Secondary Satellite Network for U. S. Academic Research Vessel Fleet (ARF)

PROGRAM SOLICITATION
NSF 18-562

National Science Foundation

Directorate for Geosciences
Division of Ocean Sciences

Full Proposal Deadline(s) (due by 5 p.m. submitter's local time):

October 29, 2018

IMPORTANT INFORMATION AND REVISION NOTES

The deadline date has been extended to October 29, 2018.

Any proposal submitted in response to this solicitation should be submitted in accordance with the revised *NSF Proposal & Award Policies & Procedures Guide* (PAPPG) (NSF 18-1), which is effective for proposals submitted, or due, on or after January 29, 2018.

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Secondary Satellite Network for the U. S. Academic Research Vessel Fleet

Synopsis of Program:

This solicitation seeks proposals to support the diverse network-dependent research and operational requirements of vessels in the U.S. Academic Research Fleet (ARF) and associated platforms by providing satellite communication system(s) that can be used as one of multiple options for at-sea access to the Internet.

Cognizant Program Officer(s):

Please note that the following information is current at the time of publishing. See program website for any updates to the points of contact.

- James Holik, telephone: (703) 292-7711, email: jholik@nsf.gov
- Bauke Houtman, telephone: (703) 292-7704, email: bhoutman@nsf.gov

Applicable Catalog of Federal Domestic Assistance (CFDA) Number(s):

- 47.050 --- Geosciences

Award Information

Anticipated Type of Award: Continuing Grant

Estimated Number of Awards: 1

Anticipated Funding Amount: $12,500,000

($2,500,000/year for 5 years), subject to availability of funds.

Eligibility Information

Who May Submit Proposals:

Proposals may only be submitted by the following:

- Institutions of Higher Education (IHEs) - Two- and four-year IHEs (including community colleges) accredited in, and having a campus located in the US, acting on behalf of their faculty members. Special Instructions for International Branch Campuses of US IHEs: If the proposal includes funding to be provided to an international branch campus of a US institution of higher education (including through use of subawards and consultant arrangements), the proposer must explain the benefit(s) to the project of performance at the international branch campus, and justify why the project activities cannot be performed at the US campus.

Who May Serve as PI:

There are no restrictions or limits.

Limit on Number of Proposals per Organization:

There are no restrictions or limits.

Limit on Number of Proposals per PI or Co-PI:

There are no restrictions or limits.

Proposal Preparation and Submission Instructions

A. Proposal Preparation Instructions

- **Letters of Intent:** Not required
- **Preliminary Proposal Submission:** Not required
- **Full Proposals:**
  - Full Proposals submitted via FastLane: *NSF Proposal and Award Policies and Procedures Guide* (PAPPG) guidelines apply. The complete text of the PAPPG is available electronically on the NSF website at: https://www.nsf.gov/publications/pub_summ.jsp?ods_key=pappg.
  - Full Proposals submitted via Grants.gov: *NSF Grants.gov Application Guide: A Guide for the Preparation and Submission of NSF Applications via Grants.gov* guidelines apply (Note: The *NSF Grants.gov Application Guide* is available on the Grants.gov website and on the NSF website at: https://www.nsf.gov/publications/pub_summ.jsp?ods_key=grantsgovguide).

B. Budgetary Information

- **Cost Sharing Requirements:**

  Inclusion of voluntary committed cost sharing is prohibited.

- **Indirect Cost (F&A) Limitations:**

  Not Applicable

- **Other Budgetary Limitations:**

  Not Applicable

C. Due Dates

- **Full Proposal Deadline(s)** (due by 5 p.m. submitter's local time):

  October 29, 2018

Proposal Review Information Criteria

Merit Review Criteria:

National Science Board approved criteria. Additional merit review considerations apply. Please see the full text of this solicitation for further information.

Award Administration Information

Award Conditions:

Standard NSF award conditions apply.

Reporting Requirements:

Additional reporting requirements apply. Please see the full text of this solicitation for further information.

TABLE OF CONTENTS

I. INTRODUCTION

The University National Oceanographic Laboratory System (UNOLS) is an organization of 58 academic institutions involved in oceanographic research. UNOLS institutions operate 5 Global Class ships, 6 Ocean/Intermediate Class ships, and 7 Regional/Coastal/Local Class ships constituting the U.S. Academic Research Fleet (ARF). The UNOLS office coordinates their scheduling and research activities.

Productive, successful ocean science research and operations increasingly requires efficient, reliable, and robust connectivity to the Internet. The instrumentation and operating infrastructure have become more complex and demands for stable, reliable off-ship networking have grown. The responsibilities of scientists and vessel operators are increasing, with greater demands on real-time and near real-time data, outreach, shore side IT support and vendor support. These dependencies make functional Internet access mission critical.

Internet connectivity for the majority of vessels in the ARF is provided by HiSeasNet, a satellite communications network operated by the University of California San Diego's Scripps Institution of Oceanography designed specifically to provide continuous Internet connectivity for oceanographic research ships and platforms. The network supplies connectivity using either C-band (4-8 GHz) or Ku-band (12-18 GHz) depending on the vessel size and operational area. Various factors (weather, antenna shadowing, latitude, etc.) can limit the efficacy of the HiSeasNet network. In order to maintain seamless connectivity, a secondary system is required. Currently, this is accomplished through L-band (1–2 GHz) via Inmarsat FleetBroadband (FBB) on certain vessels and a combination of Ka (20-40GHz) and L-bands via Inmarsat Fleet Express (Fx). The table below summarizes the platforms and services currently supported within the secondary satellite system.

