NSF 24-533: Sustainable Regional Systems Research Networks (SRS RNs)

Program Solicitation

Document Information

Document History

- **Posted:** January 29, 2024
- **Replaces:** NSF 20-611

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National Science Foundation
Directorate for Engineering
Directorate for Social, Behavioral and Economic Sciences
Directorate for Biological Sciences
Directorate for STEM Education
Directorate for Geosciences
Directorate for Mathematical and Physical Sciences
Directorate for Technology, Innovation and Partnerships
Office of Integrative Activities
Office of International Science and Engineering

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

May 15, 2024

Table Of Contents

Important Information And Revision Notes

IMPORTANT WEBINAR: NSF will hold an informational webinar on **March 5, 2024**, from 2:00-3:00 pm EST to discuss the SRS RNs solicitation and answer questions.

Zoom link: https://nsf.zoomgov.com/j/1604433860?pwd=MlRvQ1BXSjljZGpMMlBrTEovekZ6Zz09 Passcode: 290083

There is no longer an option for Planning Grants. This solicitation will fund Research Network proposals for up to $15 million and 5-year duration.

Separately submitted collaborative proposals are now an option for this solicitation.

The Directorate for Technology, Innovation, and Partnerships (TIP) is now participating in the SRS RNs solicitation.

The Directorate for Computer and Information Science and Engineering (CISE) is no longer participating in the SRS RNs solicitation. Topics relevant to CISE are still encouraged in proposals.

The "Diversity and Culture of Inclusion" section has been changed to the "Diversity, Equity, Inclusion, and Access (DEIA)" section and clarification has been added that "aspects of the DEIA section may be a focus of the SRS research as part of the Research Network activities".

A "Social Sustainability" section has been added to address "the historical context of the region" and to include "communities most at risk or vulnerable as lead participants in sustainability and resilience research to reduce vulnerability to current and future social-environmental-technological issues."

The "Education and Education Evaluation" section has been changed to the "Education and Education Research" section. Clarification on what education research is has been added.

The "development of new tools and techniques to enable persons with disabilities to perform research on sustainable rural and urban systems" has been added to the program description.

An emphasis has been added to consider positive and negative environmental research impacts.

An emphasis has been added on including other ways of knowing, such as Indigenous Knowledge.

Any proposal submitted in response to this solicitation should be submitted in accordance with the *NSF Proposal & Award Policies & Procedures Guide* (PAPPG) that is in effect for the relevant due date to which the proposal is being submitted. The NSF PAPPG is regularly revised and it is the responsibility of the proposer to ensure that the proposal meets the requirements specified in this solicitation and the applicable version of the PAPPG. Submitting a proposal prior to a specified deadline does not negate this requirement.

Summary Of Program Requirements

General Information

Program Title:

Sustainable Regional Systems Research Networks (SRS RNs)

Synopsis of Program:

The United States is made up of regional systems comprising interdependent urban and rural systems and every community category between urban and rural. Urban systems and rural systems are interdependent for the provisioning of food, energy sources, water, other materials and natural resources, markets, manufactured goods, and medical resources. These systems are also connected by ecological processes that both influence and are influenced by human behavior. The vital interconnection of urban-rural systems underscores the critical need for the advancement of sustainable regional systems (SRS). The goal of this solicitation is to fund convergent research and education that will advance sustainable regional systems science, engineering, and education to facilitate the transformation of current regional systems to enhance sustainability. To further the advancement of SRS science, engineering, and education, NSF will support proposals for Sustainable Regional Systems Research Networks (SRS RNs).

Sustainable regional systems are connected urban and rural systems that are transforming their structures and processes collaboratively with the goal of measurably and equitably advancing the well-being of people and the planet. The purpose of the SRS RNs competition is to develop and support interdisciplinary, multi-organizational teams working collaboratively to produce cutting-edge convergent research, education, and outreach that addresses grand challenges in sustainable regional systems. SRS RNs will study multi-scale regional systems to further SRS science, engineering, and education. Key elements will include new data, methods, and models to understand interactions between natural, human-built, and social systems; improved understanding of interdependencies, mutual benefits, and trade-offs of different wellbeing outcomes for humans and the environment; new and generalizable theories of change relevant to SRS; the co-production of knowledge; and exploration of concepts of social equity in sustainable regional systems across spatial and temporal scales. SRS RN outcomes will have the potential to inform societal actions for sustainability across urban systems and the connected rural communities that make up regional systems.

Subject to availability of funds and quality of proposals, this SRS RN solicitation will support:

- **SRS RN Awards.** These awards will support fundamental convergent research, education, and outreach that addresses engineering, chemistry, biology, geosciences, mathematics, statistics, environmental, data, computational, education, and social, behavioral, and economic sciences of sustainable regional systems in partnerships that may embrace universities, colleges, federal, state, and local governments, tribal communities, non-governmental and international bodies, non-profit organizations, industry, practitioners, and other community groups. The award size is up to $15 million total with a duration of 5 years.

SRS RNs will conduct innovative and pioneering fundamental research and education that is of a scale and complexity that would not be possible within a single organization, center, or through the normal collaborative modes of NSF research support in core programs.

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.

- Bruce K. Hamilton, Program Director, Division of Chemical, Bioengineering, Environmental, and Transport Systems, telephone: (703) 292-7066, email: SRS@nsf.gov
- Thomas Evans, Program Director, Division of Behavioral and Cognitive Sciences, telephone: (703) 292-4891, email: SRS@nsf.gov
- Laura Lautz, Program Director, Division of Earth Sciences, telephone: (703) 292-7775, email: SRS@nsf.gov
- Robyn Smyth, Program Director, Division of Environmental Biology, telephone: (703) 292-2996, email: SRS@nsf.gov
- Anne-Marie Schmoltner, Program Director, Division of Chemistry, telephone: (703) 292-4716, email: SRS@nsf.gov
- Fengfeng Ke, Program Director, Division of Research on Learning in Formal and Informal Settings, telephone: (703) 292-2411, email: SRS@nsf.gov
- Rajesh V. Mehta, Program Director, Division of Translational Impacts, telephone: (703) 292-2174, email: SRS@nsf.gov
- Keith Chanon, Program Director, Office of International Science and Engineering, telephone: (703) 292-7305, email: SRS@nsf.gov
- Hongmei Luo, Program Director, Office of Integrative Activities, telephone: (703) 292-8867, email: SRS@nsf.gov

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

- 47.041 --- Engineering
- 47.049 --- Mathematical and Physical Sciences
- 47.050 --- Geosciences
- 47.074 --- Biological Sciences
- 47.075 --- Social Behavioral and Economic Sciences
- 47.076 --- STEM Education
- 47.079 --- Office of International Science and Engineering
- 47.083 --- Office of Integrative Activities (OIA)
- 47.084 --- NSF Technology, Innovation and Partnerships

Award Information

Anticipated Type of Award: Cooperative Agreement

Estimated Number of Awards: 1 to 2

1 to 2 as cooperative agreements

The number of awards is dependent upon the proposals received and the degree to which proposals meet the solicitation goals, NSF merit review criteria, and solicitation-specific review criteria, as well as availability of funds.

