



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!

I'm looking forward to seeing many of you next month at our Spring Meeting! We have an exciting program planned, including plenty of time for networking and discussions. As always, we will offer our sessions in a hybrid format for those who cannot make it in person.

In addition to our normal Spring Meeting, this year we are holding a half-day funding workshop on the day following the meeting, April 26. The community has let us know that it would be helpful to learn more about the various opportunities and funding mechanisms that NASA's Space Technology Mission Directorate has to offer. While we have held funding and awardee panels at some of our meetings, the goal of this meeting is to go deeper, providing more time to hear about the different types of programs. Space Tech offers a wide range of opportunities, from academic grants, through large and small contracts, to space act agreements. Navigating eligibility for these various programs, as well as assessing what makes a competitive proposal, is not always easy. While many of you will at times compete with one another, I have been excited to see how many in the community also participate as partners. Growing a thriving space community (and economy) will take all of us, so the more we can mentor our colleagues, the more we can all grow to take on the great challenges ahead of us.

So, if you are interested in learning more about NASA Space Tech funding and programs, I invite you to sign up for the funding workshop here: <https://lsic.jhuapl.edu/Events/Agenda/index.php?id=441>. The meeting will primarily include panels and discussion, including breakout sessions for smaller groups to talk about the various programs. Hope to see you there!

To the Moon!



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

Last Wednesdays at 2PM Eastern

Extreme Access

Second Thursdays at 3PM Eastern

Extreme Environments

Second Tuesdays at 3PM Eastern

In Situ Resource Utilization

Third Wednesdays at 3PM Eastern

Surface Power

Fourth Thursdays at 11AM Eastern

LSIC General Updates

LSIC Spring Meeting Set for April 24–25

Leaders from NASA, the Department of Defense, and other government agencies will share insights and engage with members of the space technology community at the Lunar Surface Innovation Consortium (LSIC) Spring Meeting on April 24–25. Held virtually and on the campus of the Johns Hopkins Applied Physics Laboratory (APL) in Laurel, Maryland, the meeting will focus on the nation’s vision for a sustained presence on the lunar surface. Panels, discussions, and working sessions will include topics such as long-term use cases for infrastructure on the lunar surface, lunar technology developments, and transitioning from a mostly NASA-supported presence on the Moon to industry or other public or private involvement.

Featured speakers and panelists include: Pam Melroy, NASA deputy administrator; Stefanie Tompkins, director of the Defense Advanced Research Projects Agency; Matt Daniels, assistant director of the White House Office of Science and Technology Policy for space security and special projects; James Reuter, NASA associate administrator for the Space Technology Mission Directorate; Kurt “Spuds” Vogel, NASA director of space architecture; and Walter Englund, NASA deputy associate administrator for programs in the Space Technology Mission Directorate.

Registration deadlines are April 10 for in-person attendance and April 17 for virtual attendees. Learn more on the [LSIC website](#).

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

Focus and Working Group Updates

Dust Mitigation

In its February meeting, the Dust Mitigation (DM) Focus Group covered the ongoing LSIC Community White Paper effort. Sarah Hasnain, co-facilitator of both the Dust Mitigation and Excavation and Construction focus groups, presented an overview of the paper titled “The Path to an Enduring Lunar Presence.” The group had an engaging follow-on discussion regarding the dust mitigation section of the paper, as well as the community’s vision for needs and opportunities in dust mitigation as it relates to Moon-to-Mars development.

The DM Focus Group is also looking for new leads for its three new subgroups: **Materials and Coatings, Modeling and Monitoring, and Mechanisms and Connectors**. See more information and register interest in the survey linked here: <https://forms.gle/AGpyJcNZBd6ihdaq7>.

Excavation & Construction

In February, the Excavation and Construction (E&C) Focus Group met under the theme of “Let’s Build It on the Moon!” Ramesh Malla, of the University of Connecticut, presented an overview of the work of the American Society of Civil Engineering’s Space Engineering and Construction Committee to develop a framework for designing and building structures on the Moon. Following Malla was Andrew Detor, program manager at the Defense Advanced Research Projects Agency, who provided

an overview of the Novel Orbital and Moon Manufacturing, Materials, and Mass-efficient Design program, or NOM4D.

The group also held breakout sessions for our four subgroups: [Autonomy and Site Planning](#), [Additive Manufacturing and Raw Materials](#), [Site Prep, Horizontal and Vertical Construction](#), and [Outfitting and Maintenance](#).

