Request for Proposals NO. CASIS 2013-3

Remote Sensing from the International Space Station

ISSUANCE Date: January 13, 2014

Center for the Advancement of Science in Space
Space Life Sciences Lab
505 Odyssey Way
Exploration Park, FL 32953

Letters of Intent due 5pm EST, February 21, 2014

Proposals due 5pm EST, March 27, 2014

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1. INFORMATION ON CASIS

The Center for the Advancement of Science in Space (CASIS) is an IRC Section 501(c)(3) entity responsible for management of the International Space Station (ISS) U.S. National Laboratory under a Cooperative Agreement with NASA (NNH11CD70A). Per Section 504 of the NASA Authorization Act of 2010, the purpose of CASIS is to maximize the value of the investment the U.S. government made in the ISS National Lab and demonstrate the scientific and technological productivity of the National Lab over the next decade. CASIS seeks to advance scientific research, technology development and education in conjunction with utilization of the ISS, managing a diverse research and education portfolio across a broad range of scientific fields.

1.1 CASIS Goals

a) Stimulate, develop and manage the U.S. national uses of the National Lab by U.S. government agencies, academic institutions and private firms.
b) Develop tools and techniques to communicate the value of uses of the ISS research platform and increase the return on the U.S. investment in the National Lab.

1.2 CASIS Strategies and Objectives

a) Identify the capabilities of the ISS and provide breakthrough opportunities for uses in science and applications, technology development and education, including remote sensing data collection, applications and technology development.
b) Identify and prioritize research pathways, ensuring diversity without over-committing National Lab resources.
c) Increase customer base and facilitate the matching of research pathways with qualified funding sources.
d) Formulate a comprehensive portfolio of activities to maximize the value of the National Lab as a venue for education activities.
e) Track the research portfolio and projects to understand and communicate the net value created.

2. DESCRIPTION OF RESEARCH GRANT

2.1 Award Information

CASIS anticipates total funding for this solicitation to be $1,000,000. The number of grants awarded and the amount of the grants will depend on the number of meritorious applications received and instrument/equipment requested. Further information on maximum CASIS funding available based upon the instrument/equipment requested is outlined in Appendix I.

2.2 Purpose of Grant

This Request for Proposal (RFP) solicits applications from commercial and academic investigators in the field of remote sensing for 1) The development and deployment for testing of sensors or instrumentation for remote sensing on the ISS U.S. National Laboratory or 2) The utilization of existing hardware (Appendix I) for remote sensing on the ISS U.S. National Laboratory. Proposals should seek to use the National Lab for development of sensors and/or use of existing hardware for studies of Earth, Earth's atmosphere, and astronomy and planetary science with the goal of benefitting life on Earth.

Emphasis Area 1: New Technology Development and Demonstration (ISS Test Bed)
Innovative new technologies for remote sensing purposes are requested to expand the capabilities of the National Lab. Proposals to use the National Lab as a test bed for commercial technology development are encouraged. We seek proposals to develop these new capabilities by testing them on the ISS for up to 90 days. Technologies may be mounted on an ISS external platform (ExPRESS Logistics Carrier, NanoRacks External Platform, Japanese Experiment Module – Exposed Facility or Columbus – External Payload Facility) or internally in the Window Observational Research Facility (WORF). Proposers may also elect to use the ISS National Lab as a launching platform for Cubesats, Smallsats and other deployables.

This emphasis area is intended for externally mounted and deployable equipment verification and testing in the space environment for CubeSats, instrumentation and sub-systems. Additionally, the WORF and other observational windows provide proposers additional internal space for larger test equipment or instrumentation with additional constraints.

Emphasis Area 2: Existing Instrument Applications
The National Lab hosts a collection of operational remote sensing instrumentation for scientific and commercial use. We seek proposals to utilize the Hyperspectral Imager for the Coastal Ocean (HICO) and the ISS SERVIR Environmental Research and Visualization System (ISERV) for specific scientific or commercial applications by utilizing them for up to 18 months. Should more than 18 months be necessary, a mutually agreed upon time period will be determined prior to award.

Examples of past success in using existing ISS instrumentation include the discovery of two new X-ray sources in space and the first space-based method of tracking global maritime traffic capable of autonomously monitoring ships' speed, position, course, cargo and voyage information in open waters (compared with Earth-based systems, which can monitor only coastal waters).

Proposals must be responsive to one of the two described emphasis areas and seek to exploit the National Lab for remote sensing of Earth, Earth's atmosphere or space—or development/testing of sensors that will support such activities. It is expected that the scope of solicited research, scientific emphasis area, budget and schedule guidelines for each of the two research emphasis areas may be different—but the proposal must include potential benefits of the project for life on Earth. (Note: NASA exploration-related research and associated benefits do not fall within the scope of the CASIS mission.) Additionally, the proposed research approach must adhere to any specific constraints or guidelines outlined within the research emphasis area.

Excluded areas: New Instrument Commercial Applications
CASIS will not consider at this time any proposals that would utilize new sensors or instruments to be flown to the ISS to engage in remote sensing for ongoing or long-term commercial purposes. In the future, CASIS may issue a separate RFP concerning such activity.

2.3 Background

The ISS offers an advantageous platform for remote sensing. CASIS is seeking to increase use of the ISS National Lab as an advanced platform for (a) testing of next-generation sensors for future commercial applications and (b) Earth observation by utilizing current ISS instrumentation.

Its location in low Earth orbit affords the ISS an impressive vantage point with an altitude of approximately 230 mi or 370 km (ranges from 186–285 mi or 300–460 km), distinct from most other Earth observation platforms, and an orbital path covering approximately 80% of Earth's surface and 90% of Earth's population. Unlike many traditional Earth observations platforms, the ISS orbits the Earth in an inclined equatorial orbit that is not sun-synchronous. This can provide improved spatial resolution and variable lighting conditions compared to the sun-synchronous orbits of typical Earth remote-sensing satellites. The ISS passes over locations on the Earth between 51.6 degrees north and 51.6 degrees south latitude at different times of the day. With a 90-minute orbital period, the ISS makes about 16 orbits around the Earth each day and views the same location approximately every three days.

The ISS National Lab is capable of hosting a broad range of remote sensing payloads while imparting unique benefits, potentially at lower cost than conventional solutions. Access to the National Lab may cost considerably less than most space-based Earth observation missions, which tend to cost between $100M and $500M, with a lifetime of 1–15 years. This lower cost is primarily due to launch subsidies as well as the ability to utilize the National Lab as a satellite platform or "bus" rather than funding a standalone bus for a given payload. This creates a unique opportunity to test sensors in the space environment and return them to Earth prior to launching them on a standalone bus, removing a significant amount of risk in a sensor deployment while additionally allowing for improvements prior to its permanent deployment. Moreover, the National Lab offers unique benefits for remote sensing applications: access to NASA personnel, "free" launch services, attractive low-altitude orbital parameters covering populated areas, virtually unlimited power, in-flight maintenance and reconfiguration and high-bandwidth communications.

In addition, the presence of crew aboard the ISS means that they can react to unfolding events in real time. This is particularly important for collecting imagery of unexpected natural hazard events such as volcanic eruptions, earthquakes and tsunamis. The crew can also determine whether viewing conditions, such as cloud cover or illumination, will allow useful data to be collected, as opposed to a robotic sensor that collects data automatically without regard to quality.

Handheld digital camera imagery taken by astronauts and the current internal and external automated sensor systems and facilities aboard the space station provide exciting capabilities for Earth remote sensing. In addition, the station's power and data infrastructure encourages the development/testing of new sensors.

The remote sensing market is diverse in its industries; its major segments range from $13M to $3.2B. Geospatial measurements are obtained with digital imaging, laser scanning and other technologies. Strong growth of 11% per year is expected for Earth observation data sales over the next decade. According to a team of commercial remote sensing experts at McKinsey & Co., right-of-way inspections, urban planning and forestry offer the most promising combination of suitability of the National Lab, market size and growth.

2.4 Research Objectives

CASIS seeks to increase use of the National Lab for studies of Earth's surface, Earth's atmosphere, and astronomy and planetary science as it relates to benefits on Earth. To facilitate and expedite these studies, CASIS is issuing this RFP to support use of specific facilities currently aboard the ISS, thereby minimizing the time from proposal selection to data collection. CASIS is also issuing this RFP to promote technology development and short-duration instrument demonstration (maximum of 90 days) for the specific purpose of remote sensing. CASIS requests that the U.S. research and education communities,

as well as U.S. commercial entities and others, propose projects that will use the facilities and capabilities identified in this RFP.

CASIS will make available for a limited amount of time four Earth observation facilities currently aboard the station, which are detailed in Appendix I, to National Laboratory users on a resource-limited basis. Proposals may include use of any/all of these facilities for observations of Earth's surface, hydrosphere or atmosphere. Ideal proposals should describe a commercial, civil or academic project to achieve research, education or other novel objectives.

Prospective proposers should read the payload synopses below under "Available Hardware and Facilities" and reference Appendix I to understand the basic capabilities of the offered payload facilities. Additional technical data are available in the table accompanying the text in Appendix I, and still further information is available in the cited references and Web links for each facility.

CASIS strongly recommends submitting letters of support to demonstrate feasibility or commercial interest, when applicable.

CASIS will facilitate grantees in translating ground-based and aerial experiments into space-appropriate models. However, each proposer should be familiar with the capabilities of flight hardware and National Lab facilities for on-orbit studies. Details regarding flight-certified and ground experiment hardware are included in Appendix I of this RFP. Additional information on implementation partners is available on the CASIS Web site (http://www.iss-casis.org/IP Directory). Information on ISS facilities is available in NASA publication NP-2012-10-027-JSC, *International Space Station Facilities: Research in Space 2013 and Beyond*, which is available at http://www.nasa.gov/pdf/ISS Utilization Brochure. An ideal proposal will demonstrate investigator knowledge of the significant challenges and importance of remote sensing research from low Earth orbit. If proposing to develop new hardware, proposers should be familiar with the guidelines and constraints for successful approval and flight, also found at the Web address above. **All proposers should read this online material and the hardware section below under "Services and Support Provided by CASIS"** to clearly understand the remote sensing capabilities on the ISS and the restrictions governing new hardware proposals**.**

2.5 Qualifications of Grantee

Any U.S. institution that can respond to the target area described in this RFP may apply. However, CASIS will not consider projects using non-U.S. sponsorship.

Please note: Due to the limitations under the CASIS Cooperative Agreement and our strategic approach, CASIS will not be able to accept and fund proposals submitted by NASA and/or NASA employees.

