



Leveraging the ISS National Lab to Enable Digital Engagement and Higher Education

National Lab Research Announcement NLRA 2021-4

Instructions to Offerors

The Center for Advancement of Science in Space
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Note: For any updates regarding submission deadlines, please visit www.issnationallab.org/research-on-the-iss/solicitations/nlra2021-4. For general questions relating to this research announcement, please contact info@issnationallab.org.

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I. SUMMARY

The International Space Station (ISS) is a one-of-a-kind laboratory that enables research and technology development not possible on Earth. As a public service enterprise, the ISS U.S. National Laboratory allows researchers to leverage this multiuser facility to improve quality of life on Earth, mature space-based business models, advance science literacy in the future workforce, and expand a sustainable and scalable market in low Earth orbit (LEO).

Through this orbiting national laboratory, research resources on the ISS are available to support non-NASA science, technology, and science, technology, engineering, and mathematics (STEM) education initiatives from U.S. government agencies, academic institutions, and the private sector. The Center for the Advancement of Science in Space (CASIS) manages the ISS National Lab, under Cooperative Agreement with NASA, facilitating access to its permanent microgravity research environment, a powerful vantage point in LEO, and the extreme and varied conditions of space.

As a U.S. taxpayer-funded organization, CASIS works only with U.S.-based organizations and researchers. This document will assist offerors in the development of quality proposals to use the ISS National Lab for educational outreach and engagement.

II. DESCRIPTION OF PROGRAM

The ISS has enabled a revolution in educational access to space. The same assets that make the ISS a powerful laboratory for scientists also make it an invaluable platform for student research investigations and educational outreach. Accessible through frequent launches, real-time connectivity to data streams from in-orbit experiments, and crew member activities, the ISS offers access to a unique perspective of Earth, persistent microgravity to explore its effects on living and nonliving things, and the environmental extremes of LEO. Moreover, a global cadre of scientists, engineers, educators, and entrepreneurs are committed to pushing the envelope to convert innovative research and development (R&D) ideas realized in space into realities that improve life on Earth—including those that support STEM education.

Currently, the ISS National Lab partners with more than 40 organizations that form the Space Station Explorers Consortium. This Consortium is a community of educators, learners, and organizations working in partnership with CASIS to make STEM learning engaging and immersive through connections with the ISS National Lab. CASIS collaborates with these and other partner organizations on innovative learning programs and resources for K-12 students, educators, and the public, including opportunities to design student-led experiments that launch to space, function as ground controls for flight experiments, or utilize data generated from flight experiments. CASIS seeks to expand on this programming, extend the learning community to include opportunities in higher education and workforce development, and improve digitization and/or online access to space-themed programming for everyone.

Program Objectives or Priorities

The purpose of this NLRA is to solicit applications directed toward utilization of the ISS National Lab from principal investigators and educators associated with any U.S.-based institution (academic, government, commercial, not-for-profit) in the field of STEM education. Applications must seek to expand education programs, projects, and public-private partnerships that leverage the ISS and/or space-based research to engage K-12 students and/or enhance higher education, promoting diversity and outreach into

underrepresented demographics.

To be competitive, all responsive proposals must explicitly state how programming will target and reach underrepresented demographics and must address at least one of the following goals:

- Expand the Space Station Explorers Consortium and offerings to increase student and educator participation in and/or digital engagement with existing or new partner programs, including online education products.
- Create higher education initiatives that deliver opportunities for students enrolled in U.S. colleges and universities to explore education, background, pathways, and career opportunities associated with space-based R&D on the ISS National Lab or the commercialization of LEO.
- Digitizing space-themed K-12 or higher education programming.

Of particular interest are proposals that seek to expand online engagement via existing or new programming and post-secondary education initiatives.

Background

The ISS enables students to think differently and explore thought-provoking questions in novel ways that will shape and inform their ability to think critically and sharpen their STEM tools. For example, how do plants grow on an orbiting platform free of the physical force that shaped their evolution? What aspects of a dynamic world and changing climate can be seen from the ISS? How do gases and liquids behave differently in microgravity, and how do these changes in fundamental physical forces affect how machines and living organisms function? How do fluctuations in radiation and temperature affect the function of solar panels, energy transfer, and communication systems?

