# Advanced Cyberinfrastructure Coordination Ecosystem: Services & Support (ACCESS)

## PROGRAM SOLICITATION
### NSF 21-555

**National Science Foundation**

Directorate for Computer and Information Science and Engineering
Office of Advanced Cyberinfrastructure

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

June 16, 2021

## IMPORTANT INFORMATION AND REVISION NOTES

Any proposal submitted in response to this solicitation should be submitted in accordance with the revised *NSF Proposal & Award Policies & Procedures Guide* (PAPPG) (NSF 20-1), which is effective for proposals submitted, or due, on or after June 1, 2020.

## SUMMARY OF PROGRAM REQUIREMENTS

### General Information

**Program Title:**

Advanced Cyberinfrastructure Coordination Ecosystem: Services & Support (ACCESS)

**Synopsis of Program:**

The national research cyberinfrastructure (CI) ecosystem is essential to computational- and data-intensive research across all of 21st-century science and engineering (S&E), driven by rapid advances in a wide range of technologies; increasing volumes of highly heterogeneous data; and escalating demand by the research community. Research CI is a key catalyst for discovery and innovation and plays a critical role in ensuring US leadership in S&E, economic competitiveness, and national security, consistent with NSF's mission. NSF, through the Office of Advanced Cyberinfrastructure (OAC), has published a vision that calls for the broad availability and innovative use of an agile, integrated, robust, trustworthy and sustainable CI ecosystem that can drive new thinking and transformative discoveries in all areas of S&E research and education. In support of this vision, NSF is releasing two solicitations in parallel: this solicitation, Advanced Cyberinfrastructure Coordination Ecosystem: Services & Support (ACCESS), and Advanced Cyberinfrastructure Coordination Ecosystem: Services & Support - Coordination Office (ACCESS-ACO). This solicitation (ACCESS) aims to establish a suite of CI coordination services - meant to support a broad and diverse set of requirements, users, and usage modes from all areas of S&E research and education - and calls for proposals for five independently-managed yet tightly-cooperative service tracks (see Figure 1). The second solicitation (ACCESS-ACO) focuses on the creation of a coordination office to support the collective and coordinated operation of the ACCESS service tracks.

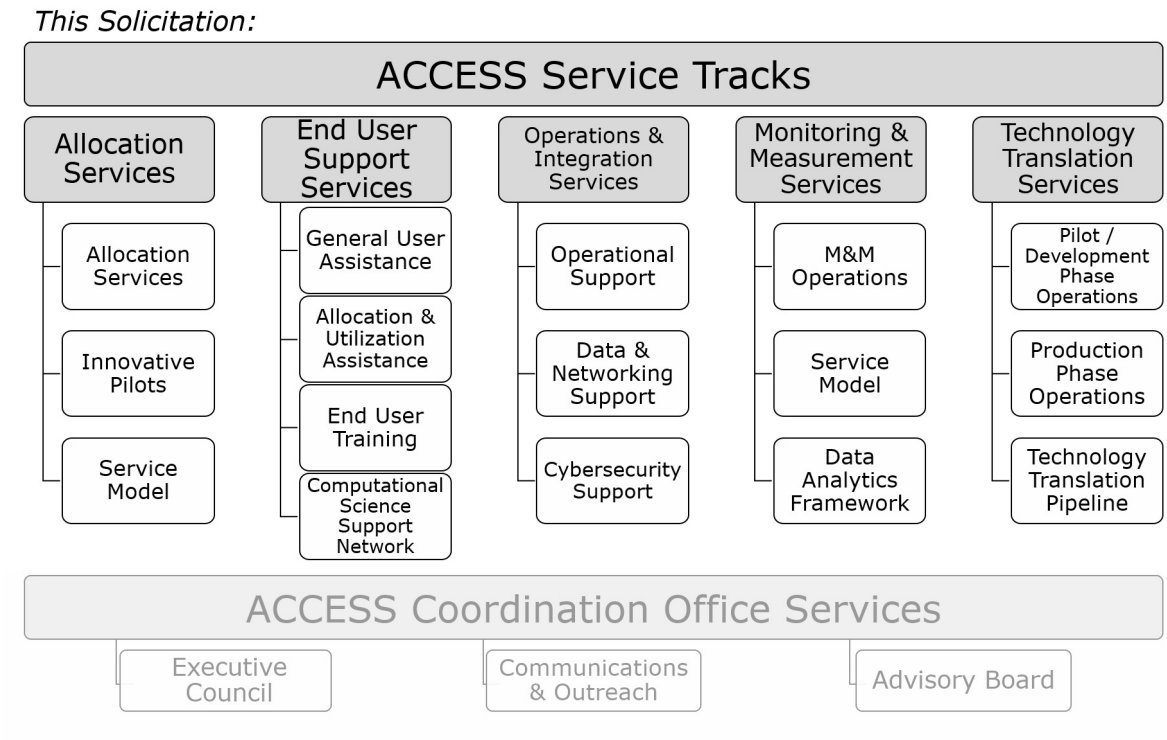


Figure 1: Network of ACCESS services, with a focus on those supported by this solicitation.

This solicitation expects to fund five awards for five independently-managed yet tightly-coordinated services defined in the following five tracks: (1) Allocation Services; (2) End User Support Services; (3) Operations & Integration Services; (4) Monitoring & Measurement Services; and (5) Technology Translation Services. Together, these services are expected to provide a seamless experience for an increasing breadth of research users across a highly performing innovative array of national computational computing resources.

- Allocation Services (Track 1) will be responsible for providing equitable access to NSF-funded CI resources for the Nation's S&E research and education community with the goal of enabling discoveries at scales beyond the reach of an individual or regional academic institution. The Allocation Services track comprises three defined activities: Allocation Services; Innovative Pilots; and a Service Model.
- End User Support Services (Track 2) will be responsible for coordinated activities that ensure a high-quality productive experience for prospective and current users when engaging with the NSF-funded CI resource providers at any stage. The End User Support Services track comprises four defined activities: General User Assistance; Allocation and Utilization Assistance; End User Training; and a Computational Science Support Network.
- Operations and Integration Services (Track 3) will be responsible for providing coordinating functions across the computational resource providers to enable the different elements of the NSF-funded national CI ecosystem to work together effectively and securely. The Operations and Integration Services track comprises three defined activities: Operational Support; Data and Networking Support; and Cybersecurity Support.
- Monitoring & Measurement Services (Track 4) will be responsible for providing an integrated and open data collection and analytics platform to ensure optimal performance, robustness, and usage of NSF-funded resources (including compute, storage, networking, software/data services, etc.) as well as to facilitate timely decision making for a broad range of stakeholders. The Monitoring & Measurement Services track comprises three elements: Monitoring & Measurement Operations; Service Model; and Data Analytics Framework.
- Technology Translation Services (Track 5) will be responsible for the development and establishment of technical and programmatic mechanisms to translate and integrate innovative cyberinfrastructure technologies and capabilities supported by OAC programs into robust production operations within NSF-funded CI resource providers. The Technology Translation Service track comprises two defined activities: Operations, including both Pilot/Development Phase Operations and Production Phase Operations; and Technology Translation Pipeline, including processes for selection and deployment.