Vessel/Platform	Class	System(s)	Funding Mechanism	
RV ATLANTIS	Global	FBB (2ea)	U.S. ARF	Woods Hole Oceanographic Institution
RV NEIL ARMSTRONG	Ocean/ Intermediate	Fx(1ea), FBB(1ea)	U.S. ARF	Woods Hole Oceanographic Institution
RV TIOGA	Non- U.S. ARF	FBB(1ea)	Direct Pay	Woods Hole Oceanographic Institution
RV CONNECTICUT	Non- U.S. ARF	FBB(1ea)	Direct Pay	University of Connecticut
RV OCEANUS	Ocean/ Intermediate	Fx(1ea), FBB(1ea)	U.S. ARF	Oregon State University
RV ROGER REVELLE	Global	Fx(1ea),	U.S. ARF	Scripps Institution of Oceanography

		FBB(1ea)		
RV SALLY RIDE	Ocean/ Intermediate	FBB(2ea)	U.S. ARF	Scripps Institution of Oceanography
RV ROBERT GORDON SPROUL	Local	FBB(1ea)	U.S. ARF	Scripps Institution of Oceanography
RP FLIP	Other	FBB(1ea)	U.S. ARF	Scripps Institution of Oceanography
RV HUGH R. SHARP	Regional	FBB(1ea)	U.S. ARF	University of Delaware
RV ATLANTIC EXPLORER	Ocean/ Intermediate	Fx(1ea),	U.S. ARF	Bermuda Institute for Ocean Sciences
RV ENDEAVOR	Ocean/ Intermediate	FBB(1ea)	U.S. ARF	University of Rhode Island
RV MARCUS G. LANGSETH	Global	FBB (2ea)	U.S. ARF	Lamont-Doherty Earth Observatory
RV F.G. WALTON SMITH	Local	FBB(1ea)	U.S. ARF	University of Miami
RV PELICAN	Local	FBB(1ea)	U.S. ARF	Louisiana University Marine Consortium
RV THOMAS G. THOMPSON	Global	Fx(1ea), FBB(1ea)	U.S. ARF	University of Washington
RV CLIFFORD A. BARNES	Local	FBB(1ea)	U.S. ARF	University of Washington
RV KILO MOANA	Ocean/ Intermediate	FBB(2ea)	U.S. ARF	University of Hawaii
RV KOK	Non- U.S. ARF	FBB(1ea)	Direct Pay	University of Hawaii
RV BLUE HERON	Local	FBB(1ea)	U.S. ARF	University of Minnesota, Duluth
RV LAURENCE M. GOULD	Global	Fx(1ea), FBB(1ea)	U.S. ARF	NSF Office of Polar Programs
RV NATHANIEL B. PALMER	Global	Fx(1ea), FBB(1ea)	U.S. ARF	NSF Office of Polar Programs
RV SAVANNAH	Local	FBB(1ea)	U.S. ARF	University of Georgia
RV SIKULIAQ	Global	Fx(1ea), FBB(1ea)	U.S. ARF	University of Alaska, Fairbanks
RV APALACHEE	Non- U.S. ARF	FBB(1ea)	Direct Pay	Florida State University
MV OLEANDER	Non- U.S. ARF	FBB(1ea)	Direct Pay	Acoustic Doppler Current Profiler (ADCP) Volunteer Observing Ships (VOS) Stonybrook
Ocean Observatories Initiative (OOI)	Non- U.S. ARF	FBB(43ea)	Direct Pay	NSF Ocean Observatories Initiative (OOI)

The vessels within the U.S. ARF, along with the RV NATHANIEL B. PALMER and RV LAURENCE M. GOULD, are directly supported by a grant from NSF. Other platforms are directly billed by the secondary provider for their Internet use. It is anticipated that this model will continue.

This solicitation details requirements to provide a secondary system for Internet connectivity on vessels equipped with HiSeasNet, and serve as the primary system for vessels or platforms that are not equipped with HiSeasNet. The award (OCE-1748802) for the current secondary system expires February 28, 2019. The new system may include all or parts of the existing system, providing all requirements of the solicitation are addressed.

II. PROGRAM DESCRIPTION

Network Requirements

The research vessel secondary internet system envisioned by this solicitation shall effectively address the following requirements:

- For large vessels including the Global, Ocean/Intermediate and Regional Class, the capability to operate at a bidirectional speed of 2-6 MBPS on a per ship basis, with worldwide coverage in the expected latitudes for geosynchronous satellites. For all other vessels and platforms, the capability to operate at a bidirectional speed of 512 KBPS on a per unit basis.
- Capability to dynamically allocate increased bandwidth on a per vessel basis as required.
- Capability to provide an open, non-proprietary method for user access of network status and metric information, including satellite link statistics and other metrics.
    - Ship-based features should include:
        - A Web User Interface (WUI) containing basic status information
        - An Application Programmer Interface (API) such as a platform independent Extensible Markup Language (XML) or Representational state transfer (RESTful) JavaScript Object Notation (JSON) interface
        - Simple Network Monitoring Protocol (SNMP)
        - Ready Access to per-satellite status including Signal to Noise Ratio, Frequency, Azimuth and Elevation information
        - Network Flow Data export such as netflow or sFlow
        - Syslog support to allow system logs to be written to a shipside logging server
    - Internet features should include:
        - Off-ship web portal for administrators to view network status
        - Capability to configure Access Control Lists (ACLs) or cybersecurity to limit unsolicited traffic

Capability to support dual radome installations aboard ship if needed to work around superstructure interference issues.

