Lunar Surface Innovation
CONSORTIUM

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LSIC Newsletter

The Lunar Surface Innovation Consortium is administered by the Johns Hopkins Applied Physics Laboratory and operates in collaboration with the NASA Space Technology Mission Directorate under the Lunar Surface Innovation Initiative. Its purpose is to harness the creativity, energy and resources of the nation to help NASA keep the United States at the forefront of lunar exploration. To find out more, sign up to participate or access past additions of this newsletter, please visit lsic.jhuapl.edu.

LSIC Update

Director's Corner

Hello LSIC Community!

It was really fantastic to see so many of you at the LSIC Spring Meeting and Space Technology Competitive Opportunities Workshop in April! For those who were able to make it, either online or in-person, we invite you to let us know what you thought through the Slido poll here. Your feedback is extremely important to us; we will use it to determine how to balance the content in our next meeting, and to think about whether we need to try to find new options for making sure the meetings continue to be engaging.

This year's meeting had me reflecting on how much we have learned since our kickoff meeting three years ago. At that time, we knew that NASA was looking to engage more technology developers in the return to the Moon, but a lot of us were still trying to figure out how to contribute. Since that time, NASA's Space Tech has shared their envisioned futures for many technical areas, and investments have been made in developing some of the most critical first infrastructure services, such as surface power. I am thrilled to see that the Moon to Mars objectives explicitly identify areas where industry or academia can bring their skills and knowledge to bear and help NASA solve key challenges. It is also inspiring to see that recommendations that have come from both within LSIC and beyond, about being mindful in our approach now, considering standardization of interfaces, responsible use, and coalition building both inside of and between nations, have been heard, and in many cases codified into the plan itself.

I encourage all of you to share the excitement and challenges of this effort with your friends, family, and others. Let's keep the discussions going, as we go forward to the Moon together!

Rachel Klima
Director, Lunar Surface Innovation Consortium
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Focus Areas

Monthly Telecon Schedule

Dust Mitigation
Third Thursdays at 12PM Eastern

Excavation & Construction
Last Wednesdays at 2PM Eastern

Extreme Access
Second Thursdays at 3PM Eastern

Extreme Environments
Second Tuesdays at 3PM Eastern

In Situ Resource Utilization
Third Wednesdays at 3PM Eastern

Interoperability
First Wednesdays at 1PM Eastern

Surface Power
Fourth Thursdays at 11AM Eastern

LSIC General Updates

Save the Date: Lunar Proving Grounds Workshop, July 12–13

The Lunar Surface Innovation Consortium (LSIC) will host a hybrid Lunar Proving Grounds Workshop on July 12–13, at the Johns Hopkins Applied Physics Laboratory (APL) in Laurel, Maryland. The topics of test facilities and Earth-based Lunar Proving Grounds (LPG) have come up across all six Focus Areas of LSIC, and component- and instrument- level testing have been developed extensively at various facilities across the U.S. 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 LPG Workshop, we will dive into these topics and explore the requirements and characteristics that will be necessary for a unified LPG.

While the LSIC Lunar Proving Grounds Workshop will be offered in hybrid format, we strongly encourage in-person participation, if possible, in order to maximize discussion and collaboration opportunities. A tentative agenda and a link to register will be disseminated shortly. Registration is free but required for participation, and a catered lunch may be purchased during the workshop registration process if desired.

Additional Upcoming Meetings

- Lunar Proving Grounds Workshop, July 12–13 (hybrid)
- Surface Power Reliability Workshop, July 26–27 (virtual)
- Joint Excavation & Construction/Extreme Access Autonomy Workshop, August 21 (virtual)
- 2023 LSIC Fall Meeting: October 10–12 (hybrid) & Transition to Industry Workshop
  Hosted by Community College of Allegheny County, Pittsburgh, PA
- 2024 LSIC Spring Meeting: Week of April 22, 2024 (hybrid)
  Johns Hopkins Applied Physics Laboratory, Kossiakoff Center, Laurel, MD

LSIC harnesses the creativity, energy, and resources of the nation to help NASA keep the United States at the forefront of lunar exploration. LSIC operates in collaboration with the NASA Space Technology Mission Directorate under the Lunar Surface Innovation Initiative, fostering communications and collaboration among academia, industry, non-profits, and government. Visit http://lsic.jhuapl.edu for more information.

