

Total Life Cycle Sustainability Analysis of Critical Materials in Electric Vehicle (EV) Lithium-Ion Batteries for Circular Economy

Project Synopsis

Convergent Project Team:

University of Kentucky: I.S. Jawahir – Institute for Sustainable Manufacturing (ISM) (Sustainable product design & manufacturing); F. Badurdeen – ISM and Dept. of Mech. Eng. (Systems thinking & optimization); J. Werner – Dept. of Mining Eng. (Material recovery & recycling); P. Wang – Dept. of Elect. & Comp. Eng. (Sensing & machine condition monitoring); D. Atwood - Dept. of Chemistry (Chemistry & sustainability), J. Schoop – ISM and Dept. of Mech. Eng. (Engineered Materials); K. Liu – Center for Applied Energy Research and Dept. of Mech. Eng. (Energy efficiency); J. Caudill – ISM and Dept. of Mech. Eng. (Additive manufacturing); W. Hoyt – Martin School of Public Policy and Administration (Public policy & sustainability); Bob Sandmeyer – Environmental and Sustainability Studies Program, Dept. of Philosophy (Environmental philosophy); T. Elam – Center for Computational Sciences (Project management).

Other Potential Participants:

Universities: University of Texas at Rio Grande Valley (James Li, Anil Srivastava + Others)
University of Tennessee (Tom Goldsby + Others)

Industry: Amazon, Ford, Toyota, SRC.

National Labs/Agencies: ORNL, NIST

Project Overview: This project aims to develop quantitative understanding of the total life cycle sustainability effects of the use of critical materials such as *Li*, *Ni* and *Co* in electric vehicle (EV) *Li*-ion batteries. This will include a comprehensive total life cycle sustainability analysis of these materials through ***all four life cycle stages (Pre-manufacturing, Manufacturing, Use and Post-use)***. A metrics-based sustainability evaluation method, with ***6Rs (Reduce, Reuse, Recycle, Recover, Redesign and Remanufacture)***, will be developed for product sustainability. The overall sustainability impacts of these materials will be used to achieve ***improved closed-loop product/process design methods for circular economy.***

Project Objectives:

- (a) Developing novel 6R-based total life cycle sustainability evaluation methods for critical materials in EV *Li*-ion batteries.
- (b) Evaluating total life cycle sustainability impacts of critical materials;
- (c) Developing sensing and AI-based systems for the product use stage; and
- (d) Developing education, training, and outreach programs.

Deliverables:

1. A validated model-based, data-driven product sustainability evaluation toolkit/dashboard for predicting EV battery performance and life cycle impacts; and
2. Comprehensive curricula (for-credit & professional) on closed-loop sustainable manufacturing with life cycle analysis of products and associated manufacturing processes.

These deliverables are ***uniquely significant*** as no such capability currently exists, nationally or internationally, and the proposed ***university-industry-government partnership*** will enable accelerated economic growth and societal prosperity, providing benefits to ***all stakeholders.***

Sandmeyer, Bob

From: Atwood, David A.
Sent: Tuesday, May 31, 2022 11:56 AM
To: Sandmeyer, Bob
Subject: Fwd: Invitation to join NSF Convergence Accelerator Proposal Lol
Attachments: Lol (Draft 3).docx

Dear Bob: Ibrahim Jawahir in Engineering is organizing an NSF proposal on the sustainability of strategic elements like lithium and cobalt (see text below and attached draft). The proposal will be holistic and address all the sustainability aspects of the metals including engineering, chemistry, policy, and the various human impacts. Ideally, the proposal will integrate these aspects to create a unique transdisciplinary project.

Would you consider working with us on the social science aspects of the eventual proposal? At this point we only need to submit a one-page letter of intent outlining the project (the latest draft is attached) and I only need your expression of interest from this email. Once the LOI is approved we will begin planning our actual contributions to the project.

Jawa managed to organize a team on short notice to create the LOI. Jawa is a magician with funding so I'm excited to be involved and hopeful that the project will be funded and ultimately demonstrate how resource sustainability should be conducted.

Best,
David

David Atwood
Lexington, KY

Begin forwarded message:

From: "Atwood, David A." <datwood@uky.edu>
Date: May 31, 2022 at 10:02:09 AM CDT
To: "Atwood, David A." <datwood@uky.edu>
Subject: Invitation to join NSF Convergence Accelerator Proposal Lol

Begin forwarded message:

From: "Jawahir, Ibrahim S." <is.jawahir@uky.edu>
Date: May 31, 2022 at 8:27:54 AM CDT
To: "Atwood, David A." <datwood@uky.edu>
Subject: Re: NSF Convergence Accelerator Proposal Lol

Dear Proposal Team,

I received excellent feedback with edits from many of you for my earlier draft. Thank you all so much.

I have incorporated all your changes/corrections in the new draft (Draft 3) - attached. This version includes additional minor edits from me too. Based on the recommendation by David, I have taken the liberty to include Professor William Hoyt from Martin School of Public Policy and Administration and Gatton School of Business and Economics. Also, included are our friends Adib Bagh and Tony Elam, both will make excellent contributions to the proposal. I have just sent them a formal invitation. Hopefully they will agree to join our proposal team. The only area of expertise missing in the draft is social science. Hopefully, we can add someone in the proposal.

We need to submit this one-page LoT later today, most likely early afternoon. If you find anything that needs to be changed. Please let me know quickly.

Thanks.

Jawa

Dr. I. S. Jawahir

James F. Hardyman Chair in Manufacturing Systems,
Professor of Mechanical Engineering, and
Director of Institute for Sustainable Manufacturing (ISM)
414B, CRMS Building
University of Kentucky
Lexington, KY 40506
U.S.A.

Phone: (859) 323-3239

Fax: (859) 257-1071

E-mail: is.jawahir@uky.edu

Website: <http://www.engr.uky.edu/ism/>

NSF Convergence Accelerator Phases 1 and 2 for the 2022 Cohort - Tracks H, I, J

PROGRAM SOLICITATION NSF 22-583



National Science Foundation

Directorate for Technology, Innovation and Partnerships

Letter of Intent Due Date(s) (required) (due by 5 p.m. submitter's local time):

May 31, 2022

Letter of Intent (required for Phase 1 Full Proposals only)

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

July 20, 2022

Phase 1 Full Proposals

August 29, 2023

Phase 2 Full Proposals, only Phase 1 awardees are eligible to apply

IMPORTANT INFORMATION AND REVISION NOTES

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.

IMPORTANT INFORMATION

A key aspect of Convergence Accelerator projects is the innovation curriculum that requires a significant time investment and frequent participation of all partners such as academia, industry, non-profit, government, and other sectors under the guidance of coaches (see section V and a link to a sample curriculum can be found [here](#)). The curriculum includes a team science and human-centered design approach that rapidly moves projects towards deliverables in both Phase 1 and Phase 2 that will have broad scale national impact.

REVISION NOTES

The substantive changes in this FY 2022 solicitation include:

- A Letter of Intent is required for all Phase 1 Full Proposals.
- Meetings, including those associated with the innovation curriculum, Pitch Presentations, and Expo reflect changes in format resulting from the COVID-19 pandemic and rules associated with in-person and/or virtual meetings.
- In Full Proposals, *Letters of Collaboration* are now submitted in a standard format. The participation of any unfunded collaborators in the project must be substantive and their roles and responsibilities should be clearly described in appropriate Sections of the Project Description.
- This solicitation and the corresponding BAA support both US-only proposals and proposals with international partnerships. For Track I only, this solicitation includes a collaboration with The Commonwealth Scientific and Industrial Research Organisation (CSIRO), an Australian Government agency responsible for scientific research. Participants who would like to qualify for CSIRO funding will submit their proposals as a single proposal, with the US Lead PIs submitting to NSF and the Australian Participants sharing information with CSIRO as described in the solicitation and the corresponding BAA.

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:

Synopsis of Program:

The National Science Foundation (NSF) Convergence Accelerator program addresses national-scale societal challenges through use-inspired [convergence research](#). Using a convergence approach and innovation processes like human-centered design, user discovery, and team science and integration of multidisciplinary research, the Convergence Accelerator program seeks to transition basic research and discovery into practice — to solve high-impact societal challenges aligned with specific research themes (tracks).

NSF Convergence Accelerator tracks are chosen in concordance with the themes identified during the program's ideation process that have the potential for significant national impact. The NSF Convergence Accelerator implements a two-phase program. Both phases are described in this solicitation and are covered by this single solicitation and corresponding Broad Agency Announcement. The link to the corresponding Broad Agency Announcement can be found at <https://sam.gov/opp/cad229a574774c038559d0c9fc22d9b4/view>. The purpose of this parallel funding opportunity is to provide increased opportunities for proposals that are led by non-academic entities. Proposals that are led by Institutions of Higher Education (IHEs), non-profits, independent museums, observatories, research labs, professional societies and similar organizations should respond to this solicitation. Proposals led by for-profit or similar organizations should respond to the BAA. Phase 1 awardees receive resources to further develop their convergence research ideas and to identify important partnerships and resources to accelerate their projects. Phase 2 awardees receive significant resources leading to deliverable research prototypes and sustainability plans.

This solicitation for FY 2022 invites proposals for the following Track Topics:

Track H: Enhancing Opportunities for Persons with Disabilities

The NSF Convergence Accelerator's Track H: Enhancing Opportunities for Persons with Disabilities (PWDs) will serve as a platform to bring together researchers, practitioners, and stakeholders from a wide range of disciplines and sectors to work on use-inspired solutions to enhance quality of life and employment access and opportunities for PWDs.

Track I: Sustainable Materials for Global Challenges

The objective of the NSF Convergence Accelerator's Track I: Sustainable Materials for Global Challenges will be to converge advances in fundamental materials science with materials design and manufacturing methods in an effort to couple their end-use and full life-cycle considerations for environmentally- and economically-sustainable materials and products.

Track J: Food & Nutrition Security

The overarching goal of the NSF Convergence Accelerator's Track J: Food & Nutrition Security will be to accelerate convergence across food and nutrition sectors to address intertwined challenges in supporting population health, combating climate change, and addressing the nutritional needs of the most vulnerable by empowering youth, women, and disadvantaged communities.

It must be evident how the proposed work will be integrated to achieve success of the entire track. Each proposal should include a description of how the proposed project will contribute to an integrated environment that will deliver beneficial outputs for the track. It should also be clear how the projects will convergently align with the overarching goal of each track rather than as independent projects.

Proposers are required to submit a Letter of Intent in order to submit a Phase 1 Full Proposal. The information required in the Letter of Intent is described in Section V.

Letters of Intent should identify a team with the appropriate mix of disciplinary and cross-sector expertise required to build a convergence research effort. Letters of Intent must identify one or more deliverables, how those research outputs could impact society at scale, and the team that will be formed to carry this out.

Phase 1 proposals must describe the deliverables, a research plan, and the process of team formation that will help lead to a proof-of-concept during Phase 1.

If selected, Phase 1 awards may receive funding up to \$750,000 for 12 months duration, of which nine months includes intense hands-on activities, centering around the Program's innovation curriculum, and three months of other activities, such as participation in the NSF Convergence Accelerator Pitch Presentations and Expo.

During the nine-month intensive planning phase, teams will participate in a curriculum that will assist them in strengthening team convergence and accelerating the identified idea toward Phase 2. The curriculum provides modules on innovation processes, including human-centered design, user discovery, team science, and integration of multidisciplinary partnerships. Teams will also be provided with coaches who will support them in Phase 1 and who may continue with them into Phase 2 if the teams choose to continue with the same coach. Alternatively, the teams can request to work with a different coach.

Only awardees of Phase 1 awards under this solicitation may submit a Phase 2 proposal. Phase 2 proposals must outline a 24-month research and development plan that transitions research into practice through convergence activities, multi-sector partnerships, and collaboration with other partners and end-users.

If selected for Phase 2, teams will be expected to apply program fundamentals and innovation processes gained in Phase 1 to enhance partnerships, develop a solution prototype, and build a sustainability model to continue societal impact beyond NSF support.