The CASIS Operations team will conduct a technical review to ensure that the proposed project can meet the requirements for delivery to and research on the ISS. The general requirements for flight are as follows:

- Overall readiness of materials and hardware
- Availability of existing hardware or a well-developed plan to build new hardware
- Scientific justification for using the ISS
- Ability to comply with NASA flight certification requirements.

NASA has specified details regarding flight certification requirements, available on the Web at http://www.iss-casis.org/solicitations. The Operations team may disqualify proposals that cannot meet these requirements.

Before submitting proposals, new-to-space proposers must consult with the CASIS Operations team (opsinfo@iss-casis.org) for feedback regarding feasibility and compliance with flight requirements and capabilities. The Operations team will be available for these consultations until March 27, 2014. CASIS also encourages proposers to seek the support of implementation partners (service providers who assist in payload integration) that have experience in and understand the requirements for space-based research. See Appendix I in this RFP for a list of suggested implementation partners.

2.6 Deadline for Completion of Project

Selected projects must be flight ready within 12 months of the award and must be completed (with final report submitted) by six months postflight. If flight schedules change, investigators may modify proposed timelines, subject to review and approval by the CASIS Operations team.

2.7 Services and Support Provided by CASIS

CASIS offers many support services to enable efficient execution of space-science initiatives, even for first-time users. In accordance with a cooperative agreement with NASA, CASIS will assist researchers and grantees in transitioning their science and research experiments into manifested payloads—including identifying and executing steps to meet the requirements discussed below in the "Progress Reports" section.

Services include solicitation and coordination of implementation partners, identification of and facilitation in acquiring required hardware and software, access to state-of-the-art laboratories, coordination of ground-based work, and coordination with NASA. CASIS will facilitate in these processes, sometimes covering costs for implementation partner services. However, service provider costs are the responsibility of the grantee(s); CASIS does not cover these costs unless the written agreement between the grantee(s) and CASIS so specifies and all parties agree. The projected budget submitted should include these costs. Proposers should thus contact prospective implementation partners while developing their application and should include the implementation cost in the budget. In addition, as addressed in Section 5.8 below, CASIS will offer to grantees a service of providing support in seeking a license (or a determination that no license is required) from the National Oceanic and Atmospheric Administration (NOAA), if necessary, for a fee in an amount to be determined after grant award. As addressed in Section 5.9 below, CASIS will also offer a similar service of providing support to grantees in seeking a license from the Federal Communications Commission (FCC), to the extent that such a license is required, for a fee in an amount to be determined after grant award.

For funded projects, CASIS will provide without charge access to on-orbit facilities, data processing capabilities and crew time for experiments. NASA will supply transport and on-orbit resources within the available capacity and without additional cost. The grantee will be responsible for all other costs. In addition to overall project management, CASIS will facilitate the following specific support services.

Before research on the ISS begins, CASIS offers ground-based products and services for grantees to assist with science definition and payload development. CASIS can facilitate:

- Access to a large repository of previous space experiments with promising commercial development and innovation

- Collaboration with experienced payload developers and other subject matter experts to ensure successful experiments and completion of all mission requirements; to provide payload integration support and to coordinate with NASA in crew training, procedure development and timeline activities planning
- Help in finding resources for compliance with export control regulations
- Access to a state-of-the-art facility offering specialized capabilities for payload verification testing and pre-launch processing
- Coordination with NASA and launch vehicle providers to produce an integrated schedule.

During flight, CASIS offers project management services and support for product development to facilitate the interface between the investigator, the implementation partner, and NASA:

- Coordination of "real time" on-orbit payload operations
- Development of data and software interfaces
- Coordination of contingency planning and mission changes to preserve science objectives.

After completion of research on the ISS, CASIS may facilitate additional services:

- Identification of appropriate facilities for post-processing activities
- Coordination with implementation partners to ensure that all postflight data and report requirements are submitted to NASA and the principal investigator (PI) in a timely fashion
- Help in finding resources for intellectual property identification, registration and protection
- Coordination and collaboration with the PI to ensure overall project success.

2.8 Available Hardware and Facilities

Information on hardware of specific relevance to this RFP is available in Appendix I. Additional information on flight certified hardware and ISS National Lab facilities are available at http://www.iss-casis.org/solicitations. Proposers should familiarize themselves with these hardware options and contact the CASIS Operations team (opsinfo@iss-casis.org) to submit any questions. The Operations team will be available through March 27, 2014, to receive these queries. Answers will be posted on the CASIS Web site at http://www.iss-casis.org/solicitations. However, CASIS will not post answers that would jeopardize intellectual property or proprietary information and therefore cannot answer questions containing intellectual property or proprietary information. This policy ensures all proposers have the same information when submitting a proposal to CASIS.

Proposers whose flight proposals include the development of new hardware should be cautious. CASIS recommends using existing or proven hardware to ensure meeting budget and schedule requirements. Flight operations must commence within 12 months of selection; therefore, viable strategies are probably limited to the use of currently available and certified flight hardware.

2.9 Progress Reports

Grantee will submit progress reports in six-month intervals.

Many milestones and required preflight activities will take place in collaboration with implementation partners—interactions that CASIS will facilitate. Whether grantees reach these milestones directly or in collaboration with service providers, progress reports must document completion. Each report must include the following:

- An overview of grant expenditures and financial records, categorizing expenses using the same categories as employed in the proposal. Reports should note any anticipated future changes to the originally proposed budget.
- Status of each projected milestone in the proposal or grant agreement, including analysis of any unmet milestones. (For unmet milestones, grantees may have to meet with CASIS Operations staff to develop a plan to meet project objectives within the required timeline.)
- Identified resources for ground-based preflight and postflight activities.
- Results and relevant information from preflight activities, ground testing and on-orbit testing, including any changes in proposed experimental methodology or data analysis and processing.
- Development and testing status of required payload integration products, including elements to be flight certified (e.g., hardware, software, delivery timeline).
- When appropriate, status of development, testing and operation of hardware and products.
- Details confirming that flight research and development complies with NASA's ISS payload requirements and all NASA rules and regulations of such activity.
- Information and data for consideration in the CASIS review process.

2.10 Final Report

At the completion of the project, each grantee will submit a final report that addresses the following additional items:

- A listing of each objective in the original proposal.
- The extent to which the project achieved each objective and, for unmet objectives or expectations, an analysis of underlying issues and assumptions that may have influenced the unexpected outcome.
- A listing, from the investigator perspective, of each new finding that can be traced to methods or approaches developed in the funded work. The list should note any new outcomes related to microgravity or other flight-related variables.
- How the work benefits scientific advancement and/or commercial potential:
  - The status of the project's influence on the greater U.S. population, as described in the initial proposal (i.e., scientific and economic impact).
  - Discuss future directions for commercialization, if applicable, or for disseminating results, moving forward with the scientific or other relevant pathways.
  - A list of publications submitted or published.

2.11 Resulting Grant Agreements and/or User Agreements

Upon selection of a proposal for award, CASIS and the proposer will execute a grant agreement with terms and conditions as set forth in RFP Section 5. The award of a grant agreement does not guarantee the grantee that its payload will be flown on the ISS. As set forth in Section 5.8 below, no grantee payload will be launched unless NOAA has either (1) granted a license to the grantee for the remote sensing system, or (2) determined that a license is unnecessary. Furthermore, as set forth in Section 5.9 below, no grantee payload will be launched if the grantee has failed to secure any required FCC or NTIA license. In addition, at an appropriate time to be set forth in the grant agreement, CASIS, with input from NASA, will make a determination as to whether the grantee's project is flight-capable. If the grant

project is determined to be flight capable, then CASIS and the grantee may either amend the grant agreement or execute a separate user agreement regarding the use of the National Lab. CASIS, with input from NASA, shall determine the launch priority to be given each grantee's project.

3. PROPOSAL SUBMISSION

3.1 Required: Letters of Intent

All investigators who wish to submit a proposal for this RFP must submit a letter of intent to LOI@iss-casis.org no later than February 21, 2014.

The letter of intent (maximum one page) is not binding and will not be considered during the review of a subsequent proposal. The letter should include the following information, which CASIS requests to allow staff to estimate the potential review workload:

- Title of proposed research
- Brief description of the proposal
- Name, address and telephone number of the principal investigator
- Name, address and telephone number of the authorized institutional official
- Participating institution(s)

Please do not include any information that is considered to be proprietary or confidential.

3.2 Questions About RFP

Submit questions regarding the RFP to info@iss-casis.org. Questions and answers will be posted on the CASIS Web site (http://www.iss-casis.org/solicitations). CASIS encourages prospective proposers to submit questions by February 21, 2014 to ensure that questions will be answered well before the submission date. CASIS will not accept questions or provide information concerning the RFP or proposal process by phone, and proposers should not rely upon any information provided orally. Moreover, CASIS cannot accept questions or provide answers containing confidential or proprietary information. This policy ensures all proposers have the same information when submitting a proposal to CASIS. It is the responsibility of the proposer to stay informed of all questions and answers posted to the CASIS website at http://www.iss-casis.org/solicitations. Questions related to the CASIS standard terms and conditions found at the link provided in Section 5.6 or at the CASIS website should be directed to contracts@iss-casis.org.

3.3 Modifications to RFP

CASIS may issue written modifications to information in the RFP. It is the responsibility of the proposer to stay informed of all modifications posted to the CASIS website.

3.4 Instructions for Submission of Proposal

Each section specified below, in section 3.5, should be clearly identified in the proposal, prepared in electronic format and provided in a single PDF file. CASIS will accept electronic submission of proposals from March 17–27, 2014. Instructions for uploading these documents will be available at http://www.iss-casis.org/solicitations. All proposals must be submitted by 5:00 p.m. EST, March 27, 2014.

3.5 Proposal Format

Please identify specifically all information in the proposal that is considered to be proprietary or confidential. The proposal will be reviewed by only CASIS and third parties providing assistance to CASIS in proposal review, in accordance with the procedures set forth in Section 4 below. Proposals must be single-spaced. Margins should be 0.75". Font size should be 11-point Arial, Calibri, Helvetica, Palatino Linotype, or Georgia typeface, black type only. Do not include headers or footers. Avoid using columns in text. Proposals may include graphics, which must fit within the designated page limits and should be kept to a minimum. The proposal must contain the following sections. If any sections are not included in the proposal, the proposal may be deemed non-responsive and ineligible for consideration.

Proposals may include information that is considered to be proprietary or confidential. All such information must be specifically marked as such. If information in a proposal is not marked as proprietary or confidential, it may be circulated among the space-science community at large, and it may be used by CASIS in connection with its other activities.