Focus and Working Group Updates

Dust Mitigation

The Dust Mitigation (DM) Focus Group held its monthly focus group meeting on April 20. The meeting centered on the topic of "Dust Mitigation in Spacecraft and Testing Facilities," and featured technology presentations by Morgan Steadham, APL, on "Dust and Particulate Mitigation for Flight Hardware in APL Cleanrooms," and by Todd Peters, NASA Johnson Space Center, on "Lunar Surface Environment Test Capabilities – JSC B351." In addition, we also discussed monthly LSIC updates, upcoming opportunities, and provided an update on our DM subgroups. If you are interested in leading or joining a DM Subgroup, please fill out our survey.

You can view the recording, slides, and notes from April's DM Focus Group meeting and previous meetings on the LSIC Dust Mitigation Focus Group page.

Update on the 2nd LSIC Dust Mitigation Workshop: The workshop has been moved to early fall 2023 to deconflict with other workshops held in the spring. This workshop is a follow-on to the successful LSIC Dust Mitigation Workshop held in 2021 and will feature a combination of invited presentations from NASA and the community, contributed talks, and breakout discussion sessions. Dates will be announced!

Our next focus group meeting will be held Thursday, May 18, at 12:00 p.m. EST. The meeting will include featured technology presentations along with a discussion session. We look forward to seeing you then!

Excavation & Construction

The Excavation and Construction (E&C) Focus Group hosted a meeting on April 18, which was scheduled outside of our usual meeting cadence to enable our community to participate in the LSIC Spring Meeting and the adjacent Space Tech Competitive Opportunities Workshop. We heard from two sets of speakers. Hung Nguyen serves as the Director of Virtual Design and Construction at Herrero Builders. His talk was a follow-on to the March monthly meeting, and focused on "Terrestrial Outfitting Approaches & Key Technologies." Our second talk was led by Mary Lang, a principal at YU & Associates, and collaborators, and discussed "Master Planning for Aviation Projects and Applications to a Lunar Base."

This meeting was followed by two breakout sessions for our four subgroup communities — one breakout room for Autonomy & Site Planning and Additive Manufacturing & Raw Materials, and another covering Site Prep, Horizontal & Vertical Construction and Outfitting & Maintenance.

Extreme Access

In April, Extreme Access featured a presentation from Chuck Quintero on a "Conceptual Design for a Communications Network for Earth-Lunar Communications." We also continued to work on starting up an autonomy subgroup, and are targeting June for its first meeting. In other autonomy news, the joint workshop on autonomy with Excavation and Construction is scheduled for August 21, and we will be releasing a signup form and other information over the next couple of months. We also submitted our draft on communications and position, navigation, and timing to the LSIC community-driven whitepaper and discussed it at a session during the LSIC spring meeting.

Extreme Environments

April was a great month for LSIC EE-ers! Our monthly meeting featured two NASA Small Business Innovation Research (SBIR) awardees: Ilya Ponomarev from Euclid Techlabs LLC for "Single Event Burnout Hardened High-power Quasi-lateral Diamond Transistor," and Brian Elliott from TDA Research for "Rechargeable Batteries with Improved Discharge Capacity at -40°C to -60°C for Surviving the Lunar Night." The LSIC EE Confluence site contains the presentation slides and meeting recording. These incredible initiatives are part of the 2022 NASA SBIR technology portfolio that targets the unique challenges associated to the lunar surface radiation and thermal environments. We hope to follow these technologies as they mature and become candidate solutions for lunar surface systems!

The 2023 LSIC Spring Meeting was a wonderful in-person venue for EE-ers, with many joining us in a meet-and-greet dinner on Monday night — thank you! With the announcement of the 2023 LSIC Fall Meeting in October, our goal is to repeat the tradition and have an even larger table reservation!

While the LSIC EE monthly meeting for May is cancelled, we will still hold several LSIC EE subgroup meetings, to be announced via e-mail and the LSIC EE Confluence site. Reminder — we are still looking for an External Hazards Subgroup lead to join our team. For more information, please contact our EE facilitator, Dr. Milena Graziano.

