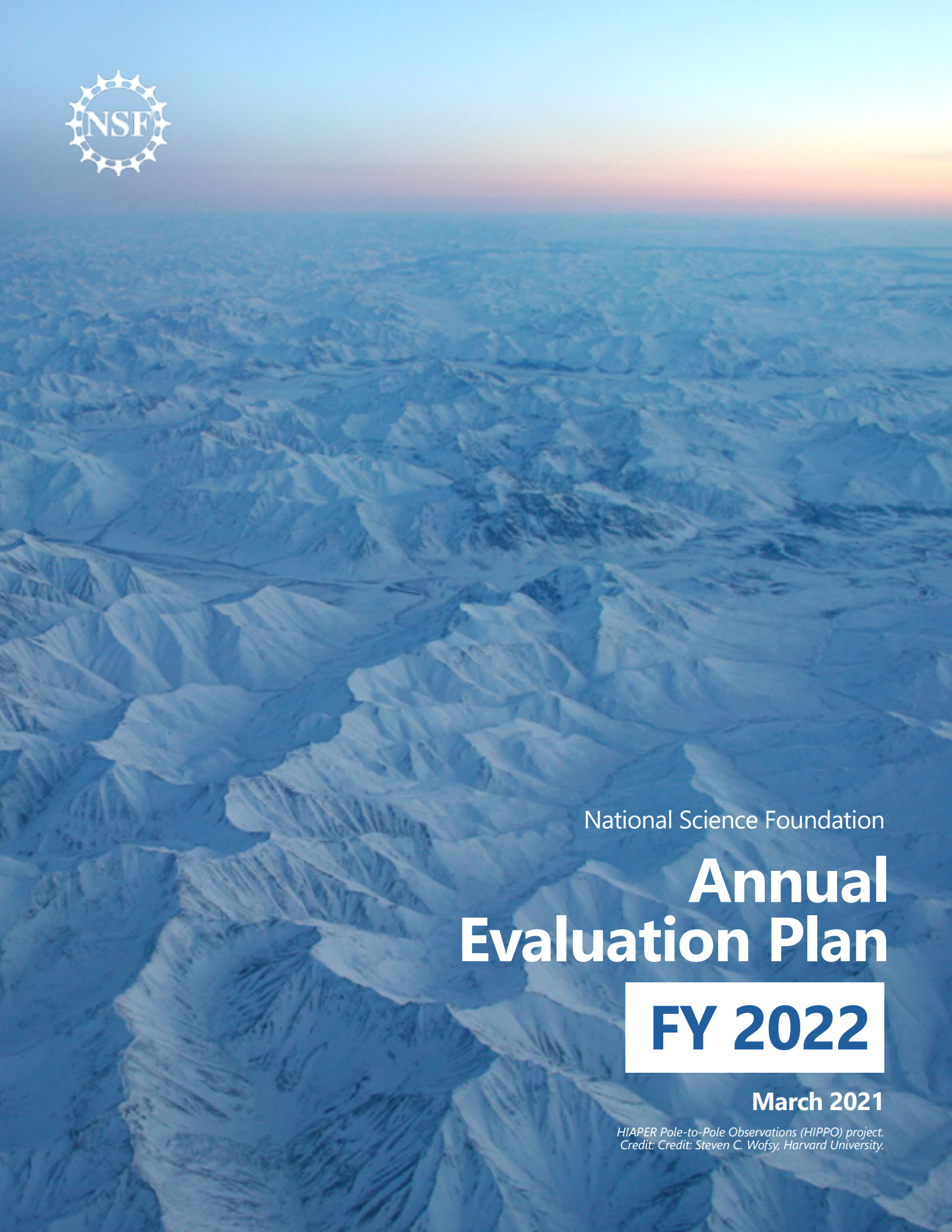
National Science Foundation

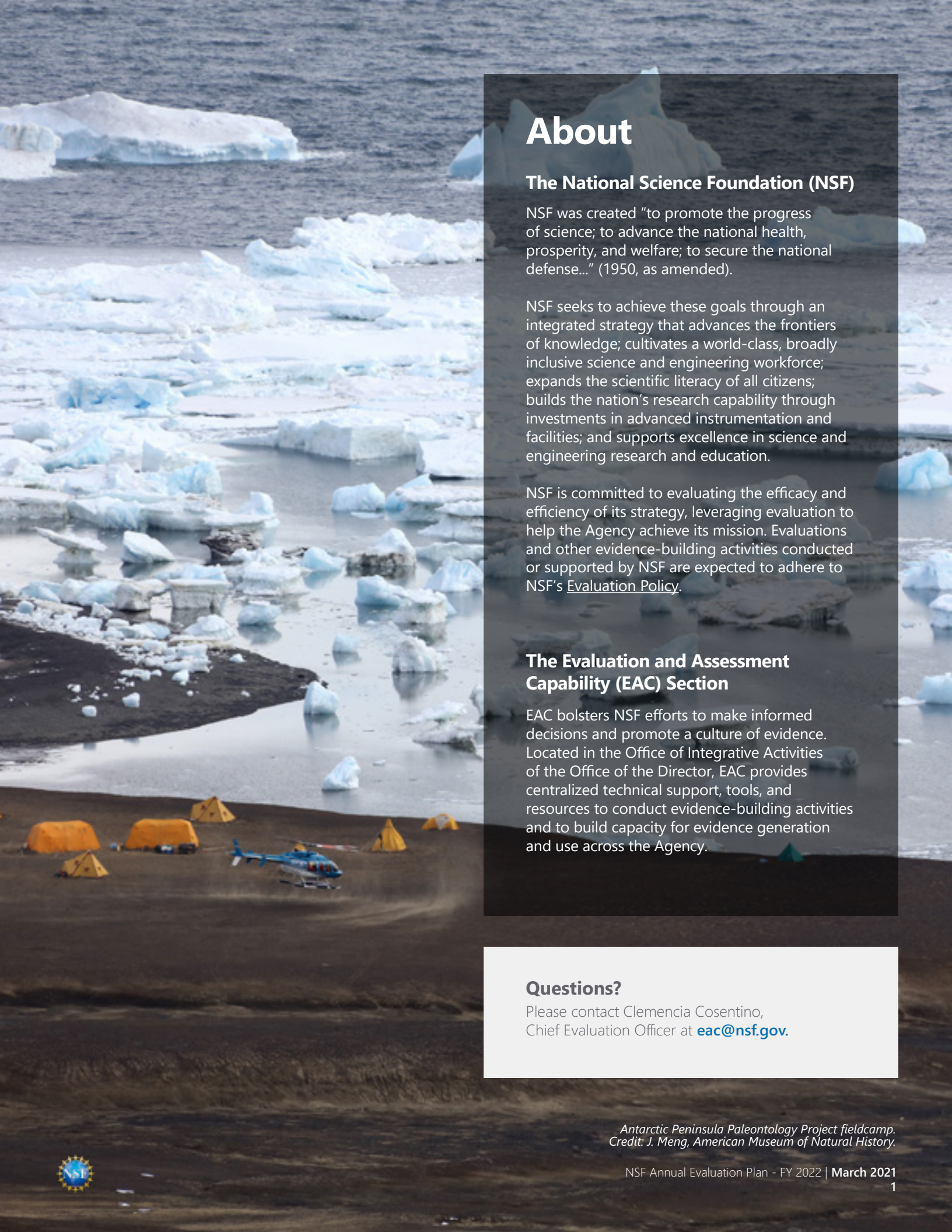
Annual Evaluation Plan

FY 2022

March 2021



HIAPER Pole-to-Pole Observations (HIPPO) project.
Credit: Credit: Steven C. Wofsy, Harvard University.



About

The National Science Foundation (NSF)

NSF was created "to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense..." (1950, as amended).

NSF seeks to achieve these goals through an integrated strategy that advances the frontiers of knowledge; cultivates a world-class, broadly inclusive science and engineering workforce; expands the scientific literacy of all citizens; builds the nation's research capability through investments in advanced instrumentation and facilities; and supports excellence in science and engineering research and education.

