

# Audit of NSF's Divestment of Major Facilities

NATIONAL SCIENCE FOUNDATION  
OFFICE OF INSPECTOR GENERAL

September 2, 2022  
OIG 22-2-006





## AT A GLANCE

### Audit of NSF's Divestment of Major Facilities

Report No. OIG 22-2-006  
September 2, 2022

#### WHY WE DID THIS AUDIT

NSF's major facilities have construction costs greater than \$100 million, with total construction costs typically ranging from \$100 million to \$800 million over multiple years. Once construction is complete, NSF facilities may operate for 20 to 40 years, with annual operations and maintenance budgets ranging between 6 and 10 percent of the original construction cost. Divestment occurs when NSF no longer considers a facility an operational priority. Our objective was to determine the adequacy of NSF's processes for planning and managing major facility divestments.

#### WHAT WE FOUND

NSF has some processes for planning divestment of its major facilities. For example, NSF identifies major facilities for divestment based on input from the scientific community, and it starts planning and estimating the costs for a major facility's divestment during the facility's design stage. However, NSF could improve its processes for planning and managing divestments to better comply with requirements and best practices. Specifically, we found NSF had not planned divestment for the older facilities we reviewed; did not ensure divestment cost estimates were reasonable for some of the major facilities in our sample; and did not provide Congress full life-cycle cost information as required. Additionally, although NSF has successfully transferred the operation and maintenance of some major facilities to other organizations, its experience with divestment is limited. NSF acknowledged our concerns and is taking steps to strengthen its oversight of the complete life cycle.

#### WHAT WE RECOMMEND

We made three recommendations to improve NSF's planning and management for the divestment of its major facilities.

#### AGENCY RESPONSE

NSF agreed with all three recommendations. NSF's response is included in Appendix A.

FOR FURTHER INFORMATION, CONTACT US AT [OIGPUBLICAFFAIRS@NSF.GOV](mailto:OIGPUBLICAFFAIRS@NSF.GOV).



**National Science Foundation • Office of Inspector General**  
2415 Eisenhower Avenue, Alexandria, Virginia 22314

**MEMORANDUM**

**DATE:** September 2, 2022

**TO:** Karen A. Marrongelle  
Chief Operating Officer  
Office of the Director

**FROM:** Mark Bell [REDACTED]  
Assistant Inspector General  
Office of Audits

**SUBJECT:** Report No. 22-2-006, *Audit of NSF's Divestment of Major Facilities*

Attached is the final report on the subject audit. We have included NSF's response to the draft report as an appendix.

This report contains three recommendations aimed at improving NSF's planning and management for the divestment of its major facilities. NSF concurred with all our recommendations. In accordance with Office of Management and Budget Circular A-50, *Audit Followup*, please provide a written corrective action plan to address the report recommendations. In addressing the report's recommendations, this corrective action plan should detail specific actions and associated milestone dates. Please provide the action plan within 60 calendar days.

We appreciate the courtesies and assistance NSF staff provided during the audit. If you have any questions, please contact Elizabeth Kearns, at 703.292.8483 or [ekearns@nsf.gov](mailto:ekearns@nsf.gov).

cc:

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## TABLE OF CONTENTS

Background .....	1
Audit Objective .....	3
Results of Audit.....	3
NSF Has Some Processes for Planning Major Facility Divestments.....	3
Stakeholder Interests Affect NSF’s Divestment Decisions .....	4
NSF Does Not Have Agency-Level View of All Major Facilities.....	5
NSF Did Not Ensure Cost Estimates Were Reasonable or Reported to Congress.....	6
NSF Does Not Have Enough Policies or Procedures to Guide Divestment.....	7
Conclusion .....	8
Recommendations.....	8
OIG Evaluation of Agency Response .....	9
Appendix A: Agency Response .....	10
Appendix B: Objective, Scope, and Methodology .....	11

## ABBREVIATIONS

AICA	American Innovation and Competitiveness Act
ATA	Alaska Transportable Array
CORF	Chief Officer for Research Facilities
IMP	Internal Management Plan
NSB	National Science Board
O&M	Operations and Maintenance
RIG	Research Infrastructure Guide
RV	Research Vessel



## Background

The National Science Foundation is an independent federal agency created by Congress in 1950 “[t]o promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense; and for other purposes” (Pub. L. No. 81-507). As part of its mission, NSF funds the construction, management, and operation of major multi-user research facilities (major facility), which are shared-use infrastructure accessible to a broad community of researchers and educators.

