United States Antarctic Program Vision and Strategy

National Science Board

July 24, 2024

PRESENTATION OVERVIEW

Overview of the Geopolitical and Policy Framework

Sethuraman Panchanathan
NSF Director

Strategic Vision

Alexandra Isern
Assistant Director Geosciences

Implementation of USAP Strategy

Jean Cottam Allen
Acting Director, Office of Polar Programs

USAP Vision

"U.S. leadership in Antarctica through groundbreaking science"

Overview of Geopolitical and Policy Framework

The Antarctic Treaty

The Antarctic Treaty was **signed in 1959** by **12 countries** and **entered into force in 1961**

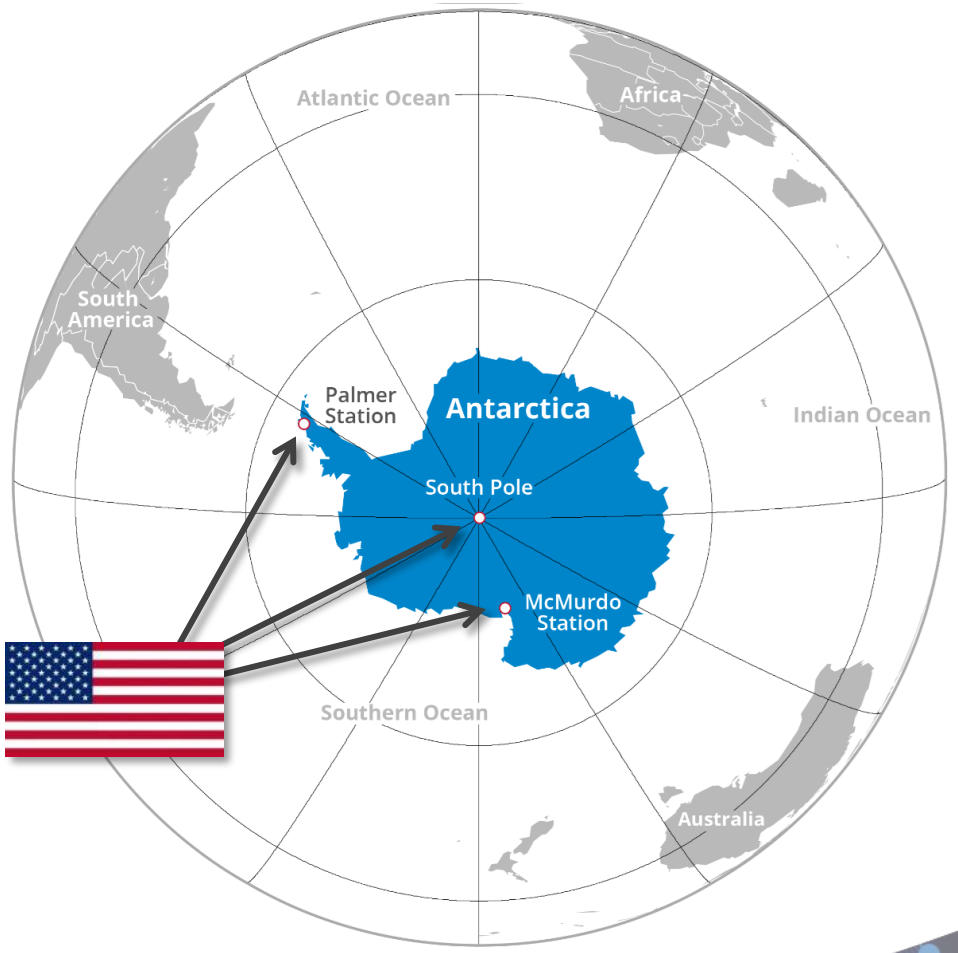
- Reserves Antarctica for peaceful use
- Establishes freedom of scientific investigation
- Promotes scientific cooperation
- Holds in abeyance all territorial claims
- Establishes access and inspection rights
- Decisions made by consensus

There are currently **57 Member Nations** with **29 Consultative Parties** *"conducting substantial scientific research activity…"*

U.S. National Science Foundation's Role

Presidential Memorandum 6646 (1982)

- Mandates an "**Active and influential presence**":
  - "the conduct of **scientific activities** in major disciplines;
  - year-round **occupation** of the **South Pole and two coastal stations**;
  - and availability of related necessary logistics support."
- NSF manages the United States program for the whole of government
- DoD provides logistical support



U.S. Antarctic Policy – New Memorandum

National Security Memorandum on United States Policy on the Antarctic Region (NSM-23; May 17, 2024)

- Reaffirms importance of Antarctic Treaty System and U.S. support for treaty provisions
- Emphasizes environmental protocols
- Department of State is the lead for treaty engagement
- National Science Foundation is the lead in Antarctica

Major USAP Milestones

1960 Executive Branch USAP Responsibilities established post IGY (OMB A-51)

1970 USAP Management from DoD to NSF; "*Active & Influential Presence*" affirmed (NSDM-71)

1976 "*Active & Influential Presence*" and NSF Management reaffirmed (NSDM-318)

1982 "*Active & Influential Presence*" and NSF Management reaffirmed (Presidential Memorandum 6646)

1993 NSF role expands as Navy begins withdrawal

1994 Statement of U.S. policy objectives (NSC-26)

1996 NSTC Review affirms need for three stations

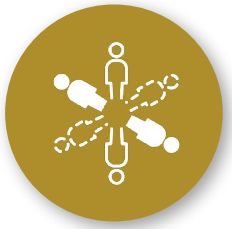
1998 US Air Force assumes role of DoD Executive Agent

