Cover

The Phoenix Airfield at McMurdo Station appears on the cover of this year's *Science Planning Summary.* The photo captures a southbound C-17 landing behind the waiting Kress personnel carrier that will transport arriving scientists and support personnel to McMurdo Station.

Photo by Colin M. Harnish, December 2018.

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2019 - 2020

Science Planning Summary

United States Antarctic Program

This *Science Planning Summary* is subject to change based on project funding allocation, Antarctic operational considerations, and other factors. For the latest 2019-2020 information, please consult the online *Science Planning Summary* via the USAP web site at www.usap.gov/sps or by scanning the QR code below.

Editor's Note: To submit a comment about how to improve the Science Planning Summary or to report an error, please email PlanningCoords.Science@usap.gov.

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Planning and On-Ice Support Points of Contact

Each project has both a planner and implementer point of contact (POC). Some projects may also have a project manager. POCs are listed on the bottom right of project pages (see below).

Program Director **ASC Points of Contact**

Dr. Program Director Joe Planner / Jane Implementer / Jack Project Manager

The planner is the point of contact during the proposal and early planning phases of a project; six planners are based in Alexandria, Virginia and one in Centennial, Colorado. A project's implementer becomes the point of contact when the support information package (SIP) is submitted and detailed planning and resource allocation begins. The implementer develops and distributes the research support plan (RSP) and will deploy to Antarctica. Each planner and implementer is responsible for a portfolio of projects as well as other duties.

The first name will always be the planner; In some cases where projects are supported from more than one station, there may be two or more implementers. The order of the implementers' names will correspond with the order of the location designation included in the science event number. (For more information on the science event numbering system, please turn to page iii.)

Finally, a project manager is assigned when the scope of the science proposal is unusually complex and/or requires greater oversight and budgetary responsibilities. The project manager may be assigned either during the proposal review or planning phase, depending on the project's needs and complexity.

Science Event Numbering System

Every funded science project is assigned a unique science event number, e.g., A-000-S.
The first letter, or prefix, indicates the USAP program funding the project.

Prefix	USAP Program
A	Astrophysics and Geospace Sciences
B	Organisms and Ecosystems
C	Integrated System Science
D	Instrumentation and Technology Development
G	Earth Sciences
I	Glaciology
O	Ocean and Atmospheric Sciences
T	Technical Events
W	Artists and Writers Events
X	Other Science Events
Y	Education and Outreach Events

The three digits in the middle are issued consecutively as needed.

The suffix represents the supporting station. If field work will occur at multiple locations, event numbers may have more than one suffix separated by a slash.

Suffix	Supporting Station
E	Special projects supported by the USAP, e.g., investigators working with other national programs
L	ARSV* *Laurence M. Gould*
M	McMurdo Station
N	RV/IB** *Nathaniel B. Palmer*
P	Palmer Station
S	South Pole Station
*ARSV: Antarctic Research and Supply Vessel **RV/IB: Research Vessel/Icebreaker	

Station and Vessel Schedules

Below are the 2019-20 USAP station and vessel schedules. Opening and closing dates are subject to change depending on weather, ice conditions, aircraft availability, and other factors.

Austral Summer Season Openings			**Austral Winter Season Opening**
Location	**Operational**	**Science**	
McMurdo (early season)	19 Aug 2019	22 Aug 2019 / 19 Sep 2019	24 Feb 2020
McMurdo (Mainbody)	30 Sep 2019	2 Oct 2019	
South Pole	05 Nov 2019	05 Nov 2019	15 Feb 2020
Palmer	13 Oct 2019	13 Oct 2019	05 Apr 2020
Research Vessels	Year-round operations; Vessel schedules are available at www.usap.gov/vesselScienceAndOperations		

Estimated Population		
Location	**Summer**	**Winter**
McMurdo	850 (weekly average) 2,300 (total)	180 (winter total)
South Pole	150 (weekly average) 450 (total)	42 (winter total)
Palmer	36-44 (weekly average) 196 (total)	
RV/IB *Nathaniel B. Palmer*	39 science and staff/25 crew (per cruise)	
ARSV *Laurence M. Gould*	Capacity per cruise: 27 science and staff Capacity per transit to/from Palmer Station: 37 science and staff with two berthing vans	

Staffed Field Camps

In 2019-20, seven field camps will have resident staff providing logistics and operations support to McMurdo-based researchers. In addition to the map of each camp location, descriptions of camp activities are also included.

Figure 1. Map of 2019-20 USAP field-camp locations

Byrd Surface Camp (NBY), 80° 1.094' S, 119° 35.184' W
900 nautical miles from McMurdo Station

Byrd Surface Camp serves as a fueling point for aircraft operating between McMurdo Station and West Antarctica. A staff of three will provide daily weather observations, maintain the camp, and receive bulk fuel for out-year operations in support of the Thwaites Glacier campaign. In addition, this season the camp will support O-400-M (Cassano) for two weeks during the installation of a 30-meter tower supporting instrumentation that will collect year-round, autonomous, atmospheric and surface measurements. Byrd camp will also house and feed Kenn Borek Air (KBA) Twin Otter flight crews as needed.

Dry Valleys: Taylor Valley Camps, 77° 37.38' S, 162° 53.99' E (Lake Hoare)
50 nautical miles from McMurdo Station

Each year, multiple science teams conduct research in the Dry Valleys while based at the semi-permanent facilities in Taylor Valley. All the facilities are supported by helicopter operations based at McMurdo Station. This year, two resident staff based at Lake Hoare will oversee operations at Lake Hoare, Lake Fryxell, F6, Lake Bonney, and New Harbor camps, as well as a small temporary camp at Lake Miers (located farther south in the Dry Valleys).

The McMurdo Long Term Ecological Research (MCM LTER) science teams C-504-M (Gooseff), C-505-M (Priscu), C-506-M (Gooseff), C-507-M (Adams), C-508-M (Takacs-Vesbach), C-509-M (McKnight), and C-511-M (Doran) will be working out of Lake Hoare, Lake Fryxell, F6, Lake Bonney, and Lake Miers again this season, along with two groups that collaborate with the MCM LTER: T-295-M (Pettit - UNAVCO (University NAVSTAR Consortium)) and Antarctic New Zealand K-080 (Hawes). The science team G-183-M (Lyons) will be working at New Harbor. An Artists & Writers grantee team, W-221-M (Anderson), may stay for a night or two at Lake Hoare or one of the Taylor Valley camps in order to work with LTER. In addition, media team W-222-M (Anderson) may visit with LTER on day trips to the Taylor Valley camps.

Lower Erebus Hut (LEH) Camp, 77° 30.63' S, 167° 8.891' E
22 nautical miles from McMurdo Station

The Lower Erebus Hut (LEH) camp supports high-altitude work on Ross Island in areas near the Mount Erebus volcano. The facility is helicopter-supported and a resident camp supervisor or support contractor staff member typically provide oversight during USAP operations. An Antarctic New Zealand project, K-023 (Craig), will occupy LEH for the first half of the 2019-20 season. Mid-season, the support contractor construction and field science staff to install a replacement survival shelter in the area of the former Upper Erebus Hut, and raise the partially-buried survival shelter at CONEZ. Also during this period, a proposed USAP science project may occupy LEH for about three weeks to drill and install seismic stations and a telemetry network at five high-elevation sites. The temporary tent camp at Fang Glacier will be set up to support acclimatization for any groups working from LEH camp.

Lower Thwaites Glacier (LTG) Camps, 76° 27.498' S, 107° 46.920' W
1,050 nautical miles from McMurdo Station

The Lower Thwaites Glacier site acts as an intermediary support hub between WAIS Divide and Thwaites Glacier field sites. Three residential staff (two USAP support contractor, one British Antarctic Survey) will provide weather observation, aviation ground and communication support, site maintenance, skiway grooming, and food service for transient science personnel and residential flight crews. Supported projects include C-443-M, (Goerhring-Johnson-GHC Hudson Mts.), C-444-M, (Holland-MELT), C-445-M (Pettit-TARSAN), C-446-M (Tulaczyk-TIME), C-448 (Goerhring-Johnson-GHC Mt. Murphy) and G-079-M (Wilson-POLENET).

RAID Traverse & Camp, 78° 37.107' S, 166° 40.679' E
75 Nautical Miles From McMurdo Station

RAID Camp is a traverse and helo-supported field camp supporting the third Antarctic field trial for the Rapid Access Ice Drill (RAID- D-551-M, D-552-M). Located in close proximity to Minna Bluff, RAID Camp will be installed via the

Heavy Science Traverse. Four resident camp staff will support a science and driller team with equipment operations, generator support, helo operations, and food service.

Siple Dome (SDM), 81° 39.840' S, 149° 1.050' W
507 nautical miles from McMurdo Station

This camp serves as a fueling point for aircraft operating between McMurdo Station and West Antarctica or South Pole. Two resident staff will provide daily weather observations and maintain the camp. Siple Dome will also house and feed KBA Twin Otter flight crews as needed. This season, two USAP science events are scheduled to use Siple Dome: C-533-M (Priscu), led by Matt Siegfried, will complete a retro of eight GPS stations in the Whillans Ice Plain. A three-person KBA Twin Otter flight crew will also work residentially from Siple Dome in support of C-533-M.

O-325-M (Lubin) will deploy multiple instrument assemblies at Siple Dome to conduct measurements of the surface energy balance in West Antarctica. Camp staff will also provide aviation support to Antarctic New Zealand's work at the Kamb Ice Stream (K-862 and K-863A), on an as-needed basis.

WAIS Divide Field Camp (WSD), 79° 29.000' S, 112° 5.000' W
891 nautical miles from McMurdo Station

The West Antarctic Ice Sheet (WAIS) Divide field camp, with 13 resident staff, will act as a regional aviation hub for West Antarctica. The camp will support the transit of five Thwaites Glacier science projects: C-443-M, (Goerhring-Johnson-GHC Hudson Mts.), C-444-M, (Holland-MELT), C-445-M (Pettit-TARSAN), C-446-M (Tulaczyk-TIME), C-448 (Goerhring-Johnson GHC Mt. Murphy) from McMurdo Station to forward field sites. In addition to Thwaites Glacier science, O-283-M (Lazzara-AWS) will be supported with aviation coordination for regional weather station maintenance. WAIS camp staff will also assist in the retrograde movement to McMurdo of field gear cached by T-150-M (IDPO).

Air Operations

McMurdo-based aircraft, including helicopters, fixed-wing aircraft, and unmanned aircraft systems (UAS) will continue to support USAP researchers and program logistical functions.

Helicopter Support

Air Center Helicopters, Inc. (ACHI) has been awarded the USAP helicopter contract and will provide helicopter support for the next five seasons, with four available aircraft (two AS350-B3e Astars and two Bell 412s) based out of McMurdo Station. The helicopters will support approved research in and around McMurdo Sound, the McMurdo Dry Valleys, the Royal Society Range, and Ross Island.

In addition, Antarctica New Zealand (ANZ) will continue to provide an AS350-B3 Astar (operated by **Southern Lakes Helicopters**) from mid-October through mid-February. ANZ and USAP may collaborate on helicopter tasking, if necessary and supportable.

~air.center

~www.southernlakeshelicopters.co.nz

Fixed Wing Aircraft

The New York Air National Guard (ANG) 109 AW LC-130 Hercules will provide research and operational support to South Pole Station and deep-field locations including West Antarctic Ice Sheet (WAIS) Divide, Byrd Camp, Siple Dome, and AGAP South.

~www.109aw.ang.af.mil

Kenn Borek Air will provide three DHC6 Twin Otter and one DC3 Basler aircraft to support a number of projects throughout the USAP area of operations. They will be based at South Pole and WAIS for much of the season, and there will be one Twin Otter based out of Union Glacier for a number of weeks.

In addition, ANZ will be operating a Twin Otter for a period of time during the 2019-20 season.

~www.borekair.com

Unmanned Aircraft Systems

A number of USAP and ANZ projects will operate fixed-wing and rotary-wing unmanned aircraft systems/unmanned aerial vehicles (UAS/UAV) in the Ross Island vicinity and deep-field locations.

Antarctic Astrophysics and Geospace Sciences

NSF/OPP Program Director: Dr. Vladimir Papitashvili

(Presented in order of science event number)

A-100-M/S	Chartier, Alex
A-106-M/S	Clauer, Robert
A-111-M/P/S	Gerrard, Andrew
A-112-M/S	Gerrard, Andrew
A-115-M	Krawczynski, Henric
A-118-S	Seunarine, Surujhdeo
A-119-M/P/S	Taylor, Michael
A-123-M	Chu, Xinzhao
A-127-M/S	Barwick, Steven
A-128-S	LaBelle, James
A-129-E	Hartinger, Michael
A-142-M	Rauch, Brian
A-145-M	Franco, Hugo
A-147-M	Devlin, Mark
A-149-S	Kovac, John
A-284-M	Palo, Scott
A-333-S	Halzen, Francis
A-334-M/S	Hanson, Kael
A-340-S	Vieregg, Abigail
A-343-M/S	Conde, Mark
A-368-S	Swindle, Thomas
A-369-M/S	Bristow, William
A-379-S	Carlstrom, John
A-382-E	Fritts, David
A-454-M	Smith, David

For more information, and for a complete list of deploying participants, go to www.usap.gov/sps

Oblique sounding of ionized patches in the Antarctic ionosphere - instrument development and testing

A-100-M/S

NSF/OPP Award 1643773
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Research Locations
Observation Hill, South Pole
Antenna Field

Supporting Station/Vessel
McMurdo Station, South Pole Station

Dates in Antarctica
Mid January to early February - No deployment

Project Description
Ionospheric regions/structures associated with ionized patches are known to disrupt radio signals at high latitudes, which can impact search-and-rescue operations and other radio communications. Recent statistical studies showed a strong annual trend for ionized patches at an altitude of ~300-kilometers, which appears to peak in the same months in the Arctic and Antarctic. This contrasts with established theories that predict seasonal trends, with patch occurrence peaks during each hemisphere's winter. Researchers on this project hope to confirm the Antarctic patch occurrence rates using independent sounding observations, as well as observations of ionospheric electric field behavior from existing ionospheric radars.

Field Overview
For the upcoming field season, the HF transmitter installed last year on Observation Hill and the receiver installed in Crary Lab at McMurdo Station will be retrograded. Similarly, the HF receiver in the V8 Vault at South Pole Station will be retrograded.

Program Director
Dr. Vladimir Papitashvili

ASC Points of Contact
John Rand / Elizabeth Kauffman / Paul Sullivan

Polar Experiment Network for Geospace Upper-atmosphere Investigation – PENGUIn: Interhemispheric investigations along the 40-degree magnetic meridian

A-106-M/S

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Research Locations
East Antarctic Plateau PG0 - PG5 Sites

Supporting Station/Vessel
McMurdo Station, South Pole Station

Dates in Antarctica
Instruments operate year around.

Project Description
The solar wind-magnetosphere-ionosphere coupling system is a complex and dynamic environment that affects critical infrastructure, such as satellite communications and power grids, thus driving so-called "space weather." To forecast, and thus adapt to, the effects of space weather events, researchers must develop accurate geomagnetic models of the Sun-Earth environment. The Northern Hemisphere is relatively well instrumented, but the Southern Hemisphere is not. This project established a chain of Autonomous Adaptive Low-Power Instrument Platforms (AAL-PIP) along the 40-degree magnetic meridian in Antarctica. This deployed chain of instruments will measure variations in the geomagnetic field that are conjugate to the West Coast of Greenland (which is also equipped with magnetometers) for investigating the interhemispheric electrodynamic coupling.

Field Overview
This project consists of Autonomous Adaptive Low-Power Instrument Platforms (AAL-PIPs) previously installed along the 40-degree magnetic meridian. This chain of instruments will continue to operate unattended. No science personnel are scheduled to deploy.

Program Director
Dr. Vladimir Papitashvili

ASC Points of Contact
John Rand / Jennifer Blum / Paul Sullivan

The next generation of Geospace research facilities at South Pole and McMurdo stations

A-111-M/P/S

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Research Locations
Arrival Heights, Terra Lab, South Pole Antenna Field

Supporting Station/Vessel
McMurdo Station, Palmer Station, South Pole Station

Dates in Antarctica
December to January

Project Description
The geomagnetic field protects life on Earth from geomagnetic storms and coronal mass ejections. These events could also affect satellites and disrupt communication with ground stations. The polar caps are specific areas around the geomagnetic poles where geomagnetic field lines are open and directly interact with the interplanetary magnetic field. There are many Geospace-monitoring stations over the northern polar cap but far fewer on the southern polar cap. This project integrates clustered instrumentation at all three USAP stations to examine solar-wind interactions within the entire Geospace system. Instruments include ground-based fluxgate and search-coil magnetometers, extremely low frequency (ELF) and very-low-frequency (VLF) receivers, imaging and broadband riometers, sky-looking optical systems, and GPS scintillation-rated receivers.

Field Overview
This year, there will be no additional activities at Palmer Station. The team will run the fluxgate magnetometer and VLF remotely, as they have in past years. At South Pole and McMurdo stations, field team members will check instruments, change the data acquisition from OS to Windows 10, and inspect the VLF system.

Program Director
Dr. Vladimir Papitashvili

ASC Points of Contact
John Rand / Elizabeth Kauffman / Jamee Johnson / Paul Sullivan

Scientific studies from a network of sustainable, robotic observatories across the Antarctic ice shelf: A new approach to polar research

A-112-M/S

Research Locations
AGO sites

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Supporting Station/Vessel
McMurdo Station, South Pole Station

Dates in Antarctica
November to early January; mid December through January; Instruments operate year around.

