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Future Manufacturing (FM)

PROGRAM SOLICITATION
NSF 22-568

REPLACES DOCUMENT(S):
NSF 21-564

National Science Foundation

Directorate for Engineering

Directorate for Mathematical and Physical Sciences

Directorate for Biological Sciences

Directorate for Education and Human Resources

Directorate for Computer and Information Science and Engineering

Directorate for Social, Behavioral and Economic Sciences

Office of International Science and Engineering

Office of Integrative Activities

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

May 10, 2022

IMPORTANT INFORMATION AND REVISION NOTES

Revision Notes

Descriptions of the three thrust areas have been revised.

Required sections for proposals in the two tracks have been revised. Please see "Proposal Preparation Instructions" below.

An informational webinar will be held February 25, 2022. Please see further information below.

Important Information

Innovating and migrating proposal preparation and submission capabilities from FastLane to Research.gov is part of the ongoing NSF information technology modernization efforts, as described in Important Notice No. 147. In support of these efforts, research proposals submitted in response to this program solicitation must be prepared and submitted via Research.gov or via Grants.gov, and may not be prepared or submitted via FastLane.

Any proposal submitted in response to this solicitation should be submitted in accordance with the revised *NSF Proposal & Award Policies & Procedures Guide* (PAPPG) (NSF 22-1), which is effective for proposals submitted, or due, on or after October 4, 2021.

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Future Manufacturing (FM)

Synopsis of Program:

The global manufacturing ecosystem has evolved dramatically in recent decades, driven by forces of technology and globalization and steered by the pursuit of greater efficiencies at scale. The Strategy for American Leadership in Advanced Manufacturing states that worldwide competition in manufacturing has been dominated in recent decades by the maturation, commoditization, and widespread application of computation in production equipment and logistics, effectively leveling the global technological playing field and placing a premium on low

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wages and incremental technical improvements.   The *next* generation of technological competition in manufacturing will be dictated by a combination of the use of computation to ensure the reliable translation of product designs to manufacturing plans; process controls that provide assurances that the execution of those plans will produce products that meet specifications; inventions of new materials, chemicals, devices, systems, processes, machines, and design and work methods; and new social structures and business practices. Fundamental research will be required in robotics, artificial intelligence, biotechnology, chemical conversion processes, materials science, sustainability, education and public policy, and workforce development to lead this global competition.

The goal of Future Manufacturing is to support fundamental research and education of a future workforce to overcome scientific, technological, educational, economic, and social barriers in order to catalyze new manufacturing capabilities that do not exist today. Future Manufacturing imagines manufacturing decades into the future. It supports research and education that will enhance U.S. leadership in manufacturing by providing new capabilities for established companies and entrepreneurs, by improving our health, quality of life, and national security, by expanding job opportunities to a diverse STEM workforce, and by reducing the impact of manufacturing on the environment. At the same time, Future Manufacturing enables new manufacturing that will address urgent social challenges arising from climate change, global pandemics and health disparities, social and economic divides, infrastructure deficits of marginalized populations and communities, and environmental sustainability.

Future Manufacturing will require creative convergent approaches in science, technology and innovation, empirical validation, and education and workforce development. It will benefit from cross-disciplinary partnerships among scientists, mathematicians, engineers, social and behavioral scientists, and experts in arts and humanities to provide solutions that are equitable and inclusive.

Future Manufacturing will require major advances in technologies for the synthesis and production of new materials chemicals, devices, components and systems of assured quality with high yield at reasonable cost. It will require new advances in artificial intelligence and machine learning, new cyber infrastructure, new approaches for mathematical and computational modeling, new dynamics and control methodologies, new ways to integrate systems biology, synthetic biology and bioprocessing, and new ways to influence the economy, workforce, human behavior, and society.

Among this array of technologies and potential research subjects, three thrust areas have been identified for support in FY 2022 under this solicitation:

Future Cyber Manufacturing Research,

Future Eco Manufacturing Research, and

Future Biomanufacturing Research.

This solicitation seeks proposals to perform fundamental research to enable new manufacturing capabilities in one or more of these thrust areas.

This solicitation will support the following two award tracks:

Future Manufacturing Research Grants (FMRG) - up to $3,000,000 for up to four years; and

Future Manufacturing Seed Grants (FMSG) - up to $500,000 for up to two years.

