

ANTARCTIC INFRASTRUCTURE RECAPITALIZATION (AIR)**\$24,000,000****Requested MREFC Funds**

(Dollars in Millions)

	FY 2026 Request
Antarctic Infrastructure Recapitalization	\$24.00

Brief Description

The AIR 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 scientific leadership on the continent. As discussed below, FY 2022 funding supported the newly re-baselined Antarctic Infrastructure Modernization for Science project (AIMS) and initial activities within the broader recapitalization portfolio of NSF's Antarctic infrastructure under the AIR program.

Previously funded AIMS construction continues, with a focus on meeting the most critical near-term need, the Lodging Building. The \$60.0 million enacted in FY 2023 and FY 2024 and the \$24.0 million in the FY 2026 Request are exclusively for funding of activities within the AIR program.

Baseline History

In 2011, the Office of Science and Technology Policy and NSF convened a Blue Ribbon Panel (BRP) to conduct a review of NSF facilities and operations supporting science in Antarctica to ensure that those facilities could enable scientific opportunities articulated by an earlier National Research Council (NRC) report, *Future Science Opportunities in Antarctica and the Southern Ocean*.¹ The BRP report, *More and Better Science in Antarctica Through Increased Logistical Effectiveness*,² made numerous recommendations to maintain and enhance USAP's ability to support world-class science 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 infrastructure plans for each of the three year-round U.S. stations: Palmer, Amundsen-Scott South Pole, and McMurdo. The AIMS project resulted from recommendations in the McMurdo Station Master Plan. The AIR program will continue to refine and carry forward long-term plans for all three USAP stations.

The AIR program will meet critical science needs while engaging the research community and other stakeholders broadly in an ongoing infrastructure renewal program that will keep the U.S. at the forefront of Antarctic research. AIR will assure safety, enhance efficiency and sustainability, increase resilience, and fulfill NSF's mandate to facilitate continued U.S. leadership on the continent.

The AIR program comprises a portfolio of investments that improve general-purpose USAP

¹ www.nap.edu/catalog/13169/future-science-opportunities-in-antarctica-and-the-southern-ocean

² www.nsf.gov/geo/opp/usap_special_review/usap_brp/rpt/index.jsp

infrastructure including facilities, utilities, equipment, and vehicle fleet equipment. This critical infrastructure supports all fields of science. Investments are prioritized across all USAP locations, and acquisition strategies are tailored to individual activities.

Project Status

Construction of the Vehicle Equipment and Operations Center (VEOC) and Lodging facility resumed in the FY 2023 field season under the newly revised AIMS baseline schedule, following significant delays resulting from the COVID-19 pandemic. In FY 2024, NSF placed construction of VEOC on hold and required that the construction site be placed in a safe and stable condition, allowing a focus on completing the Lodging facility. Unfunded components of the original AIMS project will be evaluated and considered for inclusion in the AIR program in future years. Construction of the Lodging facility has progressed steadily, with enclosure of the building achieved in January 2025. Interior work will be conducted during the Austral winter of 2025, with beneficial occupancy of the building anticipated in March 2026.

The AIR program is being managed as a portfolio of investments guided by station master plans developed with robust engagement from across the science community and with inter-agency partners. Activities are prioritized by a Capital Investment Review Board (CIRB) as conditions and requirements change, which allows the program to be responsive to the research community, proactive in mitigating risks, and well-positioned to take advantage of opportunities as they arise. Details for individual AIR projects, including status, are outlined in the *Cost and Schedule* section below.

Meeting Intellectual Community Needs

- The need for upgrades in many components of Antarctic infrastructure was informed by the 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, *A Strategic Vision for NSF Investments in Antarctic and Southern Ocean Research* and in the 2022 follow-on mid-term assessment.^{3,4}
- Members of the research community participated in development and refinement of requirements during the planning and design stages for AIMS, as well as in design reviews.
- Community engagement was intrinsic to the development of the McMurdo and Palmer Station master plans—critical documents that describe the future desired state of the respective stations and inform the AIR Program—and will again be sought in routine updates to the plans for each station. Similarly, community input is being integrated into the development of the South Pole master plan, which was completed in draft form for public comment in Spring 2024 and is anticipated to be final by summer 2025.
- The research community, through the proposal submission and merit review process, informs focus areas for logistics support. For example, through this process, the case was made to defer closing the West Antarctic Ice Sheet Divide field camp until the completion of the Thwaites Glacier project, from which it was based.