Project Description
The Automatic Geophysical Observatories (AGOs) are five unmanned stations deployed over the Antarctic Plateau that provide power and data transmission capabilities for various research instruments. Historically, the AGO program has collected magnetospheric data in the polar cap and auroral zone, with each AGO unit housing fluxgate and search-coil magnetometers, a riometer, a VHF antenna, and all-sky imagers. AGO platforms have attracted the attention of the broader scientific community, and now the AGO facilities also support seismometers, GPS receivers, and automatic weather stations.

Field Overview
One team of four, accompanied by an ASC mountaineer, will visit AGO3, AGO4, and AGO5 to upgrade and repair equipment. The first missions will be to AGO3 and AGO4 in mid to late December from South Pole. The second will be to AGO5 in mid January from McMurdo Station.

Program Director
Dr. Vladimir Papitashvili

ASC Points of Contact
Samina Ouda / Elizabeth Kauffman / Paul Sullivan

X-Calibur

A-115-M

NSF / NASA Agreement
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Research Locations
Long Duration Balloon Facility

Supporting Station/Vessel
McMurdo Station

Dates in Antarctica
No deploying team members; recovery by support contractor personnel in January

Project Description
X-Calibur is a balloon-borne X-ray polarimetry mission that will observe mass-accreting black holes and neutron stars in the 25-60 kiloelectronVolts (keV) energy range. X-Calibur measures the linear polarization degree and angle – two new observables relating to the uniformity and orientation of the electric field carried by X-rays. This new capability of polarimetry allows X-Calibur to obtain geometrical information about objects that are too far away and too small to be imaged. The 2018-19 balloon flight will be used to observe four to ten sources and to measure their energy-dependent, hard X-ray polarization properties. The sources will include the accreting neutron star and X-ray pulsar Vela-X1, and the results will constrain the location and physical mechanisms that accelerate particles in Vela-X1.

Field Overview
Activities this season will focus exclusively on recovering the balloon payload that was deployed last year and landed approximately 725 miles east-south-east of the South Pole. ASC personnel will lead the recovery efforts. No science personnel are scheduled to deploy.

Program Director
Dr. Vladimir Papitashvili

ASC Points of Contact
John Rand / Jennifer Blum / Paul Sullivan / Chad Naughton

Element composition of high-energy solar particles

A-118-S

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Research Locations
On station

Supporting Station/Vessel
South Pole Station

Dates in Antarctica
January

Project Description
This project operates a neutron-monitor suite, which serves as the linchpin of the worldwide neutron monitor network. Opening the IceCube Neutrino Observatory has added a new dimension to this capability: the IceTop array of ice Cherenkov detectors. Central to the research is understanding the response of these detectors to the radiation environment of the South Pole, particularly in determining the cause of the decline in cosmic ray intensity at South Pole over the last 50 years. Understanding this decline is important because cosmic rays produce radionuclides like Beryllium-10 that become trapped in the ice and are used to determine ice-core ages and precipitation levels over Earth's polar regions. An understanding of the production rate is vital to interpreting these data.

Field Overview
The main activities of the science team will be to update the data acquisition hardware and software to comply with the transition to Windows 10. They will also inspect the equipment and perform routine maintenance on heaters in the outdoor detectors. The goal is to ensure another year of continuous, high-quality data from the equipment. The research associate support will provide routine equipment monitoring and maintenance, if required, for up to two hours per week.

Program Director
Dr. Vladimir Papitashvili

ASC Points of Contact
John Rand / Paul Sullivan

Continental-scale studies of Mesospheric dynamics using the Antarctic Gravity Wave Instrument Network (ANGWIN)

A-119-M/P/S

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Research Locations
Arrival Heights, Terra Lab, B2 Science Building, Vernadsky Station

Supporting Station/Vessel
McMurdo Station, Palmer Station, South Pole Station

Dates in Antarctica
January

Project Description
The Antarctic Gravity Wave Imaging Network (ANGWIN) is a cooperative effort of six international Antarctic programs to collect continent-wide gravity-wave measurements. This network capitalizes on existing optical and radar measurement capabilities at McMurdo, Palmer, South Pole, and six other research stations: Halley (UK), Syowa (Japan), Davis (Australia), Rothera (UK), and Ferraz (Brazil). Infrared (IR) all-sky mesospheric OH (hydroxyl) imagers are installed at Davis, McMurdo, and Halley stations. The network quantifies the properties, variability, and momentum fluxes of short-period (less than one hour) mesospheric gravity waves and their dominant sources and effects over the Antarctic continent. An all-sky near-IR imager is also installed at Palmer Station to augment the existing instrumentation and create a capability for studying gravity wave properties at each site.

Field Overview
This is the last field season in the current project. Following recent discussions with NSF, the science team requested permission to defer retrograde pending consideration of a new proposal to continue operations as part of the ANGWIN network. During winter operations, approximately one hour per week of support by an ASC Research Associate for system maintenance, troubleshooting, and data download is required. The team will not visit Palmer station this season. Two team members will deploy to McMurdo to service the all-sky imager and the Advanced Mesospheric Temperature Mapper (AMTM) at Arrival Heights. They will then go to South Pole to work on the imaging instruments located there.

Program Director
Dr. Vladimir Papitashvili

ASC Points of Contact
John Rand / Paul Sullivan / Elizabeth Kauffman / Jamee Johnson

Simultaneous Na Doppler and Fe Boltzmann LiDAR observations and modeling of the middle and upper atmosphere at McMurdo, Antarctica

A-123-M

NSF/OPP Award 1443726
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Research Locations
Arrival Heights, ANZ Lab

Supporting Station/Vessel
McMurdo Station

Dates in Antarctica
Instruments operate year around.

Project Description
Researchers on this project operate two narrow-band, multi-frequency Doppler LiDARs at McMurdo Station. These LiDARs can make high-resolution observations of winds and temperatures in the middle and upper atmosphere. Simultaneous observations by the two instruments - a sodium (Na) LiDAR and an iron (Fe) Boltzmann LiDAR - provide unprecedented levels of detail to characterize atmospheric conditions. The instruments have been hosted by the Antarctica New Zealand (ANZ) program in their Arrival Heights laboratory since late 2010. The observations provide critical data to address key science challenges associated with the space-atmosphere interaction region, and in particular in the sparsely observed high-latitude southern hemisphere.

Field Overview
Six participants will deploy to conduct observations with the Na Doppler and Fe Boltzmann LiDARs. They will upgrade, refurbish, and perform routine maintenance on the instruments. They will also train students who will analyze data and progress toward completing their graduate degrees.

Program Director
Dr. Vladimir Papitashvili

ASC Points of Contact
John Rand / Richard Dean

Precision operation of Hexagonal Radio Array (HRA)

A-127-M/S

NSF/OPP Award 1607719
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Research Locations
ARIANNA site at Moore's Bay / South Pole Station

Supporting Station/Vessel
McMurdo Station, South Pole Station

Dates in Antarctica
Late October to early December

Project Description
This pilot project for the Antarctic Ross Ice-Shelf Antenna Neutrino Array (ARIANNA) consists of seven autonomous stations, called the Hexagonal Radio Array (HRA). Located on the surface of the Ross Ice Shelf in Antarctica, the HRA is designed to detect short-duration radio pulses generated by neutrino interactions in the ice, which reflect from the ice-water boundary at the bottom of the Ross Ice Shelf up to the stations on the surface. These measurements provide important insight regarding the locations of the most powerful particle accelerators in the universe, and they allow physicists to probe for novel physics beyond the standard model used in the field.

Field Overview
Four participants will deploy to McMurdo Station and travel by helicopter to the ARIANNA site at Moore's Bay, where they will remove all data-acquisition electronic boxes and antenna towers and return them to McMurdo for retrograde. Two participants will continue to South Pole for ten days to completely remove and retrograde the two stations installed there.

Program Director
Dr. Vladimir Papitashvili

ASC Points of Contact
Jenny Cunningham / Jennifer Blum / Paul Sullivan

Earth's electromagnetic environment: Advancing recent discoveries in auroral plasma radio emission research

A-128-S

Research Locations
On station

Supporting Station/Vessel
South Pole Station

Dates in Antarctica
Instruments operate year around.

NSF/OPP Award 1911335
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Project Description
This project uses existing instruments at South Pole Station to answer outstanding questions raised by the discovery of correlations between auroral kilometric radiation (AKR) observed 200,000 kilometers above Earth and AKR-like signals observed simultaneously at South Pole Station. The higher electron cyclotron harmonic radiation is polarized, which suggests a different and possibly nonlinear generation mechanism. These phenomena are best observed, and in most cases can only be observed, from Antarctica, making the South Pole a perfect location for the experiment.

Field Overview
This project runs continuously every day of the year, and the researchers access their previously installed equipment remotely via the Internet. No personnel will deploy. An on-station research assistant will spend approximately one day during the austral summer recording antenna orientations using GPS, according to the PI's instructions, to enable more accurate direction finding of radio signals. During winter months, on-station technicians will maintain computers in the science lab and in the V8 vault.

Program Director
Dr. Vladimir Papitashvili

ASC Points of Contact
John Rand / Paul Sullivan

High-Latitude Conjugate Area Array Experiment to Investigate Solar Wind - Magnetosphere - Ionosphere Coupling

A-129-E

NSF/OPP Award 1744828
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Research Locations
Taishan and Kunlun stations (China)

Supporting Station/Vessel
Special Project

Dates in Antarctica
Mid November to mid February

Project Description
Using several magnetometers deployed in the Antarctic, Greenland, and Svalbard, this project is directed toward investigating the coupling phenomena between the solar wind and the Earth's magnetosphere and ionosphere, particularly on the day side of the Earth and observed simultaneously at high latitudes in both the Northern and Southern hemispheres. In addition to the meridional array of already deployed autonomous, low-powered (AALPIP) magnetometers in the East Antarctic, two more stations will be deployed across Dome A and eastward toward the Chinese station Zhongshan. This deployment will establish two conjugate latitudinal chains of four stations in each polar cap that would be capable of addressing outstanding questions pertaining to the generation and propagation of natural, ultra-low frequency (ULF) waves.

Field Overview
One USAP team member will travel to Australia, where he will board the Chinese research vessel Snow Dragon for a cruise to Zhongshan station in Antarctica. Once there, he will join an inland traverse team and assist with deploying the project's instruments. The instruments will remain the property of the USAP, but the Polar Research Institute of China (PRIC) will accept custody and support responsibility for them, including their removal from the field at the end of the project. Once the equipment has been installed, the USAP participant will return to Zhongshan station and return to Australia via the Snow Dragon.

Program Director
Dr. Vladimir Papitashvili

ASC Points of Contact
John Rand / Curt Labombard

SuperTIGER-2

A-142-M

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Research Locations
McMurdo LDB Site

Supporting Station/Vessel
McMurdo Station

Dates in Antarctica
November to January

Project Description
SuperTIGER builds on the heritage of the smaller Trans-Iron Galactic Element Recorder (TIGER) flown from Williams Field in 2001 and 2003. This next-generation version is a large-area instrument that measures the elemental abundances of cosmic rays, from zinc to molybdenum. The instrument can detect an unprecedented combination of individual elements at an extraordinary resolution and statistical precision. The data collected will permit a sensitive test of the hypothesis that microquasars or other phenomena could superpose spectral features on the otherwise smooth energy spectra previously measured with less statistical accuracy.

Field Overview
Eight team members will be housed at McMurdo Station and will make day trips to the Long Duration Balloon (LDB) launch facility to prepare the SuperTIGER-2 balloon payload for a December launch. If the instrument launches and terminates this season, three team members will assist in recovery efforts.

Program Director
Dr. Vladimir Papitashvili

ASC Points of Contact
John Rand / Kaija Webster / Chad Naughton

NASA Long Duration Balloon (LDB) support program

A-145-M

NSF / NASA Agreement
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Research Locations
Long Duration Balloon Facility

Supporting Station/Vessel
McMurdo Station

Dates in Antarctica
Mid October to early February

Project Description
During the austral summer, the Columbia Scientific Balloon Facility (CSBF) launches balloons as part of NASA's Long-Duration Balloon (LDB) program. The balloons measure up to 400 feet in diameter, expand to a volume of 40 million cubic feet, and ascend at a rate of about 900 feet per minute to float altitudes of up to 125,000 feet. Because of the Antarctic wind pattern that typically starts in early December, the balloons circumnavigate Antarctica between 70° and 80° south latitude for durations of 30-60 days on average. Payload are composed of scientific instruments, command and control systems, and solar- and/or battery-powered units. The bulk of the data collected is stored using onboard hard drives, with a small amount sent by radio telemetry to the United States.

Field Overview
Thirty-five field team members will facilitate the preparation, launch, and recovery of NASA-sponsored high-altitude balloons and science payloads from the Long Duration Balloon (LDB) launch facility. They will be housed at McMurdo and will make day trips to and from the site. The balloons will ascend to an altitude between 115,000 feet to 130,000 feet and float around the Antarctic continent, returning to the McMurdo area in one-to-60 days. The balloons will then be terminated over a suitable location and recovered by helicopter if the instrument package lands within range of LDB, or by Twin Otter or Basler if it lands farther out.

Program Director
Dr. Vladimir Papitashvili

ASC Points of Contact
John Rand / Kaija Webster / Chad Naughton

Balloon-borne Large Aperture Submillimeter Telescope (BLAST-POL)

A-147-M

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Research Locations
Long Duration Balloon Facility

Supporting Station/Vessel
McMurdo Station

Dates in Antarctica
November to January

Project Description
The Balloon-born Large Aperture Submillimeter Telescope (BLAST) experiment measures polarized dust emissions in our galaxy. The asymmetric dust grains are spun up by interacting with ultra-violet photons in star-forming regions. The dust grains can then align with the galactic magnetic field. Since they preferentially emit along their long axis, the dust polarization can be used to map the magnetic fields. Researchers on this project hope to understand the role magnetic fields play in star formation. In addition, they will work to better understand the polarized dust emission as a foreground for current and future cosmic microwave background experiments.

Field Overview
Sixteen team members will reside at McMurdo Station and make day trips to the Long-Duration Balloon (LDB) launch facility to prepare the BLAST high-altitude balloon payload for launch. They will use liquid helium and liquid nitrogen to get their instrument flight-ready on schedule. After the launch, the team will monitor and control the balloon payload around the clock from office space at McMurdo Station. At flight termination, the team will use aircraft or traverse resources to retrieve the payload for additional data analysis.

Program Director
Dr. Vladimir Papitashvili

ASC Points of Contact
John Rand / Kaija Webster / Chad Naughton

Imaging the beginning of time from the South Pole: The next stage of the BICEP program

A-149-S

NSF/OPP Award 1638957
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Research Locations
South Pole

Supporting Station/Vessel
South Pole Station

Dates in Antarctica
Early November to late February

Project Description

This project continues the Background Imaging of Cosmic Extragalactic Polarization (BICEP)/Keck/BICEP3 program of observing cosmic microwave background (CMB) polarization while also initiating the phased upgrade to the new BICEP array. This upgrade follows the tradition of improving upon the previous generation's detectors housed in the mounts originally built for the Degree Angular Scale Interferometer (DASI), then subsequently used by the Small Polarimeter Upgrade for DASI (SPUD) and, most recently, the Keck Array.

Field Overview

This season the research team will focus on the large-scale upgrade planned in coordination with ASC to replace Keck Array with the first receiver of BICEP Array. The work will be directed toward three major goals: (1) replacing the DASI mount currently in use in the MAPO tower with a new mount; (2) deploying the first BICEP Array receiver (BA1) operating at 30-40 GHz and retrofitting the Keck receivers into the new mount; and (3) performing maintenance and minor upgrades to the ongoing BICEP3 experiment.

Program Director
Dr. Vladimir Papitashvili

ASC Points of Contact
Paul Sullivan / Leah Street

Lower thermospheric science using new meteor radar at McMurdo Station

A-284-M

NSF/OPP Award 1543446
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Research Locations
On station

Supporting Station/Vessel
McMurdo Station

Dates in Antarctica
Instruments operate year around. Deploying late January through mid February

Project Description
This project will observe the mesosphere and lower thermosphere (MLT) between 80 and 120 kilometers above the earth. This is a highly dynamic region that couples the lower terrestrial atmosphere with the upper atmosphere near-earth space environment. Of particular importance in this region are both the upward propagating thermally forced atmospheric tides, global-scale planetary waves, and small-scale gravity waves. All these phenomena transport heat and momentum from the lower atmosphere into the upper atmosphere. The primary goal of this research is to observe, quantify, model, and further understand the spatial-temporal structure and variability of the MLT circulation above Antarctica.

Field Overview
Two to three team members will arrive on station in late January and stay for approximately two weeks. They will travel to the radar site to upgrade system software, make a full inspection of the system and grounds, and collect and replace archival data disks. The experiment runs year around. An on-site research associate provides weekly support throughout the year.

Program Director
Dr. Vladimir Papitashvili

ASC Points of Contact
John Rand / Elizabeth Kauffman

Management and operations of the IceCube Neutrino Observatory 2016-2021

A-333-S

NSF/OPP Award 1600823
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Research Locations
South Pole

Supporting Station/Vessel
South Pole Station

Dates in Antarctica
Mid October to late September; instruments operate year around.