Proposal Cover Sheet

Use the cover sheet form provided in Attachment A. (*Attachment A can be found on page 40 of this RFP*)

Cover Letter

Proposals may include a cover letter (maximum one page), which should briefly summarize the proposal: outline of project, scientific significance and potential commercial impact. Include any conflicts of interest and special situations (these should also be detailed in Section V). Short bullet points are encouraged.

Section I: Background and Overview

Maximum three pages.

1) Abstract (*Please reference whether proposing to Emphasis Area 1 or Emphasis Area 2)*
2) Background, Significance and Preliminary Studies: Specifically note relevance to the CASIS mission and to RFP objectives. Include and explain background information from previous studies and preliminary data (e.g., syntheses, measurements, or tests).

Section II: Detailed Project Plan

Maximum six pages.

1) Research Design and Methodology

    a) *Research Questions:* What are the main scientific questions that you plan to address? If appropriate, present as a hypothesis with specific aims. State concisely the goals of the proposed research and summarize the expected outcome(s), including how the proposed research will affect the research field(s) involved. List succinctly the specific objectives of the research proposed (e.g., to test a stated hypothesis, create a new design, solve a specific problem, challenge an existing paradigm, address a critical barrier to progress in the field, or develop new technology).

b) *Research Strategy:* Outline the overall technical approach that you plan to use to address the above. Describe the proposed research, stating its significance and how it will be conducted. Cite published experimental details in the Research Strategy section, and supply the full reference in the Bibliography and References Cited section. (*For the Full Scientific Evaluation Criteria, refer to Section 4.3*)

i. *Significance:* Explain why the problem is important and how the project addresses any critical barriers to progress in the field. Explain how the proposed project will improve scientific knowledge, technical capability, and/or commercialization efforts in one or more broad fields. Describe how achieving the proposed aims will change the concepts, methods, or technologies that drive this field.

ii. *Innovation:* Explain how the application challenges and seeks to shift current research paradigms. Describe any new theoretical concepts, approaches or instrumentation to be developed or used, as well as any advantage over existing methods and instrumentation. Explain any improvements or new applications of theoretical concepts, approaches, or instrumentation. Describe any potential to yield a new line of space research or to build upon prior ISS research.

iii. *Approach*: Describe the project's overall strategy, approach, and analyses to accomplish specific aims. Include how the data will be collected, analyzed, and interpreted. Discuss potential problems, alternative strategies, and benchmarks for success anticipated to achieve the aims. If the project is in the early stages of development, describe strategies to establish feasibility, and address the management of any high-risk aspects of the proposed work.

- *Experimental conditions:* Discuss the rationale for testing conditions, including details regarding proper statistical design and appropriate sample sizes, if relevant. Proposals should include information from any preliminary ground-based studies, if available.
- *Translation:* Describe how the proposers intend to translate ground-based and aerial experimental methods and conditions to function within the available space-based hardware, taking into account hardware limitations and conditions. Note specific materials to be used to allow the Operations team to review ISS protocols and requirements.

2) Technical Aspects of Spaceflight: CASIS will facilitate new-to-space grantees in identifying service providers, hardware and experimental modifications, as well as developing a realistic budget and time frame for the project. However, proposers must provide estimates or suggested approaches and ideal proposals will provide well-researched information in response to the below topics.

a. Service Providers: List implementation partners for payload integration and the rationale for choosing them. If implementation partners have not yet been identified, describe the services needed to complete the proposed research.

b. Flight Hardware: Clearly delineate existing or proposed flight hardware to be used in the proposed project. For information regarding current and in-development hardware, see

"Available Hardware and Facilities" and Appendix I. Explain plans to integrate flight hardware into the project timeline. Requirements for applications proposing hardware development:

i. Clearly describe design requirements, including detailed schematics and critical components, requisites and ground testing.

ii. Outline the steps to product development, including manufacturing timelines.

iii. List alternatives for hardware and components where applicable.

3) Facilities and Other Resources: Describe how the scientific environment will enhance the probability of success of the project, unique features of the environment and the institutional investment in the success of the investigator (e.g., resources).

Section III: Economic Impact of Project Success

Maximum three pages (*For the Full Economic Evaluation Criteria, refer to Section 4.4*)

1) Describe the project's potential commercial impact. Which market vertical(s) will it address (e.g., to which specific industries will it be relevant)? Describe further the scientific or commercial value of the research, development or testing of the remote sensing research or technologies. Is the research relevant to current commercial or industrial applications, or would it create a new market? Describe the estimated size of (in dollars and in population, if applicable), growth of and competition within (company, product, cost) the market vertical(s). For all proposals, be explicit about potential applications of successful project results, and note whether successful results will be published or disseminated. If relevant, explain how your project, if successful, might enter its relevant market(s)—and how the advances from your work would be superior to other products or would be unique in the market. Estimate the time to market, including necessary certification steps. Describe how you will measure progress toward potential commercial application. Describe funding received to date and estimated funding required to bring the product to market. List any potential opportunities for intellectual property, supporting these anticipated successes with potential comparable intellectual property.

2) Describe any other impact of your results relevant to economic evaluation, including humanitarian impact. For example, explain how successful results might promote teaching, training and learning or broaden participation of underrepresented groups in science or technology. Describe how successful results would affect quality of life in the U.S. Describe how the project might advance U.S. leadership in space.

Section IV: Budget and Time Frame

No page limit, but be succinct.

Provide a projected budget and time frame, broken down by month and organized using the following categories of cost, including personnel effort, supplies and ground experiments/controls: (*A Budget Template is provided on Attachment C - page 42 of this RFP*)

- Salary and fringe benefits for personnel

- Equipment and supplies
- Consultant costs
- Alterations and renovations
- Publications and miscellaneous costs
- Contract services
- Consortium costs
- Travel expenses
- Implementation partner services and hardware integration (if appropriate)
- Adequately define all indirect costs (not to exceed 25% of direct costs)
    - Indirect costs are costs not directly and exclusively accountable to the project. Examples are shared facilities/equipment and overhead. Direct costs are costs directly attributable to the project. The costs of materials and specific project labor are examples of direct costs. The institution or facility charge for indirect costs cannot exceed 25% of direct costs.
    - Indirect costs are not permitted to be recovered on certain types of costs. For the avoidance of doubt, excluded costs include purchased equipment, capital expenditures and the portion of subawards or subcontracts that exceed $25,000.

Include justification for major cost elements. Include preflight development and testing considerations, time to flight and time to completion. Include milestones for project feasibility, preparation and success. For projection purposes, assume a cost of $25,000 for seeking any necessary licenses or determinations from NOAA, FCC or other regulatory agencies.

Section V: Additional Information

No page limit, but be succinct.

1) Provide a signed Certificate Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion, using the form provided in Attachment B. (*Attachment B can be found on page 41 of this RFP*)

2) Provide a brief statement of the proposer's qualifications, including financial resources and organizational abilities to manage and complete the proposed project.

3) Provide letters of commercial support (should not exceed five pages).

4) Provide letters of commitment from collaborators. The proposal should contain a signed letter from each collaborator to the proposer that identifies the contribution the collaborator intends to make and a commitment to perform the work.

5) If another government or funding agency has reviewed the proposed project, proposers must provide the results and scoring details/comments of that review.

6) Provide a list of up to three references familiar with the proposer's qualifications and/or prior research experience.

7) Disclose all potential conflicts of interest.

8) Furnish a bibliography of any references cited. Each reference must include the names of all authors (in the same sequence in which they appear in the publication), the article and journal title, book title, volume number, page numbers and year of publication.

Section VI: Biographical Sketch

Maximum three pages per biographical sketch

Supply a biographical sketch for each proposer and background on key collaborators. Include information on past success in the field of study. Specifically describe the research team's experience and expertise relevant to this research project. In addition, please include four sections in the following sequence:

a. Educational History (in reverse chronology)
b. Professional Experience
c. Publications
d. Current Grant Funding

4. PROPOSAL EVALUATION

4.1 Overview of Selection Process

The evaluation process for solicited proposals will include five steps:

1. **Operations Evaluation.** Expedited review by the CASIS Operations team to determine technical feasibility of the proposed project and achievability of the estimated budget and timeline.

2. **Scientific Evaluation.** Evaluation by the Scientific Project Selection Panel (PSP), an external panel of subject matter experts, to score both scientific merit and potential impact.

3. **Economic Evaluation.** A two-pronged economic evaluation led by the CASIS economic team to score potential commercial and intangible value.

4. **Risk and Compliance Review.** Review by the CASIS Compliance Team for regulatory and legal risks.

5. **Final Determination.** The Executive Director, Chief Economist, and Chief Scientist will perform the final prioritization and award determination, initiating discussions with members of the operations/science/economic review teams and CASIS management-level staff as necessary.

If CASIS receives proposals with information marked proprietary or confidential or with information related to other CASIS remote sensing activities, CASIS will take steps to avoid inappropriate use of such information and to avoid conflicts of interest. These steps may include establishing internal firewalls or designating external panel(s) of experts to undertake all or portions of the above evaluation processes.

4.2 Detailed Description of Operations Evaluation

Technical feasibility of proposals is performed to ensure the viability and readiness for flight. The review is performed by the CASIS Operations team, who may consult as needed with NASA and outside technical experts to determine overall feasibility. This review is an unscored, pass–fail initial screening; however, CASIS may consider an interview with the investigator(s) to clarify technical elements of the proposal as well as the proposed budget and schedule in order to make its determination. Specifically, the technical feasibility review considers the following elements (not a comprehensive list):

- Logistics: Proposed resources including implementation partner support, facility needs for ground testing and flight operations support, use of ISS crew for research support, power and data requirements, weight and any known hazards
- Hardware: Availability, limitations, appropriate planned use and (alternatively) the costs and feasibility of proposed new hardware development
- Projected Budget and Time Frame: Preflight development and testing considerations, time to flight and time to completion
- Hazards: Procedures, situations and materials that could potentially be hazardous and a plan to mitigate any identified issues
- Questions: Follow-up questions for the investigator(s), including as appropriate—
  - Revised methods/analyses, and how results will be collected, analyzed and interpreted
  - Awareness of potential barriers and ideas about alternative approaches

The Operations team will organize its comments into an Operations Appendix to the proposal. The Appendix will provide crucial input for prioritization (e.g., time frame and budget) and will flesh out logistical challenges in the proposals in areas where new-to-space investigators will potentially be deficient. This function serves to support the new-to-space investigator so that appropriate considerations are made in their proposals, as well as to prevent experienced space investigators from scoring higher in the later rounds of review.

Only proposals that demonstrate feasibility will pass this round of review and advance to scientific evaluation. The decision of the Operations review is final and not subject to appeal.