Interdisciplinary teams commensurate with the scope of the proposed research, education plan, and budget are required. Proposals must include demonstrated expertise among the team members to carry out the proposed research, education, and workforce development activities. The use of a convergence approach is expected[2]. Teams including minority-serving institutions, primarily undergraduate institutions, and community colleges are especially encouraged.

The goal of this solicitation is to enable new manufacturing that represents a significant change from current practice. Therefore, proposers responding to this solicitation must include within the Project Description a section titled **Enabling Future Manufacturing**. Please see "Proposal Preparation Instructions" for additional details.

Realization of the benefits of the fundamental research supported under this solicitation will require the simultaneous education of a skilled technical workforce that can transition new discoveries into U.S. manufacturing companies. The National Science Board has recently emphasized this perspective in its report, "THE SKLLED TECHNICAL WORKFORCE: Crafting America's Science and Engineering Enterprise."[3] Therefore, proposers responding to this solicitation must include a plan to equip students and upskill the workforce to enable Future Manufacturing. Please see "Full Proposal Preparation Instructions" for additional details.

FURTHER INFORMATION: An informational webinar will be held on **February 25, 2022 from 1:00-2:00 PM EST** to discuss the Future Manufacturing program and answer questions about this solicitation. Details about how to join this webinar will be posted at https://www.nsf.gov/events/event_summ.jsp?cntn_id=304116&org=NSF. A recording and transcript will be posted there soon after the webinar is held.

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[1] https://trumpwhitehouse.archives.gov/wp-content/uploads/2018/10/Advanced-Manufacturing-Strategic-Plan-2018.pdf

[2] https://www.nsf.gov/od/oia/convergence/index.jsp

[3] https://www.nsf.gov/nsb/publications/2019/nsb201923.pdf

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.

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- Ralph F. Wachter, Program Director, (CISE/CNS), telephone: (703) 292-8950, email: rwachter@nsf.gov

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

- 47.041 --- Engineering
- 47.049 --- Mathematical and Physical Sciences
- 47.070 --- Computer and Information Science and Engineering
- 47.074 --- Biological Sciences
- 47.075 --- Social Behavioral and Economic Sciences
- 47.076 --- Education and Human Resources
- 47.079 --- Office of International Science and Engineering
- 47.083 --- Office of Integrative Activities (OIA)

Award Information

Anticipated Type of Award: Standard Grant or Continuing Grant

Estimated Number of Awards: 22

In FY 2022, depending on the quality of submissions and the availability of funds:

- approximately 8 FMRG will be awarded as Standard Grants or Continuing Grants for a period up to four years; and
- approximately 14 FMSG will be awarded as Standard Grants or Continuing Grants for a period up to two years.

Proposals Involving Multiple Organizations. The Proposal & Award Policies & Procedures Guide (PAPPG) describes two kinds of collaborative proposal formats. This solicitation allows only a single proposal submission with subawards administered by the lead organization (Chapter II.D.3.a). For proposals involving multiple organizations, a lead organization must submit a proposal that describes the entire project. Funds may be distributed to other participating organizations as subawards from the lead organization. A budget on the standard NSF budget form and budget justification should be included for each subawardee. Separately submitted collaborative proposals will be returned without review.

Anticipated Funding Amount: $30,500,000 Estimated program budget, number of awards and average award size/duration are subject to the availability of funds.

Eligibility Information

Who May Submit Proposals:

The categories of proposers eligible to submit proposals to the National Science Foundation are identified in the *NSF Proposal & Award Policies & Procedures Guide* (PAPPG), Chapter I.E. Unaffiliated individuals are not eligible to submit proposals in response to this solicitation.

Who May Serve as PI:

There are no restrictions or limits.

Limit on Number of Proposals per Organization:

There are no restrictions or limits.

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

An investigator may be a PI, co-PI or Senior Personnel on only one proposal in each track (FMRG and FMSG). In the event that an investigator exceeds this limit, proposals received within the limit will be accepted based on earliest date and time of proposal submission. The remainder will be returned without review. This limitation includes proposals submitted by a lead organization and any subawards included as part of a proposal involving multiple institutions.

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 10, 2022

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.

