunar dust on robotic and human systems.
- Dust Mitigation Members: Who's Who in LSIC-DM**: Lists the facilitator as @Jorge Nunez, contact email as Facilitator_DustMitigation@jhuapl.edu, and listserv address as LSIC_DUSTMITIGATION@LISTSERV.JHUAPL.EDU.
- Upcoming Events**: A table listing the Dust Mitigation Monthly Meeting on 17 Mar 2022.
- Past Monthly Meeting Records**: A list of past meetings from February 2022 to December 2021.
- Join the Conversations!**: A section encouraging users to create new conversations.
- Upcoming Opportunity**: A link to ICES 2022 Abstracts due November 15.
- Recent space activity**: A list of recent updates, including DM Monthly Meeting and Dust Mitigation Home updates.

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



The screenshot shows a Confluence page for 'Dust Mitigation'. The main content area includes:

- DM Monthly Meeting**
Created by Andrea Harman, last modified by Sarah Hasnain yesterday at 11:10 PM
- Dust Mitigation meetings usually occur on the third Thursday of the month at 12:00PM Eastern Time.
- Next Meeting:**
17 March 2022 at 12:00PM - 1:00PM EDT + 30 min Networking Event afterwards
- Topic: Spacesuits**
 - Welcome, LSIC and Focus Group Updates
 - Upcoming Opportunities and Meetings
 - Featured Presentations:
 - Anthony (Drew) Hood, NASA Johnson Space Center**
 - "High Level Introduction on EVA Tool Development for Space Suit Dust Mitigation"
 - Dr. Inseob Hahn, NASA Jet Propulsion Laboratory, California Institute of Technology**
 - "Lunar dust mitigation technology using electron beam"
 - Discussion on Dust Mitigation for Space Suits/EVA
 - Networking Subgroups
- Meeting Information**
Jorge Nunez is inviting you to a scheduled ZoomGov meeting.
Join ZoomGov Meeting
<https://jhuapl.zoomgov.com/j/1605131411?pwd=RjBWSlkyUS93YkRmclMxb3dzZWgydz09>
Meeting ID: 160 513 1411
Password: 261321

The right sidebar contains a 'Past Meetings' list with dates from February 2022 back to March 2020.

Updates and Communications

- Monthly LSIC newsletter – New edition came out early March 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 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 (<https://lsic.jhuapl.edu/Events/>)

- LSIC Extreme Environments Focus Group Meeting (03/15)
 - Topic: Plasma/Dust/Regolith Cross Talk Event
- LSIC Dust Mitigation Focus Group Meeting (03/17) – Today!
 - Topic: Dust Mitigation for Space Suits/EVA
- LSIC Joint DM & E&C Meeting (04/27)
 - Topic: Impact of Dust on Building on the Moon
 - Replaces DM FG Meeting on 04/21
- LSIC Spring Meeting (05/04-05/05)
 - Abstract deadline March 4; Registration deadline: April 6 (In-person) & April 25 (virtual)

Other Recent and Upcoming Dust Mitigation Related Workshop and Meetings

- LSSW Virtual Session 14: Heliophysics Applications Enabling and Enabled by Human Exploration of the Lunar Surface (02/17)
 - “What are the electrodynamic conditions on the lunar surface and their relationship to exploration hazards such as dust and electrostatic discharge?”
 - <https://www.hou.usra.edu/meetings/lunarsurface2020/>
- AIAA ASCEND Conference (10/24-26)
 - Call for Content now open! Propose a session or submit an abstract (Deadline: March 31, 2022)
 - <https://www.ascend.events/call-for-content>

LSIC Spring Meeting

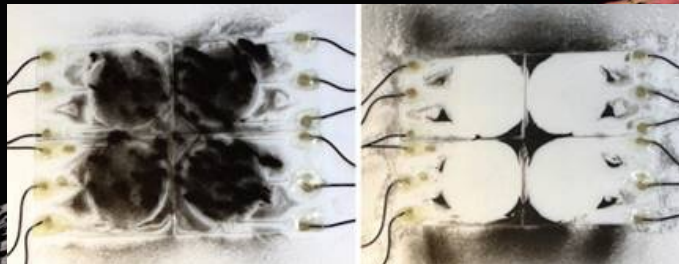
- Dates: May 4-5, 2022
- Venue: Virtual and In-Person, Johns Hopkins Applied Physics Laboratory, Laurel, MD
- The LSIC 2022 Spring Meeting will concentrate on understanding NASA's plans and technology investments relevant to building a sustained presence on the lunar surface. The meeting will include invited speakers, panels, posters, and breakout discussions.

