U.S. Antarctic Program

Blue Ribbon Panel Review

Overview

The U.S. Antarctic Program (USAP), which is managed by the National Science Foundation (NSF), executes and provides oversight for numerous Antarctic science programs and the logistical and administrative resources to carry out the science mission. It also supports the U.S. policy of maintaining a permanent, peaceful presence in Antarctica. Current scientific efforts in Antarctica encompass a wide variety of fields and topics, from penguin population dynamics to astrophysics. The remote location and extreme environment require massive logistics support to every scientific endeavor. The USAP provides an umbrella capability that allows numerous government agencies to carry out scientific work in Antarctica and draws on the military and commercial sectors and cooperates with international partners to provide logistical and administrative support.

The Office of Science and Technology Policy and the National Science Foundation are initiating a major review of the program to ensure that it continues to support the most relevant and important science in the most effective, efficient, sustainable, technologically advanced, innovative, safe, and environmentally-friendly manner, and to set the stage for the next two decades of U.S. research, discovery, and environmental stewardship in Antarctica. The results of the study will inform policy-makers and budget requests in FY 2013 and beyond.

Called for in the FY 2010 President's budget, this review will be conducted in two complementary phases. The first will be an examination of the scientific drivers that will shape the USAP science program in the coming decades and will be conducted by a panel formed by the National Research Council (NRC). The NRC study will focus on describing the scope of Antarctic research over the next several decades, based, in part, on initial results, gaps, and directions identified during the International Polar Year, as well as from other community-based workshops, reports, and studies, including those conducted or evaluated by the National Academy of Sciences.

The second phase of the review will be an examination of the logistics, management, and infrastructure efforts needed to support the science and maintain the U.S. presence in the Southern Ocean and on the Antarctic Continent and will be conducted by a FACA Blue Ribbon Panel.

This document provides an overview of the U.S. Antarctic Program's current infrastructure and logistics.

I. Science Support – The "As Is"

The USAP infrastructure and logistics capability is currently configured to support terrestrial and marine-based research in the range of disciplines funded by NSF and by U.S. mission agencies. In order to do so, stations and other resources have been established and are briefly described below.

In 2010/11, 166 science groups, 11 technical events, and 4 Artists & Writers groups were supported in Antarctica:

- 113 through McMurdo
- 27 at South Pole
- 22 at Palmer

A total of 945 researchers to the stations and 458 to the field camps.

During the same period, research vessels *Nathaniel B. Palmer* and *Laurence M. Gould* supported 24 projects:

- 13 on the Palmer
- 11 on the Gould

A total of 177 researchers on the vessels.

A. Terrestrial Stations

1. Fixed Stations

NSF operates three year-round, permanent stations on the Antarctic continent.

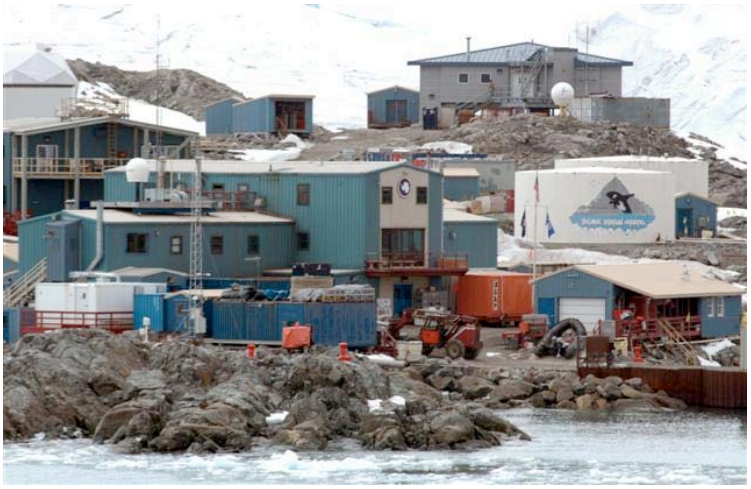
McMurdo Station

- Located on Ross Island in the Ross Sea region, McMurdo Station is the largest U.S. Antarctic Program station.
- 1000-1100 people in the austral summer operating season, which is approximately 21 weeks in duration, and 180 in the winter (February to early October).
- Includes a harbor, airfields for wheeled and ski-equipped aircraft, a helicopter pad and more than 100 buildings, including the Albert P. Crary Science and Engineering Center.
- ~ 6 million gallons of fuel delivered annually for heat, power, vehicles and aircraft.

