Designing Materials to Revolutionize and Engineer our Future (DMREF)

PROGRAM SOLICITATION
NSF 21-522

REPLACES DOCUMENT(S):
NSF 19-516

National Science Foundation

Directorate for Mathematical and Physical Sciences
    Division of Materials Research
    Division of Chemistry
    Division of Mathematical Sciences

Directorate for Engineering
    Division of Civil, Mechanical and Manufacturing Innovation
    Division of Electrical, Communications and Cyber Systems
    Division of Chemical, Bioengineering, Environmental and Transport Systems

Directorate for Computer and Information Science and Engineering
    Office of Advanced Cyberinfrastructure
    Division of Computer and Network Systems
    Division of Information and Intelligent Systems

Air Force Research Laboratory

Air Force Office of Scientific Research

Submission Window Date(s) (due by 5 p.m. submitter's local time):

    January 11, 2021 - January 25, 2021

IMPORTANT INFORMATION AND REVISION NOTES

This document replaces Program solicitation NSF 19-516.

Revisions from NSF 19-516 include:

1. The submission window (January 11-25) ends ten days earlier than in 2019 and is one week longer in duration.
2. The Division of Chemistry is participating in the 2021 DMREF competition. The Division of Computing and Communication Foundations is not participating in this competition.
3. The Air Force Research Laboratory (AFRL), including the Air Force Office of Scientific Research (AFOSR), will participate in the 2021 DMREF competition.
4. DMREF recognizes the importance of partnerships among universities, industries (e.g. Grant Opportunities for Academic Liaison with Industry - GOALI), Federal Agencies, and National and Federal Laboratories.
5. Where appropriate (i.e., depending on where a proposed project lies along the Materials Development Continuum), DMREF proposals should consider the feasibility of deployment of new materials and address the scientific questions relevant to their processing and manufacture.
6. The list of Cognizant Program Officers was updated.
7. Specific strategic potential application areas have not been defined for this competition. DMREF aligns with national priorities and continues to be open to all areas of materials research.
8. Additional requirements have been included for proposal preparation related to the Data Management Plan. Review guidance is provided on evaluating Data Management Plans.
9. Proposals may now include requests for cloud computing resources through an external cloud access entity supported by NSF's Enabling Access to Cloud Computing Resources for CISE Research and Education (Cloud Access) Program. Cloud Access replaces the cloud credit mechanism used in the previous DMREF solicitation.
10. The award size had been increased from $1,000,000 - $1,750,000 to $1,200,000 – $1,800,000 over a duration of four years.

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:

Designing Materials to Revolutionize and Engineer our Future (DMREF)

Synopsis of Program:

DMREF is the primary program by which NSF participates in the Materials Genome Initiative (MGI) for Global Competitiveness. MGI recognizes the importance of materials science and engineering to the well-being and advancement of society and aims to "deploy advanced materials at least twice as fast as possible today, at a fraction of the cost." MGI integrates materials discovery, development, property optimization, and systems design with a shared computational framework. This framework facilitates collaboration and coordination of research activities, analytical tools, experimental results, and critical evaluation in pursuit of the MGI goals. Consistent with the MGI Strategic Plan, DMREF highlights four sets of goals:

- Leading a culture shift in materials science and engineering research to encourage and facilitate an integrated team approach;
- integrating experimentation, computation, data-intensive/-driven approaches, and theory, and equipping the materials science and engineering communities with advanced tools and techniques;
- making digital data findable, accessible, interoperable, and reusable, and useful to the community; and
- creating a world-class materials science and engineering workforce that is trained for careers in academia or industry.

DMREF will accordingly support activities that significantly accelerate materials discovery and development by building the fundamental knowledge base needed to advance the design and development of materials with desirable properties or functionality. This will be accomplished through forming interdisciplinary teams of researchers working synergistically in a "closed loop" fashion, building a vibrant research community, leveraging data science, providing ready access to materials data, and educating the future MGI workforce. Achieving this goal could involve some combination of:

- strategies to advance materials design through testing methodology;
- theory, modeling, and simulation to predict behavior or assist in analysis of multidimensional input data; and
- validation through synthesis, growth, processing, characterization, and/or device demonstration.