Phase 2 awards may be up to \$5 million for 24 months. Phase 2 proposals must clearly describe deliverables that will be produced within 24 months. The Phase 2 teams must include partnerships critical for success and end-users (e.g., industry, Institutions of Higher Education (IHEs), non-profits, government, and others), each with a specific role(s) in deliverable development and facilitating the transition of research outputs into practical uses. Successful Phase 2 proposals will be funded initially for 12 months, with a second year being provided on the basis of an assessment of performance (see below).

Each Phase 2 team's progress will be assessed during the year through approximately four virtual and/or in-person meetings with NSF program staff. At the end of 12 months, overall progress will be evaluated based on a report and presentation that the team presents to a panel of internal and/or external reviewers. The review panel will include NSF reviewers and staff, and competing teams only. Phase 2 teams that show significant progress during the first year in accordance with the agreed timetable of milestones and deliverables will receive funding

for a second year. Phase 2 teams must plan on completing the effort within 24 months. No-cost extensions are **not** permitted except under clearly documented exceptional circumstances. Grantees must first contact the cognizant Program Officer prior to submitting a request.

The NSF Convergence Accelerator program is committed to research that derives expertise from and provides broad benefits to everyone. The program places a very strong emphasis on broadening participation by encouraging proposals from, and partnerships with, minority-serving institutions (e.g., Historically Black Colleges and Universities (HBCUs), Tribal Colleges and Universities, Hispanic Serving Institutions, Alaska Native-Serving Institutions, Native Hawaiian-Serving Institutions, Asian American and Native American Pacific Islander-serving Institutions, and Native-American-serving non-tribal Institutions, see also [U.S. Department of Education](#)), and other organizations.

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.

- Douglas Maughan, telephone: (703) 292-2497, email: dmaughan@nsf.gov
- Lara A. Campbell, telephone: (703) 292-7049, email: lcampbel@nsf.gov
- Aurali E. Dade, telephone: (703) 292-7049, email: adade@nsf.gov
- Pradeep P. Fulay, telephone: (703) 292-2445, email: pfulay@nsf.gov
- Ibrahim Mohedas, telephone: (703) 292-4329, email: imohedas@nsf.gov
- Linda Molnar, telephone: (703) 292-8316, email: lmolnar@nsf.gov
- Michael Pozmantier, telephone: (703) 292-4475, email: mpozmant@nsf.gov
- Michael Reksulak, telephone: (703) 292-8326, email: mreksula@nsf.gov

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

- 47.084 --- NSF Technology, Innovation and Partnerships

Award Information

Anticipated Type of Award: Standard Grant or Cooperative Agreement

Estimated Number of Awards: 36 to 48

NSF expects to make up to 48 Phase 1 awards across all topics as a result of this solicitation and the corresponding BAA.

NSF expects to make 4-5 Phase 2 awards for each topic as a result of this solicitation and the corresponding BAA.

Anticipated Funding Amount: \$36,000,000

Anticipated funding for \$36,000,000, pending availability of funds, to support Phase 1 awards. Proposers may request up to \$750,000 for Phase 1.

The estimated funding level for Phase 2 awards depends on the availability of funds and the number of Phase 1 awards. Phase 2 proposals may request up to \$3,000,000 for year 1 and up to \$5,000,000 in total for the 24-month Phase 2 project.

Eligibility Information

Who May Submit Proposals:

Proposals may only be submitted by the following:

- Institutions of Higher Education (IHEs) - Two- and four-year IHEs (including community colleges) accredited in, and having a campus located in the US, acting on behalf of their faculty members. Special Instructions for International Branch Campuses of US IHEs: If the proposal includes funding to be provided to an international branch campus of a US institution of higher education (including through use of subawards and consultant arrangements), the proposer must explain the benefit(s) to the project of performance at the international branch campus, and justify why the project activities cannot be performed at the US campus.
- Non-profit, non-academic organizations: Independent museums, observatories, research labs, professional societies and similar organizations in the U.S. associated with educational or research activities.
- For-profit organizations: U.S. commercial organizations, especially small businesses with strong capabilities in scientific or engineering research or education.

Who May Serve as PI:

The PI and any co-PIs must hold an appointment at an organization that is eligible to submit as described under "Who May Submit Proposals." At least one PI or co-PI from a Phase 1 award must be included as a PI or co-PI on a Phase 2 proposal based on that Phase 1 award. The same individual who served as PI for the Phase 1 award does not have to be PI for the Phase 2 proposal. Any change of PI and co-PI should be fully explained in the proposal.

Limit on Number of Proposals per Organization:

There are no restrictions or limits.

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

Phase 1 proposals

An individual may serve as PI or co-PI on no more than two Phase 1 proposals. Submissions to the BAA are included in this number.

However, it is unlikely that multiple Phase 1 awards would be made to organizations that included the same PI or co-PI on separate proposals.

Phase 2 proposals

Anyone may serve as a PI or co-PI on only one Phase 2 proposal. This limitation includes PIs and co-PIs listed for the proposing organization or any subaward submitted as part of the proposal. There are no restrictions or limits on serving as other Senior Personnel.

See section IV. below for additional eligibility information.

Proposal Preparation and Submission Instructions

A. Proposal Preparation Instructions

- **Letters of Intent:** Submission of Letters of Intent is required. Please see the full text of this solicitation for further information.
- **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:**

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

C. Due Dates

- **Letter of Intent Due Date(s) (required)** (due by 5 p.m. submitter's local time):

May 31, 2022

Letter of Intent (required for Phase 1 Full Proposals only)
- **Full Proposal Deadline(s)** (due by 5 p.m. submitter's local time):

July 20, 2022

Phase 1 Full Proposals

August 29, 2023

Phase 2 Full Proposals, only Phase 1 awardees are eligible to apply

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

[Summary of Program Requirements](#)

- I. **Introduction**
- II. **Program Description**
- III. **Award Information**
- IV. **Eligibility Information**
- V. **Proposal Preparation and Submission Instructions**
 - A. Proposal Preparation Instructions
 - B. Budgetary Information
 - C. Due Dates
 - D. Research.gov/Grants.gov Requirements
- VI. **NSF Proposal Processing and Review Procedures**
 - A. Merit Review Principles and Criteria
 - B. Review and Selection Process
- VII. **Award Administration Information**
 - A. Notification of the Award
 - B. Award Conditions
 - C. Reporting Requirements
- VIII. **Agency Contacts**
- IX. **Other Information**

I. INTRODUCTION

Research is often driven by a compelling societal or scientific challenge; however, it may take the researcher community years to develop a solution. To deliver tangible solutions that have a societal impact and at a faster pace, the NSF Convergence Accelerator brings together multiple disciplines, expertise, and partnerships from academia, industry, non-profit, government, and other sectors together to develop solutions to solve national grand challenges through convergence research.

[Convergence Research](#) is a critical mechanism for solving many vexing research problems, especially those stemming from complex societal and/or scientific challenges. In this NSF Convergence Accelerator Phase 1 and Phase 2 solicitation for FY 2022, NSF seeks to support and facilitate research that advances ideas from concept to deliverables within each of the convergence research topics (tracks).

The NSF Convergence Accelerator Phases 1 and 2 for the 2022 Cohort - Tracks H, I, J solicitation consists of three tracks as follows:

Track H: Enhancing Opportunities for Persons with Disabilities

Track I: Sustainable Materials for Global Challenges

Track J: Food & Nutrition Security

The NSF Convergence Accelerator seeks to support use-inspired research and enable the accelerated transition of that research into benefits for society through a two-phase process.

Phase 1: Learning + Applying the Convergence Accelerator Fundamentals, Convergence Research Planning

Phase 1 is for funding up to \$750,000 for 12 months duration. It supports nine months of planning effort to further develop the initial concept, identify new team members, participate in the innovation curriculum, and develop an initial prototype. The innovation curriculum consists of training with professional coaches in human-centered design, team science activities, inter-team communications, pitch preparation, developing a Public Executive Summary and presentation coaching — all of which are essential components of the Convergence Accelerator's model. This training helps the teams better prepare to be successful in the next phase. In addition, this provides the teams with presentations by (and access to) experts on anticipated use cases for government, industry, and society, in general.

At the end of Phase 1, teams will spend the remaining three months presenting to a pitch review panel as part of their Phase 2 proposal and participating in the NSF Convergence Accelerator Expo (Expo) and other activities.

Phase 1 efforts will focus on research plan development, team formation leading to a proof-of-concept and will include NSF convenings for training and cross-cohort collaboration. The Phase 1 innovation curriculum is a significant time investment with frequent participation of all partners under the guidance of coaches.

Phase 2: Continued Application of the Convergence Accelerator Fundamentals, Prototyping and Sustainability Planning

Phase 1 teams that are selected for Phase 2 through the merit review process will proceed to Phase 2, with potential funding of up to \$5 Million as a cooperative agreement for 24 months. Phase 2 teams will continue to apply Convergence Accelerator fundamentals, including identifying new team members and end-user partnerships to further develop solution prototypes and to build a sustainability model to continue impact beyond NSF support.

At the 12-month mark of Phase 2, the Convergence Accelerator will review the team projects to assess and ensure each team is working towards the expected deliverables. Assessments from the reviewers will be shared with the team along with the guidance/decision for the next steps. At the end of Phase 2, teams are expected to provide/demonstrate outcomes/solutions that were part of the proposal.

II. PROGRAM DESCRIPTION

This NSF Convergence Accelerator Phase 1 and Phase 2 for the 2022 Cohort - Tracks H, I, J solicitation seeks to address the topics described in the convergence tracks identified above and detailed below. Phase 1 awards are grants for planning and preliminary prototyping of projects that leverage basic research investments. Phase 2 awards are cooperative agreements for projects that build upon the Phase 1 efforts, leading to rapid research advances to

deliver useful results and impactful solutions to society.

The guiding rationale of the NSF Convergence Accelerator is that a high level of interdisciplinarity and engagement with multiple diverse stakeholders, including researchers and the ultimate users of research products, is essential to deliver progress on scientific challenges of societal relevance — such as those embodied by the three tracks in this solicitation.

Successful NSF Convergence Accelerator proposals are expected to have four important characteristics: 1) *convergence* research approach; 2) strong, multi-organization *partnerships* involving researchers, users, and other stakeholders; 3) high probability of successful *deliverables within a 24 month period* that will ultimately benefit society (such as those discussed under the Tracks in Section II, Program Description), and 4) *strong alignment with the track goals* as described in this solicitation.

Track H: Enhancing Opportunities for Persons with Disabilities

Research Background

The NSF Convergence Accelerator's Track H: Enhancing Opportunities for Persons with Disabilities will serve as a platform to bring together researchers, practitioners, and stakeholders from a wide range of disciplines and sectors to work on use-inspired solutions to enhance the quality of life, employment access, and opportunities for people with disabilities (PWD or PWDs). The big picture goal is to enhance equity, inclusion, and accessibility for PWDs. Track H was chosen based on the results of two NSF-funded community workshops related to this topic. The reports from these workshops are [Accelerating Disability Inclusion in Workplaces Through Technology Workshop](#) and [Liberate 2021: Living Better through Rehabilitative and Assistive Technology](#).

This track offers opportunities to community stakeholders to bring in knowledge, expertise, insights, methods, and tools from disparate areas of research including, but not limited to, engineering, manufacturing, robotics, computer/data science (including artificial intelligence (AI) and machine learning (M/L)), healthcare, social, behavioral, and economic sciences, policy, and ethics. The resulting collaborative projects must work toward ensuring the development of tangible tools, resources, hardware, or software, and/or improving the participation of PWDs in the workforce. Proposals that are driven by use-inspired research are encouraged. Proposed research must leverage convergence between disciplines; be ready for acceleration; fueled by strong public-private partnerships; and ultimately enable translation into tangible solutions that are sustainable.

PWDs represent the largest minority group in the United States ([Invisible Disabilities Association](#)) and in the world. According to the Centers for Disease Control and Prevention (CDC), about 26% of people in the United States (~ 1 in 4 adults) have a disability ([Disability and Health Data System](#)). In addition, data from the United Nations indicates that about 15% of the people in the world (~1 billion) live with some form of a disability ([Factsheet on Persons with Disabilities](#)). Disabilities may be apparent or non-apparent, temporary or permanent, and may change or develop during a person's lifetime. Disabilities can vary in type and affect a person's development, thinking, learning, hearing, mobility, vision, self-care, mental health, and other activities of daily living.