Project Description
The IceCube neutrino telescope transforms a cubic kilometer of ice into a Cherenkov detector. IceCube will open unexplored wavelength bands for astronomy using neutrinos as cosmic messengers. The project is an international collaboration, and the University of Wisconsin Madison serves as the host institution providing oversight and staffing.

Field Overview
On-Ice activities will include maintenance and operational improvements to existing IceCube infrastructure, primarily in the South Pole IceCube Counting Laboratory (ICL). The following is planned: (1) replacing half the dedicated IceCube servers in the ICL; (2) logging in the South Pole Ice Core (SPICECore) borehole; (3) training winter-over personnel; (4) conducting calibration runs; (5) fixing ICL air handlers; (6) retrograding and replacing JADE archival disks; (7) performing IceACT work: upgrading the field telescope electronics and FieldHub connections, upgrading the sky camera in the doghouse, and reworking IceACT ICL networking; (8) disposing of 2,000 lbs of UPS batteries; (9) providing on-Ice DAQ upgrades support, doing a master clock upgrade, and performing a DOM power supply swap; (10) surveying IceTop corners (a long-term monitoring project); and (11) performing a variety of ICL IT/DAQ-related tasks.

Program Director
Dr. Vladimir Papitashvili

ASC Points of Contact
Paul Sullivan / Leah Street

IceCube Gen2 Phase 1; an IceCube extension for precision neutrino physics and astrophysics

A-334-M/S

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Research Locations
B2 Science Building, Ice Cube Lab

Supporting Station/Vessel
McMurdo Station, South Pole Station

Dates in Antarctica
mid November to late January

Project Description

Leveraging the experience of the IceCube collaboration and the currently operating infrastructure of the IceCube Neutrino Observatory, a five-year project is proposed to advance the state of the art in multimessenger astronomy with neutrinos and improve on the ability of IceCube to make a unique measurement of the unitarity of the PMNS (Pontecorvo-Maki-Nakagawa-Sakata) matrix. This award, the IceCube Gen2 Phase 1 extension, will fund the deployment of seven additional strings of photon sensors at the bottom center of IceCube. The new strings will use multiple photomultiplier tube (PMT) Digital Optical Modules (mDOMs) that provide better directionality and more than double the photocathode area per module, at lower cost per unit area, than traditional IceCube DOMs.

Field Overview

The team's mission while in McMurdo is to gain access to the Enhanced Hot Water Drill (EHWD) generators and Power Distribution Module (PDM) to perform repairs, start-up, and testing. Their activities at Pole will focus on better defining the status of the Gen1 EHWD that will be refurbished for the upgrade project. Specific activities include: (1) flagging the perimeter of the construction zone for the proposed 2022-23 season upgrade; (2) performing a ground penetrating radar survey of the construction zone; (3) performing a detailed review of all dedicated EHWD mobile drill structures; (4) testing high pressure pumps using station power; and (5) preparing equipment for retrograde.

Program Director
Dr. Vladimir Papitashvili

ASC Points of Contact
Paul Sullivan / Matthew Kippenhan / Leah Street

Radio detection of the highest energy neutrinos with a ground-based interferometric phased array

A-340-S

NSF/PHY 1607555
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Research Locations
South Pole Station

Supporting Station/Vessel
South Pole Station

Dates in Antarctica
Mid December to late January

Project Description
This ground-based, interferometric, phased-array, high-energy neutrino detector is designed to discover the highest energy particles in our universe. Radio emission from particle cascades induced by neutrinos in glacial ice will be observed using an interferometric phased array that will be co-located with the Askaryan Radio Array (ARA) (A-107-S). These observations will be used to verify and extend IceCube astrophysical neutrino flux data to higher energies, inform design decisions for future detectors, and search for high-energy neutrinos. This project will be located at the South Pole to take advantage of the radio clarity and depth of the ice.

Field Overview
The previously retrofitted phased array trigger system is currently operational, as is the rest of ARA. This season, a team of three will travel by snowmobile and PistenBully from South Pole Station to the ARA 5 site, where they will perform calibration and change antenna orientations in an installed surface antenna array.

Program Director
Dr. Vladimir Papitashvili

ASC Points of Contact
Paul Sullivan / Leah Street

High-resolution mapping of thermospheric wind and temperature fields near the equatorward edge of the Antarctic polar cap

A-343-M/S

NSF/OPP Award 1341545
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Research Locations
Arrival Heights, ARO Building

Supporting Station/Vessel
McMurdo Station, South Pole Station

Dates in Antarctica
Instruments operate year around. Deploying late December to mid January

Project Description
This project operates and maintains all-sky imaging Fabry-Perot spectrometers at McMurdo Station and South Pole Station to map the wind and temperature fields that occur in the thermosphere above Antarctica. Data collected from these instruments will be used to test the hypothesis that the thermosphere's most dynamic weather occurs in latitudes just poleward of the boundary between the auroral oval and the polar cap.

Field Overview
The team's mission while in McMurdo is to gain access to the Enhanced Hot Water Drill (EHWD) generators and Power Distribution Module (PDM) to perform repairs, start-up, and testing. Their activities at Pole will focus on better defining the status of the Gen1 EHWD that will be refurbished for the upgrade project. Specific activities include: (1) flagging the perimeter of the construction zone for the proposed 2022-23 season upgrade; (2) performing a ground penetrating radar survey of the construction zone; (3) performing a detailed review of all dedicated EHWD mobile drill structures; (4) testing high pressure pumps using station power; and (5) preparing equipment for retrograde.

Program Director
Dr. Vladimir Papitashvili

ASC Points of Contact
John Rand / Elizabeth Kauffman / Paul Sullivan

Probing satellite interiors with long-duration photometric observations

A-368-S

NSF / AFOSR Interagency Agreement
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Research Locations
Near the SuperDARN Facility

Supporting Station/Vessel
South Pole Station

Dates in Antarctica
Mid November to early October

Project Description
This project will investigate the internal structure of the planets Jupiter and Saturn to discriminate between competing models for their formation, and subsequently advance understanding of solar-system evolution. The principal investigator will use the Lightweight Antarctic Day and Night Imaging Telescope (LANDIT) to provide the first unambiguous identification or normal modes of oscillation of Jupiter and Saturn, providing a probe into their deep internal structure and rotation profiles.

Field Overview
Team members will arrive at South Pole shortly after station opening and reside there for approximately 12 weeks. In the first two months, they will focus on assembling, aligning, and troubleshooting the LANDIT, its dual-instrumentation, and its thermal subsystem. During the third month, they will focus on calibrating and characterizing the instruments in preparation for uninterrupted observations of Jupiter during the austral winter. At the end of the season, they will pack and ship all equipment back to the PI's home institution.

Program Director
Dr. Vladimir Papitashvili

ASC Points of Contact
Paul Sullivan / Leah Street

Antarctic and conjugate research using SuperDARN

A-369-M/S

NSF/OPP Award 1443504
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Research Locations
Arrival Heights, Antenna Field

Supporting Station/Vessel
McMurdo Station, South Pole Station

Dates in Antarctica
Instruments operate year around; deploying January

Project Description
The Super Dual Auroral Radar Network (SuperDARN) is a global international radar network of 32 installations observing high-frequency (HF) bands between eight and 22 MHz. These systems help answer questions about the geomagnetic conjugacy of global magnetic storms and substorms and the differences in ionospheric plasma convection caused by the asymmetry of solar illumination in both hemispheres. The SuperDARN network can observe global-scale convection with excellent temporal and spatial resolution, which makes it a powerful tool for ground-based research, enabling scientists to address fundamental and important questions of space physics. The data it acquires are also relevant to space-weather studies and enhance the usefulness of data from other instruments.

Field Overview
Two team members will deploy to both McMurdo and South Pole to perform system maintenance, such as inspecting the equipment, tightening guy wires and antennae, replacing shackles, and re-leveling the radar poles. They will also check the transmitter's operational status and make any adjustments needed to bring the beam into optimal working condition.

Program Director
Dr. Vladimir Papitashvili

ASC Points of Contact
John Rand / Elizabeth Kauffman / Paul Sullivan

Cosmological research with the 10-meter South Pole Telescope

A-379-S

NSF/OPP Award 1852617
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Research Locations
South Pole

Supporting Station/Vessel
South Pole Station

Dates in Antarctica
Early November to late September

Project Description
The South Pole Telescope (SPT) aids cosmological research by measuring the intensity and polarization anisotropy of the cosmic microwave background (CMB) radiation. The project's goal is to detect all galaxy clusters in this region of the sky through the spectral distortion they impart on the CMB. Called the Sunyaev- Zel'dovich effect, it has the remarkable property of being independent of the distance to the cluster. The second key project started in 2012 with the installation of an ultra-sensitive polarization receiver. Through measurements of the polarization, researchers can determine the sum of the masses of the neutrinos and either detect or set stringent upper limits on the energy scale of inflation.

Field Overview
The plan for the upcoming season is to perform maintenance on the telescope drive electronics and the SPT-3G and Event Horizon Telescope (EHT) receivers. The work on the SPT telescope drive system is meant to fix major issues that have interrupted winter observations for the past two seasons. Other SPT tasking and maintenance projects this season include: (1) inspecting the telescope backing structure, cover-plates, and insulation; (2) servicing and maintaining the telescope components and computer systems; (3) upgrading and servicing the computer; (4) cryogenic maintenance of the SPT and optics cryostats; and (5) training winter-over personnel.

Program Director
Dr. Vladimir Papitashvili

ASC Points of Contact
Paul Sullivan / Leah Street

Multi-Scale Dynamics Studies Using the Drake Antarctic Agile Meteor Radar

A-382-E

NSF/OPP Award 1744801
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Research Locations
King George Island

Supporting Station/Vessel
Special Project

Dates in Antarctica
Early February to mid March

Project Description
This project will reinstate the Drake Antarctic Agile MEteor Radar (DrAAMER) that was deployed at the Brazilian Antarctic Station Comandante Ferraz in 2010. Upon reinstatement, the radar will be employed in diverse observations, along with the Southern Argentina Agile MEteor Radar (SAAMER) deployed in Southern Argentina. These observations will be used to study the coupling and dynamics of atmospheric waves generated at lower altitudes over the Drake Passage and then propagating into the mesosphere, lower thermosphere, and ionosphere. This research addresses topics that are of high interest and relevance to diverse scientific communities, especially for defining more accurate parameterizations of mesosphere, lower thermosphere, and ionosphere (MLTI) dynamics for weather prediction and climate modeling.

Field Overview
Team members will travel to Brazil to meet with international collaborators and from there will travel to King George Island to install and repair instrumentation on the Drake Passage Agile Meteor Radar (DrAAMER). The Brazilian Institute of Space Research (INPE) will provide all travel and cargo support between Brazil and Ferraz Base, King George Island.

Program Director
Dr. Vladimir Papitashvili

ASC Points of Contact
David Rivera / Cara Ferrier

E-MIST (Exposing Microorganisms In the STratosphere)

A-454-M

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Research Locations
Long Duration Balloon Facility

Supporting Station/Vessel
McMurdo Station

Dates in Antarctica
No deploying team members.

Project Description
The impact of the extreme cold and dry Martian environment on the survival and response of terrestrial microbes is unknown. Exposing Microorganisms In the STratosphere (E-MIST) is a NASA balloon payload built to enable studies of Earth's stratosphere, which closely resembles the Martian environment. Using this payload, the project will evaluate the survival and response of two bacterial species to Mars-like conditions in the stratosphere over Antarctica. It will fly as an additional study on the A-142-M (Binns / SuperTIGER 2) Long-Duration Balloon (LDB) mission.

Field Overview
E-MIST is an autonomous hardware system that will be mounted to the exterior of the SuperTIGER-2 payload. It is comprised of four independent sample holders for exposing pre-loaded microbiological samples to the stratosphere, which can then be returned to the ground for analysis. Five dormant microbial strains are inside the E-MIST payload in triple containment. Permits are in place to transport the samples through New Zealand, in accordance with the Antarctic Conservation Act.

Program Director
Dr. Vladimir Papitashvili

ASC Points of Contact
John Rand / Kaija Webster / Chad Naughton

Antarctic Organisms and Ecosystems

NSF/OPP Program Director: Dr. Jennifer Burns

(Presented in order of science event number)

B-005-N/P	Kohut, Josh
B-006-L	Watters, George
B-009-M	Rotella, Jay
B-027-P	McClintock, James
B-030-M	Liwanag, Heather
B-031-M	Ainley, David
B-040-M	Ballard, Grant
B-041-M	Schmidt, Britney
B-046-L	Teets, Nicholas
B-195-M	Cziko, Paul
B-197-M	Ponganis, Paul
B-198-L/P	Weissburg, Marc
B-207-M	Todgham, Anne
B-232-L	Costa, Daniel
B-234-N	Young, Jodi
B-303-N	Sanders, Robert
B-307-M	Moran, Amy

For more information, and for a complete list of deploying participants, go to www.usap.gov/sps

Physical mechanisms driving food web focusing in Antarctic biological hotspots

B-005-N/P

NSF/NOAA Interagency Agreement
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Research Locations
Joubin and Wauwermans Islands, Palmer Deep

Supporting Station/Vessel
RV/IB *Nathaniel B. Palmer*, Palmer Station

Dates in Antarctica
Early November and early January to mid March

Project Description
Undersea canyons are important oceanic biological hotspots and are critical for understanding coastal ecosystems. Observations of currents over Palmer Deep canyon indicate that surface phytoplankton blooms enter and exit the local hotspot on scales of about 1-2 days. This time of residence is in conflict with the prevailing idea that canyon-associated hotspots are primarily maintained by the upwelling of nutrient-rich deep water that fuels local phytoplankton growth. Instead, the implication is that horizontal ocean circulation is likely more important to maintaining these biological hotspots than local upwelling and its physical concentrating effects. Researchers on this project will integrate a modeling and field program that will target the processes responsible for transporting and concentrating phytoplankton and krill biomass to known penguin foraging locations.

Field Overview
Four team members will sail on the RV/IB *Nathaniel B. Palmer* (NBP) to deploy a high-frequency radar (HFR) network near Palmer Deep. HFR sites will be constructed on-site at the Joubin and Wauwermans Islands. After installing each HFR, the team will conduct a few conductivity-temperature-depth (CTD) casts and plankton net tows. They may also deploy three gliders from the NBP. Once this work is complete, the team will travel via small boat to Palmer Station, where they will install and calibrate a third HFR system at the Terra Lab. They will deploy three gliders for 60-day missions using small boats and marine technician support. Net tows, bioacoustics surveys, and CTD casts for chlorophyll filtering and extraction will be conducted to calibrate and ground-truth the glider data.

Program Director
Dr. Jennifer Burns / Dr. Karla Heidelberg

ASC Points of Contact
Rachel Shackelford / Cara Ferrier

NOAA / AMLR

B-006-L

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Research Locations
South Shetland Vicinity

Supporting Station/Vessel
ARSV *Laurence M. Gould*

Dates in Antarctica
Early August to early October

Project Description
National Oceanic and Atmospheric Administration (NOAA) Fisheries' Antarctic Marine Living Resources (AMLR) program supports the development of U.S. policy regarding the conservation and management of marine living resources in the Southern Ocean. For the past 25 austral summers, the AMLR field program has been conducted in the vicinity of Elephant Island, the South Shetland Islands, and the Antarctic Peninsula. This year, researchers will participate on two cruises aboard the ARSV *Laurence M. Gould* (LMG) to continue testing newly developed U.S. AMLR sampling techniques using autonomous underwater technology. This broad-scale survey will be augmented with additional sampling to better understand the small-scale patterns of krill distribution in relation to circulation and to understand habitat use in enclosed bays.

Field Overview
Two participants will sail on on two cruises, LMG19-10 and LMG20-02, to deploy and recover up to eight subsurface moorings and four gliders. Mooring deployment/recovery sites will be located north of Livingston Island. Prior to deployment, all moorings will be pre-assembled in the ship's laboratory and on deck. Gliders will undergo a pre-mission test before they are launched by a small boat frm the LMG.

Program Director
Mr. Tim McGovern

ASC Points of Contact
David Rivera / Cara Ferrier

The consequences of maternal effects and environmental conditions on offspring success in an Antarctic predator

B-009-M

NSF/OPP Award 1640481
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Research Locations
Erebus Bay

Supporting Station/Vessel
McMurdo Station

Dates in Antarctica
Early October to mid December

Project Description
The consequences of variation in maternal effects on the ability of offspring to survive, reproduce, and contribute to future generations has rarely been evaluated in polar marine mammals. This is because of inadequate data on the survival and reproductive outcomes of offspring born in diverse environmental conditions to mothers with known and diverse sets of traits. This project will evaluate the survival and reproductive consequences of early-life environmental conditions and offspring traits related to maternal attributes (e.g. birth date, birth mass, weaning mass, and swimming behavior) in a population of individually marked Weddell seals in the Ross Sea.

Field Overview
Researchers will work out of a camp at Big Razorback Island and will focus on all pupping colonies and haul-outs from Cape Evans to Pram Point, as well as at White Island, Marble Point, and Lewis Bay. They will visit each colony every other day to find, tag, and weigh newborn pups. Pups will be located two more times during maturation for reweighing. One hundred fifty pups will be sampled each year. The team will also conduct six to eight surveys per season throughout the study area to re-sight tagged individuals, tag unmarked animals, and replace broken or missing tags. The team will travel by snowmobile and helicopter between sites and to search for seals.