NSF’s major facilities life cycle has five stages: development, design, construction, operations, and divestment. Major facilities have construction costs greater than \$100 million, with total construction costs typically ranging from \$100 million to \$800 million over a multi-year period. Once construction is complete, NSF facilities may operate for 20 to 40 years, with annual operations and maintenance (O&M) budgets ranging between 6 and 10 percent of the original construction cost. Divestment occurs when NSF no longer considers a facility an operational priority.

According to NSF’s Research Infrastructure Guide (RIG),<sup>1</sup> which “contains NSF policy on the planning and management of major facilities ... through their full life cycle,” divestment may take various forms:

- obtaining additional support from other agencies or non-governmental entities;
- completely transferring a major facility to another entity’s operational and financial control; or
- decommissioning, which may include complete removal of the infrastructure and site restoration.

Over the last 15 years (2006–2021), NSF has divested the following major facilities or major facilities’ components, such as detectors or research vessels, shown in Table 1:

**Table 1. NSF’s Divested Major Facilities or Components of Major Facilities**

Facility/Component Name	FY Divested
Academic Research Fleet’s <i>Research Vessel (RV) Alpha Helix</i>	2008*
Academic Research Fleet’s <i>RV Cape Hatteras</i>	2013
Academic Research Fleet’s <i>RV Wecoma</i>	2013
Academic Research Fleet’s <i>RV Point Sur</i>	2014
National Center for Atmospheric Research’s Columbia Scientific Balloon Facility	2016
Academic Research Fleet’s <i>RV Clifford A. Barnes</i>	2018
Cornell High Energy Synchrotron Source	2019
National Solar Observatory’s Synoptic Long-term Investigations of the Sun (SOLIS) Vacuum Tower	2019
Academic Research Fleet’s <i>RV Marcus G. Langseth</i>	2020
National Superconducting Cyclotron Laboratory	2021
Seismological Facility for the Advancement of Geoscience’s Alaska Transportable Array	2022**
Geodetic Facility for the Advancement of Geoscience’s Network of the Americas	2022***

Source: NSF OIG-generated based on NSF-provided information. This list may not include all divested major facilities or components as NSF’s definition of divestment is evolving.

\*Estimated date based on Budget Requests to Congress. \*\*Divestment activities completed December 31, 2021.

\*\*\*Partially divested. Divestment activities began during the scope period and are expected to be completed by end of FY 2022.

<sup>1</sup> The RIG was published December 2021. It is formerly known as the *Major Facilities Guide* and *Large Facilities Manual*. We reviewed guidance issued from 2003 through 2021. Any variations in requirements are noted throughout the report.



For the divested facilities in our audit sample, NSF transferred or sold most divested major facilities to another entity. Table 2 details the divested major facilities in our audit sample, the divestment activity that occurred, and the O&M costs<sup>2</sup> for the major facility in the fiscal year prior to divestment.

**Table 2. NSF's Divested Major Facilities or Components of Major Facilities in Audit Sample**

Facility/Component Name	FY Divestment Activity Completed	Divestment Activity	NSF's O&M Costs in the facility/component's final full year of operations
Academic Research Fleet <i>RV Clifford A. Barnes</i>	2018	Sold to University of Washington	\$68,000*
Cornell High Energy Synchrotron Source	2019	Transitioned from a stewardship to partnership model	\$20 million*
National Solar Observatory's SOLIS Vacuum Tower	2019	Demolished; Tower last used in 2014 when the SOLIS instrument was removed	\$0*
National Superconducting Cyclotron Laboratory	2021	Transferred facility to Department of Energy	\$22 million**
Seismological Facility for the Advancement of Geoscience's Alaska Transportable Array	2022	Stations removed, transferred to other institutions, or repurposed by NSF Arctic Sciences	\$7.7 million*

Source: NSF OIG-generated based on NSF-provided information

\*Amount provided by the Program Officer.

\*\*Amount based on the NSF Budget Requests to Congress.

In addition to the major facilities listed above, NSF reduced funding for some observatories but does not consider these divestments.