NSF expects that these services, when funded, will come online with minimal disruption to the S&E research community.

Please note that each of the five service tracks has an associated set of requirements detailed in the body of this solicitation, including defined roles and responsibilities for the services, and specific requirements to interface operationally with one or more other defined ACCESS service tracks and with a coordination function to be supported by NSF through the separate ACCESS Coordination Office (ACCESS-ACO) solicitation. Proposers are advised to carefully read this solicitation for these requirements and for guidance regarding eligibility and overall strategy.

**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.*

- Robert B. Chadduck, Program Director, CISE/OAC, telephone: (703) 292-2247, email: rchadduc@nsf.gov
- Alejandro Suarez, Associate Program Director, CISE/OAC, telephone: (703) 292-7092, email: alsuarez@nsf.gov

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

- 47.070 --- Computer and Information Science and Engineering

## Award Information

**Anticipated Type of Award:** Cooperative Agreement

**Estimated Number of Awards:** 5

Up to one (1) award is estimated to be made for each award track.

**Anticipated Funding Amount:** $57,500,000

$7,500,000 to $20,000,000 per award, dependent on award track. A total of $57,500,000 is available for this solicitation, subject to the availability of funds.

## Eligibility Information

**Who May Submit Proposals:**

Proposals may only be submitted by the following:

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

**Who May Serve as PI:**

There are no restrictions or limits.

**Limit on Number of Proposals per Organization:** 1

An organization may submit only one proposal as a lead. An organization may also be a subawardee on proposals to tracks other than the track to which it has submitted a proposal as the lead organization.

Collaborative projects may **only** be submitted as a single proposal in which a single award is being requested (PAPPG Chapter II.D.3.a). The involvement of partner organizations should be supported through subawards administered by the submitting organization.

**These eligibility constraints will be strictly enforced in order to treat everyone fairly and consistently**. In the event that an organization exceeds this limit, the proposals received within the limit will be accepted based on the earliest date and time of proposal submission. **No exceptions will be made.**

**Limit on Number of Proposals per PI or Co-PI:** 1

An individual may be the PI on no more than one proposal that responds to this solicitation. An individual may also serve as a co-PI or senior personnel on proposals to tracks other than the track to which they have submitted a proposal as the PI.

**These eligibility constraints will be strictly enforced in order to treat everyone fairly and consistently**. In the event that an individual exceeds these limits, the proposals received within the limit will be accepted based on the earliest date and time of proposal submission. **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 FastLane: *NSF Proposal and Award Policies and Procedures Guide* (PAPPG) guidelines apply. The complete text of the PAPPG is available electronically on the NSF website at: https://www.nsf.gov/publications/pub_summ.jsp?ods_key=pappg.
  - Full Proposals submitted via Grants.gov: *NSF Grants.gov Application Guide: A Guide for the Preparation and Submission of NSF Applications via Grants.gov* guidelines apply (Note: The *NSF Grants.gov Application Guide* is available on the Grants.gov website and on the NSF website at: https://www.nsf.gov/publications/pub_summ.jsp?ods_key=grantsgovguide).

**B. Budgetary Information**

- **Cost Sharing Requirements:**

  Inclusion of voluntary committed cost sharing is prohibited.

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

  Not Applicable

- **Other Budgetary Limitations:**

  Other budgetary limitations apply. Please see the full text of this solicitation for further information.

**C. Due Dates**

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

  June 16, 2021

## 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:**

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

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## I. INTRODUCTION

National research cyberinfrastructure (CI) has become essential to computational- and data-intensive research across all of science and engineering (S&E) in the 21st century. It is a key catalyst for discovery and innovation and plays a critical role in ensuring US leadership in S&E, economic competitiveness, and national security, consistent with NSF's mission. NSF, through the Office of Advanced Cyberinfrastructure (OAC), has published a vision that calls for the broad availability and innovative use of **an agile, integrated, robust, trustworthy and sustainable CI ecosystem** that can **drive new thinking and transformative discoveries in all areas of S&E research and education**.

National CI coordination services are integral to NSF's CI vision and ecosystem. Consequently, it is imperative that these services be made broadly available to the Nation's S&E research community consistent with the goals and intent of the diverse set of NSF-funded resources. These services support critical aspects such as allocation, measurement and user support, and enable researchers across every field of NSF-supported S&E to effectively and efficiently use the CI ecosystem and ensure overall user productivity in spite of rapidly changing application and CI landscapes.

NSF recently published a forward-looking blueprint for future national CI coordination services, "Transforming Science Through Cyberinfrastructure: Coordination Services." This blueprint was informed by the community through advisory bodies, requests for information (RFIs), workshops and conferences, and national initiatives. In particular, the 2019 NSF-funded National Cyberinfrastructure Coordination Service Conference specifically focused on the CI service ecosystem. As outlined in the blueprint document, NSF envisions a fabric of national coordination CI services that can effectively support a broad and diverse

set of requirements, users, and usage modes from all areas of S&E research and education. It is also essential that this fabric of services is agile and can evolve and adapt to respond to emerging requirements and technology landscapes. This solicitation, one of two ACCESS solicitations, focuses on the execution of this blueprint and the creation of the national coordination CI services fabric.