Program Director
Dr. Karla Heidelberg

ASC Points of Contact
Jenny Cunningham / Elizabeth Kauffman

Assemblage-wide effects of ocean acidification and ocean warming on ecologically important macroalgal-associated crustaceans in Antarctica

B-027-P

NSF/OPP Award 1848887
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Research Locations
On station

Supporting Station/Vessel
Palmer Station

Dates in Antarctica
Early December to mid May

Project Description
Forests of seaweed dominate the shallow coastal waters of the western Antarctic Peninsula and provide habitat and food for many marine organisms. Most of the seaweeds are chemically defended against herbivores yet support high densities of herbivorous amphipods, which consume algae that would otherwise overgrow the seaweeds. This project builds on recent research showing that several species of amphipods suffer significant mortality when chronically exposed to the increased acidity and elevated temperatures representative of near-future oceans. By simulating these conditions in the laboratory, researchers will test the hypothesis that ocean acidification and warming will play a significant role in re-structuring the crustacean assemblages associated with seaweeds. The research will also expand knowledge of climate change impacts by focusing on a geographic region uniquely susceptible to it.

Field Overview
Five participants will deploy to Palmer Station on the ARSV *Laurence M. Gould* (LMG). Divers working from small boats will acquire samples within the traditional small boat limits around the station for three to five hours per day. Team members will analyze samples and conduct experiments in indoor tanks with seawater flow-through in the station aquarium building. Most of the team will depart on or before the LMG20-03 cruise, but one member will remain through LMG20-04.

Program Director
Dr. Jennifer Burns / Dr. Karla Heidelberg

ASC Points of Contact
Rachel Shackelford / Jamee Johnson

Growing up on ice: Physiological adaptations and developmental plasticity in Weddell seal pups across two extreme physical environments

B-030-M

NSF/OPP Award 1543539
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Research Locations
Sea Ice in Erebus Bay, Hutton Cliffs

Supporting Station/Vessel
McMurdo Station

Dates in Antarctica
Mid September to late December

Project Description
A large body and thick blubber keep Weddell seals warm on and under the ice. Their streamlined shape, oxygen storage capacity, and collapsible lungs allow them to reach depths of 600 meters and remain under water for over an hour. At birth, however, they have small bodies and virtually no blubber. Their oxygen storage capacity is similar to other small terrestrial mammals and they must develop diving capabilities over time. There is likely a trade-off in terms of energy allocated to thermoregulation or to development. Researchers seek to answer the following questions: (1) How do these animals develop the capacity to transition, in a matter of weeks, above and then below the Antarctic sea ice? and (2) What are the energetic trade-offs associated with the developmental period during the transition?

Field Overview
The team will make day trips to the sea-ice field sites. Team members will access water through natural cracks or holes in the sea ice, or they will drill holes with a Jiffy drill. Their work will involve recording the mass and morphometrics of the seal pups. They will use a forward-looking infrared (FLIR) camera to quantify surface body temperature and an ultrasound machine to measure blubber thickness. They will place pups in a chamber outfitted with analytical equipment to measure metabolic rates. For some sampling, the group's veterinarian will anesthetize the pups to collect blood and muscle biopsies. Additionally, pups will be tagged with an accelerometer/transmitter/time-depth-recorder device.

Program Director
Dr. Karla Heidelberg

ASC Points of Contact
Jenny Cunningham / Elizabeth Kauffman

Adélie penguin response to climate change in the Ross Sea region – a full life-cycle approach

B-031-M

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Research Locations
Capes Crozier and Royds

Supporting Station/Vessel
McMurdo Station

Dates in Antarctica
Mid October to late January

Project Description
Sea-ice on the Ross Sea is expanding. How that affects Antarctic marine biota is unknown. This study aims to better understand the biotic effects of these changes by using a widely recognized indicator species, the Adélie penguin. Researchers will record the breeding activities of marked individuals and outfit penguins with time-depth recorders to monitor foraging efforts. These data will lead to a better understanding of how changing sea-ice conditions affect penguins through their annual cycles and through individuals' lifetimes, and they will enable an inference of how climate change may influence penguin populations.

Field Overview
Ten participants will deploy this season to continue their long-term study of Adélie Penguin demographics and response to environmental change in the Ross Sea. Deployments will be staggered throughout the field season. Team members will travel via helicopter and occupy camps at two field sites, Cape Royds and Cape Crozier, starting in late October. The team will also conduct surveys by helicopter along the fast-ice edge in McMurdo Sound. Team members will identify marked penguins at each location, collect breeding behavior data, deploy various instruments to obtain foraging and location data, and band new penguins near the end of the season. Should United States Coast Guard helicopter support become available, the team will request access to the Beauford Island Adélie penguin colony.

Program Director
Dr. Karla Heidelberg

ASC Points of Contact
Jenny Cunningham / Jennifer Blum

Does nest density matter? Using novel technology to collect whole-colony data on Adelie penguins

B-040-M

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Research Locations
Ross Island, Capes Crozier and Royds

Supporting Station/Vessel
McMurdo Station

Dates in Antarctica
Mid November to late January

Project Description
New methodologies for deploying coordinated unmanned aerial vehicles will be developed, with the aim of attaining whole-colony imagery that can be used to characterize the nesting habitats of Adélie penguins at Cape Crozier. This information will be used to test hypotheses regarding relationships between terrain characteristics, nesting density, and breeding success. This population, potentially the largest in the world and at the southern limit of the species' range, has doubled in size over the past 20 years while most other colonies in the region have remained stable or declined. Information gained from this project will be useful in understanding the potential for – and potential impact of – climate-driven changes in Adélie penguin nesting habitats.

Field Overview
The team will use several inter-communicating unmanned aerial vehicles (UAVs) to fly simultaneous surveys of the Adélie Penguin colonies at Cape Crozier and Cape Royds. Multiple surveys will be flown at each site and will be conducted from mid November to late January. There is only one deploying participant under B-040-M; this is a collaborative project with event B-031-M (Ainley). Two other participants, including the PI for B-040-M, will deploy under B-031-M (Ainley) and work on both projects.

Program Director
Dr. Karla Heidelberg

ASC Points of Contact
John Rand / Jennifer Blum

RISE-UP: Ross Ice Shelf and Europa Underwater Probe

B-041-M

NASA 15-PSTAR15_2-004
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Research Locations
McMurdo Sound, McMurdo Ice Shelf, ANZ Hot Water Drill Site 1

Supporting Station/Vessel
McMurdo Station

Dates in Antarctica
Mid October to mid January

Project Description
Researchers on the Ross Ice Shelf and Europa Underwater Probe (RISE-UP) project seek to improve understanding of the environments below ice shelves and sea ice. The science team will use the purpose-built, remotely operated vehicle-autonomous underwater vehicle (ROV-AUV) "Icefin" to search for biological communities, map the ice and seafloor, and increase understanding of ocean-water structure and currents. By enhancing our knowledge of the constraints on terrestrial ice/ocean cryosphere processes, this project will shed light on the evolution of other ocean-world environments in our solar system (e.g. Europa's ice shell), which are prime targets in NASA's search for life. This project aims to continue chasing the limits of life on Earth while developing techniques for future exploration of other planets or moons.

Field Overview
During the 2019-20 season, RISE UP team members will primarily conduct deep field deployments of Icefin along with their Antarctica New Zealand (ANZ) collaborators. A research team of six participants will reside at McMurdo Station and make day trips by PistenBully or snowmobile to dive sites in McMurdo Sound to ready the Icefin instrument for deep-field work. In early December, the team will go to the ANZ camp at Kamb Ice Stream to deploy Icefin, and they will remain there for approximately two weeks.

Program Director
Ms. Jessie Crain

ASC Points of Contact
Samina Ouda / Elizabeth Kauffman / Chad Naughton

Mechanisms of adaptation to terrestrial Antarctica through comparative physiology and genomics of Antarctic and sub-Antarctic insects

B-046-L

NSF/OPP Award 1850988
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Research Locations
Byers Peninsula on Livingston Island, Berthelot Island, Palmer Station

Supporting Station/Vessel
ARSV *Laurence M. Gould*

Dates in Antarctica
Mid February to mid March

Project Description
Antarctica is inhospitable for insects, and only three midge species live there. Of these, Belgica antarctica is the only species found exclusively in Antarctica. It has been difficult to pinpoint the evolutionary adaptations this insect needed to survive in Antarctica due to a lack of information about closely related species. This project will compare adaptations, genome sequences, and population characteristics of four midge species spanning an environmental gradient from sub-Antarctic to Antarctic habitats. Researchers from the U.S., U.K., Chile, and France, will sample insects from across their geographic range and measure their ability to tolerate environmental stressors, quantify molecular responses to stress, and compare their patterns of genetic diversity. This will contribute to a greater understanding of biodiversity and adaptation to extremes, and it will help in predicting the changes that accompany environmental change.

Field Overview
Four people will deploy on the ARSV *Laurence M. Gould* (LMG) in February 2020 to conduct field work via day trips to Byers Peninsula on Livingston Island, Berthelot Island, and other remote field sites, in coordination with another project on the same expedition. Team members will also collect insect samples from islands within the two-mile boating limit while the LMG is at Palmer Station. Approximately nine days will be used for remote island sampling expeditions and about five days will be based at Palmer Station for sampling in that region.

Program Director
Dr. Jennifer Burns / Dr. Karla Heidelberg

ASC Points of Contact
Rachel Shackelford / Cara Ferrier

Habitat severity and internal ice in Antarctic notothenioid fishes

B-195-M

NSF/OPP Award 1644196
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Research Locations
Sea Ice

Supporting Station/Vessel
McMurdo Station

Dates in Antarctica
No deploying team members; ASC divers will perform prescribed work.

Project Description
Notothenioid fishes live in the world's coldest marine waters surrounding Antarctica and have evolved strategies to avoid freezing. Past studies have shown that most Antarctic notothenioids produce special antifreeze proteins that prevent the growth of ice crystals that enter the body. While these proteins help prevent individuals from being killed by growing ice crystals, it is unclear how these fish avoid the accumulation of these small ice crystals inside their tissues over time. This project will observe how ice-crystal accumulation relates to the harshness of the fish's habitat and fish behavior within different habitats of McMurdo Sound, Antarctica.

Field Overview
No team members will deploy in this season. ASC Dive Services will retrieve dataloggers and remove/uninstall the McMurdo Oceanographic Observatory (MOO) for retrograde. All removal operations require diving and may require overnight trips at remote sites to monitor hole melters. The Auger drill will be required to create diving holes to retrieve dataloggers deployed at Cape Evans and near McMurdo Station and to retrieve the MOO at the end of the McMurdo Jetty. The MOO and data loggers will be shipped back to the home institution via the vessel.

Program Director
Dr. Jennifer Burns / Dr. Karla Heidelberg

ASC Points of Contact
Jenny Cunningham / Elizabeth Kauffman

From air sacs to tissues: Oxygen transfer and utilization in diving emperor penguins

B-197-M

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Research Locations
Sea Ice

Supporting Station/Vessel
McMurdo Station

Dates in Antarctica
Early October to mid December

Project Description
Birds have a unique respiratory system that has a one-way air flow pattern that includes both air sacs and lungs. This allows most of the oxygen inhaled to be transferred into the blood and circulated by the cardiovascular system, which allows the emperor penguin to dive deeper than 500 meters. However, the physiological mechanisms underlying the transfer of oxygen from air sacs to blood and the subsequent distribution of oxygen to tissues are poorly understood. Researchers hope to provide insight into (1) the mechanisms underlying the efficiency of the avian oxygen transport system; (2) the physiological basis of penguin dive behavior and the ability of penguins to adapt to environmental change; and, (3) the design of better therapeutic strategies and tools for treating respiratory disease.

Field Overview
Six participants will deploy to McMurdo Station from early October to mid December. They will set up a field camp on the sea ice within 12 miles of McMurdo Station, where they will work with temporarily captive emperor penguins. Isolated holes will be drilled in the ice at the camp and encircled by snow and corral fencing. Participants will capture emperor penguins and bring them to the camp, where they will outfit the birds with internal sensors. Birds will be allowed to dive and forage freely for three days at the hole before the instruments are recovered. The birds will be released from the camp (if the ice edge is near) or returned to their original capture site at the end of the season.

Program Director
Dr. Jennifer Burns / Dr. Karla Heidelberg

ASC Points of Contact
Jenny Cunningham / Elizabeth Kauffman

Individual based approaches to understanding krill distributions and aggregations

B-198-L/P

NSF/OPP Award 1840927
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Research Locations
Palmer Station

Supporting Station/Vessel
ARSV *Laurence M. Gould*, Palmer Station

Dates in Antarctica
Early November to mid December

Project Description
Antarctic krill are an important component of the Southern Ocean's food web, yet little is known about their behavior in response to relevant environmental conditions. This project will examine individual responses to light, flow, and attractive and repulsive chemical cues. Analysis of the data will be used to better understand krill swimming and schooling, predict preferred environments, define the capacity of krill to detect and move toward or away from chemical cues. These data will establish better parameters for models of krill energetics. Linking individual behavior to aggregations will also improve assessments of krill acoustic data. The project will increase our understanding of high latitude ecosystems and their capacity to respond to environmental perturbations, as well as provide information for krill fisheries management.

Field Overview
Four participants will deploy to Palmer Station via the ARSV *Laurence M Gould* (LMG) to conduct experiments on krill behavior. Flow, light, and chemical conditions will be controlled and altered in specialized tanks outfitted with high speed digital camera systems that will allow quantification of individual krill responses in relevant schooling settings. During the southbound transit, team members will conduct net tows in the Gerlache Strait to collect krill. Additional net tows for krill will be conducted from rigid-hulled inflatable boats (RHIBS) or by using ring nets from one of the smaller boats. Team members will also collect penguin guano from nearby colony sites and test elicited chemical cues it in flumes with krill.

Program Director
Dr. Jennifer Burns / Dr. Karla Heidelberg

ASC Points of Contact
David Rivera / Jamee Johnson

Interacting stressors: Metabolic capacity to acclimate under ocean warming and CO_2-acidification in early developmental stages of Antarctic fishes

B-207-M

NSF/OPP Award 1744999
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Research Locations
Sea Ice

Supporting Station/Vessel
McMurdo Station

Dates in Antarctica
Late August to mid December

Project Description
Many Antarctic marine organisms evolved in stable, cold-ocean conditions and possess a limited capacity to respond to environmental fluctuations. Research on the physiology of Antarctic fishes has focused largely on adult life stages, with much less research on early life stages, in which the fishes likely allocate energy for growth and development over other physiological processes. This project will examine the specific mechanisms that Antarctic fishes use to respond to changes in ocean conditions during early-life development and thus balance the organism's overall energetic needs for survival. The aim is to provide a unifying framework for linking environmental change, gene expression, metabolism, and organismal performance across a range of different fishes with different life-history strategies.

Field Overview
Four participants will deploy to McMurdo Station from WinFly to mid December. A fifth participant, a PolarTREC teacher, will deploy in mid October and redeploy at the end of November. The group will make day trips from the station to various sea-ice locations in McMurdo Sound, including the Intake Jetty, Arrival Heights, Little Razorback Island, Turtle Rock, Cape Evans, and the Cape Evans Wall. The team will collect eggs and capture early-life stages of fishes (primarily larvae and juveniles of dragonfish and rock cod) using traps suspended below the sea ice and traps placed on the ocean floor. The group will require dive support, auger drill support, a dedicated fish hut, snowmobiles, and a PistenBully to transport live fish back to the station. They will use Crary Laboratory aquarium space, a chemistry lab, and cold-room space.

Program Director
Dr. Jennifer Burns / Dr. Karla Heidelberg

ASC Points of Contact
Jenny Cunningham / Elizabeth Kauffman

Foraging ecology and physiology of the leopard seal

B-232-L

NSF/OPP Award 1644256
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Research Locations
Cape Shirreff

Supporting Station/Vessel
ARSV *Laurence M. Gould*

Dates in Antarctica
Mid April to mid May

Project Description
This project will examine the physiology and behavior of leopard seals in an effort to determine their ability to respond to potential changes in their habitat. Using satellite tracking devices, the research team will examine the movement and diving behavior of leopard seals and couple this information with measurements of their physiological capacity. The project will determine whether leopard seals—who feed on a diverse range of prey—are built differently than their deep-diving relatives, Weddell seals and elephant seals, which feed on fish and squid.

Field Overview
A team of six will travel on the ARSV *Laurence M. Gould* (LMG) to the Cape Shirreff field camp, where they will reside for about five weeks. There they will anesthetize up to 11 hauled-out leopard seals per season, using a Tele-inject air gun and darts containing an anesthetic. Once the anesthetic has taken effect and the seal is secured by a net, additional anesthesia (isoflurane gas) will be administered. This will allow team members to collect physiological and foraging samples and attach instruments using quick-setting marine epoxy. While sedated, animals will be flipper tagged, sexed, measured, and have their body condition estimated using morphometrics. Analysis of tissue and blood samples will be conducted later at the scientists' home institutions. Tag recovery will be attempted every season.