The Office Head of the Large Facilities Office is responsible for developing mandatory policies for all stages of the major facility life cycle. The *American Innovation and Competitiveness Act* (AICA, Pub. L. No. 114-329), enacted in 2017, required NSF to “strengthen oversight and accountability over the full life-cycle of each major multi-user research facility project, including [...] shut-down of the facility, in order to maximize research investment.” In response to the AICA's requirement to “appoint a senior agency official whose responsibility is oversight of” major facilities, NSF created the position of Chief Officer for Research Facilities (CORF) in the Office of the Director.<sup>3</sup> The CORF briefs the National Science Board (NSB) annually and periodically on major facility decisions, including the divestment stage. NSF also recently established the Facilities Governance Board, which oversees and makes recommendations on all aspects of major facilities and mid-scale research infrastructure governance.

<sup>2</sup> For additional context, NSF's O&M costs for all major facilities in FY 2019 was \$1.02 billion; in FY 2020 was \$912.76 million; and in FY 2021 was \$967.01 million.

<sup>3</sup> Pub. L. No. 114-329, Sec. 110(a)(2)(H)



## Audit Objective

The objective of this performance audit was to determine the adequacy of NSF's processes for planning and managing major facility divestments. To accomplish this objective, we judgmentally sampled 15 major facilities or components of major facilities. The sampled major facilities or components were selected from the following categories: (1) facilities that entered the design stage after the AICA's enactment; (2) facilities that were currently in the construction, operations, or divestment stages; and (3) facilities that NSF divested from 2006–2021. Please see Appendix B for more information about our objective, scope, and methodology.

## Results of Audit

NSF has some processes for planning divestment of its major facilities. For example, NSF identifies major facilities for divestment based on input from the scientific community, and it starts planning and estimating the costs for a major facility's divestment during the facility's design stage. However, NSF could improve its processes for planning and managing divestments to better comply with requirements and best practices. Specifically, we found NSF had not planned divestment for the older facilities we reviewed; did not ensure divestment cost estimates were reasonable for some of the major facilities in our sample; and did not provide Congress full life-cycle cost information as required. Additionally, although NSF has successfully transferred the operation and maintenance of some major facilities to other organizations, its experience with divestment is limited. NSF acknowledged our concerns and is taking steps to strengthen its oversight of the complete life cycle.

### NSF Has Some Processes for Planning Major Facility Divestments

NSF has some processes for planning major facility divestments. NSF issued standard operating guidance, titled *Process for Recommending Competition, Renewal and Divestment of Major Facilities*, in May 2021 to help staff make the programmatic recommendation to Senior Leadership to renew, compete, or divest a major facility as the end of the current award is approaching. The guidance states:

... the value and merits of the Major Facility should be informed by experts in the scientific fields served by the Facility, experienced users of the Facility, and others who can provide an objective evaluation of the significance of research undertaken and the effectiveness of the management and operations of the Facility.

For the divested major facilities in our audit sample, NSF based divestment decisions on internal assessments as well as scientific community and advisory committee studies. For example, the Nuclear Science Advisory Committee identified the need to replace the National Superconducting Cyclotron Laboratory. Additionally, an internal management review recommended the Cornell High Energy Synchrotron Source's transition to a new operations funding model.



The NSB issued a statement<sup>4</sup> that “... decisions about the partial or full divestment of these major facilities should be brought to the attention of the Board ....” Similarly, Congress requested NSF include in future budget requests any proposal to divest an observatory.<sup>5</sup> We found that for all divested major facilities in our audit sample, NSF informed the NSB and Congress of divestment decisions through memoranda, presentations, and budget requests to Congress. Additionally, for most of the divested major facilities, NSF updated the Office of the Director on divestment decisions and informed the scientific community through formal announcements.

According to the AICA,<sup>6</sup> NSF must develop and consider a major facility’s full life-cycle costs in its pre-award analysis. NSF updated its policies to reflect this requirement. For the major facilities in our audit sample that were funded after the AICA was enacted, NSF planned for and estimated the major facility’s divestment costs in the design stage.