Extreme Access

In the Extreme Access February telecon, the Extreme Access (EA) Focus Group hosted a Small Business Innovation Research (SBIR) information session and discussed the recent Lunar Surface Technology Research (LuSTR) call around multi-robot teaming. We devoted our subgroup meetings to discussion of the community-driven white paper. We are also planning to start a subgroup on autonomy, and we had discussions with the E&C group about how we can coordinate autonomy discussions between our two areas. To sign up for the EA autonomy subgroup, visit <https://lsic-wiki.jhuapl.edu/display/EA/Autonomy+subgroup>. Anyone interested in the subgroup lead position should email sarah.withee@jhuapl.edu.

Extreme Environments

In February, the Extreme Environments (EE) Focus Group covered the 2023 SBIR/Small Business Technology Transfer (STTR) solicitations. We received some great feedback on the calls as well as some recommendations from the community on a path forward. For at least the next three months, we will hear from some of the 2022 SBIR awardees. Our March showcase technologies are “Low Temperature Durable Siloxane/Epoxy Nanocomposite Coating for Drastic Reduction in Lunar Particulate Adhesion” and “Cryogenic Oscillating Heat Pipes.” As we get closer to the LSIC Spring Meeting, we invite everyone register so we can have a great EE turnout!

EE also wants to jumpstart its “Crosstalk” series, so reach out to EE leadership at Facilitator_ExtremeEnvironments@jhuapl.edu with any specific topics of interests. Additionally if anyone is interested in joining one of our subgroups, visit <https://lsic.jhuapl.edu/Our-Work/Focus-Areas/index.php?fg=Extreme-Environments> for more information.

In Situ Resource Utilization

The In Situ Resource Utilization (ISRU) Focus Group held an open discussion about our vision for 2023 during our February monthly telecon. We gathered input on subgroup content and formats, monthly meeting content, interactions with the other five focus groups, networking opportunities with other companies, and specific requests from NASA, among other topics. We gathered a substantial amount of feedback and are excited to dive into the poll responses and define a set of modifications and improvements to how the ISRU Focus Group is conducted. These results, and our recommendations to address them, will be made available as soon as possible. If you missed the chance to provide input, feel free to reach out to any member of the ISRU leadership team at Facilitator_ISRU@jhuapl.edu. We also briefly discussed the community-derived white paper, and are excited to share the first draft within the next couple months. Add your thoughts on what should be included in this white paper to the dedicated ISRU Confluence page: <https://lsic-wiki.jhuapl.edu/x/PQUiAw>.

Surface Power

In its February telecon, the Surface Power team hosted Mark Storm (Fibertek) as the guest speaker. Fibertek is an aerospace laser system designer that has built multiple space-qualified lasers currently operating on Department of Defense and NASA astrophysics missions. Storm discussed

power beaming on the lunar surface, and advocated for a Commercial Lunar Payload Services (CLPS)-scale technology demonstration mission using 100- to 300-watt lasers that have been proven and qualified on-orbit. Beaming energy over kilometer-length distances at this power scale could enable the exploration and resource prospecting of permanently shadowed regions (PSRs) of lunar craters by autonomous rovers without tethers. Storm also addressed potential higher-power applications of power beaming on the Moon such as grid-scale distribution between a base camp and remote solar arrays situated near peaks of nearly eternal light at the lunar poles. Additional topics of discussion during the meeting included the results of the 2022 surface power community survey, plans for the upcoming LSIC community white paper, and upcoming NASA Space Technology Mission Directorate (STMD) solicitations.

The Surface Power Focus Group's monthly telecon on March 16 will address radiation tolerant electronics. Akin Akturk, vice president at CoolCAD Electronics, will provide an overview of radiation testing programs and facilities (including gamma, neutron, and heavy ion) and discuss results from recent investigations into the performance of gallium nitride (GaN) and silicon carbide (SiC) power transistors and diodes in the lunar environment. On April 13, the monthly telecon will feature updates from the LuSTR 2020 awardees for power, and speakers from all three Vertical Solar Array Technology (VSAT) Phase II winners (Lockheed Martin, Honeybee Robotics, and Astrobotic) will headline the May 25 telecon. On July 26–27, the Surface Power team will host a two-day virtual workshop on power system reliability; more information on this event, including abstract submission instructions, will be available soon. If you are interested in presenting at a telecon or coordinating a meeting with the Surface Power team, reach out to Facilitator_Power@jhuapl.edu.