- Capability to support tunneling and/or a road warrior type Virtual Private Network (VPN) between the primary HiSeasNet and secondary satellite systems to preclude loss of Transmission Control Protocol (TCP) connection when signal is swapped between primary and secondary satellite systems.
- Capability to establish advanced network engineering techniques (such as dynamic routing advertisements, site-to-site virtual tunnel interfaces, Network Address Translation (NAT) and Port Address Translation (PAT) between a ground station and central institutional ingress/egress points.
- Capability to back up configurations and send the backup to data storage on or off the ship, as well as the ability to revert firmware in event of errors or faults.
- Capability to provide voice services.

Scope of the Project

The scope includes management of the secondary satellite communication program for the U.S. ARF and other associated platforms as outlined above. The program has been in operation since 2008 and is expected to rely heavily on contract agreements executed between the successful proposer and commercial satellite communications provider(s).

Secondary internet services shall meet or exceed the requirements stated above and include the facilities, organizational and administrative support for a network with operations, maintenance, technical and application support as outlined below. The proposer needs to demonstrate that:

1. **Satellite Access:** Satellite Internet access will be provided for existing marine research platforms as outlined above. The proposed network should have the capability to accommodate up to 75 systems.
2. **Hardware:** consideration will be given to the use of existing infrastructure within the fleet as practicable. The grantee shall have the ability to procure and install additional antenna units and equipment as needed.
3. **Maintenance & Technical Support:** comprehensive and responsive technical support will be provided, which includes a maintenance plan. If this is provided through contract mechanisms, the agreements are subject to review and approval by NSF.
4. **Bandwidth Allocation:** there is the ability to dynamically allocate bandwidth based on vessel requirements.
5. **Shore to Ship Calling Support:** the necessary support will be provided to enable voice communications through the proposed system.

III. AWARD INFORMATION

Estimated program budget, number of awards and average award size/duration are subject to the availability of funds.

IV. ELIGIBILITY INFORMATION

Who May Submit Proposals:

Proposals may only be submitted by the following:

- Institutions of Higher Education (IHEs) - Two- and four-year IHEs (including community colleges) accredited in, and having a campus located in the US, acting on behalf of their faculty members. Special Instructions for International Branch Campuses of US IHEs: If the proposal includes funding to be provided to an international branch campus of a US institution of higher education (including through use of subawards and consultant arrangements), the proposer must explain the benefit(s) to the project of performance at the international branch campus, and justify why the project activities cannot be performed at the US campus.

Who May Serve as PI:

There are no restrictions or limits.

Limit on Number of Proposals per Organization:

There are no restrictions or limits.

Limit on Number of Proposals per PI or Co-PI:

There are no restrictions or limits.

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

Full Proposal Preparation Instructions: Proposers may opt to submit proposals in response to this Program Solicitation via Grants.gov or via the NSF FastLane system.

- Full proposals submitted via FastLane: Proposals submitted in response to this program solicitation should be prepared and submitted in accordance with the general guidelines contained in the *NSF Proposal & Award Policies & Procedures Guide* (PAPPG). The complete text of the PAPPG is available electronically on the NSF website at: https://www.nsf.gov/publications/pub_summ.jsp?ods_key=pappg. Paper copies of the PAPPG may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from nsfpubs@nsf.gov. Proposers are reminded to identify this program solicitation number in the program solicitation block on the NSF Cover Sheet For Proposal to the National Science Foundation. Compliance with this requirement is critical to determining the relevant proposal processing guidelines. Failure to submit this information may delay processing.

- Full proposals submitted via Grants.gov: Proposals submitted in response to this program solicitation via Grants.gov should be prepared and submitted in accordance with the *NSF Grants.gov Application Guide: A Guide for the Preparation and Submission of NSF Applications via Grants.gov*. The complete text of the *NSF Grants.gov Application Guide* is available on the Grants.gov website and on the NSF website at: (https://www.nsf.gov/publications/pub_summ.jsp?ods_key=grantsgovguide). To obtain copies of the Application Guide and Application Forms Package, click on the Apply tab on the Grants.gov site, then click on the Apply Step 1: Download a Grant Application Package and Application Instructions link and enter the funding opportunity number, (the program solicitation number without the NSF prefix) and press the Download Package button. Paper copies of the Grants.gov Application Guide also may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from nsfpubs@nsf.gov.

In determining which method to utilize in the electronic preparation and submission of the proposal, please note the following:

Collaborative Proposals. All collaborative proposals submitted as separate submissions from multiple organizations must be submitted via the NSF FastLane system. PAPPG Chapter II.D.3 provides additional information on collaborative proposals.

See PAPPG Chapter II.C.2 for guidance on the required sections of a full research proposal submitted to NSF. Please note that the proposal preparation instructions provided in this program solicitation may deviate from the PAPPG instructions.