## Stakeholder Interests Affect NSF’s Divestment Decisions

According to the current and prior RIG, “... NSF will consider decreasing investments in existing facilities when the science they enable is of a lower strategic priority than science that could be enabled by alternate use of the funds.” However, even after a determination is made that a facility is a lower strategic priority, NSF may choose not to divest a major facility due to stakeholder interests. An example of stakeholder interest that could affect NSF’s decision to divest a major facility is found in the Committee Report accompanying the FY 2022 Appropriations Bill, in which the House Committee on Appropriations stated that “NSF should continue its support for existing astronomical facilities in its budget planning ....”<sup>7</sup>

In some cases, external interests influenced NSF’s decision not to divest a major facility. For example, NSF and the scientific community’s analysis identified that the Sunspot Solar Observatory’s Richard B. Dunn Solar Telescope (DST),<sup>8</sup> which became operational in 1969, would be redundant once the Daniel K. Inouye Solar Telescope (DKIST) commenced in Hawaii. However, NSF ultimately did not divest DST due to external influence, even after DKIST became operational in 2021. Instead, NSF retained stewardship of Sunspot Solar Observatory, including the DST, and reduced NSF funding, seeking partnership funding to keep it operational. Similar to DST, a 2012 portfolio review identified Green Bank Observatory’s Robert C. Byrd Green Bank Telescope as a lower priority and recommended divestment by FY 2017. Again, NSF retained stewardship of the facility and obtained significant partnership funding, allowing reallocation of NSF resources to higher-priority programs. Although this may help to reduce NSF’s operations and maintenance costs, according to internal NSF documentation, a risk associated with the use of partnership funding is that multiple partners are needed to “provide significant levels of funding” and the partnerships could fail. To ensure adequate funding is obtained, NSF is continuously monitoring partnerships currently in place and working to identify additional partners.

<sup>4</sup> Statement of the NSB on Potential Divestments of Major Research Facilities, August 17, 2017 (NSB-2017-33)

<sup>5</sup> H. Rept. 117-97

<sup>6</sup> Pub. L. No. 114-329, Sec. 110(b)(1)

<sup>7</sup> H. Rept. 117-97

<sup>8</sup> The Sunspot Solar Observatory is formerly known as the Sacramento Peak Observatory.



In other cases, NSF responded successfully to external stakeholder apprehension about a major facility divestment while still divesting the facility. For example, for the Cornell High Energy Synchrotron Source's transition, NSF determined the facility's scientific objectives were not unique and that it would only fund unique research. NSF worked with external stakeholders who wanted NSF to continue its stewardship of the facility, and, ultimately, the State of New York provided \$15 million to upgrade the facility. Subsequently, NSF transferred ownership to Cornell University and now only supports the unique characteristics of the upgraded facility. Additionally, for the Seismological Facility for the Advancement of Geoscience's Alaska Transportable Array (ATA), NSF planned — from the start — a limited life cycle with station removals beginning in FY 2019. The State of Alaska valued the ATA stations' seismic data, resulting in academic and political interest in operating beyond the planned divestment. Ultimately, NSF successfully divested ATA by facilitating interested parties' adoption of many ATA stations, which continue to operate the stations without NSF support.

## NSF Does Not Have Agency-Level View of All Major Facilities

At the time of our audit, directorates and divisions made divestment decisions, and the NSF Director reviewed those decisions. In response to the AICA's requirement to "appoint a senior agency official whose responsibility is oversight of" major facilities, NSF created the position of the CORF.<sup>9</sup> The CORF Office, which includes the CORF and Deputy CORF, chairs:

- The Facilities Governance Board, which oversees and makes recommendations on all aspects of major facilities and mid-scale research infrastructure governance, and
- The Major and Mid-scale Facilities Working Group, which provides input to the CORF and the Facilities Governance Board regarding strategy, governance, and major and mid-scale research infrastructure implementation issues.

In 2018, the NSB released the report, *Study of Operations and Maintenance (O&M) Costs for NSF Facilities*. According to the report, "O&M has not been a budgetary problem for the agency as a whole," but "divisions and facility operators have made difficult choices, including deferring maintenance, decoupling science, and underutilizing facility assets," which may not align with NSF's strategic priorities. The report further stated, "... NSF should be more than a loose federation of divisions" and recommended the "NSB and the NSF Director should continue to enhance agency-level ownership of the facility portfolio through processes that elevate strategic and budgetary decision-making."

