MAJOR RESEARCH EQUIPMENT AND FACILITIES CONSTRUCTION ACCOUNT (MREFC) OVERVIEW

$304,670,000

Major Research Equipment and Facilities Construction Funding

(Dollars in Millions)

FY 2022 Actual	FY 2023 Esimate	FY 2024 Request	Change over FY 2023 Estimate Amount	Percent
$120.60	$187.23	$304.67	$117.44	62.7%

Overview

The MREFC account supports the acquisition, construction, and commissioning of major facilities and larger mid-scale research infrastructure that provide unique capabilities at the frontiers of science and engineering. Initial development and design and post-construction operations and maintenance are funded through the R&RA account.

MREFC Account Funding, by Project

(Dollars in Millions)

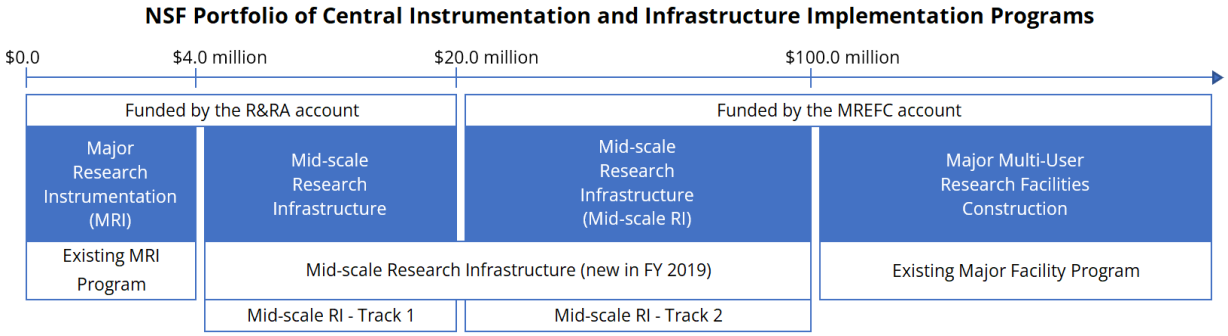
	FY 2022 Actual[1]	FY 2023 Estimate	FY 2024 Request	FY 2025 Estimate	FY 2026 Estimate	FY 2027 Estimate	FY 2028 Estimate	FY 2029 Estimate
Antarctic Infrastructure Recapitalization (AIR)	$55.20	$60.00	$60.00	$60.00	$60.00	$60.00	$60.00	$60.00
HL-Large Hadron Collider Upgrade	10.58	33.00	38.00	-	-	-	-	-
Leadership-Class Computing Facility (LCCF)	-	-	93.00	247.00	147.00	33.00	-	-
Mid-scale Research Infrastructure, Track 2[2]	36.67	76.25	105.06	85.00	90.00	100.00	100.00	100.00
Regional Class Research Vessel (RCRV)[3]	-	1.98	-	-	-	-	-	-
Vera C. Rubin Observatory (Rubin)	17.49	15.00	7.61	-	-	-	-	-
Dedicated Construction Oversight	0.65	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Total	**$120.60**	**$187.23**	**$304.67**	**$393.00**	**$298.00**	**$194.00**	**$161.00**	**$161.00**

[1] A total of $330.73 million was carried over from FY 2022 to FY 2023: $98.34 million for Mid-scale; $150.65 million for AIR; $6.50 millon for RCRV; $20,467 for the Daniel K. Inouye Solar Telescope (DKIST); $29.68 million for HL-LHC, and $40.0 million for Rubin, $1.18 million for Dedicated Construction Oversight. THe remaining $4.36 million consists of funds from recoveries from old projects not funded in FY 2022.

[2] Outyear amounts are for planning purposes only. NSF will evaluate Mid-scale RI in the context of agency priorities for future budget submissions.

[3] FY 2022 Actual excludes $25.0 million in one-time funding for necessary expenses related to RCRV construction impacted by Hurricane Ida as provided in P.L. 117-43, the "Extending Government Funding and Delivering Emergency Assistance Act."