The current NSF-supported CI coordination services landscape includes the following major projects: The eXtreme Science and Engineering Discovery Environment (XSEDE) and XSEDE Metrics Service (XMS), both part of the eXtreme Digital (XD) Program, and the Partnership to Advance Throughput Computing (PATh), funded as a continuation of the Open Science Grid (OSG). Moving forward, NSF aims to continue to provide these services while also evolving, integrating, and adapting their structures, scopes, and implementations to respond to rapidly-evolving technologies and science needs. This solicitation is part of a pair of solicitations calling for proposals for projects within the ACCESS ecosystem (see Table 1 below). It complements the second (ACCESS-ACO) solicitation, which focuses on the creation of a coordination office to support the collective and coordinated operation of the ACCESS coordination service tracks.

Table 1: ACCESS Solicited Projects

| Project | Solicitation | Relevant Activities |
|---|---|---|
| Allocation Services | **(This Solicitation)** | • Allocation Services<br>• Innovative Pilots<br>• Service Model |
| End User Support Services | **(This Solicitation)** | • General User Assistance<br>• Allocation & Utilization Assistance<br>• End User Training<br>• Computational Science Support Network |
| Operations and Integration Services | **(This Solicitation)** | • Operational Support<br>• Data & Networking Support<br>• Cybersecurity Support |
| Monitoring and Measurement Services | **(This Solicitation)** | • Monitoring & Measurement Operations<br>• Service Model<br>• Data Analytics Framework |
| Technology Translation Services | **(This Solicitation)** | • Pilot/Development Phase Operations<br>• Production Phase Operations<br>• Translation Pipeline |
| ACCESS Coordination Office (ACO) | ACCESS-ACO Solicitation | • Executive Council<br>• External Advisory Board<br>• Communications & Outreach |

Specifically, in this solicitation, NSF calls for proposals for five independently managed yet tightly cooperative services along the following tracks: 1) Allocation Services; 2) End User Support Services; 3) Operations and Integration Services; 4) Monitoring & Measurement Services; and 5) Technology Translation Services. These services are expected to:

- Provide key capabilities including the discovery of and access to available resources, access to relevant and timely expert technical guidance and focused instruction on effective uses of these CI capabilities, and support for developmental efforts to support the evolving portfolio of NSF-funded S&E;
- Ensure the effective management, operation, monitoring and measurement, evolution, and overall use of computing resources, and integrate these resources into a coherent, coordinated national CI ecosystem;
- Increase user accessibility, enable collaboration, simplify use of CI in dynamic system-of-systems scenarios, support access to relevant data, and enable timely access to novel technologies and solutions; and
- Interface closely with the ACCESS Coordination Office (funded by the separate ACCESS-ACO solicitation) on strategic planning and policy efforts, ACCESS-wide meeting and reporting activities, and other endeavors spanning several or all coordination service tracks.

## II. PROGRAM DESCRIPTION

Proposals submitted to this solicitation must be responsive to one of the tracks as defined below. Proposals will be considered for funding **only** within their selected track. A proposal cannot attempt to respond to more than one track.

**Track 1 - Allocation Services**

NSF expects to fund one award in Track 1 at up to $7,500,000 total for a duration of five years, subject to availability of funds.

The successful Allocation Services awardee will serve a forward-looking, community-based facilitation role to enable broad access to allocatable NSF-funded resources using fair and transparent mechanisms. Stakeholders for allocation services will include the Nation's research and education community, as well as NSF-funded CI resource providers. The successful awardee will collaborate with CI resource providers to implement mechanisms for ensuring that the unique capabilities provided by the resource are equitably allocated to the S&E community. The successful awardee is also expected to closely engage with the S&E community to understand the evolving nature of the scientific discovery workflow and be sufficiently agile to adapt the allocation process to maximize impact to S&E research. Moreover, the successful awardee is expected to work with the End User Support Services awardee (Track 2) to ensure that coherent information about the available resources and access request mechanisms are well advertised and supported throughout the broad S&E community.

The Allocation Services track is responsible for developing equitable access to NSF-funded CI resources for the Nation's S&E research and education community with the goal of enabling discoveries at scales beyond the reach of an individual or regional academic organization. CI resources that will be allocated must include the range of computing resources funded in the NSF advanced computing systems portfolio (including Leadership-class Computing and Advanced Computing Systems & Services) as well as NSF-funded CI resource providers that have committed to provisioning resources and services to the

wider national S&E community, such as those funded through the Major Research Instrumentation (MRI) and Campus Cyberinfrastructure (CC*) programs, and any other resources deemed necessary by the proposer to enable transformative research in next-generation, end-to-end S&E discovery workflows.

Proposers to Track 1 are requested to detail plans for three defined activities: a) Allocation Services; b) Innovative Pilots; and c) a Service Model. The listed plans are required, but plans for additional *relevant* activities at the proposer's discretion are welcome.

*Allocation Services*

Proposers are requested to present an Allocation Services plan as part of the Project Description. This section should detail near-term plans to evolve the current XSEDE Resource Allocation (XRAC) process, with concrete actions to progressively incorporate innovation and efficiencies, such as, but not limited to, leveraging off-the-shelf software components, commercial cloud computing services, new modes of evaluation, new methods for allocation of non-computing resources, etc. Proposers must describe how the proposed Allocation Services will transition into the role currently performed by the XRAC process incorporating all the resources currently funded in the NSF advanced computing systems portfolio, including the NSF leadership-class computing system Frontera, High Throughput Computing (HTC) environments such as PATh/OSG, and CI resource providers funded through the Advanced Computing Systems and Services (ACSS) program. Proposers must describe annual evaluation metrics and targets to ensure planned goals are being met.

*Innovative Pilots*

Additionally, proposers are requested to detail a longer-term vision (Innovative Pilots plan) to examine novel and potentially disruptive new allocation models and processes to incorporate the agility and responsiveness needed to address the rapidly-evolving research and CI resource provider landscape. Proposers are requested to outline comprehensive plans for implementing novel allocation pilot(s) with the goal of responding to new emerging technologies, resources classes and usage modes (e.g., cloud services, HTC environments, distributed and federated resources, testbeds and prototype systems, etc.), new and diverse application classes (machine learning-based, data-driven, online/real-time, elastic, long-running, high-throughput, etc.), as well as plans to enable allocation of other elements of the CI ecosystem (e.g., network resources, storage, etc.) that are relevant to end-to-end application workflows. These pilots must include evaluation plans with annual metrics and targets to measure progress towards a goal of successful transition-to-operations in the third or fourth year of an award.