Anticipated Funding Amount: $30,000,000

$30,000,000, depending upon 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.
- Non-profit, non-academic organizations: Independent museums, observatories, research laboratories, professional societies and similar organizations located in the U.S. that are directly associated with educational or research activities.
- For-profit organizations: U.S.-based commercial organizations, including small businesses, with strong capabilities in scientific or engineering research or education and a passion for innovation.
- **Additional Requirements:**

  Proposals must include either/or:

  - If the team of core organizations include academic organizations, then at least one must be a university or college that serves populations of students historically underrepresented in STEM. To qualify as a core partner organization, there must be financial support for a minimum of three faculty members participating in the SRS RN along with financial support for a minimum of three students.
  - A core partner, such as a community group, a non-profit, or other group/organization that supports an underrepresented community within the scope of the proposed research project. To qualify as a core partner organization, they must be allocated a minimum of 10% of the total budget request for the entire SRS RN.

Who May Serve as PI:

Individuals from the following types of organizations can participate, including as co-PIs or Senior Personnel (but not the PI), as follows:

- **Other Federal Agencies**: Researchers or participants from other Federal agencies or Federally Funded Research and Development Centers (FFRDCs) may be supported by subawards or participate as unfunded collaborators. A letter of collaboration is required for non-NSF sponsored FFRDCs and other Federal agencies.
- **State and Local Governments**: Individuals from state educational offices or organizations and local school districts may be supported by subawards or participate as unfunded collaborators. A letter of collaboration from their organization is required.
- Scientists, engineers or educators in the U.S. who are U.S. citizens may be supported by subawards or participate as unfunded collaborators. A letter of collaboration is required.

Limit on Number of Proposals per Organization:

There are no restrictions or limits.

Limit on Number of Proposals per PI or co-PI: 1

No more than one.

An individual may appear as PI, co-PI, or Senior Personnel on no more than one proposal.

If an individual exceeds the one-proposal limit, the first proposal received within the limit will be accepted based on earliest date and time of proposal submission, and the remainder will be returned without review. This limitation includes proposals submitted by a lead organization and any subawards involving multiple organizations. **No exceptions will be made.**

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 Research.gov: *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):

  May 15, 2024

Proposal Review Information Criteria

Merit Review Criteria:

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

Award Administration Information

Award Conditions:

Additional award conditions apply. Please see the full text of this solicitation for further information.

Reporting Requirements:

Standard NSF reporting requirements apply.

I. Introduction

Sustainable Regional Systems (SRS) are connected urban and rural systems, including all systems in between, designed with the goal of measurably advancing the equitable well-being of people and the planet. More than half the world's population lives in urban centers, in the U.S., over 70% of the population lives in urban centers. Population growth is expected to add 100 million new inhabitants to U.S. cities by 2050 [1]. The increase of urban inhabitants is likely to change and potentially strain the networks of connected communities that exist across the U.S. and the world. As urban systems and their connections to rural areas grow, it is imperative that current and future social, engineered, and natural systems and infrastructure are maintained, planned, and implemented to adapt to this increase in population.

NSF's Advisory Committee for Environmental Research and Education (AC-ERE) completed the report entitled "Sustainable Urban Systems: Articulating a Long-Term Convergence Research Agenda" in January 2018 (see https://nsf-gov-resources.nsf.gov/2022-12/Sustainable-urban-systems-508c.pdf?VersionId=M0OsHkQd7DX2Il8lBgKKYKJcx7p8Ldxt), in recognition of the increasing population trend in urban systems. The AC-ERE report defined **urban systems** as geographical areas with a high concentration of human activity and interactions, embedded within multi-scale interdependent social, engineered, and natural systems. These systems affect human and planetary well-being across spatial (local to global) and temporal scales. As population growth continues, the dependence of urban systems on connected rural systems also continues to increase along with interdependencies of regional systems on other systems across the globe, such as global supply chains and communication networks. **Rural systems**, in contrast to urban systems, are any settlements with population, housing, economic activity, or areas NOT in an urban geographical area. Urban systems are embedded in and interdependent on surrounding rural systems. Likewise, rural communities are interdependent upon connected urban centers. Networks of urban, rural, and all systems in between, make up a dynamic, symbiotic system with complex social and physical interactions. To support a prosperous, sustainable, economically competitive, and resilient regional system, the complex variables and smaller systems that are operating within and across these communities need to be considered.

In response to the AC-ERE report (2018), NSF issued a call for conference proposals that resulted in 27 conference awards. The conference award abstracts and reports can be found at: https://new.nsf.gov/oia/advisory-committee-environmental-research/communities-in-the-21st-century/sus-conference-and-workshop-awards These reports state that the study of multi-scale regional systems in the context of multiple sustainability goals is essential to developing the science of sustainable regional systems.

To further develop SRS science, engineering, and education, NSF issued a solicitation in January 2021 calling for Full Scale proposals and Planning Grant Proposals for Sustainable Regional Systems Research Networks (SRS RN). As a result of that solicitation, two Full Scale projects and 21 Planning Grants were awarded. Information on these awards is available at https://www.nsf.gov/awardsearch/advancedSearchResult?ProgEleCode=159Y&BooleanElement=Any&BooleanRef=Any&ActiveAwards=true&#results (publicly posted award abstracts).

The purpose of this second SRS RN competition is to support more interdisciplinary, multi-organizational teams. Teams will work collaboratively to produce cutting-edge convergent research and education that will inform societal actions for future environmental, economic, and social sustainability, addressing grand challenges in sustainable regional systems.

[1] Cutter, S. L., W. Solecki, N. Bragado, J. Carmin, M. Fragkias, M. Ruth, and T. J. Wilbanks, 2014: Ch. 11: Urban Systems, Infrastructure, and Vulnerability. Climate Change Impacts in the United States: The Third National Climate Assessment, J. M. Melillo, Terese (T.C.) Richmond, and G. W. Yohe, Eds., U.S. Global Change Research Program, 282-296. https://nca2014.globalchange.gov/downloads.