In June, our monthly LSIC EE Focus Group meeting will update our community on some exciting upcoming events and another set of NASA SBIR awardees, including Jeffrey Olson from Lockheed Martin and Darren King from CU Aerospace, who will speak on "Three-Stage Cryocooler Cold Head for Advanced Heterodyne Sensors." Don't miss it!

In Situ Resource Utilization

The April ISRU monthly telecon was canceled due to its close proximity to the LSIC Spring Meeting as we focus on preparing and ramping up for this exciting meeting! There have been several other exciting meetings and events happening this month as well that we've encouraged folks to attend, such as Space Resources Week and Space Symposium. We anticipate having much to think on and discuss at the following May telecon as a result of the many workshops and meetings this month! In addition to a recap of thoughts and takeaways from the LSIC Spring Meeting, the May ISRU telecon will feature a talk from Richard Wainner at Physical Sciences, Inc. on the status of their metal extraction technologies, and a talk from Randy Villahermosa at SpinLaunch on the application of their technology for the use of lunar-derived resources.

Surface Power

The April Surface Power telecon featured presentations from the 2020 Lunar Surface Technology Research (LuSTR) awardees for Power. After APL's Julie Peck provided a brief overview of the LuSTR program, Art Witulski (Vanderbilt) discussed recent experimental investigations into the effects of single-events on SiC high-voltage power devices. In particular, the project aims to identify components (diodes and power transistors) for a 1kV DC lunar microgrid that experience no heavy-ion induced destruction upon irradiation. Following the completion of electrical and heavy-ion testing on recently fabricated SiC MOSFETs, Professor Witulski plans to present a final overview of the project's results at the 2023 LISC Fall Meeting. Additionally, Jin Wang (OSU) presented initial results from a pair of STMD-funded projects: "Flexible DC Energy Router based on Energy Storage Integrated Circuit Breaker" (LuSTR, 2020) and Ohio State's "Electric Moon" team's 2022 Watts on the Moon Phase II award. Dr. Wang's talk detailed a novel grid modeling approach that links computational resources with an experimental setup. Moreover, the state-of-the-art modeling and simulation tools developed in his group are all publicly available to the community. If you are interested in presenting at a future telecon, or coordinating a meeting with the APL Surface Power team, please don't hesitate to reach out through the Surface Power web page.

The Surface Power Focus Group's monthly telecon on May 25 will feature presentations and a panel discussion with all three Vertical Solar Array Technology (VSAT) Phase II awardees. Chuck Taylor (NASA VSAT Project Manager) will moderate the discussion portion of the event. VSAT Business Lead Ryan Wiseman will present for Lockheed Martin, VSAT PI Dean Bergman will represent Honeybee Robotics, and Project Manager John Landreneau will speak on behalf of Astrobotic. The following month's telecon (June 22) will address power requirements for lunar habitats and the potential for power generation waste heat utilization by bioregenerative life support systems.

The Surface Power team will host a two-day virtual workshop on the topic of Power System Reliability on July 26 and 27. Keynote speakers will include ISS Program Probabilistic Risk Assessment creator and manager Clay Smith (APL), NASA JSC EHP Lunar Power Lead Blanca Lara,

NASA Principal Technologist for Power and Energy Storage John Scott, and retired NASA Senior Power Technologist Jim Soeder. Additional speakers from the DoD, terrestrial power industries, and NASA's Office of Safety and Mission Assurance (SMA) will add a broad range of perspectives to panel discussions. We welcome abstract submissions from the LSIC power community as well! Registration and abstract submission details will be released soon.

Interoperability Working Group (formerly Modular Open Systems Approach)

On April 5, Travis Thompson from Southwest Research Institute (SwRI) delivered a presentation on Vehicular Integration for C4ISR/EW Interoperability (VICTORY). It was a great telecon that presented what VICTORY is and the lessons learned. You can find the recording on our website. At the May 3 telecon, Ben Pearson, Strategic Planner at Lockheed Martin (LM) Space, presented on LM's Lunar Mobility Vehicle and its modular payload hosting capabilities.

