Lunar Surface Innovation CONSORTIUM

JOHNS HOPKINS APPLIED PHYSICS LABORATORY

Volume 3 | Issue 4

April 2022

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.

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Director's Update

Hello LSIC Community! We're all getting very excited about hosting you at APL (or online) next month. As you will read in more detail in the rest of this newsletter, a major focus of this meeting will be to formally examine envisioned futures from the "Live" portion of NASA's lunar plans: specifically in situ resource utilization, surface power, and excavation, construction, and outfitting. We have now spent a couple of years discussing these topics (as well as the more over-arching topics of dust, environments, and access) among the focus areas, so we would like to take that expertise and work and understand where the community can help further NASA's goals. We will have a breakout session at the Spring Meeting that is specifically geared towards first reactions to the NASA presentations, but we encourage members to also think creatively about ways that each focus group, as well as LSIC as a whole, can help make these futures a reality.

For those who have been involved with LSIC since the beginning in early 2020, you may recall that we showed a cyclical diagram about how dialog between NASA and the community could help NASA identify gaps and shape funding opportunities. As we've matured as a consortium, we have tried to also identify ways that we can help the community develop and build connections with one another, since those connections are critical not only for forming proposal teams, but also for developing the elements needed for a future lunar economy. Many of the groups have established a 'Who's Who' on Confluence, to share capabilities and contact information, but we're exploring new ways to try to build up an understanding of other member's capabilities (individual or institutional) as well as specific technological and/or economic relationships. An example of the latter would be providing a mechanism for those developing a system to quickly identify whether the inputs they need (metal, power, O2) will be available in the quantities they need, and who the relevant subject matter experts are that they could talk to for more detail. This Value Networking effort will be briefed at the Spring Meeting, but we need your support and engagement to make it as valuable as possible. Please stay tuned for more information from Kirby Runyon and Jibu Abraham about this effort.

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

Focus Areas

Monthly Telecon Schedule

Dust Mitigation
Third Thursdays at 12PM Eastern

Excavation & Construction
Fourth 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

Surface Power
Fourth Thursdays at 11AM Eastern

LSIC General Updates

LSIC 2022 Spring Meeting In-Person Registration Deadline 06 April

If you're planning to join us in person for the LSIC Spring Meeting on 04-05 May, don't forget to sign up soon! The deadline to register to attend in person is 06 April. Virtual registration will remain open until 25 April. We look forward to seeing you there! As a reminder, the event will concentrate on understanding NASA's plans and technology investments relevant to building a sustained presence on the lunar surface. The meeting will include invited speakers, panels, posters, and breakout discussions. Additional information and the registration link are available here: https://lsic.jhuapl.edu/Events/Agenda/index.php?id=200

Modular Open Systems Approach (MOSA) Meeting 06 April at 11AM ET

On 06 April at 11:00AM ET the LSIC MOSA working group is hosting a telecon featuring Chad Thrasher, NASA's Artemis Campaign Development Division, Systems Interoperability Lead. He will be presenting Artemis' Graphical User Interface (GUI) standards along with their plans for other interoperability standards for Artemis. Following the presentation there will be a question-and-answer session. Details about this meeting can be found on MOSA's Confluence space here: https://lsic-wiki.jhuapl.edu/x/EpsxAg

(To request access to Confluence, please email Andrea Harman at ams573@alumni.psu.edu)

Focus Group Updates

Dust Mitigation

The Dust Mitigation (DM) Focus Group held its monthly focus group meeting on 17 March. The topic for March's focus group meeting was "Dust Mitigation for Spacesuits/EVA". The meeting featured presentations by Drew Hood from NASA Johnson Space Center on "High Level Introduction on EVA Tool Development for Space Suit Dust Mitigation", and Dr. Inseob Hahn from NASA Jet Propulsion Laboratory, California Institute of Technology on "Lunar dust mitigation technology using electron beam." These presentations were followed by a brief discussion on dust mitigation needs/challenges for space suits/EVA. In addition to the featured presentations and discussion, we also held a breakout networking session for each of the DM subgroups, including: 1) Materials and Surface Coatings; 2) Seals, Soft Goods, and Fabrics; 3) Mechanisms; 4) Monitoring and Filtration; 5) Modeling; 6) Lunar Surface Modification; and 7) Isolation Technologies. The breakout groups provided an opportunity to network and meet fellow DM enthusiasts in their technology areas of interest.

