Lunar Surface Innovation CONSORTIUM

Hosted by the 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

We are all very excited about the upcoming Fall Meeting. For this meeting, we are working to develop an agenda that minimizes how much repeat information we present, while still including enough overview information for new participants. On day one, we will begin with a keynote address (details coming soon!) and a brief status update on NASA's LSII and the LSIC Focus Group work. Then we will dive into a series of community-centric discussions, including a feature about Bowie State and their partnerships with NASA, ways for newcomers (especially students and recent graduates) to develop networks in the lunar community, a panel discussing government resources for small business programs, and a panel of technology investors. Contributed technical presentations and posters will close out the day. On the second day, we will learn about NASA's investments relative to robotics and autonomy, as well as some of their overarching plans. This will set us up for a series of technical panels about specific projects, and ultimately some breakout sessions that, like last year's Fall Meeting, will focus on examining in detail several scenarios to understand what elements require autonomous operation, what technology gaps exist, and where each of our different focus areas need to be engaged to ensure clear communication among the whole community.

We are still hoping for a hybrid meeting, but given that COVID rates across the United States are still high, we are at some risk of needing to go fully virtual. For those considering attending in person, here are a few items to note. Masks and a health questionnaire will be required for all in-person attendees. We are also asking that those who attend the meeting in person be fully vaccinated. I understand that there are many reasons that someone might decline to be vaccinated, and also that many who are may not want to take the risk of traveling or mingling in a crowd. We are planning to have the same type of online content that we had at our last two (fully virtual) meetings, so anyone who attends virtually will be able to view all plenary talks, posters, and breakout sessions, and will also have dedicated networking opportunities. We are really looking forward to meeting with you all, and we will make sure to make this a dynamic event, no matter how you decide to attend. If you indicated on your registration that you would like to attend in person, you will be hearing from us soon to confirm whether you would still like to do so.

Finally, to again minimize risk to students and our community, we have decided to switch to a totally virtual career fair. If your company is interested in participating, please fill out the form here: https://forms.gle/qaEEc5198tYSn5LE6.

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 Fall Meeting: 03-04 November

The Fall Meeting of the Lunar Surface Innovation Consortium is scheduled for 03-04 November 2021, and will be held at Bowie State University in Bowie MD (with most content and some sessions also available online). The registration portal is open, though in-person registration is now closed. This year's technical theme is Autonomy and Robotics, and will be used to focus invited presentations and technical breakout discussions. To register and find additional details, please visit the event page here: http://lsic.jhuapl.edu/News-and-Events/Agenda/index.php?id=148

CIRCUIT Intern Introduction: Supriya Roy

Supriya Roy is a junior at Stanford Online High School pursuing her passions of engineering, mathematical modeling, and astronomy through the ASPIRE-CIRCUIT program and LSII. She is working in the dust mitigation focus group on formulating technologies with the assistance of Dr. Nunez to contribute to the Lunar Base Simulator, which provides output regarding general power requirements for a classified number of astronauts. Supriya hopes to participate in further work analyzing lunar simulants and working closely with LSI and the intern cohort to develop a systematic solution to further connect the LSI focus groups.

A Searchable Facilities Directory to Spur Innovation, Advancement, and Team Building

NASA and the LSIC have teamed up to create the LSIC Facilities Directory. The interface, located on the LSIC wiki (https://lsic-wiki.jhuapl.edu/x/HINf) through the LSIC Resources webpage and listed under the LSIC wiki Tools and Resources section, is made with the purpose to inform the LSIC Community of facilities that might be utilized for advancement of their future lunar surface technologies that are currently under development. These may be facilities at NASA, commercial, non-profit, or academic institutions. The interface is searchable, with some details on each facility, its location, availability, scheduling, pricing, as well as a Point of Contact that has agreed to be available for further correspondence where appropriate. The contents of the directory can also be found in a posted table, but we stress the contents of the interface will be changing rapidly as additional facilities are added and the format is updated and adapted to the need. Annual checks on content will be performed by LSIC by contacting designated Points of Contact. Upon notification of LSIC, Points of Contact will be able to make edits and additions to their content within this interface at their discretion. Institutions that would like to have their facility listed in the Facilities Directory need only be a member (free) and to fill out a questionnaire (https://forms.gle/MronYz72WeWbAqdx6).