We wanted to let everyone know that the MOSA Working Group is now named the Interoperability Working Group to reflect the broader scope of interests that are related to interoperability. You will start seeing the name change reflected in our various platforms.

Lunar Simulants Working Group

Our main activity in April has been promoting the Lunar Simulants Working Group (LSWG) and gearing up for our Speaker Series — talks on research with simulants from the community at large. To prepare for the speaker series, we started an email listserve for those interested in being a part of the LSWG, and hearing about simulants and simulant research. Please email Karen Stockstill-Cahill if you would like to be added to this list. We are also interested in hearing about your simulant-related research, and are accepting suggestions for topics you'd like to hear more about. If you have an idea or would like to volunteer to speak, please email Karen. Finally, we continue to monitor the LSII Lunar Simulant User Needs Survey, which helps us to advise NASA on the current and upcoming simulants needs.

Feature Articles

LSIC Spring Meeting — Summary

The Lunar Surface Innovation Consortium (LSIC) 2023 Spring Meeting was held on April 24–25 at the Johns Hopkins Applied Physics Laboratory in Laurel, MD. The theme of this year's meeting was to learn more about NASA's Moon to Mars (M2M) architecture, as well as how government is working across agencies to support the goal of returning humans to the surface of the Moon, to stay. In total, 550 people attended, either virtually or in person, over the course of two days. Based on the registrations, over 265 institutions were represented. Half of those who registered for the meeting have not previously worked with NASA's Space Technology Mission Directorate (Space Tech). The meeting was conducted in hybrid format, with questions being taken only via a digital tool, in an effort to provide a more equitable experience for online attendees.

The first day of the meeting focused on NASA's M2M strategy, specifically as is relates to technology development for a sustained presence on the Moon. The morning began with a keynote address from Dr. Kurt "Spuds" Vogel, NASA Director of Space Architecture, who provided background on the architecture of the M2M plan, specifically highlighting areas where the technology community could provide feedback to the plan, as well as where NASA anticipated there being onramps for industry to contribute to the program. This was followed by a keynote by James Reuter, NASA Associate Administrator for Space Tech, who provided information about the goals of Space Tech, background about the many transformative technologies that have been developed by various Space Tech programs, and the importance of fostering a space economy. The remainder of the day centered on the work of the space technology community, from the efforts underway with the LSIC focus groups, technology developments for in situ resource utilization and power being made by teams through the Lunar Surface Technology Research (LuSTR) program, and finally an assortment of advancements presented by community members through lightning talks, and a poster session.

Panel discussion, Day 2. (L-R: Spuds Vogel, Matt Daniels, Stefanie Tomkins, Pamela Melroy, Walt Englund)

The second day of the meeting centered on the "bigger picture" — how government agencies are working together to establish a human presence on and around the Moon, and to ultimately move humanity deeper into the Solar System. The session began with a keynote address by Pamela Melroy, Deputy Administrator of NASA, who focused on the synergy between the infrastructure development and the science that will be enabled on the Moon as that infrastructure is established. This was followed with talks by Dr. Stefanie Tompkins, Director of DARPA, and Dr. Matthew Daniels, Assistant Director for Space Security and Special Projects, White House Office of Science and Technology Policy (OSTP). They spoke about the broader cislunar environment, and how collaboration across U.S. government agencies, as well as with international partners, can help to achieve the goal of carrying humanity peacefully beyond Earth, stimulating technologic and economic development in the process. These speakers were then joined by Spuds Vogel to

explore these topics in more detail through a panel discussion, moderated by Walt Engelund, Deputy Associate Administrator for Programs, NASA Space Tech.

After a break, the program moved to implementation; specifically, Brad Bailey, Assistant Deputy Associate Administrator for Exploration at NASA, provided an update on the Commercial Lunar Payload Services (CLPS) program, which seeks to foster more frequent and less expensive access to the lunar surface through commercial providers. After his update, he was joined on a panel by representatives from several of the CLPS vendors, including Astrobotic, Ceres Robotics, Draper, Firefly, and Intuitive Machines. Together, they discussed their experiences with the CLPS program, how it has enabled development within the companies, how it could be improved, and how it might be used as a model for future commercial endeavors in space. After this meeting, an iSpace representative gave a brief but timely comment on their attempted lunar landing, which took place during the panel.