4.3 Detailed Description of Scientific Evaluation

Using the scoring rubric below, the Scientific Proposal Selection Panel (PSP, an external panel of subject matter experts in the RFP target field, assembled by CASIS) will evaluate feasible proposals that passed the Operations review. The PSP's evaluation will consider the original proposal and may consider additional information from the Operations Appendix.

Proposal scoring chart

Score	Descriptive Features	Potential for selection
90-100	EXCELLENT: A thorough, comprehensive, and compelling proposal of exceptional merit that fully responds to the objectives of the RFP, as documented by several major strengths, no major weaknesses, and only very minor weaknesses, if any.	Top priority for selection.

Score	Descriptive Features	Potential for selection
80-89	VERY GOOD: A competent proposal of high merit that fully responds to the objectives of the RFP, as documented by one or more major strengths and no major weaknesses; strengths substantially outweigh any minor weaknesses.	Second priority for selection, barring issues of funding availability or programmatic priorities.
70-79	GOOD: A competent proposal that represents a credible response to the RFP, as documented by no major weaknesses; strengths and weaknesses on the whole are in balance, but strengths somewhat outweigh weaknesses.	May be selected as funds permit according to programmatic priorities.
50-69	FAIR: A proposal that nominally responds to the RFP, in which one or more major weaknesses, in combination with any minor weaknesses, are in balance with its strengths.	May be selected (sometimes after revisions) as funds permit according to programmatic priorities.
0-49	POOR: A proposal having several major weaknesses or weaknesses that constitute fatal flaws.	Not selectable regardless of the availability of funds or programmatic priorities.

Minor Weakness: An easily addressable weakness that does not substantially lessen merit/impact.
Major Weakness: A weakness that severely limits merit/impact.

Scoring Approach

Reviewers will score the following categories by using the above descriptors and will then average the individual scores to produce an overall merit/impact score.

Evaluation Categories and Criteria

1. Significance

Descriptors/Criteria: If successful, the results will have rapid scientific, commercial, and humanitarian impact and significant scientific, commercial, and humanitarian potential. The results could yield a new line of space research with strong scientific, commercial, and humanitarian potential or build on prior successful research produced on the ISS. If successful, the results will advance the leading edge of the field. Negative results will have significant impact within the research area. If successful, the results will influence broad fields of study. The research builds on a foundation of existing space or ground research to bring the pathway closer to commercial application.

2. Investigators

Descriptors/Criteria: The investigator(s) has the financial stability to complete a project. The investigator(s) has documented success in the field of study (as demonstrated by strong publication record, commercial success, patents, or technology implementation resulting from R&D). The investigator(s) has a strong publication record or demonstrated success in R&D (as measured by commercial success, patents or technology implementation resulting from scientific research). If the applicant is a new investigator(s), or one in the early stages of an independent career, the investigator(s) has appropriate experience and training or has partnered with a qualified coinvestigator. If the project is

collaborative (e.g., multiple institutions or coinvestigators), the investigators have complementary and integrated expertise; their leadership approach, governance and organizational structure are appropriate for the project.

3. Innovation

Descriptors/Criteria: The project is innovative with respect to multidisciplinary integration and novelty of topic or approach. The project's results, if successful, will challenge current research or commercial practice paradigms. The project's concepts, approaches, instrumentation, or interventions are new to more than one field of research. The project improves or suggests a new application of theoretical concepts or approaches.

4. Approach

Descriptors/Criteria: The scientific merit of the proposal is sound. The proposed project fits the CASIS mission, satisfying the overall objective of the RFP and both the short- and long-term objectives of CASIS. The proposal explains the hypotheses or the required elements of the proposed technology demonstration, including well-defined ground controls. The project requires the space environment for advancement with respect to time and/or capability. The project's potential problems, alternative strategies, and benchmarks for success are presented (may refer to Operations Appendix).

5. Environment

Descriptors/Criteria: The investigator(s) has access to crucial ground technology and experience necessary for preflight work and ground controls. The proposal contains compelling and well-developed preliminary work. The project will benefit from the space environment. The investigator(s) has demonstrated understanding of how data collection, analysis and interpretation must be approached on the basis of the unique conditions of the space environment (may refer to Operations Appendix).

4.4 Detailed Description of Economic Evaluation

CASIS will assemble a team of qualified personnel to serve as the economic team to evaluate the feasible proposals that passed the Operations and Scientific reviews. The economic review process will be twofold, with each branch of the process (Commercial and Intangibles) using a 0–100 scale (100 being the best) to evaluate the criteria within its area. Reviewers will score each of eight categories using the criteria and scoring descriptors detailed in this document—five categories in the commercial evaluation branch of review and three in the intangibles branch. The scores within each branch will be averaged to produce an overall score for that branch. The weighting of the intangible score in the final combined score will range from 0 to 50%, as determined by the CASIS Chief Scientist and/or Chief Economist.

Proposal scoring chart

Score	Descriptive Features	Potential for selection
90-100	EXCELLENT: A thorough, comprehensive, and compelling proposal of exceptional merit that fully responds to the objectives of the RFP, as documented by several major strengths, no major weaknesses, and only very minor weaknesses, if any.	Top priority for selection.
80-89	VERY GOOD: A competent proposal of high merit	Second priority for selection,

Score	Descriptive Features	Potential for selection
	that fully responds to the objectives of the RFP, as documented by one or more major strengths and no major weaknesses; strengths substantially outweigh any minor weaknesses.	barring issues of funding availability or programmatic priorities.
70-79	GOOD: A competent proposal that represents a credible response to the RFP, as documented by no major weaknesses; strengths and weaknesses on the whole are in balance, but strengths somewhat outweigh weaknesses.	May be selected as funds permit according to programmatic priorities.
50-69	FAIR: A proposal that nominally responds to the RFP, in which one or more major weaknesses, in combination with any minor weaknesses, are in balance with its strengths.	May be selected (sometimes after revisions) as funds permit according to programmatic priorities.
0-49	POOR: A proposal having several major weaknesses or weaknesses that constitute fatal flaws.	Not selectable regardless of programmatic priorities or availability of funds.

Minor Weakness: An easily addressable weakness that does not substantially lessen economic value.
Major Weakness: A weakness that severely limits economic value.

4.4.1 Commercial Evaluation

Note: Reviewers will evaluate commercial letters of support during this stage. These letters may influence scoring in multiple categories.

Evaluation Categories and Criteria

1. Management and Key Employees

Descriptors/Criteria: The current management team is qualified to and can execute the project. The team has prior successful experience working together. The team or PI has prior experience in similar capacities (however, the team or PI cannot be faulted for lack of space experience) and has demonstrated high likelihood of future success in the field of interest. The project lists necessary, relevant, and qualified key collaborators.

2. Markets and Competition

Descriptors/Criteria: The current size and forecast growth rate of the relevant market(s) is noted and addressed, and these data support potential market impact of successful results. The proposal addresses both barriers to entry and market competition. The team can either commercialize products or partner with companies with established commercial success. A customer base exists for potential products (i.e., new innovation vs. advancing something existing or solving a problem).

3. Products/Services and Technologies

Descriptors/Criteria: The products/services/key technologies that will benefit from successful results are clearly defined, feasible, and unique. The resulting product/service will provide specific and significant benefits to the U.S. economy or population. Customers will easily understand the benefits/products resulting from successful results. Product/service development plan, timing, and costs are feasible and

realistic. Technology risk assessment, if applicable, has been performed and/or is not likely to pose a problem. Patents, trade secrets, or copyright protection, if available for the products/technologies/services, will increase likelihood of market impact and commercial success.

4. Business and Operating Plan

Descriptors/Criteria: The proposal coherently states project mission, strategy, and implementation. The competitive environment and CASIS objectives are clearly understood. Required resources (e.g., human, capital) are described and understood. The description of commercial application is adequate, and the forecast results are reasonable.

5. Customers and Suppliers

Descriptors/Criteria: Customer opinion about the field/market/competition is favorable to market entry and success. Key suppliers are stable and reliable/high quality (if applicable). Single-source components or technologies are unlikely or are acceptable (if applicable). Investigators are aware of companies interested in commercializing the product(s) resulting from the research.

4.4.2 Intangibles Evaluation

Evaluation Categories and Criteria

1. Greater Good to Society

Descriptors/Criteria: The overall potential for impact on the U.S. society is of significant value. The project advances discovery and understanding while promoting teaching, training, and learning. The proposed project broadens the participation of underrepresented groups. The project increases throughput of the supply chain—innovations affecting humans, animals, plants, climate and resources now or in the future (e.g., fewer deaths, fewer sicknesses, healthier livestock, a more abundant food supply, the protection of endangered plant or animal species, reduced pollution, improved ground energy efficiency).

2. U.S. Leadership in Space

Descriptors/Criteria: The success of the project will change the concepts, methods, technologies, treatments, services, or interventions that drive the relevant field. Potential exists for significant international impact. The project advances the CASIS mission to balance a diverse portfolio of research disciplines and stages. The project enhances awareness among potential ISS constituency groups regarding the advantages of performing science in space (i.e., it will promote interest in using the National Lab). The project shows how ISS technology contributes to products and services revenue and related tax revenue from profits (i.e., it demonstrates value to the public).

3. Economic and Human Capital Development

Descriptors/Criteria: The benefits of the proposed project to society include job and wealth creation, as well as improved quality of life, knowledge, skill sets and sustainability. The project bridges basic science with industrial R&D applications. Project success will enhance the infrastructure for space-based research and education (e.g., facilities, instrumentation, networks, and partnerships). The results will be disseminated broadly to enhance scientific and technological understanding, enabling developments in

science by allowing researchers to build on each other's work and providing content for educational curricula. Project success will produce future projects of significant intangible or tangible value. The project addresses an important problem or a critical barrier to progress in the field.

4.5 Risk and Compliance Review

During or after the economic review, the CASIS Compliance team will review meritorious projects providing notes regarding potential problems for risk and compliance: data integrity, ethics and research integrity, regulatory compliance, conflicts of interest and other risks or liability. The risk of an adverse determination from NOAA as to the issuance of a remote sensing license, or an adverse determination from the FCC or NTIA as to the issuance of any necessary license, shall not be considered as part of the evaluation process.

4.6 Final Determination

The Executive Director, Chief Economist, and Chief Scientist will perform the final prioritization and award determination, initiating discussions with members of the operations/science/economic review teams and CASIS management-level staff as necessary.

The Executive Director, Chief Economist, and Chief Scientist will meet and review the eligible projects, relative to the entire National Lab research portfolio, on the basis of scientific merit/value, economic impact, technology advancement, and educational value. They will consider estimated cost and timeline alongside scores and comments from all review steps.

