



Lunar Surface Innovation

C O N S O R T I U M

LSIC Dust Mitigation Focus Group

Monthly Meeting

June 15, 2023



JOHNS HOPKINS
APPLIED PHYSICS LABORATORY

Dr. Jorge Núñez
Senior Scientist
Space Exploration Sector

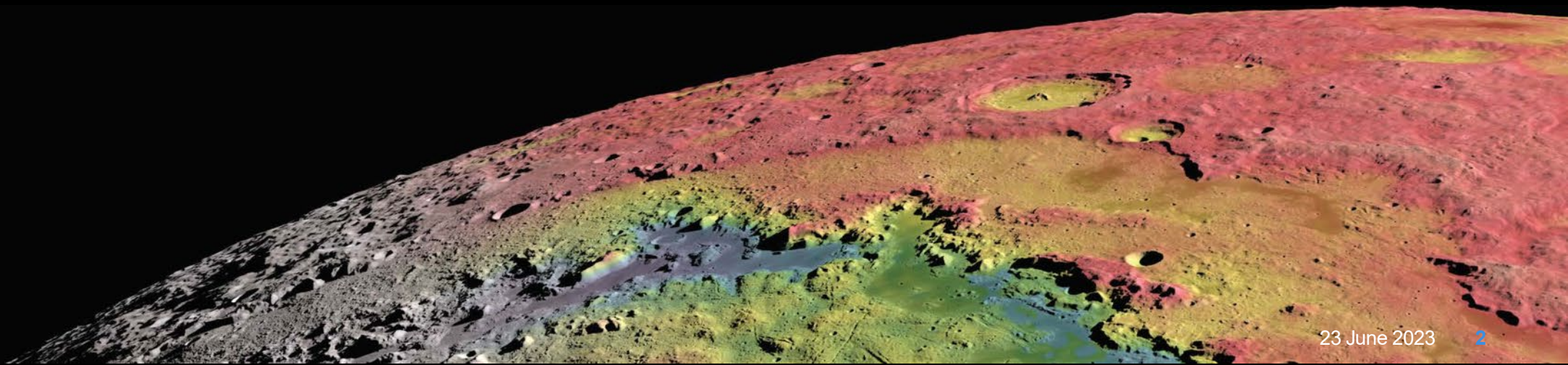
Facilitator_ DustMitigation@jhuapl.edu

APL LSIC Dust
Mitigation Team:

Lindsey Tolis
Richard Miller
Sarah Hasnain
Stephen Izon
Timothy Cole

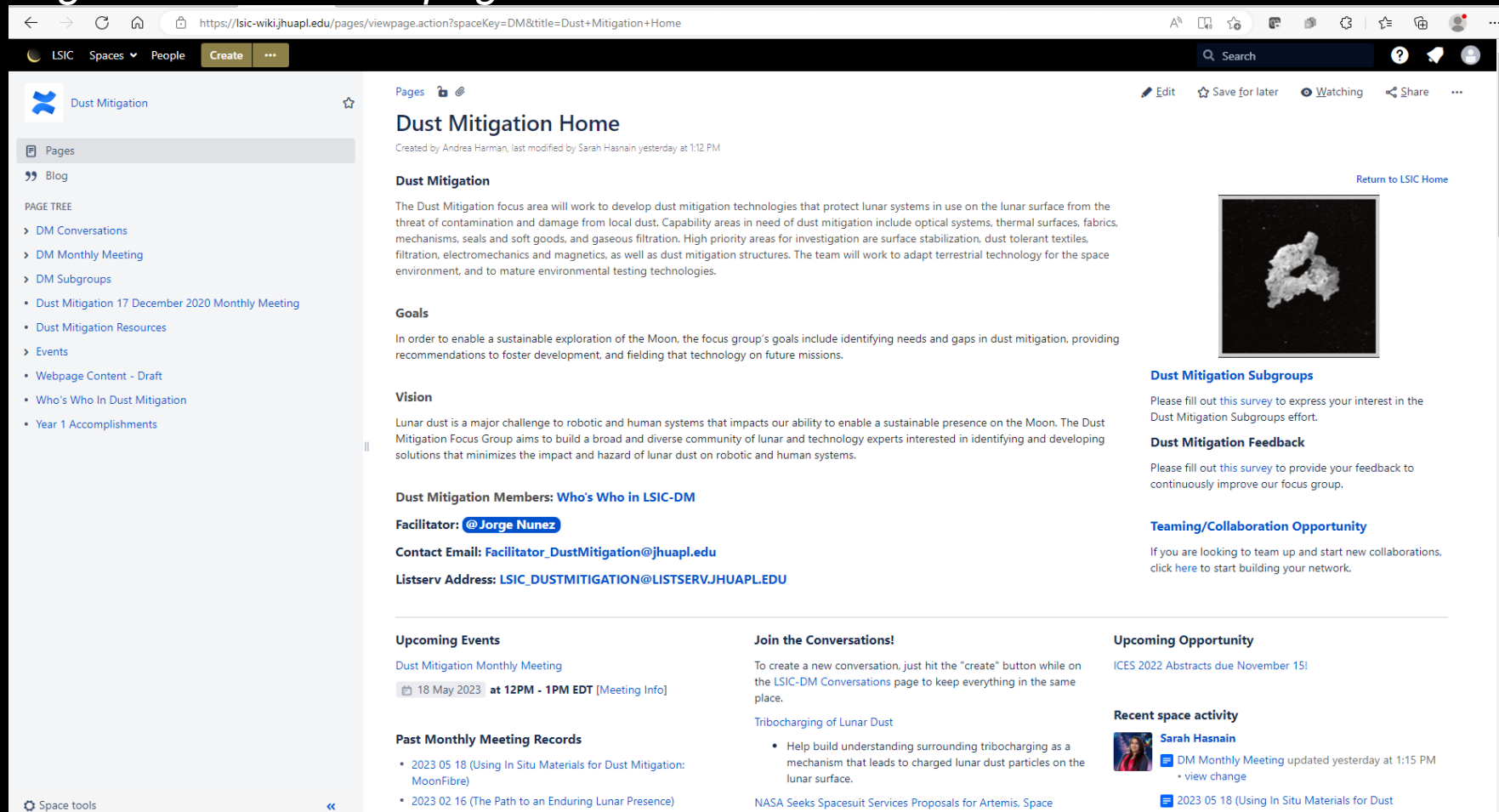
Agenda

- Welcome, LSIC and Focus Group Updates
- Upcoming Opportunities and Meetings
- Featured Technology Presentation:
 - **“2022 LSIC Simulants Assessment Report: Implications for Dust Mitigation”**
 - Dr. Karen Stockstill-Cahill, APL Lunar Regolith Simulants Lead
- Discussion on Lunar Simulants



LSIC Dust Mitigation Wiki Page

- To request access, please contact lsic-wiki-admins@listserv.jhuapl.edu
- *Dust Mitigation Discussion page and wiki*

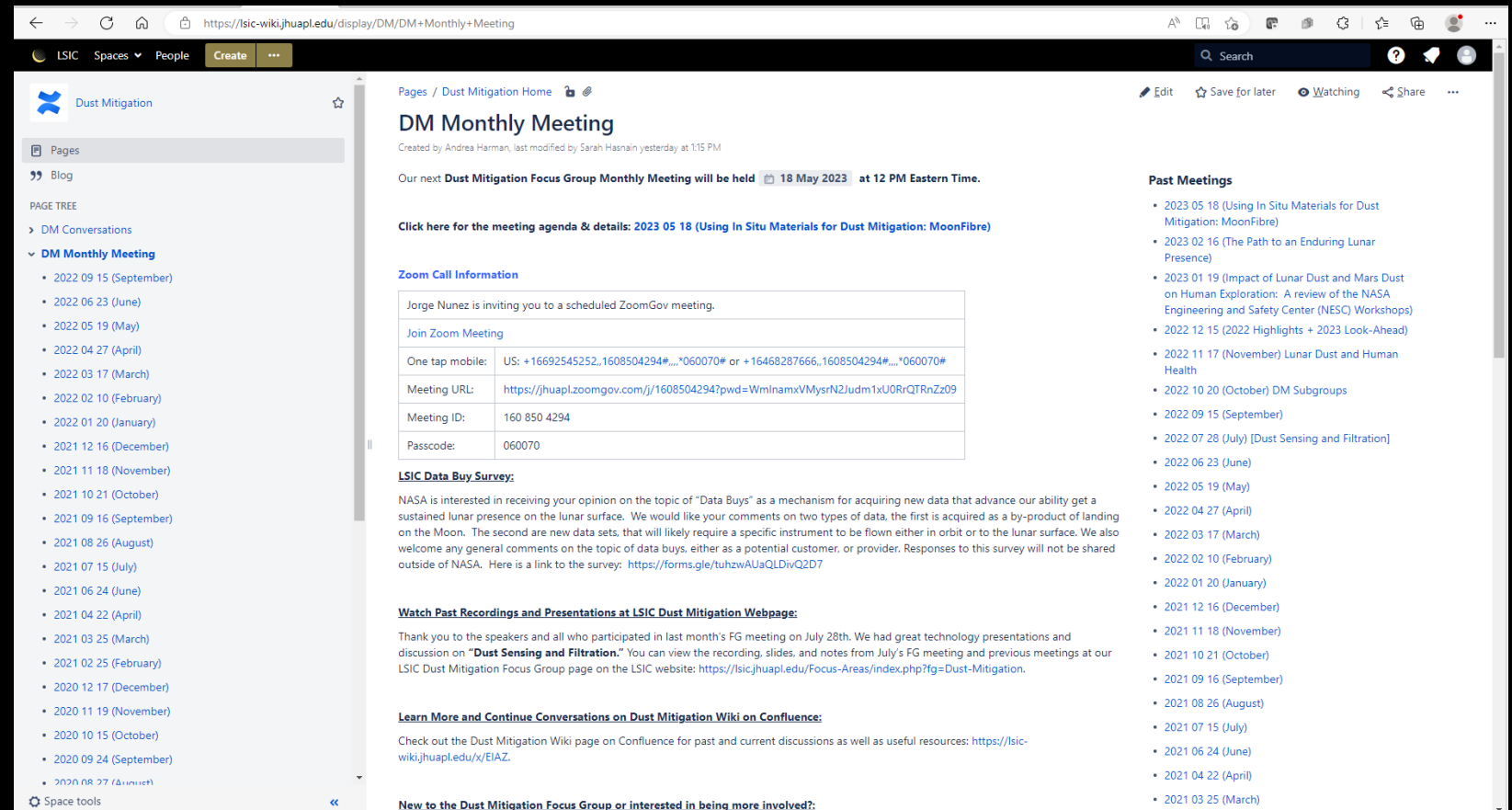


The screenshot shows the 'Dust Mitigation Home' page on the LSIC wiki. The page is titled 'Dust Mitigation Home' and was created by Andrea Harman, last modified by Sarah Hasnain yesterday at 1:12 PM. The main content area includes a 'Dust Mitigation' section with a paragraph describing the focus area's work on developing dust mitigation technologies. Below this are sections for 'Goals', 'Vision', and 'Dust Mitigation Members: Who's Who in LSIC-DM'. The 'Facilitator' is listed as @Jorge Nunez, and the 'Contact Email' is Facilitator_DustMitigation@jhuapl.edu. The 'Listserv Address' is LSIC_DUSTMITIGATION@LISTSERV.JHUAPL.EDU. On the right side, there are links for 'Dust Mitigation Subgroups', 'Dust Mitigation Feedback', and 'Teaming/Collaboration Opportunity'. At the bottom, there are sections for 'Upcoming Events' (Dust Mitigation Monthly Meeting on 18 May 2023), 'Join the Conversations!', 'Upcoming Opportunity' (ICES 2022 Abstracts due November 15!), and 'Recent space activity' (DM Monthly Meeting updated yesterday at 1:15 PM).