PWDs experience major barriers that can hamper their quality of life, health, and wellness, which often reflect on insufficient levels of support, services, and resources to help meet their access needs. Regardless of the type of impairment a person may have, the experience of living with a disability represents the interplay of several factors, including activity limitations, restricted participation, environmental factors, and personal factors ([World Health Organization Report, 2002](#)).

PWDs, especially women and racial and ethnic minorities, remain highly underemployed in the U.S., despite offering talents and skills that can benefit employers and workplaces. The Office of Disability Employment Policy (ODEP) in the U.S. Department of Labor notes that the labor force participation rates for people with and without disabilities in the U.S. in October 2021 were 22.4% and 67.1%, respectively. The unemployment rates for people with and without disabilities were 9.1% and 4.0%, respectively ([Office of Disability Employment Policy, 2021](#)). The scale and impact of these disparities are even greater for women and underrepresented minorities who have disabilities.

The COVID-19 pandemic has disproportionately affected women, minority communities, and PWDs. They have faced major challenges such as reduced access to vaccines, routine care and rehabilitation; job losses, including from safety issues hindering staying at and returning to work; an inability to telework effectively or at all; and insufficient work supports and accommodations. Even before the pandemic, many workers with disabilities lacked access to job accommodations, and their accommodations often failed to meet their access needs.

U.S. demographics for the employment of PWDs in different states, where they live in the community, and types of disability can vary widely. External factors can often make it harder for PWDs to attain and maintain gainful employment or involvement in the community. Some core access issues include reliable, accessible transportation, centralized services and accessible, affordable housing in a community or near workplaces ([Office of Disability Employment Policy, 2021](#); [Senate Help Committee, 2014](#)). Services for PWDs that help support and maintain employment and community inclusion are often not centralized or not easy to access, which compounds many of these issues.

PWDs are also underrepresented in STEM. A recent report released by the [National Center for Science and Engineering Statistics](#) states that about 10% of women and 9% of men, who are scientists and engineers with at least a bachelor's degree, reported that they are not working due to chronic illnesses or disabilities. As a result, the society is deprived of a wealth of untapped talent.

Studies show that most PWDs want to engage in meaningful life activities. Recent studies and reports emphasize that expanding opportunities for PWDs can yield major economic benefits while meeting legal obligations. Many employers remain unaware of the benefits and ease of hiring workers with disabilities ([EARN: Disability Inclusion in the Workplace](#)). These studies also suggest that misconceptions about the costs and benefits of including workers with disabilities contribute to low participation in the labor force.

Employment is the likeliest means that can help improve outcomes for many PWDs, including financial security, access to protections such as health insurance, social interaction with colleagues, a sense of self-worth and purpose, and better satisfaction with quality of life. Unemployment often has a particularly detrimental impact on quality of life, mental and physical health, and the financial stability of PWDs.

Major advances in technology, both in the workplace and in the home, have helped empower job seekers and workers with disabilities who strive for upward mobility in their fields in the modern knowledge economy. The use of universal design and workplace accessibility applies equally for emerging technologies, such as artificial intelligence (AI), extended reality, autonomous vehicles, and mainstream information and communication technologies, including those used in the workplace.

This track seeks new and affordable assistive or rehabilitative technologies, products including software enabled services, or tools. This track also seeks ways to increase workforce participation of PWDs. Deep integration of, and collaboration between, disparate disciplines are needed to develop use-inspired solutions to achieve these goals.

Partnerships and Engagements: Proposals submitted to this track should integrate expertise, insights, methods, facilities, and tools from multiple disciplines. Direct participation by PWDs, their caregivers, and stakeholder organizations, those who are trained as researchers (STEM or related disciplines), and veterans

is also strongly encouraged. Leveraging resources and projects from the National Institute on Disability, Independent Living, and Rehabilitation Research (NIDILRR), the Veterans Administration (VA), the National Institutes of Health (NIH), ODEP, and/or state and local agencies, non-profits, and industry is encouraged but not required. Involvement of these organizations will increase the likelihood of ultimately translating innovative technologies/approaches/findings into implemented solutions. Proposals should be explicit in how diversity, equity, inclusion, and accessibility will be incorporated into the overall project.

Advancing substantive innovation requires that researchers work cooperatively and collaboratively across different sectors including private industry, government, academia, advocates for PWDs, associations of employers and trades, and all types of problem solvers from all sectors of the community. Such collaborations could also help to further enhance equity, inclusion, and accessibility for PWDs.

Partnerships with state programs serving PWDs (employment advisory groups, state and local workforce boards, developmental disability and rehabilitation councils, and state and local initiatives) that will help facilitate employment opportunities are encouraged. Examples include legislatively mandated Workforce Innovation and Opportunity Act (WIOA) programs (adult program, dislocated worker program, youth program, Adult Education and Family Literacy Act Program, Wagner-Peyser Act, Vocational Rehabilitation Program, and Career and Technical Education Programs).

Tasks and Deliverables

Note: *This program is not intended to support clinical trials.*

This track seeks to fulfill its promise by accelerating the development of innovative, interconnected projects founded in creative, translational, and use-inspired innovative ideas/concepts/themes that can harness the power of partnerships to tackle the key barriers faced by PWDs.

It focuses on use-inspired, translational research that adopts the use of human-centered design and approaches. Projects must embrace and display a culture of convergence among disciplinary approaches, and must include partners from multiple sectors (e.g., colleges and universities, industry, non-profits, community organizations, and/or local, state, tribal, or federal government). Projects must articulate one or more clear deliverable(s) that will help transition research into practice with measurable impacts and benefits to society within the less than 3-year effort of a Convergence Accelerator track — 9 months of Phase 1 and two years of Phase 2. Deliverables must address challenges in enhancing the participation of PWDs in the workforce and/or developing products, services, tools that could ultimately help them.

In terms of the *primary* focus or theme, proposals submitted to this track are expected (but not required) to fall into two broad categories: (a) assistive or rehabilitative technologies to help enhance quality of life or (b) strategies for improving participation of PWDs in the workforce. As noted, race and ethnic background, gender, socioeconomic and LGBTQIA+ status, and societal attitudes can affect whether and how PWDs address and mitigate core barriers that hinder gainful employment and full inclusion in the community. Proposals that specifically address the needs of these groups are strongly encouraged. Projects should focus on achieving tangible and significant outcomes to empower PWDs or communities in which they interact or work. All proposals should be explicit in explaining how diversity, equity, and inclusion are incorporated into the overall project.

Outcomes

The outcomes from this effort are expected to yield key tangible benefits for PWDs. It is anticipated that the projects supported through this program will help enhance quality of life through assistive or rehabilitative products or services and approaches to reduce barriers that can hinder entering the workforce, sustaining jobs, and achieving high work performance, especially for women and underrepresented minorities with disabilities.

Developing innovative assistive or rehabilitative technologies can help improve equity, inclusion, and accessibility for PWDs of all ages. These could be based on advances in social and rehabilitation robotics, non-invasive stimulation technologies, advanced materials, additive manufacturing/3D printing, battery technologies, sensors, flexible, printed electronics, soft robotics, neuromorphic engineering, extended reality, AI/ML, autonomous vehicles, and mainstream information and communication technologies. It is expected that all solutions will emphasize the use of inclusive, affordable, and human-centered universal design. This approach can foster best and promising practices that drive good outcomes to become universally adopted and thus commercially viable, creating a broader impact for a wider range of stakeholders that comprise both people with and without disabilities. Broad topics within this track may include – but are not limited to – the ones listed below.

- Design of and enhancements to assistive technologies and access to digital and in-person spaces, hiring and workforce accommodations, training, workforce development, integrated services, work-based learning and K-16 education, and scalable and adaptive retraining tools. The use of universal design and workplace accessibility using emerging technologies, such as AI and ML.
- Tools/methods/software/other resources that are based on translational approaches rooted in social sciences, behavioral sciences, ethics, and economics that could ultimately advance innovative policies and procedures that will be helpful to PWDs and the communities they interact with. Projects could also focus on the provision and coordination of services, design of accessible transportation and housing, workforce programs, and other key focuses.

Track I: Sustainable Materials for Global Challenges

Research Background

The objective of the NSF Convergence Accelerator's Track I: Sustainable Materials for Global Challenges will be to converge advances in fundamental materials science with materials design and manufacturing methods in an effort to couple their end-use and full life-cycle considerations for environmentally- and economically-sustainable materials and products. This convergence research track topic was based on the results of NSF-funded community workshops, such as [Accelerating Translational Materials R&D for Global Challenges](#) and [Socioresilient Infrastructure: Precision Materials, Assemblages, and Systems](#). Broad topics within this track may include – but are not limited to – the ones listed below.

- Critical materials and manufacturing processes, such as microelectronics and their components; solutions for sustainable polymers in areas of high unmet need such as healthcare and packaging; and commercially viable materials for sustainable clean energy (e.g., batteries, photovoltaics, wind turbines, hydrogen) and transport.
- Full life cycle and sustainability "Systems Thinking" in materials design including the construction of inclusive, large-scale partner ecosystems and education/workforce development for sustainable design that is connected to opportunities in industry. Education (for and as) infrastructure, including scaling of innovative curricula and training for inclusive sustainable infrastructure design and job creation. This could include community/citizen science projects for socio-resilient infrastructure such as housing for displaced persons that is resilient to changing weather patterns.

The overarching goal of Track I is to accelerate convergence research across the materials discovery, development, and production sectors to address challenges in the manufacture and reuse and recycling of critical materials and products and to develop new, innovative, sustainable materials and manufacturing processes. The world is dependent on materials such as plastics and microelectronics for every aspect of life and work. These materials are integral to energy, infrastructure, healthcare, economic development, national security, etc. and while the research enterprise has previously paid significant attention to the discovery of new materials and material properties ([Materials Genome Initiative](#)), relatively little effort has been applied to a holistic approach to

materials development from the molecular level to their durable long-term applications and end-of-life challenges.

In addition, the world is at an unprecedented time when climate change is becoming an existential threat. Material production is widely acknowledged as the cause of over half of greenhouse gas (GHG) emissions. ([Increased carbon footprint of materials production driven by rise in investments](#)) The current production and use of materials are not sustainable for human beings and the planet. By taking a systems level view of materials and their production, we can address the urgent planetary crises that are facing society today (climate, nature and biodiversity, and pollution and waste). To address these crises, we must converge efforts in fundamental materials science with materials design and manufacturing methods coupled with their end use and full life cycle considerations for the environmentally and economically sustainable production and reuse and recycling of critical materials and products. This will require a rethinking of the current materials we use and the processes by which they are produced in addition to their interaction with the environment and society as a whole.

We must accelerate this convergence to achieve the capability to source and/or produce those critical minerals and materials as well as develop the sustainable (environmental and economic) discovery and production capabilities that are important to the economy, security, health, and energy resources of our Nation and globally. ([Building Resilient Supply Chains](#))

While the plastics problem is highly recognized ([The New Plastics Economy: Rethinking the future of plastics & catalysing action](#)), prevailing commercial incentives have made it difficult to make significant progress and the problem, often referred to as a "Gordian knot", is much more complex than simple incentives might imply. New approaches and incentives are critical to future success. ([Rethinking Plastics in Aotearoa New Zealand](#); [Plastics Innovation Fund](#))

Our efforts in microelectronics are seen as having fallen behind and our inability to manufacture critical supply chain components and assess the supply chain itself is considered by some as a significant national security risk. However, that tide is turning as there are several new programs and bold initiatives in place to solve some of the most daunting materials issues including exciting global efforts and partnerships. ([Cooperation in Quantum Science and Technology – United States Department of State](#))

Partnerships and Engagements: Related programs at NSF are numerous. Proposals should seek to build upon these programs by focusing on areas of research that are ready for accelerated convergence research and can produce solutions and deliverables in a three-year time period. NSF programs include, but are not limited to the following: Designing Materials to Revolutionize and Engineer our Future (DMREF) and Emerging Frontiers in Research and Innovation (EFRI) as well as centers, platforms, and foundries, including: Materials Science Research and Engineering Centers (MRSECs), Science and Technology Centers (STCs), Centers for Chemical Innovation (CCIs), Engineering Research Centers (ERCs), Industry – University Cooperative Research Centers (IUCRCs), Materials Innovation Platforms (MIPs), NSF Center for Sustainable Polymers (CSP), and Convergent Accelerated Discovery Foundries for Quantum Materials Science, Engineering and Information (Q-AMASE-I). In addition to leveraging NSF investments, projects may also leverage other Federal agency investments such as the Manufacturing USA Institutes, the Department of Energy's BOTTLE consortium, and numerous others. Proposals should be explicit in how diversity, equity, inclusion, and accessibility will be incorporated into the overall project.