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.
- Abstract Submission Deadline: March 4, 2022
- **Registration Deadline: April 6, 2022 (for in-person); April 25, 2022 (for virtual attendance)**
- Spring Meeting Website: <https://lsic.jhuapl.edu/Events/Agenda/index.php?id=200>

Dust Mitigation FG Updates

- 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
- Join one of the Dust Mitigation Subgroups!
 - Dust Mitigation Subgroup Membership/Leaders survey: <https://docs.google.com/forms/d/e/1FAIpQLScB6iT2fgPqj2zIaP0s-rwWQDQ04TPfgVyiC5zn0AQPAT5CZA/viewform>
- 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>



NASA SBIR & STTR Solicitations 2022

- 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 (up from **\$125K**)
- Phase II: Up to \$750 K for 24 Mo
- **Focus Area 24: “Dust Mitigation and Extreme Lunar Environment Mitigation Technologies”**
- **Phase I Solicitation Closed March 9, 2022**
- **Phase II Solicitations Due by last day of Phase I contract**
- **Phase I Selections expected May 25, 2022**
- <https://sbir.nasa.gov/solicit-detail/79614>



National Aeronautics and Space Administration



NASA SBIR PROGRAM SOLICITATION 2022

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

NASA SBIR/STTR PROGRAM | sbir.nasa.gov

NASA SBIR & STTR Solicitations 2022

- **Focus Area 24: Dust Mitigation and Extreme Lunar Environment Mitigation Technologies**
 - 4 Sub-topic areas (1 new sub-topic added)
- **1. Active and Passive Dust Mitigation Surfaces (Z13.01)**
 - Lead Center: KSC
 - Participating Center(s): JSC, LaRC
- **2. Mechanisms for Extreme Environments (Z13.02)**
 - Lead Center: KSC
 - Participating Center(s): GRC, JSC, LaRC
- **3. Technologies for Spacesuits in Extreme Surface Environments (Z13.03)**
 - Lead Center: JSC
- **4. Lunar Dust Filtration and Monitoring (Z13.04)**
 - Lead Center: GRC
 - Participating Center(s): JSC, KSC
- <https://sbir.nasa.gov/solicit-detail/79614>



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 is a collage: the top left shows an astronaut on a space station with Earth in the background; the bottom right shows a group of four NASA employees in flight suits with their hands clasped; and the bottom right corner shows a view of Earth from space. The text 'NASA SBIR PROGRAM SOLICITATION 2022' is prominently displayed in the lower half, with the tagline 'Join our diverse community of pioneers who are researching and developing technologies to change the world' below it. At the very bottom, it says 'NASA SBIR/STTR PROGRAM | sbir.nasa.gov'.

Space Technology Research Grants

- **Early Career Faculty**
- **Goal:** ECF is focused on supporting outstanding faculty researchers early in their careers as they conduct space technology research of high priority to NASA's Mission Directorates
- **Eligibility:** Accredited U.S. universities are eligible to submit proposals on behalf of their outstanding new faculty members who intend to develop academic careers related to space technology.
- **Key Dates:**
 - Release Date: February 02, 2022 (DONE)
 - **Notices of Intent Due: March 02, 2022**
 - **Proposals Due: March 31, 2022**
 - Selection Notification: August 05, 2022 (target)
 - Award Start Date: October 01, 2022 (target)
 - **Typical Technology Readiness Level (TRL):** TRL 1 or TRL 2 at the beginning of the effort.
 - **Award Duration: Maximum of three years**
 - 200K/per year

Today's Presentation – 1 of 2

“High Level Introduction on EVA Tool Development for Space Suit Dust Mitigation”

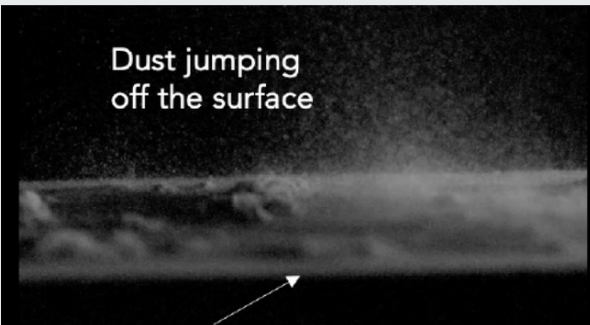


Anthony (Drew) Hood
EVA Tools, Project Manager
Crew and Systems Thermal Division
Engineering Directorate
Johnson Space Center
drew.hood@nasa.gov

Today's Presentation – 2 of 2

“Lunar dust mitigation technology using electron beam”

Overview SMD Technology Programs Technology Highlights



Dust jumping
off the surface

New “Moon Duster” Will Help Clean NASA Assets in Space

SPACE EXPERIMENTS | May 4, 2021

To help protect future space assets and astronauts from dangerous effects that arise from Moon/Mars dust exposure, NASA is developing a new technology that will utilize electron beams/ultraviolet light to remove dust.