Join the Discussion on our Wiki Page

- To request access, please contact 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 'PAGE TREE' showing 'DM Monthly Meeting' as a sub-page under 'DM Conversations'. The main content area features a heading 'DM Monthly Meeting', a creation date, and a notice about the next meeting on May 18, 2023. It also contains a 'Zoom Call Information' table with details like mobile number, meeting URL, ID, and passcode. Below this, there are sections for 'LSIC Data Buy Survey', 'Watch Past Recordings and Presentations at LSIC Dust Mitigation Webpage', and 'Learn More and Continue Conversations on Dust Mitigation Wiki on Confluence'. A 'Past Meetings' list on the right side shows a chronological list of previous meetings from March 2023 back to March 2021.

Updates and Communications

- Monthly LSIC newsletter – New edition came out early June 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 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**
- 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

<https://lsic.jhuapl.edu/Resources/LSIC-Resources.php>

Today's Technology Presentation

"2022 LSIC Simulants Assessment Report: Implications for Dust Mitigation"



Dr. Karen Stockstill-Cahill

APL Lunar Regolith Simulants Lead

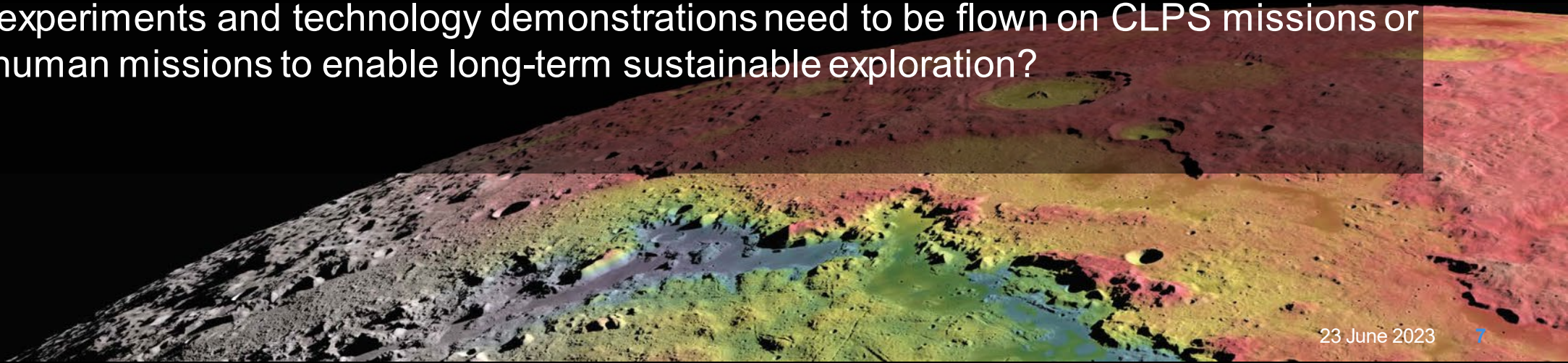
Lunar Simulants Working Group (LSWG) Facilitator

Johns Hopkins Applied Physics Laboratory

Karen.Stockstill-Cahill@jhuapl.edu

Discussion on Lunar Simulants

- What gaps exist in our understanding of lunar dust and regolith?
- What data do we still need to help improve our understanding of lunar dust and regolith?
- 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? If so, what kind of data is needed
- Do Lunar Regolith simulants approximate lunar dust sufficiently for dust mitigation testing needs? If not, what properties are missing?
- What experiments and technology demonstrations need to be flown on CLPS missions or early human missions to enable long-term sustainable exploration?



Space Technology Funding Opportunities

Current Tech Development 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: March 2, 2023 - July 5, 2023 July 6, 2023 - November 1, 2023
- [Early Stage Innovations \(ESI23\) »](#)
 - NOI Due: June 7, 2023 at 5:00pm ET Proposal Due: July 6, 2023 at 5:00pm ET
- [NASA Innovation Corps Pilot »](#)
 - Proposals may be submitted at any time through July 22, 2022, but applications will be reviewed in intervals on the following dates: Sept. 16, 2022; Nov. 17, 2022; and Jan 20, 2023
- [Technology Advancement Utilizing Suborbital and Orbital Flight Opportunities “TechFlights” »](#)
 - Mandatory Preliminary Proposals Due - 6/7/2023 Full Proposals Due - 10/4/2023

Future Solicitation and Opportunities

- [NASA Innovative Advanced Concepts \(NIAC\) 2024 Phase I Call for Proposals »](#)
 - The NIAC program supports visionary research ideas through multiple progressive phases of study. Phase I studies are nine-month efforts to explore the overall viability and advance the technology readiness level (TRL). Eligible recipients of Phase I awards can propose for a follow-on Phase II study.