2024 National Security Memorandum on United States Policy on the Antarctic Region (NSM - 23)

Peak Population for Top 5 Stations

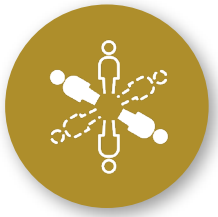
McMurdo Station
(U.S.) *1,200*

Marambio Antarctic Base
(Argentina) *170*

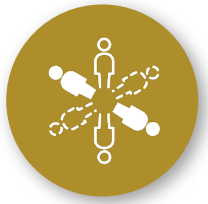


South Pole Station
(U.S.) *153*

Eduardo Frei Antarctic Base
(Chile) *150*



Rothera Research Station
(UK) *136*



Additional stations of note

Novolazarevskaya
(Russia) *70*

Zhongshan Station
(China) *60*

Palmer
(U.S.) *46*

Area Under Roof of Top 5 Stations

McMurdo Station
(U.S.) *32,750 m²*

South Pole Station
(U.S) *16,017 m²*

Casey Station
(Australia) *8,000 m²*

Davis Station
(Australia) *8,000 m²*

Mario Zucchelli
Station (Italy) *7,500 m²*

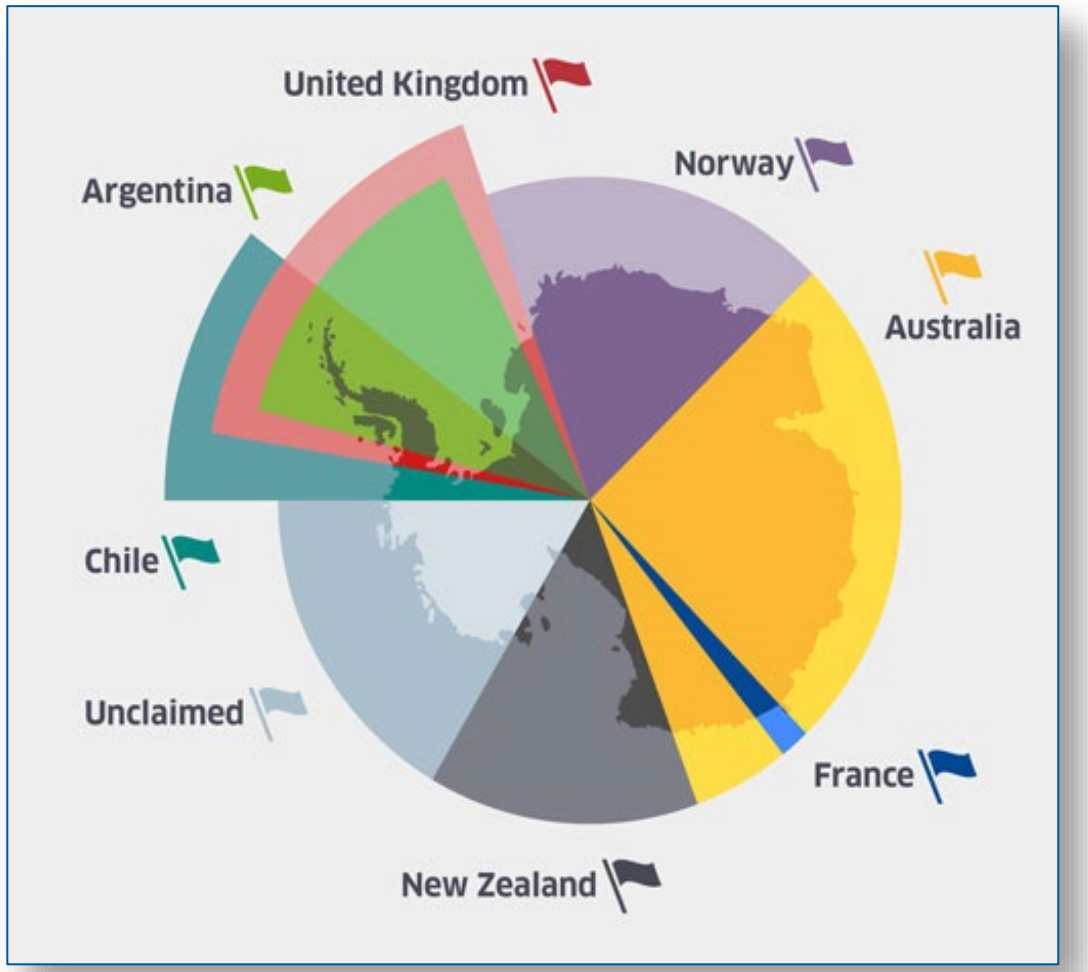
Additional stations of note

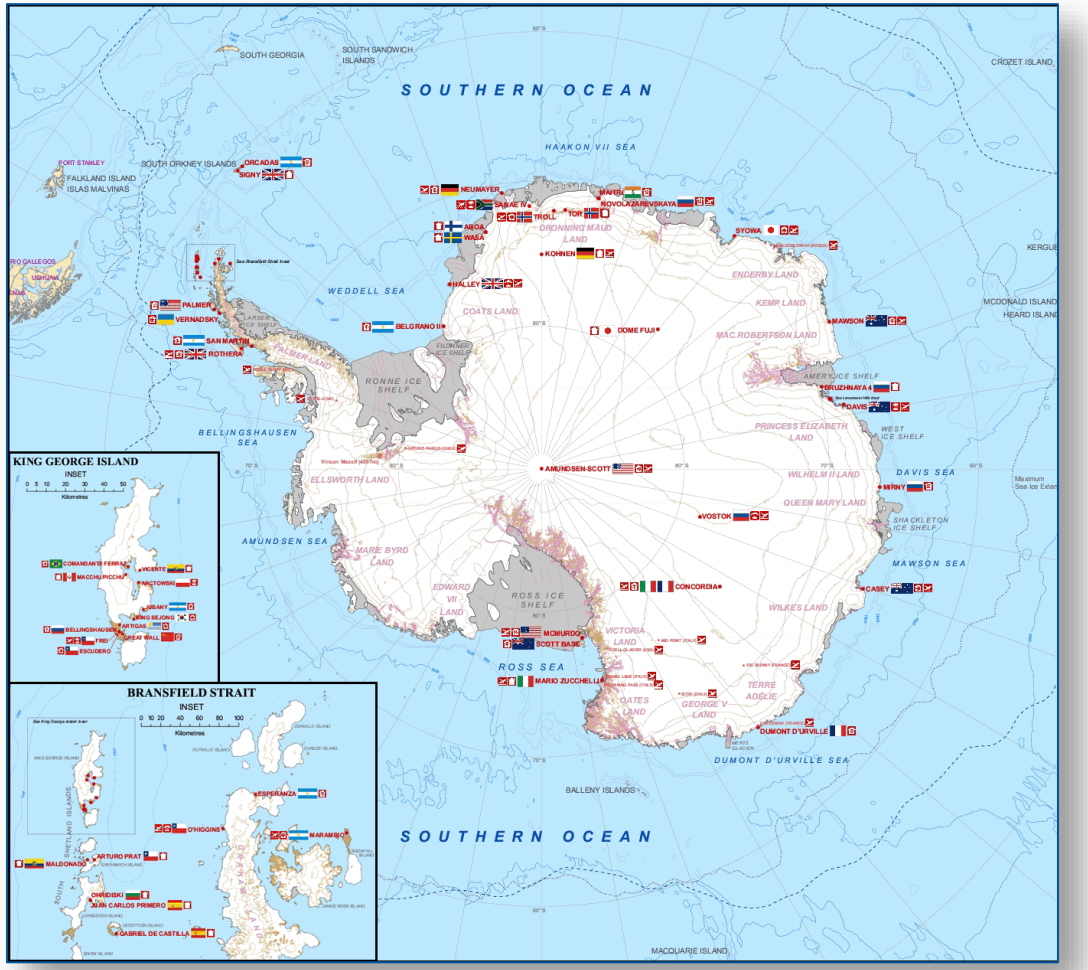