TABLE OF CONTENTS

I. INTRODUCTION

Future Manufacturing is a cross-directorate program supported by NSF's Directorates for Engineering (ENG), Mathematical and Physical Sciences (MPS), Biological Sciences (BIO), Education and Human Resources (EHR), Computer and Information Science and Engineering (CISE), and Social, Behavioral, and Economic Sciences (SBE), the Office of International Science and Engineering (OISE) and the Office of Integrative Activities (OIA).

Future Manufacturing program supports fundamental research and education that will enable new manufacturing approaches to eliminate scientific technological, educational, economic, and social barriers that limit current manufacturing. Future Manufacturing will complement existing efforts, supported by NSF and other federal agencies, in advanced manufacturing, but the focus of this program is to enable new, potentially transformative, manufacturing capabilities rather than to improve current manufacturing. Proposals that are incremental improvements over existing advanced manufacturing technologies will not be competitive.

Proposals should provide examples of how the research results could lead to transformational manufacturing advances that address significant problems. They should provide a vision statement describing the new manufacturing capabilities that could be enabled by the proposed research, and the potential industrial, economic, and societal benefits. They should also describe the implications of the proposed activities on the education of the skilled technical workforce.

Future Manufacturing will involve the production of new materials, chemicals, devices and systems, new chemical and biological processes, new semiconductor manufacturing techniques, novel domestic and local manufacturing processes to reduce supply chain risk, new methods to make manufacturing commercially viable at scale, new approaches, integration of manufacturing processes in novel ways, new mathematical and computational methods for process design and control, new secured integrated system tools for sensing and control in manufacturing processes, new data mining and predictive analytics for manufacturing, and new modalities of work. Results will help the manufacturing enterprise minimize environmental impact, manage waste, optimize the use of resources, and speed the product evolution cycle.

The results of the Future Manufacturing program, when translated to practice, should lead to the formation of new industries and organization structures, enable new manufacturing capabilities among a broad range of producers, enhance U.S. competitiveness in the development and production of new products, bolster economic growth, benefit society at large, and educate students and workforce participants with the skills required for leadership in Future Manufacturing.

Future Manufacturing proposals in both tracks should demonstrate the need for sustained support of a multidisciplinary team using a convergence research approach. Inclusion of minority-serving institutions, primarily undergraduate institutions (PUI) and community colleges is especially encouraged. Proposals must describe how the project team is appropriate to realize the project's goals, how activities of a multidisciplinary team are well-integrated throughout the project, and how the team will assure effective collaboration. A compelling rationale must be presented for a multi-institution structure of the project, if appropriate. Please see "Full Proposal Preparation Instructions" for additional details.

Proposals may take advantage of significant efforts underway to improve the nation's manufacturing capabilities. For example, proposals may leverage activities of other manufacturing initiatives such as the Manufacturing USA Institutes, NSF's Engineering Research Centers, EPSCoR-supported advanced manufacturing research collaborations, and NSF's manufacturing-focused Industry-University Cooperative Research Centers.

Educational efforts are encouraged to leverage, interface with, or adapt aspects of proven NSF funding opportunities such as Non-Academic Research Internships for Graduate Students (INTERN), Advanced Technological Education (ATE), Improving Undergraduate STEM Education (IUSE), Established Program to Stimulate Competitive Research (EPSCoR), Research Experiences for Undergraduates (REU), Research Experiences for Teachers (RET), Research in the Formation of Engineers (RFE), Professional Formation of Engineers: Research Initiation in Engineering Formation (PFE: RIEF), NSF Research Traineeship (NRT) and Revolutionizing Engineering Departments (IUSE/PFE: RED).

II. PROGRAM DESCRIPTION

This Future Manufacturing solicitation will support fundamental research and education in the following two tracks:

Future Manufacturing Research Grants (FMRG)

Awards in this track will support fundamental, multidisciplinary, and integrative research and education to enable Future Manufacturing in one or more of the thrust areas described below. FMRG funding is intended to provide support for several principal investigators with complementary expertise, graduate students, senior personnel (including post-doctoral researchers), their collective research needs (e.g., materials, supplies and travel) and educational activities. The integrative contributions of the team should clearly be greater than the sum of the contributions of each individual member of the team.