Our next focus group meeting will be jointly held with the Excavation and Construction (E&C) Focus Group on Wednesday, 27 April at 2:00PM EST. The topic for the meeting will focus on "Designing Dust-Tolerant Systems". The meeting will include invited presentations from both E&C and DM focus groups along with a panel discussion. We hope you can make it!

Excavation & Construction

The March monthly meeting featured talks from James Mastandrea (JHU/APL) and Jason Schuler (Kennedy Space Center, NASA). James gave an overview of LSIC's new initiative on Modular Open Systems Approach (MOSA). Jason gave a detailed presentation on ISRU Pilot Excavator (IPE). IPE is a robotic excavator that will demonstrate excavation and delivery of up to 10 metric tons of regolith on the lunar surface. It is based on the Regolith Advanced Surface Systems Operations Robot (RASSOR) that has been developed at Kennedy Space Center. We also had our first networking session after the meeting. Participants interacted with each other in four breakout rooms discussing different E&C sub-topics. We plan to have these sessions periodically going forward. We also prepared the report for 'Regolith to Rebar' metal workshop held last month.

Extreme Access

Last month's Extreme Access telecon featured a networking session during the last third of the main telecon. We hope you enjoyed getting to know some of the other members! If you found this helpful or would like to see more opportunities for short networking breakouts during EA meetings, please let us know. The Extreme Access subgroups are working hard on compiling discussions and thoughts from our members for our year-end feedback "white papers". Thank you to everyone who has participated in the subgroups and/or is helping compile discussion notes and feedback. These are one of the main mechanisms for direct feedback to NASA, and we appreciate your participation! Discussions will continue over the next month or so, and on Confluence, if you'd like to get involved. Next month's telecon will have a navigation focus for our technology spotlights, with guest speakers: Evan Anzalone (NASA) talking about the Lunar Node 1 navigation beacon system, and Dr. Robert Tjoelker (JPL) talking about the Deep Space Atomic Clock.

Extreme Environments

In March, the Extreme Environments (EE) Focus Group presented another "Cross Talk" event focus on plasma interactions with lunar regolith/dust. The panel for our event included Roy Christoffersen of NASA JSC covering regolith properties, Christine Hartzell of University of Maryland dust/plasma interactions, Jean-Charles Mateo-Velez of ONERA covering modeling efforts, and Paul Mackey of NASA KSC covering testing and the Electrodynamic Dust Shield (EDS). We are already planning another "Cross Talk" for the summer since the community feedback was so positive. Our April monthly meeting will discuss Simulants with Karen Stockstill-Cahill from APL. Also, planning is underway for our EE/EA workshop this June so keep an eye out for details. 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 held its monthly meeting on the 16 March, with presentations focused on water ice prospecting with talks from Holly Brown, ASU on modelling the distributions of near surface ice and from Rosario Gerhardt, GIT on new technology for the detection of near surface ice. As a reminder, Tipping Point solicitations are open and are a great opportunity to apply for funds to build and demonstrate ISRU technologies. The breakout groups continue to address the challenges associated with lunar ISRU from formulating a prospecting mission or campaign, as well as extracting O2 and metals from the regolith, connecting industry with each other and government to form a value network for sustained business model of lunar ISRU, and finally in enabling long term ISRU operations through understanding modularity and in-situ maintenance.

Surface Power

This March, the LSIC Surface Power focus group worked on distilling the input from the February subgroup sessions into future actions. One priority we identified during the subgroup session was system solutions for low-temperature power and energy storage for the lunar surface. To address this, the surface power group is planning a workshop, tentatively in late July. Our monthly telecon for March featured Ian Jakupca (NASA GRC) covering fuel cells, including a “101” introduction, details of specific fuel cell technologies under development, trades that influence fuel cell design, and relationships to related technologies in ECLSS, ISRU, and more. In April, we will continue planning the summer workshop, and in our monthly telecon we will hear from Ansel Barchowsky (NASA JPL) on the TYMPO (Tether Power Systems for Lunar Mobility and Power Transmission) Tipping point.

