

Antarctic Infrastructure and Logistics Division GPRA Highlights, FY 2009

Improved Data Communications for South Pole Science

Highlight ID: 18933, Version: AC/GPA

The Office of Polar Programs completed an infrastructure modernization of the South Pole TDRSS Relay (SPTR) in January, 2009 that has significantly enhanced high speed science data communications for Amundsen-Scott South Pole Station. A new earth station with a 4.5 meter parabolic antenna, accompanied with state-of-the-art software defined modulator/demodulators, was commissioned to replace the original earth station installed in 1997. The SPTR utilizes aged satellites operating in inclined geosynchronous orbit from the NASA Tracking and Data Relay Satellite System (TDRSS) to provide high speed data communications and Internet Protocol (IP) access to support the advanced science research programs at South Pole Station. The new earth station can transmit at 150 Mb/s, allowing for over 200 gigabytes (GB) to be sent daily from the station to universities and collaborating institutions world-wide. Commissioning tests reached an Antarctic record of 239.7 GB sent "north" on January 27, 2009. A parallel IP network service was commissioned at an average 5 Mb/s rate, doubling the prior capability. The earth station is "agile" in azimuth such that it can point to any NASA TDRS satellite longitude that possesses sufficient inclination to view South Pole Station. The primary beneficiaries of this capability are the major research projects Icecube (one-of-a-kind neutrino telescope) and South Pole Telescope (radio telescope conducting cosmic origins research).

Primary Strategic Outcome Goal:

- Polar Facilities & Logistics

Secondary Strategic Outcome Goals:

- Polar Sciences: Arctic and Antarctic Research

In terms of intellectual merit, why is this outcome notable and/or important?

Advanced data communications provided by this infrastructure improvement directly support the conduct of novel and high impact research programs operating at Amundsen-Scott South Pole Station.

In terms of broader impacts, why is this outcome notable and/or important?

[Merit Review Broader Impacts Criterion: Representative Activities, July 2007](#)

The capability of this infrastructure directly supports the experiment design and operations goals of the two major research programs operating at South Pole Station - Icecube and South Pole Telescope - which are technically advanced and operate at South Pole Station on a continual basis. The advanced data communications allow for efficiencies in the experiment design, deployment, refinement, and evolution. The remoteness and high degree of physical isolation of the experiments at South Pole Station are largely overcome via the "tele-projection" of technical expertise from a wide array of university and institutional participants located world-wide. Daily delivery of data for additional advanced processing, reduction, and analysis at computing facilities co-located with the participating science teams facilitates the delivery of research analysis results that can be shared with the broader science discipline communities (via conferences, peer reviewed papers, etc.) which in turn generates beneficial peer input for evolving experiment design and goals.

Does this highlight represent transformative or potentially transformative research? If so, please explain why. For more information, see [Report to Congress: Transformative Research at the National Science Foundation, April 16, 2008](#) and [Important Notice 130: Transformative Research](#)
No

How well does the proposed activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc?)

No

What may be the benefits of the proposed activity to society?

Yes

Societal benefits arise from this increased data communications capability by bringing South Pole Station and its active research programs more effectively into cyberspace, and hence into the public's awareness via modern networking applications (e.g. "Web 2.0"). Improved data networking capability has enabled greater use of higher quality video conferencing, timely sharing of pre-produced public outreach videos, telephone interviews, etc. - enabling NSF to share the exciting results of its science research programs for the benefit of the general public (see:

<http://icesstories.exploratorium.edu/dispatches/index.php>)

OPP/AIL 2009

Program Officer: Patrick Smith

NSF Award Numbers:

[0004191](#)

Award Title: NSF-NASA MOA Concerning Support via Tracking and Data Relay Satellite System (TDRSS)

PI: Roger Flaherty,

Institution Name: National Aeronautics and Space Administration

State Code: DC

PE Codes: 5205, 5140, 1296

[9714917](#)

Award Title: DoD Support to Antarctic Mission

PI: Michael Cheney,

Institution Name: Department of Defense

State Code: CA

PE Codes: 6898, 6109, 5292, 5281, 5280, 5219, 5205, 5146, 5140, 5116, 5115, 5113, 5112, 5111, 1647, 0835, 0609, 0608, 005F, 1361, 1296, 1283

NSF Contract Numbers:

OPP-0000373

NSF Investments: International Polar Year (IPY), Cyberinfrastructure

Airfield Efficiencies at McMurdo Station, Antarctica

Highlight ID: 19206, Version: AC/GPA

The Division of Antarctic Infrastructure and Logistics (AIL) achieved operational savings for the United States Antarctic Program (USAP) by not constructing a sea ice runway at McMurdo Station, Antarctica during the 2008-2009 field season. Traditionally the USAP has operated three runways in the McMurdo Station region: the annual sea ice runway, the Williams Field skiway, and the Pegasus compacted snow runway. The sea ice and Pegasus runways support wheeled aircraft operations, whereas Williams Field is limited to ski-equipped aircraft only. Although the decision to eliminate the sea ice runway was driven by financial considerations, the long-range goal of the USAP has been to consolidate all aviation operations to a single complex at the Pegasus runway site, approximately nine miles from McMurdo Station. The lessons learned during the 2008-2009 field season will help improve the planning for the consolidated runway complex.

Primary Strategic Outcome Goal:

- Research Resources (minor facilities, infrastructure and instrumentation, field stations, museum collections, etc.)

Secondary Strategic Outcome Goals:

In terms of intellectual merit, why is this outcome notable and/or important?
Nothing direct.