³ www.nap.edu/catalog/21741/a-strategic-vision-for-nsf-investments-in-antarctic-and-southern-ocean-research

⁴ nap.nationalacademies.org/read/26338/chapter/1

Governance Structure and Partnerships

NSF Governance Structure

The AIR program is managed by GEO and implemented by the OPP Antarctic Infrastructure and Logistics (AIL) section. NSF tailors oversight of AIR to the scope and complexity of the individual project based on the best practices outlined in NSF's Research Infrastructure Guide, 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 NSF's Chief Officer for Research Facilities and by a CIRB that includes representatives from OPP's AIL, Antarctic Sciences section, Polar Safety and Occupational Health group, and NSF's MPS directorate, as well as representatives from the National Aeronautics and Space Administration, the National Oceanic and Atmospheric Administration (NOAA), and military partners.

Partnerships and Other Funding Sources

NOAA is partnering with NSF to support upgrading satellite weather/communications data down/uplink facilities. That project is separate from, but will complement, AIR in modernizing McMurdo Station and facilitating future communication improvements.

Cost and Schedule

The table below shows active and near-term planned investments in the AIR program portfolio, not in any implied order of importance. These investments are multi-year projects that are in different stages of implementation. The projects and their respective stages of implementation will be updated in future budget narratives as appropriate. Scheduling these investments will be dynamic, depending on a combination of CIRB prioritization and complex logistical considerations.

McMurdo Pier Project	Status: Execution
<u>Mission Need:</u> McMurdo, South Pole Station, and field camps are all reliant on resupply vessels that bring food, fuel, equipment, and materials each January. Vessels have historically offloaded at McMurdo via an ice pier in Winter Quarters Bay where materials are then trucked, traversed, or flown to their destination. The ice pier has failed five times in the past 10 years, requiring the last-minute deployment of temporary offload solutions that are costly and inefficient.	
<u>Project Scope:</u> This project will construct and deploy a barge-type structure that will be moored off McMurdo and can be used reliably and efficiently year after year, significantly reducing program risk.	
<u>Project Status:</u> In FY 2024, a rebaseline review of the McMurdo Pier Project was held after the U.S. Army Corps of Engineers presented higher-than-anticipated bids for the project. During the FY 2025 season, in collaboration with Antarctica New Zealand and the U.S. Navy, pile templates were anchored and all 12 pile holes were drilled and secured. Piles, pile caps, and pre-cast concrete for bridge ramps were delivered to McMurdo. The project will be completed in FY 2027.	