*Service Model*

Proposers are requested to describe their *Service Model* to the S&E community, the NSF-funded CI resource providers, and the End User Support Services track (Track 2), as well as any other tracks defined in this solicitation as appropriate. This service model must include effective processes for on-boarding and engaging with new NSF-funded CI resources to ensure that the unique capabilities provisioned by the resource are made available to the S&E community. Furthermore, the service model must describe a well-defined process interface to the End User Support Services track (Track 2) to ensure effective communication with, and direct support of, the S&E research community with respect to the proposed allocation process(es). Other elements of the service model that will promote effective and impactful execution of the allocation services should also be described.

The PIs for the proposal awarded in this track will be expected to serve on the ACCESS Executive Council, as managed by the ACCESS Coordination Office (ACO).

Please review the Proposal Preparation and Submission Instructions Section below for more information on the specific sections required for proposals responding to this track.

**Track 2 - End User Support Services**

This track expects to fund one award at up to $10,000,000 total for a duration of five years, subject to availability of funds.

The End User Support Services track comprises coordinated activities that ensure a high-quality productive experience for prospective and current users when engaging with the NSF-funded CI resource providers at any stage. The successful End User Support Services awardee will serve end users with planned, pending, or current allocations on NSF-funded CI resources, or those who are otherwise utilizing associated services (e.g., data and software services). Additional stakeholders include members of the wider community of prospective and current end users whose computational S&E interests intersect with the capabilities provided by the broader NSF-funded national CI ecosystem. End users may include individuals, groups, or projects such as Science Gateways, CI centers of excellence, and related computational infrastructure community organizations and bodies. Moreover, the successful awardee is expected to interface with the Allocation Services awardee (Track 1), the Operations and Integration Services awardee (Track 3), and individual NSF-funded CI resource providers.

Proposals to Track 2 must detail plans for four defined activities: a) General User Assistance; b) Allocation and Utilization Assistance; c) End User Training; and d) development of a Computational Science Support Network. Plans for the activities listed above are required, but plans for additional relevant activities at the proposer's discretion are welcome.

Note that End User Support Services activities funded via this track are *not* expected to include general CI community learning and workforce development, which is separately supported through OAC's Learning and Workforce Development programs.

*General User Assistance*

The General User Assistance plan should detail how the proposed project will develop, publish, and maintain information about available ACCESS resources, services, processes, and contact points on a public website, i.e., the ACCESS portal. Such content should be developed and updated in close coordination with other ACCESS services, the computational resource providers, and the ACO.

*Allocation and Utilization Assistance*

The Allocation and Utilization Assistance plan should detail how the activity will, in conjunction with the General User Assistance plan, respond to queries from external individuals (customers) via dedicated, circumscribed staff who rely extensively on coordination with, reach back to, and hand-off to Allocation Services and relevant computational resource providers as appropriate.

Both the *General User Assistance* and *Allocation and Utilization Assistance* activities will be required to log, track, and follow-up to customer queries for assistance, using a centralized ACCESS ticketing system to ensure that such queries are fully resolved and completed to the users' satisfaction.

*End User Training*

The End User Training plan should detail how the proposed project will organize and develop training materials, courses, and events disseminated via the ACCESS web portal and ACCESS-supported workshops. The plan should also detail how online courses will be made publicly available, and how ACCESS

training workshops will be advertised to prospective and current users. Planned training activities should focus on teaching users how to make maximal, efficient and effective utilization of ACCESS services and NSF-funded CI resources.

Proposers should describe how curricular content will be developed in close partnership with the resource providers and with other experts as appropriate. Planned training activities should also be accomplished through participation, presentations, and training sessions at larger community outreach events and conferences.

*Computational Science Support Network (CSSN)*

Proposers are requested to describe plans to develop and foster a Computational Science Support Network (CSSN) that will assimilate and coordinate the human capital that is separately funded by NSF at the national, regional and campus levels, and engage with the relevant existing community organizations and structures. This includes, but is not limited, to the existing Campus Champions service, Campus Research Computing Consortium (CaRCC), and activities currently supported through the XSEDE project, among others, as well as relevant projects and individuals funded in the future. The CSSN will actively assist prospective, new, and current users through activities ranging from campus-level, one-on-one user engagements to regional and national community events.

The activities of the End User Support Services track are expected to be managed as an integrated and coordinated set, which maintains clear and well-managed connections, and dialog with external users and stakeholders and with interfaces within the ACCESS framework.

The End User Support Services track will be expected to develop appropriate performance benchmarks, metrics, and measures to continually assess them - including through external independent means - and to present the results semi-annually on the public End User Support Services web portal.

The PIs for the proposal awarded in this track will be expected to serve on the ACCESS Executive Council, as managed by the ACO.

Please review the Proposal Preparation and Submission Instructions Section below for more information on the specific sections required for proposals responding to this track.

**Track 3 - Operations and Integration Services**

This track expects to fund one award at up to $20,000,000 total for a duration of five years, subject to availability of funds.

Successful coordination of CI systems and services with wide geographical distribution, unique capabilities, and broad yet complementary user communities will require an integrative operational framework. The successful Operations and Integration Services awardee will provide the core integrative services, processes, and policies in support of the assimilation and operations of resources that are part of the NSF-funded national CI ecosystem with the goal of enabling a coordinated, secure, robust, and usable platform for transformative research across all of S&E.

NSF expects that the services in Track 3 will provide coordinating functions to the resource providers to enable the different elements of the NSF-funded national CI ecosystem to work together effectively and securely. Some of the principal goals of the coordinating activities will be to enhance the cybersecurity of the ecosystem, enable data sharing and information dissemination where appropriate, and provide technical support and best practices to assist in resource provider integration and operations.

The primary stakeholders for Operations and Integration Services will be relevant personnel at NSF-funded CI resource providers, including the operations and maintenance, end user support, and CI research staff. The successful Track 3 awardee is expected to have well-defined relationships and divisions of responsibilities with such personnel, including, but not limited to the implementation of policies for on-boarding and integrating into the NSF-funded national CI ecosystem. The successful awardee must maintain sufficient flexibility in their processes to be able to support the wide diversity of systems and services within this ecosystem, including future NSF-funded CI resource providers with new capabilities that are not currently represented.

Proposals to Track 3 must include plans for the following key activities: a) Operational Support; b) Data and Networking Support; and c) Cybersecurity Support. The following plans are required, but plans for additional *relevant* activities at the proposer's discretion are welcome.