II. Program Description

The goal of this solicitation is to fund convergent research[2] and education that will advance sustainable regional systems science, engineering, and education to facilitate the transformation of current regional systems to enhance sustainability. Advancing SRS science, engineering, and education requires intentional integration across three scales from regional to global:

i. The study of single urban system/metropolitan region and its connected rural systems where multiple sustainability outcomes are addressed from a multi-scale systems perspective that connects homes, businesses, and communities to regional and global systems.

ii. The study of multiple urban systems and their connected rural systems, exploring inter-relationships among networks of urban and rural systems, and identifying urban-rural typologies for the study of cohort groups and comparison groups.

iii. The study of supra-aggregations of connected urban-rural systems, e.g., all urban-rural systems in an electrical grid region, trans-boundary watershed, a nation, a world region, or the world, to assess the collective impact of urban-rural transformation on people and the planet.

While all 3 of these scales (i-iii) include both urban and rural systems, it is important to note that a research project does not have to have an equal emphasis on the urban and rural systems of study, but rather, a consideration of both that is relevant to the research questions. A successful research network does not necessarily have to span all three (i-iii) scales. Within each of these scales (i-iii), integration of the following seven key elements (A-G) could significantly advance SRS science:

A. Data and Methods: New data and methods are needed to understand the current drivers and interactions among natural, engineered, and social and behavioral systems in urban-rural areas as they impact multiple sustainability outcomes across scales.

B. Equity: Expertise and data on best practices in terms of implementing strategies that equitably maximize human well-being within a regional system, with consideration of the historical context, are vital for creating sustainable regional systems.

C. Generalizable Theories: Comparative, typology, and scalability studies are needed to develop generalizable theories across diverse urban-rural region types.

D. Modeling: The science to model the future of SRS across scales needs to be advanced.

E. Outcomes: New science is needed to understand the co-benefits and trade-offs among multiple outcomes for human and planetary wellbeing across spatial and temporal scales.

F. Partner engagement: Effective participation by tribal and other communities, industry groups, practitioner groups, and governments at multiple levels should be established to leverage real-world experimentation that may be ongoing in many communities.

G. Theories of Change: New science is needed to understand the drivers of and levers for change in diverse urban-rural systems, with a focus on integrative design, technology innovation, sociotechnical transitions, education, workforce impact, and/or multi-level actors and governance.

The three scales (i-iii) noted above are envisioned to enable a holistic study of regional to global SRS at different scales where appropriate for a project, while the seven key elements (A-G) could fill critical research gaps and work to provide a strategic pathway to advance SRS, starting from understanding the system, to designing change from a social-ecological-infrastructural perspective, and finally, to informing action to positively change forecasts.

SRS RNs will conduct innovative and transformative fundamental research in sustainable regional systems science, engineering, and education that may be conceptual, empirical, synthetic, and/or computational in nature, and of a scale and complexity that would not be possible within a single organization, center, or even through the normal collaborative

modes of NSF research support. The SRS RNs solicitation offers an avenue for collaborations within the academic research and education institutions in concert with non-profit, tribal, community, industry, municipal, practitioner, and international partners. Collaborations through SRS RNs will cross traditional disciplinary boundaries of engineering, chemistry, biology, geosciences, mathematics, statistics, environmental, data, computational, education, and social, behavioral, and economic sciences. SRS RNs may link existing programs and create others to advance fundamental understanding that improve predictions, technologies, policies, and practices necessary for achieving sustainability. Proposers may frame their networks around issues or topics important to the sustainability of regional systems, e.g., clean energy, sustainable chemistry, the future of work, wildland fires, urban heat islands, food systems, biodiversity, essential ecosystem services, public health, transportation, or governance. Research must focus on identified urban and rural systems that include closely coupled regions beyond their boundaries.

The goals of an SRS RN could include, but are not limited to the following ideas from the workshops held in 2019 (for workshop awards see https://new.nsf.gov/oia/advisory-committee-environmental-research/communities-in-the-21st-century/sus-conference-and-workshop-awards:

- Deeper development of linked social, ecological, and technological systems (SETS)[3] theory for sustainable regional systems.
- Development of new ways to use natural environment linkages with the built environment to promote and maintain sustainable regional systems.
- Development of new theories about sustainable regional systems that encompass the urban-rural connection, for example, theories about the circular economy, human-technology interfaces, or social justice in such systems.
- Ideas for removing infrastructure barriers to social equity in sustainable rural and urban systems.
- Development of new tools and techniques to enable persons with disabilities to perform research on sustainable regional systems.
- Development of people-centric research and implementation practices to promote sustainable regional systems.
- Development of new theoretical and mechanistic understandings of biological systems and their interactions within regional system environments and how these interactions can impart sustainability.
- Development of generalizable empirical insights from research that spans large temporal and spatial regions and generates fundamental knowledge about how regional systems function and how this functioning can be positively and sustainably altered.
- Implementation of a nation-wide data system for regional sustainability research.
- Formation of a national network focused on development of regional sustainability curricula that necessarily incorporates the effects on people, families, and workforce in those systems, including the social equity and consideration of groups that have been historically disadvantaged.
- Development of adaptation strategies that, if implemented, could help ensure continuous operation of services, protection of human and environmental health, and economic robustness in times of national emergencies/crises that disrupt the regular flow of people, goods, and services as well as disruptions in physical, technological, and social systems.

Some examples include, but are not limited to, environmental and social impacts of clean energy sourcing and generation in rural areas with major consumption in urban areas, addressing the impact of the migration to remote work on the future of work, just transitions, and regional sustainability, improving sensing and chemical analytics, developing recyclable/upcyclable plastics, reducing vulnerabilities of chemical and material supply chains while supporting healthy environments, conserving biodiversity, or addressing the social and environmental factors impacting wildland fire and exacerbated by housing development in rural areas and expansion of urban areas into the rural fringe.

Proposals must present compelling plans for implementing strong collaborations to advance use-inspired convergent research that has high potential for significant societal and sustainability impacts. Proposals must also describe plans for developing a deeper understanding of regional systems as integrated social-environmental-technological systems and to improve education related to SRS themes.

Proposals must be interdisciplinary and multi-organizational and, therefore, must identify partnerships drawn from multiple disciplines and organizations. Proposers are encouraged to consider geographical diversity when appropriate for the topic when listing partners.

Subject to the availability of funds and quality of proposals, this SRS RN solicitation will support SRS RN Awards:

SRS RN Awards. These awards will support convergent research and education that advances fundamental understanding of sustainable regional systems. Importantly, projects should consider the potential positive and negative impacts of planned research outcomes as well as impacts beyond the life of the project, including the scalability and transferability of the proposed science, dissemination of research outcomes to decision makers, and/or consideration of how research will be transitioned to full-scale implementation, if successful. Budget requests must not be greater than $15,000,000 total and five years in duration and must include funds for team members to attend an annual awardees conference.

