Lunar Surface Innovation CONSORTIUM

JOHNS HOPKINS APPLIED PHYSICS LABORATORY

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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.

DIRECTOR'S UPDATE

Director's Update

Hello LSIC Community! I've been spending a lot of time thinking about NASA's Moon to Mars objectives. In particular, it is exciting how many of the recurring tenets align with what we've discussed in our LSIC meetings over the last few years.

I think it is worth taking a bit of time to talk about some of these, and to think about how, as a technology community, we can continue to engage and advance these goals. Several of the goals, (RT1) International Collaboration, (RT2) Industry Collaboration, and (RT9) Commerce and Space Development, are clearly aligned with efforts to build partnerships throughout the community.

Many of you have spoken very clearly about how important it is to move forward together as an international effort, and I am so thrilled to see this codified in the document as an explicit goal for NASA. I hope that as an LSIC community we can continue to encourage partnerships and understand how each of us can play a role in this challenge to humanity, with enough friendly competition to push us to be our best, but with collaboration and openness, where possible.

It is fantastic to see Interoperability (RT7) mentioned explicitly, as so many of you have been advocating for interoperability and standards since our first meetings. We are working to engage others at NASA in conversations about Modular Open Systems Approach (MOSA), and hope to see that working group grow further.

Finally, two of the tenets, (RT5) Maintainability and Reuse and (RT6) Responsible Use show that NASA has heard the community's calls to think now about how humanity can move forward to the Moon (and beyond) in a better way–planning now for how to ensure peaceful relations and minimize (or even eliminate) waste as we explore our precious sister in the sky.

Thank you, again, for all of the work that you have done and the time you have contributed to provide input to the consortium and to NASA directly. What an exciting time this is!!

Rachel Klima
Director, Lunar Surface Innovation Consortium
SES-LSIC-Director@jhuapl.edu

Focus Areas

Monthly Telecon Schedule

Dust Mitigation (DM)
Third Thursdays at 12PM Eastern

Excavation & Construction (E&C)
Fourth Wednesdays at 2PM Eastern

Extreme Access (EA)
Second Thursdays at 3PM Eastern

Extreme Environments (EE)
Second Tuesdays at 3PM Eastern

In Situ Resource Utilization (ISRU)
Third Wednesdays at 3PM Eastern

Surface Power (SP)
Fourth Thursdays at 11AM Eastern

LSIC General Updates

As a reminder, If you don't have access to LSIC's Confluence wiki, please email Andrea Harman at ams573@alumni.psu.edu to get signed up.

CLPS Survive the Night Workshop (06-08 December 2022)

NASA's Science Mission Directorate (SMD) and the Space Technology Mission Directorate (STMD) are pleased to announce a workshop to facilitate collaboration between lander and rover providers and technology developers to share technologies that can enable survival through the lunar night. The Commercial Lunar Payload Services Survive the Night Technology Workshop is scheduled for December 6–8, 2022, at NASA's Glenn Research Center in Cleveland, Ohio, with an opportunity for virtual participation. General event information is available here: https://www.hou.usra.edu/meetings/clps2022/

Focus Group Updates

Dust Mitigation

The Dust Mitigation (DM) Focus Group held its monthly focus group meeting on October 20th. The focus group meeting centered on the topic of "Dust Mitigation Subgroup Networking." This was a follow-up to a networking activity earlier this year that was very successful, but too short based on participants' feedback. So, a full meeting was dedicated to the topic. The subgroups were organized into four breakout groups: Standards/Interoperability & Seals/Soft Goods/Fabrics, Mechanisms & Monitoring/Filtration, Modeling & Lunar Surface Modification, and Isolation Technologies & Materials/Surface Coatings. The breakout groups provided participants an opportunity to network and meet fellow dust mitigation enthusiasts, discuss interests in the subgroup topics and opportunities for future collaborations, and identify potential topics the subgroups want to cover in the new year. Individuals interested in joining one of the new Dust Mitigation subgroups can sign-up by filling out the interest form at the following link: https://docs.google.com/forms/d/e/1FAIpQLScB6iT2fgPqj2zIaP0s-rwWQDQ04TPfgVyiC5zn0AQPAT5CZA/viewform

You can view the recording, slides, and notes from October's DM FG meeting and previous meetings at our LSIC Dust Mitigation Focus Group page on the LSIC website: https://lsic.jhuapl.edu/Our-Work/Focus-Areas/index.php?fg=Dust-Mitigation.