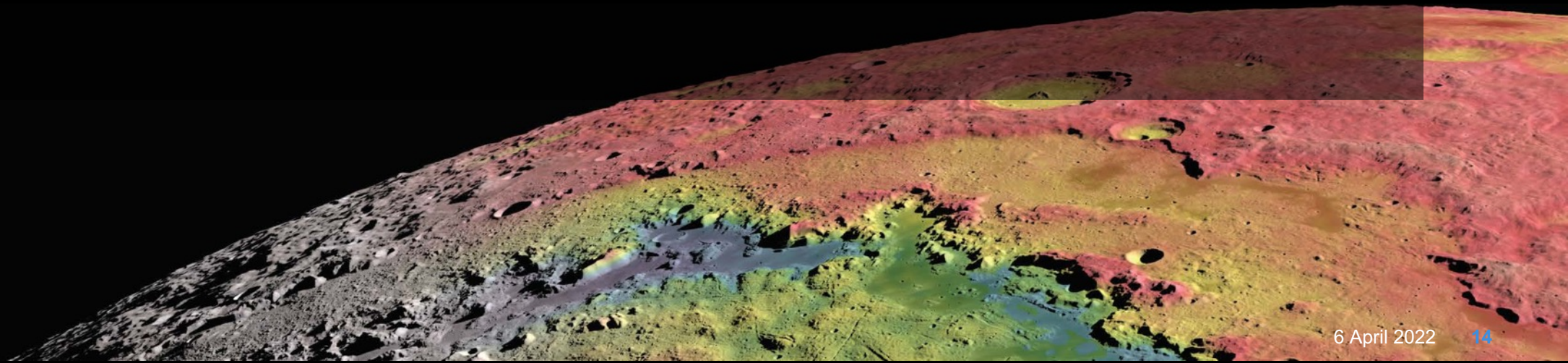
Dr. Inseob Hahn

NASA Jet Propulsion Laboratory,
California Institute of Technology

inseob.hahn@jpl.nasa.gov

Dust Mitigation for Spacesuits Discussion

- What gaps exist in our understanding of lunar dust and what data do we still need?
- 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 there priority technology areas in dust mitigation for spacesuits that are in need of investment?
- Are in-flight demonstrations needed? If so, which ones?



Subgroup Networking

- We will breakout into different subgroups
- Each subgroup will have a different room that you can join (or Andrea can help move you)
 - See next slide for list of subgroups

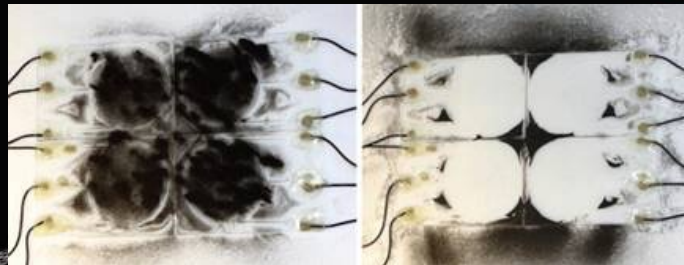
Subgroup Activities/Networking

- Brief Introductions (Name, Institution, What do you work on?)
- What would you like to see the subgroup accomplish this year?
- What is/are the biggest challenge(s) you see in your technology area?
- How can the subgroup help our Focus Group meet it's goals (see below)?

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.

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





JOHNS HOPKINS
APPLIED PHYSICS LABORATORY

Dust Mitigation FG Subgroups

- Expected subgroup products are defined below:
- Capture Quad Chart: Single slide presented at the focus group monthly telecon. Signals the start of the task.
- Discussion Package: Short presentation that defines challenges associated with category based on the work of the subgroup. Guides one ~5 minute presentation at a focus group monthly tag-up with 10 min discussion (Spring 2022 - Winter 2022).
- Confluence Wiki Catalogue: Overview of subgroup and resources - Ready by Sep 2022
- Archive Package: Revised version of the Discussion Package - Ready by Sep 2022