This FY 2021 solicitation is open to all materials research topics. DMREF aligns with the President's Council of Advisors on Science and Technology (PCAST) recommendations for strengthening American leadership in Industries of the Future, namely, artificial intelligence (AI), quantum information science, advanced manufacturing, advanced communications, and biotechnology. Furthermore, DMREF aligns with national priorities for defense and homeland security, information technologies and high-performance computing, critical minerals and sustainability, human health and welfare, clean energy, and the development of a diverse science, technology, engineering, and mathematics (STEM) workforce. By facilitating interdisciplinary integrative materials research, DMREF is supportive of the NSF long-range transformative agenda, "Big Ideas for Future NSF Investments".

This solicitation represents a crosscutting activity involving the Directorates for Mathematical and Physical Sciences (MPS), Engineering (ENG), and Computer & Information Science & Engineering (CISE). Additionally, partnership with other federal agencies, specifically the Air Force Research Laboratory (AFRL), including the Air Force Office of Scientific Research (AFOSR), may lead to an interagency effort. Submitted proposals may be shared with interested representatives from AFRL and AFOSR.

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.

- John Schlueter, Team Lead, MPS/DMR, telephone: (703) 292-7766, email: jschluet@nsf.gov

- Peter Anderson, MPS/DMR, telephone: (703) 292-4507, email: peanders@nsf.gov

- Bryan Boudouris, telephone: (703) 292-7951, email: bboudour@nsf.gov

- Marian Bocea, MPS/DMS, telephone: (703) 292-2595, email: mbocea@nsf.gov

- James Donlon, CISE/IIS, telephone: (703) 292-8074, email: jdonlon@nsf.gov

- Yuliya Gorb, MPS/DMS, telephone: (703)292-2113, email: ygorb@nsf.gov

- Ruyan Guo, ENG/ECCS, telephone: (703) 292-8339, email: rguo@nsf.gov

- Tevfik Kosar, CISE/OAC, telephone: (703) 292-7992, email: tkosar@nsf.gov

- Thomas Kuech, ENG/CMMI, telephone: (703)292-2218, email: tkuech@nsf.gov

- Robert McCabe, ENG/CBET, telephone: (703) 292-4826, email: rmccabe@nsf.gov

- Siddiq Qidwai, ENG/CMMI, telephone: (703) 292-2211, email: sqidwai@nsf.gov

- Shahab Shojaei-Zadeh, ENG/CBET, telephone: (703) 292-8045, email: sshojaei@nsf.gov

- Suk-Wah Tam-Chang, MPS/CHE, telephone: (703) 292-8684, email: stamchan@nsf.gov

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

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

- 12.800 --- Air Force Office of Scientific Research
- 12.800 --- Air Force Research Laboratory
- 47.041 --- Engineering
- 47.049 --- Mathematical and Physical Sciences
- 47.070 --- Computer and Information Science and Engineering

Award Information

Anticipated Type of Award: Standard Grant

Estimated Number of Awards: 25

The number of awards will depend on the availability of funds and the quality of the proposals.

Anticipated Funding Amount: $40,000,000

Anticipated funding amount is pending availability of funds.

These funds will be partitioned among the participating Divisions (funds are not pooled), each of which will support proposals of scientific interest to that Division. Proposals on topics situated at the boundaries between two or more Divisions may be co-reviewed by those Divisions. Such proposals, if highly ranked, will be eligible for co-funding by those Divisions.

Eligibility Information

Who May Submit Proposals:

Proposals may only be submitted by the following:

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

Who May Serve as PI:

There are no restrictions or limits.

Limit on Number of Proposals per Organization:

There are no restrictions or limits.

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

No individual may appear as Senior Personnel (PI, Co-PI, Faculty or Other Senior Personnel) on more than one DMREF proposal submitted in response to this solicitation. In the event that an individual exceeds this limit, any DMREF proposal submitted to this solicitation with this individual listed as Senior Personnel after the first DMREF proposal is received at NSF will be returned without review. 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 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

- **Submission Window Date(s)** (due by 5 p.m. submitter's local time):

  January 11, 2021 - January 25, 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:

Standard NSF award conditions apply.

Reporting Requirements:

Standard NSF reporting requirements apply.

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I. INTRODUCTION

DMREF is the primary program by which NSF participates in the Materials Genome Initiative (MGI) for Global Competitiveness. MGI recognizes the importance of materials science and engineering to the well-being and advancement of society and aims to "deploy advanced materials at least twice as fast as possible today, at a fraction of the cost." MGI integrates materials discovery, development, property optimization, and systems design with a shared computational framework. This framework facilitates collaboration and coordination of research activities, analytical tools, experimental results, and critical evaluation in pursuit

of the MGI goals. Consistent with the MGI Strategic Plan, DMREF highlights four sets of goals:

Leading a culture shift in materials science and engineering research to encourage and facilitate an integrated team approach;

integrating experimentation, computation, data-intensive/-driven approaches, and theory, and equipping the materials science and engineering communities with advanced tools and techniques;

making digital data findable, accessible, interoperable, and reusable, and useful to the community; and

creating a world-class materials science and engineering workforce that is trained for careers in academia or industry.