The meeting moved on to looking at the more distant future, with a panel discussion about long-term use cases and the technologies that enable them. The panel began with an introduction by Shatel Bhakta, Agency Lunar Architecture Team Lead for NASA, who provided additional background about the M2M architecture. He was joined by Carla Haroz, Antarctic Operations Manager at the National Science Foundation, Kristina Gibbs, Deputy Director of SSERVI at NASA, Timothy Cichan, Space Exploration Architect at Lockheed Martin, Kristen John, Technical Integration Manager for Lunar Dust Mitigation at NASA, and James Mastandrea, LSIC Interoperability Working Group Lead at APL. The panel discussed near term technologies and strategies that support a long-term presence, such as interoperability efforts and dust mitigation, as well as the long-term mission pull that can utilize the infrastructure and lessons learned from terrestrial outposts and the ISS.

In the last session, the group discussed a series of findings, distilled from questions raised and discussion sessions held at the meeting. High-level findings included:

- The community is supportive of the M2M architecture, and advocates for further development of the sustainable lunar phase. NASA's transparency in their process is well-received, and the community appreciated the candor of discussion even when no definite answer was possible.
- Many international participants voiced their questions and comments, showing global interest in NASA's objectives.
- Activities on the lunar surface will be critical for retiring risks and learning to live off-world, both for commercial confidence and to advance NASA exploration goals.
- Further development of the plans for transitioning infrastructure development, maintenance, and services to industry is desired.
- Continued discussion about interoperability, among industry and throughout the international community, is needed.
- Now that the architecture plans from NASA are more robust and publicly available, the audience would enjoy hearing more technical details about specific projects by members of the community.

Videos of the event can be accessed on the LSIC Spring Meeting page.

LSIC Space Technology Competitive Opportunities Workshop — Summary

POC: Angela Dapremont

The LSIC workshop: Space Technology Competitive Opportunities was held on April 26, the day after the 2023 LSIC Spring Meeting, at JHU/APL. The objective of the half-day workshop was to provide LSIC members with resources and knowledge about NASA Space Technology Mission Directorate (STMD)-solicited proposal opportunities. The meeting included 271 registered individuals, representing over 160 institutions, the majority of which came from the commercial sector.

Chris Baker, Program Executive for Flight Opportunities at NASA, addresses attendees during the Space Tech Competitive Opportunities workshop.

Workshop content was split into three components, the first of which was an early morning session featuring a series of NASA STMD program executives, directors, and leads providing details (e.g., award types, eligibility) about NASA STMD proposal opportunities. Representatives from NASA Techport also debuted a new online tool, showcasing the NASA portfolio of active technology projects, that can be used by LSIC members as a resource for STMD proposal opportunities. The second workshop component was a mid-morning presentation focused on the NASA Funding Process. A talk delivered by APL Space Exploration Sector Senior Advisor, and former NASA Goddard Space Flight Center Director, Dennis Andrucyk detailed how NASA receives funding from both an Executive and Legislative Branch perspective. The third and final workshop component consisted of advice-based panel discussions, along with question-and-answer sessions, from previously successful SpaceTech proposal awardees. These awardees and NASA program managers from the following STMD proposal opportunities discussed and answered questions about:

- Grant Opportunities (e.g., LuSTR, NSTGRO, NIAC, I-corps)
- Annual Contract Opportunities (e.g., SBIR, STTR, CCRPP)
- Flight Opportunities
- Funded and Unfunded Space Act Agreements Opportunities (e.g., ACOs, Tipping Points)
- Unique One-time Contract Opportunities (e.g., Vertical Solar Array, Fission Surface Power).

The workshop concluded with a Networking Lunch, during which NASA representatives from these opportunities interacted and engaged in discussion at “topic tables” designated by funding opportunity. The networking lunch also included a brief presentation about the 2023 NASA Science Mission Directorate (SMD) Entrepreneurs Challenge which has, in part, a lunar focus this year to commercialize and develop lunar payloads through an entrepreneurial and venture lens, with the aim of advancing NASA science exploration goals.