Although NSF is working to address the NSB's recommendation, as mentioned earlier, directorates and divisions make divestment decisions relying on internal assessments and external input. Two-to-three years before an operations award ends, major facility program officers answer a series of questions outlined in the standard operating guidance, titled *Process for Recommending Competition, Renewal and Divestment of Major Facilities*, to determine whether to recommend renewal, competition, or divestment of a major facility. Although the NSF Director reviews the final recommendation to renew, compete, or divest the facility, this review focuses on the assessment of one major facility and not the entire major facility portfolio. NSF has not developed a strategic-level view of all major facilities to

<sup>9</sup> Pub. L. No. 114-329, Sec. 110(a)(2)(H)



enable NSF leadership to make agency-wide divestment decisions. An agency-level view would allow the NSF Director to review the divestment decision within the context of the agency's entire major facilities portfolio.

## NSF Did Not Ensure Cost Estimates Were Reasonable or Reported to Congress

The AICA states<sup>10</sup> that NSF shall, in carrying out the requirements under section 110(a)(1), “ensure that policies for estimating and managing costs and schedules are consistent with the best practices described in the Government Accountability Office [GAO] Cost Estimating and Assessment Guide, the [GAO] Schedule Assessment Guide, and the Office of Management and Budget Uniform Guidance (2 C.F.R. Part 200).” According to GAO’s *Cost Estimating and Assessment Guide* (GAO Cost Guide), “... having full life-cycle costs is important for successfully planning program resource requirements and making wise decisions.” The GAO Cost Guide explains that a comprehensive cost estimate also includes all life-cycle costs and is reasonable. The current and previous versions of the RIG state for an estimate “to be deemed reasonable under the cost principles, the estimate must be developed in accordance with the best practices and twelve steps of the GAO Cost Guide to meet the four characteristics of a high-quality estimate (well-documented, comprehensive, accurate, and credible).” Additionally, NSF has standard operating guidance, titled *DACS Cooperative Support Branch Standardized Cost Analysis Guidance*, which establishes a cost proposal analysis process “to ensure that the costs are allowable, allocable, reasonable, and realistic.” However, according to NSF, this guidance only applies to the stage of the specific award under consideration and the guidance does not require a review of full life-cycle costs at each stage.

We determined NSF guidance does not require divestment cost estimates to be reviewed and as a result, NSF did not ensure divestment cost estimates made at the design stage were reasonable for some of the major facilities in our sample. For example, NSF is a participant in the High-Luminosity Large Hadron Collider’s A Toroidal LHC ApparatuS and Compact Muon Solenoid detectors, which investigate a wide range of physics, including any new particles. An external panel conducted a full life-cycle cost review during the Final Design Review, in which awardees estimated NSF’s share of decommissioning costs to be \$1–2 million per detector. However, when NSF conducted its cost analysis, which determines whether the awardees’ costs are “allowable, allocable, reasonable, and realistic,” it did not include the divestment costs in the review. Although the guidance does not require NSF to review the divestment costs, without NSF’s review, Congress and other stakeholders cannot know whether the full life-cycle cost estimates are reasonable.

In addition to not analyzing the divestment cost estimates, NSF did not report estimates of the full life-cycle costs in requests to Congress, as required. The *NSF Authorization Act of 2002* requires NSF to include, as part of its annual budget request to Congress, a plan for the proposed construction of, and repair and upgrades to, national research facilities, including estimates of the full life-cycle costs.<sup>11</sup> However, in the plans submitted with its Congressional Budget Requests from fiscal years 2004 to 2022, NSF did not include estimates of major facilities’ full life-cycle costs.

<sup>10</sup> Pub. L. No. 114-329, Sec. 110(a)(2)(D)

<sup>11</sup> Section 14(b) of the NSF Authorization Act of 2002, as codified at 42 U.S.C. 1862I



## NSF Does Not Have Enough Policies or Procedures to Guide Divestment

According to the AICA,<sup>12</sup> NSF must “establish policies and procedures for the planning, management, and oversight of a major multi-user research facility project at each phase of the life cycle of the major multi-user research facility project.” NSF has some guidance for managing major facility divestments, but none that guide program officers through the divestment process.