Zhongshan Station
(China) *7,436 m²*

Mirny Station
(Russia) *3,000 m²*

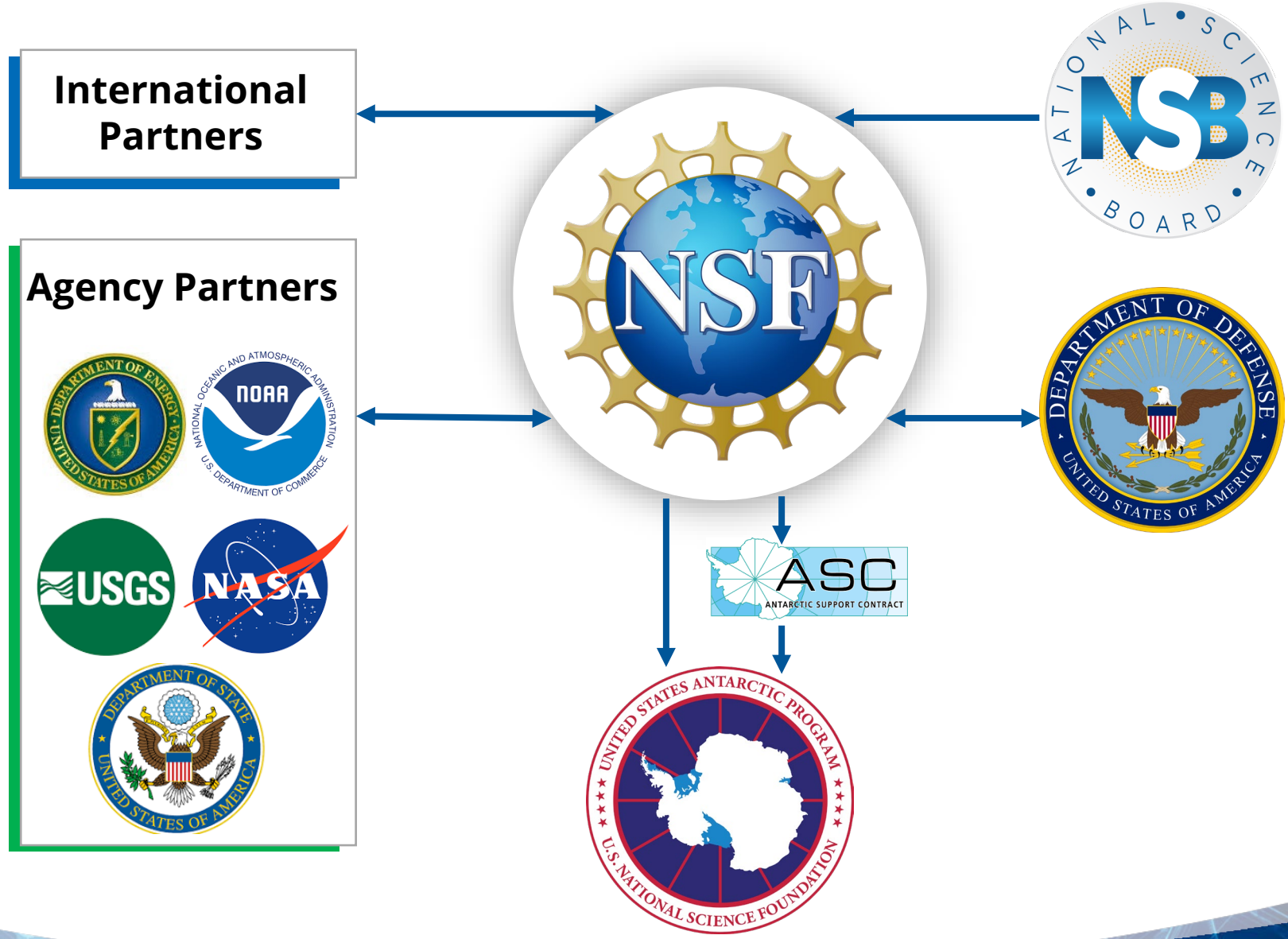
Palmer
(U.S.) *2196 m²*

Strategic Presence





Management and Coordination



USAP Strategic Vision

International Scientific Coordination

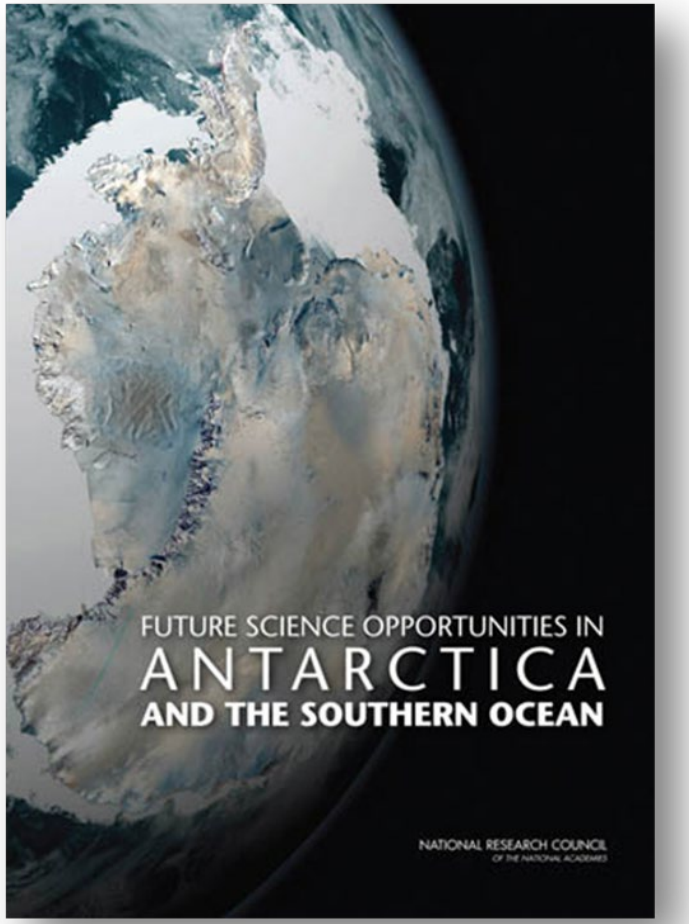
Scientific Committee on Antarctic Research: Scientific Priorities

- Define the global reach of the Antarctic atmosphere and Southern Ocean
- Understand how, where and why ice sheets lose mass
- Reveal Antarctica's history
- Learn how Antarctic life evolved and survived
- Observe space and the Universe
- Recognize and mitigate human influences

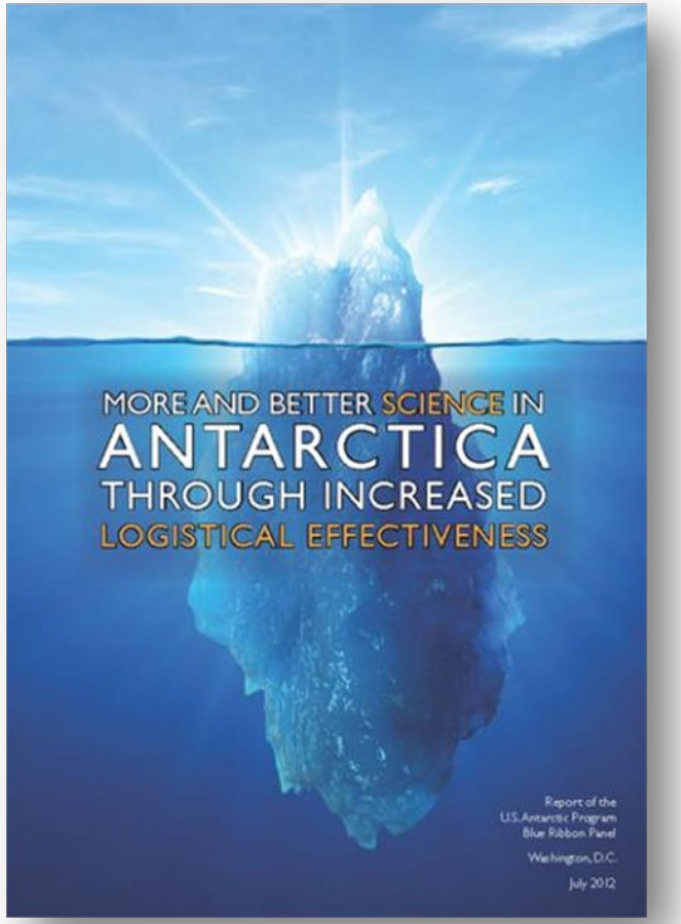
International Polar Year

- Next IPY 2032-2033

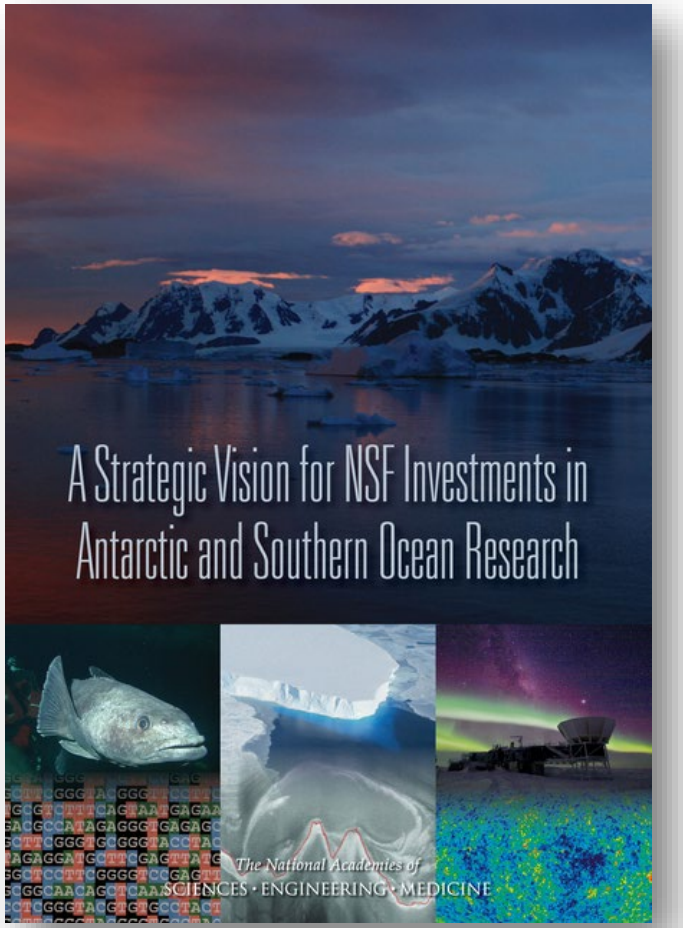
Defining U.S. Research Strategies in the Antarctic