Program Director
Dr. Karla Heidelberg

ASC Points of Contact
Samina Ouda / Cara Ferrier

Spring blooms of sea-ice algae in the Western Antarctic Peninsula: Effects of warming and freshening on cell physiology and biogeochemical cycles

B-234-N

NSF/OPP Award 1744645
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Research Locations
Western Antarctic Peninsula

Supporting Station/Vessel
RV/IB *Nathaniel B. Palmer*

Dates in Antarctica
Late October to early December

Project Description
This project will identify the physiological responses of sea-ice microalgae to increasing temperatures and decreasing salinity during the spring melt of sea ice in the Western Antarctic Peninsula. In particular, the research will focus on the temperature sensitivity of photosynthesis and respiration and the cycling of nitrogen-rich compatible solutes and carbon-rich Extracellular Polymeric Substances (EPS). Ultimately, the team aims to understand how these adaptations enable high rates of primary production, alter cellular composition, and thus influence the biochemical cycling of carbon and nitrogen in coastal Antarctic waters during spring melt.

Field Overview
Five participants will sail on the RV/IB *Nathaniel B. Palmer* (NBP) to the sea-ice edge on the Western Antarctic Peninsula. They will sample the ice, primarily by coring, but also by sampling brash ice from small boats. The team will also collect sea-ice algae samples by stepping onto the ice from the NBP or from small boats. All samples will be processed or filtered on the ship, and filtered samples will be refrozen. In addition, the science team will conduct incubations, ideally in cold rooms or incubators set at -3°C, 0°C and +3°C. Processing and filtering will require use of the cold room, filtration rigs with vacuum, the main laboratory with sink access, and freezers.

Program Director
Dr. Jennifer Burns / Dr. Karla Heidelberg

ASC Points of Contact
David Rivera / Jamee Johnson

Diversity and ecological impacts of Antarctic mixotrophic phytoplankton

B-303-N

NSF/OPP Award 1744767
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Research Locations
West Antarctic Peninsula

Supporting Station/Vessel
RV/IB *Nathaniel B. Palmer*

Dates in Antarctica
Late October to early December

Project Description
Traditional models of oceanic food chains have consisted of algae (phytoplankton) being ingested by small animals (zooplankton), which are ingested by larger animals (fish). These traditional models changed as new methods allowed recognition of the importance of bacteria and non-photosynthetic "protozoa" in more complex food webs. More recently, the widespread existence of mixotrophy (the ability to both photosynthesize and ingest food particles) has been recognized in numerous species and many oceanographic areas. Mixotrophs are now known to have a large impact as predators of microbes in oceanic systems, yet little is known about mixotrophs in Antarctic regions. This project will advance understanding of mixotroph diversity and their ecological impact within the Southern Ocean microbial food web.

Field Overview
A team of six participants will deploy to the Western Antarctic Peninsula (WAP) on the RV/IB *Nathaniel B. Palmer* (NBP). Their aim is to determine the diversity and role of mixotrophs in the Southern Ocean. The team will conduct experiments to examine bacterial grazing, bacterial production, and primary production.

Program Director
Dr. Jennifer Burns / Dr. Karla Heidelberg

ASC Points of Contact
Rachel Shackelford / Jamee Johnson

Thermal sensitivity of Antarctic embryos and larvae: Effects of temperature on metabolism, developmental rate, and the metabolic cost of development

B-307-M

NSF/OPP Award 1745130
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Research Locations
Sea Ice

Supporting Station/Vessel
McMurdo Station

Dates in Antarctica
Mid September to mid February

Project Description
Cold-blooded animals (ectotherms) in the Antarctic ocean have survived in near-constant cold conditions for millions of years and are very sensitive to even small changes in water temperature. However, the consequences of this thermal sensitivity for the energetics, development, and survival of developing embryos is not well understood. Researchers will investigate the effect of temperature on the metabolism, growth rate, developmental rate, and developmental energetics of embryos and larvae of Antarctic marine ectotherms. The project will also measure annual variations in temperature and oxygen at different sites in McMurdo Sound and compare embryonic and larval metabolism in winter and summer to determine the extent to which these life stages can acclimate to seasonal shifts. This research will provide insight into the ability of polar marine animals and ecosystems to withstand warming conditions.

Field Overview
Three team members will deploy to McMurdo Station in mid September. A fourth participant, a PolarTREC teacher, will deploy in mid mid October. They will use PistenBullys to access sites around McMurdo Sound, and will travel via helicopter on day trips to Cape Bird, New Harbor, and Granite Harbor, where they will deploy and collect dataloggers and collect animals. They will house and analyze their samples in the Crary Lab. Three team members will redeploy in early December and one team member will remain to monitor long-term experiments. Two members will return to join the remaining member in mid January and all three will stay through mid February.

Program Director
Dr. Jennifer Burns / Dr. Karla Heidelberg

ASC Points of Contact
Jenny Cunningham / Elizabeth Kauffman

Antarctic Integrated System Science

NSF/OPP Program Director: Dr. Jennifer Burns

(Presented in order of science event number)

C-013-L/P	Fraser, William
C-019-L/P	Schofield, Oscar
C-020-L/P	Steinberg, Deborah
C-021-L	Martinson, Doug
C-024-L/P	Friedlaender, Ari
C-045-L/P	Ducklow, Hugh
C-443-M	Goehring, B.; Johnson, J.
C-444-M	Holland, D.; Nicholls, K.
C-445-M/N	Pettit, E.; Heywood, K.
C-446-M	Tulaczyk, S.; Christoffersen, P.
C-447-N	Wellner, J.; Larter, R.
C-448-M	Goehring, Brent
C-504-M	Gooseff, Michael
C-505-M	Priscu, John
C-506-M	Gooseff, Michael
C-507-M	Adams, Byron
C-508-M	Takacs-Vesbach, Cristina
C-509-M	Gooseff, Michael
C-511-M	Doran, Peter
C-533-M	Priscu, John

For more information, and for a complete list of deploying participants, go to www.usap.gov/sps

Palmer, Antarctica Long-Term Ecological Research (LTER): Land-shelf-ocean connectivity, ecosystem resilience and transformation in a sea-ice influenced pelagic ecosystem

C-013-L/P

NSF/OPP Award 1440435
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Research Locations
Palmer Station and Western Antarctic Peninsula

Supporting Station/Vessel
ARSV *Laurence M. Gould*, Palmer Station

Dates in Antarctica
Mid October to early April

Project Description
Palmer LTER (PAL-LTER) started in 1990 to address the hypothesis that the annual sea ice cycle may be the major determinant of spatial/temporal changes in the structure and function of Antarctic marine communities. Research now includes bacteria, viruses, phytoplankton, krill, macrozooplankton, penguins, seabirds, and marine mammals. The PAL-LTER model traces the effects of changing climate and the extent, duration, and seasonality of sea ice on ecosystem composition and dynamics in the Western Antarctic Peninsula, where satellite observations over the past 35 years indicate the average duration of sea ice cover is now about 90 days shorter. Six collaborative projects on the ARSV *Laurence M. Gould* (LMG) cruise and at Palmer Station will use airborne and underwater vehicles, moorings, numerical modeling, oceanographic cruises, and environmental sampling to address core hypotheses.

Field Overview
Penguins and Other Seabirds Component: One component of the C-013 project will sail on the LMG. The vessel will drop the team at Avian Island, where they will establish a field camp and conduct research for five days. The second component of the project will be based at Palmer Station from late October to early April. That team will use small boats to access local islands in the station vicinity and will make some day trips to bird colonies in the extended boating area, including Dream Island, Biscoe Point, the Joubin Islands, Cape Monaco, the Wauwermans Islands, and the Rosenthal Islands.

Program Director
Dr. Jennifer Burns

ASC Points of Contact
Samina Ouda / Bruce Felix / Jamee Johnson

Palmer, Antarctica Long-Term Ecological Research (LTER): Land-shelf-ocean connectivity, ecosystem resilience and transformation in a sea-ice influenced pelagic ecosystem

C-019-L/P

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Research Locations
Palmer Station and Western Antarctic Peninsula

Supporting Station/Vessel
ARSV *Laurence M. Gould*, Palmer Station

Dates in Antarctica
Early October to early April

Project Description
Palmer LTER (PAL-LTER) started in 1990 to address the hypothesis that the annual sea ice cycle may be the major determinant of spatial/temporal changes in the structure and function of Antarctic marine communities. Research now includes bacteria, viruses, phytoplankton, krill, macrozooplankton, penguins, seabirds, and marine mammals. The PAL-LTER model traces the effects of changing climate and the extent, duration, and seasonality of sea ice on ecosystem composition and dynamics in the Western Antarctic Peninsula, where satellite observations over the past 35 years indicate the average duration of sea ice cover is now about 90 days shorter. Six collaborative projects on the ARSV *Laurence M. Gould* (LMG) cruise and at Palmer Station will use airborne and underwater vehicles, moorings, numerical modeling, oceanographic cruises, and environmental sampling to address core hypotheses.

Field Overview
Phytoplankton and Optics Component: One component of the C-019 team will sail on the LMG to the LTER research grid. At sea, they will use net and acoustic tows, conductivity-temperature-depth (CTD) casts, Slocum gliders, and other profiling sensors to assess phytoplankton community structure and abundance. The other component of the team, based at Palmer Station, will: 1) maintain the Palmer phytoplankton time-series measurements at LTER stations B and E; 2) launch several gliders; 3) use the EK-80 sonar on the rigid-hull inflatable boats (RHIBs) to assess how plankton communities change spatially and temporally; 4) use an imaging flowcytobot to take pictures of individual phytoplankton cells; and 5) conduct video-conferences with K-12th-grade classrooms.

Program Director
Dr. Jennifer Burns

ASC Points of Contact
Samina Ouda / Bruce Felix / Jamee Johnson

Palmer, Antarctica Long-Term Ecological Research (LTER): Land-shelf-ocean connectivity, ecosystem resilience and transformation in a sea-ice influenced pelagic ecosystem

C-020-L/P

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Research Locations
Palmer Station and Western Antarctic Peninsula

Supporting Station/Vessel
ARSV *Laurence M. Gould*, Palmer Station

Dates in Antarctica
Late December to early February

Project Description
Palmer LTER (PAL-LTER) started in 1990 to address the hypothesis that the annual sea ice cycle may be the major determinant of spatial/temporal changes in the structure and function of Antarctic marine communities. Research now includes bacteria, viruses, phytoplankton, krill, macrozooplankton, penguins, seabirds, and marine mammals. The PAL-LTER model traces the effects of changing climate and the extent, duration, and seasonality of sea ice on ecosystem composition and dynamics in the Western Antarctic Peninsula, where satellite observations over the past 35 years indicate the average duration of sea ice cover is now about 90 days shorter. Six collaborative projects on the ARSV *Laurence M. Gould* (LMG) cruise and at Palmer Station will use airborne and underwater vehicles, moorings, numerical modeling, oceanographic cruises, and environmental sampling to address core hypotheses.

Field Overview
Zooplankton Component: A team of five researchers will sail on the ARSV LMG to the LTER research grid west of the Antarctic Peninsula. The team will collect samples with a conductivity-temperature-depth (CTD) rosette and a variety of nets. They will use an acoustic towfish at process study stations to detect krill aggregations. At Palmer Station, two team members will use net tows and acoustic surveys to sample zooplankton community structure and grazing. Each study station will consist of approximately five net tows. Team members will also collect live animals and water samples for zooplankton feeding experiments, and they will incorporate acoustic surveys and net tows with all LTER field teams, focusing on sampling krill swarms in predator foraging areas.

Program Director
Dr. Jennifer Burns

ASC Points of Contact
Samina Ouda / Bruce Felix / Jamee Johnson

Palmer, Antarctica Long-Term Ecological Research (LTER): Land-shelf-ocean connectivity, ecosystem resilience and transformation in a sea-ice influenced pelagic ecosystem

C-021-L

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Research Locations
Palmer Station and Western Antarctic Peninsula

Supporting Station/Vessel
ARSV *Laurence M. Gould*

Dates in Antarctica
Late December to early February

Project Description
Palmer LTER (PAL-LTER) started in 1990 to address the hypothesis that the annual sea ice cycle may be the major determinant of spatial/temporal changes in the structure and function of Antarctic marine communities. Research now includes bacteria, viruses, phytoplankton, krill, macrozooplankton, penguins, seabirds, and marine mammals. The PAL-LTER model traces the effects of changing climate and the extent, duration, and seasonality of sea ice on ecosystem composition and dynamics in the Western Antarctic Peninsula, where satellite observations over the past 35 years indicate the average duration of sea ice cover is now about 90 days shorter. Six collaborative projects on the ARSV *Laurence M. Gould* (LMG) cruise and at Palmer Station will use airborne and underwater vehicles, moorings, numerical modeling, oceanographic cruises, and environmental sampling to address core hypotheses.

Field Overview
Physical Oceanography Component: During the annual LTER cruise to the LTER research grid aboard the LMG, support contractor vessel marine technicians will deploy and recover up to four moorings for this project. They will also make about 50 conductivity-temperature- depth (CTD) casts to full depth, in collaboration with C-019-L (Schofield) and C-045-L (Ducklow).

Program Director
Dr. Jennifer Burns

ASC Points of Contact
Samina Ouda / Bruce Felix

Long Term Ecological Research (LTER) Whale Component

C-024-L/P

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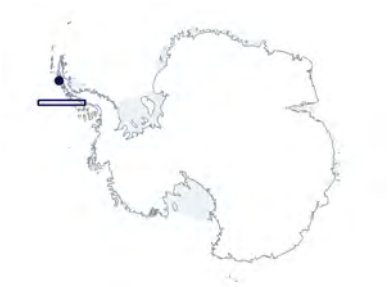

Research Locations
Palmer Station and Western Antarctic Peninsula

Supporting Station/Vessel
ARSV *Laurence M. Gould*, Palmer Station

Dates in Antarctica
Late December to early April

Project Description
Palmer LTER (PAL-LTER) started in 1990 to address the hypothesis that the annual sea ice cycle may be the major determinant of spatial/temporal changes in the structure and function of Antarctic marine communities. Research now includes bacteria, viruses, phytoplankton, krill, macrozooplankton, penguins, seabirds, and marine mammals. The PAL-LTER model traces the effects of changing climate and the extent, duration, and seasonality of sea ice on ecosystem composition and dynamics in the Western Antarctic Peninsula, where satellite observations over the past 35 years indicate the average duration of sea ice cover is now about 90 days shorter. Six collaborative projects on the ARSV *Laurence M. Gould* (LMG) cruise and at Palmer Station will use airborne and underwater vehicles, moorings, numerical modeling, oceanographic cruises, and environmental sampling to address core hypotheses.

Field Overview
Cetaceans Component: Team members will deploy on the annual LTER cruise aboard the LMG from early January to early February. During the cruise, they will use small boats to deploy suction cup tags on baleen whales, and they will deploy an unmanned aerial system (UAS) to collect whale measurements and assess condition. Two project participants will reside at Palmer Station from January through early April and will use a dedicated small boat for visual surveys of marine mammals, quantitative prey mapping, biopsy sampling, and suction cup tag deployment and recovery. When a second small boat is able to accompany the team, these studies will take place in the extended boating area around Palmer Station.

Program Director
Dr. Jennifer Burns

ASC Points of Contact
Samina Ouda / Bruce Felix / Jamee Johnson

Palmer, Antarctica Long-Term Ecological Research (LTER): Land-shelf-ocean connectivity, ecosystem resilience and transformation in a sea-ice influenced pelagic ecosystem

C-045-L/P

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Research Locations
Palmer Station and Western Antarctic Peninsula

Supporting Station/Vessel
ARSV *Laurence M. Gould*, Palmer Station

Dates in Antarctica
Late October to late March

Project Description
Palmer LTER (PAL-LTER) started in 1990 to address the hypothesis that the annual sea ice cycle may be the major determinant of spatial/temporal changes in the structure and function of Antarctic marine communities. Research now includes bacteria, viruses, phytoplankton, krill, macrozooplankton, penguins, seabirds, and marine mammals. The PAL-LTER model traces the effects of changing climate and the extent, duration, and seasonality of sea ice on ecosystem composition and dynamics in the Western Antarctic Peninsula, where satellite observations over the past 35 years indicate the average duration of sea ice cover is now about 90 days shorter. Six collaborative projects on the ARSV *Laurence M. Gould* (LMG) cruise and at Palmer Station will use airborne and underwater vehicles, moorings, numerical modeling, oceanographic cruises, and environmental sampling to address core hypotheses.

Field Overview
Microbial Biogeochemistry Component: The annual LTER cruise on the LMG will consist of eight days of transit time; three days of cargo/science operations; one day NSF/NOAA personnel transfer; a visit to Rothera Station (UK), and thirty days of LTER science operations. While at sea, the C-045-L team will conduct repeated sampling with the conductivity-temperature-depth (CTD) rosette and with nets at historical LTER grid stations. They will recover and redeploy moored sediment traps. At Palmer Station, researchers will deploy water-column profiling and sampling instruments, using both rigid-hull inflatable boats (RHIBs) and Zodiac boats. They will incubate their seawater samples in the environmental room and will also conduct work in the radioisotope laboratory.

Program Director
Dr. Jennifer Burns

ASC Points of Contact
Samina Ouda / Bruce Felix / Jamee Johnson

Geological history constraints on the magnitude of grounding line retreat in the Thwaites Glacier system

C-443-M

Research Locations
Hudson Mountains

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Supporting Station/Vessel
McMurdo Station

Dates in Antarctica
Mid November to early January

Project Description

Researchers on this project hope to obtain geological evidence from the Thwaites-Pine Island Glacier system that will show whether glaciers were less extensive than they are at present, and, if so, when. Their goals are: (1) to determine whether previous grounding-line retreat-advance cycles, as suggested by existing geological evidence, occurred in the late Holocene; (2) establish under what climate and sea-level boundary conditions they took place; and (3) investigate whether this sector of the ice sheet collapsed during previous warm Pleistocene interglacial periods. Determining the conditions under which the Thwaites and Pine Island Glacier grounding lines have retreated and advanced is critically relevant to determining whether or not present-day grounding-line retreat is irreversible.

