OFFICE OF POLAR PROGRAMS (OPP) **$534,540,000**
+$66,690,000 / 14.3%

OPP Funding
(Dollars in Millions)

	FY 2017 Actual	FY 2018 (TBD)	FY 2019 Request	Change over FY 2017 Actual Amount	Change over FY 2017 Actual Percent
Research	**$119.05**	**-**	**$113.56**	**-$5.49**	**-4.6%**
CAREER	0.50	-	1.24	0.74	146.4%
Long Term Ecological Research (LTER)	2.29	-	3.49	1.20	52.1%
Education	**2.46**	-	**0.79**	**-1.67**	**-67.9%**
Infrastructure	**346.34**	-	**420.19**	**73.85**	**21.3%**
Antarctic Infrastructure Modernization for Science (Construction)	**-**	-	103.70	103.70	N/A
Arctic Research Support and Logistics	45.06	-	39.33	-5.73	-12.7%
IceCube Nutrino Observatory (IceCube)	3.50	-	3.50	-0.00	-0.0%
U.S. Antarctic Facilities and Logistics	215.71	-	193.61	-22.10	-10.2%
U.S. Antarctic Logistical Support	69.28	-	71.00	1.72	2.5%
Geodesy Advancing Geosciences and EarthScope	1.52	-	1.29	-0.23	-14.9%
Seismological Facilities for Advancement of Geoscience and EarthScope	1.70	-	1.26	-0.44	-25.9%
Polar Environment, Safety, and Health (PESH)	6.61	**-**	6.13	-0.48	-7.2%
Facilites Development and Design Total	**2.97**	**-**	**0.37**	**-2.60**	**-87.5%**
Antarctic Infrastructure Modernization for Science (Concept and Design)	2.97	-	0.37	-2.60	-87.5%
Total	**$467.85**	**-**	**$534.54**	**$66.69**	**14.3%**

About OPP

The Office of Polar Programs (OPP) is the primary U.S. supporter of fundamental research in the polar regions. In the Arctic, NSF helps coordinate research planning as directed by the Arctic Research Policy Act of 1984, and the NSF Director chairs the Interagency Arctic Research Policy Committee (IARPC) created for this purpose. In the Antarctic, per Presidential Memorandum 6646, NSF manages all U.S. activities as a single, integrated program, making Antarctic research possible for scientists supported by NSF and by other U.S. agencies. The latter include the National Aeronautics and Space Administration (NASA), the National Oceanic and Atmospheric Administration (NOAA), the U.S. Geological Survey (USGS), the Smithsonian Institution, and the Department of Energy. The U.S. Antarctic Program (USAP) research activity supported by NSF also supports leadership by the U.S. Department of State in the governance of the continent and Southern Ocean under the aegis of the Antarctic Treaty System.

OPP supports investments in research and education and provides support for research infrastructure, such as permanent stations and temporary field camps in the Antarctic and the Arctic. OPP's FY 2019 Budget Request is influenced by three key priorities: (1) supporting critical facilities that enable frontier research in the Earth's polar regions; (2) maintaining strong disciplinary programs that provide a base for our investments in cross-disciplinary system science programs and; (3) maintaining U.S. research community activities in polar system science. As part of priority one, OPP will start the construction phase of the multi-year Antarctic Infrastructure Modernization for Science (AIMS) project. OPP will also prioritize investment in two of the Big Ideas: Navigating the New Arctic where OPP leads NSF efforts, and Windows on the Universe where OPP invests in underpinning activities. All of these priorities reflect opportunities for

fundamental scientific discovery uniquely possible in polar regions, as well as studies to investigate the causes and future trajectory of environmental and ecosystem changes now being observed at the poles that could impact global systems. This work will implement the Foundation's lead-agency role in facilitating the Nation's investment in polar science.

In addition to shared cross-directorate basic research objectives, OPP investments will be guided by recent sponsored studies to identify priority areas and ensure effective polar research programs:

- For the Arctic, IARPC's *Arctic Research Plan: FY 2017-2021*[1], and the World Meteorological Organization's *Year of Polar Prediction Implementation Plan*[2] inform science investment priorities. Efforts to build an integrated research capacity to address the potential opportunities and challenges of Arctic change for the Nation's security and economics and well-being of Arctic residents will continue.
- For the Antarctic, the 2015 National Research Council report *A Strategic Vision for NSF Investments in Antarctic and Southern Ocean Research*[3] inform science investment priorities. Specifically, in 2018, OPP initiated support of a five-year deep-field program to study the Thwaites Glacier region that was the highest priority in that study. The Thwaites program will be jointly funded, including shared logistics, with the National Environment Research Council of the U.K.