2011

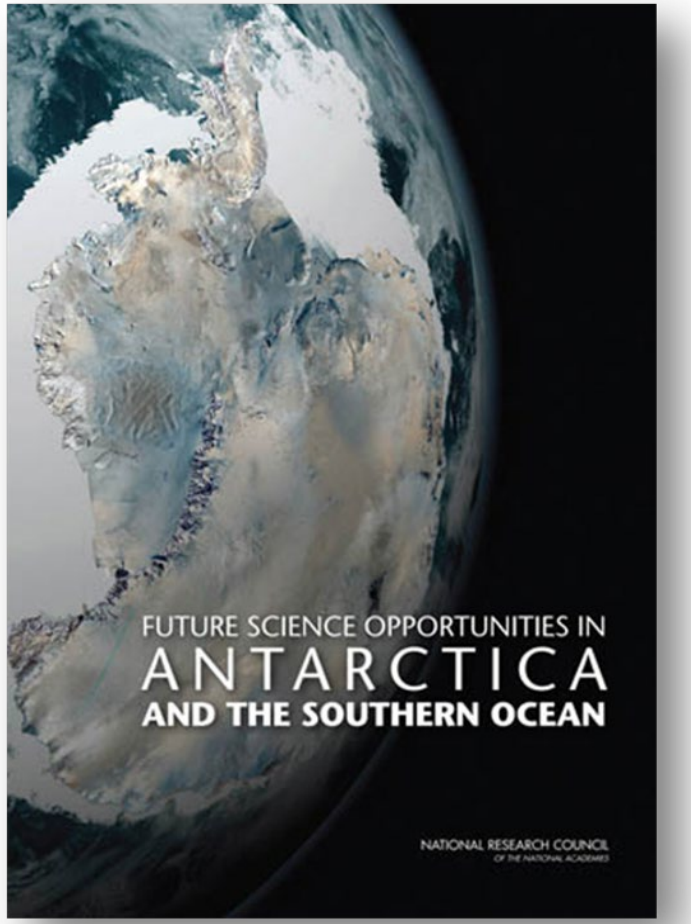


2012



2015

Research Priorities (2011)



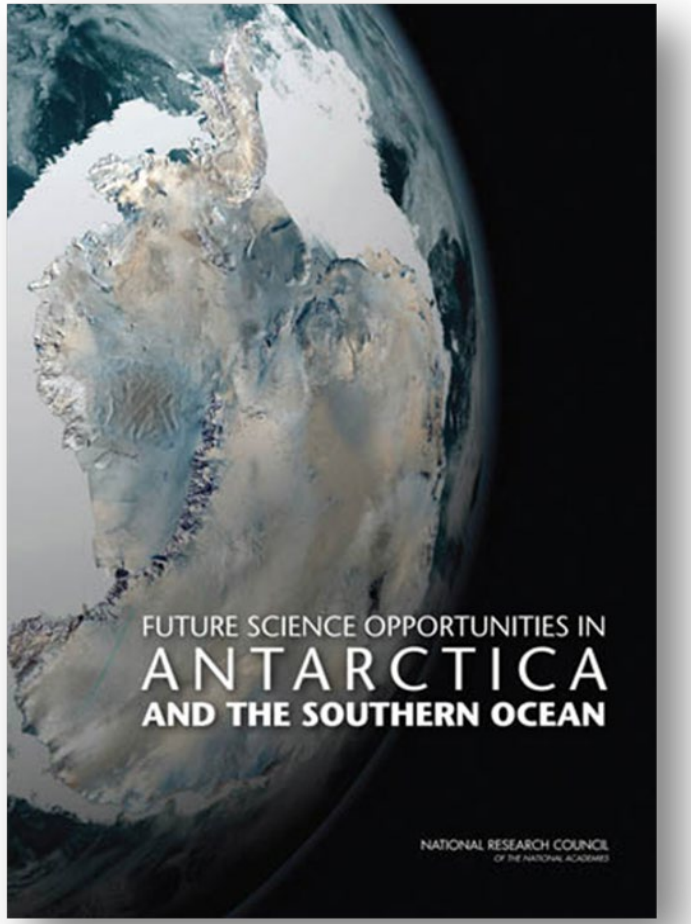
Global Change

- Antarctica's contribution to changes in **global sea level**?
- Role of Antarctica in the **global climate system**?
- Response of Antarctic **biota and ecosystems** to change?
- Role has Antarctica played in **changing the planet in the past**?

Discovery

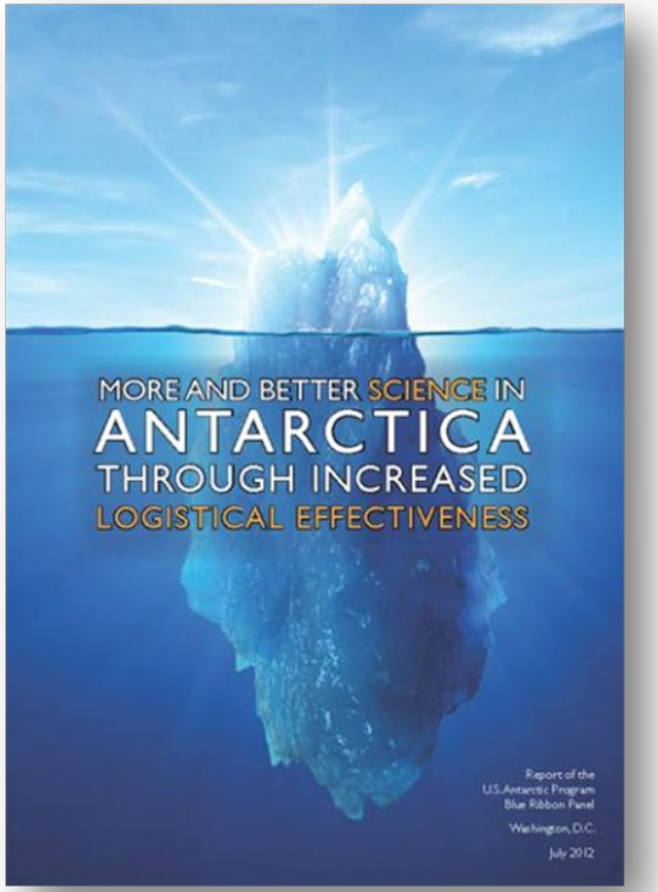
- What can records preserved in Antarctica reveal about **past and future climates**?
- How has **life adapted** to the Antarctic environments?
- What can the Antarctic platform reveal about the interactions between **Earth and the space environment**?
- How did the **universe begin**, what is it made of, and what determines its evolution?

Recommendations and Outcomes (2011)



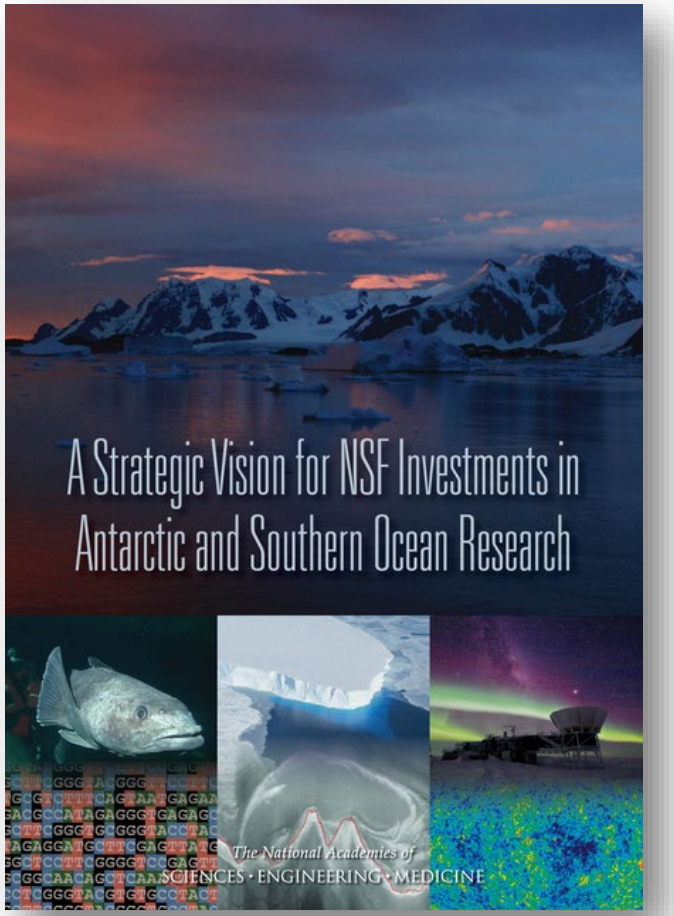
- Lead development of a large-scale **observing network** and support a new generation of **Earth system models**.
- Continue to support a wide variety of **basic scientific research**.
- Design and implement improved mechanisms for **international collaboration**.
- Exploit the host of **emerging technologies**.
- Coordinate an integrated polar **educational** program.