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
 - Awards are planned to start in October 2023.
-
- LuSTR23 NOIs Due March 22, 2023 @5:00 PM EDT
 - LuSTR23 Proposals Due April 24, 2023 @5:00 PM EDT

NASA ESI Solicitation 2023

- NASA's Space Technology Mission Directorate (STMD) has released Early Stage Innovations (ESI) as an appendix to the SpaceTech-REDDI-2023 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.
- The ESI appendix is available at:
<https://nspires.nasaprs.com/external/solicitations/summary!init.do?solId={18C324EA-320C-1A7D-5404-E436EE6A83B5}&path=open>
- Only accredited U.S. universities are eligible to submit proposals. Teaming is permitted.
- ESI solicits proposals in response to the following three topics:
 - Topic 1 – Advancing Radiation-Hardened Photon Counting Sensor Technologies
 - **Topic 2 – Advancements in Predicting Plume-Surface Interaction Environments During Propulsive Landings**
 - Topic 3 – Advancing the Performance of Refrigeration Systems Based on the Elastocaloric Effect
- Awards are planned to start in mid-January 2024. NASA plans to make approximately 6 awards as a result of this ESI solicitation,
- **NOIs Due : June 7, 2023 at 5:00pm ET**
- **Proposals Due: July 6, 2023 at 5:00pm ET**

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/

LSIC Activities

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

- LSIC Spring Meeting (April 24-25, 2023)
 - Johns Hopkins Applied Physics Laboratory (Hybrid)
- Lunar Proving Ground Definition Workshop (July 12-13, 2023)
- Surface Power Reliability Workshop (July 26-27, 2023)
- E&C Autonomy Workshop (August 21-22, 2023)
- LSIC Dust Mitigation Workshop (Fall 2023)
 - Follow-up to DM Workshop from 2021
 - Information to be sent later
- LSIC Fall Meeting (October 10-12, 2023)
 - Community College of Allegheny County, Pittsburgh, PA

Other Recent and Upcoming Dust Mitigation Related Workshop and Meetings

- Dust, Atmosphere, and Plasma Environment of the Moon and Small Bodies Workshop (June 5-6, 2023)
 - Boulder, CO
 - <http://impact.colorado.edu/dap/2023/index.html>

Lunar Simulants Working Group (LSWG)

- **LSWG on LSIC Webpage** (under Our Work)
 - <https://lsic.jhuapl.edu/Our-Work/Working-Groups/Lunar-Simulants.php>
 - Assessments under “Assessments & Databases” tab
- **LSWG Confluence Page** (requires LSIC membership, link on main page)
 - <https://lsic-wiki.jhuapl.edu/display/LSWG/Lunar+Simulants+Working+Group+Home>
 - Assessments under “LSWG Resource Library” => “Recent Simulant Assessments & Reports”

Simulant Teams
Assessments
Publications
Resources
And More!!!

Lunar Simulant Data Repository

Created by Andrea Harman, last modified by Karen Stockstill-Cahill on Jan 19, 2022

Introduction

Spurred by the Constellation Program, a 2010 report from LEAG and CAPTEM (Simulant Working Group, 2010) presented findings on the lunar regolith simulants that were available at that time (e.g., JSC-1, JSC-1A, NU-LHT) and their strengths and weaknesses for various uses. Excellent summaries of the history of, and the shortcomings of these simulants were presented by Taylor and colleagues (Taylor and Liu, 2010; Taylor et al., 2016). In the intervening decade, new simulants have become available that specifically address the limitations of the previous iterations. Here we present information on several simulants from this new generation, including new analyses of their particle size–frequency distribution, particle morphology, and composition, and their potential suitability for specific uses.

Introduction and Background

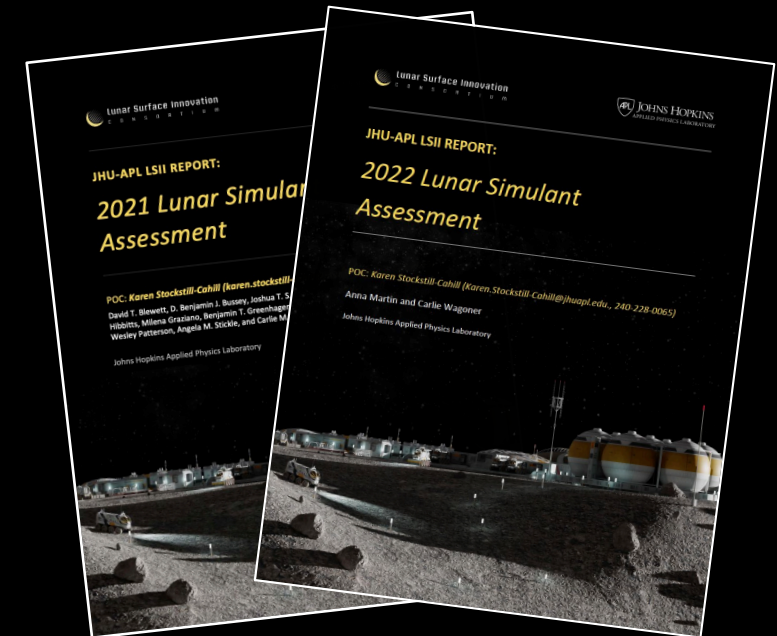
Methods used for Lunar Simulant Assessments

Assessed Lunar Highland Simulants

Assessed Lunar Mare Simulants

Assessed Lunar Agglutinates Simulants

Lunar Simulant Providers included in recent Assessments



LSWG Speaker Series starts TODAY!!!

Speaker: Dr. Doug Rickman

Title: “The Art of Simplification: Making the choices that allow simulants to be made, chosen, and used.”

Date/Time: June 15th, 2023 at 1 pm ET

Please email
Karen.Stockstill-Cahill@jhuapl.edu
to be added to new
LSWG List Serve
Format: henry@somewhere.com Henry Brown

Meeting ID: 161 580 7672

Passcode: 828569

Meeting link at:

<https://lsic-wiki.jhuapl.edu/display/LSWG/Lunar+Simulants+Working+Group+Home>

SCAN ME!