South Pole Critical Infrastructure Remediation- Phase 1	Status: Execution
<u>Mission Need:</u> Ice shelf movement and snow accumulation are crushing utilities supporting the vehicle maintenance facility and the safety escape hatches in the long underground utility tunnel at the South Pole Station. In addition, the fresh water well is coming to the end of its useful life.	
<u>Project Scope:</u> Phase 1 remediates garage arches being crushed by the weight of snow. This project will extend the useful lifespan of the garage by an estimated six years.	
<u>Project Status:</u> Work began in FY 2023 and is planned for completion in FY 2026.	
McMurdo Power Plant Switchgear Controls Upgrade	Status: Execution
<u>Mission Need:</u> Control systems manage eight generators and three wind turbines that provide power for McMurdo Station as well as New Zealand’s Scott Base. The system has no redundancy, is unreliable, and has frequent outages.	
<u>Project Scope:</u> New software will eliminate outages related to control errors and support future generator replacements. The upgrade will enable an increase in monitoring and remote diagnostics and will resolve information technology security vulnerabilities.	
<u>Project Status:</u> Work began in FY 2023 and is planned for completion in FY 2027.	
South Pole Blue Building Lifting System and the Atmospheric Research Observatory (ARO) Raise	Status: Execution
<u>Mission Need:</u> South Pole Station’s Blue Buildings (the IceCube Lab, the Dark Sector Lab that houses the South Pole telescope, Martin A. Pomerantz Observatory (MAPO) with its attached Background Imaging of Cosmic Extragalactic Polarization (BICEP) array, and the ARO) are being buried in snow and, without action, will become unusable.	
<u>Project Scope:</u> This project will lift ARO and provide a “proof of principle” for lifting the remaining structures. Lifting the buildings will extend their useful lifespan by 20 years and drastically reduce annual snow management workload.	
<u>Project Status:</u> Work began in FY 2024 and is planned for completion in FY 2027.	
Traverse Improvements and Expansion – Phase 1	Status: Execution
<u>Mission Need:</u> The South Pole Traverse (SPoT) delivers approximately 100,000 gallons of fuel to the South Pole Station each year at a fraction of the cost of airlifting the fuel. SPoT-2 modules, such as the mobile kitchen and crew quarters, were acquired in 2003, have traveled over 60,000 miles, and are failing structurally and electrically.	
<u>Project Scope:</u> Phase 1 refreshes the SPoT operational traverse modules to ensure continued fuel and cargo delivery to South Pole Station.	

Major Research Equipment and Facilities Construction

<u>Project Status:</u> Work began in FY 2024 and is planned for completion in FY 2026.	
Fleet and Equipment Refresh	Status: Execution
<u>Mission Need:</u> More than two-thirds of the USAP fleet, which includes cargo and passenger transport vehicles, snowmobiles, loaders, light tracked utility vehicles, and light trucks, is beyond end-of-life, in some cases by decades. Air Traffic Control and mobile communications equipment is also aging and at increasing risk of failure.	
<u>Project Scope:</u> This first investment makes upgrades to operational equipment, such as cranes, forklifts, and fire apparatus, as well as replaces the fleet of science-support snowmobiles with newer, more fuel-efficient models.	
<u>Project Status:</u> Work began in FY 2024 and is planned to continue with annual investments.	
Doppler Weather Radar	Status: Execution
<u>Mission Need:</u> Successful and safe flight operations rely on accurate and timely weather information. McMurdo does not have any Doppler weather radar capabilities.	
<u>Project Scope:</u> This project will deploy Doppler weather radar to McMurdo, greatly enhancing weather forecasting capabilities which, in turn, improve the level of science support possible with USAP flight operations.	
<u>Project Status:</u> Work began in FY 2024 and is planned for completion in FY 2028.	
Tactical Air Navigation Upgrade	Status: Execution
<u>Mission Need:</u> Tactical Air Navigation (TACAN) systems are critical for providing bearing and distance guidance and non-precision landing approach capability at McMurdo. The current TACAN is beyond end-of-life, and parts are no longer available, so refurbishment is not possible.	
<u>Project Scope:</u> This project will replace the McMurdo TACAN with a new, modern system.	
<u>Project Status:</u> Work began in FY 2024 and is planned for completion in FY 2028.	
South Pole Critical Infrastructure Remediation – Phase 2	Status: Execution
<u>Mission Need:</u> Ice shelf movement and snow accumulation are crushing utilities supporting the vehicle maintenance facility and the safety escape hatches in the long underground utility tunnel at the South Pole Station. In addition, the fresh water well is coming to the end of its useful life.	
<u>Project Scope:</u> Phase 2 installs a new rodwell fresh water well and outfall, required for water production and waste storage, respectively.	
<u>Project Status:</u> Work began in FY 2024 and is planned for completion in FY 2030.	