II. PROGRAM DESCRIPTION

DMREF will support activities that significantly accelerate materials discovery and development by building the fundamental knowledge base needed to advance the design and development of materials with desirable properties or functionality. This will be accomplished through forming interdisciplinary teams of researchers working synergistically in a "closed loop" fashion, building a vibrant research community, leveraging data science, providing ready access to materials data, and educating the future MGI workforce. Achieving this goal could involve some combination of:

strategies to advance materials design through testing methodology;

theory, modeling, and simulation to predict behavior or assist in analysis of multidimensional input data; and

validation through synthesis, growth, processing, characterization, and/or device demonstration.

This FY 2021 solicitation is open to all materials research topics. DMREF aligns with the President's Council of Advisors on Science and Technology (PCAST) recommendations for strengthening American leadership in Industries of the Future, namely, artificial intelligence (AI), quantum information science, advanced manufacturing, advanced communications, and biotechnology. Furthermore, DMREF aligns with national priorities for defense and homeland security, information technologies and high-performance computing, critical minerals and sustainability, human health and welfare, clean energy, and the development of a diverse science, technology, engineering, and mathematics (STEM) workforce. By facilitating interdisciplinary integrative materials research, DMREF is supportive of the NSF long-range transformative agenda, "Big Ideas for Future NSF Investments."

Computational efforts will begin at the smallest appropriate length scale, such as electronic, atomic, molecular, nano-, micro-, and meso-scale, possibly informed by chemistry/physics based or statistical models, or augmented by AI methods to provide predictive or fundamental insight that will work effectively in concert with data-intensive, experimental, and theoretical efforts to discover new materials, new states of matter, or advance understanding of materials properties and phenomena and their control through structure, applied fields, or other means. Computational efforts may include models that apply across or at multiple scales of length or time, and may include different chemistry or physics models to capture specific processes or phenomena. Creativity and innovation are encouraged to obtain the maximum predictive power or insight through computation, data-intensive methods, and theory to achieve the goals of DMREF.

DMREF will drive the development of new tools, new infrastructure, and the integration of computation, data analytics, AI, experiment and theory. These include: new data analytics tools and statistical algorithms; advanced simulations of material properties in conjunction with new device functionality; advances in predictive modeling that leverage machine learning (ML), AI, data mining, and sparse approximation; data infrastructure that is accessible, extensible, scalable, and sustainable; the development, maintenance, and deployment of reliable, interoperable, and reusable software for the next-generation design of materials; and new collaborative capabilities for managing large, complex, heterogeneous, distributed data supporting materials design, synthesis, and longitudinal study. DMREF projects should leverage existing cyberinfrastructure wherever appropriate and possible. Examples include, but are not limited to the Open Knowledgebase of Interatomic Models (OpenKIM), The Materials Project, the eXtreme Science and Engineering Discovery Environment (XSEDE), and cyberinfrastructure created through the Cyberinfrastructure for Sustained Scientific Innovation (CSSI). The proposal must provide a plan for comprehensive data management that ensures transparency, data sharing, and open source software, including an explicit statement of which open source license(s) and repositories, if applicable, will be used.

Consideration of the full range of material characteristics, properties, and manufacturing processes needed to attain the desired cost and performance of products is integral to achieving the ultimate goal of MGI. Therefore, the MGI approach also seeks to integrate seamlessly computation, experiment, and data to predict and control manufacturing process parameters to produce high-performance materials and products at low cost, thus fueling the successful discovery of new materials and their rapid deployment and incorporation into manufactured products. MGI contributes to American leadership in advanced manufacturing by supporting cross-sector and cross-disciplinary collaborations that open new avenues for innovation in efficiently solving national challenges through fundamental scientific research on the processing and manufacture of new materials and their incorporation into products and devices. Where appropriate (i.e., depending on where a proposed project lies along the Materials Development Continuum), DMREF projects should consider the feasibility of deployment of new materials, the scientific questions relevant to their processing and manufacture, and/or the fundamental research needed to revitalize American manufacturing, promote national prosperity, and educate a skilled workforce.