Amundsen-Scott South Pole Station

- Located 841 statute miles inland from McMurdo, at the geographic South Pole.
- 250 people in the austral summer over a 100-day operating season, and 65 in the winter.
- Elevated Station and Clean, Dark and Quiet Sectors.
- ~ 600,000 gallons of fuel used annually.

Palmer Station

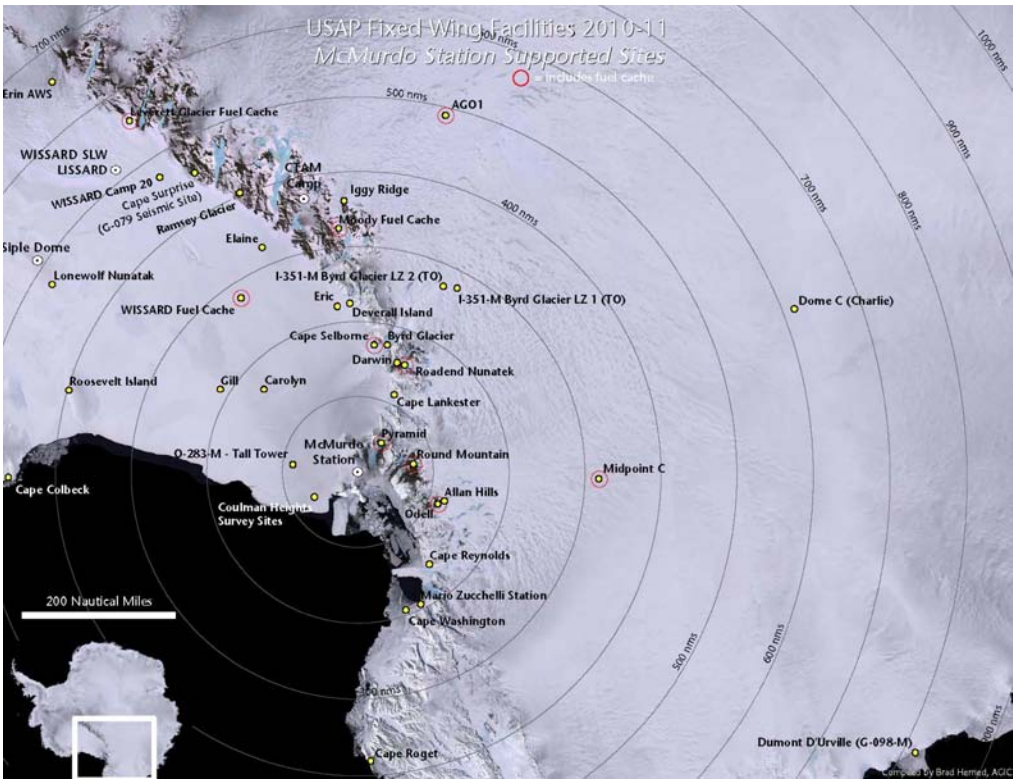


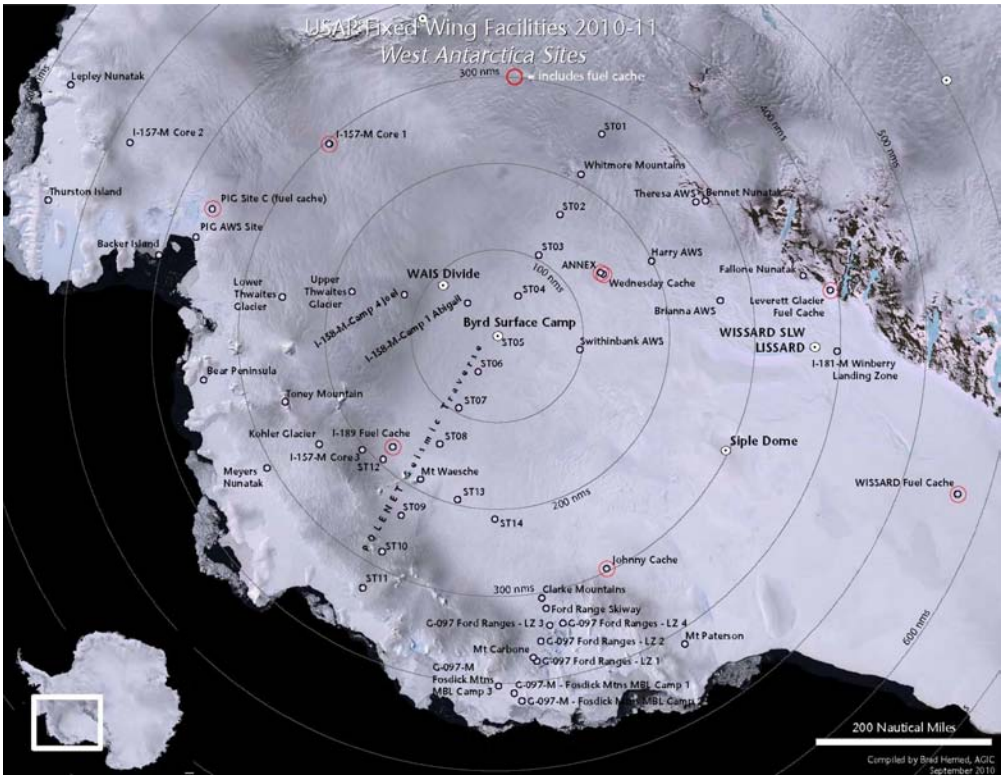
- Located on Anvers Island in the Antarctic Peninsula region and logistically isolated from the other stations.