Recommendations and Outcomes (2012)



- USAP capital budget
- Restore the polar ocean fleet
- Implement state-of-the-art logistics and transportation
- Upgrade facilities at McMurdo and Palmer
- Increase awareness of the true cost of resources
- Modernize communications
- Increase energy efficiency
- International cooperation
- Antarctic policy

Recommendations and Outcomes (2015)

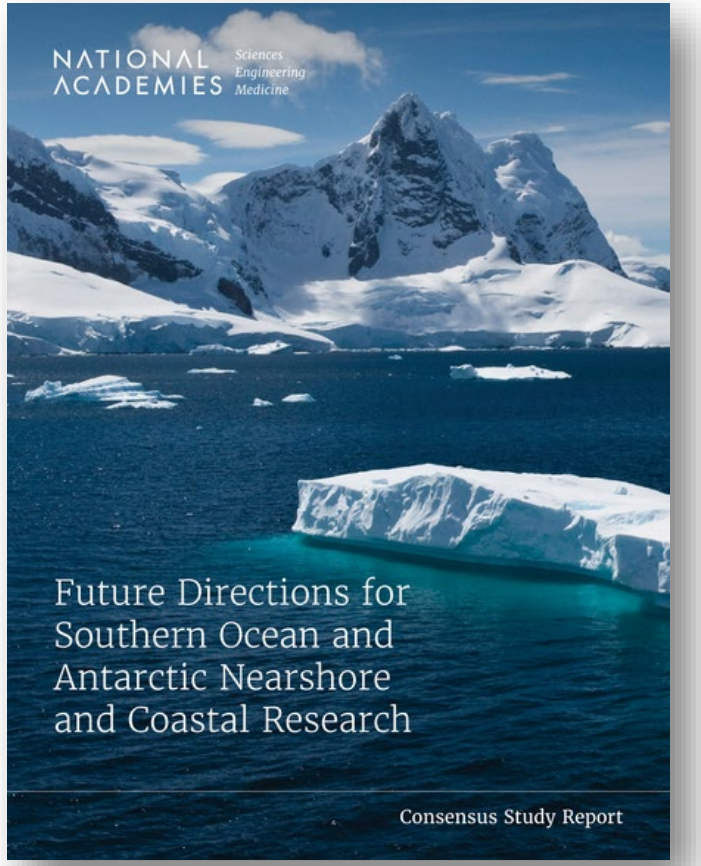


Maintain a core program of investigator-driven research across a broad base of topics

Strategic Themes:

- How much and how fast will sea level rise?
- How do Antarctic biota evolve and adapt to changing environmental conditions?
- How did the universe begin and what are the underlying physical laws?

Future Directions for Southern Ocean and Antarctic Nearshore and Coastal Research (2024)



Priority Science Drivers:

- Global Sea Level Rise
- Heat and Carbon Budgets
- Changing Ecosystems

Infrastructure and Technological Investments:

- Antarctic Research Vessel (ARV)
- Sustained Observations and Modeling
- International Collaboration
- Conservation and Management
- Workforce Development

Implementation of USAP Strategy

USAP Strategy

Leadership in Research

Leadership in Operations

Leadership in the Antarctic Community

USAP Strategy

Leadership in Research

- Identify the most compelling scientific opportunities
- Address science comprehensively
- Focus science investments for maximum impact

Leadership in Operations

- Ensure science drives infrastructure
- Advance Antarctic Infrastructure Recapitalization (AIR) program
- Focus infrastructure investments for maximum impact

Leadership within the Antarctic Community

- Strengthen and expand partnerships
- Improve community engagement

World-Leading Research

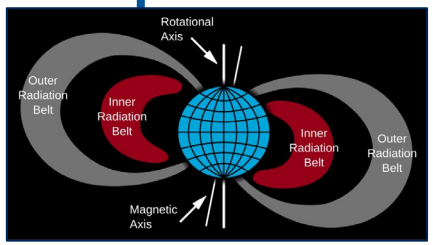
IceCube Neutrino Observatory detects high-energy neutrinos to study the most energetic phenomena in the Universe.

Over many decades scientists supported by NOAA, NASA and NSF measure **ozone depletion** from Antarctica.

The **International Thwaites Glacier Collaboration** is studying ice sheet stability to predict sea-level rise.

History of Scientific Discovery

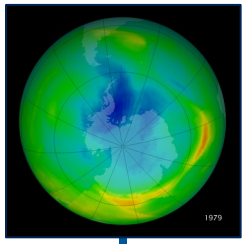
1950s — Van Allen Radiative Belts



1960s — Antifreeze Proteins in Fish

1970s — West Antarctic Ice Sheet Instability

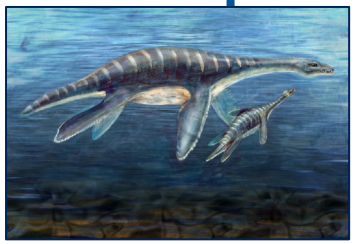
1980s — Ozone Hole



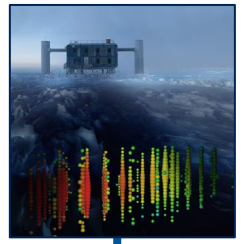
1996 — Continuous Ice Core Record

2001 — DASI, BOOMERanG measurements of CMB

2007 — Plesiosaur Fossil



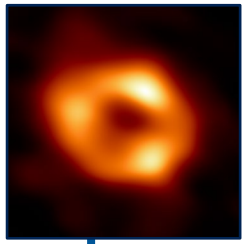
2013 — IceCube Detects Cosmic Neutrinos



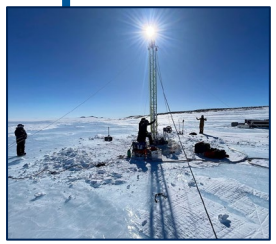
2017 — Antarctic Fossils

2022 — SPT Detects CMB B-modes

2023 — EHT Image of Black Hole

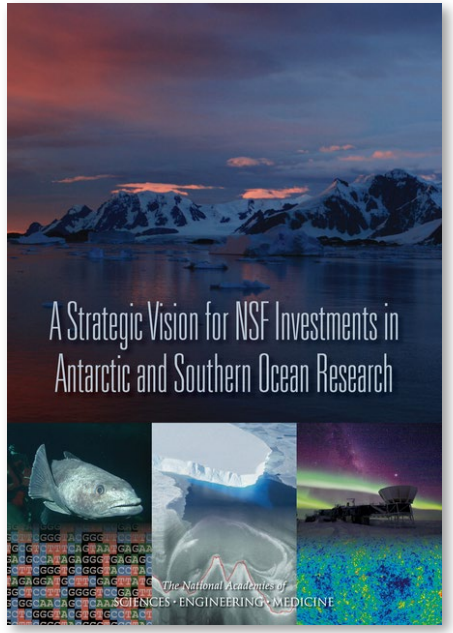


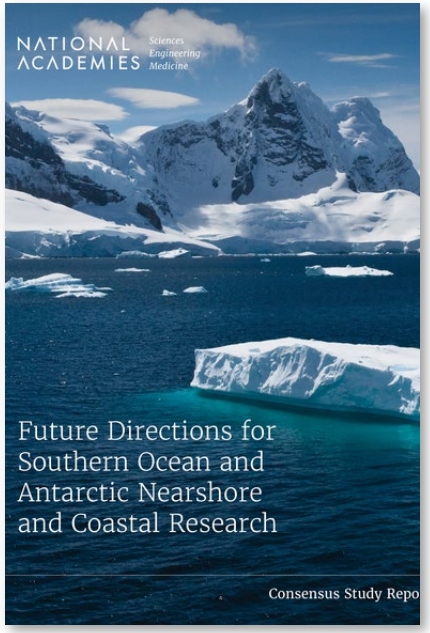
2022 — COLDEX



Implementation of Science Strategy

- Strategic Vision: NASEM Decadal Report
- Targeted Input: Studies and Workshops
- Alignment with Partners
- Guidance to Community: Solicitations and Dear Colleague Letters
- Implementation: PI proposals and awards
- Portfolio Balance





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World-Leading Presence - Stations