Over the past year, the NSF Convergence Accelerator has supported several ideation workshops aimed at distilling meaningful solutions and deliverables for some of the most pressing materials and manufacturing needs as well as broad cross-cutting resources that can contribute to many different materials and their applications, such as:

- [Accelerating Translational Materials R&D for Global Challenges](#)
- [Development of Infrastructure for Distributed Bio-Manufacturing and Bio-Readiness](#)
- [Design for Circular Economy from Molecules to the Built Environment](#)
- [Socioresilient Infrastructure: Precision Materials, Assemblages, and Systems](#)

A key 3-year milestone was identified in each of five technical areas:

1. Materials Research Data Sharing Principles & Infrastructure: Establishment of a common US-wide data standard and data sharing infrastructure for academic, government, and industrial materials data, building on FAIR data principles 1 and providing needed metadata, annotations, and access controls.
2. Incentives for Long-term Investment & Sustainability: Creation of a multi-stakeholder effort that demonstrates the effective use of a convergence approach to de-risk solutions in an area of sustainable materials, such as polymers.
3. Full-lifecycle and Sustainability "Systems Thinking" in Materials Design: Demonstration of an open data platform and program for holistic materials research and development that incorporates interdisciplinary perspectives beyond materials science (lifecycle analysis, socio-economics, policy, environmental issues, etc.) in an area with large societal impact like materials for the built environment.
4. Construction of Inclusive, Large-scale Partner Ecosystems: Implementation and evaluation of multiple embedding mechanisms (collaboration, technology transfer, internships, sabbaticals, visiting scientists, etc.) to see which are most effective at building strong, inclusive communities of innovation that connect materials science and manufacturing.
5. Making Materials Knowledge Consumable in Design and Manufacturing: Demonstration of programs that drive enhanced data sharing between academic materials research and industry in the form of student projects, industrial internships, and joint training.

Tasks and Deliverables

NSF is seeking solutions that utilize advanced technologies for the translation of materials for global challenges. The *Sustainable Materials for Global Challenges* track focuses on use-inspired, translational research that address challenges in sustainable materials for global challenges while providing significant benefits to society. Each project should incorporate community engagement and strive to include an education or training component that connects user communities. Such connections could include, but are not limited to, citizen science, co-designing projects so they provide benefits to local communities or provide user-friendly data products and services, or creating workforce training programs.

Building upon ideas for education, which mandate three core competencies: communications, teamwork and ethics, develop educational tools and programs on sustainable materials development, including experiential elements such as internships, etc., projects should consider potential benefits to local communities from the data and insights produced by project efforts and by enabling communities to participate in project evaluation activities. Also critical for this topic are projects which focus on behavior change and environmental justice. In addition, proposals should be explicit in how diversity, equity, inclusion, and accessibility (DEIA) will be incorporated into the overall project. Projects that redefine and quantify value so that it includes broader value for the community, biodiversity, etc. are welcomed.

Specifically, solutions that address both the problem of waste remediation and conversion into useful products as well as an entire rethinking of the design and manufacturing process of new materials to prevent future pollution and waste are sought. Further, while there has been increasing attention paid to sustainability and environment issues, viable solutions, for example, in infrastructure, must be truly converged with the humanistic fields including history, social sciences, science, technology and society studies, social justice, and diversity, equity, inclusion, and accessibility. Projects need to clearly articulate a theory of change and identify how the project is going to act as an entry point to effect lasting change. ([Accelerating the low carbon transition](#))

Potential solutions can include, but are not limited to, the creation of a circular economy that is also just and equitable providing access to natural resources and durable man-made resources. Innovative technologies which address both the sustainable production of needed products from the accumulation of waste from such materials as plastics and batteries as well as the design of entirely new ways of developing materials and products are sought. It is highly desirable to make all products (and services) "transparent" with respect to origins, production, use and end-of-life by providing accessible data and data frameworks. Efforts should also include the empowerment of the consumer to make good choices and behave in ways that support circular economies.

Further, those efforts that provide equitable access to circular financing, or how the financing, financial markets and financial actors are affected by a transition from a linear to a circular economy, will be strongly considered. Cross-cutting aspects of each effort should include the transformation of the education and training of the next generation's scientists to consider materials design, development, production, use, and fate from a transdisciplinary perspective that includes sustainable design principles, takes into account societal impact, and is also equitable and just. Concerted efforts across the fields of materials, chemistry, biology, math, physics, engineering, computer science, social, behavioral, economic, and education sciences as well as the broader materials and chemical sectors including legal, policy, design, certification, supply chain and manufacturing capabilities. Proposed solutions should be sustainable from both environmental and economic perspectives.

Outcomes

The objective of this track is to converge efforts in fundamental materials science with materials design and manufacturing methods coupled with their end use and full life cycle considerations for the environmentally and economically sustainable production of critical materials and products. Key themes and potential outcomes may include but are not limited to:

- Materials research data sharing principles & infrastructure (Materials Informatics). Software and tools to enable decision-making across the supply chain, including potential gap analysis and uncertainty analysis to support improvements in systems-level analysis packages, which use multi-disciplinary and multi-dimensional approaches such as data sharing infrastructure for inclusive co-design studios. Making materials knowledge consumable in design, manufacturing, and to all key stakeholders.
- Critical materials and manufacturing processes, such as microelectronics and their components, solutions for sustainable polymers in areas of high unmet need such as healthcare and packaging, and commercially viable materials for sustainable-clean energy (batteries, photovoltaics, wind turbines, hydrogen, etc.) & transport.
- Full-lifecycle and sustainability "Systems Thinking" in materials design including the construction of inclusive, large-scale partner ecosystems. Education and Workforce Development for sustainable design that is connected to opportunities in industry. "Education for and as infrastructure" including scaling of innovative curricula and training for inclusive sustainable infrastructure design and job creation. Community/citizen science projects for socio-resilient infrastructure such as housing for displaced persons that is climate change resilient.

For Track I ONLY:

Australia's national science agency, CSIRO, is providing sponsorship for the participation of one Australian team in Track I. All proposals that include Australian entities that wish to be eligible for CSIRO funding as partners in a US-based team are required to complete a pre-submission review to confirm fit with CSIRO Eligibility Criteria as part of the Letter of Intent. Please see <https://www.csiro.au/missionsaccelerator> for additional information.

Track J: Food & Nutrition Security

Research Background

The overarching goal of the NSF Convergence Accelerator's Track J: Food & Nutrition Security is to accelerate convergence across food and nutrition sectors to address intertwined challenges in supporting population health, combating climate change ([Executive Order 13990](#), [Executive Order 14008](#)), and addressing the nutritional needs of the most vulnerable by empowering youth, women, and disadvantaged communities ([Executive Order 14002](#)). The vision for transforming America's food systems underlying this call for proposals is in alignment with goals of the United States Department of Agriculture and focuses on:

- Ensuring access to safe, healthy, and nutritious food in all communities,
- Building more resilient local and regional food systems,
- Building new markets domestically and internationally, and streams of income for farmers and producers using climate smart food and forestry practices, and
- Making consequential investments in infrastructure and clean energy capabilities in rural America.

The convergence research track topic was chosen based on the results of NSF-funded community workshops, such as [Digital and Precision Agriculture](#) and [Sustainable Systems Enabling Food Security in Extreme Environments and Food Deserts Employing a Convergence of Food, Energy, Water and Systems for Societal Impact](#).

There exists an increasing demand for water, food, and energy resources in the world and in the United States. Concurrent with the effects of climate change and population growth, these essential resources are becoming increasingly scarce. As highlighted by the NSF-funded workshops on this topic, by 2050, water demand will increase by 55%, energy needs by 80%, and food demands by 60%. The world's population is expected to increase from 3 billion in the late 1960s to almost 10 billion by 2050, representing an increase in agricultural demand, creating an urgent need to produce more food to enable food security. Total food consumption globally is projected to increase from 2,373 kcal/person/day in about 1970 to 3,070 kcal/person/day by 2050. In addition, changes in climate, land use, resource consumption, and population growth are pushing some regions to no longer be able to support regional food requirements, contributing to large-scale human migration in parts of the world.

Food and nutrition related industries, consumption behaviors, and resources have always been important for humanity; and they are expected to play a central role over the next decades in addressing challenges related to climate change and population growth. Recognizing this opportunity, Track J of the NSF Convergence Accelerator seeks proposals to create use-inspired, integrative solutions to enable *Food & Nutrition Security*. The goal of this undertaking is to facilitate making connections between agricultural and food processing technologies, data, training, and impacted communities. In developing resilient and regenerative agricultural practices that provide societal impact, there are many obstacles and challenges to overcome. Addressing these requires deep integration and collaboration among many disciplines as well as inventive and innovative partnerships across academia, industry, the public, local/regional communities, non-profit organizations, and federal, state, and local government agencies.

Acceleration of *Food & Nutrition Security* that concomitantly advances agricultural economic interests and regenerative agriculture practices as well as a reduction in waste behavior is a challenge that requires effort and collaboration among disparate disciplines. This track has the objective to create an accessible, climate-safe, fair and just food supply chain for changing environments in interconnected rural and urban communities. It will pursue this objective by focusing on resilient and regenerative agricultural practices. The cohort of synergistic projects funded through this track will help the nation to sustainably increase access to nutritious and affordable food in ways that engage disadvantaged communities. This track will spur technology development and implementation to create good jobs and profitable, resilient businesses.

Achieving this vision requires an accelerated and concentrated effort focused on creativity; innovative ideas and technologies; the ability to collect, aggregate, process, and interpret data and information such that stakeholders from across the spectrum of users can readily obtain the information they need; and improved means to measure and monitor all aspects of the food supply chain and their interconnections. This track is intended to serve as a platform that offers an opportunity to the community to bring in expertise, insights, methods, and tools from multiple areas including, but not limited to, economics, psychology, sociology, genetic engineering, biotechnology, meteorology, hydrology, geospatial analysis, automation control systems, decisions science, nanotechnology, data science, and mathematical/computational modeling.

The resulting collaborative projects must be directed toward ensuring food and nutrition security across the nation and, ultimately, the globe. Teams will use existing datasets, coupled with data analytics, machine learning and artificial intelligence, to build upon or create predictive models and forecasting algorithms to anticipate future food deserts and propose sustainable systems that enable food security in susceptible regions, while accounting for the potential effects of climate change.

Partnerships and Engagements: Partnerships could include, but are not limited to citizen science, co-designing projects so they provide benefits to local communities or provide user-friendly data products and services or creating workforce training programs. Projects should consider potential benefits to local communities from the data and insights produced by project efforts and by enabling communities to participate in project evaluation activities. Projects that focus specifically on community engagement and education are also encouraged. Proposals should be explicit in how diversity, equity, inclusion, and accessibility will be incorporated into the overall project.

Tasks and Deliverables

This track focuses on use-inspired, translational research. Projects must embrace and display a culture of convergence among disciplinary approaches and must include partners from multiple sectors. Projects must articulate one or more clear deliverable(s) that will help transition research into practice with measurable impacts and benefits to society within the less than 3-year effort of a Convergence Accelerator track — 9 months of Phase 1 and 24 months of Phase 2. Deliverables must address challenges in resilient and regenerative agricultural and food consumption practices while providing significant benefits to society. Each project should incorporate community engagement and strive to include an education or re-training component that enables better individual and community understanding of nutrition.