OPP Funding for Facilities

OPP Funding for Facilities
(Dollars in Millions)

	FY 2017 Actual	FY 2018 (TBD)	FY 2019 Request	Change over FY 2017 Actual Amount	Change over FY 2017 Actual Percent
Total	**$346.34**	**-**	**$420.19**	**$73.85**	**21.3%**
Arctic Research Support and Logistics	45.06	-	39.33	-5.73	-12.7%
Geodesy Advancing Geosciences and Earthscope (GAGE)	1.52	-	1.29	-0.23	-14.9%
IceCube Neutrino Observatory	3.50	-	3.50	0.00	-
Seismological Facilities for Advancement of Geosciences and Earthscope (SAGE)	1.70	-	1.26	-0.44	-25.9%
U.S. Antarctic Facilities and Logistics	215.71	-	193.61	-22.10	-10.2%
Polar Environment, Safety, and Health (PESH)	6.61	-	6.13	-0.48	-7.2%
AIMS Concept and Design	2.97	-	0.37	-2.60	-87.5%
AIMS Construction	-	-	103.70	103.70	N/A
U.S. Antarctic Logistical Support	69.28	-	71.00	1.72	2.5%

For detailed information on individual facilities, see the Facilities chapter.

[1]www.iarpccollaborations.org/uploads/cms/documents/iarpc_arctic_research_plan_2017-2021.pdf
[2]www.polarprediction.net/documents/implementation-science-plans/
[3]www.nap.edu/catalog/21741/a-strategic-vision-for-nsf-investments-in-antarctic-and-southern-ocean-research

Funding Profile

OPP Funding Profile

	FY 2017 Actual Estimate	FY 2018 (TBD)	FY 2019 Estimate
Statistics for Competitive Awards:			
Number of Proposals	707	-	650
Number of New Awards	226	-	190
Funding Rate	32%	-	29%
Statistics for Research Grants:			
Number of Research Grant Proposals	673	-	620
Number of Research Grants	196	-	160
Funding Rate	29%	-	26%
Median Annualized Award Size	$152,717	-	$140,400
Average Annualized Award Size	$199,542	-	$183,500
Average Award Duration, in years	2.6	-	2.6

People Involved in OPP Activities

Number of People Involved in OPP Activities

	FY 2017 Actual Estimate	FY 2018 (TBD)	FY 2019 Estimate
Senior Researchers	895	-	800
Other Professionals	530	-	500
Postdoctoral Associates	102	-	90
Graduate Students	328	-	300
Undergraduate Students	215	-	200
K-12 Teachers	-	-	-
K-12 Students	-	-	-
Total Number of People	**2,070**	**-**	**1,890**

Program Monitoring and Evaluation

Science and Technology Policy Institute (STPI) Reports:
In 2017, OPP initiated an "analysis of alternatives" study of its airlift requirements in both polar regions. It is an analysis to help refine options and inform management decisions regarding the NSF-owned LC-130 aircraft. This study is expected to be completed in mid-2018.

Workshops and Reports:
OPP sponsored several studies over the past seven years to gather direction from the polar science community and to help plan for effective research programs into the future. The findings and recommendations from these reports continue to influence and drive OPP funding and investment policy decisions as described above. In addition, the execution of the merit review process by OPP has been recently reviewed by the GEO Advisory Committee.

Committees of Visitors (COV):
- In FY 2016, separate COVs were conducted to review the Antarctic Sciences Section (ANT) and the

Arctic Sciences Section (ARC). The COV report for each section was presented to the GEO Advisory Committee, which convened in October of 2016. The COVs found that the programs under review were well-managed by each section.

- The next COVs for ANT and ARC will be conducted in FY 2020.

The Performance chapter provides details regarding the periodic reviews of programs and portfolios of programs by external Committees of Visitors and directorate Advisory Committees. Please see this chapter for additional information.

