

ANTARCTIC INFRASTRUCTURE RECAPITALIZATION (AIR)

\$90,000,000

**Appropriated and Requested MREFC Funds
for the Antarctic Infrastructure Modernization for Science (AIMS) Project and the Antarctic Infrastructure
Recapitalization (AIR) Program**

(Dollars in Millions)

	FY 2019	FY 2020 Revised Plan	FY 2021 Request	FY 2022 Request ¹	FY 2023 Estimate	FY 2024 Estimate	Total Project Cost
Authorized AIMS Total Project Cost	\$103.70	\$97.89	\$90.00	\$90.00	\$28.81	-	\$410.40
COVID-19 Adjustment	-	-19.40	-	-	-	-	-19.40
Unfunded AIMS scope transferred to AIR	-	-	-	TBD	-28.81	-	TBD
Revised Estimated AIMS Total Project Cost	\$103.70	\$78.49	\$90.00	TBD	-	-	TBD
AIR Request	-	-	-	TBD	60.00	60.00	120.00
AIMS+AIR TOTAL	\$103.70	\$78.49	\$90.00	\$90.00	\$60.00	\$60.00	\$482.19

¹ The division of the FY 2022 Request between AIMS and AIR will depend on a re-baseline currently in progress.

Brief Description

The Antarctic Infrastructure Recapitalization program is a portfolio of investments in facilities and infrastructure across U.S. Antarctic Program (USAP) stations and gateways that will assure safety, enhance efficiency, increase resilience, and support USAP’s continued leadership on the continent. Near-term AIR investments have been developed and prioritized in close coordination with internal and external stakeholders, and work planned for FY 2022 can make progress even with continued COVID restrictions in place. FY 2022 funding for AIR is requested as part of a re-baselining of the Antarctic Infrastructure Modernization for Science (AIMS) project. AIMS construction will continue with a focus on meeting near-term needs, and unfunded parts of AIMS will be incorporated into the longer-term AIR program.

AIMS was initiated in FY 2019 with an investment of \$103.70 million, followed by \$78.49 million in FY 2020, and \$90.0 million in FY 2021. The NSB authorized a Total Project Cost (TPC) of \$410.40 million for AIMS. The project was in the early stages of field work when COVID restrictions required on-ice construction to be placed on hold. That extended on-ice work stoppage, as well as significant disruptions to workforce and supply chains, will significantly delay completion of the project and require a re-baselining of AIMS.

These significant schedule delays also mean that other investments in facilities and infrastructure across USAP are now emerging as priorities that cannot be deferred until after completion of AIMS. As a result, the re-baselined scope of AIMS will include the Vehicle Equipment and Operations Center (VEOC) and the Lodging Building, both of which continue to be important near-term needs. Remaining work in AIMS will not be funded in lieu of funding being used for emerging priorities in the AIR program. The re-baselined AIMS scope will not require funds in excess of the NSB-authorized TPC, and unfunded AIMS scope will be integrated and prioritized within the broader AIR program. The FY 2022 request of \$90.00 million will be used to fund re-baselined AIMS scope, if necessary, and transition to a broader recapitalization of NSF’s Antarctic infrastructure under the AIR program.

AIMS was envisioned to replace several major structures at McMurdo Station, Antarctica, one of three permanent stations that comprise the U.S. presence on the continent, to meet anticipated science support requirements for the next 35 to 50 years while improving operational efficiency and safety, reducing energy consumption, and containing operations costs. Completion of the VEOC and Lodging Building will make progress on these goals, and the transition to an enduring AIR program will further these goals and broaden their reach across all USAP stations and gateways. Such improvements help ensure continued U.S. leadership and influence in this strategic region. They also support critical scientific research and

capabilities such as nuclear test detection, earthquake monitoring, and real-time weather data collection for global forecasting.

Scientific Purpose

By Presidential directive, the National Science Foundation is the single-point manager of all U.S. activities in Antarctica and is required to, among other things, occupy the geographic South Pole and operate two coastal stations, one being McMurdo Station. In 2011, a Blue-Ribbon Panel (BRP) of experts reviewed the USAP and recommended that NSF undertake a long-term capital upgrade program to redevelop the infrastructure for better long-term support of Antarctic science. AIMS initiated on-site construction activities in FY 2020 to provide a new, more efficient core infrastructure for McMurdo Station. The USAP-wide approach of AIR will strengthen NSF's response to the BRP report.