Broader impacts associated with DMREF projects encompass both the scientific impact on society and the development of human resources. DMREF aligns with America's Strategy for STEM Education. Building a world-class materials science and engineering workforce proficient in the tools and techniques necessary to accelerate the discovery, development, and deployment of advanced materials is one of the four pillars of the MGI Strategic Plan. Students who will go on to become experts in materials synthesis, processing, or manufacture must have enough training to understand materials modeling and theory, while modelers and theorists must understand the vocabulary and challenges of those who make, characterize and implement materials solutions. In light of DMREF's emphasis on an integrated approach to materials science and engineering research, cross-disciplinary educational and public outreach activities are encouraged. As such, proposals are strongly encouraged to describe substantial efforts to enhance the development of a next-generation workforce that is prepared to advance materials science and engineering research with an integrated approach consistent with the aims of the MGI. A 2019 Report addresses the strategic plan's goals for education and training initiatives which are critical for achieving MGI's national objectives.

The MGI Strategic Plan recognizes the importance of partnerships among universities, industries, Federal Agencies, and National and Federal Laboratories to provide opportunities for real world experience in applying the MGI approach. DMREF projects may benefit from collaboration with MGI-related efforts sponsored by the NSF, including the Materials Innovation Platforms, and federal MGI partners. While not required, ties with industry, national laboratories, and/or NSF-supported facilities (e.g. National High Magnetic Field Laboratory- NHMFL, ChemMatCARS, and Center for High Energy X-ray Sciences- CHEXS) are encouraged. If there are strong collaborations with industry, Grant Opportunities for Academic Liaison with Industry (GOALI) can be used in conjunction with this effort. Collaborative Proposals involving two or more academic institutions may also be appropriate (PAPPG Chapter II, Section D.3). This solicitation offers

a specific opportunity for DMREF teams to collaborate with activities sponsored by AFRL, including AFOSR.

The DMREF program will support, but is not limited to, efforts that span research in materials, chemistry, physics, mathematics, biology, computer science, and engineering, thereby bridging Program and Divisional interests. Proposal review will be coordinated and funded among the participating NSF Programs and Divisions, as appropriate. The complexity and challenge of activities addressed by this initiative require a transformative interdisciplinary approach to discovering and developing new materials, predicting and optimizing properties of materials, and informing the design of material systems. Accordingly, the proposed research must involve a collaborative and iterative 'closed-loop' process wherein theory guides computational simulation, computational simulation guides experiments, and experimental observation further guide theory. This collaborative and iterative process will require a team of PIs with the requisite expertise. Accordingly, projects proposed to this solicitation will be directed by a team of at least two Senior Personnel with complementary expertise. Strategies must be included in the proposed research to advance knowledge related to materials design through synthesis / growth / processing techniques, characterization / testing methodology, theory / mathematics, data science, and computation / simulation approaches needed to develop reliable predictive computational and/or data models or to assist in simplifying the analysis of multidimensional input data.

PIs should select as the primary Unit of Consideration the participating Division with which the topic of the proposal is most closely aligned. Secondary division(s) may be selected, as appropriate. Awards are expected to range from $1,200,000 – $1,800,000 over a duration of four years.

Subject to the availability of funds, it is anticipated that the DMREF program will continue with competitions biennially in odd-numbered years.

Cloud Computing Resources

Proposals may request cloud computing resources to use public clouds such as Amazon Web Services (AWS), Google Cloud Platform (GCP), Microsoft Azure, and IBM Cloud. Cloud computing resources described in proposals may be obtained through CloudBank (CloudBank.org), an external cloud access entity supported by NSF's Enabling Access to Cloud Computing Resources for CISE Research and Education (Cloud Access) Program.

Proposers should describe the request in a Supplementary Document no longer than two pages with (a) anticipated annual and total costs for accessing the desired cloud computing resources, based on pricing currently available from the public cloud computing providers; (b) which public cloud provider will be used; and (c) a technical description of, and justification for, the requested cloud computing resources. The NSF Budget should not include any such costs for accessing public cloud computing resources via CloudBank.org. The total cost of the project, including this cloud computing resource request from CloudBank.org, may not exceed the budget limit described in this solicitation. Proposers should include "CloudAccess" (one word without space) at the end of the Overview section (before the section on Intellectual Merit) of the Project Summary page if incorporating this request into the proposal. Proposers may contact CloudBank.org (see https://www.cloudbank.org/faq) for consultation on estimating the budget for using cloud computing resources.