For the past 20 years, students have investigated these and other questions—designing, building, launching, and operating experiments on the ISS. They program and control robots, select targets for Earth photography and analyze space imagery, operate experiments in chemistry and physics, plant seeds exposed to the space environment, communicate via radio from ground to space and back, and even conduct cutting-edge genetic research. For more information on actual student experiments (excluding activities in which students passively learn about the ISS or participate in lessons that present results of experiments done by others), see the ISS National Lab [20 Years of Student Experiments using the ISS](#) report. For information on all ISS National Lab educational programming, visit www.issnationallab.org/stem.

Typically, in-orbit activities focus on the following benefits of performing research and technology development in space.

Microgravity: The ISS National Lab offers the opportunity to conduct long-duration research and technology development investigations in persistent microgravity, where gravity-driven physical forces are nearly absent. Results of research inspired by microgravity-driven phenomena have been shown to provide new practical insights and tangible benefits to multiple, cross-cutting life science, physical science, and engineering fields and areas of industrial application.

LEO Extreme Conditions: In addition to microgravity, the extreme conditions of the space environment are demonstrably hostile to many materials. In LEO, these conditions include:

- Atomic oxygen, which is highly reactive with plastics and some metals, causing severe

- erosion.
- Ultraviolet radiation, which deteriorates and darkens many plastics and coatings.
 - Vacuum conditions, which alter the physical properties of many materials.
 - Impact from meteoroids and orbiting man-made debris, which can damage materials exposed in space.
 - Continuous cycling between extreme high and low temperatures, which can result in accelerated thermal degradation of materials.

Vantage Point: The ISS offers a vantage point in LEO with unique opportunities for technology development and demonstration in remote sensing:

- The ISS orbits at an average altitude of 400 km (250 miles), offering a wide range of Earth viewing geometries and spatial resolutions for sensors mounted on the externally attached platforms. Sensors may also be mounted inside the ISS with access to observation windows offering Earth-facing or other orientations.
- The orbital inclination of 51.6 degrees covers approximately 90% of Earth's populated area every 90 minutes and allows revisits of the same targets every 3-5 days.
- The ISS offers variable illumination conditions for Earth viewing and similar solar illumination conditions approximately every 63 days.
- The ISS provides power, communications, and data handling infrastructure to hosted payloads.
- Payloads may be returned for post-mission analysis; however, this is a heavily constrained resource, so payload return requests should include a strong rationale for this experiment requirement.

For more information about the benefits of R&D in space, see www.issnationallab.org/research-on-the-iss/areas-of-research.

ISS National Lab Implementation Partners, Facilities, and Capabilities

If proposing a flight project, each offeror should be familiar with the capabilities of flight hardware for in-orbit studies that are relevant to their proposed effort. The ISS National Lab partners with a variety of Implementation Partners, organizations that provide research, engineering, and technical services—and, in some cases, operate and maintain commercial payload facilities on the ISS, to support and facilitate research projects. For details about these providers and their specific hardware/services, visit our [Implementation Partner database](#). Where applicable, the ISS National Lab encourages contact between offerors and Implementation Partners prior to concept or proposal submission to obtain information that may be useful for budget and schedule estimates. If requested, the ISS National Lab can facilitate contacts between Implementation Partners and offerors. In addition, multiple facilities for research and technology development are available on the ISS. Detailed descriptions of facilities are provided in NASA's [ISS Researcher's Guides Series](#).

III. SUBMISSION AND SELECTION PROCESS

This research announcement will follow a two-step proposal submission process. Before being invited to submit a full proposal, all interested investigators must first complete and submit a Step 1 Concept

Summary for review. The purpose of Step 1 is an initial evaluation of the offeror's concept for operational feasibility, scientific or technological scope, compliance, and alignment with the NLRA scope.

Step 1 Concept Summary Submission

- Concept summaries must use the template provided at www.issnationallab.org/research-on-the-iss/solicitations/nlra2021-4.
- Concept summaries may be submitted and will be received, evaluated, and potentially approved continuously during the NLRA open period.
- A CASIS internal review team with representatives from science, business, operations, and compliance will evaluate each concept summary. Approved concept summaries will be invited to submit a full proposal.
- Concepts approved based on Step 1 evaluation will proceed to Step 2 by invitation only.
- Concepts not invited to submit a full proposal will receive feedback.