- 40-45 people in the summer and 15-20 people in the winter period (there is no real winter period (i.e. no access), only periods of time with reduced activity).

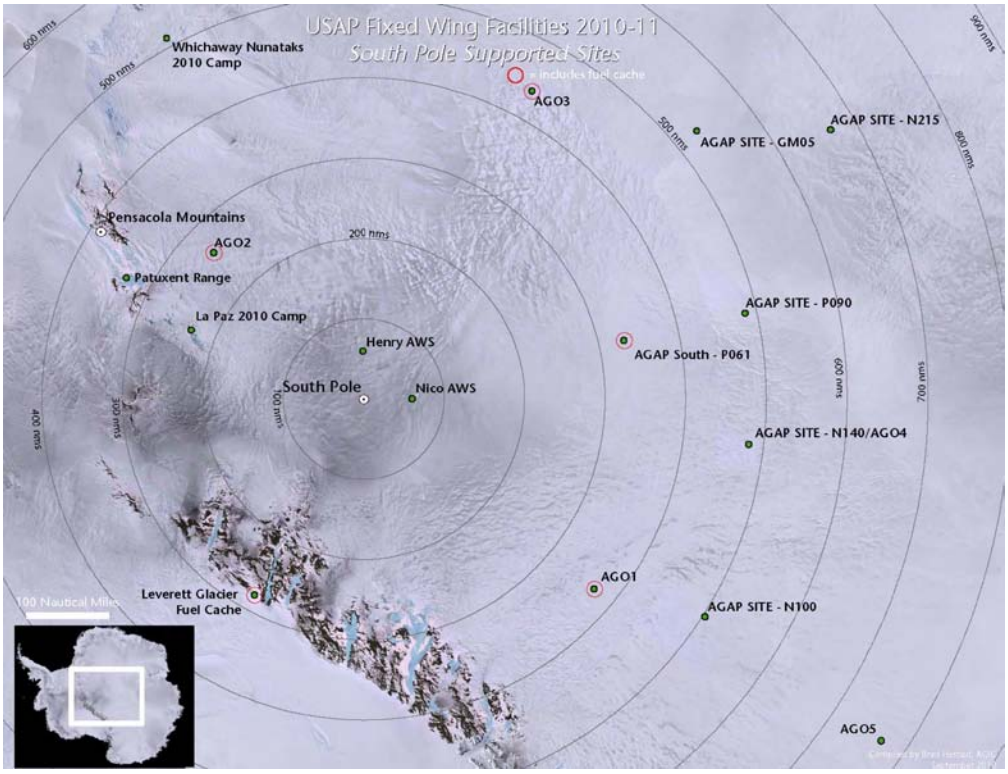
- Includes science labs in the Bio-Lab Building, a pier and a helicopter landing site; there is no runway, although Twin Otter aircraft have landed on the glacier above the station in emergencies.
- 115,000 gallons of diesel fuel annually.