Focus Group Updates

Dust Mitigation

The Dust Mitigation (DM) Focus Group has continued to work on revamping our Confluence page to better facilitate collaborations, discussions, and access to resources. We held our monthly meeting on September 16, where we focused on CLPS/PRISM and how dust mitigation fits into their objectives. During this meeting, we heard presentations from Michael Johansen (NASA STMD) on the current dust mitigation payloads that are manifested to fly on future CLPS missions, Allison Goode (Aegis Aerospace) on the Regolith Adherence Characterization (RAC) payload (scheduled to

fly in 2023) and the CLPS payload process, Dr. Denis Dufour (INO) on INO's Technologies for Lunar Dust Sensing, and Dr. Ryan Watkins (NASA ESSIO and NASA Program Scientist for the 2021 Prism Solicitation) with an overview of the 2021 NASA PRISM Call. The presentations were followed by a discussion among the community about what kinds of dust mitigation technologies need to be flown on future CLPS missions and how we can leverage solicitations, like PRISM, to foster community collaboration and work towards those visions. On Thursday, October 7 at 12:00 PM Eastern, we will be hosting a teaming session to provide the community a space to allow for teaming among LSIC members for NASA's PRISM call and general collaboration efforts. Our next monthly meeting on Thursday, October 21st will focus on the newly-released, NASA Technical Standards Document NASA-STD-1008: "Classification and Requirements for Testing Systems and Hardware to be Exposed to Dust in Planetary Environments."

Excavation & Construction

In September, E&C focus group wrapped up our August workshop report, which we will share with NASA and the LSIC community. We had a great monthly meeting in which the three winners of NASA's 'Break the Ice Challenge, Phase 1' (Redwire Space, Colorado School of Mines and Austere Engineering) presented their winning concepts. The talks were enlightening and over 80 people attended the meeting. Starting with the October monthly meeting, we plan to shift to interactive workshop-type sessions to enhance community engagement. Also from October, we will hold our monthly meetings at a new time: on the fourth Wednesday of the month at 2 PM Eastern.

Extreme Access

We continue to prep for the LSIC Fall meeting, which will be "co-hosted" by Extreme Access and Extreme Environments in November. To aid this, the September telecon featured a discussion about technology gaps and needs for Extreme Access on the lunar (sub)-surface. We also had a technology spotlight presentation from Dr. Hannah Stuart (UC Berkeley) discussing forceful mili-robot teams (leveraging teams of small, lightweight, robots to perform forceful tasks and large-scale maneuvers for lunar and planetary exploration). In addition, this past month we focused on getting the subgroups for the Extreme Access focus area running. We have 5 subgroups that were created to foster networking opportunities and provide a place for more technical and in-depth discussions. To see meeting notes or get involved, check out the subgroup discussion pages on the LSIC Extreme Access wiki! Recurring meetings are being set for these groups, so stay tuned for upcoming discussions. These groups will also be the main location where conversations happen to achieve the EA annual goal and generate content for our white paper to NASA. The next EA telecon will be on October 14 at 3pm ET.

Extreme Environments

The Extreme Environments focus group monthly meeting went through the feedback from community member interviews that established what we were doing well and where we needed to improve. A great discussion came from our guest speaker Wesley Chambers on "DSNE and the lunar plasma environment". Our subgroups met and covered a variety of things including the continuation of developing resource guides, featured article discussions, possible featured speakers, etc. In October, we will walk through the next, multiple month focus for the EE group and subgroups along a featured presentation covering test facilities at MSFC from Erin Hayward.

ISRU

At this month's ISRU focus group meeting Kartik Kumar of Satsearch updated us on the status of the Value Chain Analysis subgroup, and Jodi Berdis updated us on the results of the ISRU facilities needs survey. The next step with the facilities survey is to 'close the loop' with the facilities database LSIC is developing to provide an initial assessment of how well industry's ISRU facilities needs can currently be met. We also heard a great science talk about lunar impact gardening from Emily Costello of the University of Hawai'I, detailing how impacts shape the composition and geotechnical properties of the lunar regolith. This process is thought to be important for modifying the distribution of volatiles in the top 20 cm of regolith in the Permanently Shadowed Regions. In upcoming news, we are preparing a joint workshop with the Excavation and Construction Focus group on linking the in-situ production of metals that are by-products of O2 extraction (supply) to their need and use (demand) for construction on the lunar surface; likely to be scheduled in mid to late January. Additionally, the value network breakout group looks at how input and output connect in ISRU, power, and excavation. We'll be holding our next meeting Wednesday, Oct. 6 at 3:00 pm EDT(UTC-4). To participate in the discussion, point your browser to the LSIC wiki at https://lsic-wiki.jhuapl.edu/x/YIliAQ.