1. **Cover Sheet:** Proposers should select "Center/Research Infrastructure" for the Type of Proposal.
2. **Project Description (up to 30 pages):** The Project Description section of each proposal should address the qualifications and capabilities of the proposing organization to perform the responsibilities required of the Grantee. The Project Description must address the following factors that are considered key to successful selection:
    a. **Merit Review Criteria**

    Discuss how the proposal addresses each of the elements of the Merit Review Criteria listed in Section VI. Include a description of special capabilities or qualifications likely to achieve and enhance intellectual merit and broader impacts as defined below.

    b. **Network Requirements**

    Describe how the proposed network will achieve the requirements listed in Section II in terms of capabilities relating to bidirectional speed, allocation of increased bandwidth, user access to network status and metric information, hardware procurement and installation, strategies to preserve connectivity during signal swapping between primary (HiSeasNet) and secondary system, network engineering techniques and data backup, export and storage. Discuss any recent technological advancements or practices likely to improve network capability or reduce operating costs.

    c. **Scope of the Project**

    Describe how satellite and internet services will be provided to the U.S. ARF and other associated platforms by means of the proposed secondary satellite communications system. Include a discussion of the essential agreements and procedures necessary to assure access. Discuss data capacity and how the network can be expanded to accommodate future access by up to a total of 75 systems.

    Describe how existing hardware could be supported in terms of tracking status, planning and performing maintenance, and assuring operational readiness. Discuss the organizational capability to procure and install antenna units and equipment on research platforms.

    Discuss the approach to establishing and administering commercial agreements and contracts necessary for providing maintenance and support of the proposed network.

    Discuss the approach to dynamically allocating bandwidth in support of varying operational needs.

    Discuss the approach to enabling and supporting the secondary system's voice communications to all vessels.

    d. **Electromagnetic Spectrum Usage**

    Describe the project's radio frequency usage and requirements (if any), whether they are active, passive or both. Include, if applicable, frequency or frequency bands and bandwidth, expected power levels if transmitting, geographic and temporal details of the usage, available information of proposed radio-frequency equipment, and whether pre-existing communication systems will be enlisted for the project. If the project only intends to use commercially available equipment, please provide the FCC license number if available. If the project involves any non-standard usage, licensing may be required. The Principal Investigator may contact the NSF Spectrum Management Unit (esm@nsf.gov) for information and assistance. Federal and Commercial Regulations are available at these web sites: https://www.ntia.doc.gov/page/2011/manual-regulations-and-procedures-federal-radio-frequency-management-redbook, https://www.fcc.gov/licensing.

3. **Budget:** The budget should be based on the preceding Network Requirements and Scope Of The Project. Describe the cost model for the proposed system, i.e., will costs be by the byte or a fixed price or a combination thereof.

   Budget should include all costs related to:

   a. Administrative office
   b. Procurement of bandwidth and voice service
   c. Maintenance and Customer Support
   d. Hardware
   e. Related Software

   Budget Assumptions:

   For the basis of this proposal, assume that 10 vessels will have access to the bidirectional 2-6Mbps link. All platforms (~75) will have at least a bidirectional 512Kbps link and use approximately 150,000 MBs per month distributed between the platforms utilizing the 512Kbps link.

4. **Supplementary Documentation:** Except as specified here or in the PAPPG (see Chapter II.C.2.j), special information relevant to determining the quality of the proposed work must be included either as part of the Project Description or as part of the budget justification.
   a. **Documentation of collaborative arrangements of significance to the proposal:** Proposers should document with letters of collaboration any collaborative arrangements of significance in performing the proposed work. Letters of support are not permitted under this solicitation, and proposals containing such letters may be returned without review. Please see the NSF PAPPG Chapter II.C.2.d (iv) for further details.
5. **Single Copy Documents:** Information for the items below should be entered via the Single Copy Documents section in NSF's electronic systems.
   a. **Collaborators and Other Affiliations Information:** For all PIs, co-PIs, named senior personnel, and contractors (including for subawardees), provide the information specified in Chapter II.C.1.e of the NSF PAPPG.
   b. **Additional Single Copy Document - Project Personnel:** Provide the full names, affiliations, educational background, and specific role for each person for whom support is sought, including all PIs, co-PIs, named senior personnel, subawardees and contractors.
6. **The following section is NOT required for the Full Proposal:**

   Facilities, Equipment and Other Resources (all relevant information must be provided in the Project Description). Proposers should insert text or upload a document in that section of the proposal that states, "Not Applicable for this Program Solicitation." Doing so will enable NSF's electronic systems to accept your proposal.

   General Information

   For additional information on this solicitation, NSF proposal policies and procedures, and/or access to a NSF-maintained Resource Library that provides further detail, including responses to frequently asked questions (FAQs), proposing organizations should contact the cognizant Program Officers, James Holik (jholik@nsf.gov) or Bauke Houtman (bhoutman@nsf.gov)

   Also, the following publicly available websites may be informative:

   - UNOLS Satellite Network Advisory Group (SatNAG)
   - University National Laboratory System (UNOLS)

B. Budgetary Information

Cost Sharing:

Inclusion of voluntary committed cost sharing is prohibited.

