



## Technology Advancement and Applied Research Leveraging the ISS National Lab

### **ISS National Lab Research Announcement (NLRA) 2023-1**

#### **Instructions to Offerors**

#### **Center for Advancement of Science in Space, Inc.**

6905 N. Wickham Road, Suite 500, Melbourne, FL 32940

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#### **Cycle 1:**

**End Date of Step 1: Concept Summary submission period: January 10, 2023**

**Due Date for Step 2: Full Proposal submission: March 15, 2023\***

#### **Cycle 2:**

**End Date of Step 1: Concept Summary submission period: April 17, 2023**

**Due Date for Step 2: Full Proposal submission: July 17, 2023\***

(\* by invitation only)

*Note: For any updates regarding submission deadlines, please visit [www.issnationallab.org/research-on-the-iss/solicitations/nlra2023-1](http://www.issnationallab.org/research-on-the-iss/solicitations/nlra2023-1). For general questions related to this research announcement, please email [info@issnationallab.org](mailto:info@issnationallab.org).*

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## **I. SUMMARY**

Since 2000, the International Space Station (ISS) has enabled humans to live and work in space, supporting research and technology development that is not possible anywhere on Earth. Since its designation in 2005, the ISS National Laboratory has expanded access to this orbiting laboratory to research communities from U.S. academic institutions, government agencies, and the private sector. ISS National Lab-sponsored research seeks scientific discovery and technology advancement on the ISS that directly benefits humanity by increasing fundamental knowledge, scientific application, education outreach, workforce development, and demand creation for sustainable, scalable innovation and production in low Earth orbit (LEO).

As managers of this national laboratory in partnership with NASA, the Center for the Advancement of Science in Space, Inc. (CASIS) awards access to funding and resources on the ISS via competitive grant solicitations to support nonexploration science and technology development as well as science, technology, engineering, and mathematics (STEM) education initiatives from U.S.-based institutions.

As a U.S. taxpayer-funded organization, CASIS only contracts with U.S. Persons, as defined by the Code of Federal Regulations at 22 CFR §120.15. Submitted proposals must be compliant with all U.S. Export Administration Regulations (EAR) and International Traffic in Arms Regulations (ITAR). This document will assist offerors in the development of concepts and proposals to leverage the ISS for applied research and technology development and demonstration.

## **II. DESCRIPTION OF RESEARCH**

This ISS National Lab Research Announcement (NLRA) solicits flight proposals that seek to advance technology for use-inspired research and development (R&D) in space across a broad range of existing or emerging technology areas able to benefit needs on Earth. Flight projects must justify access to space for development, demonstration, or technology maturation that improves knowledge and enables improved performance, novel solutions, or the creation of new products and business opportunities. The objective is to leverage the unique ISS environment to develop, test, and mature products and processes that have a demonstrated potential to produce near-term, positive economic impact on Earth.

The ISS National Lab enables scientific research and technology demonstration within a persistent microgravity environment in orbit. When gravity is no longer a dominant physical force, myriad effects on physical and biological systems and chemical and biological processes are induced. In some cases, these unique effects may enable the discovery of new phenomena that can be leveraged to improve existing or create new technologies. Technology demonstrations utilizing the extreme conditions of the space environment in LEO may be conducted using facilities within the crewed habitat of the ISS or on external facilities attached to the ISS, including platforms for materials exposure testing. Offerors' proposals may also seek to develop new ISS National Lab facilities for technology development applications.

### Background

The ISS National Lab offers the opportunity to conduct experiments in persistent microgravity, where gravity-driven physical forces are negligible. Research results have been shown to uncover new practical insights and tangible benefits to multiple, cross-cutting science and engineering fields and areas of industrial application.

The ISS National Lab supports a variety of facilities and hardware to exploit the extreme LEO environment for development and testing of new materials, devices, and subsystems. Such testing provides a mechanism for rapid failure mode analysis, thereby accelerating the qualification and commercial readiness of these new devices and products.

#### *ISS National Lab Implementation Partners, Facilities, and Capabilities*

Offerors should be familiar with the capabilities of flight hardware for in-orbit studies that are relevant to their proposed scientific and technical objectives. Multiple facilities and services for research and technology development are available on the ISS. Facilities and services may be provided by NASA or by ISS National Lab Implementation Partners. Existing flight hardware can be referenced on NASA's [Space Station Research Explorer website](#). Additional information is also provided in NASA's [ISS Researcher's Guides Series](#).