Surface Power

This month, we kicked off our modularity and standards working group with two sessions introducing the topic and brainstorming on how to approach system decomposition and define potential interfaces appropriate for modularity. We also held initial meetings for our working group on seven topics: rad-hard power electronics, low temperature batteries, transmission, fuel cells, photovoltaics, nuclear, and road map analysis. These groups will continue to work to identify the most critical components in need of development as well as provide feedback about funding structures and acquisition options. Our telecon featured a crossover from ISRU, Kartik Kumar (Satsearch). Kartik gave an overview on organic value chain mapping, instigated in the ISRU focus group but also a topic that goes towards the surface power annual goal. Jump into the conversation on Confluence (https://lsic-wiki.jhuapl.edu/x/YIliAQ).

Feature Article

Power Beaming for the Lunar Surface Workshop Summary

On July 22nd and 23rd, 2021, the LSIC Surface Power Focus Group hosted a workshop on power beaming for the lunar surface. A few months before the workshop, the topic was raised at one of the LSIC Surface Power Focus Group regular monthly telecons. LSIC community members, as well as our NASA POC John Scott agreed that a workshop covering the latest in power beaming would be timely given current solicitations, potential STMD gaps, and additional stakeholders with expertise, particularly within the DoD. As a result, we quickly organized a workshop on power beaming, taking input during registration on topics of interest. Through the course of the workshop, we were able to address every topic raised as well as produce a notional summary of the state of the art (figure below).

Day one of the workshop covered broader context and demand, while day two focused on deeper technical discussions. NASA Principal Technologist John Scott started things off, describing STMD's Watts on the Moon (WoTM) challenge and the metrics under consideration for the trade between beamed and cabled power. Then, Paul Jaffe (NRL) delivered a succinct history and introductory presentation on power beaming for space applications – defining power beaming as delivering at least over 1 m at least 1% efficiency for at least 1 minute. He also highlighted the first power beaming demo to meet that target in space, a 1.725 m demonstration planned for the ISS (SWELL, Space Wireless Energy Laser Link). Next, Geoffrey Landis (NASA) presented on power beaming for PSR exploration, describing it as a viable use-case, complete with qualitative details covering the varied power beaming modalities (mm wave, microwave, and laser).

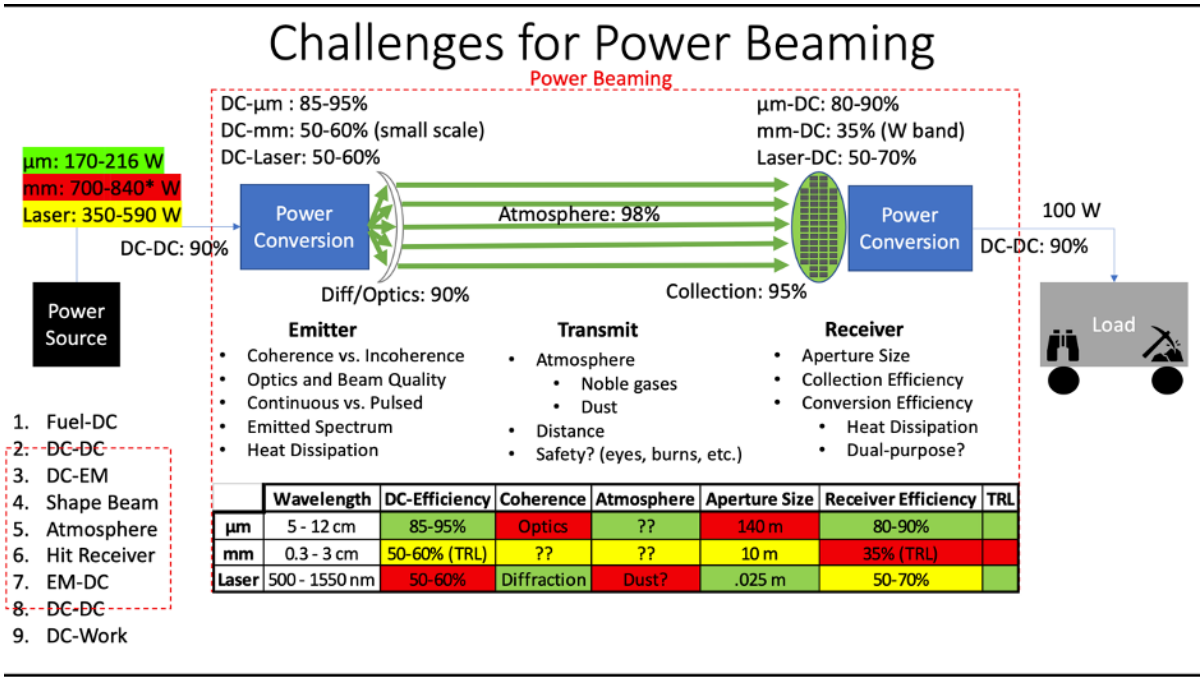
After the plenary talks, we transitioned to breakout sessions. Each group started from a different initial topic and worked through them as discussion warranted, covering (1) Use cases and CONOPS, (2) Trades, (3) Mobility, (4) Dual use and terrestrial applications, (5) Efficiencies, (6) Relationships to other focus areas. To close out day one, we engaged in "pop-corn" networking of repeated short sessions of small groups; lively conversation among participants lasted well beyond the initially allotted time.