McMurdo Station's main purpose is to support both near- and deep-field science in Antarctica, including activities at Amundsen-Scott South Pole Station. Continued recapitalization of USAP stations and gateways will enable faster, more streamlined logistics and science support across the continent. AIR will also continue to replace outdated lodging facilities and upgrade utilities to support these facilities, as well as incorporating previously envisioned scope elements of AIMS (see below) too heavily impacted by the pandemic to be included in the re-baselined project. Other elements of AIR will be determined in the context of a developing vision for Antarctic science that involves higher data and communications bandwidths and a concomitant reduction in the number of people needed at McMurdo Station to execute all components of the NSF mission. Development of a detailed plan for a re-visioned, long-term AIR program is currently underway.

Baseline History

In 2011, the Office of Science and Technology Policy and NSF convened a Blue-Ribbon Panel to evaluate the USAP logistical enterprise. The BRP was asked to conduct a review of NSF facilities and operations supporting science in Antarctica and to ensure that the facilities could support the scientific opportunities articulated by an earlier 2011 National Research Council report entitled *Future Science Opportunities in Antarctica and the Southern Ocean*. The BRP report made numerous recommendations regarding maintaining and enhancing the United States' world-class science program in Antarctica.

NSF responded to the BRP report by immediately addressing issues of safety, implementing operational efficiencies that resulted in a rapid return on investment, and developing long-term plans for each of the three year-round U.S. stations: Palmer, Amundsen-Scott South Pole, and McMurdo. The AIMS project was a pivotal component of the McMurdo Station Master Plan with a specific focus on the primary core functions of this critical logistics hub.

AIMS sought to enhance operational support for science by improving operations efficiency, containing operating costs, and enhancing safety. The following major scope elements were targeted to achieve these goals:

- Construction of a Centralized Services building that replaces and modernizes multiple existing facilities on station including centralized warehousing.
- Construction of an Emergency Operations Center to replace the existing fire station, medical facilities, and fitness and skills development facilities.
- Construction of a consolidated Field Science Support Facility.
- Construction of an Industrial Trades Shop to consolidate existing facilities across the station.

Major Research Equipment and Facilities Construction

- Construction of a Vehicle Equipment Operations Center (VEOC) that facilitates maintenance and repair of both heavy and light equipment ranging from traverse tractors, cranes, loaders, and earth moving equipment to trucks, vans, snowmobiles, and field generators.
- Construction of one new lodging facility to ensure adequate bed space to support near-term needs, including population surges from an influx of construction workers. Importantly, this facility comprises primarily single-occupancy rooms recommended by the BRP to promote safety and health. Single rooms mitigate rest issues that can arise from unique work shifts and travel schedules of the station workforce and scientists; they also help control the spread of contagious illnesses.
- Upgrade of utilities distribution networks for fire protection water, domestic water, heating, power, communications, and sanitary sewer.

The AIMS Final Design Review was held in October 2018 and the National Science Board (NSB) authorized NSF to award a contract for AIMS in February of 2019. The AIMS award was made under the Antarctic Support Contract to Leidos. The NSB-approved not-to-exceed TPC for AIMS was \$410.40 million. As noted in the next section, several the AIMS scope elements will now be folded into the longer-term AIR program.

Project Status

To manage the potentially severe risks of COVID-19, on-site AIMS work at McMurdo was paused in March 2020 and construction personnel were not deployed to McMurdo for the FY 2021 construction season. It is anticipated that COVID-19 risks and severe restrictions on international travel to Antarctica through southern gateways will persist into FY 2022. In addition, NSF must prioritize basic facility and experiment maintenance, fuel distribution, and pending communications upgrades that were not executed during FY 2021 because of the necessity to minimize the staffing numbers at McMurdo during the pandemic. As a result, on-ice construction of AIMS will be deferred for another season and would be slowed significantly thereafter. These impacts delay the completion of AIMS sufficiently that other priorities must be addressed.