MOSA Working Group

On February 1, Jaret Matthews (Venturi Astrolab) presented on the FLEX rover's capabilities and payload accommodation; details can be found in the Payload Interface Guide. Astrolab offers quarterly payload field testing opportunities and invites the community to reach out regarding these opportunities. You can catch the replay of this event on the LSIC website.

The next Modular Open Systems Approach (MOSA) Working Group telecon is scheduled for April 5, when team members from the Southwest Research Institute (SwRI) will present on VICTORY and provide feedback on what lessons can be leveraged for developing interoperability for the space industry.

Lunar Simulants Working Group

The [Lunar Simulants Working Group's](#) (LSWG) main activity in February was accepting inputs to our [LSII Lunar Simulant User Needs Survey](#), which helps us advise NASA on current and upcoming needs. The results will also guide our annual simulants assessment, so we can evaluate the appropriate simulant characteristics. We encourage simulant users to fill out the survey so that we know what is important for your work! We also have our 2022 Lunar Simulants Assessment document available on the LSIC [webpage](#) (under the Assessments and Databases tab) and on the LSIC [Confluence](#) page, as well as results displayed with previous years' results in the [Lunar Simulants Data Repository](#). We also plan to expand the role of the LSWG, so join up with the group at the [LSWG Confluence page](#) and click "Watch" in the top menu bar—and don't forget to introduce yourself on our [Welcome page](#)!

Feature Article

LSIC to Support Host and Payload Provider Searches for ‘Access to Space’

Joshua T.S. Cahill, LSIC Deputy Director & Alysén Regiec, LSIC Web Developer

Web Interface at: lsic.jhuapl.edu/access-to-space

If our generation is to achieve the Artemis program’s ultimate goal to establish a habitat and community at the lunar South Pole, we must make on-ramps more recognizable between rideshare providers and vendors of payloads and technical services. Both need to expeditiously test equipment, instruments, algorithms, and theories, or attain that elusive data critical for decision-making in areas of the Moon where no one has ever ventured. And both need a steadily reliable supply of customers. To manage this, our efforts must enable, if not a direct ride to the lunar surface, an iterative development pathway to the Moon via suborbital, Earth-orbital, and cislunar testing stages. And to enable that pathway and activities consistently, we need to form, cultivate, and refine a cislunar-focused economic ecosystem.

Despite the exciting creation of NASA’s Commercial Lunar Payload Services (CLPS) program, pathways to the lunar surface sustained with U.S. government support should only be the first of many pathways established. Encouragingly, though none have yet succeeded, these additional pathways to expedite transport of technology to the lunar surface are gradually appearing, being forged by a mixture of commercial, private, and other government (international) providers. But, all of them will need sustained business and healthy competition to further innovate and succeed. A straightforward place to start is for providers to be more readily and consistently seen, so potential customers and partners have the appropriate points of contact (POCs) and know enough about provider endeavors to recognize opportunities to constructively engage. While CLPS certainly offers a place to start, success in other sectors is key to establishing footholds on the lunar surface and in a burgeoning lunar economy—which is the only path to a truly sustained presence.

But even in the Artemis age, where does one find an “open seat” or, in this context, the available resources (such as mass, volume, and power) that will enable payload testing not just in orbit, but perhaps directly on the lunar surface? Until recently, news reports, word of mouth, or going “door-to-door” to the providers were the only ways to see what, if any, opportunities each flight might still have available. And while a few businesses offer web services filling out launch vehicles, there is virtually nothing primarily focused on the Moon and filling out host platforms (e.g., orbiters, landers, rovers, hoppers, etc.) that will support development of lunar-specific technologies.

We need a better way.

Connecting the Community

Responding to this need, over the last couple of years, LSIC has been conceptualizing and, in the last six months or so, shaping a basic interface that may serve as the Artemis generation’s lunar-focused marketplace, or clearinghouse. ***The interface is designed to cultivate customers and partnerships by focusing on a vendor’s residual available services and needs that ultimately provide, or prevent, “access to space” and subsequent support of activities during cislunar and lunar surface exploration.***

LSIC envisions that anyone can readily learn about funded or not-yet-funded rideshare opportunities, stay up-to-date on sliding integration deadlines and launch timing, the payloads or technical services they may require, and, of course, their willing POCs (often most important). Such information is basic, yet crucial to enable efficient purchase of equipment or services and establishment of partnerships for ventures on the lunar surface.