NSF is committed to evaluating the efficacy and efficiency of its strategy, leveraging evaluation to help the Agency achieve its mission. Evaluations and other evidence-building activities conducted or supported by NSF are expected to adhere to NSF's Evaluation Policy.

The Evaluation and Assessment Capability (EAC) Section

EAC bolsters NSF efforts to make informed decisions and promote a culture of evidence. Located in the Office of Integrative Activities of the Office of the Director, EAC provides centralized technical support, tools, and resources to conduct evidence-building activities and to build capacity for evidence generation and use across the Agency.

Questions?

Please contact Clemencia Cosentino, Chief Evaluation Officer at **eac@nsf.gov.**

Antarctic Peninsula Paleontology Project fieldcamp. Credit: J. Meng, American Museum of Natural History.

Introduction

The Foundations for Evidence-Based Policymaking Act of 2018, Public Law No. 115-435 (Evidence Act), gave impetus to ongoing federal efforts to use evidence in decision making. This legislation created an opportunity to focus attention on promoting government effectiveness and efficiency by building and using evidence in the most impactful way. This document presents the FY 2022 Annual Evaluation Plan (AEP) that NSF developed in response to this opportunity and following guidance provided by the Office of Management and Budget (OMB M-19-23, OMB M-20-12, and OMB Circular No. A-11).

This AEP describes the evaluations prioritized by NSF for FY 2022. Section 1 presents the criteria used for selecting them. Section 2 provides the research questions guiding each evaluation. Section 3 provides overviews of the background/rationale, timeline, technical approach, data sources, expected challenges and mitigating strategies, and use and dissemination plans for each evaluation question. These evaluations—and all other evidence-building activities—shall be conducted in adherence to NSF's Evaluation Policy.

Study of lichens in the Sonoran Desert.
Credit: ©Frank Bungartz, Ph.D., Arizona State University Lichen Herbarium.

Torres del Paine National Park, Chile.
Credit: ©University Corporation for Atmospheric Research.

Acknowledgments

NSF gratefully acknowledges the contributions of a wide range of stakeholders who were consulted or otherwise participated in the preparation of the Agency's Evidence-Building Plan, which includes the Interim Learning Agenda and this Annual Evaluation Plan.

NSF Leadership and Staff

Leadership and staff from all NSF directorates and offices joined brainstorming sessions and helped prioritize learning questions and draft or review the plans to answer those questions.

Federal Government Agencies

NSF consulted with other government agencies with similar investment portfolios to assess the merits of the questions, technical approaches to answer them, and potential to generate evidence that is useful for other agencies.

Other Stakeholders

NSF consulted with evaluators and researchers across multiple sectors—in academia, private and philanthropic organizations, and state and local government—and solicited input from the public through a request for information published in the Federal Register.

Section 1
Significant Evaluations

Terrain-induced Rotor Experiment (T-REX) field project.
Credit: ©University Corporation for Atmospheric Research.

Criteria used to identify significant evaluation questions:

(1) fill a knowledge gap—that is, the information sought is not available from existing sources, such as evaluations supported by other agencies implementing similar efforts or the scholarly literature

(2) have leadership support—to prioritize the staff time and commit the resources that the work demands

(3) have potential to support upcoming decisions—that is, are likely to yield actionable and useful evidence in a timely fashion

(4) have potential for broad impacts—that is, will likely result in findings that are useful for a broad set of stakeholders, programs, or organizations

(5) are prioritized by NSF leadership to respond to requirements or the evolving scientific and societal landscape—such as Congressional mandates and national long-term strategic priorities

During NSF's initial phase of Evidence Act implementation, these criteria were applied as follows to select evaluation questions:

- Individually, criteria 1-3 are necessary but not sufficient conditions
- Questions meeting criteria 1-4 are likely to be prioritized, absent resource constraints
- Criterion 5 is a sufficient condition to identify a question as significant

These criteria, and their use, may be revised as the Agency's implementation of the Evidence Act, and related legislation, matures and as the Agency responds to changes in priorities and external events, such as those observed in recent years (COVID-19, government shutdowns, and delays in appropriations).