NSF’s current and prior RIG requires, at the Conceptual Design Phase, an Internal Management Plan (IMP) to describe how it will oversee a major facility’s development, construction, operation, and eventual divestment. Because the IMP is a living document that can be updated at transition points during the facility’s life cycle, NSF can therefore update it to account for new circumstances and plan for upcoming transitions, such as divestment. However, because NSF’s IMP requirement started in 2003, none of the facilities we reviewed that were built before 2003 had an IMP. Although this is consistent with NSF’s internal guidance, NSF may divest older facilities sooner, and is not using a tool it has already developed to plan for these transitions.

In addition, although NSF has guidance to help staff recommend whether NSF should renew, compete, or divest from a major facility, this guidance and the RIG do not identify steps for managing the divestment process, available resources within NSF to facilitate the process, and required reviews and approvals. According to the RIG, once NSF makes a divestment decision, “[t]he transition team needs to develop a transition plan” for the NSF program office; the plan “should first specify the model of divestment and the final goal of the transition, such as a new operation model under different funding mechanism, or decommissioning.” The RIG also lists the elements staff should include in the plan. We attempted to review transition plans for the five divested major facilities in our audit sample. In one instance, however, the transition plan did not exist. For the other major facilities, the transition plans consisted of various documents and did not have all the required elements. Some missing elements included the identification of the equipment or facilities that needed to be disposed, costs and procedures for proper disposal of equipment, or identified risks and risk mitigation and management plans, among other factors.

Other than the requirement to develop a transition plan, the RIG does not detail or define steps that NSF must follow to divest a major facility. Program officers told us that unlike other major facility life-cycle stages, no one office provides support for the divestment stage, and they learned how to divest a facility as they went through the process. Many rely on knowledge from other experts within their directorate or division to identify whom to contact. Additionally, the RIG is missing information about roles and responsibilities for divestment. The RIG includes a summary of the roles and responsibilities of the program officer, grants and agreements or contract officer, and Large Facility Office liaison for each stage — except for divestment, for which the guide says, “reserved for future content.”

NSF’s policies and procedures also do not clearly define how NSF transfers property and equipment to the new owner following a major facility divestment. Although NSF has standard operating guidance, titled *NSF Oversight and Monitoring of Property in the Custody of Recipients*, covering the disposition

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<sup>12</sup> Pub. L. No. 114-329, Sec. 110(a)(2)(C)



of property post award, it does not clearly establish the legal transfer of the property or how NSF's future responsibility for maintenance and disposal of the property, if any, is communicated to the recipient. NSF plans to add these additional steps to the guidance.

Additionally, the *National Environmental Policy Act* (NEPA) requires federal agencies to consider the environmental impacts of major federal actions significantly affecting the quality of the human environment.<sup>13</sup> Before a decision is made to fund a proposal, NSF requires the "identification and consideration of environmental impacts stemming from the proposed activities[.]"<sup>14</sup> NSF describes the categories of actions that "normally" require an environmental assessment or an Environmental Impact Statement, and those that are "categorically excluded" in its regulations.<sup>15</sup> We met with NSF staff and reviewed documentation such as NSF's Record of Environmental Compliance form to determine whether NSF followed environmental compliance activities. We determined NSF guidance did not clearly indicate when proposed divestments trigger environmental review and what to do when one is required.

## Conclusion

Although NSF has successfully divested some major facilities, it does not have complete policies and procedures to guide program officers through a major facility's divestment. Without clearly defining the divestment process, NSF staff may encounter pushback, delays, and inconsistencies in how the facility is divested, which may lead to unnecessary operations and maintenance costs.

## Recommendations

We recommend the Chief Operating Officer:

1. Develop a process that establishes an agency-level view of all major facilities to enable NSF leadership to make agency-wide divestment decisions.
2. Develop a process to ensure full life-cycle costs of major facilities, including costs associated with divestment, are developed, deemed reasonable, and included in the Budget Requests to Congress, as required by the NSF Authorization Act, as amended in 2002.
3. Improve policies, procedures, and guidance to clearly define the last major facility life cycle stage and define how NSF will carry out these transitions. These documents should identify steps for managing the transition, for designating and identifying internal resources to facilitate the process, and for obtaining required reviews and approvals.