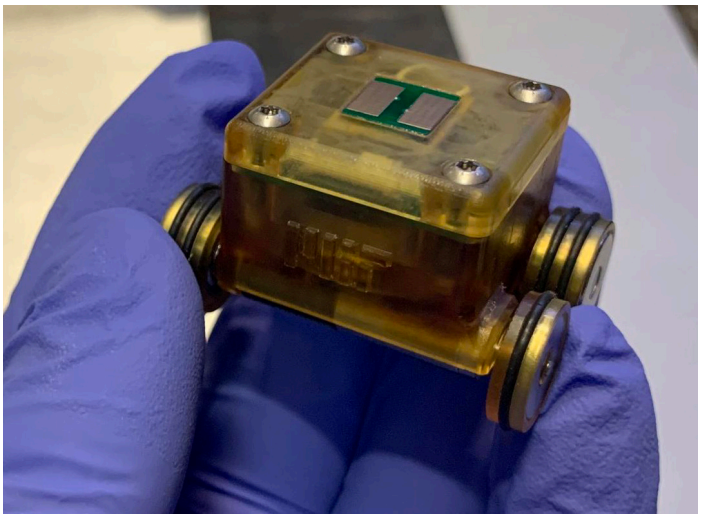
The half-day workshop was run in a hybrid format. Questions during both morning sessions were taken using a digital tool in an effort to provide a balanced experience for online and in-person attendees. During the breakout sessions, questions were taken both in person and via Zoom.

The online program booklet is available now on the LSIC Workshop page. Videos and presentations from the event will also be added to that page.

Member Spotlight: MIT Media Lab's AstroAnt

By: Michael Buckley

If mission plans play out, not long after Lunar Outpost's Mobile Autonomous Prospecting Platform (MAPP) begins rolling over the dusty lunar surface, a 1- by 1-inch microrover will emerge from an equally small "garage" and move across MAPP's top deck. Secured by magnetic wheels and with a temperature sensor on its belly, the tiny rover will monitor the heat emanating from MAPP's radiator.



The AstroAnt team includes Ariel Ekblaw, the Lunar Mission principal investigator and MIT Space Exploration Initiative director; Sean Auffinger, mission integrator; Joseph Paradiso, academic advisor; Fangzheng Liu, lead engineer; Nathan Perry, software engineer; and Tobias Röddiger, hardware engineer. Learn more about the AstroAnt program. (Credit: Fangzheng Liu)

The team at the Massachusetts Institute of Technology's Media Lab Space Exploration Initiative developed this tiny tracker — called AstroAnt — and say this first demonstration could open the door for other technologies designed to monitor mechanical systems in extreme environments.

"Many things we develop for the Moon — small sensors, for example, or low-temperature batteries — can also be used for exploration on other planets and throughout the rest of the solar system," said Fangzheng Liu, a second-year PhD student at MIT who leads the project. "It's very exciting."

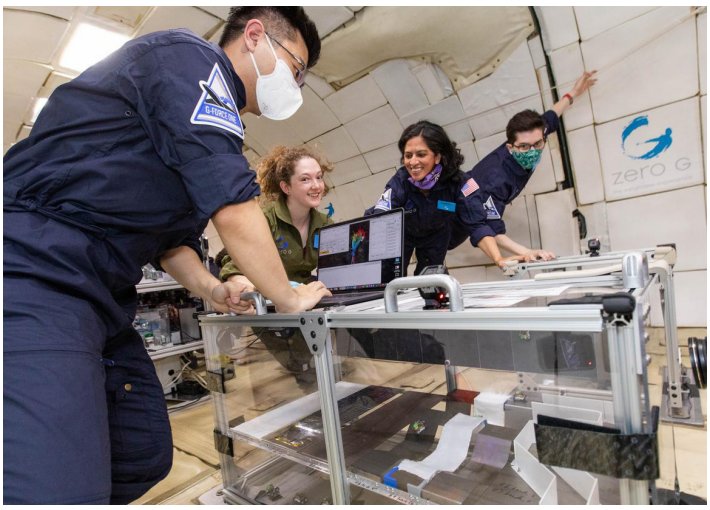
AstroAnt will head to the Moon on an Intuitive Machines Nova-C lander, expected to launch by the end of this year. Nova-C will be carrying the MAPP rover, itself equipped with Nokia LTE/4G communications equipment. Over 12 days, MAPP will traverse the lunar surface and enable Nokia to collect performance data on its communications system. And AstroAnt will be riding along, equipped with a thermopile, taking contactless temperature measurements of MAPP's radiator.