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 flight 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 the submission of a Step 1 concept in order to obtain accurate and current information required for budget and schedule estimates. If requested, the ISS National Lab can facilitate contacts between Implementation Partners and offerors. Proposals to utilize commercial facilities owned and operated solely by international partners on the ISS will not be considered for this research announcement.

#### *Research and Technology Development Objectives or Priorities*

ISS National Lab applied research and technology development is intended to validate technological advancements and rapidly advance the development of new Earth or space-based products to bring value to our nation and drive a robust, sustainable, and scalable LEO economy. These objectives will be achieved by successfully executing flight experiments utilizing microgravity, the extreme conditions in LEO, or the vantage point of the ISS.

This NLRA is open to a broad range of technology areas, including chemical and material synthesis in space, bonding, translational medicine, in-space edge computing and on-demand cloud computing technologies, and the application of ISS remote sensing data to improve geospatial analytics with commercial use as an intent.

Emphasis will be placed on proposals for testing and space-qualification of hardware prototypes and on advancing process improvements. Suggested concepts under these areas are described below:

- **Hardware prototype testing:** Innovations addressing hardware product development gaps and emerging technology proliferation in the following areas: computing, electronics, nanotechnologies, robotics, sensors, communications, space-based quantum communication, remote sensing, and satellite technology (assembly, inspection, refueling, operations, and in-orbit servicing). Proposals of interest in this area will typically feature ground-tested, ready-to-fly hardware prototypes that require space qualification to capture new market opportunities.
  - Sensors are either hosted on external platforms or mounted inside the ISS where targets on

Earth or in space may be viewed through observation windows. Past and current remote sensing instruments include commercial off-the-shelf (COTS) high-resolution cameras and prototypes of a variety of sensor technologies including hyperspectral, multispectral, and light detection and ranging (LIDAR). Sensor data have been used to demonstrate several commercial and practical applications, such as the monitoring and mitigation of environmental pollutants (methane and carbon dioxide) from chemical processing facilities; measurement of atmospheric carbon dioxide; monitoring of cloud and aerosol characteristics to aid understanding of climate and weather patterns; monitoring and optimization of agricultural practices; analysis of ocean and forest ecosystems; and assistance with disaster relief. Proposals for remote sensing should indicate novel features of new sensors to be tested and describe how the data acquired from new or existing sensors will be used to generate products of commercial value. For more information on the remote sensing features of the ISS, see NASA's [A Researcher's Guide to Earth Observations](#).

- **Process improvements:** Use of the ISS as a test bed for advancing development of facilities for high-throughput research, testing, and screening (e.g., multiuser/autonomous platforms, analytical capabilities); use of spaced-based data to facilitate modeling or operations of industrial systems; and demonstrating new methodologies for spaceflight research and development (e.g., combinations of ISS edge computing and Earth-based cloud computing), including the use of robotics/automation and artificial intelligence.
- **Advanced materials:** Current advanced materials research that addresses the development of next-generation production methods, the synthesis and testing of novel materials, and the exploitation of mechanisms involved in material transformations for production of new materials with unique properties.
  - Potential topic areas of interest under this NLRA include but are not limited to material bonding (e.g., soldering, brazing, or welding); biomaterials; soft materials (e.g., emulsions, foams, or liquid crystals); metamaterials; and hard, functional materials with unique microstructure (e.g., metal alloys, semiconductors, ceramics, glassy alloys, metallic foams, or composites).
- **Translational medicine:** Potential topics for consideration in translational medicine include validation of accelerated disease models using cell- or organism-based models, analyzing macromolecular structures for structure-based drug design, and demonstration of novel drug delivery and diagnostic devices.

Proposals must include a statement defining how the scientific or technical aims will benefit from execution in space and why the proposed investigation can only be performed in space. Offerors should explore the literature for prior research on the ISS, space shuttle, MIR, and Skylab that may help improve their experimental design and deliver novel, high-impact results.

Responsive proposals must describe milestones for successful space-based experiments and the projected timeline to mature the technology or advance a product toward a viable market offering. Technologies proposed for testing should generally be beyond basic concept validation and instead focus on seeking technological maturity through development and/or demonstration in the space environment. Desirable flight experiments will target raising the TRL from 4 or higher to 6 or higher (see Appendix A for a description of TRL).