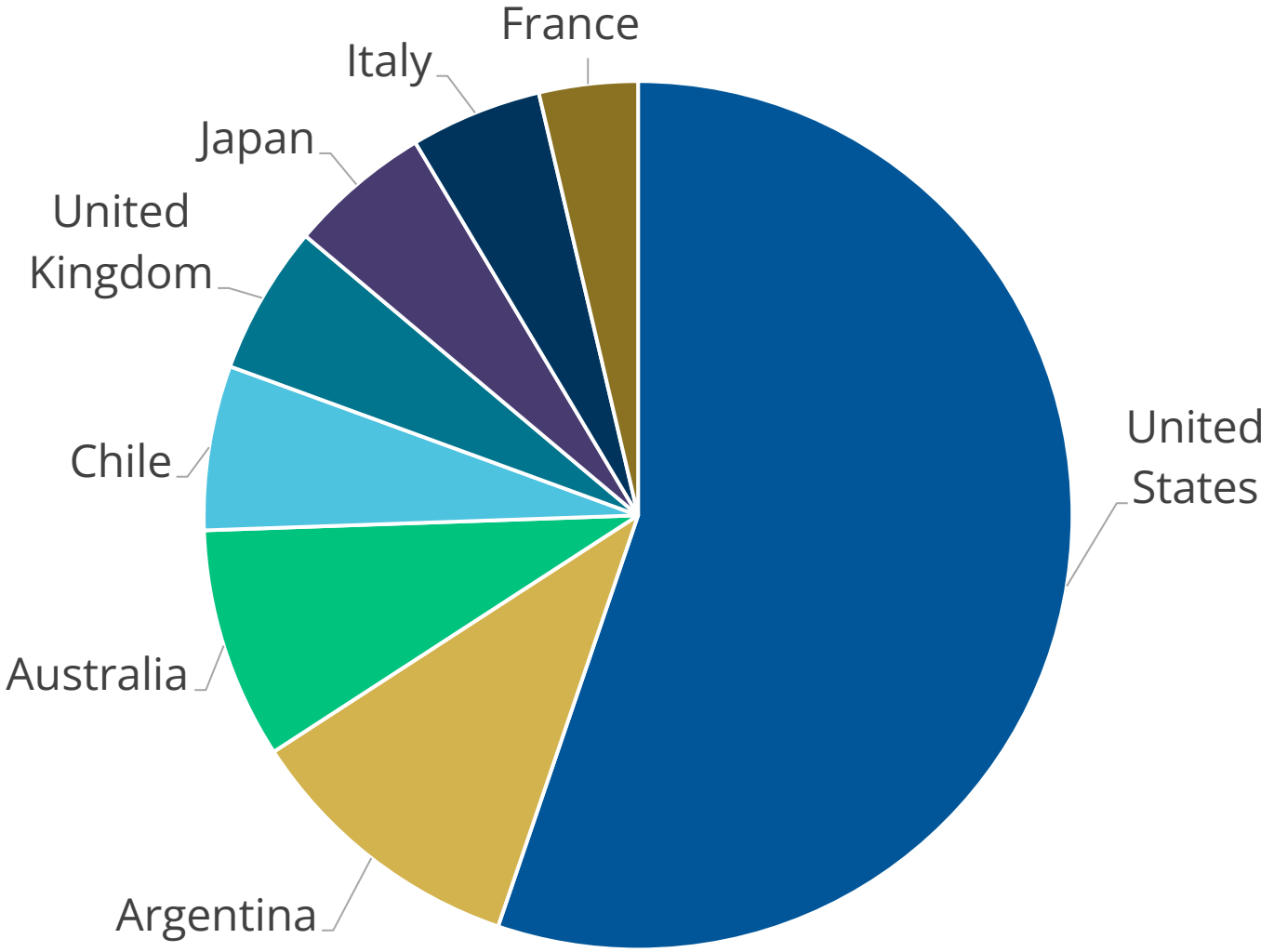
McMurdo Station is the largest station in Antarctica and logistics hub for South Pole station and deep field projects.

Amundsen-Scott South Pole Station provides a world-class science platform and deep-field hub.

Palmer Station supports a range of research in the peninsula including long-term studies of marine ecosystems.

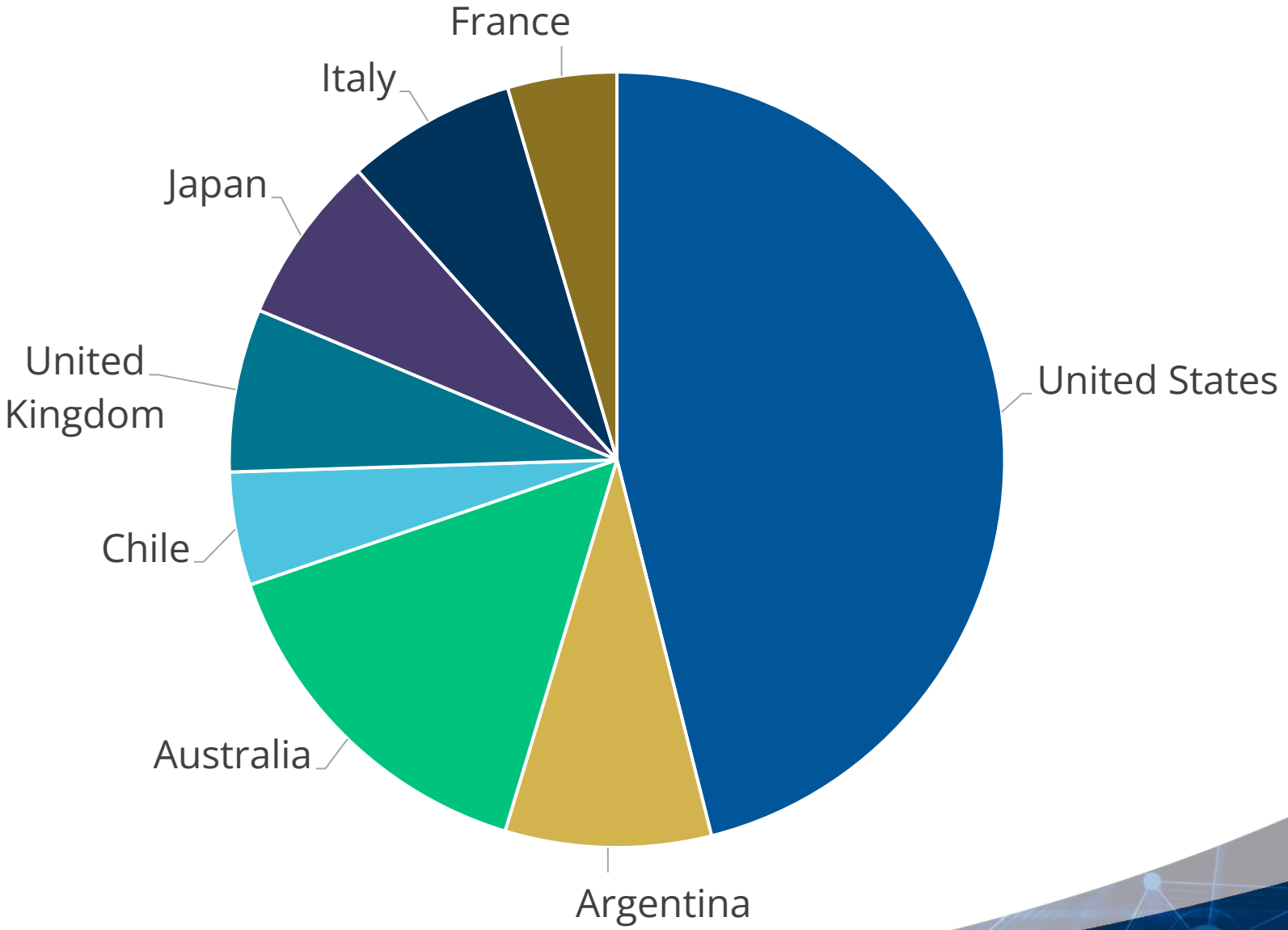
Peak Population Size for Top 11 Stations

1. NSF McMurdo Station
2. Marambio Base (Argentina)
3. NSF South Pole Station



‘Area Under Roof’ for Top 11 Stations

1. NSF McMurdo Station
2. NSF South Pole Station
3. Casey Station and Davis Station (Australia)



Scale of United States Antarctic Program

Populations

- McMurdo has the largest population with a peak in the Summer of **1200**.
- Marambio Base (Argentina) is the second largest at **165**.
- South Pole Station is the third largest with a peak of **150**.
- Palmer Station is ranked #37 with a capacity of **46**.