FMRG proposals must describe the current state of art in the relevant manufacturing area and the specific challenges that will be addressed by the proposed research. They must present a compelling technical rationale and convincing technical approach to enable Future Manufacturing to address these challenges. An essential part of this argument is to explain clearly how the proposed research will overcome barriers that limit current manufacturing to provide new manufacturing capabilities not currently available and how that will transform manufacturing practice. Proposals must include a prospective vision for translation of fundamental research results to manufacturing practice, even if that translation is not part of the proposed research. They must explain the potential benefits and challenges of new manufacturing to the economy, communities and to society as a whole.

Future Manufacturing Seed Grants (FMSG)

Awards in this track will provide support to stimulate fundamental research and education in one or more of the thrust areas described below through multidisciplinary team-building, the exploration of new fundamental research concepts or approaches, and the initiation of research and educational activities that could provide the basis for a subsequent proposal for an FMRG.

FMSG proposals should describe the building of multidisciplinary research teams that will engage community stakeholders to develop new directions in Future Manufacturing. Proposals must describe innovative and creative methods to establish new research directions and plans to demonstrate their feasibility. A variety of activities may be proposed, including pilot research projects to obtain preliminary results that could strengthen a proposal to a future solicitation, workshops, development of new partnerships, benchmarking current manufacturing capabilities on a global scale, and prototyping new educational activities. Proposals should demonstrate the composition of the multidisciplinary team is appropriate for the scope of proposed activities. The Broader Impacts section of FMSG proposals should explain how proposed educational activities will equip students and workforce participants with skills to engage in Future Manufacturing, how proposed activities will benefit the economy, labor force, and industry and society at large.

Considerations for Proposals in Both Tracks

Successful proposals in both tracks will reflect interdisciplinary convergence research to enable new manufacturing capabilities, innovative education and workforce development plans, and research into the benefits and challenges of new manufacturing to communities, the economy, and society. Proposals in both tracks will be reviewed by experts in the subject area of each proposal and may be reviewed by experts engaged to evaluate the educational and societal aspects of the proposal.

Future Manufacturing supports multidisciplinary teams with the necessary depth and breadth to explore transformative and convergent approaches addressing manufacturing challenges. This strategy toward manufacturing research and education, its emphasis on teaming, and its focus on the long-term distinguish Future Manufacturing from complementary programs at NSF.

International collaborations in both tracks are welcome, and proposers may take advantage of opportunities provided by existing NSF programs that promote international collaborations; NSF funds should be used to support only U.S.-based participants in any international collaboration.

New materials and new processes may be inextricably linked in some applications of Future Manufacturing. If new materials are involved in Future Manufacturing activities, proposals must address explicitly the coupling between those new materials and new processes that will be required to produce them and should focus on the manufacturing aspects of the process/structure/property relationship.

Partnerships with industry, including GOALI proposals, are encouraged in proposals in both tracks. When industrial collaborators are involved, the proposal must contain a rationale for the collaboration, an explanation of the industrial collaborators' contributions and responsibilities to the project, and a description of how the collaboration will be managed. The proposal must contain a letter of collaboration from each industrial organization participating in the project that specifies the tasks that the industrial partner will carry out. GOALI proposals must be prepared in accordance with the guidance provided in Chapter II.E.4 of the PAPPG.

Future Manufacturing projects are particularly encouraged to engage with two-year educational institutions.

To take advantage of potential synergies among activities supported by awards, a Future Manufacturing kickoff meeting will be held within three months of the award issuances. Awardees in both tracks will present their research and educational plans, discuss community engagement, and explore strategies to build research and education communities in Future Manufacturing. Every PI and co-PI from all participating institutions is required to attend the kickoff meeting, and proposers should include costs of participating in their budgets.

There will also be an annual grantees' conference for sharing of successes, challenges, and future plans, and for NSF program officers to review progress. At least one PI and one co-PI from each award will be required to attend, and all PIs and co-PIs will be encouraged to participate. Proposers should include costs of participating in their budgets.