SRS proposals must clearly define the regional system(s) of study, the various components that make up the regional system(s) to be studied, the major topics that will frame the networks, and the goals of the project that will lead to a more sustainable regional system or systems. Significant anticipated outcomes should also be included in the proposal.

[2] Convergent Research is defined as research that is a) driven by a specific and compelling problem and b) requires deep integration across disciplines.

[3] Markolf, S.A.; Chester, M. V.; Eisenberg, D.A.; Iwaniec, D.M.; Davidson, C.I.; Zimmerman, R.; Miller, T.R.; Ruddell, B.L.; Chang, H.; "Interdependent Infrastructure as Linked Social, Ecological, and Technological Systems (SETSs) to Address Lock-in and Enhance Resilience", *Earth's Future*, **2018**, 6, 1638-1659. https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2018EF000926.

III. Award Information

Anticipated Type of Award: Cooperative Agreement

Estimated Number of Awards: 1 to 2

The number of awards is dependent upon the proposals received and the degree to which proposals meet the solicitation goals, NSF merit review criteria, and solicitation-specific review criteria, as well as availability of funds.

Anticipated Funding Amount: $30,000,000, depending upon availability of funds.

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.

- Non-profit, non-academic organizations: Independent museums, observatories, research laboratories, professional societies and similar organizations located in the U.S. that are directly associated with educational or research activities.
- For-profit organizations: U.S.-based commercial organizations, including small businesses, with strong capabilities in scientific or engineering research or education and a passion for innovation.
- **Additional Requirements:**

  Proposals must include either/or:

  - If the team of core organizations include academic organizations, then at least one must be a university or college that serves populations of students historically underrepresented in STEM. To qualify as a core partner organization, there must be financial support for a minimum of three faculty members participating in the SRS RN along with financial support for a minimum of three students.
  - A core partner, such as a community group, a non-profit, or other group/organization that supports an underrepresented community within the scope of the proposed research project. To qualify as a core partner organization, they must be allocated a minimum of 10% of the total budget request for the entire SRS RN.

Who May Serve as PI:

Individuals from the following types of organizations can participate, including as co-PIs or Senior Personnel (but not the PI), as follows:

- **Other Federal Agencies**: Researchers or participants from other Federal agencies or Federally Funded Research and Development Centers (FFRDCs) may be supported by subawards or participate as unfunded collaborators. A letter of collaboration is required for non-NSF sponsored FFRDCs and other Federal agencies.
- **State and Local Governments**: Individuals from state educational offices or organizations and local school districts may be supported by subawards or participate as unfunded collaborators. A letter of collaboration from their organization is required.
- Scientists, engineers or educators in the U.S. who are U.S. citizens may be supported by subawards or participate as unfunded collaborators. A letter of collaboration is required.

Limit on Number of Proposals per Organization:

There are no restrictions or limits.

Limit on Number of Proposals per PI or co-PI: 1

No more than one.

An individual may appear as PI, co-PI, or Senior Personnel on no more than one proposal.

If an individual exceeds the one-proposal limit, the first proposal received within the limit will be accepted based on earliest date and time of proposal submission, and the remainder will be returned without review. This limitation includes proposals submitted by a lead organization and any subawards involving multiple organizations. **No exceptions will be made.**

Additional Eligibility Info:

Proposals from minority-serving institutions, emerging research institutions, and institutions in EPSCoR-eligible jurisdictions, along with collaborations between these institutions and those in non-EPSCoR jurisdictions, are encouraged.

For cooperative projects involving U.S. and foreign organizations, support will only be provided for the U.S. portion. Researchers from a foreign organization must be listed in the Overview section of the Project Summary as "non-NSF funded collaborators". A letter of collaboration from their organization is required. In addition, if one of the personnel is a foreign collaborator(s) who does (do) not already have funding, a letter of collaboration is required in which the foreign collaborator(s) must identify a point of contact in the foreign funding agency or agencies that is or are considering their proposal.

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 Research.gov or Grants.gov.

- Full Proposals submitted via Research.gov: Proposals submitted in response to this program solicitation should be prepared and submitted in accordance with the general guidelines contained in the *NSF Proposal and Award Policies and 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) 292-8134 or by e-mail from nsfpubs@nsf.gov. The Prepare New Proposal setup will prompt you for the program solicitation number.
- 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) 292-8134 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 Research.gov. PAPPG Chapter II.E.3 provides additional information on collaborative proposals.

See PAPPG Chapter II.D.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.

The following information SUPPLEMENTS (note that it does NOT replace) the guidelines provided in the PAPPG and NSF Grants.gov Application Guide. See also Section II, Program Description, in this solicitation for additional guidance.

A. Proposal Titles: All proposal titles should start with "SRS RN:..."

B. Project Description:

In addition to the required components in the PAPPG, including the Intellectual Merit and Broader Impacts narrative that will comprise the bulk of the proposal:

- The Project Description is ***not to exceed 25 pages*** including tables and figures.

- The Results from Prior NSF Support section should not be included as part of the Project Description. Instead, this information should be provided in the Other Supplementary Documents section of the proposal. The document should be labeled "Results from Prior NSF Support" and should not exceed five pages in length.
- **The Intellectual Merit (IM) and Broader Impacts (BI) for the proposed project must be addressed and described as an integral part of the narrative**.

Required components of SRS RNs proposals in the Project Description:

A successful SRS proposal will clearly define the regional system(s) of study, the various components that make up the regional system(s) to be studied, the major topics that will frame the networks, and the goals of the project that will lead to more sustainable regional system or systems. Significant anticipated positive and negative outcomes should also be included in the proposal as well as impacts beyond the life of the project, including the scalability and transferability of the proposed solutions.

Each of the following topics is to be covered in a section labeled with the indicated component title.

1. Scope and Scale

SRS RNs will conduct innovative and pioneering fundamental research in sustainable regional system science, engineering, and education that is of a considerable scale and complexity that would not be possible within a single organization, center, or through the normal collaborative modes of NSF research support. This section should present a compelling case for why an award as large as $15 million with a duration of 5 years is required to successfully achieve the objectives stated in the proposal.

2. Convergent Research

The NSF identifies convergent research as research that is a) driven by a specific and compelling problem and b) requires deep integration across disciplines. The AC-ERE report already cited discusses extensively SRS convergent research gaps and needs. Together, an SRS convergent research network team will develop new knowledge and tools that significantly advance network integration, coordination, innovation, and the convergent science of SRS. Collaborations through SRS RNs should cross traditional disciplinary boundaries to foster new knowledge, data, and tools. The SRS RNs solicitation also offers an avenue for collaboration within academic research and education institutions in concert with non-profit, tribal, industry, municipal, practitioner, international, and other community partners. SRS RNs may also link existing programs and create others to advance fundamental understanding and enable actionable outcomes such as improving predictions, technologies, policies, and practices necessary for achieving sustainability.