Feature Article

LSIC Spring Meeting Preview

On the fourth and fifth of May, attendees from all over the world will be gathering together for LSIC's 2022 Spring Meeting. The event is being held both in person at the Johns Hopkins University's Applied Physics Laboratory (APL) campus in Laurel, MD and online via Zoom and GatherTown. The program covers a variety of topics, and we wanted to provide a 'sneak peek' about some key parts of the program. The full agenda is available for review anytime on the event page here: https://lsic.jhuapl.edu/Events/Agenda/index.php?id=200. The overarching goal of the Spring Meeting is to provide technical and strategic updates from NASA to the community, while also providing a forum for NASA to learn about the community's technical capabilities and challenges.

Updates from NASA

NASA Associate Administrator Bob Cabana's keynote address will provide an overview and update about the Artemis missions and the agency's Moon to Mars strategy. He will talk about progress being made for both near and far-term milestones. Cabana will discuss how the technology and robotic lunar precursor missions are laying the groundwork for NASA's exploration goals. He will emphasis the importance of the contributions of industry, academia and the international community to building a long-term presence for exploration at the Moon.

NASA Space Technology Chief Architect Mark McDonald will provide an update on the Strategic Technology Architecture Roundtable process and resulting Envisioned Future Priorities packages. The packages provide examples of known technologies or systems in development that could contribute to the closure of gaps between the State-of-the-Art and the accomplishment of the stated envisioned futures. He will discuss the next steps in the process and how LSIC members can contribute to the process.

The Law and Tech-Policy Lunar Panel

The Law and Tech-Policy Lunar Panel will focus primarily on the following broad topics: (1) addressing need for a governance and regulatory structure incorporating technology policies specific to the lunar environment, (2) the lunar business ecosystem, and (3) dispute settlement through management of lunar conflicts and competition. These topics are particularly appropriate for discussion due to the current lunar activity plans of major space-faring nations and private companies, within and extending beyond the current decade. The panel will also discuss utilization of the Moon as a stepping stone for deep space exploration to Mars, with the aim of addressing jurisdictional rules applicable to these celestial bodies and possible policy differences. Through discussion of these various topics, the panel will provide useful knowledge for the LSIC community pertaining to present-day knowledge gaps in technology policy.

The panel will feature five leading experts who are at the forefront of shaping and influencing the nation's laws and policies within the space domain. Our esteemed panelists include the following: Timiebi Aganaba, Assistant Professor/Space Law and Governance Expert, Arizona State University; Mary Guenther, Director of Space Policy, Commercial Spaceflight Federation; Chris Johnson, Space Law Advisor for the Secure World Foundation; Steve Mirmina, Senior Attorney at NASA; and Jessy Kate Schingler, Director of Policy and Governance, Open Lunar Foundation. The panel seeks to explore the latest views on fostering stable and predictable regulatory conditions to facilitate

the development of the commercial space industry and to encourage government and private sector investments in key technologies. In so doing, the panel is designed to elicit each expert's unique contributions and insight to the lunar space, in a manner that is most conducive to both continuing the discussions long after the session concludes, while also engaging in concrete steps to actualize the way forward for our lunar community.

Modular Open Systems Approach (MOSA) Panel

The MOSA working group is hosting a panel session on Lunar Interoperability. Five subject matter experts (SMEs) have been assembled to address key questions on lunar interoperability and what are the next steps for the community. The panelists are Mark Mazzara, Robotics Interoperability Engineer & Project Manager, US Army; Meera Towler, Senior Research Engineer, Southwest Research Institute; Mathew DeMinico, Power Portfolio Manager, NASA Glenn Research Center; Amalaye Oyake, Senior Flight Software Engineer, Blue Origin; and Chad Thrasher, Systems Interoperability Lead, NASA's Artemis Campaign Development Division.