Modern and effective research infrastructure is critical to maintaining U.S. international leadership in science and engineering. The future success of entire fields of research depends upon access to new generations of powerful research tools. Over time, these tools are becoming larger and more technically complex and have significant information technology or cyberinfrastructure component. To be considered for MREFC funding, NSF requires that a major multi-user research facility (major facility) project represent an exceptional opportunity to enable research and education. The project should be transformative in nature, with the potential to shift the paradigm in scientific understanding. The major facility projects included in this budget request meet these criteria based on NSF and National Science Board review and approval. The mid-scale research infrastructure projects funded through this budget line are evaluated separately as described in a distinct section below.



The graphic above summarizes NSF's centralized instrumentation and infrastructure programs. Information presented in this chapter focuses on the items funded at levels above $20.0 million, through the MREFC account. All Mid-scale Research Infrastructure (RI) – Track 2 (Mid-scale RI-2) investments are managed as a single portfolio, with individual projects selected from submissions to a dedicated program solicitation that are evaluated using NSF's merit review process. The NSF-established thresholds for Mid-scale RI-2 projects and major facilities construction projects are consistent with definitions in the 2017 American Innovation and Competitiveness Act (AICA), as amended by the National Defense Authorization Act (NDAA) for FY 2021.

In FY 2024, NSF requests a total of $304.67 million to support mid-scale research infrastructure, initiation of construction of the Leadership-Class Computing Facility (LCCF), and continued construction on three ongoing major facility projects; Antarctic Infrastructure Recapitalization (AIR), the High Luminosity-Large Hadron Collider (HL-LHC) Upgrade, and the Vera C. Rubin Observatory. For more information on each major facility project, see the individual narratives later in this chapter.

Major Facilities

Since FY 2009, major facility projects funded through the MREFC account have been subject to NSF's "no cost overrun" policy. As a result, NSF processes and procedures must assure the development of realistic and well-supported total project cost estimates so that approved budgets for the award recipient are sufficient to accomplish the scientific objectives. The current policy, as published in NSF's Research Infrastructure Guide (RIG), requires that: (1) the total project cost estimate when exiting the preliminary design phase includes adequate contingency to cover foreseeable risks manageable by the recipient; (2) any cost increases not covered by contingency be accommodated first by reductions in scope, with any significant scope reductions reviewed by the agency prior to implementation; and (3) if the project is approved to continue and further scope reductions become too detrimental to science, then the first 10 percent of any cost increase must be covered by the sponsoring directorate through R&RA funding. NSF holds the risk to total project cost for unforeseen events that are beyond the recipient's control. The COVID-19 pandemic constituted such an unforeseen event for all major facility construction projects, and mitigation of that risk falls outside the "no cost overrun policy" and cannot be addressed through the use of contingency. NSF policy allows for both authorization of management reserve and re-baselining, with a subsequent increase in total project cost, to address the consequences of unforeseen events. The overall NSF response to COVID-19 for its major facilities is described at the end of this section.

Mid-scale Research Infrastructure

AICA required the agency to develop a strategy for supporting research infrastructure with a total project cost above the upper limit for the MRI program, which is $6.0 million including cost sharing, and below the lower threshold for the MREFC account, which was then at $70.0 million. The CHIPS and Science Act of 2022 waives the required cost-sharing for the MRI program for a period of five years. NSF has lowered the threshold for Mid-scale RI-Track 1 proposals in response, starting with the current solicitation (NSF 22-637). NSF assessed community demand via a Request for Information[1] that resulted in the submission of approximately $10.0 billion in ideas for projects in the NSF cost range of $20.0–$100.0 million. After evaluating that community input, existing mechanisms, and implementation options, NSF included a dedicated funding line within the MREFC account beginning in FY 2020 for research infrastructure projects in the $20.0–$70.0 million range. The upper limit has been increased to $100.0 million in the second Mid-scale RI-2 solicitation to align with the lower threshold defining a major facility project as given in the FY 2021 NDAA that amended the original AICA definition. This funding line supports upgrades to major facilities as well as stand-alone projects. Projects between $6.0 million and $20.0 million in total project cost are addressed by individual directorates and an NSF-wide program (Mid-scale RI-1) that draws its heritage from the NSF-wide MRI program.