Dust, Atmosphere, and Plasma Environment of the Moon and Small Bodies

June 5 - 6, 2023 in Boulder, CO

<https://impact.colorado.edu/dap/2023>

- (i) Discuss current understanding of the surface environment of the Moon and other small bodies
- (ii) Share new results from past and ongoing missions to the moon, airless bodies and comets
- (iii) Describe expectations, problems, and solutions for planned future missions to dusty destinations

*Presentations are now posted
on DAP website!*

Oral and Poster sessions on:

- Lunar Dust and Plasma Environment
- Dust Hazards and Mitigation for Lunar Exploration
- Cosmic, Asteroid, and Cometary Dust

LSIC | Lunar Proving Grounds Definition Workshop

July 12-13, 2023

Summary:

- The topic of test facilities and Earth-based Lunar Proving Grounds has come up across all six Focus Areas of LSIC, and component- and instrument- level testing has been developed extensively at various facilities across the US. However, an integrated testing facility (or network of testing locations) where technology developers can verify and validate their technologies in conjunction with other dependent technologies at the larger system-level, specifically to ensure system readiness for flight and operation on the lunar surface, still requires development. Over the course of this two-day Lunar Proving Grounds (LPG) Definition Workshop, we intend to dive into these topics and explore the requirements and characteristics that will be necessary for a unified LPG.

This is a discussion-based workshop, no abstracts will be solicited!

Save The Date sent out in April, Announcement sent out in May. Registration is now open!

A tentative agenda and registration is provided on the workshop website

(<https://lsic.jhuapl.edu/Events/Agenda/index.php?id=460>)

Registration is free but required for participation, and will close on June 23, 2023.

Objectives:

1. Define the role of a lunar proving ground on the Earth (and potentially on the Moon).
2. Collect/define needs, attributes, and performance capabilities of Lunar Proving Grounds from technology developer's perspective.
3. Identify the programmatic and logistics required to implement the Lunar Proving Ground.

LSIC | Surface Power Reliability Workshop



- Date: July 26-27
- Time: 11:00AM – 3:30 PM ET
- Location: Virtual via Zoom
- Abstracts Due: 30 June

- **REGISTRATION AND ABSTRACT SUBMISSION ARE OPEN**

- How do we approach reliability from the system/grid level and how should this affect the early-TRL development at the component level?



John Scott (NASA)
Principal Technologist
Power & Energy



Clay Smith (APL)
ISS Probabilistic Risk
Assessment Creator



David McGlone (NAVSEA)
Director
Submarine Safety Program



Steve Miller (NSF)
Antarctic Facilities
Program Manager



Jim Soeder (NASA, re)
Senior Power Technologist (08-21)
Power Development Chief (87-08)



Roger Boyer (NASA)
Artemis Probabilistic
Risk Assessment Lead



Blanca Lara (NASA)
JSC EHP Lunar Power
Lead



Bill Anderson (NAVFAC)
Director of Utilities and
Energy Management

LSIC | Surface Power June Telecon



We hope to see you all at our next telecon, which will take place on **Thursday June 22nd, 2023 at 11:00AM ET.**

Theme: Power Requirements for Lunar Habitats

Speakers:

- **Paul Kessler (NASA LaRC)**
NASA Surface Habitat Lead Architect
- **Ali Bazzi (UConn)**
Resilient Extra Terrestrial Habitats research institute (RETHi)
- **Marshall Porterfield (Purdue)**
Professor of Agricultural and Biological Engineering

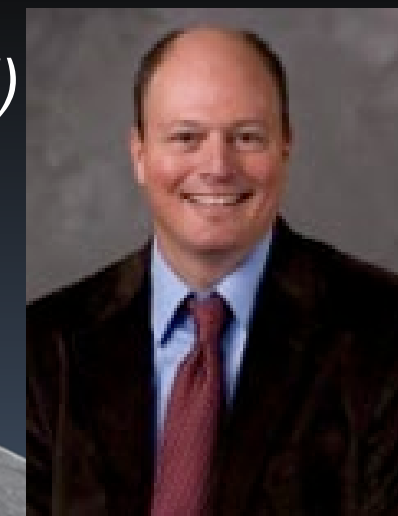
Paul Kessler



Ali Bazzi



Marshall Porterfield



Autonomy Workshop (EA and E&C)

August 21-22, 2023

Full-days, Virtual

Registration
open soon!
Check back on
the LSIC
webpage.

Objective: The goal of this workshop is to gather the Lunar community to exchange ideas on autonomy, as well as identify technology gaps and use cases for establishing a sustainable presence on the Moon and Mars.

Day 1:

- Morning - Autonomous Systems, Situational and Self Awareness, Reasoning and Acting
- Afternoon - Collaborative Systems

Day 2:

- Morning - Applications in Autonomy on Lunar Surface - Current Champions (e.g. Autonomous Construction & Assembly)
- Afternoon - Challenges in Autonomy (Test & Evaluation, Cybersecurity, Dynamic Reasoning Models, Environmental Considerations)

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
- 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>

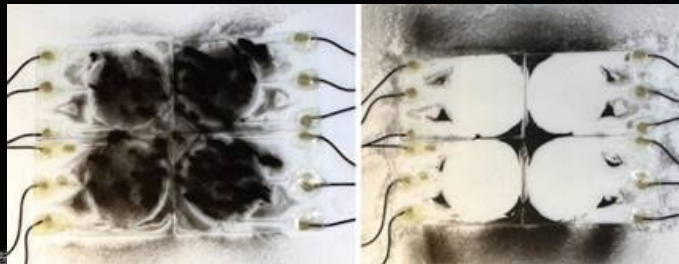
Dust Mitigation FG Subgroups

- **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?