Our next focus group meeting will be held on Thursday, November 17th at 12:00 pm Eastern Time. The meeting will include featured technology presentations along with a discussion session. We look forward to seeing you then!

Excavation & Construction

In October, the Excavation and Construction (E&C) Focus Group did not host a monthly meeting, to allow our community to focus on attending conferences including AIAA ASCEND and the upcoming LSIC Fall Meeting – which has a focus on Excavation & Construction!

We look forward to seeing everyone there, and plan to hold our next monthly focus group meeting in November. In the meantime, you can ask questions, share resources, and connect with the four E&C Subgroups: Autonomy & Site Planning (https://lsic-wiki.jhuapl.edu/x/qoaXAQ), Additive Manufacturing & Raw Materials (https://lsic-wiki.jhuapl.edu/x/rYaXAQ), Site Prep, Horizontal & Vertical Construction (https://lsic-wiki.jhuapl.edu/x/slaXAQ), and Outfitting & Maintenance (https://lsic-wiki.jhuapl.edu/x/tIaXAQ) on Confluence.

Extreme Access

At the main Extreme Access telecon this month, we spoke with membership about plans for spring activities, and received feedback on how to better communicate information about EA activities such as subgroup meetings. The communications subgroup had a presentation from Tom Wagner at Advanced Space about the CAPSTONE mission and its progress to date. The PNT subgroup discussed draft 4 of the LunaNet Interoperability Standards and held the first meeting of its PNT paper reading group on October 24.

We continue to work on organizing an open source in aerospace supersized telecon for the spring, and hope to have details worked out in time for the December newsletter.

October activities also included notifying members of opportunities to speak with NASA leadership at the AIAA ASCEND conference, and organizing an opportunity for Extreme Access members to meet each other in person during the conference.

For November, our main EA activity will be the fall meeting at the beginning of the month. We will be organizing an EA meetup at that meeting – look for details to be announced on the Extreme Access listserv.

Extreme Environments

Extreme Environments is getting ready for a new agenda and some new faces in our subgroup leads! In October, our subgroup leads did some amazing overviews of the work they have done since we last checked in. In that meeting, we introduced Dr. Michael Zimmerman, our new “Space Weather and Plasma” subgroup lead, and Dr. Milena Graziano, who will lead the new subgroup “External Hazards”. To learn more about External Hazards, please visit Confluence (https://lsic-wiki.jhuapl.edu/x/xYMZ) for a proper introduction. This new subgroup will kick off in November. We will not hold a monthly meeting in November since it’s so close to the Fall Meeting. In December, we will start our deep dive into SBIR/STTR solicitations applicable to Extreme Environments. As always, if community members have ideas for what they would like to see or discuss, please reach out to any member of EE leadership.

ISRU

The ISRU Focus Group returned to its regular schedule on the 19th, just three weeks after our last meeting, which occurred at the tail end of September. Karl Hibbitts (APL) gave a debrief of the LSSW-18 Workshop: Implementing a Coordinated Lunar Resource Evaluation Campaign, which we participated in during mid-October. LSSW-18 featured panel discussions on policy and space law, and stakeholder perspectives on a water ice evaluation campaign. At our monthly meeting, we also had a presentation by Paul Burke (APL) on modeling of bubble formation and detachment during molten regolith electrolysis and water electrolysis in 1 g and 1/6 g gravity fields. We are currently working on refining the subgroups to foster more engagement and collaboration within the community. Stay tuned for next month's ISRU meeting, which will likely serve as a joint November/December telecon with December being cancelled for the holidays. We look forward to seeing you all at the LSIC Fall Meeting in early November!