Dedicated Construction Oversight

All major facility projects funded through the MREFC account undergo periodic cost, schedule, and risk reviews as required by the RIG and the terms and conditions of the cooperative agreements or contracts governing the projects. NSF policies and routine reporting are designed to ensure timely and reliable tracking of progress, including monitoring of project schedule and cost (*via* Earned Value Management metrics) and use of contingency, ensuring that program managers and recipients each have timely information to provide sufficient oversight and management authority, respectively, to meet project objectives.

Enhanced oversight of the construction stage includes mandatory incurred cost audits, Earned Value Management System surveillance, and independent cost estimates of re-baseline proposals, as well as other audits and reviews based on NSF's annual major facility portfolio risk assessment. These efforts are conducted by NSF and are generally not attributable to a specific project at the time of budget formulation, nor are they part of the total project cost developed and managed by the recipient. To properly support and transparently account for these efforts, actual costs and future estimates for Dedicated Construction Oversight are shown separately from the costs of individual projects in the MREFC account table above.

Oversight of the mid-scale research infrastructure projects is more flexible and tailored to the technical nature of each project. All mid-scale research infrastructure projects funded through the MREFC account are required to provide a detailed Project Execution Plan for review. The RIG, Section 5, notes that the detailed oversight requirements, and application of major facility oversight practices, depend on characteristics such as the technical scope, type and mix of work performed, and assessment of the technical and programmatic risks.

[1] NSF 18-013: Dear Colleague Letter: Request for Information on Mid-scale Research Infrastructure. Available at https://nsf.gov/pubs/2018/nsf18013/nsf18013.jsp

Continued COVID-19 Impacts on MREFC Projects

From FY 2020 and through FY 2022, NSF increased investments in programs that aid institutions and groups of people most strongly impacted by COVID-19, with an emphasis on supporting individuals at vulnerable career transition points. The COVID-19 pandemic constitutes an unforeseen event that was not within the control of the recipients managing the ongoing major facility construction projects. NSF had policies for responding to unforeseen events that were established in advance of the COVID-19 pandemic, which subsequently have been further refined to support the agency's response to pandemic impacts.

In FY 2021, Congress passed the American Rescue Plan Act (ARP). Within NSF's awarded amount, $55.48 million went towards mitigating COVID-19 impacts on several NSF research infrastructure projects within the MREFC account. Projects include: the Daniel K. Inouye Solar Telescope (DKIST, $8.95 million), the Vera C. Rubin Observatory ($30.0 million), Mid-scale RI-2 ($2.48 million), and RCRV, ($14.05 million). Accordingly, funding requests for FY 2022 and subsequent years for all projects have been adjusted from previous estimates based on NSF's current assessment of pandemic impacts. Re-baselining of several projects, resulting in revised total project costs and schedules, has taken place (e.g., RCRV, Rubin Observatory, and AIR). Re-baselining of HL-LHC is anticipated in FY 2024 as cost and schedule impacts become better known. Impacts due to COVID-19 that can now be forecast (e.g., higher personnel costs and slower progress due to known social-distancing and quarantining requirements) are included in the re-baseline as known risks to be addressed through budget contingency. Potential impacts that cannot be forecast (e.g., deteriorating circumstances because of the impact of new COVID-19 variants and lingering supply chain issues) are held as agency-level risks that would be covered by application of management reserve, in accordance with existing policy described in the RIG. Further details for each project can be found in the individual narratives later in this chapter.

For appropriations language and the carryover statement for the MREFC Account, see the Technical Information chapter.