Outcomes

The cohort of projects in this track will ultimately deliver novel, effective, unbiased data-driven AI tools to scale and transform our agricultural systems; economic models for increased and sustainable agriculture and nutrition security; biodiversity and climate-safe biological systems, biotech solutions in agriculture and food processing; adoption-informed automation, robotics, and transportation; and digital and precision agriculture platforms. Partnerships in this cohort will include start-ups and small business, non-profits and foundations, professional societies, scientists, engineers, and economic development organizations at all levels of governance.

Outcomes of the *Food & Nutrition Security* Track may include – but are not limited to – the following:

- Assessing, modeling, and prediction of food deserts (geographic areas with limited access to affordable and nutritious food); food security in extreme environments; and analyzing food deserts with the focus to create socially, politically, economically, and culturally acceptable solutions.
- Planning, prototyping or modeling for food optimization and minimization of waste, including the utilization of sensors, data, and networks while also addressing policy, food labels and discard behavior.
- Combining concepts and approaches from social sciences, biology, chemistry, and engineering to develop plans and methods to promote sustainable systems and enable food security and food literacy.

KEY COMPONENTS OF THE NSF CONVERGENCE ACCELERATOR

Letters of Intent, Phase 1 proposals, and Phase 2 proposals must address the following key components. See Section VI.A (solicitation specific review criteria) for more detail.

Convergence Research

Research and development efforts proposed must represent the highest level of multidisciplinary expertise in [convergence research](#) needed to encompass the full scope of the topic selected. Since transition to practice is a core goal of the Convergence Accelerator, projects need to include personnel with expertise relevant to applications and use, as well as the technologies themselves. Teams must include the necessary expertise in appropriate areas of the physical sciences, math, engineering, data and computer sciences, biological sciences, geological sciences, social and behavioral sciences, general education and science education, and other disciplines to ensure success.

Partnerships

Convergence Accelerator projects should embody use-inspired research that seeks to accelerate research to practice in ways that benefit society at a national scale. The Convergence Accelerator program seeks to encourage partnerships with many types of organizations from academia, industry, government, non-profit, and other sectors, to ensure that research efforts are use-inspired and have a clear path to transition to practice. Therefore, stakeholders from multiple types of organizations and sectors must be involved in ways that allow the project to identify and work with end users.

Letters of Intent should describe envisioned partnerships and a path to expand relationships as needed.

Phase 1 proposals must include non-academic partners who are directly engaged in the activities described and should include letters of collaboration, where necessary (refer to Section V.A.). The proposal must also describe how additional partners would be identified and recruited, as needed.

Phase 2 proposals may engage cross-cutting partners in the following ways:

- As part of the effort described in the proposal. Partners may contribute effort and/or resources that are described under Facilities, Equipment and Other Resources. The NSF review process will consider the team qualifications and resources of the full effort described in the proposal.
- As part of activities, such as the Expo 2023. These activities do not guarantee an opportunity for partnership with one or more teams, but do provide an opportunity to develop potential partnerships in collaboration with awardee teams. NSF's award-making process will not be tied to negotiation of agreements based on these partnerships and are not a requirement for a Phase 2 award.
- After awards are made. Partners or contributors may join projects through agreements developed directly with awardee organizations or NSF after an award has been made. These partnership agreements may be subject to terms and conditions of the NSF award.

Partnerships supported under this solicitation are not intended as a mechanism to conduct corporate sponsored research, though they may take advantage of

synergistic activities. While NSF encourages engagement and submissions from for-profit entities, including sharing of data, tools, expertise, or other resources, fees or profit may not be requested in NSF proposals submitted under this solicitation.

Deliverables

Proposers must clearly identify the deliverables that will result from the proposed project and describe how those outputs will benefit society at a national scale. While deliverables may take many forms (e.g., hardware, software, data, services, processes, protocols, standards, and more) projects must clearly articulate how benefits to society would result from deliverables developed by the end of Phase 2.

Track Alignment

The proposed effort must clearly match the goals described in the track description. Track alignment and contributions to track success must be clearly described. The proposer must clearly describe both the track relevance (fit within the overall track topic or specific subtopic) and, also, how the proposed work fits into the overall goals of the Track to enable the transition of convergence research into practice.

Intellectual Property

Partnerships that facilitate the research effort and transition to practice of research results are a key component of the Convergence Accelerator program. Phase 2 proposals have a required Intellectual Property Management Plan which is essential for current and future partnerships.

The disposition of rights to inventions made by small business firms, large business firms, and non-profit organizations, including universities, during NSF-assisted research is governed by Chapter 18 of Title 35 of the USC, commonly called the Bayh-Dole Act and EO12591, as amended by EO 12618. Additional information can be found in the *NSF Proposal & Award Policies & Procedures Guide (PAPPG Chapter XI.D)*. Potential awardees and their partners should familiarize themselves with the information in these documents. Intellectual property (IP) developed with funds from this award is subject to the Bayh-Dole Act and should be differentiated from IP developed separately and contributed by partners. An Intellectual Property Management Plan is a required element of every proposal (see supplementary documents below), and appropriate IP agreements will be required to be in place prior to an award being made.

The Intellectual Property Management Plan should clearly describe the management of (1) any pre-existing IP that is relevant to the project and (2) IP that may be developed during the award. The Intellectual Property Management Plan should also indicate the path through which any partners who join later could access IP when appropriate and allowed.

For Track I ONLY: Please note that CSIRO funding of Australian teams is subject to CSIRO approval of the IP Management Plan for Phase 2.

Broadening Participation in the NSF Convergence Accelerator

NSF is committed to broadening the participation in Science, Technology, Engineering, and Mathematics (STEM) fields and research endeavors of members of underrepresented groups — including women, Blacks and African Americans, Hispanics, American Indians, Alaska Natives, Native Hawaiians, Native Pacific Islanders, and persons with disabilities.

Broadening participation is a critical element to a successful Convergence Accelerator project capturing a diverse set of perspectives, ideas, and strengths. The Convergence Accelerator focuses on key elements (e.g., end-users, impact, convergence, acceleration, and deliverables), that include capturing all team member perspectives and expertise when determining the deliverables and project impact to society at scale. All proposals (e.g., Phase 1 proposals, and Phase 2 proposals) will be assessed on Broader Impacts and Intellectual Merit.

This solicitation requires that each project, in either Phase 1 or 2, include a *Broadening Participation Plan* (under Broader Impacts) that describes activities that will be undertaken to increase the participation of underrepresented groups in the project's research efforts. Examples of ways to engage groups and/or individuals that are underrepresented may include: through the expertise of personnel, via partnerships, through work with users and user groups, via engagement with stakeholders, through use of datasets that represent information about underrepresented groups, etc.

The Broadening Participation Plan must include:

1. Context: Does the plan describe a goal using institutional or local data?
2. Intended population(s): Does the plan identify the characteristics of participants from an underrepresented group listed above, including school level (e.g., African-American undergraduates or female high-school students)?
3. Strategy: Does the plan describe activities that address the goal(s) and intended population(s)? Is there a clear role for each PI and co-PI?
4. Preparation: Does the plan describe how the PI is prepared (or will prepare or collaborate) to do the proposed work? Does the plan highlight prior experience with broadening participation?
5. Measurement: Is there a plan to measure and disseminate the outcome(s) of the activities?

We encourage partnerships that include IHEs in Established Program to Stimulate Competitive Research (EPSCoR) jurisdictions and Minority Serving Institutions (MSIs) accredited in, and having a campus located in the US, acting on behalf of their faculty members. We particularly encourage partnerships with NSF INCLUDES Alliances and/or the National Network.

More information, including potential metrics for activities and examples, can be found at the following links:

- https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=505289
- <https://www.nsf.gov/od/broadeningparticipation/bp.jsp>
- https://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf21070
- https://www.nsf.gov/mps/broadening_participation/index.jsp
- <https://www.nsf.gov/cise/bpc/>

III. AWARD INFORMATION

Anticipated Type of Award:

Cooperative Agreement or Standard Grant

Estimated Number of Awards: 36 to 48

NSF expects to make up to 48 Phase 1 awards across all topics as a result of this solicitation and the corresponding BAA.

NSF expects to make 4-5 Phase 2 awards for each topic as a result of this solicitation and the corresponding BAA.

Anticipated Funding Amount: \$36,000,000

Anticipated funding is \$36,000,000, pending availability of funds, to support Phase 1 awards. Proposers may request up to \$750,000 for Phase 1.

The estimated funding level for Phase 2 awards depends on the availability of funds and the number of Phase 1 awards. Phase 2 proposals may request up to \$3,000,000 for year 1 and up to \$5,000,000 in total for the 24-month Phase 2 project.

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

IV. ELIGIBILITY INFORMATION

Who May Submit Proposals:

Proposals may only be submitted by the following:

- Institutions of Higher Education (IHEs) - Two- and four-year IHEs (including community colleges) accredited in, and having a campus located in the US, acting on behalf of their faculty members. Special Instructions for International Branch Campuses of US IHEs: If the proposal includes funding to be provided to an international branch campus of a US institution of higher education (including through use of subawards and consultant arrangements), the proposer must explain the benefit(s) to the project of performance at the international branch campus, and justify why the project activities cannot be performed at the US campus.
- Non-profit, non-academic organizations: Independent museums, observatories, research labs, professional societies and similar organizations in the U.S. associated with educational or research activities.
- For-profit organizations: U.S. commercial organizations, especially small businesses with strong capabilities in scientific or engineering research or education.

Who May Serve as PI:

The PI and any co-PIs must hold an appointment at an organization that is eligible to submit as described under "Who May Submit Proposals." At least one PI or co-PI from a Phase 1 award must be included as a PI or co-PI on a Phase 2 proposal based on that Phase 1 award. The same individual who served as PI for the Phase 1 award does not have to be PI for the Phase 2 proposal. Any change of PI and co-PI should be fully explained in the proposal.

Limit on Number of Proposals per Organization:

There are no restrictions or limits.

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

Phase 1 proposals

An individual may serve as PI or co-PI on no more than two Phase 1 proposals. Submissions to the BAA are included in this number. However, it is unlikely that multiple Phase 1 awards would be made to organizations that included the same PI or co-PI on separate proposals.

Phase 2 proposals

Anyone may serve as a PI or co-PI on only one Phase 2 proposal. This limitation includes PIs and co-PIs listed for the proposing organization or any subaward submitted as part of the proposal. There are no restrictions or limits on serving as other Senior Personnel.

See section IV. below for additional eligibility information.

Additional Eligibility Info:

For Track I ONLY:

NSF anticipates the following possible scenarios for Track I proposal preparation and submission. These scenarios are:

1. *Proposals submitted with solely U.S. entities.*
2. *Proposals submitted by a U.S. lead from academia with Australian participants. These proposals could also be submitted through the BAA. The Australian participants may be funded through CSIRO.*
3. *Proposals submitted by a U.S. lead from industry, non-profits, etc. with Australian participants. The Australian participants may be funded through CSIRO.*
4. *Proposals submitted by an Australian lead with U.S. participants from academia, industry, etc. **This type of proposal must be submitted through the BAA.** If this type of proposal is recommended for award after the NSF-managed review process described below and CSIRO funds the Australian participants, then NSF will fund only the U.S. participants.*

Phase 2 proposals

Eligibility to submit a Phase 2 proposal is limited to proposers who receive a Phase 1 Award under this solicitation. The organization that received the Phase 1 award does not have to be the proposing (lead) organization for the Phase 2 proposal, however they must have been part of the Phase 1 team. Any change of proposing organization from Phase 1 should be explained in the proposal.

Only one Phase 2 proposal may be submitted per Phase 1 award.

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

Letters of Intent (required):

Letters of Intent for Phase 1 are required and must be submitted via Research.gov, even if full proposals will be submitted via Grants.gov.

Letters of Intent must be submitted by 5:00 p.m. submitter's local time on the due date indicated elsewhere in this solicitation.