The panel will be moderated by SME Jessy Kate Schingler, Director of Policy and Governance at the Open Lunar Foundation. The session will begin with Mark Mazzara giving a brief introduction to MOSA and the experiences had by the Department of Defense while implementing MOSAs. The panel will then transition to questions and answers. With stakeholders from various institutions across the lunar ecosystem present, our goal is to get pragmatic steps to develop standards, modular systems, and/or open architectures to ensure a robust and open lunar economy.

Breakout Groups

On the afternoon of the second day, attendees will be given the option to join one of four breakout sessions, which will be held in hybrid format (both in-person and virtually). The four topics to be covered in each of these sessions are:

- Regolith to Rebar: Next Steps
  The Regolith to Rebar workshop was held on 23 February (event details available here: https://lsic.jhuapl.edu/Events/Agenda/index.php?id=177) to explore the supply and demand issues surrounding in situ processing of lunar regolith for construction. This breakout group will follow up on the findings from that meeting to establish fundamental gaps and next steps for understanding the technical and economic drivers.
- Funding Opportunities: LuSTR and More
  Lunar Surface Technology Research (LuSTR) is a university-focused program element (https://www.nasa.gov/directorates/spacetech/strg/lustr/) designed to advance technologies, aligned with the six LSII focus areas, for Lunar surface exploration and to accelerate the technology readiness of key systems. This session will provide an opportunity to speak with the stakeholders for this project, and also solicit feedback on ways in which LSIC can help the community understand and take advantage of this and other NASA Space Tech opportunities.
- Envisioned Futures: Initial Roadmap Discussions
  During Thursday's plenary sessions, NASA will be presenting their Envisioned Futures/ Roadmaps for establishing a sustained presence on the lunar surface, specifically related to Surface Power, ISRU, and Excavation, Construction, and Outfitting. In this session, the community will discuss these presentations in more detail, and identify near-term

opportunities where the LSIC focus groups can help inform and assist in these efforts.

– Space Law, MOSA, and the Big Picture
  Since LSIC was established, there have been ongoing questions that are on the margin of, or extend beyond, the technical scope of LSIC. These include how (and whether) to formally standardize specific elements or practices to enable interoperability among varied customers and what is the current legal framework for companies seeking to develop and operate technology on the lunar surface. This breakout group will follow up on the Wednesday panel discussions about these topics and identify high-priority, unresolved questions.

Hybrid Format – In Person and Virtual

Holding the event both in person and in a virtual format allows for as much participation as possible during a busy meeting season and while people are still navigating a changing COVID-19 landscape. We'll be using Slido to manage Q&A both for in-person and virtual attendees, just as we did at the Fall Meeting. This both keeps the level of access fair for everyone, and allows for ease of moderation for our event leadership team. For presentations and panels, we have a mix of in-person and remote speakers, which will be facilitated using the Zoom webinar platform. All speakers will be broadcast both into the in-person event space and onto Zoom, and will be recorded for availability after the event as well. The breakout sessions will also be mixed attendance, with Owl technology supporting rooms of in-person attendees interacting with their virtual counterparts.

Networking sessions will be separate, with in-person networking taking place onsite and virtual networking taking place via GatherTown, where virtual posters will also be set up for remote attendees to review throughout the event. The poster session will also be held both virtually and in person, with presenters attending the event physically interacting with in-person attendees and virtual presenters interacting with remote attendees in GatherTown. Confluence will allow for asynchronous communication between authors and attendees if there are questions folks would like to ask authors who are attending remotely when they are in person, or vice versa.