This solicitation focuses on three thrust areas described below. Proposals should address Future Manufacturing in one or more of the thrust areas. *The discussion of each thrust area is not intended to be limiting, and examples mentioned in each area are not intended to indicate any special interest on the part of NSF in the example topics. They are presented only to illustrate possible considerations in each thrust area.*

Future Cyber Manufacturing Research

Future cyber manufacturing exploits research opportunities at the intersection of computing and manufacturing with the potential to radically transform concepts of manufacturing. It anticipates new abstractions in design and manufacturing, the availability of a data infrastructure that capitalizes on the convergence of innovative sensors, actuators, devices and systems; low-latency and reliable secure sensing and communications; cloud and edge computing; data analytics; mathematical and computational modeling; uncertainty quantification and risk analysis; advanced controls; and artificial intelligence and machine learning to increase the generality and reliability and reduce the expense of manufacturing processes and system control. Recent advances in machine learning and predictive analytics, autonomy, wireless communications, cyber-physical-human systems, the industrial internet of things, and advanced computing systems and services provide powerful incentives to rethink, reconceptualize, reinvent, and explore new possibilities for manufacturing.

Future Eco Manufacturing Research

Research in this thrust area will enable holistic manufacturing processes that encompass the entire manufacturing lifecycle and account for energy consumption, health and environmental impact, and cost effectiveness. Fundamental research could enable manufacturing processes that are designed from the start to produce products that degrade naturally or on cue, or can be re-purposed without harmful byproducts and without reliance on technologies that are potentially harmful to the environment and society at large. Research in this thrust area could lead to new processes or synthesis of manufacturable materials, chemicals, devices, systems, and products that enable facile and direct re-purpose, reuse, or up-cycling into environmentally benign products. The goal of such research in eco manufacturing is to keep resources in use as long as possible, extract their maximum value while in use, and recover materials at the end of their service life.

Future Biomanufacturing Research

Research in this thrust area will enable biologically based production of therapeutic cells and molecules, chemicals, pharmaceuticals, materials, polymers, and fuels, as well as bio-based technologies for computing, signal processing and communication. Fundamental research to enable new biomanufacturing will expand knowledge in biology and engineering to create products that interact effectively and seamlessly with cells, living tissues, and synthetic substrates. In addition, the seamless integration of new biological knowledge with manufacturing technology during product and process development may overcome longstanding barriers to scalability of new types of biomanufacturing platforms. Research should uncover and exploit fundamental biological principles to address scaling challenges in biomanufacturing that will facilitate rapid transition from benchtop to production readiness. Research in this thrust area may complement and leverage advances at NSF centers for biomanufacturing and has the potential to enable new biomanufacturing paradigms that can benefit personalized healthcare, sustainable energy, environmental sustainability, and society at large.

III. AWARD INFORMATION

Anticipated Type of Award: Continuing Grant or Standard Grant

Estimated Number of Awards: 22

In FY 2022, depending on the quality of submissions and the availability of funds:

- approximately 8 FMRG will be awarded as Standard Grants or Continuing Grants for a period up to four years; and
- approximately 14 FMSG will be awarded as Standard Grants or Continuing Grants for a period up to two years.

Proposals Involving Multiple Organizations. The Proposal & Award Policies & Procedures Guide (PAPPG) describes two kinds of collaborative proposal formats. This solicitation allows only a single proposal submission with subawards administered by the lead organization (Chapter II.D.3.a). For proposals involving multiple organizations, a lead organization must submit a proposal that describes the entire project. Funds may be distributed to other participating organizations as subawards from the lead organization. A budget on the standard NSF budget form and budget justification should be included for each subawardee. Separately submitted collaborative proposals will be returned without review.

Anticipated Funding Amount: $30,500,000

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:

The categories of proposers eligible to submit proposals to the National Science Foundation are identified in the *NSF Proposal & Award Policies & Procedures Guide* (PAPPG), Chapter I.E. Unaffiliated individuals are not eligible to submit proposals in response to this solicitation.

Who May Serve as PI:

There are no restrictions or limits.

Limit on Number of Proposals per Organization:

There are no restrictions or limits.

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

An investigator may be a PI, co-PI or Senior Personnel on only one proposal in each track (FMRG and FMSG). In the event that an investigator exceeds this limit, proposals received within the limit will be accepted based on earliest date and time of proposal submission. The remainder will be returned without review. This limitation includes proposals submitted by a lead organization and any subawards included as part of a proposal involving multiple institutions.