Section 2

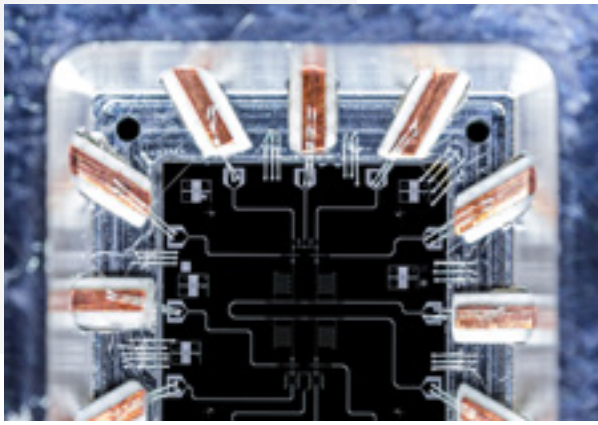
Evaluation Questions At A Glance - FY 2022

Evaluation of EPSCoR

How do EPSCoR funding strategies (infrastructure, co-funding, and outreach) contribute to increasing academic research competitiveness across jurisdictions?

Evaluation of partnerships

What are the benefits of receiving an award from a program supported by a partnership? How do these differ from benefits associated with awards from programs not supported by a partnership? What outputs and outcomes are associated with partnership programs? To what extent can these be attributed to the partnership programs? What improvements could make partnership programs more effective or easier to implement?



Evaluation of Convergence Accelerator

In what ways does the Convergence Accelerator Innovation Training contribute to the emergence of new capacities among participating researchers to meet pressing societal needs?

Photo credits provided on the back cover.

Section 3
Evaluation Plans - FY 2022

This section includes a brief study plan for each prioritized evaluation question. They show the alignment of these questions with NSF's current Strategic Plan. These plans also provide overviews of the background/rationale, timeline, technical approach, data sources, expected challenges and mitigating strategies, and use and dissemination plans.

Seismic vibration research at the red rock arches of the Colorado Plateau. Credit: Alison Starr, University of Utah.

How do EPSCoR funding strategies (infrastructure, co-funding, and outreach) contribute to increasing academic research competitiveness (ARC) across jurisdictions?

Strategic Goal

Expand knowledge in science, engineering, and learning

Strategic Objective

Advance knowledge through investment in ideas, people, and infrastructure

Background and Rationale

As its name indicates, the Established Program to Stimulate Competitive Research (EPSCoR) seeks to stimulate sustainable improvements in research and development (R&D) capacity in the 28 jurisdictions (states and territories) that individually received 0.75 percent or less of total NSF funding over the most recent five-year period. The EPSCoR program employs three investment strategies: (1) it supports physical, human, and cyber infrastructure in academic institutions through its Research Infrastructure Improvement funding tracks; (2) it co-funds meritorious proposals reviewed by other NSF programs that also satisfy EPSCoR programmatic criteria; and (3) it promotes interaction within the EPSCoR community and NSF through workshops and other outreach activities that help build mutual awareness and develop areas of potential strength. The program's theory of change asserts that EPSCoR jurisdictions have opportunities to use EPSCoR funds and other available resources to improve their science, technology, engineering, and mathematics (STEM) ecosystems by strengthening academic research competitiveness (ARC)—that is, the research competitiveness of the academic institutions in their jurisdictions. EPSCoR seeks to expand its capacity to generate and use evidence to monitor program progress in increasing academic research competitiveness through its three funding strategies.