Member Spotlight

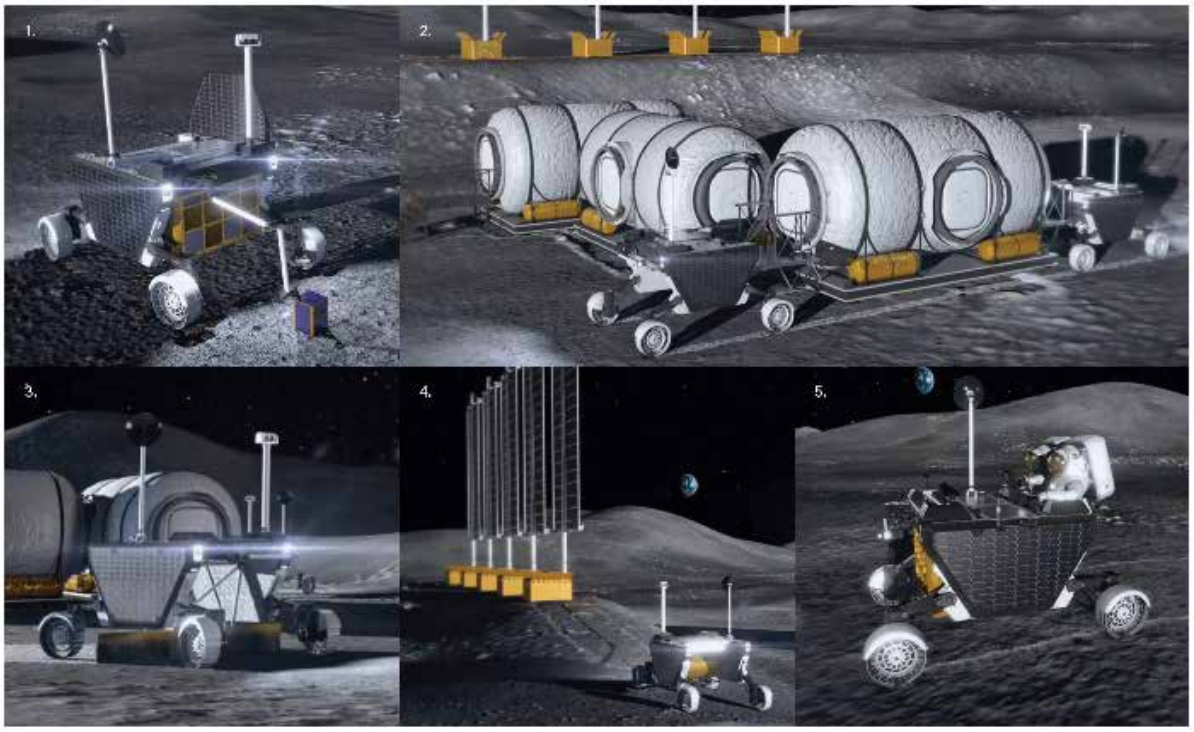
Venturi Astrolab

Jaret Matthews, Venturi Astrolab's (Astrolab) founder and CEO, has been into rovers for as long as he can remember. He was inspired watching Sojourner land on Mars in 1997, the same year he graduated high school. Right out of university he started his career at NASA's Jet Propulsion Laboratory (JPL) in the same group that developed Sojourner, and his career there saw him work on both Spirit and Opportunity as well as serving as the Lead Systems Engineer and Project Manager for ATHLETE (All-Terrain Hex-Limbed Extra-Terrestrial Explorer), a six-legged robotic lunar rover dedicated to large scale infrastructure deployment such as moving habitats, which was part of the Constellation program. When Constellation ended, he moved to the Curiosity mobility engineering and operations team and spent the first few months of operations on Mars getting the mobility system commissioned. Matthews then left to spend seven years at SpaceX as manager of their Spacecraft Mechanisms Deployment team, working to develop the docking system (including the development of a novel approach), hatches, and nose cone actuation system for the Crew Dragon, which gave him experience in terms of work on crew certified systems. They have now been successfully flying and docking with the International Space Station (ISS) since 2019 on almost a dozen successful missions and counting. Matthews' career has given him years of experience working on both rovers and crew-rated systems for space exploration and operations.