Day two featured more community presentations, including from Watts on the Moon (WoTM) and LuSTR winner Philip Lubin (UCSB, Moonlight), who presented a plethora of details on the latest in laser power beaming, including novel advanced concepts. Brian Turner, captain of the WoTM-winning team KC Space Pirates, presented their work, as well as a helpful notional summary of the trade between laser power beaming and cabled power. Justin Zipkin from Astrolight rounded out the presentations from WoTM awardees with an interactive survey of the participants related to their award. Next came lightning talks covering deeper technical content from the LSIC community.

Following the lightning talks we held a panel discussion on "Challenges and Critical Steps to Advance Power Beaming," with panelists spanning from startups, to defense, academia, and non-profits. Working expeditiously to incorporate the content already presented in the workshop, Don Jenket from NREL produced a summary figure taking values from technical talks to produce a "power beaming summary slide" covering efficiencies and challenges across modalities, and sketched out the path to meeting a notional 100 We load via power beaming. This 'summary slide' was immediately useful as a reference, and is now undergoing refinement. Notes for the summary slide can be given at (https://lsic-wiki.jhuapl.edu/display/SP/Power+Beaming+Summary+Figure+improvement), or by

annotating the figure in Miro (https://miro.com/app/board/o9J_lvf1oWQ=/, no log-in required).

To finish out the day and the workshop, we held self-sorted technical breakout rooms. Topics were selected to cover remaining content called for by registrants, ranging from the practical and critical thermal management to new ideas in materials such as bio-inspired metasurfaces for lensing. The discussion can be continued on the Confluence page (https://lsic-wiki.jhuapl.edu/x/GIEiAQ).



Member Spotlight

Heni Ben Amor, Arizona State University

Dr. Heni Ben Amor is an assistant professor at Arizona State University's (ASU) Fulton School of Engineering. His research foci are artificial intelligence, machine learning, human-robot interaction, robot vision, and automatic motor skill acquisition. And while the department's focus is on upcoming technological applications of computer science, artificial intelligence, and autonomy, it also reaches out to work across different disciplines and bring the many schools at ASU together to answer big questions. Ben Amor has specifically worked with the on-campus Interplanetary Initiative, a pan-university space center that creates private-public partnerships and drives a positive future for human space exploration by finding key needs and filling them with interdisciplinary teams. "It's across the entire university," said Ben Amor, "everyone from arts and media working with computer scientists, the School of Earth and Space Exploration, and more." Individuals can submit proposals to the Interplanetary Initiative for seed funding to help get new ideas and projects off the ground, leveraging for additional funding or other means of collaboration in the future.

When the Interplanetary Initiative began, Ben Amor was one of the first to receive funding for a proposal to build exoskeletons for low gravity environments – robot suits that would help astronauts in space for two main reasons. First, to intelligently assist with activities such as carrying weight or pulling objects, but also (and perhaps more importantly) to provide resistance forces to astronauts for exercise at the right times. "It would keep track of the intentions of an astronaut, only providing resistance when they aren't engaged in physical activity," explained Ben Amor. "Then it would just provide resistance to exercise different muscles in the body to ensure they don't atrophy. By leveraging AI and robotics, we could reduce the bodily impact of space missions."