Timeline

FY 2022 - FY 2024

Technical Approach

This outcomes evaluation will build on prior work, such as an exploratory study completed in FY 2020, to develop a design that helps NSF determine whether and how EPSCoR, through its different funding tracks, may be associated with observed project outcomes. The technical approach will be developed once background work is completed and may include analyses overall and by funding track, such as (1) descriptive analyses of jurisdictional characteristics, outputs, and outcomes to determine variation in characteristics and progress in implementation and outcomes over time, (2) a regression analysis of longitudinal data on EPSCoR jurisdictions (most likely done using a lower unit of analysis, such as participating institutions) to establish associations between observed outcomes and program participation, controlling for other factors that are known or hypothesized to be associated with outcomes, and (3) case studies of former EPSCoR program jurisdictions (or those nearing graduation or improving their research competitiveness) to understand the strategies that enabled them to increase their research competitiveness.

Continued...

Data Sources	This study will rely on a monitoring data system that will be developed for the EPSCoR program and will draw data from NSF administrative data systems, existing national data collections, and new collections (as needed).
Challenges and Mitigating Strategies	A prior study (to be released by Summer 2021) indicated that it would be challenging to detect progress toward success for EPSCoR jurisdictions when the sole outcome measure was the program's eligibility criteria. This challenge will be mitigated by relying on a rich set of output and outcome measures that can be used both to monitor institutional and jurisdictional progress and for program improvement.
Use and Dissemination	Findings from this study will be shared with EPSCoR NSF program officers, grantee universities, and jurisdiction science and technology steering committees to inform decisions that may influence the ARC of institutions and jurisdictions.

What are the benefits of receiving an award from a program supported by a partnership? How do these differ from benefits associated with awards from programs not supported by a partnership? What outputs and outcomes are associated with partnership programs? To what extent can these be attributed to the partnership programs? What improvements could make partnership programs more effective or easier to implement?

Strategic Goal

Advance the capability of the nation to meet current and future challenges

Strategic Objective

Support research and promote partnerships to accelerate innovation and provide new capabilities to meet pressing societal needs

Background and Rationale[1]

Building partnerships is a high priority for NSF, as evidenced by two consecutive Agency Priority Goals (APGs for FY 2020 and FY 2021) focused on developing a partnerships strategy. The importance of partnerships is echoed in the recent National Science Board's Vision 2030 report. Partnerships can accelerate discovery in several ways. They can expand the kinds of questions that can be addressed, enable access to expertise and infrastructure, and expand communities of researchers. NSF engages in two types of partnerships—direct and indirect. Direct partnerships are established by NSF with other federal agencies, industry, private foundations, non-governmental organizations, and foreign science agencies. Indirect or "NSF-stimulated" partnerships are required or encouraged by NSF and established by principal investigators (PIs) on NSF grants seeking collaborators with complementary expertise or resources. These types of partnerships are common in many NSF programs, such as the Established Program to Stimulate Competitive Research, and can vary greatly in their characteristics. Having acquired deep experience in building, managing, sustaining, and ending partnerships, NSF is prioritizing evaluation activities that complement other ongoing learning efforts (such as conducting a landscaping study) to reap the greatest benefits from partnerships. This study will be the second of several conducted to learn about the efficacy of NSF's partnership strategy and identify ways to improve it.

Timeline

FY 2022 - FY 2023

Technical Approach

This study will rely on the design developed in FY 2021 to begin evaluating NSF partnerships by studying direct partnerships with industry through the Directorate for Computer and Information Science and Engineering (CISE). NSF selected this type of partnership for the first evaluation for several reasons. Partnerships with industry are a priority for NSF and those in CISE (1) account for a substantial share of existing partnerships (for example, six of the seven new industry partnerships in FY 2019 were in CISE), (2) have sufficient cohorts of grantees to support retrospective or prospective evaluations, and (3) may have

[1]Source: National Science Foundation. 2020. NSF Partnerships: Landscape Study.

Continued...

Technical Approach *(Cont'd)*

comparable non-partnership programs that could be used in support of a more rigorous (quasi-experimental) design to evaluate measurable outputs and outcomes. This study will also rely on qualitative analyses—such as analyses of interviews with partners and grantees—to uncover the benefits of partnerships and the barriers and facilitating factors to successful implementation (from the perspective of participants). These analyses will identify opportunities for improvements and dissemination of promising practices. NSF will use findings from the quantitative analyses to select samples of partners and grantees for surveys and/or interviews to ensure that NSF is able to tease out factors that are likely associated with successful partnerships.