Matthews was inspired by looking at NASA's investments in lunar landers through the Commercial Lunar Payload Services (CLPS) and Human Landing Systems (HLS) to start his own company dedicated to pioneering new ways to explore and operate on distant planetary bodies. "We're anticipating going from this era where you land something once a decade on the Moon or Mars to where you could be landing monthly," he explained, "and also going from landing 100 kg at a time to landing 100 tons. We're watching the railroad to the West being built right now." In hindsight, January 2020 was a weird time to start a business – but the network of professionals that Matthews had built allowed him to recruit a stellar team starting with Rius Billing, one of the world's foremost experts in planetary robotics, now Astrolab's Technical Fellow. The company has been steadily growing ever since, with a staff deeply experienced in putting hardware in space and operating on other planets. Their headquarters in Hawthorne, CA has grown as well, and now boasts everything needed to design, build, test, and operate rovers. Their facilities include everything from creative engineering offices to a mission control center, environmental test labs - including vacuum and thermal chambers, a clean room, a high bay for vehicle integration, and a substantial Moon yard in the parking lot.

The goal that Astrolab is working towards, in alignment with how they see NASA's objectives, is a permanent human presence off Earth. To bridge from where we are now to that target, they've developed the multi-functional Flexible Logistics & Exploration (FLEX) rover to support human operations, robotic science, exploration, logistics, construction, resource utilization, and other activities critical to enabling a sustained human presence on the Moon, Mars, and beyond. Its design is responsive to NASA's official Lunar Terrain Vehicle requirements, and the rover is intended to have a lifespan of over a decade. FLEX can not only carry two suited astronauts and all their EVA equipment but can also perform many useful functions without a crew. "Our intent is to make FLEX the most versatile rover ever made," stated Matthews. Astrolab sees realistic and regular landing

capability coming to the market soon, and has identified the next logical step as a transportation market – which is where FLEX comes in.



FLEX's modular payload interface and novel mobility system enable it to perform a multitude of functions, including 1. Distributed science; 2. Coordinated multi-rover manipulation of large payloads to support outpost construction; 3. Regolith grading and excavation; 4. Surface power and transmission cable deployment; and 5. Crew transport and exploration

"What we're really excited about as an application for FLEX is deploying large scale infrastructure, particularly for energy collection, storage, and distribution," continued Matthews. Underlying all the many activities planned for the lunar surface, energy will be required to power everything from the equipment and life support systems used by astronauts to the robots that run autonomously. Astrolab's field tests of FLEX have specifically included deploying vertical solar array towers (VSATs) – just a mockup, but on a representative scale of a 5kW+ VSAT. The LSIC Surface Power focus group recently published the results of their Power Users Survey, which indicated many technologies and activities require power in the range of tens of kilowatts to megawatts. The potential Astrolab sees in FLEX is that in a single mission, Starship could land one FLEX rover that deploys 20 or more 10kw VSATs – providing ample power for subsequent missions in one fell swoop. It's no coincidence that NASA's VSAT program is working to get various solar arrays to TRL 6, and that their reference mission showed a rover deploying them – Astrolab envisions FLEX as that rover. Currently it's a fully realized terrestrial prototype, with all the sensing and other elements the lunar version will have. It has served as a vital development platform for the team as they've honed the software and hardware for the rover, and can now serve to demonstrate its capabilities to potential users on Earth. And how has Astrolab moved from starting up just over two years ago to having an operational prototype? Matthews describes their work culture as 'moving with urgency', whether it's 'build, break, repeat', 'fail fast', or 'sprint to testing'. "We like to get out of the cartoons and into the real world as quickly as possible," shared Matthews.

Looking at FLEX from a broader perspective, Astrolab sees its role as working with payload developers in the space community and enabling them to do whatever their work requires. The

company's value proposition aims to allow customers to focus on perfecting their technology and payloads – Astrolab will take care of the mobility, communication, and power needed to deploy and utilize it. A payload interface guide has been created for FLEX, which will allow users to design payloads conforming to standards that the company hopes will be open and widely used, contributing to the development of economies of scale just like global shipping on Earth. Matthews points to how Earth's supply chain revolves around shipping containers moving from ships to cranes to trains and trucks. "The analogy is that the landers are the ships crossing the ocean, and FLEX is the local delivery truck," stated Matthews, explaining how payloads take the place of those shipping containers – which is why having standards is so important. The launch of LSIC's Modular Open Systems Approach (MOSA) Working Group is an example of the value that Astrolab finds in involvement with the Consortium. Instead of everyone reinventing the wheel separately, encouraging communication and collaboration to arrive at a standard together will enable the community to move forward more efficiently.