Surface Power

This month the Surface Power (SP) team attended the AIAA ASCEND conference that had significant focus on the Moon, Artemis, and how humans can live sustainably on the Lunar surface. John Scott (Principal Technologist for Power and Energy Storage, Space Technology Mission Directorate) held a roundtable discussion on Lunar Power, and it was great to see so many from the LSIC Surface Power community participate in the discussion. Finally, we had a well-attended lunchtime meet up for the LSIC SP community; we really enjoyed meeting so many of you face-to-face and look forward to many more of these interactions in the future.

On Thursday, October 27th we had our monthly telecon which featured the theme of Space Power Integration and Testing. We had two great talks by Annette Dolbow of JHU/APL and by Lee Mason and Jeff Csank of NASA Glenn Research Center (GRC). Annette spoke about the challenges and considerations that need to be addressed when designing modern spacecraft power systems, focusing on component level testing and touching on some important lessons learned from her experience integrating NASA spacecraft. Lee and Jeff debuted a notional NASA plan for a distributed power system test capability at GRC called Adaptable Surface Power Integration & Research (ASPIRe). They detailed the need to provide power system testing across mission directorates, industry, and government and presented a plan for addressing this wide range of needs. NASA is soliciting feedback on this plan, so please view the session recording on the LSIC website at your leisure and provide feedback here on confluence (https://lsic-wiki.jhuapl.edu/x/qwQiAw).

The next Surface Power Focus Group telecon will be at 11:00 AM EST on December 1st, where the APL SP facilitators will present an overview of the past year of activities and events within the focus group, and provide a forum to solicit feedback and input from the community to guide 2023 activities.

Working Group – Modular Open Systems Approach (MOSA)

Interoperability continues to be a major topic in October after the release of the NASA's Moon to Mars Objectives (https://www.nasa.gov/sites/default/files/atoms/files/m2m-objectives-exec-summary.pdf), where interoperability, maintainability, and reuse are identified as Recurring Tenets. The MOSA Working Group participated in the AIAA ASCEND conference and presented on a lunar interoperability In-Situ Resource Utilization case study.

The existing interoperability and standards list continues to grow on Confluence, with several new additions this month. We invite the LSIC community to feel free to drop a comment on this Confluence page (https://lsic-wiki.jhuapl.edu/x/3IQxAg) with any suggestions or updates for the list.

MOSA has moved on the LSIC website, you can find us under "Our Work". If you are interested in joining the MOSA WG or need a Confluence account, please email Andrea Harman at ams573@alumni.psu.edu.

Working Group – Simulants

In October, Dr. Lucas de Melo (JHU) was able to complete repairs to the shear strength equipment once replacement parts arrived and he completed final testing of lab equipment to ensure proper operation and calibration. This allowed the APL-LSII Lunar Simulants team to finish the final geotechnical tests on the eight lunar regolith simulants. We will analyze all the data and incorporate it into our 2022 assessment. Dr. Karen Stockstill-Cahill also met with the NASA LSII Simulants Team to coordinate our support for their activities and projects. In particular, we are working together to analyze geotechnical data collected for the 2022 Assessment to fully define the geotechnical characteristics of the simulants included in the study. In addition, we are working together to analyze the responses to the Lunar Simulants Survey to fully understand the simulants needs of NASA and the broader community and to direct our future activities.

Feature Article

A Brief Summary of Lunar Technology as explored in the Planetary Decadal

By Caleb Fassett and Stacy Teng of the JHU Applied Physics Laboratory

The Planetary Decadal Survey for 2023-2032 ("Origins, Worlds, and Life") was released in April 2022 by the National Academy of Sciences. The Decadal Survey process engages the planetary science community to provide inputs to NASA to determine science priorities for the following decade. The broad science themes outlined by the current Decadal were the origin of the solar system and its planets and moons, planetary processes, and astrobiology. The report also discussed future needs in planetary defense, and how studying our solar system can be used to learn about exoplanetary system and vice versa. Investments in technology development for planetary exploration were examined with an emphasis on how "early and substantial investments" in technology is necessary to enable cutting-edge planetary exploration missions. These investments can be made both directly by NASA or by incorporating technology advanced by academia, industry, and other government.