Letters of Intent are non-binding with respect to the team members, title, and specific goals of the research, but the track and thrust area(s) of the research in the Phase 1 proposal must match what was stated in the Letter of Intent. The Letters of Intent will not be used as pre-approval mechanisms for the submission of proposals, and no feedback will be provided to submitters. The Letters of Intent will be used by NSF to assess requirements for proposal review. For more information on Letters of Intent, please review the NSF PAPPG. Note that no Supplementary Documents are allowed.

Letters of Intent should identify a team with the appropriate mix of disciplinary and cross-sector expertise required to build a convergence research effort. Letters of Intent must identify one or more deliverables, how those research outputs could impact society at scale, and the team that will be formed to carry this out.

No project will be considered for an award without a Letter of Intent. Letters of Intent are not reviewed; however, in order to submit a Phase 1 proposal, the proposer must submit a Letter of Intent. Letters of Intent shall not exceed one page and include the following:

- Title that includes "NSF Convergence Accelerator and the track identifier (H, I or J)".
- Names, departmental and organizational affiliations, and expertise of the Principal Investigator and Co-Principal Investigators. For proposals with intent to involve multiple organizations and partnerships, the same information should be provided for all sub-awardees to the extent it is known at the time.
- A brief description of the specific goals of the proposal and how the proposed convergence research and broad partnerships will lead to a deliverable that would be refined during Phase 1 and describe how the deliverable would impact society at a national scale.

For Track I only:

The letter of intent for Track I projects that include Australian participants must be simultaneously submitted to NSF as described above and to CSIRO at globalapplications@csiro.au. Projects that include Australian Participants to be funded through CSIRO should consult <https://www.csiro.au/missionsaccelerator> for additional information.

Letter of Intent Preparation Instructions:

When submitting a Letter of Intent through Research.gov in response to this Program Solicitation please note the conditions outlined below:

- Submission by an Authorized Organizational Representative (AOR) is not required when submitting Letters of Intent.
- A Minimum of 0 and Maximum of 4 Other Senior Project Personnel are permitted
- A Minimum of 0 and Maximum of 4 Other Participating Organizations are permitted
- Submission of multiple Letters of Intent is permitted

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.

Collaborative proposals submitted as separate submissions from multiple organizations will not be accepted.

Phase 1 Full Proposals

Phase 1 efforts will focus on research plan development and team formation leading to a proof-of-concept and will include NSF-organized convenings for training and cross-cohort collaboration. The Phase 1 innovation curriculum is a significant time investment with frequent participation of all partners under the guidance of coaches (a link to a sample curriculum can be found [here](#)).

Letters of Intent (LOI) are required for all Phase 1 proposals in response to this solicitation. A Phase 1 proposal submitted without a corresponding LOI will be returned without review.

Proposal Title: The title of the proposal must begin with "NSF Convergence Accelerator Track" followed by the track identifier (H, I, or J) followed by a colon (e.g., NSF Convergence Accelerator Track (H, I, or J): Project Title). The rest of the title of the proposal should describe the project in concise, informative language, without use of acronyms, so that a technically literate reader can understand the project. The title should emphasize the science and engineering work to be undertaken and be suitable for use in the public press. The title does not need to be the same as the Letter of Intent, but it should reference the Letter of

Intent if the title is not the same.

Personnel Listed on the Cover Sheet: Provide complete information requested on the cover sheet for the PI and up to four co-PIs.

Project Summary: Prepare as described in the PAPPG.

Project Description:

Project descriptions are a maximum of 15 pages and must contain a separate "Broader Impacts" section. Results from prior NSF support must be discussed (see PAPPG for guidelines).

The project description should include the following sections in the following order (a through f):

Objectives and Significance of the Proposed Activity

- a. **Convergence Research:** Explain how the work conducted in Phase 1 represents research at the highest level of integration and interdisciplinarity. Explain how your project uses a [convergence research](#) approach, including discussing the intellectually distinct disciplines and areas of expertise needed. Discuss how you will identify additional areas of expertise that may be needed.

Proposing teams MUST be comprised of researchers and stakeholders from different disciplines that can help catalyze the proposed scientific discovery and accelerate the transition of that innovation into practical use. Phase 1 teams can involve different partners than were mentioned in the Letter of Intent. However, at least one of the PI or co-PIs in the Phase 1 proposal must have been identified as a PI or co-PI in the Letter of Intent.
- b. **Partnerships including a Roles and Responsibilities Table:** Describe how stakeholders from multiple kinds of organizations, including academic and non-academic partners, are poised to form deep and diverse partnerships in support of the proposed use-inspired research. Every team is expected to include at least two types of organizations (e.g., industry, government, academia). Describe the roles of different partners and team members in developing deliverables. The Roles and Responsibilities Table should also clearly identify the roles and responsibilities of all individuals and major groups and entities included in the project. The inclusion of a qualified project manager for effective oversight is strongly encouraged for Phase 1 proposals.
- c. **Coordination Plan:** Describe a mechanism for how collaboration and team effectiveness will be promoted.
- d. **Deliverables:** Describe potential future deliverables should the project continue beyond Phase 1 and describe the timeline for those deliverables. Phase 2 will end ~March 2026 and your deliverables are expected at that time. You should also discuss preliminary deliverables that will be developed in Phase 1. Explain why there is a high probability that this plan will be achieved.
- e. **Track Alignment:** Explain fully the alignment to the track in this solicitation (H, I, or J) and how the proposed work in Phase 1 will assist in the success of the entire track.
- f. **Broader Impacts:** This section must include a Broadening Participation Plan. As broadening participation is an important aspect of the Convergence Accelerator program (see Section II) the Broader Impacts Section MUST include a separate sub-section outlining a specific plan for broadening participation.

Supplementary Documents:

The proposal should include applicable supplementary documents as instructed in the PAPPG. The following items are to be provided as additional supplementary documents and do not count against the 15-page limit for the project description.

If submitting via Research.gov, the Data Management Plan should be uploaded to the Data Management Plan section and the Postdoctoral Researcher Mentoring Plan should be uploaded to the Postdoctoral Mentoring Plan section. Both documents should be included as Other Supplementary Documents in Grants.gov.

Letters of Collaboration:

Letters of support or endorsement for the project are not acceptable and will be cause for return without review.

Individuals whose role is discussed in the Project Description as providing assistance or collaboration to the project that is substantive in nature (but are not included in the budget, refer to PAPPG Chapter II.C.2.d.iv. Unfunded Collaborations) must verify their participation and role with a document in the following format.

To: Convergence Accelerator Program Director(s),

By signing below, I acknowledge that I will provide the assistance or collaborate as indicated in the proposal, entitled "_____ " with _____ as the Principal Investigator. I agree to undertake the tasks assigned to me, as described in the proposal, and I commit to provide or make available the resources described in the proposal.

Signed: _____ Print Name: _____

Date: _____ Organization: _____

There is no limit on the number of letters of collaboration.

Priority will be place on the quality and significance of the collaboration and the role and involvement of the collaborator must be evident from relevant sections of the project description.

Data Management Plan: (*up to two pages*) In addition to the general elements of the data management plan described in the PAPPG, proposals should address within the Data Management Plan their plans for data-sharing across their team, across the track with other teams, and with the general public, during the project and after its completion as well.

Postdoctoral Researcher Mentoring Plan: (*up to one page*) As described in PAPPG Chapter II.C.2.j, each proposal that requests funding to support postdoctoral researchers must upload a description of the mentoring activities that will be provided for such individuals. Note that the Convergence Accelerator program differs in duration and goals from traditional academic research efforts. The Postdoctoral Researcher Mentoring Plan should reflect how mentoring will be appropriate for the specific roles of postdoctoral researchers in this project effort.

Consolidated Personnel List. The Consolidated Personnel List is a spreadsheet with all key personnel, subaward and collaborations listed. The spreadsheet template can be downloaded by clicking [here](#). Please read the instructions carefully. Using the Excel file template, compile information for all persons identified in the proposal as: "PI/PD or co-PI/PD" (i.e., those listed on the cover page); "Other Senior Personnel"; "Subawardee Personnel"; or "Other Personnel" who have a biographical sketch included in the proposal; or "Collaborators" (Letters of Collaboration). Only one spreadsheet should be submitted per proposal and be converted into a PDF document. The file name should be "Consolidated Personnel List". Once completed, the file should be uploaded as a supplementary document. The purpose of this document is to assist the program in the management of reviewer selection. There are likely to be additional individuals and organizations in the COA (see single copy documents below) that are not included in the Personnel List Spreadsheet. If you are unsure of whether to include someone in the Personnel List Spreadsheet, err on the side of including the person.

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

- **Collaborators & Other Affiliations (COA) Information.** As detailed in the PAPPG (II.C.1.e), information regarding collaborators and other affiliations must be provided for each individual who has a biographical sketch in this proposal. The COA information must be provided through use of the [COA template](#).
- **Suggested Reviewers and Reviewers Not to Include (optional).**

Phase 2 Full Proposals

Proposal Title: The title of the proposal must begin with NSF Convergence Accelerator Track" followed by the track identifier (H, I, or J) followed by a colon (e.g., NSF Convergence Accelerator Track (H, I, or J): Project Title). The rest of the title of the proposal should describe the project in concise, informative language, without use of acronyms, so that a technically literate reader can understand the project. The title should emphasize the science and engineering work to be undertaken and be suitable for use in the public press. The title does not need to be the same as the Phase 1 proposal title.

Personnel Listed on the Cover Sheet: Provide complete information requested on the cover sheet for the PI and up to four co-PIs.

Project Summary: Prepare as described in the PAPPG.

Project Description:

Project descriptions are a maximum of 20 pages. Proposals should clearly describe the specific role and contribution of each team member or group. Proposals should describe how the proposer will organize collaboration among project members to promote team effectiveness, taking into account lessons learned from Phase 1 activities, such as human-centered design, user interviews, team science techniques, as well as domain-specific activities.

Proposing teams MUST be comprised of researchers and stakeholders from different disciplines that can help catalyze the proposed scientific discovery and accelerate the transition of that innovation into practical use. Phase 2 teams can involve different partners than were part of the Phase 1 proposal. However, at least one of the PI or co-PIs in the Phase 2 proposal must have served as a PI or co-PI for that project in Phase 1. Any exception to this must be discussed with NSF in advance of proposal submission.

Results from prior NSF support must be discussed including work conducted during Phase 1 (see PAPPG for guidelines). The proposal must also include the following Sections in the following order (a through j):

Objectives and Significance of the Proposed Activity

- Convergence Research:** Explain how the work conducted in Phase 1 and the work proposed in Phase 2 represent research at the highest level of integration and interdisciplinarity.
- Partnerships including a Roles and Responsibilities Table:** Describe how stakeholders from multiple kinds of organizations, including academic and non-academic partners, form deep and diverse partnerships in support of the proposed use-inspired research. Proposers should include a qualified project manager for effective oversight in Phase 2 projects.
- Coordination Plan** (up to two pages): Each proposal must contain a *Convergence Coordination and Management Plan* that describes how the project will be managed across disciplines, institutions, and stakeholder entities over time. This plan should identify specific convergence activities that will enable cross-disciplinary and cross-sectoral integration of teams, such as mentoring and/or professional development/training to support convergent outcomes, and the plan should provide a timeline showing principal tasks and associated interactions. The plan must address the specific roles and responsibilities of the collaborating PI, Co-PIs, other Senior Personnel, paid consultants, partners, and any other participants, and describe the timing and how tasks will be integrated over the course of the project.
- Phase I Portfolio:** (up to two pages) Each proposal should provide discussion of the participation of the project team in the Phase 1 curriculum, meetings and webinars, discussion of how Phase 1 efforts may have modified the project path, and documentation of any creative products or preliminary results developed during Phase 1 and how they will be incorporated into the Phase 2 work plan.
- Timeline of Milestones and Deliverables** (one page): Along with the Convergence Coordination and Management Plan, each proposal must provide a visual representation (e.g., Gantt chart or alternative) of key milestones during the 24-month award period, including creation of specific deliverables.
- Deliverables:** In alignment with the timeline above state clearly what are the planned, tangible deliverables, along with milestones, during the 24-month award period as well as after 24 months of funding. Explain why there is a high probability that this plan will be achieved.
- Track Alignment:** Explain the close match to the track in this solicitation (H, I, or J) and how the proposed work in Phase 2 will assist in the success of the entire track. Each proposal should include a description of how the proposed project will contribute to an integrated environment that will deliver beneficial outputs for the track. It should be evident how the projects will convergently align with the overarching goal of each track rather than as independent projects. This Section should also describe the types of activities undertaken that directly promote track integration.
- Intellectual Property (IP) Management Plan** (up to three pages): Partnerships that facilitate the research effort and transition to practice of research results are a key element of the Convergence Accelerator program and a clear Intellectual Property Management Plan is essential for current and future partnerships. Both ownership and management of IP should be addressed in the Intellectual Property Management Plan.