Special Instructions for Proposals Selecting the Office of Advanced Cyberinfrastructure (OAC) as a Unit of Consideration

DMREF topics of special interest to OAC include, but are not limited to, software and data components with the potential to:

- Become part of a comprehensive, integrated, sustainable, and secure research cyberinfrastructure (CI) at the national or international scale;
- Extend benefits across multiple science disciplines;
- Enhance existing research CI investments; and
- Transition from prototypes to robust, usable, reusable components applicable to effective practice.

DMREF-OAC awardees will be encouraged to address and report on a set of cyberinfrastructure-specific requirements as a condition of the award. Such awardees will also be invited to participate in the principal investigators' meeting for the Cyberinfrastructure for Sustained Scientific Innovation (CSSI) program.

Participants interested in selecting OAC as the primary Unit of Consideration are strongly encouraged to confer with the cognizant OAC Program Officer listed above.

Co-funding from OAC may be available to teams that, in their Data Management Plan: 1) state the specific open-source or other license(s) under which developed code will be released, 2) describe plans to transition the software to sustainability after NSF funds have ended, and 3) define community usage metrics for each year of the award. These simple, but well thought out metrics should demonstrate what will be accomplished each year and should show the impact of the software on the breadth of the user/developer community. Potential metrics include the number of individuals or research groups using the software, the number of citations, and the number of contributors.

Special Instructions for Proposals Selecting the Division of Information & Intelligent Systems (IIS) as a Unit of Consideration

In recent years the research community has witnessed a rapid increase in the impact of AI on materials research. Increased computing power, the growing availability of large materials datasets, and algorithmic advances in ML enable multidisciplinary acceleration of materials research.

Proposals that incorporate substantial collaboration with AI, and potentially in other areas of information and intelligent systems (e.g., data science, human-computer interaction) are encouraged to identify IIS as a secondary unit of consideration. Co-funding from IIS may be available to teams that present an ambitious plan for incorporating use-inspired or foundational AI into the research plan. DMREF-IIS awardees will be encouraged to address and report on a set of AI-specific requirements as a condition of the award.

Opportunity for PIs to Engage with the Air Force Research Laboratory (AFRL), including the Air Force Office of Scientific Research (AFOSR)

This solicitation provides an opportunity for DMREF teams to partner with AFRL/AFOSR in order to: 1) bolster the scientific/engineering aspects of the critical iterative feedback loop to accelerate materials research consistent with MGI principles, 2) facilitate the translation of fundamental materials research toward application, and 3) provide educational, training, and workforce development opportunities. DMREF teams that wish to take advantage of this opportunity should include a Letter of Collaboration from one or more AFRL researchers. AFRL personnel should not be listed on the cover page. The Project Description should explain how this collaboration would benefit both the DMREF team and AFRL in advancing the goals of the project. The Management Plan must describe how this activity would be implemented. The Budget may include funds, such as student support or travel, to enable these activities. No funds may be budgeted, or subawarded, to AFRL: AFRL personnel will participate as un-funded collaborators. Teams that exercise this option must agree to participate in biennial meetings at AFRL headquarters in Dayton, OH and funds may be budgeted for this purpose.

III. AWARD INFORMATION

Awards are expected to range from $1,200,000 - $1,8000,000 for a duration of four years. The budget must be commensurate with the scope of the project and thoroughly justified in the proposal.

Anticipated funding amount is pending availability of funds.

IV. ELIGIBILITY INFORMATION

Who May Submit Proposals:

Proposals may only be submitted by the following:

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

Who May Serve as PI:

There are no restrictions or limits.

Limit on Number of Proposals per Organization:

There are no restrictions or limits.

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

No individual may appear as Senior Personnel (PI, Co-PI, Faculty or Other Senior Personnel) on more than one DMREF proposal submitted in response to this solicitation. In the event that an individual exceeds this limit, any DMREF proposal submitted to this solicitation with this individual listed as Senior Personnel after the first DMREF proposal is received at NSF will be returned without review. No exceptions will be made.

Additional Eligibility Info:

All DMREF proposals must involve at least two Senior Personnel (PI, Co-PI, Faculty or Other Senior Personnel) to ensure that all aspects of the project (synthesis / growth / processing, characterization / testing, theory / data / computation / simulation) are adequately covered by relevant expertise. These partnerships may occur through either a proposal from a single institution or one involving multiple institutions.

Proposals submitted in response to this solicitation may not duplicate or be substantially similar to other proposals funded or concurrently under consideration by NSF or to proposals previously declined by NSF and not substantially revised. Proposals not satisfying this condition will be returned without review.