The Executive Director, Chief Economist, and Chief Scientist will analyze the Operations Appendix to proposals to ensure sufficient facility capacity and on-board resources in the given increment. Based on the facility and resource requirements known at the time of prioritization, they will categorize and organize payloads accordingly, consulting CASIS Operations staff as necessary for clarification. If all eligible projects fall within the available CASIS resources and facility capacity, then prioritization, for this purpose, would not be necessary. If unforeseen changes to available resources occur, CASIS will reprioritize the payloads.

All projects must meet minimum eligibility requirements such as readiness for an increment, secured funding (including CASIS grant funding), and an agreement with an implementation partner. Prioritized proposals with sufficient funding will advance to the CASIS Operations team for preflight activity and project management. CASIS Operations staff will participate in NASA research processes to support established strategic and tactical planning processes.

Lower priority proposals will be notified that their project needs improvement with feedback on its weaknesses.

4.7 Procedure for Conducting Negotiations

After completion of the evaluation process described above, CASIS will determine whether there are proposers with whom CASIS may choose to conduct negotiations. If CASIS chooses to negotiate with proposers, negotiations shall continue to the satisfaction of CASIS or, if CASIS determines a satisfactory agreement cannot be reached, CASIS may initiate negotiations with other proposers. CASIS may, at any time during the negotiation process, choose to negotiate with one or more proposers at the same time,

but is under no obligation to do so. CASIS may request a revised proposal from any proposer to elicit additional information that is required.

In the event that (i) CASIS decides not to engage in any negotiations, or (ii) a grant award cannot be negotiated with any of the proposers, CASIS may issue a new RFP or utilize another process to seek qualified grantees.

4.8 Appeals

CASIS shall inform all proposers whether they have been selected for a grant award. CASIS shall inform all non-selected proposers of the bases for the decision. Any proposer who is adversely affected by CASIS's decision concerning a grant award and who wants to appeal such decision shall submit a written appeal to the Executive Director of CASIS within 10 days of the date on which the proposer is informed of the bases for CASIS's decision. This appeal shall consist of a written statement of up to 10 pages setting forth the bases for the proposer's appeal. The appeal shall be considered by a member of the CASIS senior management who was not involved in the decision making. Failure to file an appeal within the prescribed time shall preclude any appeal.

5. MISCELLANEOUS PROVISIONS

5.1 Provisions Governing Grant Award

1. A response to this RFP does not commit CASIS to award a grant or to pay any costs incurred in the preparation of a response. CASIS reserves the right to accept or reject any or all responses received or to cancel this RFP.
2. CASIS is not liable for any costs incurred by a proposer in responding to this RFP.
3. A material misrepresentation in a proposal shall result in the rejection of the proposal, and shall be grounds for termination of any grant award.
4. Proposers shall not offer or exchange any gratuities, favors or anything of monetary value to or with any Board member, employee, consultant of CASIS or any Project Selection Panel member for the purpose of influencing the disposition of their proposal.
5. Proposers shall not engage in any activity that will restrict or eliminate competition in response to this RFP. This prohibition does not preclude joint ventures or subcontracting.
6. Proposers must be familiar with Section 504 of the NASA Authorization Act of 2010, the remote sensing regulations of NOAA, and other applicable laws, regulations and government requirements. All grantees will be required to comply with all such laws, regulations, and government requirements.
7. Proposals and reviewer comments will be maintained by CASIS securely and will be exempt from disclosure or release, unless required by law.

5.2 Grant Period

This Agreement becomes effective on the date on which it is executed and will continue for a period of 18 months, unless extended by mutual agreement of the Parties in writing. Grantee's project(s) must be ready to fly within 12 months of the effective date of the Agreement, and projects must be completed (with final report submitted) by 6 months post flight.

5.3 Funding of Grant

CASIS's liability to make payments to the grantee will be limited to the funds awarded as set forth in the grant agreement. All activities under or pursuant to the grant agreement outside the federal fiscal year under which the award was granted are subject to the availability of federal funds and are subject to CASIS receiving funding through its cooperative agreement with NASA.

5.4 Modifications to Grant

Grants awarded as a result of this RFP may be modified or extended upon agreement of the grantee and CASIS. CASIS may negotiate an increase in grant funding based on funds available or if it is in the best interest of CASIS. CASIS may unilaterally modify a grant agreement to de-obligate funds if funding becomes unavailable or if it is in the best interest of CASIS.

5.5 Payments

Grant funds will be transmitted using bill.com as either an e-payment (Automated Clearing House – ACH) or a physical check issued by CASIS. Before funds are transmitted, CASIS will require the following information: grantee's bank, bank routing number and account number; complete and signed W-9, and contact name, e-mail address and phone number to confirm a test banking transaction. Once this information is received, a test transaction will be conducted and confirmed by grantee. Payments will be made in amounts and at times as set forth in the grant agreement. CASIS is not liable for any expenses incurred by grantee above the awarded grant amounts.

5.6 Grant Terms and Conditions

Upon selection of a proposal for award, CASIS and the proposer will execute a grant agreement with terms and conditions including, but not limited to, those set forth in this section and at the following link: http://www.iss-casis.org/Standard Terms and Conditions.

The award of a grant agreement does not guarantee the grantee that its payload will be flown on the ISS. At an appropriate time to be set forth in the grant agreement, CASIS, with input from NASA, will make a determination as to whether the grantee's project is flight-capable. If the grant project is determined to be flight capable, then CASIS and the grantee may either amend the grant agreement or execute a separate user agreement regarding the use of the National Lab.

5.7 Termination

The grant agreement may be terminated in whole or in part if any of the following conditions have occurred:

1. By CASIS, if CASIS determines that grantee fails to comply with any material requirement of the grant agreement;
2. By CASIS, if CASIS determines that the action or inaction of the grantee substantially endangers the performance of the grant agreement or such occurrence can be reasonably anticipated;
3. By either party, if CASIS and the grantee mutually agree to complete or partial termination; or
4. By grantee, upon grantee's sending to CASIS written notification setting forth the reasons for the termination, the effective date and, in the event of a partial termination, the portion to be terminated. However, if CASIS determines in the case of partial termination that the reduced or

modified portion of the grant will not accomplish the purposes for which the grant was made, it may terminate the grant in its entirety under sections 1, 2, or 3 above.

Grantees shall submit to CASIS, within 90 calendar days after the date of any termination, all financial, performance, and other reports as required by the terms and conditions of the grant agreement.

5.8 NOAA License Determination

Proposers are not required to have submitted before proposal submission an application for a license or a determination that no license is required from the National Oceanographic and Atmospheric Administration (NOAA). After award, all awardees shall be required to promptly contact NOAA to obtain a determination on the requirement for a license. If NOAA determines a license is required, the awardee must submit an application for the license. Awardees may submit their applications or determination requests on their own behalf, or alternatively they may arrange with CASIS for CASIS to assist with the application/determination process for a fixed service fee, to be determined after award.

An awardee that fails to secure either a remote sensing license or a determination that no license is required from NOAA shall not have its payload determined eligible for launch and shall return unexpended grant funds to CASIS.

Background on NOAA Licensing Process: The National and Commercial Space Programs Act (NCSPA), 51 U.S.C. § 60101, et seq. as amended (the Act), provides that no person who is subject to the jurisdiction or control of the U.S. may operate any private remote sensing space system without a license, and authorized the Secretary of Commerce to license private sector parties to operate private remote sensing space systems. By law, the Secretary can grant a license only upon determining, in writing that the applicant (licensee) will comply with the requirements of the Act, any regulations issued pursuant to the Act and any applicable international obligations and national security concerns of the United States. Information on applying for a license can be found in the Code of Federal Regulations (CFR) at 15 CFR Part 960, specifically, Subpart B and Appendix 1.

For the information of proposers, the NOAA determination process generally can be done quickly. If a license is required, the licensing process can take up to 120 days. Further information concerning the NOAA licensing process can be obtained by contacting the Commercial Remote Sensing Regulatory Affairs Office at the following address:

SSMC1 Room 8137
1355 East-West Highway
Silver Spring MD 20910
301-713-3387
crsra@noaa.gov

Although CASIS believes the information herein is accurate, proposers and awardees should not rely on this information, and are expected to be familiar with all regulatory requirements applicable to their proposals.

5.9 FCC or NTIA License Determination

It is possible that certain awardees may propose activities that would require a license from the Federal Communications Commission (FCC) or the National Telecommunications & Information Administration (NTIA). Proposers are not required to have submitted before proposal submission an application for a license or a determination that no license is required from the FCC or NTIA. After award, all awardees shall be required to determine whether their proposed activity may require a license from the FCC or NTIA. Awardees may make this determination and submit any necessary application on their own behalf, or they may arrange with CASIS for CASIS to assist with the application/determination process for a fixed service fee, to be established after award. An awardee that fails to secure a license that is required from the FCC or NTIA shall not have its payload determined eligible for launch and shall return unexpended grant funds to CASIS.

Background on Licensing: Awardees that propose remote sensing on the ISS may not require any license if all transmission from station to ground is conducted through NASA downlink. However, awardees that propose remote sensing on small satellites such as cubesats may require licenses from the FCC or NTIA. For guidance concerning FCC licensing of spectrum for use by non-Federal small satellites, including satellites that fall within the categories of pico-satellites, nano-satellites and cubesats, please refer to http://www.fcc.gov/document/guidance-obtaining-licenses-small-satellites. Although CASIS believes the information herein is accurate, proposers and awardees should not rely on this information, and are expected to be familiar with all regulatory requirements applicable to their proposals.

APPENDIX I: ISS EXISTING HARDWARE, REMOTE SENSING IMPLEMENTATION PARTNERS & HARDWARE PROVIDERS

CASIS strongly encourages prospective proposers to learn about the availability and capability of flight hardware and integration services by directly communicating with implementation partners and the CASIS Operations team (opsinfo@iss-casis.org). The maximum CASIS funding available for a proposer is determined by the instrument/equipment requested and is outlined in the table below. Please note that CASIS can be the implementation partner for existing hardware. If a proposer chooses to use CASIS as the implementation partner, that decision should be communicated to CASIS prior to proposal submission.