2. Temporary Field Camps

- The USAP has the capability to set up both large and small field camps, depending on the type of research activity and duration of field stay.
- For some large campaign efforts more elaborate camps are constructed which are capable of serving as base camps for helicopter and fixed wing aviation.
- From McMurdo Station, a variety of field camps are established on a seasonal basis, some multi-year and some short term. South Pole is starting to function as a hub for field activity on the Antarctic Plateau.
- Access to the interior by air/traverse allows camps to be set up which until recently were clustered in West Antarctica but more recently are in other areas.


USAP Fixed Wing Facilities 2010-11
McMurdo Station Supported Sites
* includes fuel cache
300 nms
400 nms
500 nms
600 nms
700 nms
800 nms
900 nms
1000 nms
Erin AWS
Leverett Glacier Fuel Cache
AGO1
WISSARD SLW
LISSARD
WISSARD Camp 20
Cape Surprise
(G-079 Seismic Site)
Ramsey Glacier
CTAM Camp
Iggy Ridge
Moody Fuel Cache
Elaine
Siple Dome
Lonewolf Nunatak
I-351-M Byrd Glacier LZ 2 (TO)
I-351-M Byrd Glacier LZ 1 (TO)
Dome C (Charlie)
WISSARD Fuel Cache
Eric
Deverall Island
Cape Selborne
Byrd Glacier
Darwin
Roadend Nunatek
Roosevelt Island
Gill
Carolyn
Cape Lankester
Pyramid
Round Mountain
O-283-M - Tall Tower
McMurdo Station
Midpoint C
Cape Colbeck
Allan Hills
Coulman Island Survey Sites
Odell
Cape Reynolds
200 Nautical Miles
Mario Zucchelli Station
Cape Washington
Dumont D'Urville (G-098-M)
Cape Roget
Compiled by Brad Herried, AGIC


USAP Fixed Wing Facilities 2010-11
West Antarctica Sites
300 nms
* includes fuel cache
400 nms
500 nms
Lepley Nunatak
I-157-M Core 2
I-157-M Core 1
ST01
Whitmore Mountains
Thurston Island
PIG Site C (fuel cache)
Theresa AWS
Bennet Nunatak
ST02
PIG AWS Site
Backer Island
ST03
Harry AWS
ANNEX
Wednesday Cache
Fallone Nunatak
Lower Thwaites Glacier
Upper Thwaites Glacier
WAIS Divide
100 nms
ST04
Brianna AWS
Leverett Glacier Fuel Cache
I-158-M-Camp 4 Joel
I-158-M-Camp 1 Abigail
Byrd Surface Camp
ST05
Swithinbank AWS
WISSARD SLW
LISSARD
I-181-M Winberry Landing Zone
Bear Peninsula
ST06
Toney Mountain
ST07
POLENET Seismic Traverse
Kohler Glacier
I-189 Fuel Cache
ST08
Siple Dome
I-157-M Core 3
ST12
Meyers Nunatak
Mt Wausche
ST13
WISSARD Fuel Cache
ST09
200 nms
ST14
Johnny Cache
ST10
ST11
300 nms
Clarke Mountains
Ford Range Skiway
G-097 Ford Ranges - LZ 3
OG-097 Ford Ranges - LZ 4
Mt Paterson
Mt Carbone
OG-097 Ford Ranges - LZ 2
OG-097 Ford Ranges - LZ 1
G-097-M Fosdick Mtns MBL Camp 3
G-097-M - Fosdick Mtns MBL Camp 1
OG-097-M - Fosdick Mtns MBL Camp 2
600 nms
200 Nautical Miles
Compiled by Brad Herried, AGIC
September 2010



B. Marine Research Infrastructure

- *R/V Laurence M. Gould,* for transport of passengers and resupply of Palmer Station from a port at the southern tip of South America.
  - 76-meters.
  - 26 science berths.

- *R/V Nathaniel B. Palmer*, a research platform operating in the Southern Ocean.
  - 94-meters.
  - 37 science berths.

- AUV capability.

- Occasionally, USAP vessels operate in concert with the research vessels of national Antarctic programs.

- Ships of the U.S. academic fleet and the ocean drilling program also occasionally support research in Antarctica.

- In recent years, the Swedish icebreaker *Oden* has been used to break the channel to McMurdo Station and for collaborative Southern Ocean research by U.S.-Swedish teams.