The goal of this short summary is to list some of the findings from the Decadal Survey especially relevant to technologies for lunar surface exploration (Since this summary distills a 30-pg chapter of an 800-pg report to 1.5 pages, it cannot capture every nuance. The full report is here: http://nap.nationalacademies.org/26522; see Chapter 21 for the Technology chapter). Several of the key programmatic findings related to technology were:

- **There is a lack of information on the expected return of current investments.** While enabling technologies warrant funding, investments in enhancing or dormant technologies can be more cost-effective. Publication of metrics for technology developments would be valuable for guiding smart investments.
- **Currently, there is imperfect transparency about what technology activities NASA is prioritizing,** and how funding is allocated between different priorities. More open, transparent technology development plans would enable the broader science and exploration community to be better prepared to take advantage of NASA's technology work. New avenues for community input into NASA's technology development priorities was also recommended.
- **Challenges remain in incorporating new technologies into missions.** New technologies are not being integrated into flight projects because they are deemed too risky, even if they might improve mission capabilities and science return. Figuring out how to bring TRL-6 level technologies to flight remains an issue.

The Decadal listed out specific technology areas meriting investment this decade. Those with relevance to lunar exploration are listed below with relevant LSIC focus group areas in parentheses:

- **Instruments for science measurements** on the surface and in orbit with improved sensitivity/ dynamic range, spectral and spatial coverage and resolution, and reduced mass/power/volume;
- Technologies for **sample handling, processing, and analysis** (ISRU);
- Advancements in **autonomy**, at the system and subsystem level, for making decisions and executing operations in remote and complex environments (Extreme Access);
- Technologies for handling and overcoming **challenging environments** with extreme temperatures, pressures, radiation, and dust accumulation issues (Extreme Environments; Dust);
- Technologies that enable operations in, and return of samples from, **cryogenic conditions**, such as found at the lunar poles (Extreme Environments; Extreme Access);
- Improved **communication** systems (Extreme Access);
- Improved **power** systems, including radioisotope thermoelectric generators, solar arrays, and batteries (Power);
- Technologies for precise **deorbit, descent, and landing**, including terrain relative navigation / hazard detection & avoidance, and high-ISP, throttleable engines (Extreme Access).
- Improved **surface mobility**, as enabled by advances in autonomy and mechanical endurance (Extreme Access; Extreme Environments).
- Technologies for **subsurface access** and drilling, particularly at depths >1-2m (Excavation and Construction).

The Decadal endorsed the Endurance-A rover, a mission to complete a long traverse across South Pole-Aitken basin and collect samples for eventual return by astronauts (NASA/PSD's initial response to the Decadal noted that other implementation options for the goals of Endurance-A would be explored). Several other long-range rovers were also studied, including the Intrepid mission for a long traverse to explore volcanic terranes on the lunar near-side, and INSPIRE, which would be a longer and deeper traverse across potentially ice-bearing regions at the lunar poles than will be accomplished by the VIPER rover. Although these latter two missions were not prioritized, the interest in their goals highlights the desire for investments in autonomy, which is especially critical for operating in darkness and when even slight communication delays limit traverse speed.

Additionally, the extreme thermal environments of the lunar poles are particularly challenging and merit new technology investment. Specific technologies requiring improvements include power generation and storage, spacecraft materials, actuators, and electronics. Returning volatiles from these polar environments in a cryogenic sample return mission was highlighted as scientifically important, although no cryogenic sample return mission was ultimately recommended for the next decade. The task of acquiring, containing, and preserving volatile materials at the conditions from which they were sampled is daunting, as it requires maintaining cryogenic conditions through collection, encapsulation, launch from the Moon, return to Earth, and ultimately to sample storage and curation. In the Human Exploration chapter, the absence of cryogenic sample return development was found to be a key capability gap for Artemis, with potentially insufficient technology investments by NASA to fill the gap.