Under the labeled heading "Convergent Research," a plan for convergent research must be presented. **If aspects of the proposed research themselves can be anticipated to have potential negative impacts on the environment or social systems, these potential impacts should be identified, and mitigation plans presented.** For example, if sensors are to be installed in the environment (e.g., in soil) to perform the proposed research, a plan should be presented to deal with the installed sensors once the research is completed. Other examples might include new material or technologies which require energy or use natural resources or generate contaminants in soil, air, or water.

For more information on convergent research approaches, see "Convergence Research at NSF" - https://www.nsf.gov/od/oia/convergence/index.jsp, and the Dear Colleague Letter: Growing Convergence Research at NSF March 2018 - https://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf18058.

3. Partnerships and Partner Engagement for Impact

This section should make a compelling case for how the proposed activities in the research network will result in generation of new knowledge that would advance sustainable regional systems through potential implementation.

The inclusion of non-academic partners in the project (industry, government, non-governmental organizations, practitioner, tribal and other community partners, etc.), including early engagement in the conception of SRS RN proposals, can enhance the chances for the knowledge produced by SRS RNs to inform the sustainability of regional systems. *An SRS RN proposal is expected to present a compelling case on how what is proposed can be anticipated to result in*

new SRS knowledge. Proposals should clearly identify and define these non-academic partners, and also describe activities that reflect meaningful engagement of these partners. This engagement should consider these partners as integral to the research. Investigators and these partners are encouraged to work closely to develop, pilot, and evaluate creative approaches to accomplish the goals of the proposed research. Non-academic partners may also have leadership roles within the proposing team, including as a PI, co-PI (see limitations on "Who may serve as PI or co-PI"), or Senior Personnel if appropriate for the project, and are encouraged to be active participants in the project and proposal formulation.

Many of the 27 workshops funded by NSF in summer 2019 (https://new.nsf.gov/oia/advisory-committee-environmental-research/communities-in-the-21st-century/sus-conference-and-workshop-awards) emphasized the importance of partner engagement, including early engagement of partners in the conception of SRS RN proposals. These workshops made the case that partner engagement is an approach that enhances the chances for an SRS RN to impact significantly and beneficially sustainable regional communities. Partner engagement can take several forms, such as co-production, advisory councils and boards, citizen science, etc., and inclusion of organization or community member leaders that are part of the regional system of study on the project and proposal formation is encouraged where appropriate for the research topic(s).

For those projects that include collaboration between scientist and non-scientist actors, see the AC-ERE report on Engaged Research https://nsf-gov-resources.nsf.gov/2022-12/Engaged-research-for-environmental-grand-challenges-508c.pdf?VersionId=QwBICw1M0eQa6rawrjW7H4OmzWZhuImR.

4. Diversity, Equity, Inclusion, and Access (DEIA)

Describe the vision and plan for nurturing a culture of inclusion to support diverse participation in the SRS RN. A culture of inclusion has many important aspects that are essential for deep collaboration, including the full spectrum of diverse talent including members of groups historically underrepresented in STEM, and a diversity of partner organizations (including practitioners and other co-production partners) that will bring different perspectives to bear on the goals of the SRS RN.

Diversity, Equity, Inclusion, and Access considerations must be addressed through actions within the multidisciplinary teams. In addition, aspects of the DEIA section may be a focus of the SRS research as part of the Research Network activities.

In addition to this vision and plan(s), proposals must include either/or:

- If the team of core organizations include academic organizations, then at least one must be a university or college that serves populations of students historically underrepresented in STEM. To qualify as a core partner organization, there must be financial support for a minimum of three faculty members participating in the SRS RN along with financial support for a minimum of three students.
- A core partner, such as a community group, a non-profit, or other group/organization that supports an underrepresented community within the scope of the proposed research project. To qualify as a core partner organization, they must be allocated a minimum of 10% of the total budget request for the entire SRS RN.

These partners must be fully integrated into the SRS RN. The vision for the diversity, equity, inclusion, and access activities should go well beyond numbers and include a description of the integration and roles of diverse participants in the SRS RN.

Suitable metrics to assess the SRS RN's DEIA section goals should be described, and feedback loops should be in place for independent assessment and improvement of DEIA at all levels of the SRS RN, including participating faculty members, leadership, practitioners, students, and other partners. The Diversity, Equity, Inclusion, and Access section should include a timetable and methods for assessment.

This section must describe how the leadership team will effectively create an inclusive culture for the SRS RN in which all members will be valued and welcomed, creatively contribute, and gain mutual benefit from participating.

To promote broadening participation in SRS science, engineering, and education, proposals that explore innovative approaches to broadening participation and the incorporation of Indigenous Knowledge or the concepts and aspects of NSF Inclusion across the Nation of Communities of Learners of Underrepresented Discoverers in Engineering and Science initiative (INCLUDES) are desired. Information on NSF INCLUDES and the objectives of this initiative are accessible at the following link: https://www.nsf.gov/news/special_reports/big_ideas/includes.jsp.

5. Social Sustainability

For regional systems to be fully sustainable, they must include social sustainability. Proposals should propose community-driven research that advances sustainable regional science and engineering by addressing the historical context of the region and includes communities most at risk of vulnerable as lead participants in sustainability and resilience research to reduce vulnerability to current and future social-environmental-technological issues.

This section of the proposal should describe activities in the research network that address just treatment and meaningful involvement of all people who may be impacted by issues specific to the region of study.

6. Education and Education Research

Based on the AC-ERE report and SUS conference reports, there is an urgent need as well as a historic time sensitivity to develop a new educational paradigm in SRS. An education and education research plan are required in the Project Description with the label "Education and Education Research". *This plan should encompass convergence science and engineering in which a complex compelling problem drives the deep integration of diverse disciplines that transcend traditional disciplinary siloes.* The education and education research plan should describe how the proposed SRS RN will integrate education, research, and practice as a fully integrated model of environmental, social, and economic sustainability. Education research, to better understand or improve formal and informal education systems, programs, practices, tools, and policies and the impacts on future workforce preparation or development, student cognition and social emotional development, learning, success in improving diversity, equity, inclusion, and access, and other outcomes is encouraged. The education and education research plan should focus on the interdependence of SRS with local, regional, and/or global communities.