C. Due Dates

- **Full Proposal Deadline(s)** (due by 5 p.m. submitter's local time):

  October 29, 2018

D. FastLane / Grants.gov Requirements

For Proposals Submitted Via FastLane:

To prepare and submit a proposal via FastLane, see detailed technical instructions available at: https://www.fastlane.nsf.gov/a1/newstan.htm. For FastLane user support, call the FastLane Help Desk at 1-800-673-6188 or e-mail fastlane@nsf.gov. The FastLane Help Desk answers general technical questions related to the use of the FastLane system. Specific questions related to this program solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this funding opportunity.

For Proposals Submitted Via Grants.gov:

Before using Grants.gov for the first time, each organization must register to create an institutional profile. Once registered, the applicant's organization can then apply for any federal grant on the Grants.gov website. Comprehensive information about using Grants.gov is available on the Grants.gov Applicant Resources webpage: http://www.grants.gov/web/grants/applicants.html. In addition, the NSF Grants.gov Application Guide (see link in Section V.A) provides instructions regarding the technical preparation of proposals via Grants.gov. For Grants.gov user support, contact the Grants.gov Contact Center at 1-800-518-4726 or by email: support@grants.gov. The Grants.gov Contact Center answers general technical questions related to the use of Grants.gov. Specific questions related to this program solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this solicitation.

Submitting the Proposal: Once all documents have been completed, the Authorized Organizational Representative (AOR) must submit the application to Grants.gov and verify the desired funding opportunity and agency to which the application is submitted. The AOR must then sign and submit the application to Grants.gov. The completed application will be transferred to the NSF FastLane system for further processing.

Proposers that submitted via FastLane are strongly encouraged to use FastLane to verify the status of their submission to NSF. For proposers that submitted via Grants.gov, until an application has been received and validated by NSF, the Authorized Organizational Representative may check the status of an application on Grants.gov. After proposers have received an e-mail notification from NSF, Research.gov should be used to check the status of an application.

VI. NSF PROPOSAL PROCESSING AND REVIEW PROCEDURES

Proposals received by NSF are assigned to the appropriate NSF program for acknowledgement and, if they meet NSF requirements, for review. All proposals are carefully reviewed by a scientist, engineer, or educator serving as an NSF Program Officer, and usually by three to ten other persons outside NSF either as *ad hoc* reviewers, panelists, or both, who are experts in the particular fields represented by the proposal. These reviewers are selected by Program Officers charged with oversight of the review process. Proposers are invited to suggest names of persons they believe are especially well qualified to review the proposal and/or persons they would prefer not review the proposal. These suggestions may serve as one source in the reviewer selection process at the Program Officer's discretion. Submission of such names, however, is optional. Care is taken to ensure that reviewers have no conflicts of interest with the proposal. In addition, Program Officers may obtain comments from site visits before recommending final action on proposals. Senior NSF staff further review recommendations for awards. A flowchart that depicts the entire NSF proposal and award process (and associated timeline) is included in PAPPG Exhibit III-1.

A comprehensive description of the Foundation's merit review process is available on the NSF website at: https://www.nsf.gov/bfa/dias/policy/merit_review/.

Proposers should also be aware of core strategies that are essential to the fulfillment of NSF's mission, as articulated in *Building the Future: Investing in Discovery and Innovation - NSF Strategic Plan for Fiscal Years (FY) 2018 – 2022*. These strategies are integrated in the program planning and implementation process, of which proposal review is one part. NSF's mission is particularly well-implemented through the integration of research and education and broadening participation in NSF programs, projects, and activities.

One of the strategic objectives in support of NSF's mission is to foster integration of research and education through the programs, projects, and activities it supports at academic and research institutions. These institutions must recruit, train, and prepare a diverse STEM workforce to advance the frontiers of science and participate in the U.S. technology-based economy. NSF's contribution to the national innovation ecosystem is to provide cutting-edge research under the guidance of the Nation's most creative scientists and engineers. NSF also supports development of a strong science, technology, engineering, and mathematics (STEM) workforce by investing in building the knowledge that informs improvements in STEM teaching and learning.

NSF's mission calls for the broadening of opportunities and expanding participation of groups, institutions, and geographic regions that are underrepresented in STEM disciplines, which is essential to the health and vitality of science and engineering. NSF is committed to this principle of diversity and deems it central to the programs, projects, and activities it considers and supports.

A. Merit Review Principles and Criteria

The National Science Foundation strives to invest in a robust and diverse portfolio of projects that creates new knowledge and enables breakthroughs in understanding across all areas of science and engineering research and education. To identify which projects to support, NSF relies on a merit review process that incorporates consideration of both the technical aspects of a proposed project and its potential to contribute more broadly to advancing NSF's mission "to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense; and for other purposes." NSF makes every effort to conduct a fair, competitive, transparent merit review process for the selection of projects.

1. Merit Review Principles

These principles are to be given due diligence by PIs and organizations when preparing proposals and managing projects, by reviewers when reading and evaluating proposals, and by NSF program staff when determining whether or not to recommend proposals for funding and while overseeing awards. Given that NSF is the primary federal agency charged with nurturing and supporting excellence in basic research and education, the following three principles apply:

- All NSF projects should be of the highest quality and have the potential to advance, if not transform, the frontiers of

knowledge.
- NSF projects, in the aggregate, should contribute more broadly to achieving societal goals. These "Broader Impacts" may be accomplished through the research itself, through activities that are directly related to specific research projects, or through activities that are supported by, but are complementary to, the project. The project activities may be based on previously established and/or innovative methods and approaches, but in either case must be well justified.
- Meaningful assessment and evaluation of NSF funded projects should be based on appropriate metrics, keeping in mind the likely correlation between the effect of broader impacts and the resources provided to implement projects. If the size of the activity is limited, evaluation of that activity in isolation is not likely to be meaningful. Thus, assessing the effectiveness of these activities may best be done at a higher, more aggregated, level than the individual project.