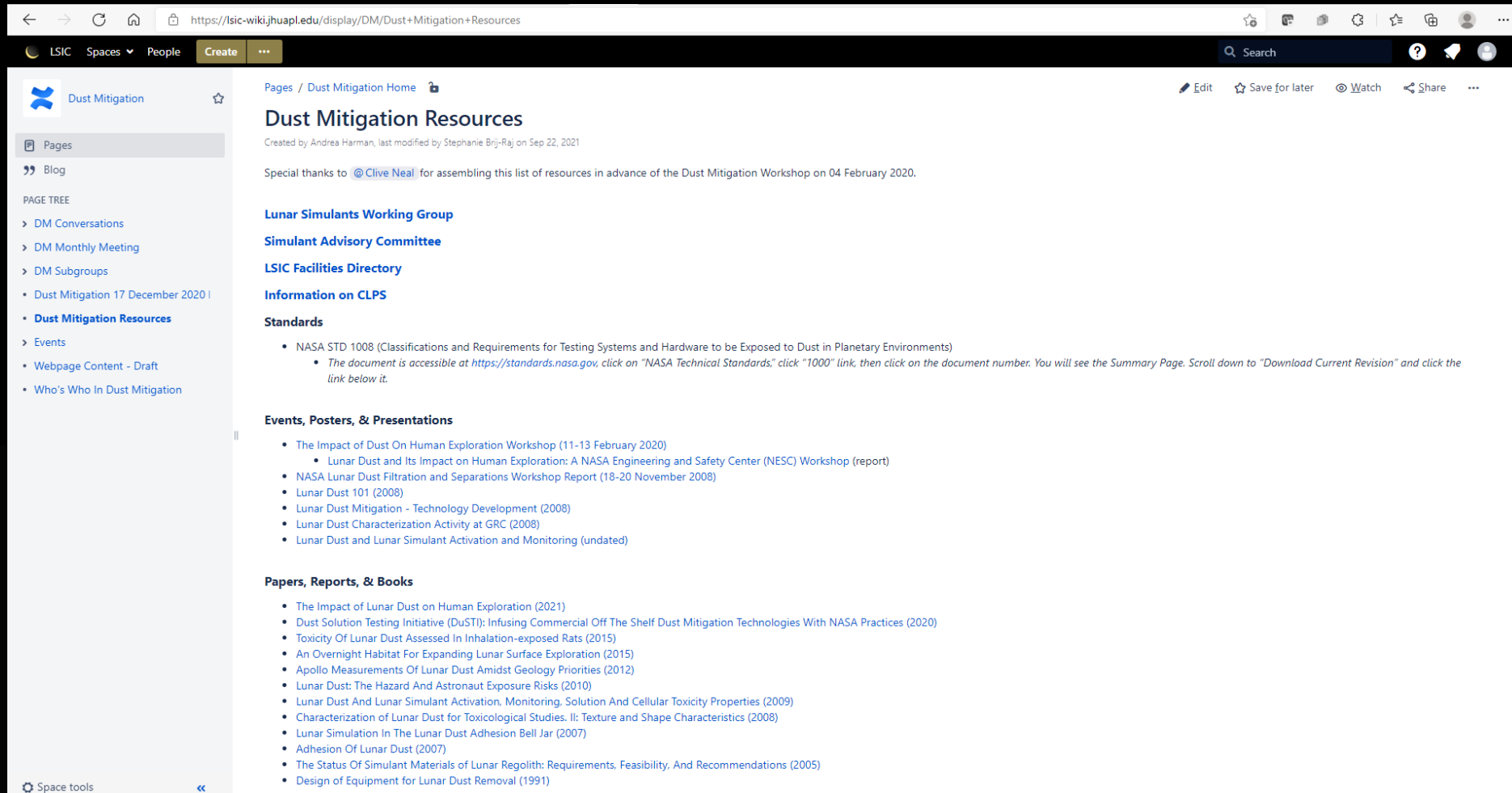
Fill out our survey!

<https://forms.gle/AGpyJcNZBd6ihdaq7>



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 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 is organized into several sections:

- 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)

Looking for Funding?

The Funding Opportunities tool can help match your needs to NASA funding resources.



[Read More](#)



Search Projects

[Advanced Search](#)

[Home](#) » [Funding Opportunities](#)

Funding Opportunities

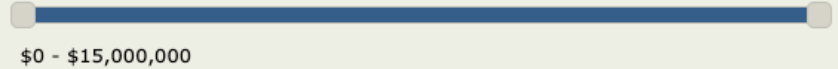
Interested in developing technology with NASA?

Tell us about the types of opportunities you are looking for. Please note, this page is for informational purposes only, and solicitation dates are subject to change. This information does not constitute a solicitation. To respond to a funding opportunity listed, please access and respond according to the provided solicitation link. NASA does not collect or store any of the information provided by users of this page.

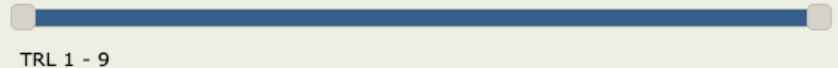
Your roles or organization:

- General Public / Innovator
- Small Business
- Large Business
- Non-Profit or Research Institution
- International
- NASA
- Undergraduate Student
- Graduate Student
- High School Student
- Other Academic Researcher
- Minority-Serving Institution

Funding Needed



Technology Maturity (i)



These opportunities might be a good fit for you:

[Clear all filters](#)

19 results found

Funding Opportunity	Average Project Funding	Average Duration (Months)	Frequency	Next Opportunity	Mission Directorate	Topic-Specific or Open
BIG Idea Challenge	\$180,000	9	Annual	2024/01	STMD	Topic
Centennial Challenges	\$500,000	36	Ongoing	Ongoing	STMD	Topic



THE PATH TO AN ENDURING LUNAR PRESENCE

In the early 2030s, lunar infrastructure could support a science outpost and exploration proving grounds that can also bootstrap commercial activities.