The plan should articulate clear goals and objectives. SRS RNs must:

- Incorporate systems thinking and develop convergent educational practices that balance the trade-off between depth of knowledge versus breadth of knowledge;
- Implement learning environments or experiences, tools, and pedagogies that emphasize active, experiential, inquiry-based learning and real-world problem solving;
- Add to the body of knowledge about what works in SRS education and the conditions that lead to improved SRS teaching, learning, and research;
- Measure progress and achievement of SRS RN education goals;
- Clearly indicate the educational sector or sectors involved, e.g., K-12, informal, community colleges, MSIs, undergraduate, graduate, etc.

All SRS RNs are expected to increase knowledge about effective SRS education. The education and education research plan presented should draw on research literature about evidence-based practices. Education broadly includes both formal and informal learning, the teaching of Indigenous Knowledge, and different ways of knowing and learning. Knowledge generation should be based on well-formulated research questions that guide convergence education, and state how the questions will be answered or should have a research plan that is aligned with the stated goals and objectives.

The education research plan should state specific strategies for empirical data collection and analysis beyond summative and formative assessment. The education research plan should describe how different disciplines are coming together to examine and solve complex problems in convergence education and in which educational sector. The research plan should examine both SRS education implementation and outcomes; the specific data sources, data collection instruments, and methods that will be employed to address research questions, and how data will be analyzed and

interpreted to answer research questions and reach conclusions about the nature, the design or implementation theory or protocol, conditions, and impacts of SRS education development, implementation, and outcomes. The research plan is expected to address both the impacts of individual learning as well as the actual development and implementation activities of the project including communication and dissemination. A timeline for the research should be provided that identifies when data will be collected and analyzed, when reports will be submitted, and the frequency of communication between education researchers (including an external evaluator, see below) and other SRS RN personnel.

Funds to support an evaluator independent of the SRS RN must be requested. The requested funds must match the scope of the proposed evaluative activities. The evaluator may be employed by an SRS RN's member organization, as long as this individual works in a separate organizational unit (e.g., a different department) that has a different reporting line than that of the SRS RN member. An SRS RN should engage staff, participants, or an internal evaluator to work with the external evaluator to improve the quality of data collected and feasibility of conducting the education evaluation.

It is recommended that the evaluator be named in the proposal. If the evaluator is named, a biographical sketch must be included in the proposal following the format specified in the PAPPG. If the proposer's organization requires evaluation consultants to be selected through a competitive bid process after an award is made, the proposer should note the organizational policy that prohibits noncompetitive selection and describe the procedures that will be used to select an evaluator after the award is made.

Additionally, graduate education can be greatly enhanced by internships in industry, national laboratories, government offices, non-profits, and NGOs. Submissions that include these opportunities are encouraged.

Proposals that include a strong workforce development component, including undergraduates, K12 STEM teachers, and/or community college faculty are encouraged. Additionally, proposals could include Research Experiences for Undergraduates (REU), Research Experiences for Teachers (RET), or Veteran Research supplement (VRS) mechanisms **when appropriate**. Information on NSF REU is accessible at the following link: https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5517.

Information on NSF RET is accessible at the following link: https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=505170.

Information on the DCL for Veterans Research Supplement (VRS) Program is accessible at the following link: https://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf20111.

7. Broader Impacts

Per the guidance in the PAPPG, the proposal must contain a separate section labeled Broader Impacts. The heading must be on its own line with no other text on that line. This solicitation requires the Intellectual Merit (IM) and Broader Impacts (BI) for the proposed project to be addressed and described as an integral part of the narrative of each portion of the Project Description (see required sections 1-5 above). Therefore, the required Broader Impacts section should include only the following statement: "See Sections 1-5 of the Project Description."

Additional Considerations and Cross Cutting Themes

SRS-RNs are expected to provide pathways for translating research into practice. An SRS-RN will link scientists, engineers, and educators or learning scientists in multiple organizations and be geographically dispersed. Humanities researchers may be included in the team if appropriate to the project scope. The SRS RN may build upon, but not duplicate, existing activities. Funding and other resources will be shared among the network partners. The network could promote collaboration, when appropriate, with resource managers, policymakers, end-users, and other partners. in the private and public sectors through the direct involvement - from the outset - of participants from federal, state, and local agencies, tribal communities, non-governmental and international bodies, non-profit organizations, practitioners, and industry. The RN should be designed to adapt and grow as new opportunities arise.

Proposals that address clean energy or climate solutions, and NSF INCLUDES are encouraged.

NSF welcomes proposals that include efforts to broaden geographic and demographic participation. Proposals from minority-serving institutions, emerging research institutions, and institutions in EPSCoR-eligible jurisdictions, along with

collaborations between these institutions and those in non-EPSCoR jurisdictions, are encouraged.

In addition, NSF promotes international cooperation that links scientists and engineers from a range of disciplines and organizations to solve the significant global challenges of SRS. Proposals including international collaboration are encouraged when those efforts enhance the merit of the proposed work. Such proposals should address how the proposed international collaboration enhances intellectual merit and broader impacts in the following ways:

- Mutual benefit of the collaboration for all partners
- True intellectual collaboration with the international partner(s)
- Benefits to be realized from the expertise and specialized skills, facilities, sites and/or resources of the international counterpart
- Active research engagement of U.S. students and early-career researchers

Research may involve any country/countries, but the U.S. team's international counterparts generally should have support or obtain funding through non-NSF sources. Proposals that choose to involve international collaboration should clearly describe the work that will be accomplished by the entire team, including the international partners, and how the international partners' efforts will be or are already supported. Additionally, for projects that will study SRS in international settings, a case must be made for why this research benefits the United States, even if there are no international collaborators. For information on foreign research opportunities and funding see: Counterpart Science Funding Agencies.

C. Senior Personnel Documents

All members of the project leadership team should be listed as PI, a co-PI, or as Other Senior Personnel. All members of the leadership team should have a biographical sketch in the appropriate section.

D. Budget

Up to $15,000,000, with an expected project length of 5 years.

In addition to standard budget requirements in the PAPPG, each proposal must contain:

- **Funds to Support Broader Impacts Activities:** Funds for activities described that are intended to enhance the broader impacts of the project must be included where appropriate.
- **Funds for attendance at an annual SRS RN Awardee Conference:** In order to (a) accelerate the rate of dissemination of ideas among researchers and partners; (b) build intellectual collaborations to address the challenges of SRS, and (c) enable enhanced research collaborations, the SRS RNs program plans to host awardee conferences every year with participation from all funded projects and other representatives from academia, industry, government, and tribal and other community organizations. PIs or their designees must participate in the entirety of each awardee conference throughout the duration of their awards. Lead investigators from each subaward organization are expected to participate. A substitute project representative may be designated to attend a PI meeting, but only with prior approval from a cognizant NSF Program Officer. Budgets for all projects must include funding for one or more designated SRS RN project representatives (PI/co-PI/Senior Personnel or NSF-approved replacement) to attend each SRS RNs awardee conference during the proposed lifetime of the award. It is also strongly encouraged for at least one community partner to attend the awardee conference and for the budget to include funding to support the participation of the attending partner.
- **For the education plan:** Funds to support an evaluator independent of the SRS RN must be requested. The requested funds must match the scope of the proposed evaluative activities. The evaluator may be employed by an SRS RN's member organization, as long as they work in a separate organizational unit (e.g., a different department) that has a different reporting line than that of the SRS RN member. An SRS RN should engage staff, participants, or an internal evaluator to work with the external evaluator to improve the quality of data collected and feasibility of conducting the education evaluation.