In terms of broader impacts, why is this outcome notable and/or important?
[Merit Review Broader Impacts Criterion: Representative Activities, July 2007](#)

By optimizing the airfield operations, AIL was able to use the "recovered" labor and material to better support other logistical demands in the support of science.

Does this highlight represent transformative or potentially transformative research? If so, please explain why. For more information, see [Report to Congress: Transformative Research at the National Science Foundation, April 16, 2008](#) and [Important Notice 130: Transformative Research](#)
No

How well does the proposed activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc?)
No

What may be the benefits of the proposed activity to society?
Yes

One less airfield is that much less 'stress' on the Antarctic environment.
OPP/AIL 2009

Program Officer: Mike Scheuermann
NSF Award Numbers:
NSF Contract Numbers:
OPP-0000373

NSF Investments: None Applicable

Oversnow Traverse to South Pole

Highlight ID: 19211, Version: AC/GPA

Following a multi-year proof-of-concept project to develop the route and technology, a team of ten operators and tractors successfully achieved the first production resupply traverse to the Amundsen-Scott South Pole station. Driving 1600 km entirely over moving snow and ice terrain from the main US logistics hub in McMurdo, the team delivered over 400 tonnes of fuel and cargo. They back-loaded about 10 tonnes of waste materials and returned to McMurdo after a total of 64 days round trip driving and 11 days at South Pole. The traverse delivery offset the need for 40 flights and was achieved using 400,000 fewer liters of fuel than would have been consumed by those flights.

Primary Strategic Outcome Goal:

- Polar Facilities & Logistics

Secondary Strategic Outcome Goals:

- Polar Sciences: Arctic and Antarctic Research

In terms of intellectual merit, why is this outcome notable and/or important?

The technology and experience now present provides the US Antarctic Program with the ability to more efficiently and reliably achieve logistics and science project goals.

In terms of broader impacts, why is this outcome notable and/or important?

[Merit Review Broader Impacts Criterion: Representative Activities, July 2007](#)

The now-proven traverse capability opens wide new areas of Antarctica to research accessibility and supportability.

Does this highlight represent transformative or potentially transformative research? If so, please explain why. For more information, see [Report to Congress: Transformative Research at the National Science Foundation, April 16, 2008](#) and [Important Notice 130: Transformative Research](#)

Yes

New types of scientific research are now possible with new this new mechanism for field deployment.

How well does the proposed activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc?)

No

What may be the benefits of the proposed activity to society?

Yes

Per unit of material delivered, the traverse consumes 75% less fuel and emits 1000 times fewer atmospheric pollutants than the current method of delivery by aircraft.

OPP/AIL 2009

Program Officer: George Blaisdell

NSF Award Numbers:

NSF Contract Numbers:

OPP-0000373

NSF Investments: Climate Change, International Polar Year (IPY), Environment (including the importance of fresh water and dynamics of water processes)

Antarctic Gamburtsev Province Project Support

Highlight ID: 19271, Version: AC/GPA

NSF Office of Polar Programs provided major logistics support for two remote field camps in the Antarctic Gamburtsev Mountain Province. Both camps were established at elevations higher than 11,000 feet and supported round-the-clock Twin Otter aircraft operations. The US Air Force, working together with NSF, delivered over 20,000 gallons of fuel in four C-17 Globemaster III air drop missions, the first C-17 air drops to an Antarctic deep field site. These airdrops replaced the need to bring that fuel in to the camp over land, saving potentially weeks of effort. The logistics supported an aerogeophysical and seismic survey of the last unexplored mountain range on the planet, similar in size and topography to the European Alps and buried entirely under ice. The survey was part of an International Polar Year scientific collaboration between NSF-funded researchers at the Lamont-Doherty Earth Observatory and polar researchers from the United Kingdom, Australia, Germany, China, France, Italy, and Japan. The researchers hope to use the data to identify how the Gamburtsev Mountains and the East Antarctic ice sheet formed. They also hope to identify the role that subglacial melt water plays in ice sheet dynamics.

Primary Strategic Outcome Goal:

- Polar Facilities & Logistics

Secondary Strategic Outcome Goals:

- Polar Sciences: Arctic and Antarctic Research

In terms of intellectual merit, why is this outcome notable and/or important?

The logistics capabilities of the US Antarctic Program allow researchers to work in the most remote places on the planet. The support in the Gamburtsev Mountains enables researchers to answer critical questions about ice sheet and mountain formation and ice dynamics. These play a role in our understanding of Antarctic and global climate history and how the ice sheets may react to changing global climate.

In terms of broader impacts, why is this outcome notable and/or important?

[Merit Review Broader Impacts Criterion: Representative Activities, July 2007](#)

The logistics support in the Gamburtsev Mountains proves US capabilities to work safely at remote, high altitude sites in Antarctica. The C-17 air drops offer a new method for delivering large volumes of fuel to sites which would otherwise be too remote to conduct scientific activity of this scale. This opens Antarctica to new areas of discovery.

Does this highlight represent transformative or potentially transformative research? If so, please explain why. For more information, see [Report to Congress: Transformative Research at the National Science Foundation, April 16, 2008](#) and [Important Notice 130: Transformative Research](#)

No

How well does the proposed activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc?)

No

What may be the benefits of the proposed activity to society?

Yes

The logistics support in the Gamburtsev Mountains enabled research that may add to our understanding of ice sheet and mountain formation and ice dynamics. Discovering these mechanisms may shed light on Antarctic and global climate history and how the ice sheets may react to changing global climate.

OPP/AIL 2009

Program Officer: Jessie Crain

NSF Award Numbers:

NSF Contract Numbers:

OPP-0000373

NSF Investments: Climate Change, International Polar Year (IPY)