Step 2 Full Proposal Submission

- The process for developing full proposals is outlined below and set forth in greater detail within the Proposal Instructions published on the NLRA webpage.
- Full proposals will undergo a peer review in accordance with proposal evaluation documents provided as attachments.
- At the end of Step 2, the proposals recommended for selection will be presented for final determination to the CASIS executive director, who is the selecting official.

Further details and requirements on concept summary and full proposal submission, including instructions and templates, can be found in the Proposal Instructions document available on the NLRA webpage at www.issnationallab.org/research-on-the-iss/solicitations/nlra2021-4.

The NLRA open period, concept submission cutoff dates, and proposal development periods are published on the NLRA webpage.

Award Information

CASIS may award a funded or unfunded agreement for a selected proposal. If proposing a flight project, awarded proposals will receive ISS National Lab sponsorship of ISS resource utilization, payload launch to the ISS, in-orbit ISS crew time, data return, and payload return, if required.

Funds Availability: The obligation of CASIS to make an award is contingent upon the availability of funds from which payment can be made. The number of grants awarded and the amount of grant funding for each award will depend on the number of meritorious applications.

Funding for this NLRA: The total set aside funding for this NLRA is approximately \$200,000, with an expectation to make three or more awards for either ground-based programming or, potentially, programs that require flight resource allocation. CASIS reserves the right to refuse award of grant if no meritorious offers are received. Matching funds are not required, but proposals that contribute resources (money or in-kind) will be favorably reviewed.

Notice of Award: For selected proposals, a CASIS officer will contact the principal investigator named in the proposal. Offerors have the right to be informed of the major factor(s) that led to the acceptance or

rejection of their proposal.

Period of Performance: It is anticipated that the period of performance will be no longer than three (3) years from date of award.

CASIS assumes no liability (including bid and proposal costs) for cancelling this NLRA or for any entity's failure to receive notice of cancellation.

IV. PROPOSAL PREPARATION AND CONTENT

Step 1 Concept Summary instructions and the Step 2 Full Proposal submission guidelines can be found in the Proposal Instructions available on the NLRA webpage.

If proposing a flight project, before finalizing proposals, offerors are strongly encouraged to consult with the CASIS Payload Operations team (Ops@ISSNationalLab.org) for feedback regarding feasibility and compliance with flight requirements and capabilities. Please include reference to NLRA 2021-4 in the subject line and note that questions and answers will be posted on the ISS National Lab website. Offerors are also encouraged to work with an Implementation Partner—organizations that work with the ISS National Lab to provide services related to payload development. There are two ways to do this:

- Visit www.ISSNationalLab.org/implementation-partners to browse, select, and contact an Implementation Partner.
- Contact the CASIS Payload Operations team for guidance.

Offeror Qualifications

Proposals must be submitted by a principal investigator or an authorized official of the proposing organization. Any individual business entity or institution capable of executing the proposed research may submit a proposal. However, CASIS will **NOT** consider proposals requiring funded or unfunded agreements between CASIS and any non-U.S. entity (business or individual).

V. PROPOSAL EVALUATION FACTORS AND PROCESS

Proposals will be evaluated under the ISS National Lab's review and selection criteria for its STEM engagement and educational outreach line of business, which includes programs, projects, and partnerships that leverage the ISS and space-based research to engage K-12 students and enhance higher education. Proposals that are determined to better fit other CASIS lines of business (fundamental science, technology development/demonstration, in-space production applications, and Commercial Service Provider utilization) will be redirected to those areas.

Please note that CASIS will not accept or consider proposals submitted by NASA and/or NASA civil servants.

For further information on proposal evaluation criteria and processes, refer to the ISS National Lab Proposal Evaluator Instructions in the information package linked to the NLRA webpage.

The proposal review is guided by an overall assessment of expected project impact upon successful completion of proposed objectives. CASIS has overall responsibility for conducting and facilitating reviews, presenting information for final determination, and ensuring compliance with CASIS-defined processes.

VI. CONTRACTING

To be considered, proposals must be received from U.S. persons and U.S. entities as defined in the Code of Federal Regulations ([CFR](#)) and be compliant with ISS National Lab export control programs and policies.

Award recipients will be required to enter into a User or Grant Agreement with the ISS National Lab. A representative list of mandatory flow down provisions contained in the agreement can be accessed via the ISS National Lab's [Contracts and Compliance webpage](#).