The LSIC community is publishing a white paper to share their perspectives on key enabling actions that will help our nation and the world move together toward our shared use of the lunar surface.

LSIC Community
Draft White Paper



JOHNS HOPKINS
APPLIED PHYSICS LABORATORY

LSIC White Paper and M2M Feedback

LSIC Whitepaper

The Path to an Enduring Lunar Presence

Perspectives on key enabling actions that will help our nation and the world move together toward our shared use of the lunar surface.

Access White Paper:

<https://lsic.jhuapl.edu/Resources/files/The%20Path%20to%20an%20Enduring%20Lunar%20Presence.pdf>

Send feedback to: LSIC-Feedback@jhuapl.edu

NASA Moon to Mars Whitepapers

Architecture Concept Review

Systems Analysis of Architecture Drivers

Why NRHO: The Artemis Orbit

Why Artemis will Focus on the Lunar South Polar Region

Gateway: The Cislunar Springboard for International and Sustainable Human Deep Space Exploration

Mars-Forward Capabilities to be Tested at the Moon

Mars Transportation

Access White Papers:

<https://www.nasa.gov/MoonToMarsArchitecture>



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APPLIED PHYSICS LABORATORY



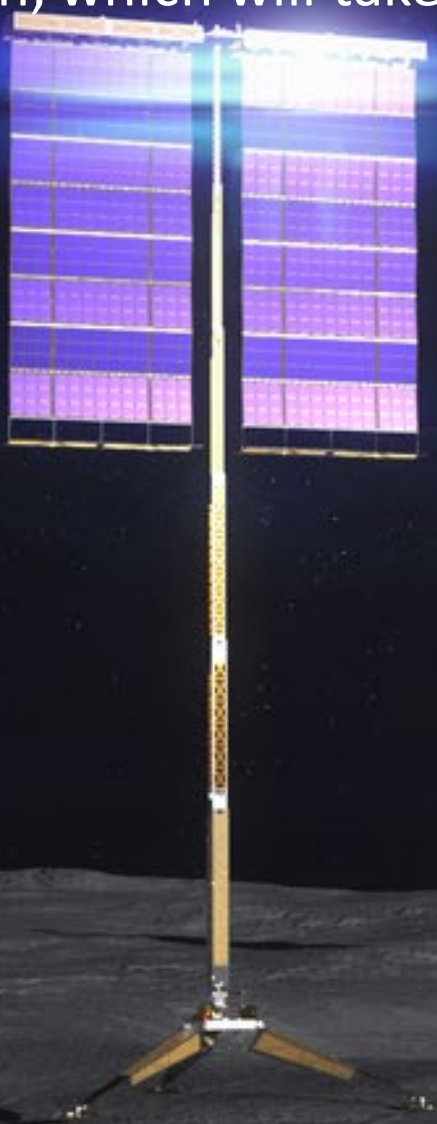
LSIC | May Telecon

We hope to see you all at our next telecon, which will take place on **Thursday May 25th, 2023 at 11:00AM ET.**

Theme: NASA VSAT Phase 2

Speakers:

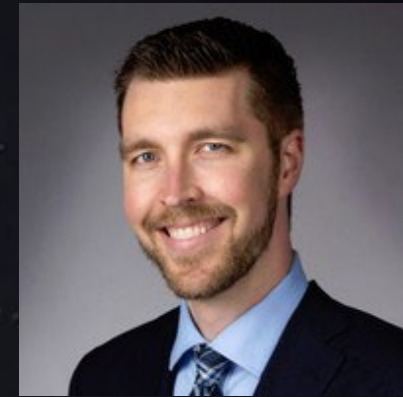
- **Chuck Taylor**
VSAT PM, NASA
- **Ryan Wiseman**
VSAT Business Lead, Lockheed Martin
- **Dean Bergman**
VSAT PI, Honeybee Robotics
- **John Landreneau**
VSAT PM, Astrobotic



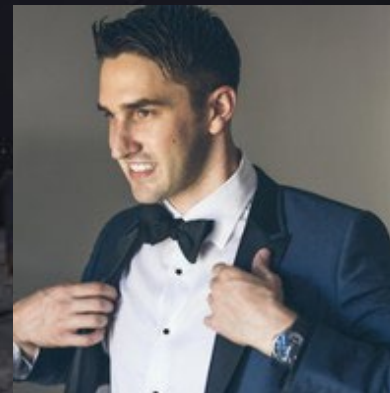
Chuck Taylor



Ryan Wiseman



Dean Bergman

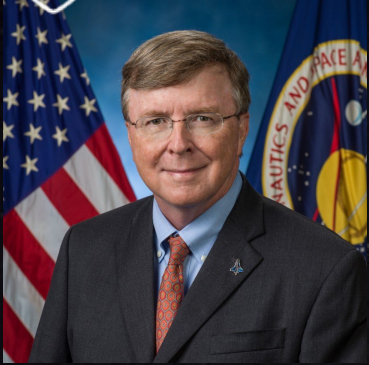


John Landreneau





LSIC | Surface Power Reliability Workshop: July 26-27



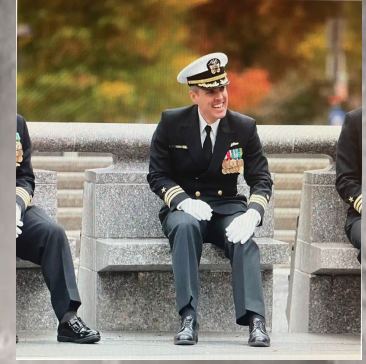
John Scott (NASA)
*Principal Technologist
Power & Energy
Storage*



Clay Smith (APL)
*ISS Probabilistic Risk
Assessment Creator*



**Jim Soeder (NASA,
retired)**
*Senior Power Technologist (08-
21)
Power Development Chief (87-08)*



David McGlone (NAVSEA07)
*Director
Submarine Safety Program*

- 11:00AM – 3:30 PM ET via ZOOM
- How do we quantify and design for reliability?
- How should reliability be approached from the system/grid level and how should this affect the early-TRL development at the component level?
- Bring in Different Perspectives
 - ESDMD, STMD, Industry, Terrestrial Grids, Microgrids, DoD, and you!