Currently, Ben Amor is working on several projects that result from collaborations with NASA. A recently completed initiative was the development of arm augmented cubesats. Cubesats are cheaper and easier to deploy in space because of their size, and the arm augmentation means they could engage in new applications such as collecting space debris or assembling structures and scaffolds in space. As part of this work Ben Amor worked with Dr. Renaud Detry and a team of students to create a Rendezvous and Proximity Operations (RPO) software package that leverages state-of-the-art machine vision, motion planning, and motor control to guide assembly activities. More information, including a video demonstrating autonomous assembly behaviors with truss components on their custom-developed test bed, can be found here: https://interactive-robotics.engineering.asu.edu/autonomous-in-space-assembly-with-arm-augmented-cubesats/

An important point made by Ben Amor is that technology sent to space doesn't (and perhaps can't) always be cutting edge. Instead, qualities like radiation hardening must come first. When working on the augmented arm cubesats, the team needed to balance the needs for real-time computer vision, intelligent arm control, and processing sensor data all running on minimal computer hardware – in this case, a Raspberry Pi. "It was brutal back in 2019 and 2020, but we're very proud of the results," laughed Ben Amor. While that project has been fully delivered to NASA, Ben Amor is already thinking of the next step – instead of assembling a fixed truss structure, how about using the arm augmented robots to build – other robots? While this may sound like science fiction, that's exactly what draws Ben Amor to this kind of idea. And it is solving a real-world issue – the long lead time for planning, assembling, launching, and deploying robots for space missions can mean that if one tool doesn't work the way it's supposed to, there's a huge amount of wasted resources, and the cycle has to begin

again to try to succeed where the past version failed. Ben Amor asks, how about building the robot in space? “So instead of one robot for one task, have a robot arm that on one hand has access to a 3D printer, on the other hand has waiting energy resources and actuated components. The chassis can be 3D printed – we could 3D print any morphology for the robot that we want, and rapidly iterate over different designs to find one suited to the environment.” This is one of the ‘blue sky’ visions Ben Amor is working on in his lab.

This kind of big thinking has led to filling some real-time gaps in needed technology. The kind of manipulation needed by robots to do this kind of work means researching more than just the uni-manual robotics that have already been done. Bi-manual manipulation will be required, and there isn’t a lot of research on that subject – which Ben Amor is now looking to solve. “But what we’re mostly interested in is semi-autonomy. We want robots to be able to exert forces on the real world, assemble and manufacture things, but we want the human at the center of the exploration process,” stated Ben Amor. This focus has led to another project currently being worked, which is complementing human cognition by being able to interpret human language. He gave the example of trying to direct a system like Alexa to cook your breakfast. It may have the ability to do components of the task – sourcing bacon and eggs, timing portions of the process, and finding recipes, but it doesn’t really understand what breakfast means such that it could open the fridge, get out ingredients, and start cooking. Ben Amor wants to create robots you don’t need to spend years training on joysticks and buttons to use – he wants humans to be able to talk to robots as a natural interface. This means he’s working on grounding of language in physical understanding of the environment so that robots could not only provide information but actually perform useful tasks based on normal human speech. All of which continues serving his lab’s goal – enabling and empowering human exploration of space.

The Interactive Robotics Lab at ASU is where Ben Amor does his work with teams of students. “I can’t stress enough how brilliant our students are,” he proudly shared. Students work on research involving machine learning, human-robot interactions, grasping and manipulation, as well as robot autonomy. Ben Amor believes that there needs to be more opportunities for students, earlier in their careers, to work on space-related projects. Students often have to graduate with a master’s degree to start getting into what it means to work on space missions – it’s challenging for undergraduates to get involved at all. He sees initiatives like NASA’s Space Grant Consortium, of which students at his lab have been beneficiaries, as a good start. Looking for new ways to engage with students and draw them in to this cutting-edge research as early as possible is as important to his mission as delivering the success he has already given to NASA and other stakeholders. You can find out more about the Interactive Robotics Lab here: https://interactive-robotics.engineering.asu.edu/

NASA News

NASA Announces Virtual Webb STEAM Day Event for Students, Educators

23 September 2021 (RELEASE 21-124): NASA invites learners of all ages, including students and teachers who recently returned to the classroom environment, to register for a special event ahead of the upcoming launch of the James Webb Space Telescope. Webb STEAM Day: A Learning Journey Together is a virtual, interactive event that will take place from 9:30 a.m. to 5:30 p.m. EDT Thursday, Sept. 30. STEAM stands for science, technology, education, arts, and mathematics. Educators and families can register starting Thursday, Sept. 23, at: https://go.nasa.gov/WebbSTEAMDay