Station and Field Communication Improvements	Status: Planning
<u>Mission Need:</u> USAP uses a combination of mobile radios and HF radios for on-station and station-to-field communication including emergency and flight operations.	
<u>Project Scope:</u> This project replaces these systems to better support science and operations.	
Environmental Satellite Ground System	Status: Planning
<u>Mission Need:</u> Environmental satellite ground systems are crucial for weather forecasting and flight planning. They are also essential for safe aviation, station operations, and science support. The current McMurdo and Palmer Station systems, Tera Scan, are at or beyond end-of-life.	
<u>Project Status:</u> This project will replace the McMurdo and Palmer systems, providing modern weather forecasting tools that ensure compatibility with new and future weather satellites.	
McMurdo Airfield Power System	Status: Planning
<u>Mission Need:</u> More efficient airfield equipment and facilities have lowered power demand, making the existing generators oversized, inefficient, and obsolete.	
<u>Project Scope:</u> This project replaces generators with more efficient units that are easier to maintain, and for which spare parts are readily available.	
Heavy Science Traverse Platform	Status: Planning
<u>Mission Need:</u> The existing Heavy Science Traverse, used to haul scientific drilling equipment to remote areas of Antarctica, is aging and difficult to maintain.	
<u>Project Scope:</u> This project will deploy new, more efficient, and reliable traverse equipment with expanded geographic reach, reducing reliance on costly airlift.	
McMurdo Station Utility Modernization	Status: Planning
<u>Mission Need:</u> Existing McMurdo Station outside plant infrastructure (e.g., potable and fire protection water requirements, electrical, heat loop, sewer, fuel services, IT communications cable and conduits) is degraded, prone to failure, costly to maintain, and will not support future facilities.	
<u>Project Scope:</u> This project upgrades outside plant utilities, builds a new water storage tank, and installs a fire-water booster pump.	

Major Research Equipment and Facilities Construction

South Pole Satellite Communications Upgrade	Status: Planning
<u>Mission Need:</u> The mainland link to South Pole Station satellite communication has restricted access to the currently available and future satellites.	
<u>Project Scope:</u> This project replaces that ground station with a new antenna, tripling bandwidth.	
South Pole Satellite Communications Transformation	Status: Planning
<u>Mission Need:</u> The mainland link to South Pole Station satellite communication has restricted access to the currently available and future government owned and operated satellites.	
<u>Project Scope:</u> This project installs infrastructure to capitalize on commercially available proliferated low earth orbit satellite constellations serving the Antarctic continent.	
Ross Island Wind Energy Feeder	Status: Planning
<u>Mission Need:</u> As New Zealand upgrades the wind turbines at nearby Scott Base from 990 kW production to 3 MW production, McMurdo Station has an opportunity to capitalize on excess production on the combined McMurdo/Scott Base grid when available.	
<u>Project Scope:</u> This project installs appropriately sized resilient infrastructure to carry greater electrical supply directly to the McMurdo power plant.	
Sea Ice Infrastructure Modernization and Upgrade	Status: Planning
<u>Mission Need:</u> Sea ice is the defining feature of polar marine systems. Existing sea ice equipment and infrastructure is too heavy to safely operate on changing sea ice conditions. Lighter and more flexible sea ice infrastructure will allow US scientists to continue conducting important research in and around McMurdo sound.	
<u>Project Scope:</u> This project will replace the existing sea ice platforms with new lighter and more versatile infrastructure.	
McMurdo Aquarium Infrastructure Improvements	Status: Planning
<u>Mission Need:</u> The McMurdo Aquarium in the Crary Lab facility supports aquatic research. The existing aquarium infrastructure has failed to provide adequate sea water to support the needs of marine scientists.	
<u>Project Scope:</u> This project will improve the seawater delivery system and controls.	