"Area under Roof"

- McMurdo (**32,750** m^2) and South Pole (**16,017** m^2) are the two largest stations on the Antarctic Continent by "Area under Roof"
- Casey and Davis Stations (AUS) are next both with **8,000** square meters of coverage

Other Facts

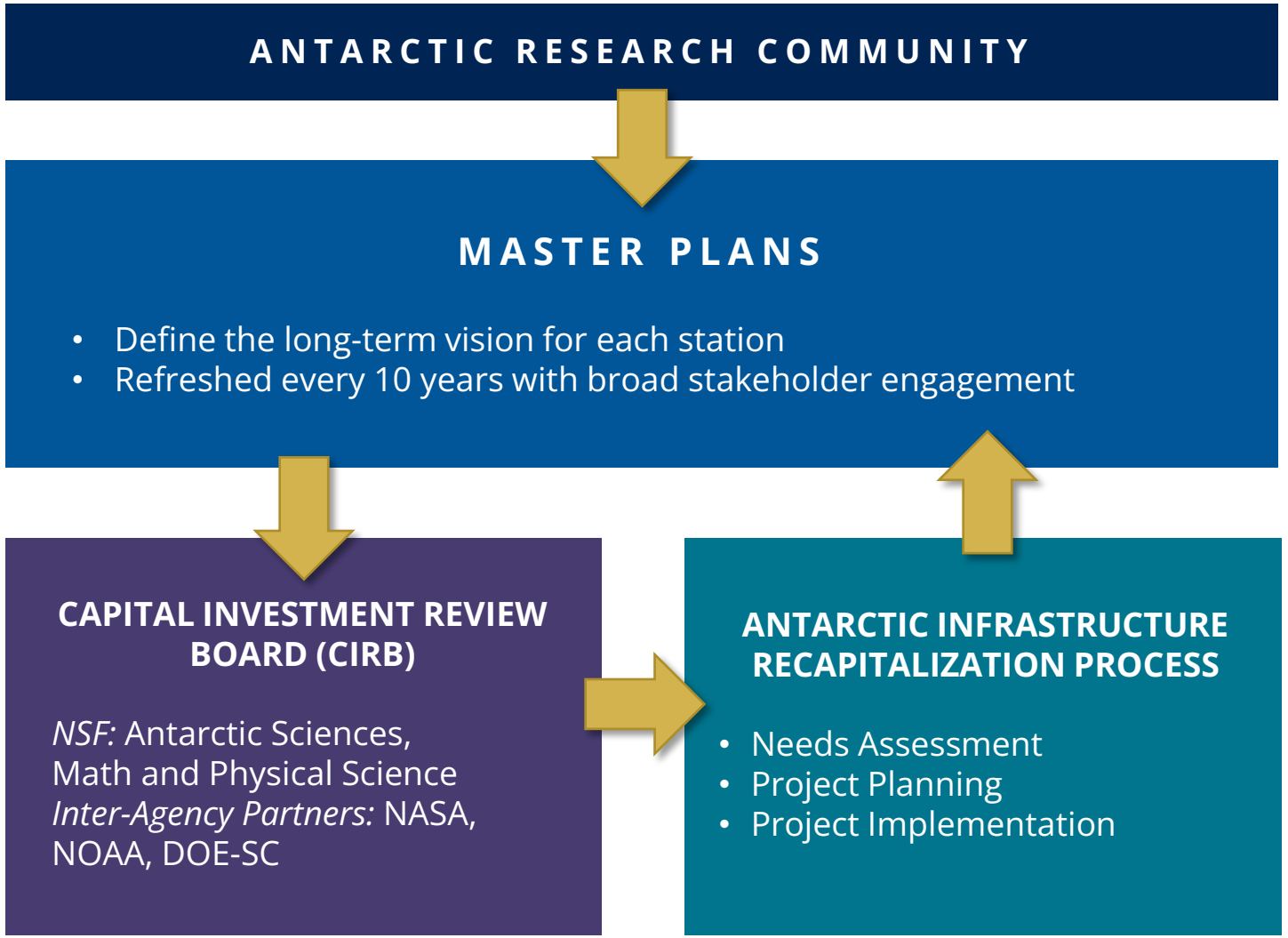
- MCM has a rare, sheltered, deep-water port.
- MCM is served by both wheeled and ski-equipped aircraft with a year-round airfield.
- MCM is one of only two stations operating with C-17 support, and the only station with an airfield that supports C-17s year-round.

World-leading Presence – Aircraft and Vessels

US Air Force **LC-130** fleet is a unique asset providing the largest cargo capacity and reach of any aircraft on the continent.

The **R/V Nathaniel B. Palmer** and anticipated new **Antarctic Research Vessel** support ground-breaking research into the Southern Ocean.

Infrastructure Strategy – “Infrastructure for Science”



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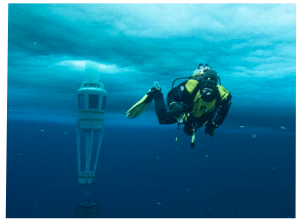
Global Engagement

- International Engagement
  - Active and Influential Presence
  - Environment
  - Inspections
  - Science & Operations
- Interagency Partnerships
  - Science Partners
  - Department of Defense
  - Department of State
- NSF Internal Partnerships

Polar Community



U.S. Leadership in Antarctica through Groundbreaking Science

Leadership in Research

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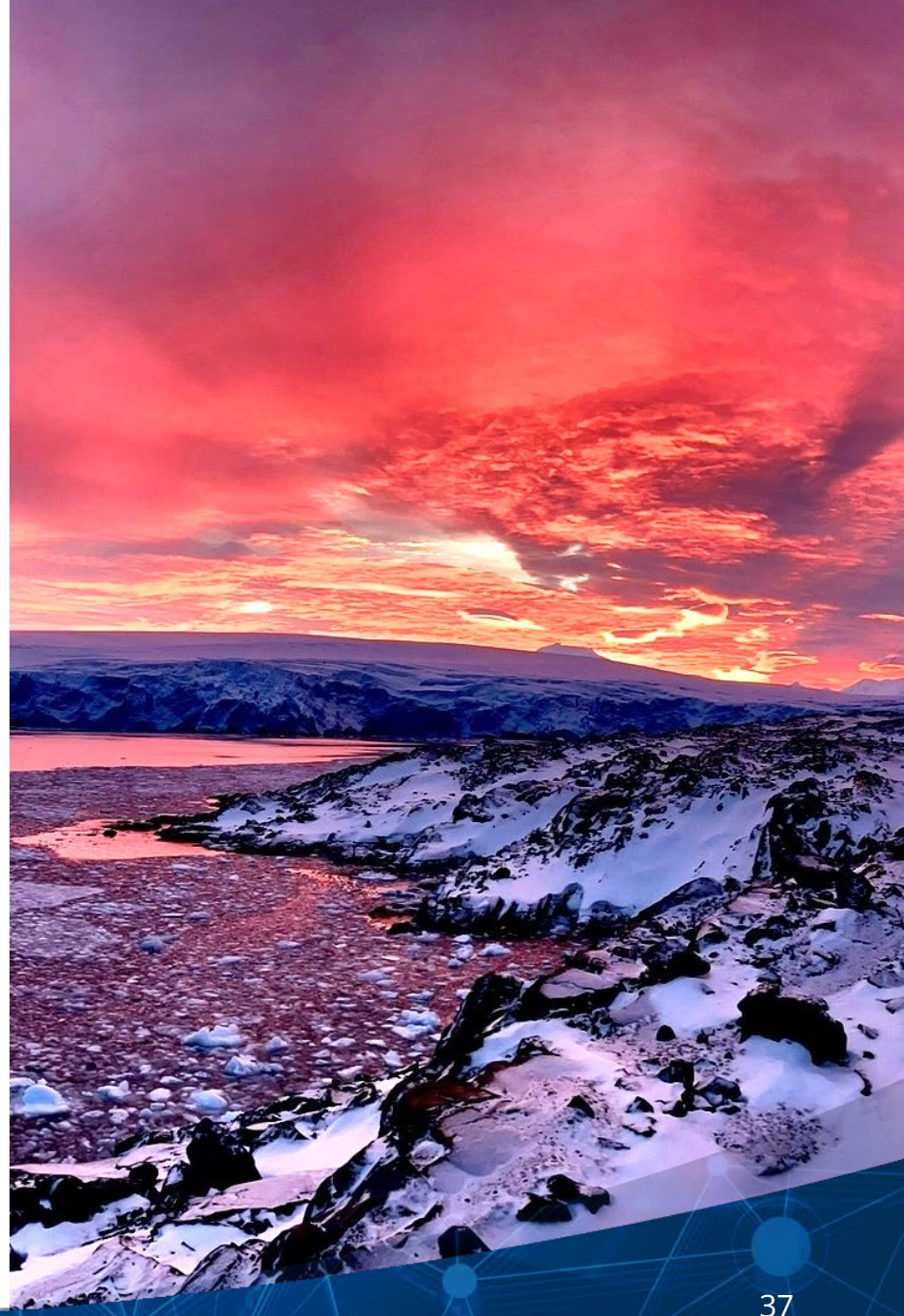
Leadership within the Antarctic Community