Click here to read more: https://www.nasa.gov/press-release/nasa-announces-virtual-webb-steam-day-event-for-students-educators

NASA Awards Orion Main Engine Contract for Future Artemis Missions

21 September 2021 (CONTRACT RELEASE C21-027): NASA has awarded a contract to Aerojet Rocketdyne Inc. of Redmond, Washington, for the development of the Orion Main Engine (OME), which will be used on the Orion spacecraft as part of the agency's Artemis program. The contract includes certification of the OME design, production, and special studies and tasks. It is a single-award, indefinite-delivery/indefinite-quantity contract with firm-fixed-price orders. The period of performance is from Sept. 21, 2021, through April 23, 2032, with a maximum value of $600 million. Click here to read more: https://www.nasa.gov/press-release/nasa-awards-orion-main-engine-contract-for-future-artemis-missions

NASA Leadership Positions Agency for Future

21 September 2021 (RELEASE 21-122): NASA Administrator Bill Nelson announced Tuesday the agency is creating two new mission directorates that will best position the agency for the next 20 years. The move separates the agency's current Human Exploration and Operations Mission Directorate into the new Exploration Systems Development Mission Directorate (ESDMD) and Space Operations Mission Directorate. NASA is making the changes because of increasing space operations in low-Earth orbit and development programs well underway for deep space exploration, including Artemis missions. Click here to read more: https://www.nasa.gov/press-release/nasa-leadership-positions-agency-for-future

NASA's Artemis Rover to Land Near Nobile Region of Moon's South Pole

20 September 2021 (RELEASE 21-121): In 2023, NASA's Volatiles Investigating Polar Exploration Rover (VIPER) will land near the western edge of the Nobile Crater at the Moon's South Pole to map and explore the region's surface and subsurface for water and other resources. Part of Artemis, VIPER will launch on a SpaceX Falcon-Heavy rocket for delivery to the Moon by Astrobotic's Griffin lander under NASA's Commercial Lunar Payload Services initiative. The Moon's South Pole is one of the coldest areas in our solar system. No prior missions to the Moon's surface have explored it – scientists have thus far only studied the region using remote sensing instruments, including those on NASA's Lunar Reconnaissance Orbiter and the Lunar Crater Observation and Sensing Satellite. Click here to read more: https://www.nasa.gov/press-release/nasa-s-artemis-rover-to-land-near-nobile-region-of-moon-s-south-pole

NASA Selects Five U.S. Companies to Mature Artemis Lander Concepts

14 September 2021 (RELEASE 21-115): NASA has selected five U.S. companies to help the agency enable a steady pace of crewed trips to the lunar surface under the agency's Artemis program. These companies will make advancements toward sustainable human landing system concepts, conduct risk-reduction activities, and provide feedback on NASA's requirements to cultivate industry capabilities for crewed lunar landing missions. The awards under the Next Space Technologies for Exploration Partnerships (NextSTEP-2) Appendix N broad agency announcement are firm fixed-price, milestone-based contracts. The total combined value for the awards is $146 million, and the work will be conducted over the next 15 months. Click here to read more: https://www.nasa.gov/press-release/nasa-selects-five-us-companies-to-mature-artemis-lander-concepts

NASA Invites Students, Educators to Join Artemis I Mission

01 September 2021 (RELEASE 21-114): As students and educators return to classrooms online and in-person, NASA welcomes the next generation of explorers – the Artemis Generation – to learn more about the mission that will pave the way to land the first woman and first person of color on the Moon. NASA's Artemis program will reach new heights this school year with the uncrewed Artemis I mission, the first integrated launch of the agency's Space Launch System (SLS) mega-rocket to send the Orion spacecraft around the Moon and back to Earth ahead of future flights with astronauts. Click here to read more: https://www.nasa.gov/press-release/nasa-invites-students-educators-to-join-artemis-i-mission