ANTARCTIC INFRASTRUCTURE MODERNIZATION FOR SCIENCE (AIMS) $103,700,000

Appropriated Funding Requirements
for the Antarctic Infrastructure Modernization for Science Project
(Dollars in Millions)

	FY 2019 Request	FY 2020 Estimate	FY 2021 Estimate	FY 2022 Estimate	FY 2023 Estimate	Total Project Cost
AIMS	$103.70	$75.00	$75.00	$60.00	$41.25	$354.95
Total	**$103.70**	**$75.00**	**$75.00**	**$60.00**	**$41.25**	**$354.95**

The Antarctic Infrastructure Modernization for Science (AIMS) construction project is initiated in FY 2019 with an investment of $103.70 million. This amount is the first year in a multi-year funding profile with an estimated total project cost of $354.95 million. In accordance with NSF's No Cost Overrun policy, NSF is currently planning within the estimated Total Project Cost (TPC) following the Preliminary Design Review. NSF will finalize the total project cost and the associated scope, schedule, and funding profile at time of award; benefiting from both the Final Design Review and the Independent Cost Estimate.

FY 2019 funds will be used to complete the designs of all construction components, begin the site preparation work for the backbone utilities and the initial buildings, such as the Vehicle and Equipment Operations Center, and procure the first phases of construction materials. The construction of the remaining buildings that comprise AIMS (descriptions provided below), will be supported by funding in subsequent fiscal years. The AIMS Project is currently anticipated to take approximately 8 to 10 years to complete; a further refined schedule will be developed as part of the final design phase.

The total cost of the AIMS construction project will be funded within the R&RA account.

The AIMS project will replace major facilities at McMurdo Station, Antarctica, one of three stations that comprise the U.S. presence in Antarctica, to meet anticipated science support requirements for the next thirty-five to fifty years. The project will help ensure enduring U.S. leadership and influence in this strategic region. It will also support critical scientific research and capabilities such as nuclear test detection, earthquake monitoring, and real-time weather data ingestion for global forecasting.

McMurdo Station's main purpose is to support both near- and deep-field science in Antarctica including activities at Amundsen-Scott South Pole Station. AIMS will enable faster, more streamlined logistical and science support by co-locating or consolidating warehousing, skilled trades work, and field science support where field projects are prepared for movement into the field, into four connected enclosed buildings. AIMS will also provide necessary up-graded utilities to support these facilities. The AIMS scope described below was determined to be the most efficient and cost-effective combination of work packages in support of science operations at McMurdo.

Baseline History
In 2011, the Office of Science Technology and Policy and NSF convened a Blue Ribbon Panel (BRP) to evaluate the U.S. Antarctic Program (USAP) logistical enterprise. The BRP was asked to conduct a review to discern any discrepancies with future science support needs, to identify opportunities for increased efficiencies, and to propose corrective actions that address 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 U.S.'s world-class science program in Antarctica. The report offered 84 implementing actions that target three areas: (1) efficient and cost-effective support of science, (2) maintaining high standards of safety, and

(3) flexibility of support infrastructure and logistics to facilitate evolving science areas in the future.

NSF responded to the BRP report by immediately addressing issues of safety, implementing operational efficiencies which resulted in immediate 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 is a pivotal component of the McMurdo Station Master Plan with a specific focus on the primary core functions of this critical logistics hub.

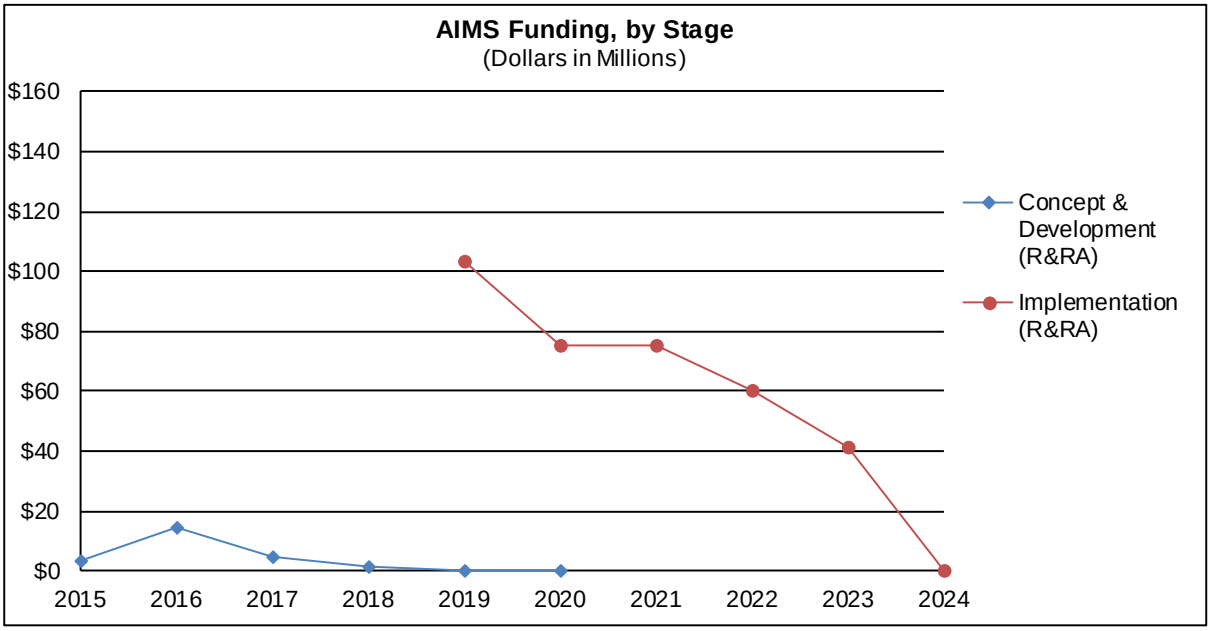
The scope of AIMS includes:

1) Core Facility, including:
   a. Central Services Facility: mission command and control, food service, warehousing, and materials handling,
   b. Continuity of Operations and Emergency Facilities: fire station, medical clinic, emergency berthing, and recreation,
   c. Field Science Support Facility,
   d. Station Operating Support facility: industrial trades shops and supplies/materials, and
2) Utilities: domestic and firefighting water, power, waste water, heating distribution, IT, and communications,
3) Vehicle and equipment operations center (VEOC), and
4) A permanent lodging facility that will also be utilized to accommodate the increased workforce required for AIMS construction.

Total Funding Requirements for AIMS

(Dollars in Millions)

	Prior Years	FY 2017 Actual	FY 2018 Estimate	FY 2019 Request	ESTIMATES FY 2020	FY 2021	FY 2022	FY 2023	FY 2024
R&RA:									
Concept and Development	$18.20	$2.97	$1.80	$0.37	-	-	-	-	-
Implementation	-	-	-	103.70	75.00	75.00	60.00	41.25	-
TOTAL	**$18.20**	**$2.97**	**$1.80**	**$104.07**	**$75.00**	**$75.00**	**$60.00**	**$41.25**	**-**



Note: Outyear (FY 2020 through FY 2024) Implementation funding reflects current estimates.

Management and Oversight

AIMS will be accomplished under the Federal Acquisition Regulations (FAR) via an existing contract to Leidos Innovation Corporation as the current Antarctic Support Contractor. OPP will provide technical oversight and the Division of Acquisition and Cooperative Support (DACS) will provide contract oversight. Although funded through the R&RA account, not the MREFC account, AIMS is considered a major facility under the definitions contained in the 2017 American Innovation and Competitiveness Act (AICA). Therefore, all of NSF's current oversight requirements will apply, including project management assistance and oversight from the Large Facilities Office (LFO), with due consideration of award through a FAR-based contract.

Under an interagency agreement, the Defense Contract Management Agency negotiates, manages, and audits Leidos' forward pricing rate agreements and associated business systems in place for monitoring and ensuring effective performance.

Routine oversight activities include, but are not limited to:

- Integrated master scheduling and project management oversight;
- Monthly program management reviews;
- Earned value management on discrete projects;
- Configuration and change review boards for cost and scope control management;
- Contractor performance management; and
- Internal controls for finance and property management, including A-123 compliance.

The Naval Facilities Engineering Command Pacific provided expert engineering advice during the design phase of the project. NSF intends to continue to use the services of a third-party expert for engineering advice during the construction phase of AIMS.

Leidos will initiate the acquisition process by performing market research leading to a request for qualifications for construction. All steps of the acquisition process will be subject to review by NSF and appropriation of funds. Prior to an award for construction, the AIMS project will complete a Final Design Review, which is anticipated to be held in fall 2018.

The AIMS project will entail a combination of design/bid/build (DBB) and design/build (DB) subcontracts. General contractors asked to submit proposals will be pre-qualified, and a single general contractor is expected to complete all four projects under a firm fixed price or an alternative contract type that the government deems appropriate for the particular activity. NSF will take an active role in overseeing all efforts to ensure the government's interests are achieved.