Field Overview

Four team members will deploy from Rothera Station by BAS Twin Otter aircraft to the Hudson Mountains where they will establish a camp and reside for approximately five weeks. After that, two members will transfer to another BAS project and two individuals will redeploy through WAIS Divide and McMurdo Station. Science activities include: (1) radar surveys of potential drill sites via skidoos traveling between and around nunataks in the Hudson Mountains; (2) rock sample collection from several nunataks in the Hudson Mountains, in order to choose suitable rock types for the drilling; and (3) rock sample collection from the same nunataks for cosmogenic surface exposure dating.

Program Director
Dr. Paul Cutler

ASC Points of Contact
Samina Ouda / Sadie Rusby / Leslie Blank

Melting at Thwaites grounding zone and its control on sea level (THWAITES-MELT)

C-444-M

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Research Locations
Eastern Ice Shelf of Thwaites Glacier (Cavity Camp) / Grounding Line at Grounding Zone Upstream (GZUS) / Grounding Zone Downstream (GZDS) sites

Supporting Station/Vessel
McMurdo Station

Dates in Antarctica
Mid November to early February

Project Description

Thwaites Glacier is a primary contributor to sea-level rise, and its flow is accelerating in response to reduced buttressing from a floating ice shelf, which is thinning due to ocean-driven melting from below. Thus, the degree to which sea-level rise will occur depends largely on the ice-ocean interaction beneath Antarctic ice shelves. Researchers will use autonomous sensors to monitor the ice and the ocean beneath the ice shelf in the critical area of the grounding line. They will also use airborne radar flights to study ice flow, seismic surveys to study the ocean floor under the ice shelf, and the ICEFIN underwater autonomous vehicle to examine the water beneath the shelf. Ocean moorings will monitor ocean conditions for a year or more. Ground-based, phase-sensitive radar will monitor the basal melt rate.

Field Overview

The science team will fly in LC-130 aircraft from McMurdo to WAIS Divide and to remote study areas via Twin Otter. At the Cavity Camp and GZDS sites, the team will drill access holes through the ice, collect sediment cores, and deploy the ICEFIN underwater autonomous vehicle and other instrumentation beneath the ice. The TARSAN project will install additional instrumentation in the Cavity Camp main access hole following MELT investigations. The MELT team will drill two additional holes to collect sediment cores on the floating ice shelf and to collect sediment cores and install instrumentation at the GZUS site. Airborne and ground-based radar and active seismic investigations will also be used.

Program Director
Dr. Paul Cutler

ASC Points of Contact
Samina Ouda / Sadie Rusby / Leslie Blank

Thwaites-Amundsen Regional Survey and Network (TARSAN) integrating atmosphere-ice-ocean processes affecting the sub-ice-shelf environment

C-445-M/N

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Research Locations
Thwaites and Dotson ice shelves, Thwaites Glacier

Supporting Station/Vessel
McMurdo Station, RV/IB *Nathaniel B. Palmer*

Dates in Antarctica
Mid November to early February

Project Description

Thwaites and neighboring glaciers in the Amundsen Sea Embayment are rapidly losing mass in response to recent climate warming and related changes in ocean circulation. Better understanding of the dominant processes at and near grounding zones is needed, especially in regard to their spatial and temporal variability and their atmospheric and oceanic drivers. Using state-of-the-art technology, such as autonomous underwater vehicles (AUVs) and automated land-ice stations, the TARSAN project will measure ocean circulation and thinning beneath the floating part of the glacier to investigate how the ocean and atmosphere are affecting it.

Field Overview

A team of 11 will deploy to WAIS Divide via McMurdo for four to seven days. Six will continue on to Cavity Camp for 10 days. All will then travel to the Dotson Ice Shelf, and, if time allows, Crosson Ice Shelves, then back to McMurdo via WAIS Divide. Objectives include: 1) installing atmosphere-ice-ocean autonomous stations on the ice shelves; 2) measuring ice-shelf thickness and internal structure with multi-frequency radar; 3) collecting shallow ice cores to analyze for melt layers and firn properties; 4) using seismic and gravity surveys; and 5) sampling sediment for the THOR project. Another team of two sail on the RV/IB *Nathaniel B. Palmer* to tag seals and measure continental shelf ocean properties.

Program Director
Dr. Paul Cutler

ASC Points of Contact
Judy Shiple / Sadie Rusby / Leslie Blank

TIME - Thwaites Interdisciplinary Margin Evolution - The role of shear margin dynamics in the future evolution of Thwaites Drainage Basin

C-446-M

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Research Locations
Eastern Shear Margin

Supporting Station/Vessel
McMurdo Station

Dates in Antarctica
Early December to late January

Project Description

The Thwaites Interdisciplinary Margin Evolution (TIME) project will test the overarching hypothesis that shear-margin dynamics may exert powerful control over the evolution of ice flow in the Thwaites Drainage Basin. The work will combine geophysical data collection on the Eastern Shear Margin (ESM) of Thwaites Glacier with shear margin modeling and basin-scale numerical investigations of future sea-level contributions. Field work includes instrument installations, active seismic experiments, and radar surveys.

Field Overview

A team of four researchers and two field guides will operate from two remote sites in the Eastern Shear Margin of Thwaites Glacier for approximately six weeks. The team will deploy to WAIS Divide via LC-130 aircraft and onto their first site via Twin Otter aircraft. They will utilize snow machines to conduct ice penetrating radar surveys and to install GPS, phase-sensitive radar (ApRES), and broadband seismic instruments at their study sites and along transects that cross the margin at four locations in between the two study sites. Fuel and equipment will be cached at the T2 site at the end of the season in preparation for the start of the 2020-21 field season.

Program Director
Dr. Paul Cutler

ASC Points of Contact
Judy Shiple / Sadie Rusby / Leslie Blank

Stability and instability—records of external drivers and resulting behavior of Thwaites Glacier

C-447-N

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Research Locations
Amundsen Sea and close to Thwaites Glacier

Supporting Station/Vessel
RV/IB *Nathaniel B. Palmer*

Dates in Antarctica
January to late March

Project Description

This project will conduct marine and sub-ice shelf research to: (1) establish boundary conditions seaward of the Thwaites Glacier grounding line; (2) obtain records of past external drivers of glacier change; and (3) determine the history of past changes in grounding-line migration and conditions at the glacier base. These objectives will be achieved through high-resolution geophysical surveys of the seafloor and analysis of sediment cores from the inner shelf seaward of the Thwaites Glacier grounding line. The team will use ship-based equipment and a corer deployed through the ice shelf via hot water drill holes. The results will be incorporated into numerical ocean/ice-sheet models and will improve projections of ice loss and sea-level rise originating from the glacier.

Field Overview

The planned cruise will take place on the NBP in early 2020. Thirty-one science days are planned for THOR research in the Amundsen Sea and close to Thwaites Glacier. Work will include seismic data collection, multibeam swath bathymetry, 3.5 kHz profiles, and all types of sediment cores.

Program Director
Dr. Paul Cutler/Dr. Douglas Kowalewski

ASC Points of Contact
Samina Ouda/Jamee Johnson/Leslie Blank

Geological history constraints on the magnitude of grounding line retreat in the Thwaites Glacier system

C-448-M

Research Locations
Mount Murphy

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Supporting Station/Vessel
McMurdo Station

Dates in Antarctica
Late November to late January

Project Description

The Thwaites Glacier system dominates Antarctica's contribution to sea-level rise. Predicting how this system evolves in coming decades requires an understanding of how it has responded to past changes in climatic and oceanographic conditions. Using subglacial drilling to date bedrock samples, this project will 1) develop a regional sea-level change record by establishing chronologies for raised marine beaches, and 2) establish the timing and duration of periods of glacier retreat in the past 10,000 years. Together with climatic and oceanographic conditions from other records, these data will provide boundary conditions for past-to-present simulations and those used to predict future changes. Specifically, the project will test the hypothesis implied by existing geological evidence that the current Thwaites Glacier retreat is reversible.

Field Overview

A team of six, including one field guide, will be flown by Twin Otter aircraft from WAIS Divide camp to Mount Murphy where they will conduct subglacial bedrock recovery drilling. Once on the ground, they will travel by snowmobile several kilometers from the landing site to a drill site, where they will reside for about four weeks. Following completion of drilling, all camp and drilling equipment will be removed from the site.

Program Director
Dr. Douglas Kowalewski

ASC Points of Contact
Samina Ouda / Sadie Rusby / Leslie Blank

McMurdo LTER – Glaciers: Ecosystem response to amplified landscape connectivity in the McMurdo Dry Valleys, Antarctica

C-504-M

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Research Locations
Dry Valleys

Supporting Station/Vessel
McMurdo Station

Dates in Antarctica
Late October to late January

Project Description
Initially funded in 1980, the U.S. Long-Term Ecological Research (LTER) network is a collaborative effort of more than 1,800 scientists and students. The McMurdo LTER program is a multi-disciplinary aquatic and terrestrial ecosystems study in the McMurdo Dry Valleys. It is one of 26 LTER sites where researchers study ecological processes over long temporal and broad spatial scales. Glacier researchers will continue measuring the physical properties of Dry Valley glaciers and their response to meteorological conditions, with special emphasis on LTER core research areas. This six-year award cycle is comprised of seven collaborative projects: C-504-M (Gooseff), C-505-M (Priscu), C-506-M (Gooseff), C-507-M (Adams), C-508-M (Takacs-Vesbach), C-509-M (Gooseff), and C-511-M (Doran).

Field Overview
Glaciers: Researchers will divide time between Lake Hoare and F6 camps, with short returns to McMurdo Station to process samples. From camp, they will make day trips to glaciers in the Taylor and Miers valleys. Over the season, they will: 1) maintain established active-layer monitoring stations (ALMS); 2) perform mass-balance measurements; 3) collect shallow ice cores and meltwater from glaciers; 4) collect landscape albedo measurements from a helicopter-slinged albedo box over the Taylor Valley; 5) measure dissolved oxygen in supraglacial and valley streams, to include deploying temperature sensors and a data logger into borehole #11; 6) conduct nutrient uptake experiments in two streams on Canada Glacier; 7) maintain glacier ice temperature logging stations; 8) collect water samples from glacier cliff faces; and 9) collect stream water and sediment samples.

Program Director
Dr. Jennifer Burns

ASC Points of Contact
Jenny Cunningham / Elizabeth Kauffman / Jennifer Blum

McMurdo LTER – Limnology: Ecosystem response to amplified landscape connectivity in the McMurdo Dry Valleys, Antarctica

C-505-M

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Research Locations
Dry Valleys

Supporting Station/Vessel
McMurdo Station

Dates in Antarctica
Late October to late January

Project Description
Initially funded in 1980, the U.S. Long-Term Ecological Research (LTER) network is a collaborative effort of more than 1,800 scientists and students. The McMurdo LTER program is a multi-disciplinary aquatic and terrestrial ecosystems study in the McMurdo Dry Valleys. It is one of 26 LTER sites where researchers study ecological processes over long temporal and broad spatial scales. Researchers focusing on lakes will continue their long-term measurements of the biological, chemical, and physical properties of Dry Valley lakes and lake ice, with special emphasis on LTER core research areas. This six-year award cycle is comprised of seven collaborative projects: C-504-M (Gooseff), C-505-M (Priscu), C-506-M (Gooseff), C-507-M (Adams), C-508-M (Takacs-Vesbach), C-509-M (Gooseff), and C-511-M (Doran).

Field Overview
Limnology: A four-person research team will travel to and from the Dry Valleys via helicopter. The group will rotate through various field camps, with a final stay at Lake Hoare in January. They will work from Polarhaven tents erected on Lakes Fryxell, Bonney, and Hoare and will drill and melt holes in lake ice both under and near these structures to access the water. The researchers will also conduct similar work under a Scott tent at Lake Miers. They will use radioisotopes at field sites, at the fixed camps, and in Crary Laboratory. Field activities will include collecting lake water from various depths to create a profile of the lakes' basic chemical and physical parameters and managing sediment traps deployed in Lakes Bonney and Hoare.

Program Director
Dr. Jennifer Burns

ASC Points of Contact
Jenny Cunningham / Elizabeth Kauffman / Jennifer Blum

McMurdo LTER – Streams/ Geochemistry: Ecosystem response to amplified landscape connectivity in the McMurdo Dry Valleys, Antarctica

C-506-M

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Research Locations
Dry Valleys

Supporting Station/Vessel
McMurdo Station

Dates in Antarctica
Early November to mid February

Project Description
Initially funded in 1980, the U.S. LTER network is a collaborative effort of more than 1,800 scientists and students. The McMurdo LTER program is a multi-disciplinary aquatic and terrestrial ecosystems study in the McMurdo Dry Valleys. It is one of 26 LTER sites where researchers study ecological processes over long temporal and broad spatial scales. Streams component researchers will continue to operate a network of 16 stream-flow gauges, collect water quality samples from 30 streams, and make hydrologic measurements. This six-year award cycle is comprised of seven collaborative projects: C-504-M (Gooseff), C-505-M (Priscu), C-506-M (Gooseff), C-507-M (Adams), C-508-M (Takacs-Vesbach), C-509-M (Gooseff), and C-511-M (Doran).

Field Overview
Streams and Geochemistry: Participants will stay at the F6 camp and work out of Lake Hoare camp for a few days at a time. Field work will be conducted in Wright, Taylor, and Miers Valleys. The group will also conduct analyses in Crary Laboratory. Field sites will be accessed on foot and by helicopter day trips. Field activities may include: 1) maintaining a stream-gauge network; 2) collecting water-quality samples; 3) monitoring microbial mats in an abandoned channel in the Taylor Valley; 4) measuring dissolved oxygen in streams in the Lake Hoare and Lake Fryxell basins; 5) deploying and maintaining Aeolian sediment collectors across stream channels for over-winter collection of wind-blown material; 6) permafrost degradation experiments (PDE); and 7) glacier-stream-soil (GSS) studies.

Program Director
Dr. Jennifer Burns

ASC Points of Contact
Jenny Cunningham / Elizabeth Kauffman / Jennifer Blum

McMurdo LTER – Soils: Ecosystem response to amplified landscape connectivity in the McMurdo Dry Valleys, Antarctica

C-507-M

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Research Locations
Dry Valleys

Supporting Station/Vessel
McMurdo Station

Dates in Antarctica
Late December to mid February

Project Description
Initially funded in 1980, the U.S. LTER network is a collaborative effort of more than 1,800 scientists and students. The McMurdo LTER program is a multi-disciplinary aquatic and terrestrial ecosystems study in the McMurdo Dry Valleys. It is one of 26 LTER sites where researchers are studying ecological processes over long temporal and broad spatial scales. The soils team will maintain, monitor, and sample long-term plots near Lakes Bonney, Fryxell, and Hoare and aim to determine the impacts of natural factors and those associated with climate change on soil biota. This six-year award cycle is comprised of seven collaborative projects: C-504-M (Gooseff), C-505-M (Priscu), C-506-M (Gooseff), C-507-M (Adams), C-508-M (Takacs-Vesbach), C-509-M (Gooseff), and C-511-M (Doran).

Field Overview
Soils: Participants will make overnight trips to Dry Valleys camps and day trips on foot and via helicopter to sites in the Taylor, Miers, and Garwood Valleys. The group will store samples at camps but will do all sample processing at the Crary Lab. Field activities may include: 1) continuing long-term measurements of soil biodiversity and biogeochemical processes; 2) monitoring established soil meteorological stations; 3) sampling soils near fixed and historic camps; 4) continuing the long-term permafrost thaw experiment (P3); 5) continuing the long-term soil stoichiometry experiment (SSE); 6) establishing permanent sampling transects for the soil-lake inundation moat experiment (SLIME); 7) establishing a new study to monitor moss and algal ground cover and production in near-stream environments and dry soils; and 8) establishing soil sampling sites for the permafrost degradation experiment (PDE).

Program Director
Dr. Jennifer Burns

ASC Points of Contact
Jenny Cunningham / Elizabeth Kauffman / Jennifer Blum

McMurdo LTER – Integrative Science: Ecosystem response to amplified landscape connectivity in the McMurdo Dry Valleys, Antarctica

C-508-M

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Research Locations
Dry Valleys

Supporting Station/Vessel
McMurdo Station

Dates in Antarctica
Early November to mid February

Project Description
Initially funded in 1980, the U.S. Long-Term Ecological Research (LTER) network is a collaborative effort of more than 1,800 scientists and students. The McMurdo LTER program is a multi-disciplinary aquatic and terrestrial ecosystems study in the McMurdo Dry Valleys. It is one of 26 LTER sites where researchers are studying ecological processes over long temporal and broad spatial scales. This project will focus on microbial ecology, activity, and biodiversity across a variety of Dry Valleys habitats, including soils, streams, and lakes. This six-year award cycle is comprised of seven collaborative projects: C-504-M (Gooseff), C-505-M (Priscu), C-506-M (Gooseff), C-507-M (Adams), C-508-M (Takacs-Vesbach), C-509-M (Gooseff), and C-511-M (Doran).