*Operational Support*

The Operational Support plan should detail how the proposed service would function as an information sharing platform between the operations and maintenance staff at the NSF-funded CI resource providers. Such activities could include, but are not limited to, sharing best practices for the configuration and management of computational systems, the development of resource integration frameworks, and authentication strategies.

*Data and Networking Support*

The Data and Networking Support plan should focus on how the existing data and networking infrastructure for the NSF CI ecosystem can best be leveraged and coordinated. The plan should include information on how coordination of data and networking capabilities and services provided by the current XSEDE award will be transitioned into the vision of the proposer. Furthermore, the plan should detail how the proposer will work with the Monitoring & Measurement Services track on best practices for sharing performance data and improving data transfer and other networking performance.

*Cybersecurity Support*

The plan for Cybersecurity Support should detail how the proposer will work with service providers to ensure a safe, secure, and trustworthy shared CI ecosystem. The plan should detail how continuity from the cybersecurity activities of XSEDE will be maintained and transitioned to the proposer's vision.

Note that activities funded via Track 3 are *not* expected to include helpdesk-level support specific to a given resource provider, which is separately supported through operations and maintenance (O&M) funds in OAC's service provider acquisition programs, including the ACSS program. Activities funded under this track are also *not* meant to provide hardware, software, or other infrastructure support for other tracks in this solicitation.

The PIs for the proposal awarded in this track will be expected to serve on the ACCESS Executive Council, as managed by the ACO.

Please review the Proposal Preparation and Submission Instructions Section below for more information on the specific sections required for proposals responding to this track.

**Track 4 - Monitoring & Measurement Services**

This track expects to fund one award at up to $10,000,000 total for a duration of five years, subject to availability of funds.

NSF invests in a national CI ecosystem that enables a broad and diverse set of requirements, users, and usage modes from all areas of S&E research and education. Deep instrumentation, monitoring, measurement, and reporting across all layers of the systems and services making up the CI ecosystem is therefore essential to providing the situational awareness necessary for achieving increased levels of efficiency, understanding, autonomous operations, robustness, and performance. The Monitoring & Measurement Services track will serve in the important role of providing an integrated and open data collection and analytics platform to ensure optimal performance, robustness, and usage of NSF-funded resources (including compute, storage, networking, software/data services, etc.), as well as to facilitate timely decision making for a broad range of stakeholders.

The Monitoring & Measurement Services track is expected to engage with a broad range of stakeholders. This will include CI resource owners, S&E research users, CI software developers, as well as future CI capacity and capability planners. The successful awardee must engage with the range of CI resource owners and/or operators (including compute, storage, networking, software/data services, etc.) to successfully assimilate a wide range of custom or third-party instrumentation data into their proposed services. With the assimilated data, the successful awardee must provide services to improve the utilization, performance, and effectiveness of S&E research users on CI resources. Additionally, these services will allow resource owners to better understand how to tune policies and procedures for maximizing impact to the S&E research user community. The services must also allow CI software developers to optimize code performance to ultimately improve S&E output productivity. Moreover, the services must provide useful information to CI capacity and capability planners for evidence-based decision making. The data captured and visualizations developed by the successful awardee are expected to be shared with the S&E community to the greatest extent possible. The Monitoring & Measurement Services awardee is expected to interface with the awardees of the other tracks defined in this solicitation to provide additional utility to the stakeholders as appropriate.

Proposers to this track are requested to provide the following defined plans: a) Monitoring & Measurement (M&M) Operations; b) Service Model; and c) Data Analytics Framework. The listed plans are required, but plans for additional relevant activities at the proposer's discretion are welcome.

*M&M Operations*

Currently, the XSEDE Metrics Service (XMS), using the XDMoD tool, supports the tracking of operational, performance, and usage data for CI resources funded through the NSF ACSS program. Proposers must provide an Operations plan with a detailed schedule to begin taking on the production operational role currently performed by the XMS project within nine months of award. Note that NSF has also invested in a portfolio of monitoring and measurement research and development over the years, including networking-based monitoring and measurement such as the Center for Applied Internet Analysis (CAIDA), Route Views, NetSage, and perfSONAR. Integration and/or interoperability with existing network monitoring and measurement services in use by the community is encouraged where appropriate.

If a staged deployment of critical features for the Monitoring and Measurement Services is proposed, the project schedule must clearly indicate milestones and deliverables with detailed plans to ensure successful production services deployment. If engagement activities with new NSF CI resources are planned, this must be included in the project schedule. The Operations plan must also include a detailed risk management plan. This risk management plan must include a comprehensive identification, analysis, and mitigation of all known risk factors. Proposers must describe annual evaluation metrics and targets to ensure that planned goals are being met.

*Service Model*

Proposers are requested to describe their Service Model to the S&E community, the NSF-funded CI resource providers, and any other tracks defined in this solicitation to provide additional utility to the stakeholders as appropriate. At a minimum, this service model must include effective processes for engaging with the wider NSF-funded national CI ecosystem and the expected outcomes, as well as well-defined process interfaces with any other tracks defined in this solicitation as appropriate.

*Data Analytics Framework*

Proposers are requested to describe their Data Analytics Framework and the features it will provide to address the needs of the targeted stakeholders. Proposers must describe the usability of the framework and how it will provide customizable multi-view interfaces for reporting a broad range of operational and higher-level impact metrics across time, as well as other dimensions. Proposers must also describe the types of information and data that will be assimilated into the framework to garner insights not otherwise possible. The proposed framework must allow individual and aggregated groups of CI resources to be examined for usage trends across multiple dimensions, as well as identification of capability gaps at local and global scales. Additionally, proposers must describe the machine-readable interfaces that will be available to enable automation of S&E workflows and the incorporation of forward-looking predictive data analytics techniques such as those based on machine learning. Any other features of the proposed data analytics framework that addresses the goals of this services track should be described.

The principal investigators for the proposal awarded in this track will be expected to serve on the ACCESS Executive Council, as managed by the ACO.

Please review the Proposal Preparation and Submission Instructions Section below for more information on the specific sections required for proposals responding to this track.

**Track 5 - Technology Translation Services**

This track expects to fund one award at up to $10,000,000 total for a duration of five years, subject to availability of funds.