With respect to the third principle, even if assessment of Broader Impacts outcomes for particular projects is done at an aggregated level, PIs are expected to be accountable for carrying out the activities described in the funded project. Thus, individual projects should include clearly stated goals, specific descriptions of the activities that the PI intends to do, and a plan in place to document the outputs of those activities.

These three merit review principles provide the basis for the merit review criteria, as well as a context within which the users of the criteria can better understand their intent.

2. Merit Review Criteria

All NSF proposals are evaluated through use of the two National Science Board approved merit review criteria. In some instances, however, NSF will employ additional criteria as required to highlight the specific objectives of certain programs and activities.

The two merit review criteria are listed below. **Both** criteria are to be given **full consideration** during the review and decision-making processes; each criterion is necessary but neither, by itself, is sufficient. Therefore, proposers must fully address both criteria. (PAPPG Chapter II.C.2.d(i). contains additional information for use by proposers in development of the Project Description section of the proposal). Reviewers are strongly encouraged to review the criteria, including PAPPG Chapter II.C.2.d(i), prior to the review of a proposal.

When evaluating NSF proposals, reviewers will be asked to consider what the proposers want to do, why they want to do it, how they plan to do it, how they will know if they succeed, and what benefits could accrue if the project is successful. These issues apply both to the technical aspects of the proposal and the way in which the project may make broader contributions. To that end, reviewers will be asked to evaluate all proposals against two criteria:

- **Intellectual Merit:** The Intellectual Merit criterion encompasses the potential to advance knowledge; and
- **Broader Impacts:** The Broader Impacts criterion encompasses the potential to benefit society and contribute to the achievement of specific, desired societal outcomes.

The following elements should be considered in the review for both criteria:

1. What is the potential for the proposed activity to
    a. Advance knowledge and understanding within its own field or across different fields (Intellectual Merit); and
    b. Benefit society or advance desired societal outcomes (Broader Impacts)?
2. To what extent do the proposed activities suggest and explore creative, original, or potentially transformative concepts?
3. Is the plan for carrying out the proposed activities well-reasoned, well-organized, and based on a sound rationale? Does the plan incorporate a mechanism to assess success?
4. How well qualified is the individual, team, or organization to conduct the proposed activities?
5. Are there adequate resources available to the PI (either at the home organization or through collaborations) to carry out the proposed activities?

Broader impacts may be accomplished through the research itself, through the activities that are directly related to specific research projects, or through activities that are supported by, but are complementary to, the project. NSF values the advancement of scientific knowledge and activities that contribute to achievement of societally relevant outcomes. Such outcomes include, but are not limited to: full participation of women, persons with disabilities, and underrepresented minorities in science, technology, engineering, and mathematics (STEM); improved STEM education and educator development at any level; increased public scientific literacy and public engagement with science and technology; improved well-being of individuals in society; development of a diverse, globally competitive STEM workforce; increased partnerships between academia, industry, and others; improved national security; increased economic competitiveness of the United States; and enhanced infrastructure for research and education.

Proposers are reminded that reviewers will also be asked to review the Data Management Plan and the Postdoctoral Researcher Mentoring Plan, as appropriate.

Additional Solicitation Specific Review Criteria

Specific review criteria will include:

1. The extent to which the proposed approach demonstrates an understanding of network requirements, capacity and proposed UNOLS Satellite Network Advisory Group (SatNAG) bandwidth management protocols as set forth in this solicitation.
2. The proposer’s plan to provide the required satellite access.
3. The proposer’s plan to provide optimal customer support.
4. The extent to which the proposal demonstrates an understanding of system hardware requirements.
5. The extent to which the proposal imparts confidence in the ability to establish and administer commercial agreements and contracts necessary for maintenance and support of the proposed network.
6. The extent to which the proposed approach demonstrates the ability to allocate bandwidth dynamically as required by operations.
7. The effectiveness of the approach to enabling and supporting voice communications.
8. The extent to which the proposal demonstrates an understanding of the applicable regulatory framework with respect to radio frequency usage.
9. The proposal’s overall creativity and cost.

B. Review and Selection Process

Proposals submitted in response to this program solicitation will be reviewed by Panel Review.

Reviewers will be asked to evaluate proposals using two National Science Board approved merit review criteria and, if applicable, additional program specific criteria. A summary rating and accompanying narrative will generally be completed and submitted by each reviewer and/or panel. The Program Officer assigned to manage the proposal's review will consider the advice of reviewers and will formulate a recommendation.

After scientific, technical and programmatic review and consideration of appropriate factors, the NSF Program Officer recommends to the cognizant Division Director whether the proposal should be declined or recommended for award. NSF strives to be able to tell applicants whether their proposals have been declined or recommended for funding within six months. Large or particularly complex proposals or proposals from new awardees may require additional review and processing time. The time interval begins on the deadline or target date, or receipt date, whichever is later. The interval ends when the Division Director acts upon the Program Officer's recommendation.