PIs with Existing DMREF Projects:

The Results from Prior NSF Support section must substantially address progress made under the current DMREF award with respect to Intellectual Merit, Broader Impacts, Data Management Plan, and DMREF Solicitation Specific Review Criteria. A clear explanation of how MGI principles are being applied to accelerate materials discovery and development, and a detailed vision for advancement along the Materials Development Continuum (as described in the MGI Strategic Plan) toward eventual deployment, must be provided in the new proposal.

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

Full Proposal Preparation Instructions: Proposers may opt to submit proposals in response to this Program Solicitation via FastLane, Research.gov, 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 Research.gov: Proposals submitted in response to this program solicitation should be prepared and submitted in accordance with the general guidelines contained in the *NSF Proposal and Award Policies and Procedures Guide* (PAPPG). The complete text of the PAPPG is available electronically on the NSF website at: https://www.nsf.gov/publications/pub_summ.jsp?ods_key=pappg. Paper copies of the PAPPG may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-8134 or by e-mail from nsfpubs@nsf.gov. The Prepare New Proposal setup will prompt you for the program solicitation number.
- Full proposals submitted via Grants.gov: Proposals submitted in response to this program solicitation via Grants.gov should be prepared and submitted in accordance with the *NSF Grants.gov Application Guide: A Guide for the Preparation and Submission of NSF Applications via Grants.gov*. The

complete text of the *NSF Grants.gov Application Guide* is available on the Grants.gov website and on the NSF website at: (https://www.nsf.gov/publications/pub_summ.jsp?ods_key=grantsgovguide). To obtain copies of the Application Guide and Application Forms Package, click on the Apply tab on the Grants.gov site, then click on the Apply Step 1: Download a Grant Application Package and Application Instructions link and enter the funding opportunity number, (the program solicitation number without the NSF prefix) and press the Download Package button. Paper copies of the Grants.gov Application Guide also may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-8134 or by e-mail from nsfpubs@nsf.gov.

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

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

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

Cover Sheet:

- **Unit of Consideration.** At least one participating NSF Division from the drop-down list in FastLane must be selected as the Unit of Consideration. The first Unit of Consideration selected must be the participating NSF Division aligned most closely with the topic of the proposal. Additional Units of Consideration aligned with the topic of the proposal may also be selected. Grants.gov users should refer to Section VI.1.2. of the NSF Grants.gov Application Guide for specific instructions on how to designate the NSF Unit of Consideration. Adherence to these requirements will guide NSF Program Officers in establishing an appropriate review for the proposal. This information will be used for guidance in the review process but will not necessarily reflect the Division that will ultimately process the proposal. It is anticipated that proposals on topics situated at the boundaries between two or more Divisions may be co-reviewed by those Divisions.
- **Proposal Title.** The title of the proposal must begin with **'DMREF:'** followed by the project title. Proposals submitted by different institutions as a collaborative group must have the identical title that begins with the designation **'Collaborative Research: DMREF:'**. Titles of proposals involving **GOALI**, must begin with **'DMREF: GOALI:'**, or **'Collaborative Research: DMREF: GOALI:'**.
- **Collaborative Proposals**. All collaborative proposals submitted as separate submissions from multiple organizations must be submitted via FastLane or Research.gov. All proposals in a collaborative group must select the same Units of Consideration in the same sequence. Chapter II, Section D.3 of the Proposal & Award Policies & Procedures Guide (PAPPG) provides additional information on Collaborative Proposals.
- AFRL personnel should not be listed on the cover page.

Compliance with these Cover Sheet specifications is critical to determining the relevant proposal processing guidelines. Failure to submit this information may delay processing or result in the proposal being returned without review.

Project Summary:

- The final line of the Overview portion of the Project Summary must be a list of no more than five key words preceded by the phrase or heading **Key Words**. Proposers requesting cloud resources through CloudBank.org should include "CloudAccess" (one word without space) as one of these Key Words if incorporating this request into the proposal.

Project Description: The proposed work should be presented and its connection to the central objectives of DMREF should be clearly made. The discussion of the proposed work should clearly articulate the data and software cyberinfrastructure, as well as the research infrastructure that is planned to be used to achieve project goals. For proposals involving AFRL, the Project Description should explain how this collaboration would benefit both the DMREF team and AFRL in advancing the goals of the project. The Project Description must include a brief description of the management plan for the collaboration preceded by the phrase or heading **Management Plan**. Cyberinfrastructure and research infrastructure that will be used to carry out the research should be listed in the Management Plan. For proposals involving AFRL, the Management Plan must describe how this collaborative activity would be implemented.