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<sup>13</sup> 42 U.S.C. § 4332. NSF regulations governing compliance with NEPA are found at 45 CFR § 640. NSF regulations supplement the Council on Environmental Quality's regulations, published at 40 CFR §§ 1500-1508.

<sup>14</sup> Proposal and Award Manual (PAM), NSF Manual #10, October 2021.

<sup>15</sup> 45 CFR § 640.3(a)-(b)



## OIG Evaluation of Agency Response

NSF agreed with all three of our recommendations. We have included NSF's response to this report in its entirety in Appendix A.



## Appendix A: Agency Response



**National Science Foundation**  
Office of the Director

DATE: August 29, 2022

TO: Allison Lerner, Inspector General, NSF

FROM: Karen A. Marrongelle, Ph.D., Chief Operating Officer [REDACTED]

SUBJECT: NSF's Response to the OIG Official Draft Report, *Audit of NSF's Divestment of Major Facilities*

The National Science Foundation (NSF) greatly appreciates the professionalism and diligence of the Office of the Inspector General (OIG) in conducting the audit of the agency's procedures related to divestment, the final stage in the major facility life-cycle. We agree with the three recommendations presented and, due to frequent dialogue with the OIG during the audit process, have already taken proactive steps toward their resolution by leveraging NSF's 2022 Strategic Review process. We will develop the required Corrective Action Plan to resolve and close all of the recommendations in a timely manner.

We would like to thank the OIG for the strong partnership in making the agency more effective in supporting the U.S. scientific enterprise and building trust with the American taxpayer on these significant investments.

*2415 Eisenhower Avenue, Suite 19100 Alexandria, VA 22314*



## Appendix B: Objective, Scope, and Methodology

The objective of this performance audit was to determine the adequacy of NSF’s processes for planning and managing major facility divestments. To accomplish this objective, we judgmentally sampled 15 major facilities or components, such as detectors or research vessels, of major facilities. The sampled major facilities or components were selected from the following categories: (1) facilities that entered the design stage after the AICA’s enactment; (2) facilities that were currently in the construction, operations, or divestment stages; and (3) facilities that NSF divested from 2006–2021.

**Table 3. Major Facilities or Components of Major Facilities Judgmentally Selected**

Facility/Component Name	Life Cycle Stage
Academic Research Fleet’s <i>RV Clifford A. Barnes</i>	Divested
Cornell High Energy Synchrotron Source	Divested
Green Bank Observatory	Operations
High-Luminosity Large Hadron Collider’s A Toroidal LHC Apparatus	Construction
High-Luminosity Large Hadron Collider’s Compact Muon Solenoid	Construction
IceCube Neutrino Observatory	Operations
Leadership-Class Computing Facility	Design
National Center for Atmospheric Research	Operations
National Ecological Observatory Network	Operations
National High Magnetic Field Laboratory	Operations
National Optical-Infrared Astronomy Research Laboratory’s Vera C. Rubin Observatory	Pre-Operations
National Solar Observatory’s SOLIS Vacuum Tower	Divested
National Solar Observatory’s Sacramento Peak Observatory	Operations
National Superconducting Cyclotron Laboratory	Divestment
Seismological Facility for the Advancement of Geoscience’s Alaska Transportable Array	Divested

Source: NSF OIG-generated based on NSF-provided data

As of FY 2021, NSF had a total of 20 major facilities, not including their various components.

To perform our audit and gain an understanding of NSF’s internal controls, we reviewed applicable laws, regulations, and NSF policies and procedures. We interviewed NSF staff and program officers responsible for major facility oversight. We also reviewed documentation to assess NSF’s process for selecting facilities for divestment and whether:

- divestment practices aligned with laws and policies;
- external stakeholders influenced divestment decisions;
- NSF plans for divestment in the early stages of facility development; and
- major facilities have divestment plans.

We assessed all five components of internal control and identified in the report where NSF could strengthen internal controls. We did not identify any instances of fraud or illegal acts.



We conducted this performance audit between March 2021 and February 2022 in accordance with *Generally Accepted Government Auditing Standards*. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions, based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions.

Elizabeth Kearns, Director, Audit Execution; Vashti Young, Audit Manager; Philip Emswiler, Audit Manager; Elizabeth Argeris Lewis, Communications Analyst/Executive Officer; and Brittany Moon, Independent Report Referencer, made key contributions to this report.



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