Field Overview
Integrative Science: Team members will reside at fixed camps and access field sites via helicopter and on foot. They will process and analyze some samples in the field but will also perform work in Crary Laboratory, with radioisotopes used in some analyses. The team will also conduct diving operations in Lakes Bonney and Fryxell and sample the moats using the new "moat boats." Field activities may include: 1) collecting soil, lake water, and microbial mat samples; 2) diving and snorkeling in moats to deploy benthic chambers, collect benthic mat and sediment samples, and conduct surveys; 3) recording cyanobacterial mat locations in the moats of Lakes Bonney and Fryxell; and 4) conducting the Lake Integrated Connectivity Experiment (LICE) and the transplant Lake Integrated Connectivity Experiment (tLICE).

Program Director
Dr. Jennifer Burns

ASC Points of Contact
Jenny Cunningham / Elizabeth Kauffman / Jennifer Blum

McMurdo LTER – Algal Ops: Ecosystem response to amplified landscape connectivity in the McMurdo Dry Valleys, Antarctica

C-509-M

NSF/OPP Award 1637708

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Research Locations
Dry Valleys

Supporting Station/Vessel
McMurdo Station

Dates in Antarctica
Late December to early February

Project Description
Initially funded in 1980, the U.S. Long-Term Ecological Research (LTER) network is a collaborative effort of more than 1,800 scientists and students. The McMurdo LTER program is a multi-disciplinary aquatic and terrestrial ecosystems study in the McMurdo Dry Valleys. It is one of 26 LTER sites where researchers study ecological processes over long temporal and broad spatial scales. Geochemistry researchers monitor the inorganic geochemistry of both water and solid samples collected from Dry Valleys glaciers, streams, ponds, lakes, and land. They also study upland seeps and ponds to gain a better understanding of their hydrologic and geochemical controls. This six-year award cycle is comprised of seven collaborative projects: C-504-M (Gooseff), C-505-M (Priscu), C-506-M (Gooseff), C-507-M (Adams), C-508-M (Takacs-Vesbach), C-509-M (Gooseff), and C-511-M (Doran).

Field Overview
Algal Ops: Researchers will work out of the F6 and Lake Hoare camps in the Dry Valleys and will access sites via helicopter and on foot. They will survey and sample established algal transects in the Taylor, Wright, Garwood, and Miers Valleys and will use laboratory space at field camps to filter and process samples for transport to Crary Laboratory. Field activities may include: 1) surveying and sampling all 16 established algal transects; 2) continuing work on the Stream Mat Transplant Experiment (SMTE); 3) conducting terrestrial LiDAR surveys of the algal transects, with assistance from UNAVCO; and 4) deploying sediment traps on lake surfaces to capture Aeolian deposits with C-505-M (Priscu).

Program Director
Dr. Jennifer Burns

ASC Points of Contact
Jenny Cunningham / Elizabeth Kauffman / Jennifer Blum

McMurdo LTER – Meteorology/ Lakes: Ecosystem response to amplified landscape connectivity in the McMurdo Dry Valleys, Antarctica

C-511-M

NSF/OPP Award 1637708
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Research Locations
Dry Valleys

Supporting Station/Vessel
McMurdo Station

Dates in Antarctica
Mid October to early January

Project Description
Initially funded in 1980, the U.S. Long-Term Ecological Research (LTER) network is a collaborative effort of more than 1,800 scientists and students. The McMurdo LTER program is a multi-disciplinary aquatic and terrestrial ecosystems study in the McMurdo Dry Valleys. It is one of 26 LTER sites where researchers are studying ecological processes over long temporal and broad spatial scales. Researchers on this project will focus on the physical limnology of the McMurdo Dry Valleys lakes. They will maintain long-term, automated lake-monitoring equipment; monitor meteorological stations; and carry out manual measurements of lake properties. This six-year award cycle is comprised of seven collaborative projects: C-504-M (Gooseff), C-505-M (Priscu), C-506-M (Gooseff), C-507-M (Adams), C-508-M (Takacs-Vesbach), C-509-M (Gooseff), and C-511-M (Doran).

Field Overview
Meteorology: The research team will work out of Dry Valley camps at Lakes Fryxell, Bonney, and Hoare, with a stay at Lake Miers. They will also make day trips on foot and via helicopter to Wright and Victoria Valleys. Their field work will include maintaining long-term automated lake-monitoring equipment, monitoring meteorological stations, and conducting manual measurements of lake properties. They will also install cameras with wide-angle views of Taylor Valley for qualitative meteorological analysis and outreach and a GPS unit equipped with a time-lapse camera on the terminus of Taylor Glacier, with a view of Blood Falls to monitor active brine outflow.

Program Director
Dr. Jennifer Burns

ASC Points of Contact
Jenny Cunningham / Elizabeth Kauffman / Jennifer Blum

Subglacial Antarctic Lakes Scientific Access (SALSA): Integrated study of carbon cycling in hydrologically active subglacial environments

C-533-M

NSF/OPP Award 1543537
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Research Locations
Lake Mercer

Supporting Station/Vessel
McMurdo Station

Dates in Antarctica
Late October to early December

Project Description
This project is the surface geophysics component of the Subglacial Antarctic Lakes Scientific Access (SALSA) project and has been underway for three years. The project's GPS array on the Whillans Ice Plain is comprised of eight stations that capture subglacial lake activity and the resulting ice dynamics. The array will be retrograded this season.

Field Overview
The SALSA project has an array of eight continuous GPS stations installed on the Whillans Ice Plain, two phase-sensitive radars, and one fiber-optic temperature sensor. The GPS stations provide data on subglacial lake activity and coupled-ice-stream dynamics. This season, the team will download data from each station, demobilize it, and return it to McMurdo. Two participants and one field safety coordinator will deploy to the Siple Dome Camp for one to two weeks and visit each GPS station via Twin Otter. They will dig out each station and pack it for return. Low priority equipment (batteries, conduit, solar panels) will be shuttled to Camp 20 for return via the South Pole Traverse, while high priority equipment (GPS receivers, antennas) will travel back to McMurdo with the team.

Program Director
Dr. Jennifer Burns

ASC Points of Contact
Judy Shiple / Dean Einerson

Antarctic Instrumentation and Research Facilities

NSF/OPP Program Director: Dr. Michael Jackson

(Presented in order of science event number)

D-551-M	Goodge, John	D-553-S	de la Pena, Santiago
D-552-M	Goodge, John		

For more information, and for a complete list of deploying participants, go to www.usap.gov/sps

Phase 2 development of a Rapid Access Ice Drilling (RAID) platform for research in Antarctica

D-551-M

NSF/OPP Award 1419935
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Research Locations
Minna Bluff

Supporting Station/Vessel
McMurdo Station

Dates in Antarctica
Early December to early February

Project Description
The Rapid Access Ice Drill (RAID) aims to rapidly drill to deep ice (up to 3,300 meters deep), followed by the coring of ice, ice-sheet bed interface, and bedrock substrate below. The RAID drilling platform will give the scientific community access to a rich record of geologic and climatic change on a variety of timescales, from the billion-year rock record to thousand-year ice and climate histories. The main objective during the 2017-18 austral summer field season is to complete a trial of the drilling system begun last season to validate its operational readiness for science drilling.

Field Overview
The Rapid Access Ice Drill (RAID) project will continue its Antarctic Field Trial (AFT3) operations of a new drill system to collect ice and rock samples from a deep ice sheet near Minna Bluff. This season's goals will be to support the science team for approximately eight weeks during the drilling trials. The science team will oversee the drill trials and conduct local ice analysis and borehole logging activities. If the tests are successful, the camp and RAID system modules will be returned to McMurdo Station and winter-stored for future science events. If they are not successful the drill and supporting equipment will be removed from Antarctica.

Program Director
Dr. Michael Jackson

ASC Points of Contact
Judy Shiple / Matthew Kippenhan

Phase 2 development of a Rapid Access Ice Drilling (RAID) platform for research in Antarctica

D-552-M

NSF/OPP Award 1419935
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Research Locations
Minna Bluff

Supporting Station/Vessel
McMurdo Station

Dates in Antarctica
November to early February

Project Description
The Rapid Access Ice Drill (RAID) aims to rapidly drill to deep ice (up to 3,300-meter depth), followed by coring of ice, ice-sheet bed interface, and the bedrock substrate below. The RAID drilling platform will give the scientific community access to a rich record of geologic and climatic change on a variety of timescales, from the billion-year rock record to thousand-year ice and climate histories. The RAID drill was designed and commissioned for testing in 2015 and the drill has undergone two field tests near Minna Bluff.

Field Overview
The Rapid Access Ice Drill (RAID) project will continue its Antarctic Field Trial (AFT3) operations of a new drill system to collect ice and rock samples from a deep ice sheet near Minna Bluff. This season's goals will be to support an eight person drill team with several technicians arriving in early season to prepare and stage the drill system modules. Once completed, the heavy science traverse will deliver the RAID system, fuel, and camp cargo to Minna Bluff to establish a small, ASC-staffed field camp for approximately eight weeks in support of the drilling trials. Once drill operations are completed, the camp and RAID system modules will be returned to McMurdo Station and winter-stored for future science events.

Program Director
Dr. Michael Jackson

ASC Points of Contact
Judy Shiple / Matthew Kippenhan

EAGER: An operational system to measure surface mass balance deep in the interior of the Antarctic ice sheet

D-553-S

NSF/OPP Award 1654922
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Byrd Polar and Climate Research Center
Columbus, Ohio

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Research Locations
South Pole Station

Supporting Station/Vessel
South Pole Station

Dates in Antarctica
Late November to late January

Project Description
Snow accumulation and redistribution by wind are important components of the climate of Antarctica yet remain largely unknown. Direct observations of snowfall and related weather are few, leaving a gap in the regional climate records of the continent. Because of Antarctica's size, even small fluctuations in the total snow accumulation at the surface have a significant effect on the mass budget of the ice sheet, and thus on global sea level. This project will install sensors at South Pole to record weather, snow accumulation, and structural conditions within the layer of packed snow. The autonomous system will be tested in the austral winter and will provide the first continuous measurements of snow-accumulation processes in the interior of the ice sheet, which will be used to validate atmospheric and regional climate models.

Field Overview
The principal investigator and a graduate student will travel to the South Pole. They will make day trips to their project site by snowmobile, where they will completely dismantle their firn-monitoring station and return it by towed sled to station for retrograde. The station consists of many components, including buried sensors and structure. They expect to finish the tasks in three days.

Program Director
Dr. Michael Jackson

ASC Points of Contact
John Rand / Paul Sullivan

Antarctic Earth Sciences

NSF/OPP Program Director: Dr. Michael Jackson

(Presented in order of science event number)

G-055-M	Lamp, Jennifer	G-090-M/P/S	Anderson, Kent
G-058-M	Harvey, Ralph	G-094-L	Yu, Zicheng
G-078-M	Kemerait, Robert	G-183-M	Lyons, W. Berry
G-079-E	Wilson, Terry	G-437-E	Wilcock, William

For more information, and for a complete list of deploying participants, go to www.usap.gov/sps

Landscape evolution in the McMurdo Dry Valleys: Erosion rates and real-time monitoring of rock breakdown in a hyper-arid, sub-zero environment

G-055-M

NSF/OPP Award 1744895
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Research Locations
Dry Valleys

Supporting Station/Vessel
McMurdo Station

Dates in Antarctica
Late November to mid January

Project Description
Moisture plays a part in the erosion of rocks, but in the ice-free Dry Valleys region of Antarctica – one of the driest places on the planet – little is known about the rates and causes of rock erosion. To better understand them, researchers will instrument boulders with sensors that act as miniature seismographs, recording even the smallest microcracking on and within the rocks. They will also monitor the weather and environment around the rocks to record the conditions that trigger cracking events and will collect a variety of rock samples to study how quickly rocks break down and how their characteristics change over geologic time. The combined datasets will allow future scientists to more accurately understand the paleoclimates and landscapes of Antarctica, and possibly even Mars.

Field Overview
One team member will make three to four helicopter-supported day trips, each with six to eight hours of ground time, to perform maintenance on previously-installed equipment in Beacon Valley. The maintenance will be completed with the help of a research associate from McMurdo Station and will involve downloading data, replacing batteries, changing software settings, re-attaching or replacing sensors, replacing small electronic pieces of the solar power system, and general site maintenance. They will also install a time lapse camera at the site with support from UNAVCO.

Program Director
Dr. Michael Jackson

ASC Points of Contact
Jenny Cunningham / Bija Sass

Antarctic Search for Meteorites (ANSMET)

G-058-M

NSF/NASA Agreement
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Research Locations
Davis-Ward Icefields

Supporting Station/Vessel
McMurdo Station

Dates in Antarctica
Mid November to early February

Project Description
The Antarctic Search for Meteorites (ANSMET) program is a field-based science project that recovers meteorite specimens from Antarctica. Since 1976, teams have recovered more than 21,000 specimens from surfaces along the Transantarctic Mountains. These specimens are a reliable, continuous source of new, non-microscopic extraterrestrial material and support thousands of scientists from around the globe as they seek essential "ground-truth" concerning the materials that make up the asteroids, planets, and other bodies of our solar system. The study of ANSMET meteorites has extended knowledge of the materials and conditions from which our solar system was born and has revealed the geologic nature of asteroids.

Field Overview
A team of eight will search for and recover meteorites from blue ice areas near the Davis Nunataks and Mount Ward, at the top of the Beardmore Glacier. The team will spend approximately six weeks in the field starting around mid-December. There will be one resupply flight near the end of December that will also switch out one team member.

Program Director
Dr. Michael Jackson

ASC Points of Contact
Samina Ouda / Bija Sass

Dry Valley seismic project

G-078-M

NSF/PLR-DoD MOA
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AFTAC
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Research Locations
Dry Valleys

Supporting Station/Vessel
McMurdo Station

Dates in Antarctica
Instruments operate year around. Late October to late November.

Project Description
The Dry Valley seismic project monitors regional and global seismicity. The Dry Valleys' stations are part of the Air Force Technical Applications Center's (AFTAC) southern network, which accumulates near-real-time data from nine locations in the Southern Hemisphere. The data is transmitted to the National Data Center in Florida and made available to the international scientific community.

Field Overview
Six personnel will deploy from late October through late November to refuel diesel generators and perform annual equipment maintenance and inspections at the Bull Pass (Wright Valley) seismic and Mount Newall repeater sites. Other tasks will include installation of a seismometer at Bull Pass and wind turbine and battery replacement at Mount Newell. The team will camp at each site for seven to 10 days. Camp put-ins and pull-outs will be by helicopter. McMurdo research associate will monitor the data in McMurdo Station year round.

Program Director
Dr. Michael Jackson

ASC Points of Contact
Jenny Cunningham / Elizabeth Kauffman

Investigating ice sheet - solid Earth feedbacks in West Antarctica: Implications for ice sheet evolution and stability

G-079-E

NSF/OPP Award 1745074
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Research Locations
Union Glacier

Supporting Station/Vessel
Special Project

Dates in Antarctica
Early December to early January

Project Description
The POLENET-ANET autonomous GPS and seismic network will be reconfigured to acquire higher-resolution data across West Antarctica to capture spatially varying crustal motions and earth structure in a region where the ice sheet is rapidly changing and the solid earth is responding with some of the world's fastest glacial isostatic adjustment (GIA) rates. Observations will be integrated into three-dimensional modeling to investigate solid earth-cryosphere feedback processes that influence the past, present, and future behavior of the West Antarctic Ice Sheet (WAIS). These advanced models, constrained by the new observations, will improve estimates of West Antarctic ice-mass changes, establish where the WAIS may be stabilized by ongoing Earth deformation, and reduce uncertainties in future sea-level-change projections.

Field Overview
Six participants will deploy through Punta Arenas, Chile to Antarctic Logistics and Expedition's (ALE) Union Glacier field camp for approximately three weeks. ASC personnel will meet the field team in Punta Arenas to provide field gear and field safety training. The ANET team will download data and perform maintenance on 10 to 12 stations, upgrading the GPS to GNSS on eight to ten of these stations. The team also will decommission the GPS/seismic station at Whichaway Nunatak. Up to 17 stations will be serviced. Work planned for this season will be carried out using Twin Otter aircraft support Union Glacier.

Program Director
Dr. Michael Jackson

ASC Points of Contact
Judy Shiple / Meghan Walker

Global seismograph station at South Pole, Scott Base, and Palmer stations

G-090-M/P/S

NSF/EAR Award 1724509
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Research Locations
Scott Base (NZ), Spresso Vault, Seismic Station Site

Supporting Station/Vessel
McMurdo Station, Palmer Station, South Pole Station

Dates in Antarctica
Early January to mid May

Project Description
The Incorporated Research Institutions for Seismology (IRIS) is an NSF-sponsored university consortium dedicated to operating scientific facilities for the acquisition, management, and distribution of freely available seismic data. This project is a long-term seismicity study and is part of IRIS's 120-plus station Global Seismographic Network (GSN), a joint network operated by both IRIS and the United States Geological Survey, including installations at Palmer Station, Scott Base, and South Pole Station. Recently, the South Pole seismic station was moved from the V1 vault to the South Pole Remote Earth Science and Seismological Observatory (SPRESSO) to reduce station-related "cultural" noise. The move has made it the quietest seismic station in the entire GSN. Lower background noise levels will allow researchers to see smaller events from farther away and help identify and characterize Antarctic seismicity.