Liu said the effort builds on the MIT Media Lab's work on a mini robotic swarm called Rovables, which could move freely on unmodified clothing (think of the thermal fabric that covers many space systems) each equipped with its own battery, microcontroller and wireless communications. He said he could see the concept developing into a suite of autonomous robotic swarms for spacecraft assembly and external servicing in lunar orbit. Each robot is equipped with four magnetic wheels, which keep it connected to any magnetic surface, and can carry a small payload such as an infrared or visible camera, a temperature sensor, or a small actuator (to feel for cracks or other structural flaws).

The team has crafted two AstroAnt models, successfully testing each on parabolic flights that simulate low- and zero-gravity environments. "The robots showed good mobility on surfaces made up of different materials, including beta cloth simulant, steel, and aluminum with magnetic paint," Liu

said, adding that the rovers can also overcome obstacles with angles up to 70 degrees.

MIT will actually have two payloads on MAPP; the second is a small camera designed to create 3D imagery of various sites on the surface. Liu sees opportunities for students in lunar exploration growing as missions become more frequent and technologies become more familiar — much in the same way CubeSats have become a standard, low-cost platform for student payloads in low-Earth orbit.



AstroAnt undergoes testing on a Zero-G flight. (Credit: Fangzheng Liu)

For now, though, he acknowledges and appreciates the rare chance to send hardware to the Moon, given the resources required to develop, launch and then operate lunar technology.

"Getting to the Moon is very complicated, and it's not something you can accomplish by yourself," he said. "It takes teamwork, and you need to collaborate with other organizations, like we're doing with Lunar Outpost and Intuitive Machines."

"Launching those relationships is a goal of the Lunar Surface Innovation Consortium," said LSIC Director Rachel Klima, of the Johns Hopkins Applied Physics Laboratory.

"We've found that industry members are eager to make connections with talented students," she added, "especially companies that don't have a pipeline to schools to find students with the expertise they're looking for."

NASA and Community News

Moon to Mars Objectives Advanced through ACO

04/28/2023 \\ The Journal of Space Commerce \\ Tom Patton
https://exterrajsc.com/moon-to-mars-objectives-advanced-through-aco/2023/04/28/

Moon Mission Failure: Why Is It So Hard To Pull Off a Lunar Landing?

04/27/2023 \\ Nature \\ Alexandra Witze
https://www.nature.com/articles/d41586-023-01454-7

NASA Sets Coverage for Czech Republic Artemis Accords Signing Ceremony

04/26/2023 \\ NASA HQ \\ Jackie McGuiness \\ Roxana Bardan
https://www.nasa.gov/press-release/nasa-sets-coverage-for-czech-republic-artemis-accords-signing-ceremony

NASA Successfully Extracts Oxygen from Lunar Soil Simulant

04/25/2023 \\ NASA \\ Rebecca Wickes
https://www.nasa.gov/feature/nasa-successfully-extracts-oxygen-from-lunar-soil-simulant

NASA Selects 12 Companies to Collaborate on Key Technology Development

04/25/2023 \\ NASA HQ \\ Sarah Frazier
https://www.nasa.gov/press-release/nasa-selects-12-companies-to-collaborate-on-key-technology-development

Blue Origin Participates in a New Round of Collaborations with NASA on Space Tech

04/25/2023 \\ GeekWire \\ Alan Boyle
https://www.geekwire.com/2023/blue-origin-participates-in-a-new-round-of-collaborations-with-nasa-on-space-tech/

Moon to Mars Architecture Concept Review Released by NASA

04/24/2023 \\ The Journal of Space Commerce \\ Tom Patton
https://exterrajsc.com/moon-to-mars-architecture-concept-review-released-by-nasa/2023/04/24/