Over the last decade, OAC has provided significant support [for example, through the Cyberinfrastructure for Sustained Scientific Innovation (CSSI), OAC Core Research, Cybersecurity Innovation for Cyberinfrastructure (CICI), and Campus Cyberinfrastructure (CC*) programs, and their precursors] to projects focused on the development and use of software and data CI services that are innovative and enable science and engineering advances. To integrate these software/data innovations and further enhance the sustainability of the data and software CI ecosystem, OAC seeks to support, through this track, the development and establishment of technical and programmatic mechanisms that translate and integrate the outcomes of such projects into robust production operations, for example, as software packages or hosted services, within the NSF-funded CI resource providers.

Technology Translation Services are intended to support new models of engagements among NSF-supported CI researchers and developers, S&E research communities, NSF-funded CI resource providers, and potential providers of other CI coordination services, as appropriate. Most importantly, the Technology Translation Services are also expected to maintain well-defined and documented interfaces with the CI research and developer community as well as with resource providers to ensure the translation of CI innovations to production and to maximize their potential impact on S&E. As with all tracks, the Technology Translation Services track is expected to work cooperatively with other tracks as appropriate to maintain a successful coordination ecosystem.

Services in this track should consider how the integration of the data and software projects into production is responsive to the needs and priorities of the S&E research communities as well as the opportunities for improved efficiencies and performance in the operations of the CI ecosystem. Such services will serve as a bridge between the "push" from new innovations from the S&E research community and the "pull" from needs identified by CI resource providers, other ACCESS tracks, and the S&E research community.

Proposals to provide technology translation and integration services in response to this track are expected to demonstrate expertise in and capability to follow established data and software engineering processes and develop innovative mechanisms and processes for the continuous and sustained integration of data and software services into the robust NSF production CI ecosystem.

Anticipating the services supporting the effective translation of innovative data and software CI capabilities to operate in robust production to mature and evolve, the Technology Translation Services are anticipated to start as a pilot during the first phase of project performance, and then progress to a production level with high-availability services broadly available to the S&E research community during the second phase of the project award period.

Proposals to Track 5 must detail plans for two defined activities: a) Operations, including both a Pilot/Development phase and a Production phase; and b) Translation Pipeline, including processes for selection and deployment. While plans for these are required, plans for additional activities *relevant to the track* are also welcome.

*Pilot/Development Phase & Production Phase Operations*

Operations in this track should include two defined phases of operation: the Pilot/Development Phase and the Production phase. During the Pilot/Development phase, proposers should develop, document, and begin executing processes for determining (using established criteria and metrics, and with community inputs) which solutions to move to production and for how long (see Translation Pipeline activity below). Proposers should carefully consider the time spent in piloting and development, and how to transition to a production phase. As the project transitions to the production phase, it should exploit economies of scale to allow for less time and budget to be committed on a per-project basis.

*Technology Translation Pipeline*

The Technology Translation Pipeline should detail how the awardee will select data and software technology solution candidates and deploy them into production operations at NSF-funded CI resource providers, for example, as software packages or hosted services. The processes for selection and deployment of technology solutions should be based on established metrics, enterprise best practices, and S&E community engagement. The Translation Pipeline should also describe how the proposed service will serve as a custodian of a given solution candidate once it graduates into production, including how long the candidate will be supported, engagement mechanisms with both the solution developers and CI resource provider hosts, and relevant metrics to gauge success.

Furthermore, the Technology Translation Service providers are expected to work with resource providers to sustain these solutions in production operations so that CI innovations can be leveraged by the user community for S&E research and education.

The PIs for the proposal awarded in this track will be expected to serve on the ACCESS Executive Council, as managed by the ACO.

Please review the Proposal Preparation and Submission Instructions Section below for more information on the specific sections required for proposals responding to this track.

## III. AWARD INFORMATION

A total of $57,500,000 is available for this solicitation, with award values ranging from $7,500,000 to $20,000,000 per award, dependent on award track. Estimated program budget, number of awards and average award size/duration are subject to the availability of funds.

For each award track, there is a possibility of a renewal award contingent upon availability of funds, the successful evaluation of the awardee's performance, and NSF merit review of a renewal proposal.

**Reasoning:** This is present in the solicitation management plan and aligns with the information publicized in the companion solicitation NSF 21-556.

## IV. ELIGIBILITY INFORMATION

**Who May Submit Proposals:**

Proposals may only be submitted by the following:

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

**Who May Serve as PI:**

There are no restrictions or limits.

**Limit on Number of Proposals per Organization:** 1

An organization may submit only one proposal as a lead. An organization may also be a subawardee on proposals to tracks other than the track to which it has submitted a proposal as the lead organization.

Collaborative projects may **only** be submitted as a single proposal in which a single award is being requested (PAPPG Chapter II.D.3.a). The involvement of partner organizations should be supported through subawards administered by the submitting organization.

**These eligibility constraints will be strictly enforced in order to treat everyone fairly and consistently**. In the event that an organization

exceeds this limit, the proposals received within the limit will be accepted based on the earliest date and time of proposal submission. **No exceptions will be made.**

**Limit on Number of Proposals per PI or Co-PI:** 1

An individual may be the PI on no more than one proposal that responds to this solicitation. An individual may also serve as a co-PI or senior personnel on proposals to tracks other than the track to which they have submitted a proposal as the PI.

**These eligibility constraints will be strictly enforced in order to treat everyone fairly and consistently**. In the event that an individual exceeds these limits, the proposals received within the limit will be accepted based on the earliest date and time of proposal submission. **No exceptions will be made.**

## 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 FastLane or Grants.gov.

- Full proposals submitted via FastLane: Proposals submitted in response to this program solicitation should be prepared and submitted in accordance with the general guidelines contained in the *NSF Proposal & Award Policies & Procedures Guide* (PAPPG). The complete text of the PAPPG is available electronically on the NSF website at: https://www.nsf.gov/publications/pub_summ.jsp?ods_key=pappg. Paper copies of the PAPPG may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-8134 or by e-mail from nsfpubs@nsf.gov. Proposers are reminded to identify this program solicitation number in the program solicitation block on the NSF Cover Sheet For Proposal to the National Science Foundation. Compliance with this requirement is critical to determining the relevant proposal processing guidelines. Failure to submit this information may delay processing.
- Full proposals submitted via Grants.gov: Proposals submitted in response to this program solicitation via Grants.gov should be prepared and submitted in accordance with the *NSF Grants.gov Application Guide: A Guide for the Preparation and Submission of NSF Applications via Grants.gov*. The complete text of the *NSF Grants.gov Application Guide* is available on the Grants.gov website and on the NSF website at: (https://www.nsf.gov/publications/pub_summ.jsp?ods_key=grantsgovguide). To obtain copies of the Application Guide and Application Forms Package, click on the Apply tab on the Grants.gov site, then click on the Apply Step 1: Download a Grant Application Package and Application Instructions link and enter the funding opportunity number, (the program solicitation number without the NSF prefix) and press the Download Package button. Paper copies of the Grants.gov Application Guide also may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-8134 or by e-mail from nsfpubs@nsf.gov.