[Lander](#)
[Surface Mobility](#)
[Cis-lunar Orbiter](#)
[Sub-Orbital](#)
[Payloads](#)
[Services](#)
[+ Submit a New Host or Payload Opportunity](#)

All Categories:
 [Surface Power](#)
[Dust Mitigation](#)
[Extreme Environments](#)
[Extreme Access](#)
[Excavation and Construction](#)
[In Situ Resource Utilization](#)
[Lunar Simulants](#)

[+ Mission/Instrument](#)
[+ Launch Date](#)
[+ Contact Deadline](#)
[+ TRL](#)

Recent evidence and “tipping points” suggesting a need for an interface of this type were evident at the 2022 Lunar Exploration Analysis Group (LEAG) meeting, where multiple CLPS providers noted residual payload capacity and support they were looking to find customers to fill. Further evidence was on display at the 2022 CLPS Survive the Night Workshop, where question-and-answer sessions often veered toward the need for a marketplace that could cultivate the cislunar economic ecosystem by connecting providers and customers.

Now, perhaps we have a place to start.

The Access to Space effort was initially envisioned as a way to gather and denote the residual resources remaining to be leveraged on each CLPS flight manifest. This is because, while there will always be a limit to how much we can launch and deliver to the Moon at any given time, we should still aim to take full advantage of available rideshare resource opportunities. In some cases, only about 1 kilogram or less remains open for use by a payload, but in others, tens of kilograms remain available. In a perfect case, businesses would completely fill a manifest, but sometimes not filling it out is a CLPS providers’ prerogative to limit risk and ensure success—particularly for these early flights. In other cases, information is competitive and a provider may not want to advertise its full lift capabilities. Therefore, we have provided vendors plenty of freedom in describing their remaining resources available for customer payloads

Interestingly, in our initial discussions with them, it was the CLPS providers that expressed a desire to make Access to Space a two-way interface that not only provided this information, but listed payloads and service providers they might examine for new customers and/or service providers they might need. In this way, providers from either side of the equation may exchange basic information with the LSIC community, and then reach out to the relevant vendor’s website and POC.

This has resulted in our initial iteration of the Access to Space (lsic.jhuapl.edu/access-to-space), which includes submissions from vendors as well as LSIC’s own research from public sources and allows users to report information on the following lunar technology topics:

1. Basic, approximate, and flexible knowledge on timing of specific vendor launch opportunities (daily is requested, but quarterly is reported).
2. Types of payloads vendors are willing to accept (e.g., physical payloads, data-only payloads using host instrumentation, data buys, or all of the above).
3. Manifest space and resources (e.g., volume, mass, power) host vendors have available, or remaining, to provide payload providers.
4. Types of payloads instrument creators have ready or under development, a basic assessment of the resources they require, and their readiness (i.e., Technology Readiness Level, or TRL).

5. Host provider or payload financial support (i.e., development and flight separately) and its source(s) (i.e., government, commercial, private). This key information often provides confidence for both parties to initiate contact, and in some NASA STMD development calls both development and flight support have been options. Flight support was a specific piece of knowledge CLPS providers requested knowledge of.
6. A truthful assessment of information quality and the source(s) (e.g., vendor reported or LSIC researched with sources cited).
7. Accepting feedback for improvement on the interface, allowing listing revision, and taking tips for subsequent investigation and verification.
8. And finally, basic moderation by the LSIC to ensure content posted is reviewed and verifiable before posting.

The creation of the Access to Space interface aligns with Lunar Surface Innovation Initiative and LSIC objectives to help the Artemis initiative take hold technologically—whether by supporting the community’s need for customers, partners and planning, or gathering feedback and information from the community to advise NASA on the best course of action. It is also simple and straightforward enough to evolve with the next phases of exploration, whether adaptation to an Earth-Moon-Mars space ecosystem or another initiative. The LSIC team appreciates NASA SpaceTech’s support in building such an interface to fuel an ecosystem many of us believe is necessary to succeed, seeing where the tool falls short, fixing it, and then trying again.

Member Spotlight

GITAI US

Of the many partnerships boosting NASA’s return to the Moon, one in particular—the teamwork between humans and machines to establish a lunar infrastructure—has the attention of the team at GITAI USA.