After programmatic approval has been obtained, the proposals recommended for funding will be forwarded to the Division of Grants and Agreements for review of business, financial, and policy implications. After an administrative review has occurred, Grants and Agreements Officers perform the processing and issuance of a grant or other agreement. Proposers are cautioned that only a Grants and Agreements Officer may make commitments, obligations or awards on behalf of NSF or authorize the expenditure of funds. No commitment on the part of NSF should be inferred from technical or budgetary discussions with a NSF Program Officer. A Principal Investigator or organization that makes financial or personnel commitments in the absence of a grant or cooperative agreement signed by the NSF Grants and Agreements Officer does so at their own risk.

Once an award or declination decision has been made, Principal Investigators are provided feedback about their proposals. In all cases, reviews are treated as confidential documents. Verbatim copies of reviews, excluding the names of the reviewers or any reviewer-identifying information, are sent to the Principal Investigator/Project Director by the Program Officer. In addition, the proposer will receive an explanation of the decision to award or decline funding.

VII. AWARD ADMINISTRATION INFORMATION

A. Notification of the Award

Notification of the award is made to *the submitting organization* by a Grants Officer in the Division of Grants and Agreements. Organizations whose proposals are declined will be advised as promptly as possible by the cognizant NSF Program administering the program. Verbatim copies of reviews, not including the identity of the reviewer, will be provided automatically to the Principal Investigator. (See Section VI.B. for additional information on the review process).

B. Award Conditions

An NSF award consists of: (1) the award notice, which includes any special provisions applicable to the award and any numbered amendments thereto; (2) the budget, which indicates the amounts, by categories of expense, on which NSF has based its support (or otherwise communicates any specific approvals or disapprovals of proposed expenditures); (3) the proposal referenced in the award notice; (4) the applicable award conditions, such as Grant General Conditions (GC-1)*; or Research Terms and Conditions* and (5) any announcement or other NSF issuance that may be incorporated by reference in the award notice. Cooperative agreements also are administered in accordance with NSF Cooperative Agreement Financial and Administrative Terms and Conditions (CA-FATC) and the applicable Programmatic Terms and Conditions. NSF awards are electronically signed by an NSF Grants and Agreements Officer and transmitted electronically to the organization via e-mail.

*These documents may be accessed electronically on NSF's Website at https://www.nsf.gov/awards/managing/award_conditions.jsp?org=NSF. Paper copies may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from nsfpubs@nsf.gov.

More comprehensive information on NSF Award Conditions and other important information on the administration of NSF awards is contained in the NSF *Proposal & Award Policies & Procedures Guide* (PAPPG) Chapter VII, available electronically on the NSF Website at https://www.nsf.gov/publications/pub_summ.jsp?ods_key=pappg.

C. Reporting Requirements

For all multi-year grants (including both standard and continuing grants), the Principal Investigator must submit an annual project report to the cognizant Program Officer no later than 90 days prior to the end of the current budget period. (Some programs or awards require submission of more frequent project reports). No later than 120 days following expiration of a grant, the PI also is required to submit a final project report, and a project outcomes report for the general public.

Failure to provide the required annual or final project reports, or the project outcomes report, will delay NSF review and processing of any future funding increments as well as any pending proposals for all identified PIs and co-PIs on a given award. PIs should examine the formats of the required reports in advance to assure availability of required data.

PIs are required to use NSF's electronic project-reporting system, available through Research.gov, for preparation and submission of annual and final project reports. Such reports provide information on accomplishments, project participants (individual and organizational), publications, and other specific products and impacts of the project. Submission of the report via Research.gov constitutes certification by the PI that the contents of the report are accurate and complete. The project outcomes report also must be prepared and submitted using Research.gov. This report serves as a brief summary, prepared specifically for the public, of the nature and outcomes of the project. This report will be posted on the NSF website exactly as it is submitted by the PI.

More comprehensive information on NSF Reporting Requirements and other important information on the administration of NSF awards is contained in the *NSF Proposal & Award Policies & Procedures Guide* (PAPPG) Chapter VII, available electronically on the NSF Website at https://www.nsf.gov/publications/pub_summ.jsp?ods_key=pappg.

Content and schedule for required deliverables will be specifically defined in the Continuing Grant.

The award will be negotiated each year based on emergent technologies, fleet needs and available funds. It is therefore necessary for the annual reports to discuss accomplishments from the previous year and to address goals and budgets for the subsequent year of grant performance. They should contain information necessary to negotiate the budgets in the subsequent years. The projections should include costs for satellite data, system hardware, technical support, administration and other major expenditures. Although out-year budgets will be negotiated, the original proposal should contain a 5-year budget using best estimates.

VIII. AGENCY CONTACTS

Please note that the program contact information is current at the time of publishing. See program website for any updates to the points of contact.

General inquiries regarding this program should be made to:

- James Holik, telephone: (703) 292-7711, email: jholik@nsf.gov
- Bauke Houtman, telephone: (703) 292-7704, email: bhoutman@nsf.gov

For questions related to the use of FastLane, contact:

- FastLane Help Desk, telephone: 1-800-673-6188; e-mail: fastlane@nsf.gov.