INSTRUMENT / EQUIPMENT NAME	CLASS	MAXIMUM FUNDING	IMP. PARTNER
HICO	ANALYSIS, IMAGES, OR TARGETS ONLY	$100K	NONE REQUIRED
ISERV	ANALYSIS, IMAGES, OR TARGETS ONLY	$150K	CASIS OR OTHER
HDEV	ANALYSIS, IMAGES, OR TARGETS ONLY	$50K	CASIS OR OTHER
CEO	ANALYSIS, IMAGES, OR TARGETS ONLY	$50K	CASIS OR OTHER
WORF Rack	SMALL HARDWARE DEVELOPMENT OPTION	$200K	CASIS OR OTHER
NANORACKS CUBESAT DEPLOYER	SMALL HARDWARE DEVELOPMENT OPTION	$500K*	NANORACKS
NANORACKS EP	WILL REQUIRE INSTRUMENT DEVELOPMENT	$500K*	NANORACKS
MUSES	WILL REQUIRE INSTRUMENT DEVELOPMENT	$500K*	TELEDYNE BROWN ENGINEERING
ELC	WILL REQUIRE INSTRUMENT DEVELOPMENT	$500K*	PI TO SELECT
COLUMBUS	WILL REQUIRE INSTRUMENT DEVELOPMENT	$500K*	PI TO SELECT
JEM-EF	WILL REQUIRE INSTRUMENT DEVELOPMENT	$500K*	PI TO SELECT

* Funding needed may be more than the maximum funding grant provided by CASIS. Letter(s) of support or explanation for committed funding needed.

The CASIS Operations team (opsinfo@iss-casis.org) is available to answer questions by email and/or to facilitate pre-submission discussions to help prospective proposers determine relevant options for on-orbit investigations. Answers will appear on the CASIS Web site at http://www.iss-casis.org/solicitations. However, CASIS will not post answers that would jeopardize intellectual property or proprietary information.

Implementation Partners for Flight Experiments

NanoRacks:

NanoRacks is a commercial service provider for ISS National Lab research. Their NanoLab modules are based on the CubeSat form factor and are widely customizable. The NanoRacks' External Platform Program provides a commercial gateway to the extreme environment of space. It is an ideal location for Earth observations and remote sensing instruments, however pointing and gimbaling systems are not standard and these capabilities will require negotiation with NanoRacks. The NanoRacks Smallsat Deployment Program provides a commercial gateway to the extreme environment of space for Earth and deep space observation. NanoRacks offers complete in-house capabilities for payload integration, payload design and development as well as everything that is necessary to assure mission success.

Associated references/resources:

NanoRacks LLC
18100 Upper Bay Road, Suite 150
Houston, Texas 77058
815-425-8553
www.nanoracks.com

***Teledyne Browne Engineering*:**

Teledyne Brown Engineering (TBE) offers expertise in the entire payload operations and integration process. The company has proudly supported NASA's efforts for over 30 years in areas ranging from payload concept development through hardware fabrication, physical and analytical integration and software development. TBE has also provided well over 100,000 continuous hours of real-time science operations support to the International Space Station community since NASA's Payload Operations Integration Center became operational in February 2001.

Teledyne is developing the Multi-User System for Earth Sensing (MUSES), an Earth observing, precision pointing platform for deployment and full operations onto the ISS. Launching in 2015, MUSES will host up to four instruments simultaneously and offer the ability to change, upgrade and robotically service those instruments. Teledyne's Telescience Support Center (TSC) will provide instructions for platform pointing, instrument operations, and data downlink, as well as data processing and archiving.

Point of contact information:

Ed Russell
ed.russell@tbe.com
256-726-4345

Bill Corley
bill.corley@tbe.com
832-864-2958

***Southwest Research Institute*:**

A traditional strength of the Space Science Department is the design and fabrication of instruments for the *in-situ* measurement of space plasmas, the dilute ionized gases that populate the immediate space environments of the Earth and other solar system bodies as well as interplanetary space.

Technical strengths:

- Instrument conceptual development
- Systems engineering
- Microprocessor and digital design
- Analog design
- Real-time embedded software development
- Mechanical and electrical fabrication
- Instrument integration and test
- Environmental testing
- Spacecraft integration support

Point of contact information:

Paul Wilson, Acting Manager, Instrument Systems
Space Science, Space Science & Engineering
210-522-6212
pwilson@swri.org

***The Aerospace Corporation*:**

The Aerospace Corporation, a world leader in the application of space technology, provides advanced scientific engineering services for space and related high-technology systems. As an independent, nonprofit corporation operating federally funded research and development center, The Aerospace Corporation performs objective technical analyses and assessments for a variety of government, civil and commercial customers. With five decades of experience and a staff widely recognized for its technical knowledge and capabilities, The Aerospace Corporation provides leadership and support in all fields and disciplines of research, design, development, acquisition, operations and program management.

Research, Engineering & Technical Support Services:

- Mission planning
- Operations concepts
- Acquisition and program management
- Prototype development
- Reliability analysis
- Systems engineering
- Test and evaluation
- Independent readiness reviews

- Risk analysis and lifecycle cost modeling
- Laboratory evaluation
- Nondestructive testing
- Launch and on-orbit failure analysis and anomaly resolution

Point of contact information:

Kristine Ferrone
Program Development
571-359-7226
kristine.ferrone@aero.org

ISS National Lab Remote Sensing Instrumentation

Information about facilities specific to this RFP are available below, and proposers should familiarize themselves with these options. Information regarding ISS hardware and upgrades is subject to change.

Window Observational Research Facility (WORF)
WORF provides a facility for both automated & crew-tended observations at the 20-inch U.S. Laboratory Science Window on the ISS. It provides a highly stable internal mounting platform to hold cameras and sensors steady while offering power, command, data and cooling connections. It is based on an International Standard Payload Rack (ISPR) and utilizes avionics and hardware adapted from the EXPRESS Rack program. The payload volume equivalent to 0.8 m^3 and it is capable of supporting up to three payloads simultaneously.

Crew Earth Observations (CEO)
CEO is the NASA program for recording crew imagery of natural and human events on the Earth's surface to monitor changes over time, capture dynamic events, and support various Earth and planetary science objectives. The CEO online imagery database is also searchable and available (with attribution) for commercial use. CEO includes commercial and professional handheld cameras with a suite of lenses from wide angle to a 1200mm lens equivalent. Scientists on the ground train the crew in basic areas of Earth system science and provide the crew a daily list of targets of the greatest scientific interest.

CEO currently has the capability to include between five and ten sites daily on their task list. Additional requirements beyond that capacity will require coordination with CASIS to request additional crew time and determine prioritization. Proposers suggesting CEO use should coordinate with the CEO team to estimate support costs.

Associated references/resources:

The point of contact for CEO is Lisa Vanderbloemen (lisa.a.vanderbloemen@nasa.gov)

The Gateway to Astronaut Photography of Earth: http://eol.jsc.nasa.gov/

Hyperspectral Imager for the Coastal Ocean (HICO)

HICO is a Naval Research Laboratory (NRL) instrument now funded by NASA that is mounted on the Japanese Experiment Module's External Facility. HICO is entirely ground operated and requires no crew time. It was built from commercial-off-the-shelf components as a technology demonstrator to show how the Department of Defense could rapidly deploy a hyperspectral capability for surveying littoral regions as well as serve as a pathfinder for developing next generation space borne hyperspectral imagers.

The raw data from selected targets will be made available to awardees for the purpose of processing and creating algorithms for select product or application development or other viable commercial offerings. Use of HICO was focused on providing data for scientific research on coastal zones and other regions around the world; however, the capabilities of the facility may provide an expanded opportunity for imaging other sought after targets.

Associated references/resources:

The point of contact for HICO is Cindy Evans (cindy.evans-1@nasa.gov).

Submit requests for imagery through Oregon State University:
http://hico.coas.oregonstate.edu/

Proposers will need to specify location, frequency, duration, and other operational parameters.

HICO Summary

Sensor	Brandywine Optics 3035 spectrometer; QImaging Rolera-MGi camera
Nadir Field of View	42x192 km
Nadir Spatial Resolution	92 m
Spectral Bands	380-960 nm
Pointing	+45/-30 deg cross-track
Spectral Channel Width	5.7 nm
Number of Spectral Channels	102 (87 high quality)
Signal-to-Noise Ratio for water-penetrating wavelengths	> 200 to 1 for 5% albedo scene (10 nm spectral binning)
Polarization Sensitivity	< 5% (430-1000 nm)
Scenes per orbit	1
Owner	NASA

International Space Station SERVIR Environmental Research and Visualization System (ISERV)

The ISS SERVIR Environmental Research and Visualization System (ISERV) is a fully automated image data acquisition system that flies aboard the International Space Station (ISS) and deploys in the Window Observational Research Facility (WORF) rack within the Destiny module. ISERV functions as a mechanism by which scientists in NASA's SERVIR (Spanish, "to serve") project gain experience and expertise in rapid instrument tasking, automated image data acquisition, and rapid data downlink. While the core purpose of the project is to gain proficiency in these operations in order to inform design criteria and address engineering concerns for a similar but significantly more capable external instrument to be flown aboard ISS at a future date, useful image data is expected to accrue in the process.

ISERV's main component is the optical assembly, which consists of a 9.25 inch Schmidt-Cassegrain telescope, a focal reducer (field of view enlarger), a digital single lens reflex camera and a high precision focusing mechanism. A motorized 2-axis pointing mount allows pointing at targets approximately 23 degrees from nadir in both along- and across-track directions. The T61p WORF laptop provides system control, image storage and data downlink functions. Utilizing a Canon EOS 7D DSLR, ISERV images a 13 km by 9 km footprint from a nominal 350 km orbital altitude, capturing up to 390 km² of image data per second in 3-second bursts.

The system, based on a modified commercial telescope and driven by custom software, will use downward viewpoint to obtain near-real-time data about Earth-based environmental disasters, humanitarian crises and environmental threats. ISERV will then transmit that data within hours to scientists back on Earth. ISERV is a pathfinder instrument, the first of a new series of high-value instruments bound for the space station each featuring progressively more advanced sensors. Future versions of ISERV, if funded, eventually could be mounted on the exterior of the station for an even clearer, wider view of Earth. The Payload Operations team at Marshall Space Flight Center is creating computer-based training materials to be used by the space station crew to train for ISERV assembly and installation in the WORF rack.

Optical assembly and technical specifications:

- 9.25 inch Schmidt-Cassegrain telescope
- Focal reducer (field of view enlarger)
- Digital single lens reflex camera
- High precision focusing mechanism
- A motorized 2-axis pointing mount allows pointing at targets approximately 23 degrees from nadir in both along- and across-track directions.
- Utilizing a Canon EOS 7D DSLR, ISERV images a 13 km by 9 km footprint from a nominal 350 km orbital altitude, capturing up to 390 km² of image data per second in 3-second bursts.

Associated references/resources:

The point of contact for ISERV is Yancy Young (yancy.b.young@nasa.gov).

ISERV web link:
http://www.nasa.gov/mission_pages/station/research/experiments/ISERV.html

High Definition Earth Viewing (HDEV)

HDEV payload incorporates four commercially available high definition (HD) cameras to provide high definition views of the Earth. The HDEV visible cameras are a fixed payload camera system that requires no zoom, no pan or tilt mechanisms. The four fixed cameras are targeted for imagery of the Earth's surface and its terminators as seen from the ISS (forward, nadir, aft).