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.

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 title of the proposal must be preceded by the prefix "FMRG:" for Future Manufacturing Research Grants or "FMSG:" for Future Manufacturing Seed Grants, followed by the prefix that identifies the major thrust area of the proposal - "Cyber:" for Cyber manufacturing, "Eco:" for Eco manufacturing or "Bio:" for Biomanufacturing.

Required Sections in FMSG and FMRG proposals

In addition to the content specified in the PAPPG, including the requirement for a separate section labeled "Broader Impacts", the Project Description for an FMRG or FMSG proposal must contain the following two subsections:

Research Description: The Research Description section must describe the technical rationale and approach of the proposed activities. It should describe the challenges that drive the research problem. This section should describe the research plan including descriptions of major tasks, the primary organization

responsible for each task, and milestones. It should present metrics for success. This section should also describe major program risks and potential mitigation approaches.

Enabling Future Manufacturing: This section should describe how the proposed fundamental research will enable Future Manufacturing. This section should describe the significant impacts of the proposed research, what field(s) of manufacturing will be transformed, and the major challenges that must be overcome. It should describe how results from the proposed research could be translated to enable new manufacturing and how that manufacturing differs from current practice. This section should describe how the proposal's interdisciplinary research team is equipped to address research aimed at Future Manufacturing. Because the Future Manufacturing program strives to sustain U.S. competitiveness in manufacturing, proposals must include a brief description of the global context for their proposed work that explains what other leading countries are doing in the proposal's area of fundamental research, its translation to manufacturing and/or in future manufacturing advances.

The Project Description for FMRG proposals must contain the following additional two subsections:

Scope and Scale: This section should justify the proposed scope and scale of work. It should explain why the project requires the selected researchers and scope of expertise, why it needs the types and length of time for specific research activities, and how the transferability and scalability of the proposed solutions justify the scale. The section is not intended to be a rehashing of budget justifications, but a discussion of what resources are needed to accomplish the activity and the difference that accomplishing the proposed tasks will make.

Project Management and Collaboration Plan: This section should describe how the project and collaborations will be managed. The plan should identify organizational responsibilities and how the project will be managed, including approaches for meeting project goals. The plan should include: 1) the specific roles of the project participants in all involved organizations; 2) information on how the project will be managed across all the investigators, institutions, and/or disciplines; 3) approaches for integration of research components throughout the project and, 4) identification of the specific coordination mechanisms that will enable cross-investigator, cross-institution and/or cross-discipline integration. The plan should include a Gantt chart that lays out the sequence of activities and identifies the responsible organization for each of them. It should include a description of the milestones to be achieved in the project and evaluation criteria to assess success.

Description of Proposed Education and Workforce Development Activities

An FMSG or FMRG proposal must contain a plan that describes how the proposed research will form a basis for training a new generation in Future Manufacturing, including members of the skilled technical workforce. Commensurate with the scope of the proposal and project budget, the plan may encompass training and/or curricula for a range of future workforce participants, including graduate, undergraduate, and K-12 students; those in technical certification and associate degree programs (technicians); professionals in continuing education; and students in online education programs. The plan could describe how new and incumbent engineers, scientists, and technicians will acquire the required skills to enter the Future Manufacturing workforce. For plans focused on technician education at two-year institutions, faculty from two-year institutions must be included and have a leadership role in the implementation of the plan, and it must be clear how the project will impact the two-year institution's technician education programs.

For FMSG proposals, the Education and Workforce Development planned activities should be integrated into the Project Description.

For FMRG proposals, the planned activities must be described in a section titled "Education and Workforce Development Plan" (maximum three pages) that must be submitted as a Supplementary Document. The FMRG Education and Workforce Development Plan should recognize that convergence research produces a new content domain at the intersection of participating content domains. The plan could describe how training programs and/or curricula will be developed once a new content domain has been identified. The plan could identify evidence-based practices grounded in learning theory (e.g., experiential learning) that are likely to be successful in the new content domain. The plan could define the knowledge, skills, and abilities (KSAs) required to conduct the proposed research beyond those obtained in a traditional curriculum, how students will acquire them. The plan could describe efforts to develop instructional materials and mentoring that will enable faculty to implement the proposed education strategies.