The six-year-old California-based technology firm and LSIC newcomer aims to address the growth of construction and maintenance activities in space by developing more capable and less-expensive robotic systems to handle these tasks. Early success on some of its robotic prototypes has company leads excited about the prospects of contributing to international efforts to increase human presence and sustain operations in near-Earth space, on the Moon and beyond.

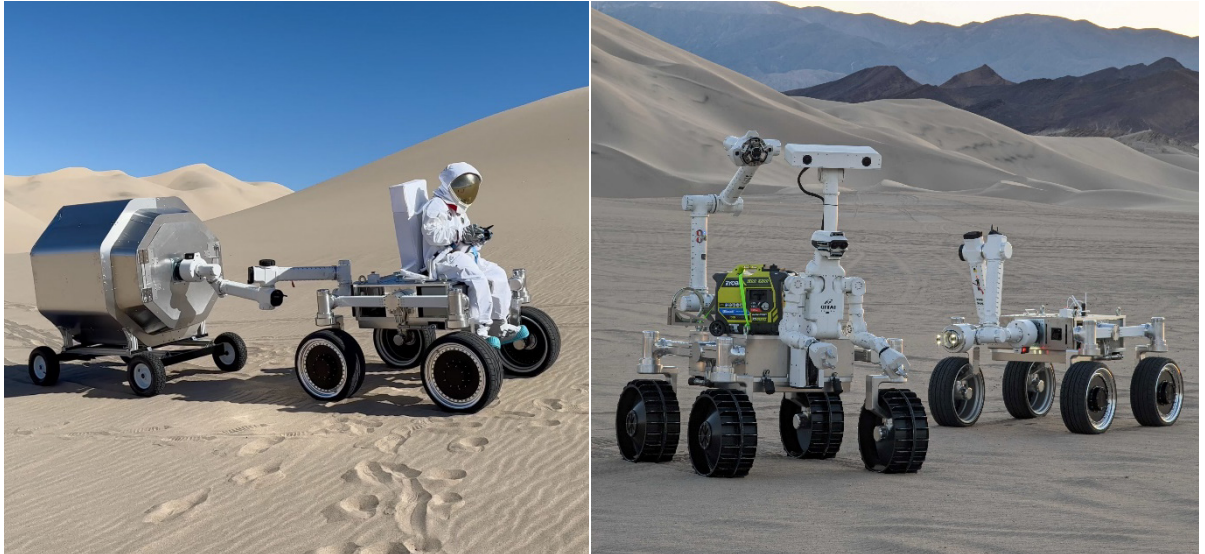
“This is a very historic moment for humankind,” said Sho Nakanose, GITAI’s chief executive officer. “Many companies are looking for ways to reduce the labor costs of returning to the Moon, and we are taking on that challenge by realizing the capacity of robotic technologies. It’s our vision and passion to contribute to exploration by developing highly capable, safe, and reliable robots to help build and maintain satellites, space stations, lunar bases, and even cities on the Moon or Mars.”

Reaching Out

Core to GITAI’s development efforts are versatile robotic arms suited for custom requirements. The arms have versatile articulation capabilities and attaching mechanisms on each end—allowing users to connect them to other arms or move them between different vehicles (such as rovers, landers, or lunar terrain vehicles) or habitats (surface structures or space stations)—and can be adapted for uses ranging from welding to construction to excavation. They operate on a combination of direct human input or autonomy, depending on the task and environment.

“We started from ground applications and developed ‘up,’” said Toyotaka Kozuki, GITAI’s chief technology officer. “Traditional space technology is focused on making things smaller and lighter, but we are improving our technology to meet certain task capabilities and durability. Like any start-up, we’ve had challenges and things to learn, but that’s how we’re proceeding.”





With a staff of about 50—approximately half of whom hold Ph.D.s, according to Nakanose—GITAI is equipped to develop, build, and test its robots in-house in Torrance, California. The company has developed and tested arms as long as 10 meters, as well as smaller “inchworm” models ranging from 2 to 3 meters. In October 2021, GITAI successfully demonstrated its arm technology inside the International Space Station, and followed up last April with another demo of its ISAM capabilities—short for in-space servicing, assembly and manufacturing—in a simulated space environment.

Another ISS test is scheduled for this spring.