The Decadal discussed key disruptive emerging technologies that could potentially mature within the next decade, mostly coming from outside NASA: (1) new launch systems, (2) advances in materials and manufacturing, (3) artificial intelligence and machine learning, (4) small fission power reactors, (5) commercial space exploration, (6) automotive electronics, (7) pulsar navigation, and (8) In Situ Resource Utilization (ISRU). Many of these technologies have game-changing implications for lunar exploration, but the pathway for incorporating these technologies into missions may not be smooth, and externalities will need to be considered. For example, in the Human Exploration chapter discussed how ISRU could impact scientific study of lunar volatiles. When prospecting for resources relevant to ISRU, science and exploration are well aligned, but ISRU extraction activities may be disruptive for science goals. The Decadal recommends that NASA develop a strategy plan to develop ISRU architecture options in a manner that both ensures sustainable exploration and maintains the possibility of addressing the important related science questions.

As can be seen from the brief description above, topics of importance to all of the LSIC focus areas were called out in the Planetary Decadal report. The work of all of the LSIC community can thus help meet the expansive vision laid out in the Planetary Decadal and advance both the science and exploration of the Moon.

Member Spotlight

University of California, Davis' Center for Spaceflight Research

Dr. Stephen Robinson (Director, Center for Spaceflight Research), Janine Rosenberg (Lab Manager, HRVIP Lab), Casey Miller (Team Lead, CHANGES Project)

Janine Rosenberg Moses and Casey Miller are both graduate students at the University of California, Davis (UC Davis) with a lot on their plates. Moses is a second year Masters student as well as being the Lab Manager for the Human, Robotic, Vehicle Integration & Performance (HRVIP) Lab. Her current research is focused on thermal control for spacecraft and space suits using sublimation phase change heat transfer, and she hopes to use it on CubeSats that the Lab will launch in the future. Miller is just starting the third year of her Masters and is the team lead for the CHANGES project at HRVIP, which is working to develop and validate a non-pharmaceutical countermeasure to space adaptation sickness in changing gravitational environments.

Both Janine and Casey have been interns at NASA during their academic careers, and are continuing to build experience in vital space research that is working to make the extreme environment of space more accessible for humans and their equipment. Their efforts are guided by Dr. Stephen Robinson, HRVIP Lab Director and Principal Investigator, who has been a professor at UC Davis for 10 years, as well as serving as the Director for the university's Center for Spaceflight Research (of which HRVIP is a part). He came to UC Davis from a 37-year NASA career spent understanding the problems of spaceflight, which strengthened his conviction that humans can do more than they have done if they just have the right tools and confidence to do it.

HRVIP is looking forward to its 10-year anniversary in the Spring of 2023, and currently has 20-25 students working in the Lab with a relatively even split between undergraduate and graduate students. During this decade of research, over 100 students have passed through the Lab and virtually all of them have graduated into employment in the aerospace industry. And Moses and Miller are not the only NASA interns on the team – there's a long history of HRVIP students interning at NASA (11 students were at different NASA centers over this past summer). The lab is currently working on a proposal for collaborative work with Blue Origin that would build on UC Davis' strength in planetary geology, field robotics in hazardous environments, as well as civil engineering and surveying (including subsurface surveying) to plan a human habitat on the Moon.

The wider Center for Spaceflight Research at UC Davis includes several laboratories as well as NASA-funded research institutes, utilizing a very broad-based and trans-disciplinary approach to research focused on human spaceflight and supporting technologies. "We're very interested in extending human capabilities in hazardous environments, including the lunar environment," explained Robinson. He believes that learning to do these things in the demanding and safety critical environment of space will translate to benefits for humans back on Earth as well. "Another reason that UC Davis is unique, and why the Center is unique among research centers around the country, is the diversity of fields that people are in who contribute to proposals and ideas," said Moses. "Getting to work with people from different educational backgrounds really lends a lot of strength to what we do here," added Miller.