For questions relating to Grants.gov contact:

- Grants.gov Contact Center: If the Authorized Organizational Representatives (AOR) has not received a confirmation message from Grants.gov within 48 hours of submission of application, please contact via telephone: 1-800-518-4726; e-mail: support@grants.gov.

IX. OTHER INFORMATION

The NSF website provides the most comprehensive source of information on NSF Directorates (including contact information), programs and funding opportunities. Use of this website by potential proposers is strongly encouraged. In addition, "NSF Update" is an information-delivery system designed to keep potential proposers and other interested parties apprised of new NSF funding opportunities and publications, important changes in proposal and award policies and procedures, and upcoming NSF Grants Conferences. Subscribers are informed through e-mail or the user's Web browser each time new publications are issued that match their identified interests. "NSF Update" also is available on NSF's website.

Grants.gov provides an additional electronic capability to search for Federal government-wide grant opportunities. NSF funding opportunities may be accessed via this mechanism. Further information on Grants.gov may be obtained at http://www.grants.gov.

ABOUT THE NATIONAL SCIENCE FOUNDATION

The National Science Foundation (NSF) is an independent Federal agency created by the National Science Foundation Act of 1950, as amended (42 USC 1861-75). The Act states the purpose of the NSF is "to promote the progress of science; [and] to advance the national health, prosperity, and welfare by supporting research and education in all fields of science and engineering."

NSF funds research and education in most fields of science and engineering. It does this through grants and cooperative agreements to more than 2,000 colleges, universities, K-12 school systems, businesses, informal science organizations and other research organizations throughout the US. The Foundation accounts for about one-fourth of Federal support to academic institutions for basic

research.

NSF receives approximately 55,000 proposals each year for research, education and training projects, of which approximately 11,000 are funded. In addition, the Foundation receives several thousand applications for graduate and postdoctoral fellowships. The agency operates no laboratories itself but does support National Research Centers, user facilities, certain oceanographic vessels and Arctic and Antarctic research stations. The Foundation also supports cooperative research between universities and industry, US participation in international scientific and engineering efforts, and educational activities at every academic level.

Facilitation Awards for Scientists and Engineers with Disabilities (FASED) provide funding for special assistance or equipment to enable persons with disabilities to work on NSF-supported projects. See the *NSF Proposal & Award Policies & Procedures Guide* Chapter II.E.6 for instructions regarding preparation of these types of proposals.

The National Science Foundation has Telephonic Device for the Deaf (TDD) and Federal Information Relay Service (FIRS) capabilities that enable individuals with hearing impairments to communicate with the Foundation about NSF programs, employment or general information. TDD may be accessed at (703) 292-5090 and (800) 281-8749, FIRS at (800) 877-8339.

The National Science Foundation Information Center may be reached at (703) 292-5111.

The National Science Foundation promotes and advances scientific progress in the United States by competitively awarding grants and cooperative agreements for research and education in the sciences, mathematics, and engineering.

To get the latest information about program deadlines, to download copies of NSF publications, and to access abstracts of awards, visit the NSF Website at https://www.nsf.gov

- **Location:** 2415 Eisenhower Avenue, Alexandria, VA 22314
- **For General Information** (NSF Information Center)**:** (703) 292-5111
- **TDD (for the hearing-impaired):** (703) 292-5090
- **To Order Publications or Forms:**

  Send an e-mail to: nsfpubs@nsf.gov

  or telephone: (703) 292-7827
- **To Locate NSF Employees:** (703) 292-5111

PRIVACY ACT AND PUBLIC BURDEN STATEMENTS

The information requested on proposal forms and project reports is solicited under the authority of the National Science Foundation Act of 1950, as amended. The information on proposal forms will be used in connection with the selection of qualified proposals; and project reports submitted by awardees will be used for program evaluation and reporting within the Executive Branch and to Congress. The information requested may be disclosed to qualified reviewers and staff assistants as part of the proposal review process; to proposer institutions/grantees to provide or obtain data regarding the proposal review process, award decisions, or the administration of awards; to government contractors, experts, volunteers and researchers and educators as necessary to complete assigned work; to other government agencies or other entities needing information regarding applicants or nominees as part of a joint application review process, or in order to coordinate programs or policy; and to another Federal agency, court, or party in a court or Federal administrative proceeding if the government is a party. Information about Principal Investigators may be added to the Reviewer file and used to select potential candidates to serve as peer reviewers or advisory committee members. See Systems of Records, NSF-50, "Principal Investigator/Proposal File and Associated Records," 69 Federal Register 26410 (May 12, 2004), and NSF-51, "Reviewer/Proposal File and Associated Records," 69 Federal Register 26410 (May 12, 2004). Submission of the information is voluntary. Failure to provide full and complete information, however, may reduce the possibility of receiving an award.

An agency may not conduct or sponsor, and a person is not required to respond to, an information collection unless it displays a valid Office of Management and Budget (OMB) control number. The OMB control number for this collection is 3145-0058. Public reporting burden for this collection of information is estimated to average 120 hours per response, including the time for reviewing instructions. Send comments regarding the burden estimate and any other aspect of this collection of information, including suggestions for reducing this burden, to:

Suzanne H. Plimpton
Reports Clearance Officer
Office of the General Counsel
National Science Foundation
Alexandria, VA 22314

Tel: (703) 292-5111, FIRS: (800) 877-8339 | TDD: (703) 292-5090 or (800) 281-8749