Nominal Technical Capabilities Summary

Facility	ISERV	CEO	HICO
Sensor	9.25 inch Schmidt-Cassegrain Telescope	Various digital cameras and lenses	Brandywine Optics 3035 spectrometer; QImaging Rolera-MGi camera
Nadir Field of View	Nadir with 23 degrees tracking	Lens dependent	42x192 km
Nadir Spatial Resolution	13 km x 9 km "footprint"	6-30 m to Oblique	92 m
Spectral Bands	Visible – Near IR	Visible – Near IR	380-960 nm
Pointing		Any USOS window	+45/-30 deg cross-track
Owner	NASA	NASA	NASA

ISS National Lab Windows

Window Observational Research Facility (WORF) provides a highly stable internal mounting platform to hold cameras and sensors steady while offering power, command, data and cooling connections.

The Cupola, Italian for "dome," is an ESA-built observatory module with seven windows used to conduct experiments, dockings, and observations of Earth. The large 80-cm diameter top bay window and six side windows provide an observation and work area for the ISS crew giving visibility to support the control of the space station remote manipulator system and general external viewing of Earth, celestial objects and visiting vehicles.

ISS National Lab External Platforms

ExPRESS Logistics Carrier (ELC) is an unpressurized attached payload platform that provides mechanical mounting surfaces, electrical power, and command and data handling services. The ELC is broken down into sites, there are 8 available payload sites spread across four different ELCs. An adapter is normally required for each payload site. Max payload mass is approximately 227 kg per site. Note, multiple payload sites may be used simultaneously. Maximum volume per site is approximately 1.2m^3. Maximum available power is approximately 750W power per site.

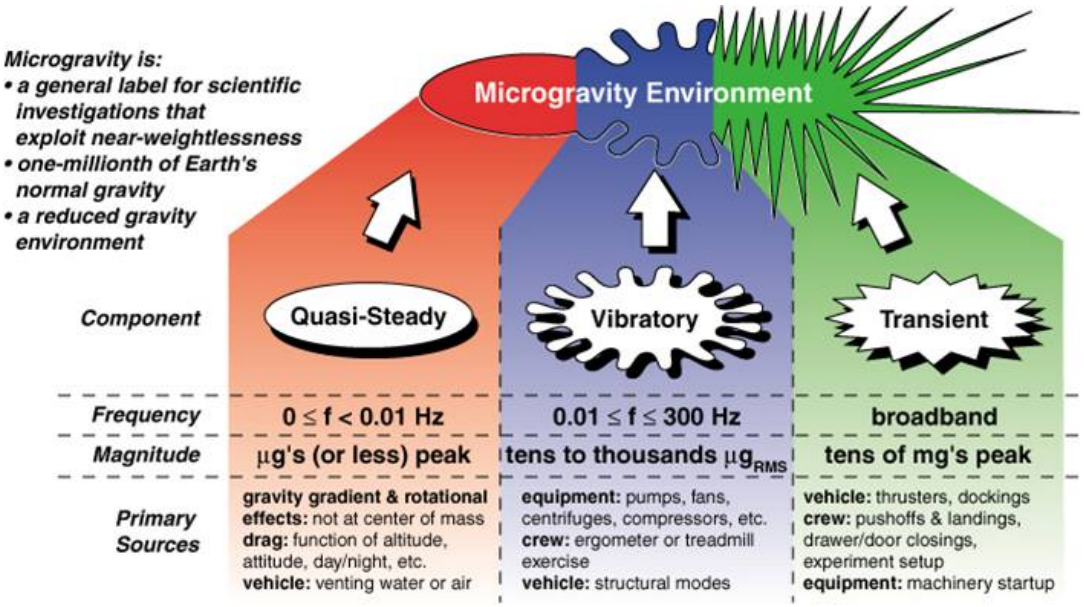
NanoRacks External Platform (NREP) is a compact research platform fitted for versatile use equipped with its own power supply to distribute power to experimental containers. An internal computer system monitors and controls the flow of power to the containers, receives commands from on-ground users, and communicates research data to those users.

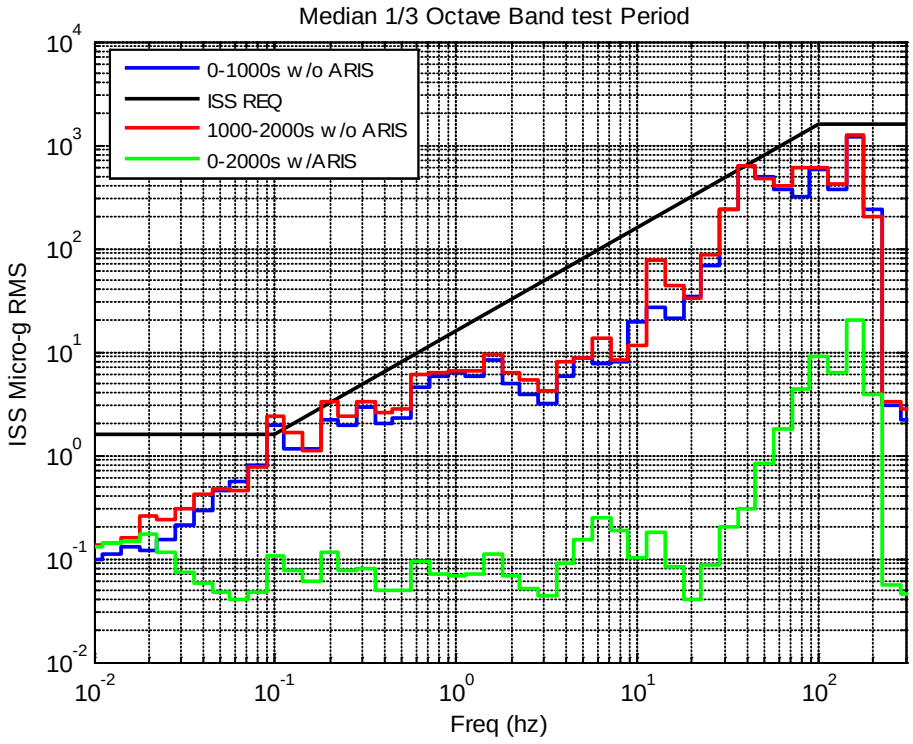
Japanese Experiment Module – Exposed Facility (JEM-EF) can hold up to 10 experiment payloads at a time outside Kibo. JEM-EF provides utilities, including two channels of 120Vdc power supply for payload normal operation. Standard payload size for the JEM-EF is 1.85 m x 1.0 m x 0.8 m with a mass of 500 kg.

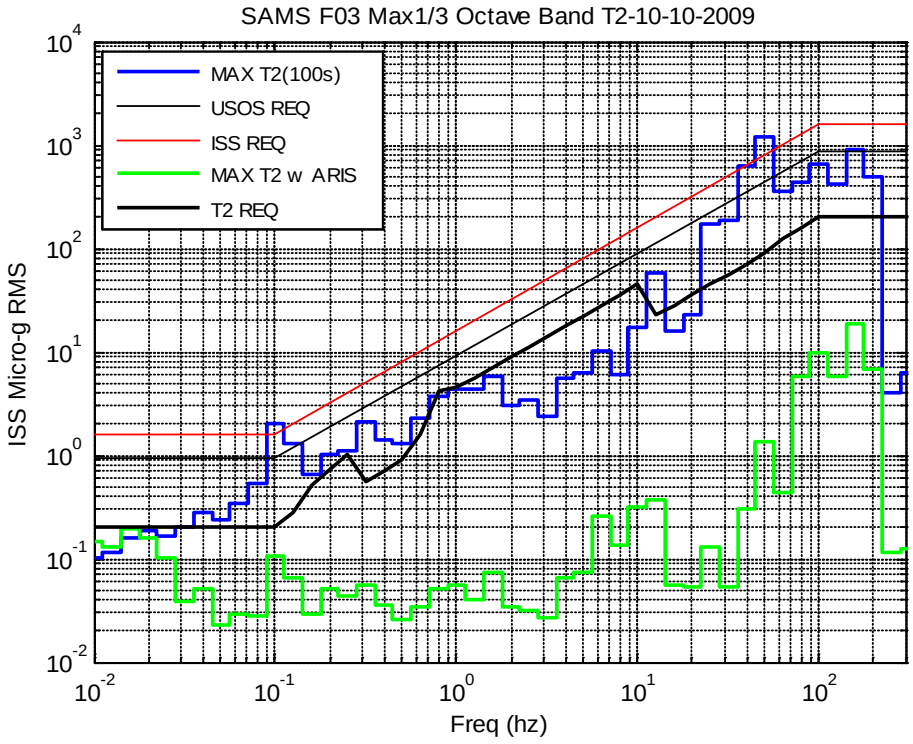
Columbus-External Payload Facility (Columbus-EPF) consists of two identical L-shaped consoles attached to the starboard cone of Columbus in the zenith (top) and nadir (bottom) positions, each supporting two platforms for external payloads or payload facilities. Four external payloads can be operated at the same time. Columbus can supply power and data to the Columbus-EPF payloads and can poll the payloads for housekeeping and user data.

ISS Environment Characteristics

The ISS is typically in a quasi-steady state of microgravity quiescence. However, vibratory and transient perturbations from mechanical equipment, crew activity, structural modes and vehicle interactions can affect the environment for sensitive experiments. On-board sensors monitor perturbations to the microgravity state on the ISS. An overview of the microgravity environment on the ISS, entitled Microgravity Science on the ISS: A primer for new investigators, is available online at http://www.nasa.gov/pdf/501343main_Microgravity_Science.pdf.