A particular focus for the Center is long-term human habitats in space, meaning not only life support and being resilient to environmental challenges on the Moon, but also having autonomous systems

that don't replace people but work with them to extend human capabilities. Humans (onboard or back at Mission Control) need to understand autonomous systems, and also need to help them learn through programming or demonstration. These efforts are housed within the Habitats Optimized for Missions of Exploration (HOME) Space Technology Research Institute, which spans seven universities and 75 researchers (both faculty and graduate students) and is funded by NASA. HOME currently has 39 different technology development projects that are integrated to demonstrate and validate in the context of operational spaceflight for deep-space, long-duration missions such as a lunar base. The reality of a lunar habitat's existence is that it would likely only be crewed 10-15% of its lifespan, but must be reliably capable of human life support at all times. This drives the HOME team's interest in autonomous systems, especially robotic systems. Another area of research is tackling self-sustaining actions for the habitat whether humans are present or not, which includes both mundane scheduled maintenance and critical responses to unexpected failures.

With so many projects going on, and so many students doing amazing work through the Center and its affiliates, it's important to find the common threads that bind everyone together. "One important thing is that humans matter, whether they're on the spacecraft or not. The humans designed the system, care about the results, need to understand degradation and failure modes, and need to make decisions about what to do," said Robinson, "we always need to integrate humans with our engineering approaches." Another theme across the Center's work is the creation and utilization of analogues – building simulators, using drones, and finding examples of complex engineering systems that must work together to accomplish different missions. And it also comes back to autonomy – there are opportunities for it everywhere, and the Center's students and researchers are working together to find out where it makes sense to use it. For example, human-understandable 'explainability' of autonomous systems is seen as enabling knowledge that has to be gained before the systems can be deployed in safety critical environments like the Moon.

With the need to not just work on the big problems related to the extreme environment of space, LSIC provides collaboration opportunities to not only find those answers, but figuring out what questions to ask and which projects to work on in the first place. "LSIC provides a community that just wasn't there before," shared Robinson. With the world of spaceflight changing rapidly, he sees LSIC as making room for people who may never have worked on spacecraft before, just like the Center at UC Davis. Their reach includes collaborators in civil and industrial engineering, human health, neuroscience, physics, education, architecture – many of whom have no background in aerospace engineering. They bring fresh ideas and perspectives, just as LSIC strives to.

When asked what is most exciting about lunar exploration to UC Davis and the Center for Spaceflight Research, Robinson had a quick response – water. "If we can be successful in finding, mining, and utilizing water, especially remotely or semi-autonomously, we will have done things humans have never done before," he explained. The potential for in situ research utilization where the resource is water is extremely motivating, with potentially huge rewards. And not just for the lunar surface – Robinson believes such technology will have applicability on Earth as well. But there are challenges too – dust and radiation chief among them. The Center's team will continue to advance our understanding of the many facets of human spaceflight, helping to tackle these issues and make space more accessible while developing technology to improve life back on Earth.

Find out more about the HRVIP Lab here: https://hrvip.ucdavis.edu/
Find out more about the HOME Institute here: https://homestri.ucdavis.edu/

NASA and Community News

NASA's Economic Benefit Reaches All 50 States

NASA News \\ 27 October 2022

https://www.nasa.gov/press-release/nasa-s-economic-benefit-reaches-all-50-states

NASA practices rover operations for future Artemis mission at Black Point Lava Flow near Flagstaff

AZ Central \\ 26 October 2022 \\ Lacey Latch

https://www.azcentral.com/story/news/local/arizona/2022/10/26/nasa-practices-rover-operations-near-flagstaff-artemis-mission/10552847002/

Artemis Mission, Telescopes Present Data Challenges for NASA

The New Stack \\ 25 October 2022 \\ Loraine Lawson

https://thenewstack.io/artemis-mission-telescopes-present-data-challenges-for-nasa/

Researchers create lunar regolith bricks that could be used to construct Artemis base camp

Phys.org \\ 25 October 2022 \\ Marisa Ramiccio

https://phys.org/news/2022-10-lunar-regolith-bricks-artemis-base.html

NASA Gives a Boost to Minority Serving Institution Innovators

NASA News \\ 25 October 2022

https://www.nasa.gov/stem/murep/feature/nasa-gives-a-boost-to-minority-serving-institution-innovators

Firefly Aerospace Adds Former NASA Administrator James Bridenstine to its Advisory Board

Firefly Aerospace \\ 24 October 2022 \\ Kim Jennett, Jennifer Hurson, Beth Wiegard

https://www.prnewswire.com/news-releases/firefly-aerospace-adds-former-nasa-administrator-james-bridenstine-to-its-advisory-board-301656935.html