"Our existence is testament to a sea change," reflected Matthews. Astrolab has grown to where it is today on private investment, which speaks to the fact that the larger community is excited about the potential for near-future space development. NASA has said that they plan to be a marginal buyer of services in a vibrant future lunar market – private investment further solidifies the potential of that future. Matthews also stressed the importance of NASA 'priming the pump' as an anchor customer while also making sure there's a pipeline ready to take advantage of the enormous potential lunar landing capabilities that are just on the horizon. But with investments in programs like Payloads and Research Investigations on the Surface of the Moon (PRISM) he hopes to see more positive movement towards that envisioned future with regular and significant payloads landing on the Moon, hopefully with Astrolab's FLEX ready to support missions for their clients.

Click here to visit Astrolab's website for more information: https://astrolab.space/

NASA News

NASA Administrator Statement on President's FY 2023 Budget Request

03/28/2022 \\ NASA News

https://www.nasa.gov/press-release/nasa-administrator-statement-on-presidents-fy-2023-budget-request

For Artemis Moon missions, science will reign supreme

03/24/2022 \\ Space.com \\ Elizabeth Howell

https://www.space.com/nasa-artemis-moon-missions-science

NASA announces next high-stakes Moon competition

3/23/2022 \\ Aerospace America \\ Paul Brinkmann

https://aerospaceamerica.aiaa.org/more-lunar-planning-to-be-announced-by-nasa/

NASA's Mega Moon Rocket, Spacecraft Complete First Roll to Launch Pad

3/18/2022 \\ NASA News

https://www.nasa.gov/press-release/nasa-s-mega-moon-rocket-spacecraft-complete-first-roll-to-launch-pad

NASA Project Takes Off with New 3D Lunar Simulation

3/15/2022 \\ NASA News

https://www.nasa.gov/feature/nasa-project-takes-off-with-new-3d-lunar-simulation

NASA's human Moon lander program finally gets full funding in new budget bill

3/9/2022 \\ The Verge \\ Loren Grush

https://www.theverge.com/2022/3/9/22968740/nasa-omnibus-spending-bill-human-lunar-lander-space-station

Bahrain Signs Artemis Accords

3/7/2022 \\ Parabolic Arc \\ Doug Messier

http://www.parabolicarc.com/2022/03/07/bahrain-signs-artemis-accords/

NASA announces launch options for 2022 student launch competition

3/3/2022 \\ Aerotech News \\ Christopher Blair

https://www.aerotechnews.com/blog/2022/03/03/nasa-announces-launch-options-for-2022-student-launch-competition/

Romania signs the Artemis Accords

03/02/2022 \\ SpaceNews \\ Jeff Foust

https://spacenews.com/romania-signs-the-artemis-accords/

Funding Opportunities

Student Tech Development

- Over the Dusty Moon Challenge (Colorado School of Mines & Lockheed Martin)
  https://www.overthedustymoon.com/

  June 2022: In-person challenge

Tech Development

- NASA TechLeap Prize: Nighttime Precision Landing Challenge No. 1
  https://www.precisionlanding1.nasatechleap.org/

  Registration due: May 5, 2022 at 5 p.m. PDT; Applications due: May 19, 2022 at 5 p.m. PDT

- Watts on the Moon Challenge, Phase 2
  https://www.nasa.gov/directorates/spacetech/centennial_challenges/watts-on-the-moon/index.html

  Registration due: June 15, 2022 at 5 p.m. EDT

- Announcement for Partnership Proposals (AFPP) to Advance Tipping Point Technologies
  https://nspires.nasaprs.com/external/solicitations/summary.do?solId=%7b9987D88F-0A12-5203-FC25-423773FAF134%7d&path=&method=init

  Final proposals due: July 28, 2022

- Space Technology Announcement of Collaboration Opportunity (ACO)
  https://nspires.nasaprs.com/external/solicitations/summary.do?solId=%7bA9C79925-6F41-69E8-4BE0-5325903D777C%7d&path=&method=init

  Final proposals due: July 28, 2022

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