The ISS National Lab strongly recommends obtaining and submitting letters of support from commercial partners and/or potential users of new technologies or products to demonstrate feasibility or commercial interest, when applicable.

Projects that may require multiple flights to the ISS will be accepted for submission. However, offerors seeking multiple flight opportunities must provide an estimate of the projected number of flights required and include sufficient detail in their concept to justify the expected R&D outcome of each flight or phase of the project leading to a complete solution.

### **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 for CASIS review a Step 1 Concept Summary. The purpose of the Step 1 summary is to provide information for an initial evaluation of the offeror's concept for operational feasibility, scientific or technological scope, compliance, and alignment with the scope of the research announcement prior to submission of a full proposal.

#### **Step 1: Concept Summary Submission**

- All offerors must complete and submit for review a Step 1: Concept form. The purpose of Step 1 is to evaluate an offeror's concept for operational feasibility, scientific or technological scope, compliance, and alignment with the scope of the solicitation.
- Concept summaries must use the template provided on the research announcement webpage.
- Concept summaries may be submitted and will be received, evaluated, and potentially approved continuously during the research announcement open period. No concepts will be accepted after the Step 1 close date for a given cycle. Offerors may revise and resubmit the concept to a later cycle.
- Concepts will be evaluated based on scientific and technical merit, business and economic merit, and operational feasibility.
- Concepts approved based on Step 1 evaluation will proceed to Step 2 by invitation only.
- Concepts not invited to submit a Step 2: 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 research announcement webpage.
- Full proposals will be evaluated 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 Chief Executive Officer, 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 research announcement webpage at [www.issnationallab.org/research-on-the-iss/solicitations/nlra2023-1](http://www.issnationallab.org/research-on-the-iss/solicitations/nlra2023-1).

#### **Award Information**

CASIS may award a funded or unfunded agreement for a selected proposal. All 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. Grant funding is not available for ground-based efforts.

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 received and favorably reviewed.

Funding for this Research Announcement: The total set aside funding for this research announcement is approximately \$750,000, with an expectation to make three to five awards. CASIS funding is to be allocated to support Implementation Partner mission integration and operations costs only. It is anticipated that CASIS will execute task orders and/or subcontracts directly with the Implementation Partner on behalf of the awarded principal investigator. No funding will be granted to cover the offeror's internal project costs. Requesting funding for cost elements not covered by this NLRA is grounds for disqualification. CASIS reserves the right to refuse award of grant if no meritorious offers are received.

*Indirect Cost Rates:* CASIS will allow any previously approved federal indirect cost rate that has been negotiated between the grantee and a U.S. government agency. If no such rate has been negotiated with a U.S. government agency, CASIS shall apply a de minimis indirect rate of ten percent (10%) for those seeking indirect costs in a grant award. Also, CASIS will allow a grantee to voluntarily waive indirect costs or charge less than the full de minimis indirect cost rate should they choose to do so.

All proposal submissions seeking funding from CASIS are subject to this policy. All grantees are required to provide satisfactory written evidence in or accompanying their proposal submission of a previously approved federal indirect rate. Such evidence shall demonstrate the existence of an approved federally recognized indirect cost rate negotiated between the grantee and a U.S. government agency. In the absence of this evidence, CASIS will apply the de minimis indirect cost rate stated above.

Notice of Award: For selected proposals, a CASIS official 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**

The Step 1: Concept Summary instructions and the Step 2: Full Proposal submission guidelines can be found in the Proposal Instructions available on the ISS National Lab research announcement webpage.

Before submission of a Step 1: Concept Summary, offerors are encouraged to identify and begin working with an Implementation Partner—organizations that work with the ISS National Lab to provide services related to payload development. There are two ways to identify an Implementation Partner:

- Visit [www.issnationallab.org/implementation-partners](http://www.issnationallab.org/implementation-partners) to browse, select, and contact an Implementation Partner.
- Email the ISS National Lab Payload Operations team at [Ops@ISSNationalLab.org](mailto:Ops@ISSNationalLab.org) for guidance.

Principal investigators are strongly encouraged to discuss any aspects of the experiment with their Implementation Partner that they deem significant beyond the standard description of the experiment.