II. Supply Chain

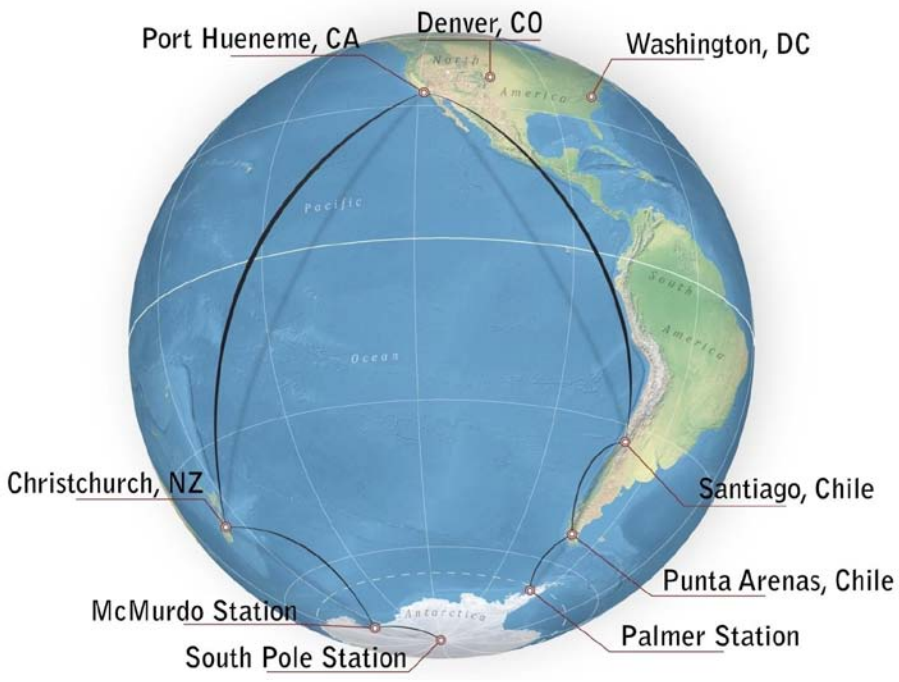
McMurdo is 2100 nautical miles from the nearest supermarket and building supply store (located in Christchurch, NZ).

A. Procurement

- Over 10,000 line items in McMurdo inventory alone.
- Peak activity in preparation for annual ship sailing.
- Incorrect purchases or inaccurate items aren't known until a year later.

B. Delivery

CONTINENTAL AND PENINSULA LOGISTICS SYSTEMS



- Over 1,800 items per month are received at Port Hueneme for shipment to either New Zealand or South America.

McMurdo Station

- Annual cargo vessel delivers 500-600 containers and some break bulk items.
- Approximately 7 million pounds delivered to McMurdo and 9.2 million pounds were backloaded (waste, recycling, and science samples).
- Annual fuel tanker delivers 6 million gallons of fuel to support McMurdo, South Pole and inland camps.
- 62 C-17 missions were flown between Christchurch, New Zealand, and McMurdo Station:
  - 6.7 million pounds of cargo.
  - 6,245 passengers.

South Pole Station

- South Pole Traverse
  - 779,000 pounds of cargo and fuel.
  - Equivalent of 38 LC-130 missions.
  - 27 days up – 19 days back.

- 215 LC-130 missions
  - 631 passengers.
  - 3.7 million pounds of fuel.
  - 1.8 million pounds of cargo.

Palmer Station
- Resupply every 6 weeks via *Gould.*
  - 415,000 pounds of cargo.
  - 567 passengers.

C. Warehousing

McMurdo
- 27 buildings for indoor storage + outdoor storage.
- 680,000 square feet of space total.

South Pole
- 16,500 square foot storage space in Logistics Facility.
- Extensive use of outside cargo lines.

Palmer Station
- 5,000 square feet of warehousing.
- 20-foot container storage.

III. On-Continent Transportation

A. Terrestrial

The USAP uses a mix of commercial and military transportation assets.

- LC-130 aircraft (a ski-equipped cargo plane)
  - Operated by 109AW, Scotia, NY.
  - Fly out of McMurdo to South Pole and temporary field camps.
  - 400 missions per operating season.
  - Carries 45 people or 26,000 pounds of cargo or some combination.
  - Fuel carried in wings (drives standard fuel type).

- Twin Otters
  - Commercial operator.
  - 3 Aircraft per year for 100 days each = ~1,500 flight hours.
  - Small payloads (2 skidoos).
  - Highly versatile, short takeoff.
  - Science survey aircraft.