Median 1/3 Octave Band test Period
0-1000s w/o ARIS
ISS REQ
1000-2000s w/o ARIS
0-2000s w/ARIS
ISS Micro-g RMS
Freq (hz)


SAMS F03 Max1/3 Octave Band T2-10-10-2009
MAX T2(100s)
USOS REQ
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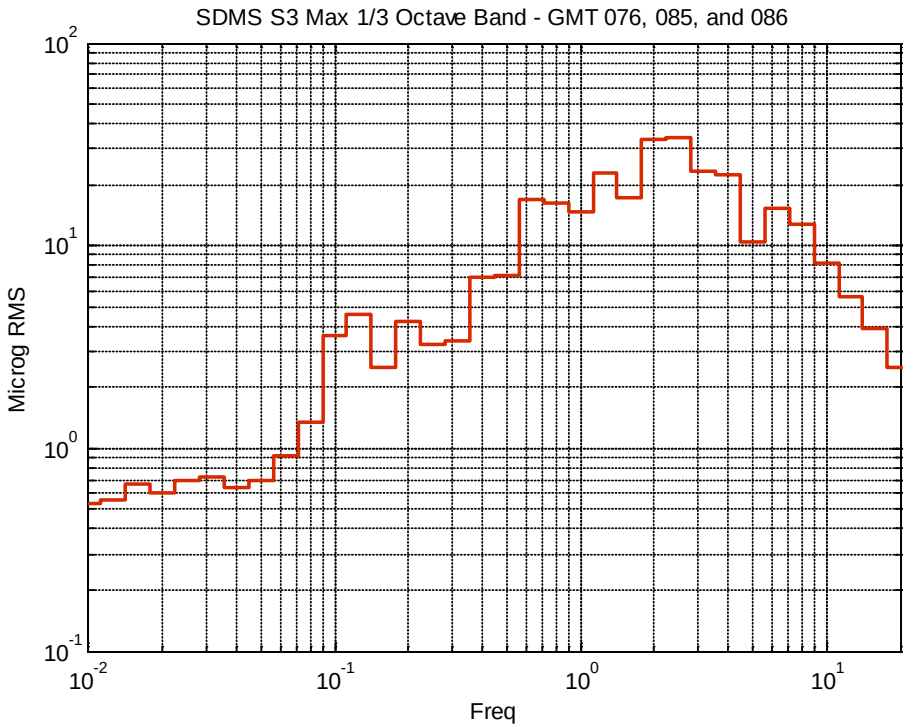
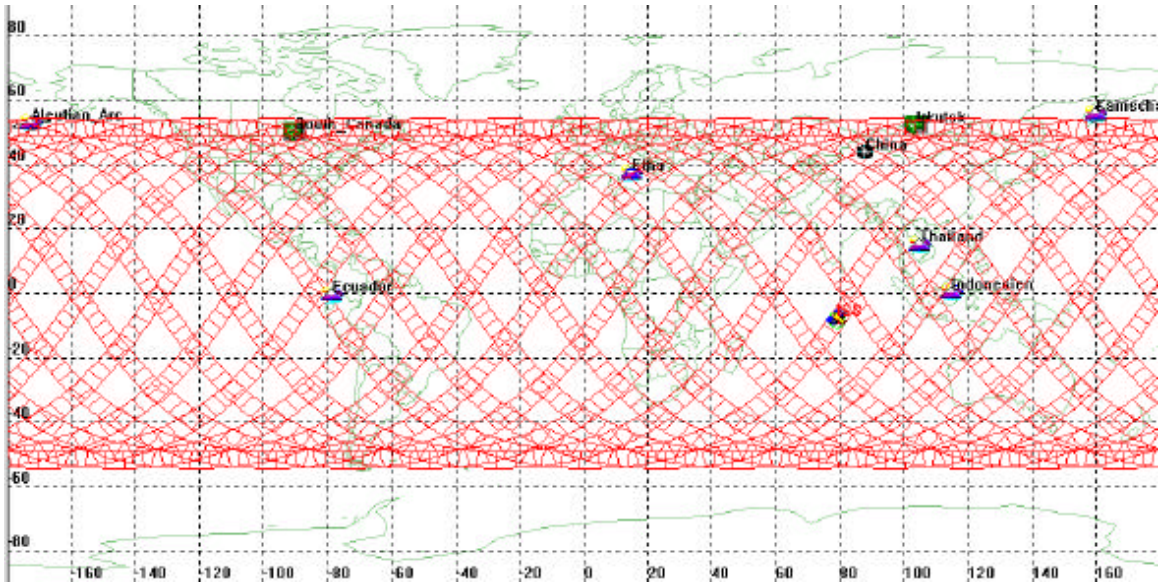
T2 REQ
ISS Micro-g RMS
Freq (hz)

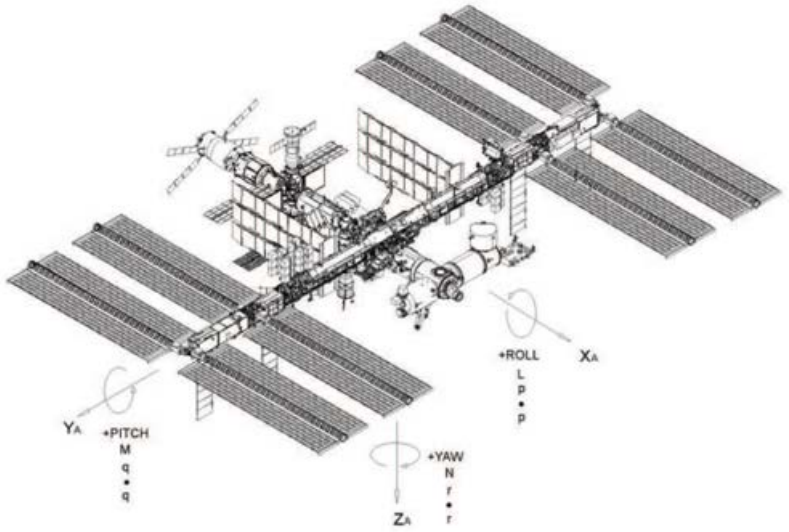


ISS Truss Vibratory Environment for External Payload Pointing Instrument



ISS coverage in 24 hrs for a 70°-swath optical payload.

For Stage configurations (i.e.; no Orbiter-sized vehicle docked on the ISS) in the foreseeable future, the predicted TEA ranges are: Roll: -1.0 ~ +3.0 deg, Pitch: -7.0 ~ +2.0 deg, Yaw: -15 ~ +15 deg.



Momentum Manager Controller Peak to Peak Attitude Wobble Oscillation

Performance Descriptions	Peak to Peak Attitude Oscillations Per Orbit			Peak Attitude Variation from Steady-State Orbit-Average Attitude		
	Roll (X) (deg)	Pitch (Y) (deg)	Yaw (Z) (deg)	Roll (X) (deg)	Pitch (Y) (deg)	Yaw (Z) (deg)
Non-Micro-Gravity (Assembly Stages) Non-Propulsive (Momentum Manager) Attitude Control Performance Requirement	10.0	10.0	10.0	+/- 5	+/- 5	+/- 5
Micro-Gravity (Assembly Complete) Non-Propulsive (Momentum Manager) Attitude Control Performance Requirement	7.0	7.0	7.0	+/- 3.5	+/- 3.5	+/- 3.5
Typical Steady-State Performance of **Minimum** *CMG momentum oscillation* Momentum Manager Controller	1.6	1.6	2.0	+/- 0.8	+/- 0.8	+/- 1
Typical Steady-State Performance of **Minimum** *Attitude oscillation* Momentum Manager Controller	1.6	0.4	0.2	+/- 0.8	+/- 0.2	+/- 0.1
Typical Steady-State Performance of **Minimum** *CMG momentum & Attitude oscillation* **Blended** Momentum Manager Controller	1.6	0.7	1.2	+/- 0.8	+/- 0.35	+/- 0.6

ISS Data Overview

Current ISS Capabilities: Air-to-Ground Data Allocation for Payloads

- 37.5 Mbps of video (3 lines of video at 12.5 Mbps each)
- 8 Mbps of MRDL data (Science return)
- 5 Mbps for payload still imagery downlink
- 20 Mbps utilized for payload data recorded over LOS

External Site Capabilities

	ELC	Columbus	JEM
Low Rate	1 Mbps (MIL-STD-1553)	1 Mbps (MIL-STD-1553)	1 Mbps (MIL-STD-1553)
High Rate	6 Mbps (shared)	2 Mbps (shared)	43 Mbps (shared)

Internal Data Handling Capabilities

- Low Rate: 1 Mbps (MIL-STD-1553)
- High Rate: 100 Mbps
- Ethernet: 10 Mbps
- Video: NTSC

Internal Wireless

- 802.11n standard (three internal LANs, including one dedicated to Payloads)
- 5 GHz band currently available; 2.4 GHz may be available by end of 2012
- Bandwidth not guaranteed because it is a shared medium

External Wireless

- 802.11n standard for ELC payloads at 5.25-5.35 GHz
- WPA2-PSK (AES) encryption
- Connectivity options
  - IEEE 802.11n NIC integrated to the payload
  - IEEE 802.3 wired interface connected to Station WAP (current limit of 8 connections)
- Data rates
  - 26-40 Mbps (ELC 1-4 → US Lab)
  - 53-63 Mbps (US Lab → ELC 1-4)
- Bandwidth not guaranteed because it is a shared medium

Data Upgrades

	Current
Medium Rate Data Link	• **95** Mbps • **23** channels per gateway w/ **all accessible** • **Direct** forward link accessible
Video downlink and recording	• **6** video downlink channels • Video compression via **MPEG4 Part 10 (H.264)** • **Solid state** recording • Video playbacks **use dedicated dump channels**
Two-way Audio	• **4** space to ground audio channels via S- **and Ku-**bands
Data recording	• **300** GB total nonvolatile memory data recording
Return & Forward Data Rates	• **300** Mbps downlink and **25** Mbps uplink.
Redundancy	• **Two fully integrated strings with ground commanded** string swap
Commanding	• **Contingency** ISS vehicle system commanding through **Ku-Band**

ATTACHMENT A: **PROPOSAL COVER SHEET**

PROPOSAL OF [NAME]

IN RESPONSE TO

Request for Proposal No. CASIS 2013-3

Remote Sensing from the International Space Station

Proposer Name:

Proposer Address:

Federal Tax Identification Number:

Contact Information:

1. Name, title, phone number and address of person who can respond to inquiries regarding the proposal

2. Name of Principal Investigator/Project Director

ATTACHMENT B: **CERTIFICATION REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY AND VOLUNTARY EXCLUSION**

This certification is required by 2 CFR Part 180, implementing Executive Orders 12549 and 12689, regarding debarment and suspension.

(1) The prospective participant certifies, by submission of this proposal, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal department or agency.

(2) Where the prospective participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

_____

Name and Title of Authorized Representative

_____ _____

Signature Date

Attachment C: Budget Template

CASIS Project:	Remote Sensing																		
Principal Investigator:																			
Company/Instituition:																			
Project Budget																			
	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15	May-15	Jun-15	Jul-15	Aug-15	Sep-15	Total
Salary and fringe benefits for personnel																			$ -
Equipment and supplies																			$ -
Consultant costs																			$ -
Alterations and renovations																			$ -
Publications/misc. costs																			$ -
Contract services																			$ -
Consortium costs																			$ -
Travel expenses																			$ -
Implementation partner services/hardware integration																			$ -
Indirect Costs																			$ -
Total Cost	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Cost-Cumulative	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
CASIS Funding	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Funding Surplus (Deficit)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	