The FMRG project team should have appropriate expertise in specific evidence-based pedagogical approaches and assessment, which should be reflected in the education plan. The plan should describe how the educational activities will be assessed and how the readiness of participants to engage in Future Manufacturing with skills and competencies desired by industry will be evaluated. The assessment plan should include a logic model or other tool that connects the education and workforce development goals and activities to specific outputs and outcomes.

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 10, 2022

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/ProposalPreparationandSubmission.html. For Research.gov user support, call the Research.gov Help Desk at 1-800-673-6188 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 the NSF FastLane system for further processing.

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 *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 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

For FMSG and FMRG proposals:

- How effective and compelling is the proposal's argument that the proposed fundamental research will eliminate barriers that limit manufacturing today and catalyze new manufacturing capabilities?

For FMRG proposals:

- How effective and compelling is the proposal's argument that the proposed educational activities will equip students and other workforce participants with the skills to engage in Future Manufacturing and broaden participation by building on best practices and evidence-based approaches?
- How effectively does the proposal anticipate effects of Future Manufacturing on the economy, labor force, industry and/or society at large, including in a global context?
- Is the composition of the multidisciplinary team appropriate for the scope of the proposed activities, and how effectively are proposed activities integrated among team members?

B. Review and Selection Process

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

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

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

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

signed by the NSF Grants and Agreements Officer does so at their own risk.

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

VII. AWARD ADMINISTRATION INFORMATION

A. Notification of the Award

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

B. Award Conditions

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

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

Awardees will be required to attend the kickoff meeting described above and annual FM grantees' conferences for the duration of their award.

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:

- William Olbricht, Program Director, (ENG/CBET), telephone: (703) 292-4842, email: wolbrich@nsf.gov
- Andrew B. Wells, Program Director, (ENG/CMMI), telephone: (703) 292-7225, email: awells@nsf.gov
- Eyad Abed, Expert, (ENG/ECCS), telephone: (703) 292-2303, email: eabed@nsf.gov
- Jose Colom-Ustariz, Program Director, (OIA), telephone: (703) 292-7088, email: jcolom@nsf.gov

- Dana L. Denick, Program Director, (ENG/EEC), telephone: (703) 292-8866, email: ddenick@nsf.gov
- Bianca Garner, Program Director, (BIO/MCB), telephone: (703) 292-2100, email: bgarner@nsf.gov
- Claudia Gonzalez-Vallejo, Program Director, (SBE/SES), telephone: (703) 292-7836, email: clagonza@nsf.gov
- Nakhiah C. Goulbourne, Program Director, (ENG/CMMI), telephone: (703) 292-7715, email: ngoulbou@nsf.gov
- John Jackman, Program Director, (EHR/DUE), telephone: (703) 292-4816, email: jjackman@nsf.gov
- Eun Heui Kim, Program Director, (MPS/DMS), telephone: (703) 292-2091, email: eukim@nsf.gov
- Bruce M. Kramer, Program Director, Senior Advisor, (ENG/CMMI), telephone: (703) 292-5348, email: bkramer@nsf.gov
- Paul A. Lane, Program Director, (MPS/DMR), telephone: (703) 292-2453, email: plane@nsf.gov
- Jenshan Lin, Program Director, (ENG/ECCS), telephone: (703) 292-7360, email: jenlin@nsf.gov
- Debasis Majumdar, Program Director, (MPS/DMR), telephone: (703) 292-4709, email: dmajumda@nsf.gov
- Elizabeth Mirowski, Program Director, (ENG/IIP), telephone: (703) 292-2936, email: emirowsk@nsf.gov
- Kenneth Moloy, Program Director, (MPS/CHE), telephone: (703) 292-8441, email: kmoloy@nsf.gov
- Erik Pierstorff, Program Director, (ENG/IIP), telephone: (703) 292-2165, email: epiersto@nsf.gov
- Carole J. Read, Program Director, (ENG/CBET), telephone: (703) 292-2418, email: cread@nsf.gov
- Ralph F. Wachter, Program Director, (CISE/CNS), telephone: (703) 292-8950, email: rwachter@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.

General inquiries regarding this program should be made to futuremanufacturing@nsf.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**   (703) 292-5111
  (NSF Information Center)**:**

- **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

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