- Basler Turbo DC-3
  - Commercial operator.
  - Medium lift for deep field.
  - 1 aircraft annually for 100 days = ~500 flight hours.
  - Extended range and payload.
  - Science survey aircraft.

- Helicopters
  - Commercial operator.
  - B212s and A-Stars for McMurdo and vicinity.
  - 2,000 flight hours annually.
  - Occasionally stationed at temporary field camps for extended periods of time supporting research.

B. Marine – see, II.B.

IV. Support Services

Utilities
- McMurdo power ~1.7Mw.
- South Pole power 650Kw.
- Palmer Station 250Kw.
- Waste heat use for supplemental heat.
- McMurdo has 1Mw wind turbine system through US/NZ partnership.
- Water produced via reverse osmosis at McMurdo and Palmer – Pole uses Rodriguez well (melting of ice using waste heat).

Clinics
- At the three year-round stations
  - Trauma Level III care with evacuation to nearest hospital.
  - Remote telemedicine capabilities.
  - Wellness activities are major productivity factors in Antarctica (e.g. flu prevention).
- EMT's aboard the research vessels.

Housing
- Dormitory housing at most locations.
- Tents in the field.

Food
- 21,000 meals per week during the summer at McMurdo.
- 5,300 meals per week during the summer at South Pole.
- 1,000 meals per week during the summer at Palmer.

Fire

- McMurdo has over 70 career firefighting personnel for structural and airfield support.
- South Pole and Palmer have volunteer fire brigades.

Vehicles

- McMurdo has over 550 pieces of equipment that are maintained at the Vehicle Maintenance Facility.
- Bulldozers to ground support equipment for aircraft.

Operations

- There are over 100 miles of roads (dirt and snow) in the McMurdo area that are routinely maintained by station personnel.
- McMurdo has three airfields, but USAP is working to consolidate to a single airfield at the Pegasus site.
- A 30-foot thick ice pier is constructed at McMurdo to offload the annual resupply vessels.
- Weather forecasting and air traffic control.
- Law enforcement is provided for McMurdo and South Pole by the NSF Station Manager, who is a Special Deputy U.S. Marshal.

"Morale, Welfare, Recreation"

- Gyms and workout facilities at all USAP locations, including the research vessels.
- Field Trips are conducted at McMurdo Station to sites of interest such as Scott and Shackleton's Huts at Cape Evans and Cape Royds.
- The USAP operates stores at each station and on each ship to provide souvenirs and necessary items that cannot be purchased elsewhere due to remote location.
- Each station has lounges and clubs.
- McMurdo Station has live TV through Armed Forces Radio and Television Services; South Pole and Palmer do not have live TV.
- Increasing demands for the Internet as a morale activity.

V. Information Technology – Computing and Communications

Network Operations

- USAP station networks all converge back through Denver contractor HQ.
- Roughly 3,000 "seats" on the USAP network during the austral summer.
- Systems in Antarctica provide operational and morale use - content filtering and bandwidth management in place.

Communications

- VHF and radio communications for all field activities
- HF radio still widely used, although Iridium through DoD is everywhere now for operational and science use (voice & data).

Satellite communications

- Full 24x7 coverage for McMurdo and Palmer Station through commercial satellites.
  - McMurdo = 20 MB/sec.
  - Palmer = ~1 MB/sec.
- South Pole has significant science data transmission requirement for outbound traffic (astronomy & astrophysics).
  - Subject of recent workshop.
- Rely on available commercial satellites and NASA-provided systems (e.g. TDRSS).
- Prioritization issues with getting access to TDRSS except in emergencies.