Data Sources

Data sources will be determined after the design is completed and are likely to include NSF administrative data and documents (such as grantee annual and final reports), data on productivity (publications, patents, funding raised, startups launched, and so on), and surveys and interviews with different stakeholders (such as partners and grantees).

Challenges and Mitigating Strategies

Two potential challenges stand out. The first is related to the complexity of creating a high-quality data file with information across programs, years, and data sources. The design phase of this project will enable NSF to devise a data strategy. The second challenge is methodological, as many factors stand in the way of effective evaluation of investments in basic science, such as long timelines to observe outcomes. In the design phase, NSF will identify opportunities to employ designs that enable causal inferences and identify cohorts for which outcomes can reasonably be expected by the time of this study.

Use and Dissemination

Findings will be shared with NSF leadership and program officers. They will be used for program improvements and to inform the design of evaluations of other types of partnerships.

In what ways does the Convergence Accelerator Innovation Training contribute to the emergence of new capacities among participating researchers to meet pressing societal needs?

Strategic Goal

Advance the capability of the nation to meet current and future challenges

Strategic Objective

Support research and promote partnerships to accelerate innovation and provide new capabilities to meet pressing societal needs

Background and Rationale

The NSF Convergence Accelerator is a unique organizational structure within NSF that was initiated in FY 2019. The Convergence Accelerator seeks to (1) accelerate the transition of use-inspired convergence research into practice and (2) build team capacity to pursue exploratory, high-risk projects in topics that vary yearly. One of the signature approaches of the Convergence Accelerator that distinguishes it from other NSF efforts is the training the program provides to grantees to prepare them to transition their research ideas into investment-ready deliverables. This training is important for the success of the program in achieving its goals. This study seeks to determine in what ways and to what extent the curriculum developed for the program and the training provided using this curriculum helped teams acquire capabilities (attitudes and skills) that promote the Convergence Accelerator program's goals of building team capacity to transition research ideas into market-ready investments.

Timeline

FY 2022 - FY 2023

Technical Approach

This study focuses on the FY 2022 cohort of Convergence Accelerator grantees and has two components to study training outcomes associated with program participation. The first component is a quantitative analysis of changes in grantees' understanding and, if possible, application of design thinking, team management, partnership development, and strategic communication concepts and practices, as these are the focus of Convergence Accelerator training. The analysis will be based on data collected through pre- and post-training surveys completed by participants. The second component will be based on a qualitative analysis of how artifacts evolved over time and may demonstrate how teams' research ideas are refined, packaged, and delivered after exposure to the Convergence Accelerator curriculum with grantee participation in trainings. This component of the study will be based on a comparison of the proposals submitted by grantees in Phase I versus Phase II and the oral pitches delivered as part of the Phase II competition. To conduct this comparison, we will develop and apply a rubric that aligns elements of grantees' work with program learning objectives.

Continued...

Data Sources

This study will rely on the Convergence Accelerator training material (agendas, presentations, workbooks, and other materials); grantee proposals, annual reports, and final deliverables/reports; pre- and post-training surveys of participants; and pitch videos. Convergence Accelerator instructors and coaches will be interviewed as sources for information about instrument development and testing.

Challenges and Mitigating Strategies

Two main challenges stand out for this study. The first is the potential for low survey response rates, based on early experiences. To address this challenge, NSF plans to motivate participants by increasing their understanding of the importance of responding to surveys. Convergence Accelerator staff will also seek to revise the solicitation and award letters to make participation in evaluation activities a program requirement. The second challenge is construct validity and reliability of the rubric developed to analyze proposals and pitches. To mitigate this challenge, NSF will interview coaches and instructors for additional calibration of the rubric and train the analysts for using the rubric to ensure high inter-rater reliability.

Use and Dissemination

Findings from this study will be shared with key NSF stakeholders and used to refine Convergence Accelerator's grantees' training.

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