Budget: Develop a realistic project budget that is consistent with the proposed activities. Proposed budgets should include funds for travel by one PI or co-PI to attend a biennial MGI Principal Investigator Meeting held in even-numbered years.

For proposals involving collaboration with AFRL personnel, the Budget may include funds, such as student support or travel, to enable these activities. No funds may be budgeted, or subawarded, to AFRL: AFRL personnel will participate as un-funded collaborators.

The total budget of the project, including any cloud computing resource request from CloudBank.org, may not exceed the budget limit for this solicitation. The total cost of the cloud computing resources requested from Cloudbank.org should not be included in the NSF budget, and should be specified only in the associated supplementary document (see below for additional instructions).

Example: Note that this solicitation limits the total proposal budget to $1,800,000. If a PI wishes to request $20,000 in cloud computing resources through CloudBank, then the proposal should request, as part of the proposal budget, no more than $1,780,000. The remaining $20,000 for cloud computing resources should be specified in the Supplementary Document. If a proposal is a collaborative project between multiple organizations, then each respective PI may request cloud computing resources separately through independent Supplementary Documents as long as the total budget (on the budget pages plus in the Supplementary Documents) does not exceed $1,800,000.

Single Copy Documents:

- **Required:** Information regarding collaborators and other affiliations (COA) must be provided for each individual identified as senior project personnel according to the instructions provided in Chapter II.C.1.e of the *NSF Proposal & Award Policies & Procedures Guide* (PAPPG).
- **Optional:** Suggested Reviewers and Reviewers Not to Include. Investigators are encouraged to upload a list (with full names, affiliations, expertise, and email addresses) of at least four suggested reviewers who are experts in the various topics described in the proposal (synthesis/processing, experiment/characterization, theory/simulation, data, etc.). Suggested reviewers should not have a conflict of interest (as described in Exhibit II-2 of the PAPPG) with any of the senior personnel involved in the proposal.

Single Copy Documents above are used by NSF staff, but are not available to reviewers.

Supplementary Documents:

- **Letters of Collaboration:** For proposals involving collaborations with researchers not listed as co-PIs, proposers should include letters confirming the collaborations. The letters must be very brief and contain no statements of support or reference. Consult the PAPPG for instructions. Details about collaborative work to be done under this project should be included within the 15 pages of the Project Description, not in the letter(s) of collaboration.

Proposals to be considered for AFRL co-funding must contain a Letter of Collaboration from at least one AFRL PI.

- **Data Management Plan (DMP):** DMPs are of particular relevance to DMREF; consistent with the pivotal role of data in the MGI. This solicitation supports the emerging area of data-intensive materials research. Investigators are strongly encouraged to think through the process of digital data creation and develop practices and a plan for sharing digital data. The Data Management Plan should discuss how digital data created through the project will be made findable, accessible, interoperable, and reusable (FAIR), as appropriate for the project and the created data. The Data Management Plan should be responsive to the guidance presented at the DMREF link at NSF's Dissemination and Sharing of Research Results webpage. It is a reasonable expectation that digital data supporting published work will be freely available without request within a reasonable time from publication. Proposers are reminded that reviewers will be asked to review the Data Management Plan. PIs are encouraged to carefully examine both NSF Data Sharing Policy and NSF Data Management Plan Requirements in the PAPPG.
- **Cloud Computing Resources** If requesting cloud computing resources through CloudBank.org, include a description of your requests (not to exceed 2 pages) that includes: (1) title of the proposal; (2) the total cost of computing resources, with yearly breakdown; (3) which public cloud providers will be used; and (4) a technical description and justification of the request, along with how the cost was estimated.

B. Budgetary Information

Cost Sharing:

Inclusion of voluntary committed cost sharing is prohibited.

Budget Preparation Instructions:

The NSF DMREF Management Team will schedule biennial meetings of DMREF PIs in the Washington, DC area. Proposal budgets should include funds to support the attendance of one PI or co-PI every other (even-numbered) year.

Proposals that wish to exercise the option to partner with AFRL must have one PI or co-PI participate in biennial meetings at AFRL headquarters in Dayton, OH. Travel funds may be budgeted for this purpose.