- **International Collaborations:** As NSF funding predominantly supports U.S. participants, network participants from organizations outside the U.S. are encouraged to seek support from their respective funding organizations. NSF funds may not be used to support the expenses of the international scientists and students at their home organization. Please see PAPPG Chapter II.E.8 for additional guidance on how NSF funds can be used for SRS RN-related international expenses.

E. Postdoctoral Mentoring Plan, 1 page:

Proposals involving funding for postdoctoral researchers must offer an innovative and forward-thinking plan for postdoctoral training that extends beyond the mentoring that would normally occur as part of a research project at a single site or in a single lab. The SRS program wants to see activities that prepare the post-doc for conducting interdisciplinary and convergent science; leading and managing interdisciplinary science teams; and provide exposure across the environmental, engineering, and human sciences represented in the project. Training opportunities could include short courses, workshops, collaborations, lab exchanges, or other related activities (national or international). Sample topics might include leadership, large project management, team science, application of statistical methods for integrating data across disciplines, analytical methods useful for sustainable urban studies, or computational techniques for dealing with large, complex, or interdisciplinary datasets.

F. Other Supplementary Documents

Preferably in this order:

1. A list of Partner organizations and Project Personnel as described below is required. This information provides NSF and reviewers with a comprehensive list of personnel and organizations involved in the RN.

- List all project personnel who have a role in the management, research, education, broadening participation, and knowledge transfer components of the Center. Use the following format: last name, first name, institution/organization.
- List of all institutions and organizations with which project personnel are affiliated. Designate for each an appropriate category: Institution of Higher Education, National Laboratory, Federal/State/Local Government, Industry, Non-Governmental Organization, or International Organization.

2. Project Management Plan (up to 5 pages): All SRS RNs proposals must provide a description of the management plan for coordinating activities. This supplementary document must be labeled "**Project Management Plan**". This description should include an organization chart, plans for internal communication, coordination of data and information management, evaluation, and assessment of progress, allocation of funds and personnel (specifically for each major task), and other specific issues relevant to the proposed activities.

A table summarizing the roles and responsibilities of each investigator is required including PI, co-PIs, other senior personnel, and paid consultants at all organizations involved.

The plan should describe governance of the project, any advisory bodies, and lines of authority. Coordination and how the project will be managed within and across organizations and disciplines should be clearly defined, including identification of the specific coordination mechanisms that will enable cross-organization and/or cross-discipline scientific integration (e.g., regular meetings or teleconferencing, yearly workshops, graduate student exchange, project meetings at conferences, video conferences, etc.).

A timetable with yearly goals should be provided that includes benchmarks for the major anticipated project milestones and deliverables and expected dates for their release.

3. Results from Prior NSF Support (5-page limit): This section is moved from the Project Description section and should be submitted as a Supplementary Document. The other requirements for the content of the Results from Prior NSF Support Section are the same as found in the PAPPG.

4. Letters of Collaboration: This section should include any letters of collaboration from individuals or organizations that are integral parts of the proposed network, such as collaborating organizations, organizations granting permission to

access sites, materials, or data for research. The purpose of letters of collaboration is solely to affirm the willingness of the individual or organization to collaborate in the network as specified in the project description of the proposal. It is not to provide an endorsement of the merits of the proposal, to seek to influence reviewers, or to provide information that should properly have been included within the 25-page limit of the project description.

If researchers or participants from Federal agencies or federally funded research and development centers (FFRDCs) are supported by subawards or participate as unfunded collaborators, a letter of collaboration from non-NSF sponsored FFRDCs or other Federal agencies is required.

If individuals from state educational offices or organizations and local school districts are supported by subawards or participate as unfunded collaborators, a letter of collaboration from their organization is required.

If a scientist, engineer, or educator in the U.S., who is a U.S. citizen, is supported by a subaward or participates as an unfunded collaborator, a letter of collaboration from that individual is required.

If researchers from a foreign organization are included in the proposal (unfunded), a letter of collaboration from their organization is required. In addition, if one of the senior personnel is a foreign collaborator(s) who does (do) not already have funding, a letter of collaboration is required in which the foreign collaborator(s) must identify a point of contact in the foreign funding agency or agencies that is or are considering their proposal.

5. Other Personnel Biographical Information: If an education evaluator is named in the proposal, and is not in the role of PI, co-PI, or other senior personnel, a biographical sketch must be included following the format specified in the PAPPG.

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):

  May 15, 2024

D. Research.gov/Grants.gov Requirements

For Proposals Submitted Via Research.gov:

To prepare and submit a proposal via Research.gov, see detailed technical instructions available at: https://www.research.gov/research-portal/appmanager/base/desktop?_nfpb=true&_pageLabel=research_node_display&_nodePath=/researchGov/Service/Desktop/ProposalPreparationa For Research.gov user support, call the Research.gov Help Desk at 1-800-381-1532 or e-mail rgov@nsf.gov. The Research.gov Help Desk answers general technical questions related to the use of the Research.gov 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: https://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 Research.gov for further processing.

The NSF Grants.gov Proposal Processing in Research.gov informational page provides submission guidance to applicants and links to helpful resources including the NSF Grants.gov Application Guide, Grants.gov Proposal Processing in Research.gov how-to guide, and Grants.gov Submitted Proposals Frequently Asked Questions. Grants.gov proposals must pass all NSF pre-check and post-check validations in order to be accepted by Research.gov at NSF.

When submitting via Grants.gov, NSF strongly recommends applicants initiate proposal submission at least five business days in advance of a deadline to allow adequate time to address NSF compliance errors and resubmissions by 5:00 p.m. submitting organization's local time on the deadline. Please note that some errors cannot be corrected in Grants.gov. Once a proposal passes pre-checks but fails any post-check, an applicant can only correct and submit the in-progress proposal in Research.gov.