Lunar Terrain Vehicle Bidders Detail Concepts as Contest Heats Up

04/21/2023 \\ Aviation Week Intelligence Network \\ Guy Norris
https://aviationweek.com/defense-space/space/lunar-terrain-vehicle-bidders-detail-concepts-contest-heats?check_logged_in=1

Lunar Outpost Joins Lockheed Martin Rover Consortium

04/19/2023 \\ Silicon Luxembourg \\ Jess Bauldry
https://www.siliconluxembourg.lu/lunar-outpost-joins-lockheed-martin-rover-consortium/

Private Companies Are Flocking to the Moon — What Does That Mean for Science?

04/18/2023 \\ Nature \\ Alexandra Witze

https://www.nature.com/articles/d41586-023-01045-6

NASA Shares First Moon to Mars Architecture Concept Review Results

04/18/2023 \\ NASA HQ \\ Rachel Kraft

https://www.nasa.gov/press-release/nasa-shares-first-moon-to-mars-architecture-concept-review-results

NASA May Build More Than One Moon Base for Artemis Lunar Missions

04/18/2023 \\ Space.com \\ Tariq Malik

https://www.space.com/nasa-artemis-base-camp-more-moon-bases

How to Build A Robot Arm that Can Flex in the Moon's Frigid South Pole

04/17/2023 \\ PHYS ORG \\ Corinne Purtill

https://phys.org/news/2023-04-robot-arm-flex-moon-frigid.html

PickNik Robotics and Motiv Space Systems Partner to Develop Advanced Robot Arm Capabilities

04/13/2023 \\ Robotics 24/7 Staff

https://www.robotics247.com/article/picknik_robotics_motiv_space_systems_partner_develop_advanced_robotics_capabilities/

First Test of Perovskite Films in Space Indicates More Resilience than Researchers Expected

04/12/2023 \\ UC Merced Newsroom \\ Lorena Anderson

https://news.ucmerced.edu/news/2023/first-test-perovskite-films-space-indicates-more-resilience-researchers-expected

Entrepreneurs Challenge

04/11/2023 \\ NASA SMD

https://www.nasa.gov/feature/nasa-s-entrepreneurs-challenge-to-advance-science-focused-technologies

Scientists Blasted Barbies with Liquid Nitrogen to Test a New Method of Moon Dust Cleanup — And It Worked Extremely Well

04/09/2023 \\ Space.com \\ Jennifer Nalewicki

https://www.space.com/barbies-blasted-liquid-nitrogen-moon-dust-cleanup

Who Will Deliver Lunar Pathfinder to the Moon Orbit?

04/01/2023 \\ ESA Business in Space Growth Network (BSGN)

https://bsgn.esa.int/2023/03/17/who-will-deliver-lunar-pathfinder-to-the-moon-orbit/

Funding Opportunities

Tech Development Opportunities

- **NASA Innovative Advanced Concepts (NIAC) Phase III**
  Final Proposals Due: May 17, 2023
- **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.) Remaining windows: March 2 – July 5, 2023, and July 6 – November 1, 2023.
- **Technology Advancement Utilizing Suborbital and Orbital Flight Opportunities "TechFlights"**
  Mandatory Preliminary Proposals Due: July 7, 2023; Full Proposals Due: October 4, 2023.
- **NASA Entrepreneurs Challenge 2023 — Round 1**
  Venture to the Moon and Beyond with NASA: Launching Lunar Payloads and Unlocking Climate Science! Round 1 Submission Deadline: June 28, 2023, 2:00 p.m. PDT.
- **Early Stage Innovations (ESI23)**
  NOI Due: June 7, 2023, 5:00 p.m. EST; Proposal Due: July 6, 2023, 5:00 p.m. EST.

Future Solicitations 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.
- **SmallSat Technology Partnerships**
  The Small Spacecraft Technology program's SmallSat Technology Partnerships (STP) initiative awards cooperative agreements to U.S. colleges and universities for projects that develop new technologies and capabilities for small spacecraft in collaboration with NASA centers. Technological advancements may be demonstrated in the laboratory environment or as suborbital, balloon, or orbital space flight demonstrations.