**Before finalizing proposals, offerors are strongly encouraged to consult with the ISS National Lab Payload Operations team** for feedback regarding feasibility and compliance with flight requirements and capabilities. Please include reference to NLRA 2023-1 in the subject line and note that questions and answers will be posted on the ISS National Lab website.

#### 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 **ONLY** consider proposals from U.S. persons (business and individual), as defined by the Code of Federal Regulations (22 CFR §120.15).

### **V. PROPOSAL EVALUATION AND SELECTION**

Proposals will be evaluated under the ISS National Lab's review and selection criteria for its technology development and demonstration line of business. The proposal evaluation factors are scientific and technical merit, business and economic merit, funding and resource commitment, implementation and commercialization feasibility, and operations and ISS utilization. These factors will be used to evaluate each proposal. Each factor is numerically weighted and scored. Project cost is not scored but is a factor in the final selection. All proposals submitted must include an expressed commercial purpose or intent. Proposals that are determined to better fit other CASIS research announcements will be redirected to those areas.

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

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. For further information on proposal evaluation and selection, including the relative importance of each evaluation factor, refer to the ISS National Lab Proposal Evaluator Instructions in the information package linked to the research announcement webpage.

### **VI. CONTRACTING**

Offerors and their sponsoring organizations shall be U.S. Persons, as defined by the Code of Federal Regulations ([CFR](#)), and must be compliant with Export Administration Regulations (EAR) and International Traffic in Arms Regulations (ITAR).

Award recipients will be required to enter into a User Agreement or Grant Agreement with CASIS. As a nonprofit corporation doing business with the federal government via a Cooperative Agreement with NASA, CASIS is contractually bound, and bound by federal procurement law and regulations, to flow down to award recipients various contractual obligations that are in the CASIS Cooperative Agreement with NASA. The obligations are regulated in part by the Federal Acquisition Regulations (FAR), 48 C.F.R., as well as NASA-specific regulations. Mandatory clauses are non-negotiable and cannot be removed from CASIS User Agreements or Grant Agreements. If an award recipient does not desire to, or cannot, comply with mandatory flow down clauses, the awardee should not accept the award opportunity. These terms and conditions from the NASA Cooperative Agreement will apply to all Grant Agreements (funded) and User Agreements (unfunded). The documents listing the mandatory flow down provisions



contained in a User Agreement and Grant Agreement are provided as part of the Step 1 and Step 2 zipped documents made available to offerors via the CASIS web page for this research announcement.

## Appendix A: Technology Readiness Level Descriptions

Actual system “flight proven” through successful mission operations	TRL 9	<b>COMMERCIALIZATION</b> <ul style="list-style-type: none"> <li>Product manufacturing</li> <li>Product sales <ul style="list-style-type: none"> <li>Roll out for real-world application/deployment</li> </ul> </li> </ul>
Actual system completed and “flight qualified” through test and demonstration (ground or space)	TRL 8	
System prototype demonstration in a space environment	TRL 7	
System/subsystem model or prototype demonstration in a relevant environment (ground or space)	TRL 6	<b>TRIALS/SCALE-UP</b> <ul style="list-style-type: none"> <li>Regulatory approval/certification</li> <li>Business analysis</li> <li>Market testing <ul style="list-style-type: none"> <li>Testing on subjects/commercial target</li> </ul> </li> <li>Manufacturing development/scale-up</li> </ul>
Component and/or breadboard validation in a relevant environment	TRL 5	
Component and/or breadboard validation in a laboratory environment	TRL 4	<b>DESIGN/PRODUCT REFINEMENT</b> <ul style="list-style-type: none"> <li>New Applications, Product Improvements, and Line Extensions (NAPILEX; existing products)</li> <li>Product development/testing in advanced models</li> <li>Production development/optimization</li> <li>Product design/market research</li> <li>Business/market definition</li> </ul>
Analytical and experimental critical function and/or characteristic proof-of-concept	TRL 3	
Technology concept and/or application formulated	TRL 2	<b>DISCOVERY/BASIC RESEARCH</b> <ul style="list-style-type: none"> <li>Testing in validated early models (optimization to candidate)</li> <li>Science development (model development/market understanding)</li> <li>Fundamental research <ul style="list-style-type: none"> <li>Research leading to understanding of natural phenomena</li> <li>Screening and testing in basic models to identify the target</li> </ul> </li> </ul>
Basic principles observed and reported	TRL 1	