Proposers that submitted via Research.gov may use Research.gov 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 *Leading the World in Discovery and Innovation, STEM Talent Development and the Delivery of Benefits from Research - NSF Strategic Plan for Fiscal Years (FY) 2022 - 2026*. 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.D.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.D.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 other underrepresented groups 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

In addition to the National Science Board merit review criteria, reviewers will be asked to apply the following program-specific criteria when reviewing SRS RN proposals:

- Are the region(s) for study as well as the sustainability topic(s) clearly identified in the proposal?
- To what extent do the collaborations proposed for an SRS RN cross traditional disciplinary boundaries to foster new sustainability knowledge, systems thinking, data, tools, and a workforce skilled in the interdisciplinary scholarship needed to understand and address the complex issues of sustainability?
- How likely is it that the proposed SRS RN will successfully link scientists, engineers, and educators in multiple organizations, be geographically dispersed, and, from the outset, engage participants from a variety of different sectors and perspectives? Does the proposal explain clearly how each of the network partners will contribute to the goals and objectives of the network?

- Are the structure, roles and responsibilities, and management for the proposed SRS RN appropriate and clear?
- Are the plans for Convergent Research, Diversity, Equity, Inclusion, and Access, Social Sustainability, and the Education and Education Research adequately well thought out and clear?
- How likely is the proposed approach to succeed in building a foundation for translating research into practice through, for example, policy, management, and public outreach?
- Are the proposed mechanisms likely to allow the network to adapt and grow as new opportunities arise?
- How likely is it that the proposed SRS RN will advance fundamental scientific and engineering knowledge, as well as address the overarching goals of overcoming barriers to sustainable human well-being and forging reasoned pathways to a sustainable future?
- Have potential negative impacts on the environment or social systems of the proposed research been adequately identified and have adequate mitigation plans been presented?

B. Review and Selection Process

Proposals submitted in response to this program solicitation will be reviewed by Ad hoc Review and/or Panel Review, or Reverse Site Review.

Proposals will be evaluated by two or more multidisciplinary panels, with the number of panels to be determined by the number of proposals received. Panelists with appropriate domain expertise in science, engineering, and education will be chosen by the SRS Working Group with input from other Program Officers. At least three panel members will be asked to prepare written reviews of each proposal, and all non-conflicted panel members will be encouraged to participate in the discussion of each proposal. External ad hoc review by relevant experts may be sought if deemed necessary by the SRS Working Group.

The panel recommendations for the SRS RNs will be considered by NSF in selecting the most promising proposals for virtual reverse site visit review. This review will focus on the management and budget of the proposed SRS RN, and any outstanding issues that were raised during the review process. Reverse site visits will be conducted by the SRS Working Group and other NSF program staff with appropriate expertise. The PIs will be given copies of the written reviews and panel summary before the reverse site visit. The PIs of the participating SRS RN teams will be informed in advance of the RSV format and requirements, including preparation of a response to the reviews at the site visit. The reviewers at the RSV will also receive copies of these reviews and panel summaries before the RSV.

Following the site visits, the SRS Working Group will develop a prioritized recommended funding list. This prioritized funding list will be used to develop award recommendations.

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 SRS RN Working Group recommends to the cognizant Division Director whether the proposal should be declined or recommended for award. NSF strives to be able to tell proposers whether their proposals have been declined or recommended for funding within six months. Large or particularly complex proposals or proposals from new recipients 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 SRS RN Working Group's recommendation.

After programmatic approval has been obtained, the proposals recommended for funding will be forwarded to the Division of Grants and Agreements or the Division of Acquisition and Cooperative Support 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 an NSF Grants and Agreements Officer. 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) 292-8134 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.

Administrative and National Policy Requirements

Build America, Buy America

As expressed in Executive Order 14005, Ensuring the Future is Made in All of America by All of America's Workers (86 FR 7475), it is the policy of the executive branch to use terms and conditions of Federal financial assistance awards to maximize, consistent with law, the use of goods, products, and materials produced in, and services offered in, the United States.

Consistent with the requirements of the Build America, Buy America Act (Pub. L. 117-58, Division G, Title IX, Subtitle A, November 15, 2021), no funding made available through this funding opportunity may be obligated for an award unless all iron, steel, manufactured products, and construction materials used in the project are produced in the United States. For additional information, visit NSF's Build America, Buy America webpage.

Special Award Conditions:

Attendance at an annual SRS RN Awardee Conference: In order to (a) accelerate the rate of dissemination of ideas among researchers and partners; (b) build an intellectual research core to address the challenges of SRS, and (c) enable enhanced research collaborations, the SRS RNs program plans to host awardee conferences every year with participation

from all funded projects and other representatives from academia, industry, government, tribal and other community organizations. PIs or their designees must participate in the entirety of each awardee conference throughout the duration of their awards. Lead investigators from each subaward organization are expected to participate. A substitute project representative may be designated to attend a PI meeting, but only with prior approval from a cognizant NSF Program Officer. As noted in Section V.D. Budget Preparation Instructions, budgets for all projects must include funding for one or more designated SRS RN project representatives (PI/co-PI/Senior Personnel or NSF-approved replacement) to attend each SRS RNs awardee conference during the proposed lifetime of the award. It is also strongly encouraged for at least one community partner to attend the awardee conference and for the budget to include funding to support the participation of the attending partner.

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.

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:

- Bruce K. Hamilton, Program Director, Division of Chemical, Bioengineering, Environmental, and Transport Systems, telephone: (703) 292-7066, email: SRS@nsf.gov
- Thomas Evans, Program Director, Division of Behavioral and Cognitive Sciences, telephone: (703) 292-4891, email: SRS@nsf.gov
- Laura Lautz, Program Director, Division of Earth Sciences, telephone: (703) 292-7775, email: SRS@nsf.gov
- Robyn Smyth, Program Director, Division of Environmental Biology, telephone: (703) 292-2996, email: SRS@nsf.gov
- Anne-Marie Schmoltner, Program Director, Division of Chemistry, telephone: (703) 292-4716, email: SRS@nsf.gov
- Fengfeng Ke, Program Director, Division of Research on Learning in Formal and Informal Settings, telephone: (703) 292-2411, email: SRS@nsf.gov
- Rajesh V. Mehta, Program Director, Division of Translational Impacts, telephone: (703) 292-2174, email: SRS@nsf.gov

- Keith Chanon, Program Director, Office of International Science and Engineering, telephone: (703) 292-7305, email: SRS@nsf.gov
- Hongmei Luo, Program Director, Office of Integrative Activities, telephone: (703) 292-8867, email: SRS@nsf.gov

For questions related to the use of NSF systems contact:

- NSF Help Desk: 1-800-381-1532
- Research.gov Help Desk e-mail: rgov@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 https://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.F.7 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) 292-8134
- **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 proposers 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 proposers 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 System of Record Notices, NSF-50, "Principal Investigator/Proposal File and Associated Records," and NSF-51, "Reviewer/Proposal File and Associated Records." 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:

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