“Given the [expected] decrease in launch costs, we think we’ll be able to send larger equipment, larger robots that can provide labor for jobs such as debris removal or construction,” said Kozuki. “We’ve made smaller robots, but we believe there is more opportunity in making larger things, to handle larger objects and build larger infrastructure.”

Both Nakanose and Kozuki said the company is eager to engage with other LSIC members and establish a presence in the space engineering community. “We’re building something from scratch,” Kozuki said. “We want to take in the technology, and we want to exchange ideas and opinions on how these technologies might be used.”

Learn more about GITAI at <https://gitai.tech/>.

NASA and Community News

NASA warns of budget challenges in year ahead

02/22/2023 \\ SpaceNews \\ Jeff Foust

<https://spacenews.com/nasa-warns-of-budget-challenges-in-year-ahead/>

Intuitive Machines rings Nasdaq bell on path to private moon landing

02/15/2023 \\ Space.com \\ Elizabeth Howell

<https://www.space.com/intuitive-machines-astronauts-moon-technology-nasdaq>

NASA Selects Nine Technologies for Commercial Flight Tests

02/13/2023 \\ Space.com \\ Sarah Mann

<https://www.nasa.gov/feature/nasa-selects-nine-technologies-for-commercial-flight-tests>

Blue Origin made solar cells by smelting simulated Moon dust

02/13/2023 \\ engadget \\ Jon Fingas

<https://www.engadget.com/blue-origina-solar-cells-moon-soil-173908801.html>

Blue Alchemist Technology Powers our Lunar Future

02/10/2023 \\ Blue Origin

<https://www.blueorigin.com/news/blue-alchemist-powers-our-lunar-future/>

NASA Redirects Intuitive Machines' First Mission to the Lunar South Pole Region

02/06/2023 \\ Intuitive Machines

<https://www.intuitivemachines.com/post/nasa-redirects-intuitive-machines-first-mission-to-the-lunar-south-pole-region>

Funding Opportunities

Requests for Information (RFIs)

- [Suborbital/Hosted Orbital Flight and Payload Integration Services 4 Solicitation](#)

Feedback Deadline: March 11, 2023

- [Lunar Science Rideshare Mission \(Luna Ride\)](#)

Also see information at:

https://newspace.asu.edu/wp-content/uploads/2023/01/FINAL_RFI_Luna-Ride_R2.3.pdf

Tech Development

- [NSF SBIR and STTR](#)

NSF recommends treating the submission window like a deadline, but you can submit anytime within a year of receiving an official invitation from NSF. (NSF uses submission windows to help gather and review proposals, but sometimes proposals are reviewed as they are received.) Windows: November 22, 2022 – March 1, 2023, March 2, 2023 – July 5, 2023, and July 6, 2023 – November 1, 2023.

- [NASA FY 2023 Phase I SBIR and STTR Solicitations](#)

The next Phase I opportunity planned to open on January 10, 2023, and close on March 13, 2023. The NASA SBIR and STTR Phase I Solicitations are open to small businesses with 500 or fewer employees. To apply for an STTR, a small business must partner with a non-profit research institution such as a university or a research laboratory. SBIR Phase I contracts last for six months and STTR Phase I contracts last for 13 months, both with a maximum funding of \$150,000. The next anticipated release of the next Phase I SBIR/STTR solicitation will be in 2023.

- [NASA Innovative Advanced Concepts \(NIAC\) Phase III](#)

Mandatory Preliminary Proposals Due: March 8, 2023

Final Proposals Due: May 17, 2023

- [NASA Innovation Corps Pilot](#)

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; September 16, 2022; November 17, 2022; and January 20, 2023.

- [MUREP Space Technology Artemis Research \(M-STAR\)](#)

Proposals Due: April 10, 2023

Optional Pre-proposal Webinar: February 23, 2023, 4:00–5:30 PM ET and March 14, 2023, 4:00–5:00 PM ET

- [Early Career Faculty 2023](#)
Notices of Intent Due: March 16, 2023
Proposals Due: April 13, 2023
- [Lunar Surface Technology Research \(LuSTR\) Opportunities](#)
NOIs Due: March 22, 2023
Proposals Due: April 24, 2023

Student Tech Opportunities/Competitions

- [PI Launchpad: Developing Your First Flight Mission Proposal](#)
Applications Due via NSPIRES: April 14, 2023
Workshop Dates: July 24–27, 2023