While plans are in place to resume construction as soon as it is safe to do so, this pause in construction activities, as well as disruption to the supply chain on which the project relies, resulted in multi-year delays to the AIMS construction schedule. As described above, AIMS will be re-baselined to include important near-term needs while unfunded AIMS scope will be integrated and prioritized within the broader AIR program.

Meeting Intellectual Community Needs

- NSF has collected and continues to seek feedback from members of the research community on the quality of the support they receive from the USAP in Antarctica.
- The research community participates actively in decisions regarding the necessary reach of the USAP's logistics system.
- Members of the research community actively participated in requirements development and refinement in the planning and design stages for AIMS, as well as in design reviews.
- The need for upgrades in many components of Antarctic infrastructure was informed by a 2011 NRC report and the 2012 BRP report. Additionally, the critical need to flexibly support a broad range of Antarctic research was further affirmed in a 2015 NRC report.

Governance Structure and Partnerships

NSF Governance Structure

The AIR program will be managed by NSF’s Directorate for Geosciences and implemented by the Office of Polar Programs Antarctic Infrastructure and Logistics (AIL) section. For oversight of AIR, NSF tailors the best practices outlined by NSF’s Major Facilities Guide (MFG), which includes the use of independent cost estimates where appropriate, routine status reports at the program and activity level, and periodic reviews of the portfolio by internal and external experts. The AIR program is overseen by the Chief Officer for Research Facilities and by a Capital Investment Review Board that includes NSF representatives from AIL and Antarctic Sciences Sections, Polar Safety and Occupational Health, Large Facilities Office, and Division of Acquisition and Cooperative Support.

Partnerships and Other Funding Sources

The National Oceanic and Atmospheric Administration is partnering with NSF to support upgrading satellite weather/communications data down/uplink facilities. That project is separate from AIR but will complement AIR in modernizing McMurdo Station and facilitating future communication improvements. As part of the transition to an enduring AIR program, the Capital Investment Review Board that oversees the portfolio of investments will be expanded to include inter-agency partners, providing a robust mechanism to develop future partnerships towards common objectives.

Cost and Schedule

Total Funding Requirements for AIMS and AIR

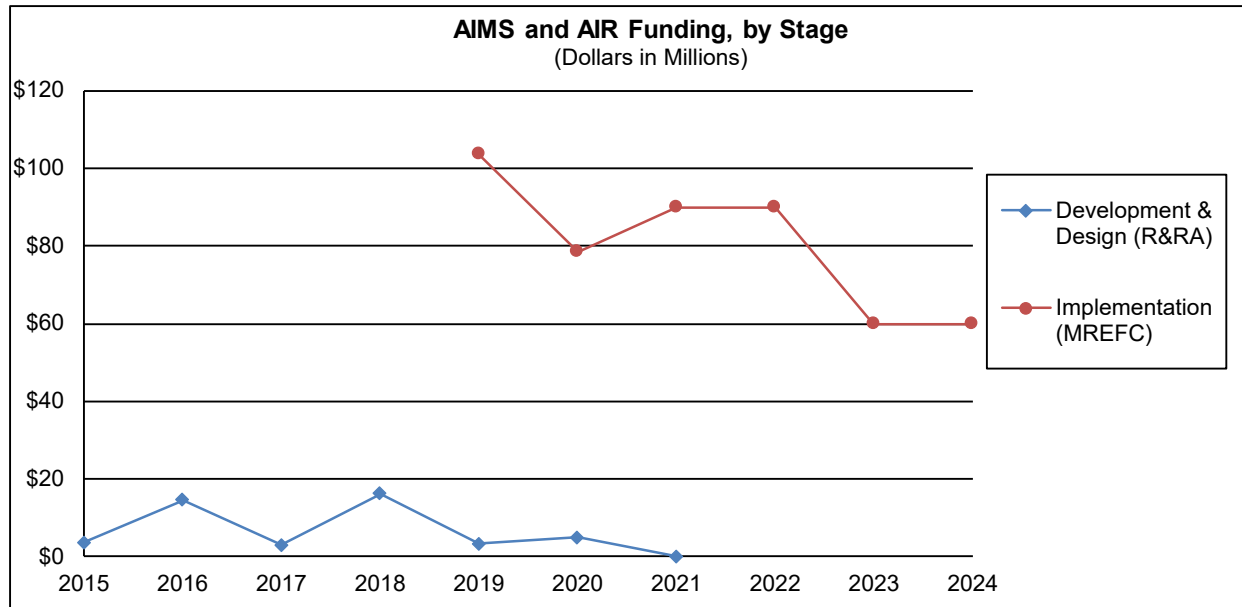
(Dollars in Millions)