LSIC Spring Meeting

April 24th – 25th at Johns Hopkins Applied Physics Lab

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>

LSIC 2023 Spring Meeting | Major Takeaways

- ✓ **Community**
 - Record-breaking attendance:
 - **Online: 200+, In-Person: 300+**
- ✓ **International Lunar Year**
- ✓ **Moon to Mars Initiative**
 - **Moon as a proving ground offers stability**
 - **Importance and relevance to other NASA efforts**
- ✓ **Commercial Lunar Payload Services (CLPS)**
 - **Block buys of landers**
 - **Expansion of services**
- ✓ **Lunar Surface Technology Research (LuSTR) Program**
- ✓ **Whole Government Engagement in Maturing Cislunar Ecosystem and Policy**
 - **International engagement for lunar operations**
- ✓ **Commercial Sector Engagement**
 - **Desirable to refine business cases and/or value propositions for terrestrial expert organizations**
- ✓ **Interoperability**
 - **Critical; clear need to establish a lunar interoperability laboratory/facility for tech assessment**
 - **Marketplace for components that meet interoperable standards**
- ✓ **Lunar Environment Considerations**
 - ***ECLIPSE: Essential Compilation of Lunar Information in Preparation of Sustained Exploration – Coming Sept 2023!***
 - **Dust mitigation and thermal management for component and next higher assemblies**
- ✓ **Autonomy**
 - **Needs further development, such as stakeholder-wide definition and frameworks that evaluate capability autonomy levels**

Lunar Surface Technology Demonstration Strategy

Power, ISRU, Autonomy, Robotics, Excavation, Construction

Early lunar surface demonstrations will increase technology readiness for key infrastructure capabilities with opportunities for collaboration with OGAs, industry, academia, and international partners

◆ IM-2 Demo (on CLPS IDIQ)

- Polar Resources Ice Mining Experiment (PRIME-1)
- Nokia 4G LTE Communications
- Intuitive Machines Deployable Hopper (TP)



Oxygen Extraction Ground Demo

◆ CT-1 Space Tech CLPS Demo

◆ CT-2 Space Tech CLPS Demo

CT Candidate Technologies (in formulation):

- ISRU Subscale Demo
- Power (e.g. Vertical Solar Array, Power Beaming, Fuel Cells)
- Dust Mitigation
- Autonomy & Robotics (e.g. Mobility, Navigation, etc.)
- Excavation
- Construction

◆ Fission Surface Power Demo

◆ ISRU Pilot Plant

Volatiles Investigating Polar Exploration Rover (VIPER)
(Science Mission Directorate)

◆ Space Tech Lunar Surface Demo

2023



2033

Near-term Lunar Technology Demos

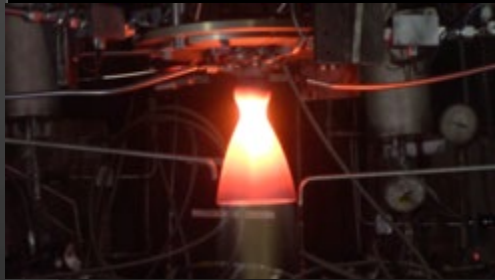
Early lunar surface demonstrations, via the Commercial Lunar Payload Services (CLPS) Program, are opportunities to mature the capabilities required for NASA and industry

Astrobotic Peregrine-1 Mission

Launch date under assessment



Astrobotic Terrain Relative Navigation (ATRN) - Tipping Point with Astrobotic

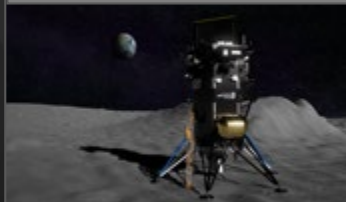


Thruster for Advancement of Low Temperature Operations in Space (TALOS)

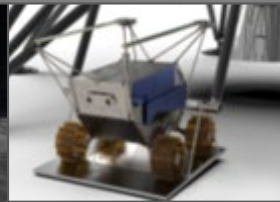
Intuitive Machines (IM)-2 Mission

Planned for Q4 CY23

Launch date under assessment



Polar Resources Ice-Mining Experiment (PRIME-1)



LTE Proximity Comms (Tipping Point w/Nokia)



Deployable Lunar Hopper (Tipping Point w/ IM)

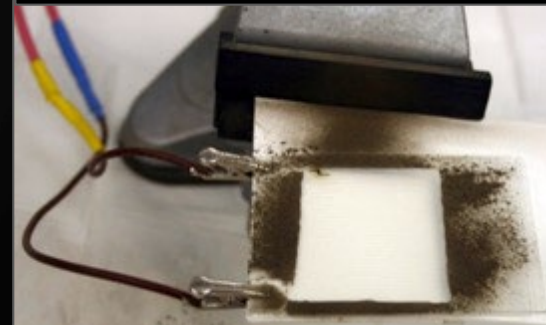
CLPS 19D Mission (Firefly)

Planned for Mid-CY24

Launch date under assessment



Stereo Camera for Lunar Plume Surface Studies (SCALPSS)



Electrodynamic Dust Shield (EDS)

CLPS CP11 Mission (IM)

Early/Mid 2024



Cooperative Autonomous Distributed Robotic Explorers (CADRE)