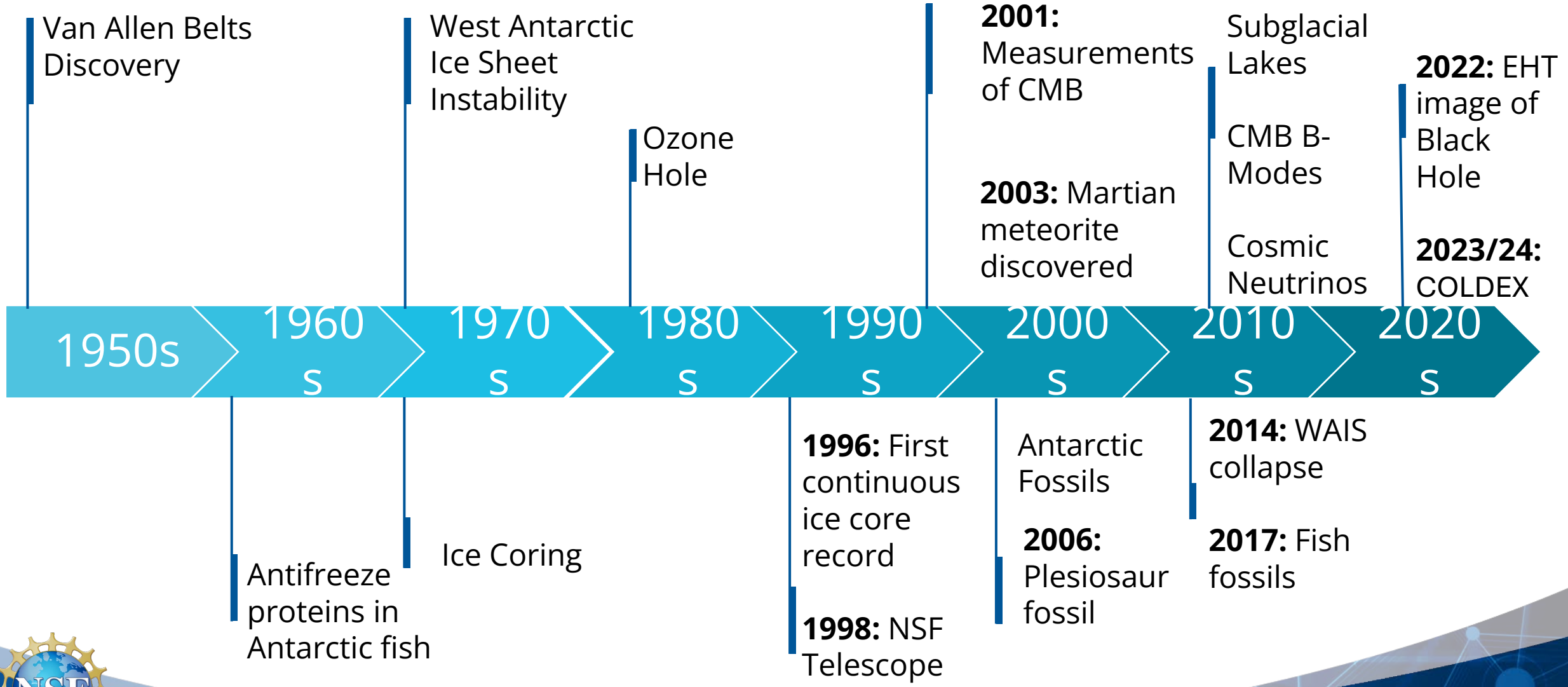
- Expand partnerships
- Improve research community engagement



Thank You

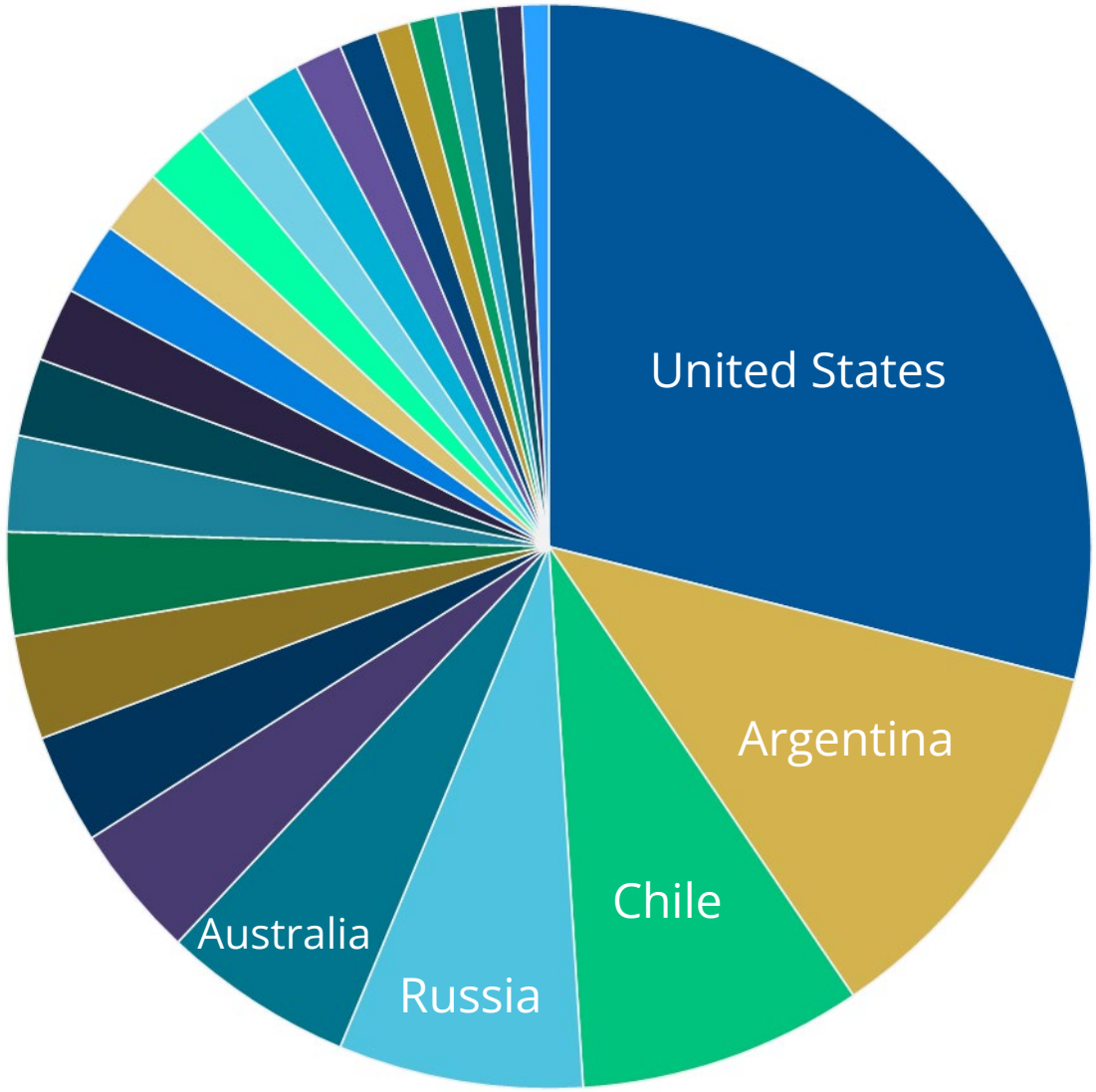
Backup Slides

Scientific Discoveries from Antarctica



Peak Population per Country

1. United States 29%
2. Argentina 12%
3. Chile 8%
4. Russia 7%
5. Australia 6%



‘Area Under Roof’ by Country

1. United States 24%
2. Argentina 10%
3. Australia 10%
4. Russia 8%
5. Chile 7%