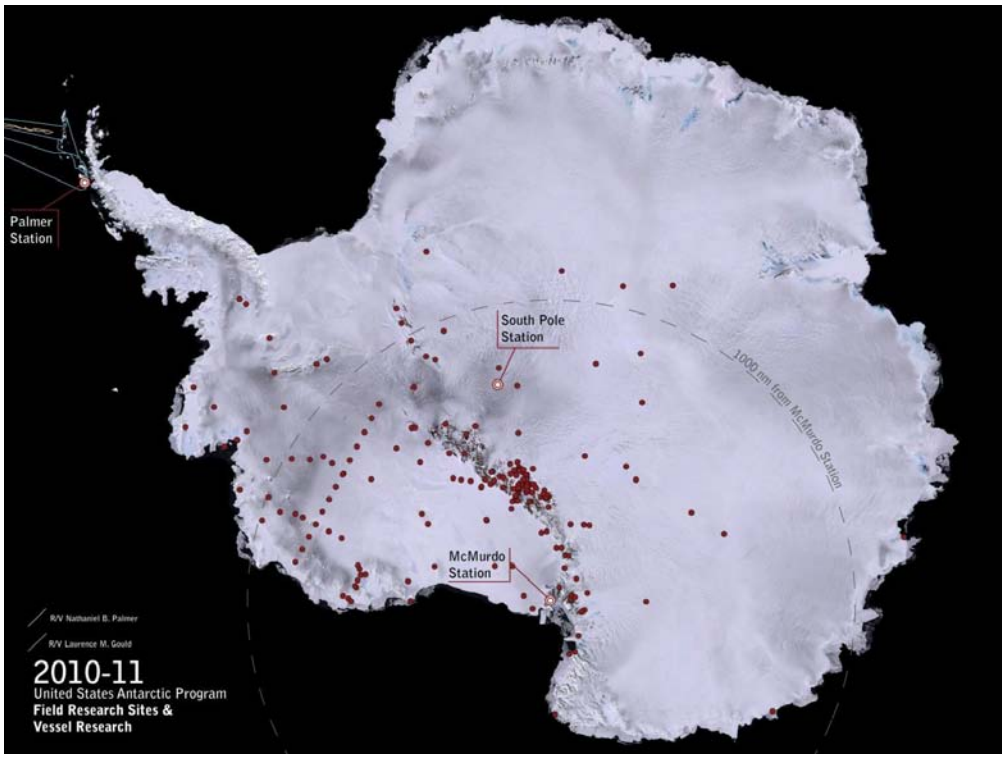


Figure 1 USAP Field Research Locations 2010-11

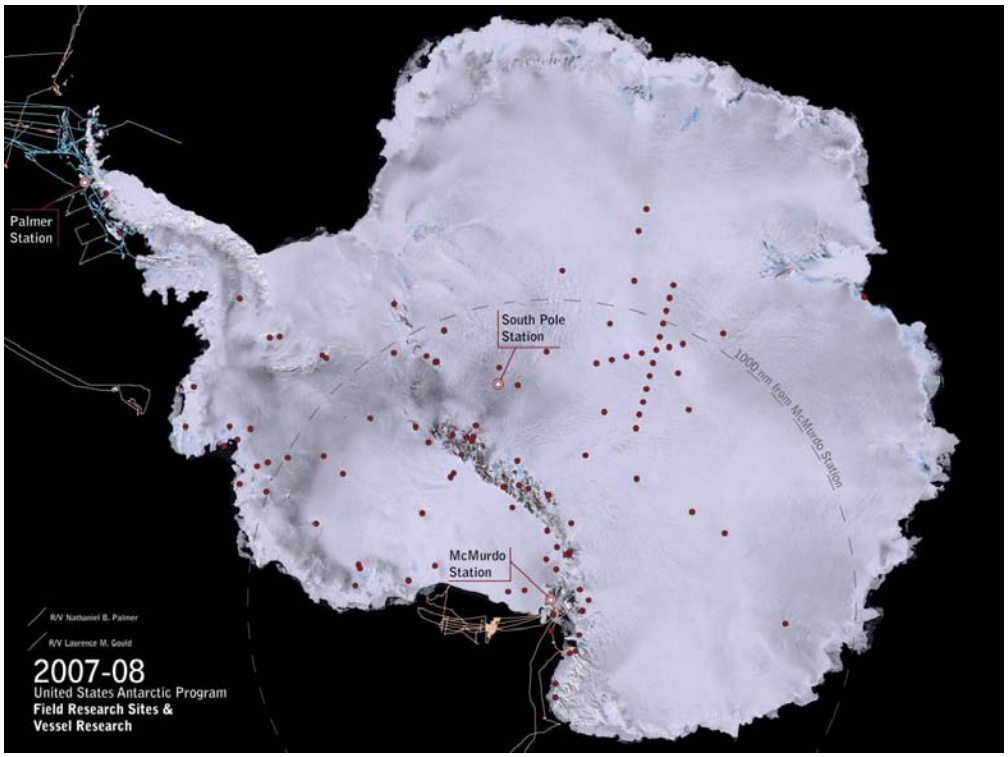


Figure 2 USAP Field Locations 2007-08 (Note Ship Tracks)