The Intellectual Property Management Plan should include:

1. IP contributed by partners included in this proposal,
2. IP that may be developed during the project, and
3. a plan for access to IP from (1) and (2) by potential future partners.

Current and future partners may include, but are not limited to, institutions of higher education, non-profit organizations such as foundations or community organizations, for-profit organizations such as companies or investment groups, local/state/federal government, and others. The Intellectual Property Management Plan must articulate how potential future partners will access intellectual property within the project. Appropriate agreements must be in place before an award is made. Similarly, commitments from partner organizations for sharing of resources (such as data, research

instrumentation, or any other required elements for carrying out the proposed work) should be described and formal agreements must be in place before an award is made. The Intellectual Property Management Plan is protected by the Privacy Act (as is the full proposal) and is the type of non-public information that NSF typically will not release beyond the closed, confidential review process, even under FOIA or other request. The Intellectual Property Management Plan will NOT be shared with organizations attending the Expo, but appropriate information that can be shared should be included in the Public Executive Summary document.

- i. **Broader Impacts** (up to two pages): This section must include a Broadening Participation Plan. This solicitation requests that each proposal include, as part of the Broader Impacts Section, a Broadening Participation Plan that describes activities that will be undertaken to increase the participation of underrepresented groups in the project's research and development efforts. Examples of ways to engage groups and/or individuals that are typically underrepresented could include: through the expertise of personnel, via partnerships, through work with users and user groups, via engagement with stakeholders, through use of datasets that represent information about underrepresented groups, etc. The Broadening Participation Plans should include: (1) the context of the proposed broadening participation activity(ies), (2) the intended participants for the activity(ies), (3) the plan of activities over the project duration, (4) prior experience (if any) with broadening participation, and/or intended plan for preparation/training of project members in broadening participation, and (5) plans for the measurement and dissemination of outcomes in broadening participation.
- j. **Public Executive Summary** (public document, for open sharing): (up to two pages) Because the NSF is interested in catalyzing partnerships with industry, foundations, the investment community, and others in Phase 2, the proposal must include a Public Executive Summary that will be posted publicly and shared with potential NSF partners prior to the Expo. A Public Executive Summary is developed during Phase 1 with the help of your coaches. This Section is the only element of the Phase 2 proposal that will be shared with attendees at the Expo and may also be posted publicly on the NSF Convergence Accelerator [website](#). At a minimum, the Public Executive Summary should include the following: (1) Summary of the project's objectives and deliverables; (2) Current status of the intellectual property associated with the project; (3) Summary of the Intellectual Property Management Plan; (4) A description of the current industry partners and how they are participating in the current Phase 1 activities and their expected participation in Phase 2; (5) A clear and concise description of how the proposed project is different from other research and a comparison to other similar work the team is aware of; and (6) A description of the timeline for proposed milestones and deliverables of the project. The Public Executive Summary may include other information to help potential NSF-catalyzed partners decide about possible co-funding or provision of resources to the project. Potential partners will not receive any additional documentation from NSF other than the Public Executive Summary, but additional information may be requested from the proposer. The Public Executive Summary must not include proprietary information.

Supplementary Documents:

The proposal should include applicable supplementary documents as instructed in the PAPPG. The following items are to be provided as additional supplementary documents and do not count against the 20-page limit for the project description.

If submitting via Research.gov, the Data Management Plan should be uploaded to the Data Management Plan section and the Postdoctoral Researcher Mentoring Plan should be uploaded to the Postdoctoral Mentoring Plan section. Both documents should be included as Other Supplementary Documents in Grants.gov.

Letters of Collaboration:

Support or endorsement letters are not acceptable and will be cause for return without review.

Individuals whose role is discussed in the Project Description as providing assistance or collaboration to the project that is substantive in nature (but are not included in the budget, refer to PAPPG Section II.C.2.d.iv. Unfunded Collaborations) must verify their participation and role with a document in the following format.

To: Convergence Accelerator Program Director(s),

By signing below, I acknowledge that I will provide the assistance or collaborate as indicated in the proposal, entitled "_____ " with _____ as the Principal Investigator. I agree to undertake the tasks assigned to me, as described in the proposal, and I commit to provide or make available the resources described in the proposal.

Signed: _____ Print Name: _____

Date: _____ Organization: _____

There is no limit on the number of letters of collaboration.

The role and involvement of the collaborator must be evident from relevant Sections of the project description.

Data Management Plan (up to two pages): In addition to the general elements of the data management plan described in the PAPPG, proposals should address within the Data Management Plan their plans for data-sharing across their team, across the track with other teams, and with the general public, during the project and after its completion as well.

Postdoctoral Researcher Mentoring Plan (up to one page): As described in PAPPG Chapter II.C.2.j, each proposal that requests funding to support postdoctoral researchers must upload a description of the mentoring activities that will be provided for such individuals. Note that the Convergence Accelerator program differs in duration and goals from traditional academic research efforts. The Postdoctoral Researcher Mentoring Plan is expected to reflect a mentoring plan that is will be appropriate for the specific roles of postdoctoral researchers in this project effort.

Consolidated Personnel List: The Consolidated Personnel List is a spreadsheet with all key personnel, subaward and collaborations listed. The spreadsheet template can be downloaded by clicking [here](#). Please read the instructions carefully. Using the Excel file template, compile information for all persons identified in the proposal as: "PI/PD or co-PI/PD" (i.e., those listed on the cover page); "Other Senior Personnel"; "Subawardee Personnel"; or "Other Personnel" who have a biographical sketch included in the proposal; or "Collaborators" (Letters of Collaboration). Only one spreadsheet should be submitted per proposal and be converted into a PDF document. The file name should be "Consolidated Personnel List". Once completed, the file should be uploaded as a supplementary document. The purpose of this document is to assist the program in the management of reviewer selection. There are likely to be additional individuals and organizations in the COA (see single copy documents below) that are not included in the Personnel List Spreadsheet. If you are unsure of whether to include someone in the Personnel List Spreadsheet, err on the side of including the person.

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

- **Collaborators & Other Affiliations (COA) Information:** As detailed in the PAPPG (II.C.1.e), information regarding collaborators and other affiliations must be provided for each individual who has a biographical sketch in this proposal. The COA information must be provided through use of the [COA](#)

[template.](#)

- **Suggested Reviewers and Reviewers Not to Include (optional).**

B. Budgetary Information

Cost Sharing:

Inclusion of voluntary committed cost sharing is prohibited.

Other Budgetary Limitations:

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

Budget Preparation Instructions:

After submitting a Letter of Intent, proposers may submit a Phase 1 full proposal. Phase 1 awards are limited to \$750,000 for a one-year period of performance.

For Track I ONLY:

Budgets for those parts of Phase 1 proposals conducted by the Australian participants and to be funded by CSIRO are not to exceed 255,000 AUD of the possible total 750,000 USD dollars budget limit for Phase 1 proposals.

Phase 2 proposals should include a two-year budget. The budget for year 1 should not exceed \$3,000,000 for the first year and the total budget for the two-year project should not exceed \$5,000,000. Teams that show significant progress during the first year, in accordance with the agreed timetable of milestones and deliverables, may receive funding for a second year. Teams should plan on completing the effort within two years; no-cost extensions will be authorized only in extraordinary circumstances.

Budgets for all projects must include funding for Senior Personnel to attend at least three meetings per year in the Washington, DC area.

Because a **significant level of personnel effort** is **expected** in order to achieve deliverables that benefit the American people in two years, PIs, Co-PIs and other Senior Personnel **may request more than two months of salary support**. The *NSF Proposal & Award Policies & Procedures Guide (PAPPG)* Chapter II.C.2.g.(i)(a) contains NSF's policy on Senior Personnel salaries and wages. Any compensation for Senior Personnel in excess of two months must be disclosed in the proposal budget, justified in the budget justification, and must be specifically approved by NSF in the award notice budget.

Not less than 5% of the overall budget amount (including direct and indirect costs) should be set aside for collaboration among Phase 2 projects for *track integration* and potential cross-track activities. The **Proposal** should describe the types of activities that are proposed to be undertaken to promote track integration, and/or other cross-track activities. After the awards are made, Phase 2 projects in each track will have the opportunity to interact and refine their plans for these activities, with approval from NSF.

Although many proposals to this solicitation will include the participation of for-profit entities, note that NSF award budgets may not include profit or fee as line items.

Contributions from Partners should be described in the Facilities, Equipment and Other Resources Section of the proposal which is described in *NSF Proposal & Award Policies & Procedures Guide (PAPPG) Chapter II.C.2.i*. It is not appropriate in this Section to list funding amounts that may be contributed by partners. Instead, proposers should describe what facilities, equipment and other resources will be possible based on contributions (financial and otherwise) from any partners. Voluntary committed cost sharing is prohibited *NSF Proposal & Award Policies & Procedures Guide (PAPPG) Chapter II.C.2.g.xii*.

C. Due Dates

- **Letter of Intent Due Date(s) (required)** (due by 5 p.m. submitter's local time):

May 31, 2022

Letter of Intent (required for Phase 1 Full Proposals only)

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

July 20, 2022

Phase 1 Full Proposals

August 29, 2023

Phase 2 Full Proposals, only Phase 1 awardees are eligible to apply.

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 *Leading the World in Discovery and Innovation, STEM Talent Development and the Delivery of Benefits from Research - NSF Strategic Plan for Fiscal Years (FY) 2022 - 2026*. These strategies are integrated in the program planning and implementation process, of which proposal review is one part. NSF's mission is particularly well-implemented through the integration of research and education and broadening participation in NSF programs, projects, and activities.

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

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

A. Merit Review Principles and Criteria

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

1. Merit Review Principles

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

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

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

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

2. Merit Review Criteria

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

The two merit review criteria are listed below. **Both** criteria are to be given **full consideration** during the review and decision-making processes; each criterion is necessary but neither, by itself, is sufficient. Therefore, proposers must fully address both criteria. (PAPPG Chapter II.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

Phase 1 Full Proposal

In addition to the Intellectual Merit and Broader Impacts criteria, reviewers will be asked to address the following questions:

- **Convergence Research**
 - Does the Project Description represent research at the highest level of interdisciplinarity and synergy, justifying this investment in supporting a convergence research team?
- **Partnership**
 - Does the Project Description make a strong case that stakeholders from multiple kinds of organizations, including academic and non-academic partners are poised to form a deep and diverse partnership that supports the use-inspired research proposed?
- **Deliverables**
 - Is the convergence research team likely to achieve results in Phase 1 that lead to development of a strong Phase 2 proposal?
- **Track Alignment**
 - Is the proposed research appropriate, i.e., is there a close match to one of the tracks in this solicitation (H, I, J)?
 - Do the proposed ideas differ markedly from research supported by other NSF programs, initiatives, Big Ideas or other NSF funding mechanisms?

Phase 2 Full Proposal

In addition to the Intellectual Merit and Broader Impacts criteria, reviewers will be asked to address the following questions:

- **Convergence Research**
 - Do the Project Description, Convergence and Partnerships, Coordination Plan, and Phase 1 Portfolio represent research at the highest level of integration and interdisciplinarity, justifying this investment in supporting a convergence research team?
- **Partnership**
 - Does the Project Description make a strong case that stakeholders from multiple kinds of organizations, including academic and non-academic partners are poised to form a deep and diverse partnership that supports the use-inspired research proposed?
- **Deliverables**
 - Does the Project Description, Coordination Plan, and Timeline of Milestones and Deliverables indicate a high probability of deliverables within a 24-month period that will ultimately benefit society?
- **Track Alignment and Track Integration**
 - Is the proposed research appropriate, i.e., is there a close match to one of the tracks in this solicitation (H, I, J)?
 - Do the proposed ideas differ markedly from research supported by other NSF programs, initiatives, Big Ideas or other NSF funding mechanisms?
 - Is there convincing evidence of how the effort in Phase 2 will contribute to the success of the entire track and support potential track integration efforts?