Replace Structures at Dry Valleys and Ross Island	Status: Planning
<u>Mission Need:</u> Dry Valley facilities support annual research to include Long Term Ecological Research network science. Existing facilities are out-of-date and do not provide the necessary support needed for modern scientific research.	
<u>Project Scope:</u> This project will replace existing facilities with newer, more efficient infrastructure.	
Raise Martin A Pomerantz Observatory (MAPO) Building and BICEP Array Replacement Tower (BART)	Status: Planning
<u>Mission Need:</u> South Pole Station’s Blue Buildings are being buried in snow and without action, will become unusable.	
<u>Project Scope:</u> This project will utilize the lifting system employed by the ARO project to raise the MAPO building. A new telescope tower will be constructed prior to the raise to ensure continuity of scientific observations.	
New Dark Sector Electrical Substation (Building 61)	Status: Planning
<u>Mission Need:</u> All power and communications to the South Pole Station’s Dark Sector labs (the IceCube Lab, the Dark Sector Lab that houses the South Pole telescope, Martin A. Pomerantz Observatory (MAPO) with its attached BICEP array) are fed through building 61. Building 61 is buried and if not replaced could fail and jeopardize the dark sector science.	
<u>Project Scope:</u> This project will replace the infrastructure in Building 61.	
Complete IT&C Primary Addition Facility	Status: Planning
<u>Mission Need:</u> COVID-19 disrupted construction of the McMurdo Information Technology & Communication (IT&C) Addition. Completion of the IT&C Addition is necessary to support the NOAA mission and is an integral part of the McMurdo Master Plan.	
<u>Project Scope:</u> This project will complete the construction of the addition and facilitate the movement of the USAP, NOAA, and NASA McMurdo-based data centers.	
Palmer New Fuel Tank Installation	Status: Planning
<u>Mission Need:</u> Palmer Station fuel is supplied from a single above-ground steel tank built in 1967. The existing tank is a single point of failure and does not meet current standards for fuel spill containment.	
<u>Project Scope:</u> This project will replace the existing tank with multiple new tanks.	

South Pole Arch Replacements Phase 1 - 4	Status: Planning
<p><u>Mission Need</u>: Critical infrastructure supporting the South Pole Station is housed within buried steel arches. The arches will begin to crush the infrastructure underneath them within the next decade due to snow accumulation. The arches protect the station power and water plants, fuel storage, logistics warehouse, and vehicle maintenance garage.</p>	
<p><u>Project Scope</u>: This project will replace the arches and infrastructure with new construction in a location identified by the South Pole Master Plan.</p>	

Reviews

Conceptual Design and Preliminary Design Reviews for AIMS were passed successfully in FY 2015 and FY 2017, respectively, resulting in a National Science Board (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 Independent Panel Review found that the project execution plan was well-developed for the FDR and recommended that the project proceed to the Construction Stage; AIMS was awarded in FY 2019.

In addition to daily and weekly communications with the Antarctic Support Contractor’s (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. In addition, annual Construction Reviews are conducted by OPP, the Research Infrastructure Office, and an external panel, with the first one having occurred in November 2020. The most recent construction review was conducted in July 2024. The panel report was delivered in August 2024 and the panel’s recommendations were incorporated into the Prime Contractor’s FY 2025 construction and quality plans. NSF has monitored progress through the routine Project Management Reviews and by increasing Government oversight at the project site. The next Construction Review is planned for the fourth quarter of FY 2025.

Extensive engagement with the National Science Board took place in FY 2023 and resulted in a formal recommendation from the Board to move forward with the AIR portfolio of work. The CIRB meets on a quarterly basis to prioritize activities within the AIR Program. Readiness reviews for AIR activities are conducted based on the scale and complexity of individual projects.

Risks

If the infrastructure that enables U.S. access to the Antarctic is not kept robust and efficient, USAP is at risk of losing science capabilities year over year as facilities, utilities, equipment, and the vehicle fleet degrade.

As described above, ongoing and planned near-term activities in the AIR program will mitigate critical risks facing USAP, including some that represent single points of failure to the mission. In executing the projects, NSF has implemented a rigorous risk management approach that includes the identification of risks and mitigation strategies. Robust risk management will also be required of contractors and awardees. In all cases, NSF holds the risk of cost and schedule increases that are

beyond the control of the contractor or awardee, including events such as pandemics, unpredictably severe weather, icebreaker and supply vessel availability, and macroeconomic changes.