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

**The following provides additional guidance beyond that contained in the PAPPG or NSF Grants.gov Application Guide.**

**Proposal Titles:**

Proposal titles must begin with "Track 1:" or "Track 2:", etc., depending on the track being proposed.

**Collaborative Proposals:**

Only personnel directly connected to the project should be listed as **collaborators**.

Collaborative efforts may **only** be submitted as a single proposal (See PAPPG Chapter II.D.3.a), in which a single award is being requested. The involvement of partner organizations should be supported through subawards administered by the proposing Service Provider organization.

**Project Description:**

The page limit for the Project Description section of the proposal is **25 pages**.

**In addition to the instructions described in the *PAPPG* or NSF Grants.gov Application Guide, the Project Description must include the following track-specific sections (to be included under "Intellectual Merit" unless otherwise noted):**

- **Track 1: Allocations Services**
  - **Allocations Services Plan:** Describe near-term plan to evolve the current XRAC process, with concrete plans to progressively incorporate innovation and efficiencies. Describe how the proposed Allocations Services will transition into the role currently performed by the XRAC, incorporating all resources in the NSF advanced computing systems portfolio. Describe annual evaluation metrics and targets to ensure planned goals are being met.
  - **Innovative Pilots Plan:** Describe longer-term vision to examine novel and potentially disruptive new allocation models and processes to incorporate the agility and responsiveness needed to address the rapidly-evolving research and CI resource provider landscape. Describe comprehensive plans for implementing novel allocation pilot(s) with the goal of responding to new emerging technologies, resources classes and usage modes; new and diverse application classes; as well as plans to enable allocation of other elements of the CI ecosystem that are relevant to end-to-end application workflows. These pilots must include evaluation plans with annual metrics and targets to measure progress towards a goal of successful transition-to-operations in the third or fourth year of the award.
  - **Service Model:** Describe a detailed service model for the allocation services to the S&E community, the NSF-funded CI resource providers, and the end user services track, as well as any other tracks defined in this solicitation as appropriate. This service model must include effective processes for on-boarding and engaging with new NSF-funded CI resources to ensure that the unique capabilities provisioned by the resource is made available to the S&E community. Furthermore, the service model must describe a well-defined process interface to the End User Support Services track to ensure effective communication with, and direct support of, the S&E research community with respect to the proposed allocation process(es). Other elements of the service model that will promote effective and impactful execution of the allocation

services should also be described.

- **Track 2: End User Support Services**
  - **General User Assistance Plan:** Describe plans to develop, publish and maintain information about available ACCESS resources, services, processes and contact points on a public website of the ACCESS portal. Such content should be developed and updated in close coordination with other ACCESS services, the computational resource providers, and the ACCESS ACO.
  - **Allocation and Utilization Assistance Plan:** Describe plans to respond to queries from external individuals (customers) via dedicated, circumscribed staff who rely extensively on coordination with, reach back to, and hand-off to Allocation Services and relevant computational resource providers as appropriate.
  - **End User Training Plan:** Describe plans to organize and develop stand-alone centralized in-person and on-line training courses and events via the ACESS web portal and ACCESS-supported workshops. More detail on activities to include the End User Training Plan can be found in the Program Description.
  - **Computational Science Support Network Development Plan:** Describe plans to coordinate human capital (separately funded by NSF) at national, regional, and campus levels, and engage with relevant existing organizations and structures.
- **Track 3: Operations and Integration Services**
  - **Operational Support Plan:** Describe how the proposed service would function as an information sharing platform between operations and maintenance staff of the NSF-funded CI resource providers.
  - **Data and Networking Support Plan:** Describe how the existing data and networking infrastructure of the NSF CI ecosystem could best be leveraged and coordinated. Describe the transition of appropriate data and networking capabilities from the current XSEDE award. Describe cooperation mechanisms with the Monitoring and Measurement Services track regarding sharing performance data and improving data transfer and networking performance metrics.
  - **Cybersecurity Support Plan:** Describe transition of appropriate cybersecurity services from the current XSEDE award.
- **Track 4: Monitoring and Measurement Services**
  - **M&M Operations Plan:** Describe a detailed project schedule with milestones and deliverables to ensure successful deployment of the proposed services. The project schedule must describe detailed plans for subsuming the services provided by the XMS project within the timeline listed in the Program Description. Describe engagement milestones in the project schedule if any. In addition, describe a detailed risk management plan which must include a comprehensive identification, analysis, and mitigation of all known risk factors. Describe annual evaluation metrics and targets to ensure planned goals are being met.
  - **Service Model:** Describe a detailed service model for the monitoring and measurement services to the S&E community, the NSF-funded CI resource providers, and any other tracks defined in this solicitation as appropriate. Describe how NSF-funded computation, storage, network, cloud, and/or other instruments will be engaged and the expected outcomes. Describe well-defined process interfaces with any other tracks defined in this solicitation as appropriate. Other elements of the service model that will promote effective and impactful execution of the proposed services should also be described.
  - **Data Analytics Framework:** Describe the usability of the framework, as well as the types of information and data that will be assimilated to garner insights not otherwise possible. Additionally, describe the machine-readable interfaces that will be available to enable automation and the use of predictive data analytics techniques. Describe any other productivity enhancing features to address the targeted stakeholders.
- **Track 5: Technology Translation Services**
  - **Operations Plan:** Describe both phases of the project (Pilot/Development and Production) and explain how the production phase will be scalable and not dependent upon significant one-on-one interactions.
  - **Technology Translation Pipeline:** Describe a clearly-defined process for selecting the target S&E application classes that will be enabled as well as a clear plan for ensuring the widespread adoption of technologies transitioned to production operations as a result of executed services.
  - **ALL TRACKS:** In all tracks, proposals must describe complementary and leveraged aspects with the CI ecosystem, with emphasis on other NSF-funded CI projects.