	Cumulative Prior Years	FY 2020 Actual	FY 2021 Estimate	FY 2022 Request	ESTIMATES					
					FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	
<i>R&RA:</i>										
Development & Design	\$37.31	\$4.93	-	-	-	-	-	-	-	-
Subtotal, R&RA	\$37.31	\$4.93	-	-	-	-	-	-	-	-
<i>MREFC:</i>										
AIMS Implementation ¹	\$103.70	\$78.49	\$90.00	TBD	-	-	-	-	-	-
AIR Implementation ²	-	-	-	TBD	60.00	60.00	TBD	TBD	TBD	
Subtotal, MREFC	\$103.70	\$78.49	\$90.00	\$90.00	\$60.00	\$60.00	-	-	-	
TOTAL REQUIREMENTS	\$141.01	\$83.42	\$90.00	\$90.00	\$60.00	\$60.00	-	-	-	

¹ Includes \$29.71 million carried forward into FY 2021.

² Outyear estimates will depend on the more complete development of a plan for AIR and are expected to be revised in the FY 2023 Budget Request.

Major Research Equipment and Facilities Construction



Note: Outyear estimates will depend on the more complete development of a plan for AIR, and are expected to be revised in the FY 2023 Budget Request..

FY 2022 funds will be used to support urgent Antarctic infrastructure projects and may include procurement of construction and other materials and capital equipment. Construction components at McMurdo Station that will require re-planning include the first Lodging unit, the VEOC, and the remaining utilities distribution work. Construction of the VEOC and Lodging facility are anticipated to resume in FY 2023. This construction will be sequenced to allow for minimal impact on other emerging infrastructure needs and continuity of operations as well as critical science support.

Implementing these critical components of the AIMS project will provide a reduction in the annual cost to maintain and operate McMurdo Station. The longer-term recapitalization of McMurdo Station and other Antarctic infrastructure under the AIR program is expected to produce further efficiencies.

Reviews

Conceptual Design and Preliminary Design Reviews (PDR) for AIMS were passed successfully in FY 2015 and FY 2017, respectively, resulting in an NSB resolution (NSB-2017-20) authorizing NSF to include AIMS in a future budget request. The AIMS Final Design Review (FDR) was conducted in October 2018. The external panel found that the project execution plan was well-developed for the FDR and recommended that the project proceed to the Construction Stage. They also recommended that NSF attempt to retain all the major science-support capabilities in the original scope, despite a cost increase since PDR related to commodity prices and market conditions, in order to realize the long-term benefits to the USAP. An Independent Cost Estimate was also carried out to support NSF's cost analysis in conjunction with the FDR process.

In addition to daily and weekly communications with Leidos' AIMS project management, NSF conducts a formal monthly project management review. This review covers progress described in the monthly project management report produced by Leidos. Also planned are annual Construction Reviews by OPP and the Large Facilities Office, with the first one having occurred in November 2020. Given the severe impacts of COVID-19 on the AIMS project, as discussed above, a re-baselining of the remaining components of AIMS

is planned for FY 2021 to inform a revised cost, scope, and schedule. Readiness reviews for components of AIR will be conducted based on the scale of the individual projects.

Risks

The two main ongoing known risks to the AIMS project are the market price uncertainty for labor and materials and the uncertainty in the supply chain—getting appropriately skilled workers and materials from the U.S. to McMurdo Station when needed. The COVID-19 pandemic exacerbated these risks. NSF and Leidos have implemented a rigorous risk management approach that includes the identification of risks and mitigation strategies. NSF holds the risk of cost and schedule increases that are beyond the control of the contractor, including events such as pandemics, unpredictably severe weather, icebreaker and supply vessel availability, and macroeconomic changes. Similar inherent risks associated with Antarctica will persist for all future projects under the AIR program and these factors will inform the risk-adjusted project costs.