Funding Opportunities

Sources Sought Notice (SSN) From NASA Goddard Space Flight Center

The National Aeronautics and Space Administration (NASA) Goddard Space Flight Center (GSFC) releases this Sources Sought Notice (SSN) for capabilities, ideas and information that will lead to commercialization of the Near Space Network (NSN) Communications and Tracking services to support multiple missions across the full NASA portfolio to include LEO, MEO, GEO, Sun/Earth L1, L2 and Lunar orbital regimes. It is the intent of NASA/GSFC to use this information for program planning purposes, with the goal to issue a solicitation in the near future. NASA/GSFC is seeking responses from all interested parties that possess the technical capability to provide Direct-to-Earth (DTE) Communications and Navigation services in Near Space region and Communication Relay and Navigation services in lunar space. Click here for more information: https://sam.gov/opp/84c5924758d64c99bc42f70038a2531c/view

NASA SBIR / STTR Interactive Learning & Networking Session: Infusion & Commercialization, Part II

Join the NASA SBIR/STTR program team on Wednesday, November 3rd from 12:00pm – 2:30pm ET for our next interactive learning & networking session, Infusion & Commercialization – Part II, during which we will highlight the various opportunities for funding and support available after award of a Phase II contract. The virtual session will consist of a short presentation, a question & answer session with NASA experts, and open networking time to speak directly with our program representatives and other small businesses and research institutions. We will cover a host of Post Phase II opportunities, including:

- Phase II-Extended (II-E)
- Sequential Phase II
- Civilian Commercialization Readiness Pilot Program (CCRPP)
- Phase III

We will also be looking at the new I-Corps enrollment opportunities made available this year to Phase II-E and CCRPP recipients.

Who Should Attend?

For all of our Phase II awardees going back to 2011, there will be information you can act on to further your own efforts toward infusion into a NASA mission and/or commercialization in the marketplace. For our active Phase I awardees, this is an opportunity to plan ahead for your Phase II proposal and beyond. And of course, the event is open to everyone in our community who would like to learn more.

For upcoming SBIR / STTR event information, visit: https://sbir.nasa.gov/events

Tech Development

- SpaceTech-REDDI-2021: Tech Flights Solicitation
https://tinyurl.com/NASA-21FO-F1

  Full Proposals due on or before October 4, 2021

- NASA Human-Autonomy Teaming Task Battery Challenge
https://www.nasa.gov/nasa-hattb

  Deadline: December 29, 2021

- 2022 Breakthrough, Innovative and Game-Changing (BIG) Idea Challenge: Extreme Terrain Mobility Challenge
http://bigidea.nianet.org/competition-basics/

  Proposal and Video deadline: January 18, 2022

Student Tech Development

- (MUREP) Innovative New Designs for Space (MINDS)
https://www.nasa.gov/stem/murep/projects/nasa-minds.html

  NASA receives applications and proposals: From Aug 17, 2020 to Oct 7, 2020

- Human Exploration Rover Challenge (HERC)
https://www.nasa.gov/roverchallenge/studentschedule

  Registration Closes—U.S. Teams: Oct. 7, 2021

- Micro-g Neutral Buoyancy Experiment Design Teams (Micro-g-NeXT)
https://microgravityuniversity.jsc.nasa.gov/

  Letters of intent due Oct. 12, 2021; Proposals due Oct. 28, 2021

- First Nations Launch
https://spacegrant.carthage.edu/first-nations-launch/

  Notice of Intent Deadline: Oct. 22, 2021 Event Dates: April 22-24, 2022

- Spacesuit User Interface Technologies for Students (SUITS)?
https://microgravityuniversity.jsc.nasa.gov/nasasuits.cfm

  Team proposals Due Oct. 28, 2021

- NASA Space Technology Graduate Research Opportunities (NSTGRO22)
https://nspires.nasaprs.com/external/solicitations/summary.do?solId={16FBBBCE-FF26-3208-38A5-447B00A8EE7D}&path=&method=init

  Proposals due: November 2, 2021

- NASA TechRise Student Challenge
https://www.nasa.gov/press-release/new-nasa-student-challenge-offers-hands-on-tech-development

  Submission Deadline: November 3, 2021

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

  Webinar Nov 29, 2021: Deadline for entries Dec 20, 2021: Notification to invitee teams for in-person challenge June, 2022: In-person challenge

- **Breakthrough, Innovative and Game-changing (BIG) Idea Challenge**
http://bigidea.nianet.org/

  Proposals are due Jan. 18, 2022

Request for Information (RFIs)

- **Near Space Network (NSN) Communications and Tracking Services**
https://sam.gov/opp/84c5924758d64c99bc42f70038a2531c/view

  Responses are due by October 15, 2021

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