**Proprietary information**

Proposals containing patentable ideas, trade secrets, and/or privileged or confidential commercial or financial information, disclosure of which may harm the proposer, should be clearly marked where appropriate in the proposal and labeled with the following legend:

> "The following is (proprietary or confidential) information that (name of proposing organization) requests not be released to persons outside the U.S. Federal Government, except for purposes of review and evaluation."

Note that proposals submitted to this solicitation will be reviewed by a group of experts that include people who are not U.S. Federal Government personnel.

See the PAPPG, Chapter II.D.1 for additional information on including proprietary or privileged information.

**Supplementary Documents**

In the Supplementary Documents section, upload the following information where relevant:

- (REQUIRED) A list of all organizations involved in the project, together with their roles within the project and the levels of funding.
- Letters of collaboration from individuals who are described in the Project Description as involved in the project in a senior capacity but who are not members of the lead proposing organization, or from representatives of organizations collaborating with the lead organization, are allowable, as described in the PAPPG Chapter II.C.2.d(iv). **Note that letters of endorsement should not be included in proposals.**

  Any substantial collaboration with individuals not included in the budget should be described in the Facilities, Equipment and Other Resources section of the proposal (see PAPPG Chapter II.C.2.i) and documented in a letter of collaboration from each collaborator. Such letters should be provided in the Supplementary Document section of the FastLane Proposal Preparation Module and follow the format instructions specified in PAPPG Chapter II.C.2.j. Collaborative activities that are identified in the budget should follow the instructions in PAPPG Chapter II.D.3.

## B. Budgetary Information

**Cost Sharing:**

Inclusion of voluntary committed cost sharing is prohibited.

**Other Budgetary Limitations:**

Budgets for proposals to all tracks must include funds to support project staff travel to PI meetings held twice per year.

The year one budget should include all start-up costs and transition activities from XSEDE, XMS, or other related coordination services.

## C. Due Dates

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

  June 16, 2021

## D. FastLane/Research.gov/Grants.gov Requirements

**For Proposals Submitted Via FastLane or Research.gov:**

To prepare and submit a proposal via FastLane, see detailed technical instructions available at: https://www.fastlane.nsf.gov/a1/newstan.htm. 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/ProposalPreparationandSubmission.html. For FastLane or Research.gov user support, call the FastLane and Research.gov Help Desk at 1-800-673-6188 or e-mail fastlane@nsf.gov or rgov@nsf.gov. The FastLane and Research.gov Help Desk answers general technical questions related to the use of the FastLane and Research.gov systems. 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 the NSF FastLane system for further processing.

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

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

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

## A. Merit Review Principles and Criteria

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

**1. Merit Review Principles**

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

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

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

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

**2. Merit Review Criteria**

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

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

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

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

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

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

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

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

**Additional Solicitation Specific Review Criteria**

Please note that each of the five service tracks has an associated set of requirements detailed in the body of the solicitation, including defined roles and responsibilities for the services, and specific requirements to interface operationally with one or more other defined ACCESS services and with a coordination function to be organized by NSF separately from this solicitation.

Reviewers will be asked to assess the quality and viability of the track-specific plans required in the Project Description (these are described in Section V.A. *Proposal Preparation Instructions* above):

**Track 1: Allocation Services**

- Allocation Services Plan
- Innovative Pilots Plan
- Service Model

**Track 2: End User Support Services**

- General User Assistance Plan
- Allocation and Utilization Assistance Plan
- End User Training Plan
- Computational Science Support Network Development Plan

**Track 3: Operations and Integration Services**

- Operational Support Plan
- Data and Networking Support Plan
- Cybersecurity Plan

**Track 4: Monitoring and Measurement Services**

- M&M Operations Plan
- Service Model
- Data Analytics Framework

**Track 5: Technology Translation Services**

- Operations Plan
- Technology Translation Pipeline

## B. Review and Selection Process

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

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

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

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

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

# VII. AWARD ADMINISTRATION INFORMATION

## A. Notification of the Award

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

## B. Award Conditions

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

*These documents may be accessed electronically on NSF's Website at https://www.nsf.gov/awards/managing/award_conditions.jsp?org=NSF. Paper copies may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-8134 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.

**Special Award Conditions:**

Awards made as a result of this competition will be governed by cooperative agreements, which will contain project-specific and ACCESS program-wide conditions agreed upon by the awardee and NSF at time of award. These conditions may include:

- Development of a Project Execution Plan containing items such as a Work Breakdown Structure (WBS), risk register, project schedule, description of project governance mechanisms, relevant performance metrics, etc.;
- Regular interactions with the ACO to be funded by NSF via a separate ACO solicitation; and
- External oversight activities developed in coordination with the ACO, such as evaluation and advisory board activities.

## 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.

Additional reporting requirements may apply. Such requirements will be negotiated with the PI institution prior to award and will be incorporated into the special terms and conditions of the award.

# 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:

- Robert B. Chadduck, Program Director, CISE/OAC, telephone: (703) 292-2247, email: rchadduc@nsf.gov
- Alejandro Suarez, Associate Program Director, CISE/OAC, telephone: (703) 292-7092, email: alsuarez@nsf.gov

For questions related to the use of FastLane or Research.gov, contact:

- FastLane and Research.gov Help Desk: 1-800-673-6188
- FastLane Help Desk e-mail: fastlane@nsf.gov
- 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.E.6 for instructions regarding preparation of these types of proposals.

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

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

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

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

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

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

  or telephone: (703) 292-8134
- **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 awardees will be used for program evaluation and reporting within the Executive Branch and to Congress. The information requested may be disclosed to qualified reviewers and staff assistants as part of the proposal review process; to proposer institutions/grantees to provide or obtain data regarding the proposal review process, award decisions, or the administration of awards; to government contractors, experts, volunteers and researchers and educators as necessary to complete assigned work; to other government agencies or other entities needing information regarding applicants or nominees as part of a joint application review process, or in order to coordinate programs or policy; and to another Federal agency, court, or party in a court or Federal administrative proceeding if the government is a party. Information about Principal Investigators may be added to the Reviewer file and used to select potential candidates to serve as peer reviewers or advisory committee members. See 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:

Suzanne H. Plimpton
Reports Clearance Officer
Policy Office, Division of Institution and Award Support
Office of Budget, Finance, and Award Management
National Science Foundation
Alexandria, VA 22314