NASA astronauts 'moonwalk' in the Arizona desert for our lunar future

Space.com \\ 21 October 2022 \\ Elizabeth Rayne

https://www.space.com/artemis-astronauts-moonwalking-desert-simulation-2022

NASA Orders Three More Orion Spacecraft From Lockheed Martin

Lockheed Martin \\ 20 October 2022

https://news.lockheedmartin.com/2022-10-20-NASA-Orders-Three-More-Orion-Spacecraft-from-Lockheed-Martin

Why Nokia wants to put an LTE network on the moon

Fast Company \\ 14 October 2022 \\ Rob Pegoraro

https://www.fastcompany.com/90795731/why-nokia-wants-to-put-an-lte-network-on-the-moon

NASA Sets Date for Next Launch Attempt for Artemis I Moon Mission

NASA News \\ 12 October 2022

https://blogs.nasa.gov/artemis/2022/10/12/nasa-sets-date-for-next-launch-attempt-for-artemis-i-moon-mission/

NASA Awards Contracts to Assess Near-Space Communications Capabilities

NASA News \\ 12 October 2022 \\ Kiana Raines \\ Lora Bleacher \\ Katherine Schauer

https://www.nasa.gov/press-release/nasa-awards-contracts-to-assess-near-space-communications-capabilities

Inspections Underway for Rocket, Spacecraft Before Setting Launch Date

NASA News \\ 06 October 2022

https://blogs.nasa.gov/artemis/2022/10/06/inspections-underway-for-rocket-spacecraft-before-setting-launch-date/

Funding Opportunities

Tech Development

- Space Technology Research Institutes (STRI) Solicitation
  https://nspires.nasaprs.com/external/solicitations/summary!init.do?solId=%7b000FAF75-9F37-814C-AC23-A21022A96037%7d&path=open

  Preliminary Proposals Due: 03 August 2022 - Invited Full Proposals Due 03 November 2022

- Break the Ice Lunar Challenge Phase 2
  https://www.nasa.gov/solve/break_the_ice_lunar_challenge_phase_2

  Proposals Due: 04 November 2022

- NASA Innovation Corps Pilot
  https://nspires.nasaprs.com/external/solicitations/summary.do?solId=%7b1B42E782-61BB-9834-F20F-44CBEF13C0A6%7d&path=&method=init

  Proposals may be submitted at any time through March 29, 2023, but applications will be reviewed in intervals on the following dates: July 22, 2022; Sept. 16, 2022; Nov. 17, 2022; and Jan 20, 2023

- Announcement for Partnership Proposals (AFPP) to Advance Tipping Point Technologies
  https://nspires.nasaprs.com/external/solicitations/summary.do?solId={9987D88F-0A12-5203-FC25-423773FAF134}&path=&method=init

  Final Proposals Due: 22 November 2022

- NASA Innovative Advanced Concepts (NIAC) Phase II Call for Proposals
  https://nspires.nasaprs.com/external/solicitations/summary.do?solId={0DD3E590-F13D-B4D4-0D48-56D01BE377B9}&path=&method=init

  Proposals Due: 15 December 2022

Student Opportunities

- NASA Space Technology Graduate Research Opportunities
  https://nspires.nasaprs.com/external/solicitations/summary.do?solId=%7b4C4796B7-1D86-C986-49E5-A76ABB0A9EAE%7d&path=&method=init

  Proposals Due: 02 November 2022

Requests for Information

- STMD EXPLORE and LAND RFI
  STMD has released the third and final Request for Information (RFI), this time for the EXPLORE and LAND thrusts, in our series of STAR RFI's that are intended to help us learn from the space community what they think of our technology development priorities.
  https://nspires.nasaprs.com/external/solicitations/summary.do?solId=%7b1B6EF822-99AE-AECA-6440-6F68C4A3FD31%7d&path=&method=init

  Responses due: 06 October 2022

For more funding opportunities, please visit LSIC's website here: http://lsic.jhuapl.edu/Resources/Funding-Opportunities.php