Reviews

- Conceptual Design Review (CDR): CDR was conducted March 31-April 2, 2015. The NSF program staff concurred with the external panel's conclusion that the project execution plan and technical design package met, and in some cases exceeded, the requirements of the Conceptual Design Phase.
- Preliminary Design Review (PDR): PDR was conducted December 5-8, 2016. The external panel found that the project execution plan and the technical design package were both well-developed for the PDR phase and recommended that the project was ready to proceed to the Final Design Phase. Following NSF deliberations, the National Science Board passed a resolution (NSB-2017-20) authorizing NSF to include AIMS in a future budget request.
- Final Design Review (FDR): FDR is anticipated in the fall of 2018 to ensure that anticipated project costs remain realistic and that no unforeseen events have arisen prior to awarding the sub-contract in mid FY 2019. The NSF will ensure an independent cost estimate is conducted during FY 2018.
- Following Board authorization, the project transitioned from the PDR milestone into the final design phase.

Project Status

Leidos has begun pre-acquisition tasks required for the FDR milestone review, including market research and an industry day presentation in August 2017. Designs for all components of AIMS have been completed to an appropriate level for the purpose of preparing the request for qualifications.

Cost and Schedule

FY 2019 funds will be used to complete the designs of all construction components, begin the site preparation work for the backbone utilities and the initial buildings such as the Vehicle and Equipment Operations Center, and procure the first phases of construction materials. Construction of the core facility will be supported by funding in the subsequent fiscal years. The phasing plan allows for managed impact on science support during construction, as well as continuity of operations in the event that subsequent funding is disrupted. Each successive phase must be fully funded to start and finish that phase so that if subsequent project funding is disrupted, the station will remain fully capable for USAP operations. The AIMS Project is currently anticipated to take approximately 8 to 10 years to complete; a further refined schedule will be developed as part of the final design phase.

Risks

Construction phasing milestones are timed such that confidence in relevant aspects of project readiness is assessed at appropriate intervals. Scope management options have been identified to ensure that the project proceeds only if it can be shown that continued investment is warranted, or that the project phase can be executed successfully. Before each phase begins, sufficient funding must be secured to ensure that that phase can be successfully completed. Should the required funding not be secured, the NSF may elect to postpone the phase or cancel the program altogether. This off-ramp assessment is critical to ensure that the station is able to meet ongoing and future science support requirements. Existing structures cannot be demolished unless the funding to construct the functional replacement is secured.

Leidos developed a bottom-up cost estimate for AIMS by integrating the construction cost estimate from their cost estimating consultant and coupled it with Leidos' estimate of logistics and support costs. The consultant estimators were retained for the construction cost estimate because of their extensive experience

estimating commercial construction globally. Leidos has the most extensive understanding of ancillary costs to support construction in Antarctica. The cost estimating and risk analysis methodology and documentation were verified for compliance with the Government Accountability Office Cost Estimating and Assessment Guide by an independent cost assessment conducted by a private contractor under contract through LFO.

The cost estimate includes a provision for inflation of 2.5 percent per year through 2026. The risk register used to develop the contingency budget is associated with known project risks: primarily events and factors that affect labor and material costs as well as construction support considerations such as the station capacity for the required number of personnel and findings related to site conditions. It also accounts for logistical risks such as accommodating critical supplies that miss the annual cargo vessel that then must be delivered through costlier means. In addition, the contingency budget also accounts for schedule risk associated with weather or other events that can create materials, equipment, and labor shortages due to delivery delays. For example, if manufacturers miss the deadline for the annual supply ship, premium air freight costs will be incurred to get supplies to McMurdo on time. Weather poses the greatest known risk to the schedule.

A primary risk mitigation tool is the design/build contract mechanism itself where the contracted firm is able to make tradeoffs within the awarded budget that do not adversely affect the final outcome. Finally, a time-phased, science-prioritized scope management plan has also been developed to identify scope that may be removed to stay within the total project cost without affecting the overall project's objectives, as well as accommodating opportunities that may arise if risks are not fully realized.

Future Operations Costs

Implementing AIMS will provide a material reduction of the cost to maintain and operate McMurdo station including an estimated $3.50 million in fuel and $2.40 million in labor per year (based on current costs). Fuel savings of about 340,000 gallons per year will be possible due to greater energy efficiency of the consolidated station made possible with AIMS. Labor savings will accrue mainly through the efficiency of consolidated warehousing (with 90 percent reduction of exterior storage), co-locating work areas, and lowering residence time of science projects, also made possible by AIMS.

Image 1: *Artist's rendering of AIMS Core Facility*