C. Due Dates

- **Submission Window Date(s)** (due by 5 p.m. submitter's local time):

    January 11, 2021 - January 25, 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

The following additional criteria will be used to evaluate all DMREF proposals:

- How effectively does the proposed work help accelerate materials discovery, understanding, and/or development by building the fundamental knowledge base needed to progress toward designing and making materials with specific, desired functions or properties?
- How effectively does the proposed research use collaborative processes with iterative feedback among tasks? Do the materials synthesis / growth / processing techniques, characterization / testing methodology, theory / mathematics, data science, and computation / simulation aspects of the project strongly interact with each other to promote significant advances in each of these components and advance materials design?
- How effectively does the proposed work provide training for the next generation of scientists and engineers, educated in a multidisciplinary, integrated experimental and computational approach to materials research? Has adequate data-related training been provided for students and postdoctoral researchers, as needed?
- How appropriate is the Data Management Plan for the type of data that the project is expected to create? How effectively does the proposal convey that the digital data generated by the project will be made freely available within a reasonable time from publication, without the need for request to the investigator, in a way that the data is findable, accessible, interoperable, and reusable (FAIR)?

In addition to being evaluated according to the previously described criteria, proposals submitted to the Division of Mathematical Sciences (DMS) as the Primary Unit of Consideration will be evaluated with respect to whether they seek new mathematical or statistical results that will advance the DMREF agenda. These proposals will be co-evaluated by other divisions in the areas of science and engineering where impacts of the projects are expected.

Proposals submitted to the Office of Advanced Cyberinfrastructure (OAC) as the Primary Unit of Consideration will be co-evaluated by other divisions in the areas of science and engineering where impacts of the projects are expected. These proposals will be further evaluated based on the extent to which they:

- Become part of a comprehensive, integrated, sustainable, and secure research cyberinfrastructure (CI) at the national or international scale;
- Extend benefits across multiple science disciplines;
- Enhance existing research CI investments; and
- Transition from prototypes to robust, usable, reusable components applicable to effective practice.

B. Review and Selection Process

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

The Air Force Research Laboratory (AFRL), including the Air Force Office of Scientific Research (AFOSR), is a collaborating agency for this FY 2021 DMREF solicitation. NSF will manage and conduct the review process of all proposals submitted. AFRL and AFOSR representatives may be permitted to view proposals, recommend reviewers, and attend the review panels as observers.

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.

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:

- John Schlueter, Team Lead, MPS/DMR, telephone: (703) 292-7766, email: jschluet@nsf.gov

- Peter Anderson, MPS/DMR, telephone: (703) 292-4507, email: peanders@nsf.gov

- Bryan Boudouris, telephone: (703) 292-7951, email: bboudour@nsf.gov

- Marian Bocea, MPS/DMS, telephone: (703) 292-2595, email: mbocea@nsf.gov

- James Donlon, CISE/IIS, telephone: (703) 292-8074, email: jdonlon@nsf.gov

- Yuliya Gorb, MPS/DMS, telephone: (703)292-2113, email: ygorb@nsf.gov

- Ruyan Guo, ENG/ECCS, telephone: (703) 292-8339, email: rguo@nsf.gov

- Tevfik Kosar, CISE/OAC, telephone: (703) 292-7992, email: tkosar@nsf.gov

- Thomas Kuech, ENG/CMMI, telephone: (703)292-2218, email: tkuech@nsf.gov

- Robert McCabe, ENG/CBET, telephone: (703) 292-4826, email: rmccabe@nsf.gov

- Siddiq Qidwai, ENG/CMMI, telephone: (703) 292-2211, email: sqidwai@nsf.gov

- Shahab Shojaei-Zadeh, ENG/CBET, telephone: (703) 292-8045, email: sshojaei@nsf.gov

- Suk-Wah Tam-Chang, MPS/CHE, telephone: (703) 292-8684, email: stamchan@nsf.gov

- Ralph Wachter, 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.

AFRL/RX Contact:

Ruth Pachter, Senior Scientist, Air Force Research Laboratory, phone: (937)255-9689, email: ruth.pachter@us.af.mil

AFRL/AFOSR Contact:

William Roach, Chief Scientist, Air Force Office of Scientific Research, phone: (703)215-6731, email: William.roach.4@us.af.mil

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
Office of the General Counsel
National Science Foundation
Alexandria, VA 22314

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National Science Foundation, 2415 Eisenhower Avenue, Alexandria, Virginia 22314, USA
Tel: (703) 292-5111, FIRS: (800) 877-8339 | TDD: (703) 292-5090 or (800) 281-8749

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