Phase 2 Full Proposals only will go through an additional Review Process as described below:

Oral Pitch Presentation and Pitch Review Panel

Following the NSF proposal review panels, the Convergence Accelerator will execute a virtual or in-person oral *pitch review presentation as part of the evaluation process and will also hold a public Convergence Accelerator Expo 2023 (Expo)*. The pitch review will consist of a separate review panel for Tracks H, I, and J.

The pitch review panel will follow NSF merit review guidelines with the review panel made up of members from academia, industry, and other sectors. The pitch review will include NSF reviewers and staff, and competing teams only. The review criteria for the pitch session are the same as those applied to the written proposal and described above. Intellectual Merit and Broader Impacts continue to be the key review criteria along with the solicitation specific review criteria: Convergence, Partnerships, Deliverables, and Track Alignment.

Schedule and Location for Pitch Presentations

The NSF Convergence Accelerator will notify all proposers of the schedule for the virtual or in-person oral pitch presentations and provide necessary details as they become available. Pitch presentations will either be virtual or in-person. If in-person, the pitch presentation will likely be held in or near Washington, DC., at a location near the NSF. Pitch presentations must comply with these instructions and any additional instructions that the NSF may provide prior to the presentation. The date of the pitch review will be approximately 2-4 weeks after the full proposal due date.

Participation and Attendance in the Pitch Session

A proposer's oral pitch presentation team may include the presenter and up to four other team members. Representatives may be from any of the Convergence Accelerator team members. The presenter must be a person regularly engaged with the project, such as the PI, a co-PI, or a Senior Personnel member. It is not required that the PI be the presenter, but the presenter cannot be a person engaged just to make the pitch.

Format of the Pitch Session

The Pitch Presentations will occur as follows: The presenter will have approximately 10 minutes to present their proposed Convergence Accelerator Phase 2 approach to the review panel. An additional amount of time will be allocated for the NSF pitch review panel to ask questions of the presenter and team following their 10-minute pitch. The question-and-answer period does not count against the oral Pitch Presentation time limit.

Expected Pitch Content

The oral pitch presentation should address the following:

1. Introduce the team number and name, names and titles of presenting personnel and their project roles and provide a brief (one sentence) description of the Phase 2 project.
2. Provide a brief summary of the Convergence Accelerator Phase 1 project that includes:
 - o The initial objectives of the project when it was funded.
 - o Key learnings during the Phase 1 project and how they resulted in revision to project plans and deliverables and informed the Phase 2 application.
 - o Any outcomes or outputs from the Phase 1 project.
3. Provide a brief summary of the proposed Convergence Accelerator Phase 2 project that includes:
 - o A clear description of the innovation and problem it is solving.
 - o The broader social impact of the project, including potential applications if the Phase 2 effort is successful.
 - o The objectives for the project.
 - o The key deliverables and expected outcomes (concrete and measurable).
 - o The capacity and capabilities of the team to execute the project including management, staffing and necessary technical and other skills.
 - o The current and expected partners making firm commitments that will help the team achieve the project goals. This may include collaborations with other teams.
 - o A description of the project elements and activities that will contribute to integrating efforts among or across projects to achieve track success.
4. Any additional topics provided by the NSF prior to the oral Pitch Presentation.

The above topics should successfully address the Merit Review Criteria of Intellectual Merit and Broader Impacts, as well as the solicitation specific criteria, set forth previously in this solicitation.

Convergence Accelerator Expo 2023

The Convergence Accelerator Expo (Expo) is a separate public event that provides the teams the opportunity to pitch and demonstrate their project and answer questions from an invited audience of potential partner organizations from industry, foundations, other government agencies, and other members of the investment community, as well as the broader public (press, etc.). The Expo will be presented to an invited audience of other potential funders and funding organizations from industry, foundations, other government agencies, and other members of the investment community, as well as the broader public (press, etc.). The Expo will be held as an in-person event, virtual, or a combination of the two depending on restrictions on in-person meetings. The Expo presentation format will be determined by the Expo format (e.g., in-person, virtual or a combination of the two). The formats may be a timed pitch with Q&A or an exhibit booth, virtual or in person to be operated by the team, or some combination of these. Additional Expo information will be provided when the Public Executive Summaries are made available on the NSF Convergence Accelerator website.

The date of the Expo will be held approximately 4-6 weeks after the full proposal due date and 2-4 weeks after the pitch panel review.

Note: Teams are encouraged to prepare different presentations, one for the Pitch Review and another for the Expo.

Presentation Media

Proposers shall prepare all materials to be used in the oral presentations using electronic presentation tools. The proposer shall provide electronic copies of the oral pitch presentation one week in advance of the presentation.

Overall Evaluation for Phase 2 awards

NSF will develop a list of recommended Phase 2 awards based on all review information available, including the written proposal reviews and the pitch presentation reviews. Proposing teams can choose if and how to engage with any organization that seeks to interact with them directly. Proposers potentially receiving support via those agreements will have a role in defining the list of materials that would be shared with any organizations providing support. NSF will consider the extent to which these interactions complement NSF goals, seem likely to assist project success, are desired by the project team, and seem likely to increase the success of the overall track.

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

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

VII. AWARD ADMINISTRATION INFORMATION

A. Notification of the Award

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

B. Award Conditions

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

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

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

Special Award Conditions:

Phase 1

This is a standard grant award. However, the innovation curriculum requires a significant time investment and frequent participation of all partners under the guidance of coaches (a link to a sample curriculum can be found [here](#)). Projects must ensure that they have set aside the necessary time for these activities. There is also significant engagement and oversight by the NSF Convergence Accelerator Program Directors during Phase 1 activities.

For Track I ONLY:

In the event that a proposal with an Australian participant is selected by NSF for funding, the Australian Participant will submit the proposal to CSIRO so that CSIRO can proceed with the funding of the Australian portion of the award.

Phase 2

NSF Convergence Accelerator Phase 2 awards will be made as cooperative agreements. The cooperative agreement awards will include Special Conditions relating to the period of performance, statement of work, awardee responsibilities, NSF responsibilities, joint NSF-awardee responsibilities, funding and funding schedule, reporting requirements, Senior Personnel, and other conditions. Within the first approximately 30 days of the Award, all Senior Personnel will be required to participate in an approximately two-day meeting at NSF or virtually. In addition, Senior Personnel will be required to attend an evaluation meeting for approximately two days at NSF or virtually near the end of year one. The purpose of the evaluation meeting is to assess progress the awardees have made towards advancing project goals via a well-functioning interdisciplinary and multi-organization team. Each awardee team will prepare briefing material (expected to be 10 pages or less) describing its accomplishments and make a short presentation which will be followed by questions and answers. The reviewers will evaluate the team's progress towards its stated goals and, in particular, progress towards creating deliverables. Taking into account reviewers' input, NSF will

decide whether the team will receive funding for the second year. As noted in "Budget Preparation Instructions," budgets for all projects must include funding for Senior Personnel to attend three meetings per year at NSF or virtually. At least one of these meetings each year is likely to focus on track integration.

No-cost extensions are **not** permitted except under clearly documented exceptional circumstances. Grantees must first contact the cognizant Program Officer prior to submitting a request.

Awardees will be required to include appropriate acknowledgment of NSF support (and partners if appropriate) under the NSF Convergence Accelerator in any publication (including World Wide Web pages) of any material based on or developed under the project, in the following terms:

"This material is based upon work supported by the National Science Foundation Convergence Accelerator under Award No. (Grantee enters NSF award number.)"

Awardees also will be required to orally acknowledge NSF support using the language specified above during all news media interviews, including popular media such as radio, television and news magazines.

Any cooperative agreement awarded in response to this solicitation will contain the following term and condition:

Ensuring Adequate COVID-19 Safety Protocols

(a) This clause implements Section 3(b) of Executive Order 14042, Ensuring Adequate COVID Safety Protocols for Federal Contractors, dated September 9, 2021 (published in the Federal Register on September 14, 2021, 86 FR 50985). Note that the Department of Labor has included "cooperative agreements" within the definition of "contract-like instrument" in its rule referenced at Section 2(e) of this Executive Order, which provides:

For purposes of this order, the term "contract or contract-like instrument" shall have the meaning set forth in the Department of Labor's proposed rule, "Increasing the Minimum Wage for Federal Contractors," 86 Fed. Reg. 38816, 38887 (July 22, 2021). If the Department of Labor issues a final rule relating to that proposed rule, that term shall have the meaning set forth in that final rule.

(b) The awardee must comply with all guidance, including guidance conveyed through Frequently Asked Questions, as amended during the performance of this award, for awardee workplace locations published by the Safer Federal Workforce Task Force (Task Force Guidance) at <https://www.saferfederalworkforce.gov/contractors/>.

(c) *Subawards*. The awardee must include the substance of this clause, including this paragraph (c), in subawards at any tier that exceed the simplified acquisition threshold, as defined in Federal Acquisition Regulation 2.101 on the date of subaward, and are for services, including construction, performed in whole or in part within the United States or its outlying areas. That threshold is presently \$250,000.

(d) *Definition*. As used in this clause, *United States or its outlying areas* means:

- (1) The fifty States;
- (2) The District of Columbia;
- (3) The commonwealths of Puerto Rico and the Northern Mariana Islands;
- (4) The territories of American Samoa, Guam, and the United States Virgin Islands; and
- (5) The minor outlying islands of Baker Island, Howland Island, Jarvis Island, Johnston Atoll, Kingman Reef, Midway Islands, Navassa Island, Palmyra Atoll, and Wake Atoll.

(e) The Foundation will take no action to enforce this article, where the place of performance identified in the award is in a U.S. state or outlying area subject to a court order prohibiting the application of requirements pursuant to the Executive Order (hereinafter, "Excluded State or Outlying Area"). A current list of such Excluded States and Outlying Areas is maintained at <https://www.saferfederalworkforce.gov/contractors/>.

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:

- Douglas Maughan, telephone: (703) 292-2497, email: dmaughan@nsf.gov
- Lara A. Campbell, telephone: (703) 292-7049, email: lcampbel@nsf.gov
- Aurali E. Dade, telephone: (703) 292-7049, email: adade@nsf.gov
- Pradeep P. Fulay, telephone: (703) 292-2445, email: pfulay@nsf.gov
- Ibrahim Mohedas, telephone: (703) 292-4329, email: imohedas@nsf.gov
- Linda Molnar, telephone: (703) 292-8316, email: lmolnar@nsf.gov
- Michael Pozmantier, telephone: (703) 292-4475, email: mpozmant@nsf.gov
- Michael Reksulak, telephone: (703) 292-8326, email: mreksula@nsf.gov

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

- FastLane and Research.gov Help Desk: 1-800-673-6188
- FastLane Help Desk e-mail: fastlane@nsf.gov
- Research.gov Help Desk e-mail: rgov@nsf.gov

For questions relating to Grants.gov contact:

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

IX. OTHER INFORMATION

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

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

ABOUT THE NATIONAL SCIENCE FOUNDATION

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

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

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

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

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

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

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

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

- **Location:** 2415 Eisenhower Avenue, Alexandria, VA 22314
- **For General Information** (NSF Information Center): (703) 292-5111

- **TDD (for the hearing-impaired):** (703) 292-5090
- **To Order Publications or Forms:**
 Send an e-mail to: nsfpubs@nsf.gov
 or telephone: (703) 292-8134
- **To Locate NSF Employees:** (703) 292-5111

PRIVACY ACT AND PUBLIC BURDEN STATEMENTS

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

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

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

[Policies and Important Links](#) | [Privacy](#) | [FOIA](#) | [Help](#) | [Contact NSF](#) | [Contact Web Master](#) | [SiteMap](#)



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

[Text Only](#)