Field Overview
A support contractor research associate (RA) provides year-round, on-site support for this research project's instruments. In addition, every other season a two-person science field team deploys to the South Pole in mid December for routine maintenance on the installed instruments. Upgrades to the seismic system at Palmer Station will be conducted this season. Two field personnel will deploy to replace seismometers, which will require rock drilling on-site. If work is necessary at either station during the off season, NSF approval is required because of limited bed space. The science team conducts training for the RA, which includes a site visit to the principal investigator's home institution for two days prior to deployment. Maintenance of the station at Scott Base (NZ) is accomplished using IRIS personnel at McMurdo Station.

Program Director
Dr. Michael Jackson

ASC Points of Contact
John Rand/Elizabeth Kauffman/Paul Sullivan/Jamee Johnson

Reconstructing late Holocene ecosystem and climate shifts from peat records in the western Antarctic Peninsula

G-094-L

NSF/OPP Award 1745068
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Earth and Environmental Sciences
Bethlehem, Pennsylvania

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Research Locations
Western Antarctic Peninsula

Supporting Station/Vessel
ARSV *Laurence M. Gould*

Dates in Antarctica
Mid January to late February

Project Description
Peat-forming ecosystems archive their own long-term history of ecosystem and climate changes in the accumulated peat deposits. Using proxy records preserved in peat deposits, this group will undertake a systematic survey and study to reconstruct ecosystem and climate change for the coastal low-elevation areas on the Western Antarctic Peninsula (WAP). Preliminary data show a pronounced warming of up to 6° C about 2,300 to 1,200 calendar years before present, in the terrestrial ice-free area of the mainland peninsula. The researcher's goal is to document and understand the transformations of the cryosphere as well as terrestrial ecosystems on the WAP in response to large-magnitude temperature shifts during the Late Holocene.

Field Overview
A three-person science team will conduct field observations and survey various peat-forming ecosystems using small boats from Palmer Station and the ARSV *Laurence M. Gould* (LMG). The team will install two microclimate stations and data loggers at Norsel Point and at a site in the Joubin or Gossler Islands. They will make reconnaissance trips using the Palmer Station rigid-hull inflatable boats (RHIBs) to help determine exact site locations. At each sample site, peat cores, peat basal samples, plant samples, and "dead" mosses re-exposed from retreating ice will be collected. Peat cores will be taken with a custom coring device. Some data retrieval and maintenance may be required from support contractor marine technicians and research associates.

Program Director
Dr. Michael Jackson

ASC Points of Contact
David Rivera / Cara Ferrier

Fe behavior and bioavailability in sub-aerial runoff into the Ross Sea

G-183-M

NSF/OPP Award 1841228
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The School of Earth Sciences
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Research Locations
New Harbor, Miers Valley

Supporting Station/Vessel
McMurdo Station

Dates in Antarctica
Mid December to late January

Project Description
Phytoplankton are an important part of the carbon cycle and can lower the rates of atmospheric carbon dioxide by transferring atmospheric carbon into the oceans. The concentration of phytoplankton in the Southern Ocean is limited by the availability of marine iron. This influences the carbon transfer rate from atmosphere to ocean. The Southern Ocean's primary iron source is eroded continental rock. Understanding the current and future sources of iron to the Southern Ocean from increased melting of terrestrial glaciers is necessary for predicting concentrations of Southern Ocean phytoplankton and subsequent influence on the carbon cycle. A poorly understood Southern Ocean iron source is stream input from ice-free regions such as the McMurdo Dry Valleys. This iron source is likely to grow if glaciers retreat. This study investigates the iron sources and amount transported by Dry Valley streams directly to the Southern Ocean.

Field Overview
Three participants will deploy to McMurdo Station and then will travel by helicopter to New Harbor camp for approximately three weeks. From New Harbor, they will travel on foot to sampling sites along Commonwealth and Wales streams, where they will collect water and stream sediment samples. They will make measurements of stream water flow, and will conduct in-situ experiments. The team will also make day trips to Miers Stream via helicopter to perform sampling. The team will process and analyze samples at New Harbor. Upon return to McMurdo Station, they will continue processing samples in Crary Laboratory for one week before redeploying.

Program Director
Dr. Michael Jackson

ASC Points of Contact
Jenny Cunningham / Jennifer Blum

The tectonic and magmatic structure and dynamics of back-arc rifting in Bransfield Strait: An international seismic experiment

G-437-E

NSF/OPP Award 1744651
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Research Locations
Bransfield Strait

Supporting Station/Vessel
Special Project

Dates in Antarctica
Early January to early February

Project Description
This project is the United States component of an international experiment led by Spain to conduct a study of the seismicity and volcanic structure of the Central Bransfield Basin, with the objective of characterizing the distribution of active extension across the basin and determining whether the volcanic structure and deformation of the rift are consistent with a back-arc basin that is transitioning from continental rifting to seafloor spreading.

Field Overview
A research team of 15 US participants will participate on a cruise onboard the Spanish research vessel Sarmiento de Gamboa. The cruise will travel to the Bransfield Strait, where the team will deploy the US ocean-bottom seismograph instrument pool (OBSIP), ocean-bottom seismometers (OBSs), National Oceanographic and Atmospheric Administration (NOAA) and Oregon State University (OSU) hydrophone-moorings instruments, along with additional German OBSs and broadband land seismometers. Some US personnel will then disembark the vessel at King George Island and return by plane to South America. The remainder of the scientific party will sail to Ushuaia, Argentina.

Program Director
Dr. Michael Jackson

ASC Points of Contact
David Rivera / Cara Ferrier

Antarctic Glaciology

NSF/OPP Program Director: Dr. Paul Cutler

(Presented in order of science event number)

I-151-E	Banwell, Alison	I-175-M/S	Christianson, Knut
I-157-M	Tulaczyk, Slawek	I-344-E	Scambos, Theodore
I-165-M	Higgins, John	I-554-M	Yan, Stephen

For more information, and for a complete list of deploying participants, go to www.usap.gov/sps

Ice-shelf instability caused by active surface meltwater production, movement, ponding and hydrofracture

I-151-E

NSF/OPP Award 1841607
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Research Locations
George VI Ice Shelf

Supporting Station/Vessel
Special project

Dates in Antarctica
Early November to early December

Project Description
The evolution of surface and shallow subsurface meltwater across Antarctic ice shelves has important implications for their (in)stability, as demonstrated by the 2002 rapid collapse of the Larsen B Ice Shelf. It is vital to understand the causes of ice-shelf (in)stability because ice shelves buttress against the discharge of inland ice and therefore influence ice-sheet contributions to sea-level rise. Ice-shelf break-up may be triggered by stress variations associated with surface meltwater movement, ponding, and drainage. These variations may cause an ice shelf to flex and fracture. This four-year project will provide key geophysical observations to improve understanding of ice-shelf meltwater and its effects on (in)stability. Researchers will conduct work on the George VI ice shelf on the Antarctic Peninsula, where hundreds of surface lakes form each summer.

Field Overview
A team of three plus one British Antarctic Survey (BAS) field mountaineer will travel via Punta Arenas, Chile to Rothera (UK), by DASH 7 aircraft. From there, they will fly to Fossil Bluff Station in November for three to four weeks. The team will split in two and visit up to five sites near station. One team will drill holes to extract shallow firn/ice cores to measure seasonal variations in vertical density profiles. The cores will be studied on-site and not sent to the home institution. The other team will conduct GPS surveys. The team will deploy an autonomous instrument array, including two automatic weather stations, 20 water-pressure sensors, three shallow, sub-surface thermistor strings, 12 UNAVCO dGPS stations, and three PASSCAL short-period seismometers. The instruments will record surface ablation conditions; surface water depths; sub-surface melt; flexure kinematics; and ice-shelf fracture seismicity near observational targets.

Program Director
Dr. Paul Cutler

ASC Points of Contact
Samina Ouda / Curt Labombard

Ross Ice Shelf Geothermal Flux (RISGF) - direct borehole measurements as part of the New Zealand Ross Ice Shelf program

I-157-M

NSF/OPP Award 1744981
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Earth Sciences
Santa Cruz, California

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Research Locations
ANZ Hot Water Drill Site 1

Supporting Station/Vessel
McMurdo Station

Dates in Antarctica
Early December to early January

Project Description
The geothermal flux is a significant source of heat in polar sub-glacial environments. It affects the temperature at the base of ice sheets, influencing the distribution and rate of basal melting or freezing. These processes affect ice-sheet mass balance because basal melting facilitates fast sliding of ice. The geothermal flux is used in ice-sheet models that predict the contribution of the West Antarctic Ice Sheet to global sea-level rise. Yet, despite the importance of the geothermal flux, there are relatively few direct measurements, mainly because it is so difficult to access sub-ice environments. This project aims to obtain new constraints on the magnitude and spatial distribution of geothermal flux beneath the Ross Ice Shelf through collaboration with a New Zealand research project that is planning to drill through the ice shelf.

Field Overview
One participant will arrive at McMurdo Station for training and to collect gear from the USAP. Antarctica New Zealand will provide food and basic facilities. The participant will fly by Twin Otter aircraft to the New Zealand drill site, KIS1, in early December and then return to McMurdo Station in early January. Most of the geothermal probe hardware to be used is at Scott Base and will be traversed by Antarctica New Zealand to KIS1.

Program Director
Dr. Paul Cutler

ASC Points of Contact
Samina Ouda / Elizabeth Kauffman

Collaborative Research: Snapshots of early and mid-Pleistocene climate and atmospheric composition from the Allan Hills blue ice area

I-165-M

NSF/OPP Award 1744993
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Research Locations
Allan Hills

Supporting Station/Vessel
McMurdo Station

Dates in Antarctica
Early November to early January

Project Description
Bubbles of ancient air trapped in ice cores have been used to directly reconstruct atmospheric composition, and its links to Antarctic and global climate, over the last 800,000 years. Previous field expeditions to the Allan Hills Blue Ice Area have recovered ice cores that extend as far back as 2.7 million years. This project will return to the Allan Hills blue ice area to recover additional ice cores that date to 2 million years or older. The climate records developed from these ice cores will provide new insights into the chemical composition of the atmosphere and Antarctic climate during times of comparable or even greater warmth than the present day. Project results will help answer questions about issues associated with anthropogenic change including the relationship between temperature change and the mass balance of Antarctic ice and the relationship between atmospheric greenhouse gases and global climate change.

Field Overview
Nine participants, including two IDP drillers, will establish a camp at the Allan Hills Blue Ice Area. Over six to seven weeks, they will use two drill rigs, the large-bore Blue Ice Drill (BID), and a smaller (four-inch) drill, both provided by the US Ice Drilling Program (IDP). Two drill teams will work in different areas to drill several cores between 100 and 140 meters deep. They will also conduct GPR surveys to identify potential pockets of old ice, and will collect some surface samples near drill sites. Recovered ice cores will be packed in ice core boxes, then removed weekly by Twin Otter or other fixed wing aircraft. Retrograded ice cores will be placed in the Ice Core Transit Facility at McMurdo Station. The group will recover up to 32,000 pounds of ice, filling up to 160 ice core boxes.

Program Director
Dr. Paul Cutler

ASC Points of Contact
Jenny Cunningham / Meghan Walker

Ice dynamics at the intersection of the West and East Antarctic Ice Sheets

I-175-M/S

NSF/OPP Award 1744649
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Research Locations
Hercules Dome

Supporting Station/Vessel
McMurdo Station, South Pole Station

Dates in Antarctica
Late November to mid January

Project Description
Researchers will use ground-based ice-penetrating radar to survey the stratigraphy and bed topography at Hercules Dome and infer changes in ice dynamics and ice-sheet elevation. The work will help determine past ice-sheet changes that may relate to collapse of the West Antarctic Ice Sheet and may verify existence of a Raymond Bump and internal stratigraphy that could help determine whether this site is suitable for a deep ice-core drilling project.

Field Overview
Six participants will deploy to McMurdo Station for one week of training and equipment preparation before deploying to South Pole Station. They will continue trainings and equipment preparations at South Pole while acclimatizing for at least three days. The team will then deploy by LC-130 aircraft to their Hercules Dome field site where they will reside there for five to six weeks. Two teams will drive snowmobiles towing radar equipment along transects to perform radar and kinematic GPS surveys. They will use deep sounding radar, shallow sounding radar, and phase sensitive radar, and plan to drive 25 miles of transects per day, up to 500 miles over the season. All work will be done within 50 miles of the camp site. The group will also conduct GPS surveys and establish a grid of coordinates with physical markers. Camp pull-out will be by LC-130 aircraft between McMurdo Station and the field site in mid-to-late January.

Program Director
Dr. Paul Cutler

ASC Points of Contact
Jenny Cunningham / Bija Sass / Paul Sullivan

Antarctic firn aquifers: Extent, characteristics, and comparison with Greenland occurrences

I-344-E

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Research Locations
Wilkins Ice Shelf, George VI Ice Shelf

Supporting Station/Vessel
Special Project

Dates in Antarctica
January to February

Project Description
Researchers will investigate areas in the Antarctic Peninsula where water from summer melting of snow drains down into the deeper snow (firn) and remains as a water-flooded snow layer throughout the Antarctic winter. These zones are called firn aquifers. The project aims to confirm indications from satellite data that these areas exist on the Wilkins Ice Shelf and the George VI Ice Shelf coast. Persistent water in the upper layers of an ice shelf can destabilize the ice shelf and cause it to fracture and disintegrate or, on a non-floating ice sheet, can cause it to flow faster by draining to the bottom of the ice and reducing the friction between bedrock and glacier. Under warmer conditions in the future, the extent of these firn aquifer areas could spread to regions in front of major outlet glaciers.

Field Overview
One participant will deploy to Rothera Station by Dash-7 aircraft and will then fly by Twin Otter to the Wilkins and George VI Automated Meteorology Ice Geophysics Observation System (AMIGOS) Mk1 sites to download recorded data on the AMIGOS storage chips, conduct any needed minor repairs, and make a series of distributed temperature sensor (DTS) measurements. A British Antarctic Survey (BAS) field guide with climbing gear will ascend the AMIGOS towers to retrieve the storage chips.

Program Director
Dr. Paul Cutler

ASC Points of Contact
Samina Ouda / Cara Ferrier

EAGER: L-band radar ice sounder for measuring ice basal conditions and ice-shelf melt rate

I-554-M

NSF/OPP Award 1921418
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Research Locations
Concordia Station

Supporting Station/Vessel
McMurdo Station

Dates in Antarctica
Early November to mid December

Project Description
Predicting the response of ice sheets to changing climate and their contribution to sea level requires accurate representation in numerical models of basal conditions under the ice. There remain large data gaps for these basal boundary conditions under the East Antarctic Ice Sheet as well as in West Antarctica, including basal melt rates under ice shelves. This project will develop and test a prototype ground-based radar system to sound and image ice more than four kilometers thick, detect thin water films at the ice bed, and determine basal melt rates under ice shelves. The team will work with European partners (France, Italy, and Germany) at Dome C to conduct deep-field Antarctic testing of the new radar.

Field Overview
Three participants will deploy to McMurdo Station in early November. They will remain on-station to complete required core and field safety trainings, then will continue on to Concordia station by Basler aircraft. All field work conducted at Dome C and Little Dome C will be supported by the Italian (PNRA) and French (IPEV) Antarctic Programs. This project is associated with the BE-OI (Beyond EPICA – Oldest Ice) consortium of 10 European countries searching for the oldest ice core record on earth. Once their work is complete, the team will return to McMurdo Station with a portion of their cargo on a foreign program's airframe.

Program Director
Dr. Paul Cutler

ASC Points of Contact
Jenny Cunningham

Antarctic Ocean and Atmospheric Sciences

NSF/OPP Program Director: Dr. Peter Milne

(Presented in order of science event number)

O-124-N	Thompson, Andrew	O-264-P	Butler, James
O-202-L	Girton, James	O-271-N	Sarmiento, Jorge
O-214-L	Munro, David	O-283-M	Lazzara, Matthew
O-241-M	Deshler, Terry	O-317-L	Chereskin, Teresa
O-257-M	Butler, James	O-325-M	Lubin, Dan
O-257-S	Butler, James	O-400-M	Cassano, John
O-260-L	Sprintall, Janet	O-456-M	Seefeldt, Mark

For more information, and for a complete list of deploying participants, go to www.usap.gov/sps

Initiation of the Antarctic Slope Front in West Antarctica

O-124-N

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Research Locations
Bellingshausen and Amundsen seas

Supporting Station/Vessel
RV/IB *Nathaniel B. Palmer*

Dates in Antarctica
Early August to early October

Project Description
The Antarctic Slope Front (ASF) is a persistent, V-shaped feature of the continental shelf and slope around much of Antarctica. It is a notable, yet under-sampled component of Southern Ocean circulation. The ASF is a primary source region for the renewal of Antarctic surface water from below and also bottom water flow into the global deep ocean. There is considerable interest in understanding the exchanges and transformations of ASF ocean heat, gases, salt, nutrients, particulates, and carbon through exchanges with components of the high-latitude ocean, polar atmosphere, sea ice, and land ice. This project will conduct a survey of the frontal circulation along the continental shelf break and the major troughs of the Bellingshausen Sea using both ocean gliders and ship-based instruments.

Field Overview
Two team members will sail on the RV/IB *Nathaniel B. Palmer* (NBP) from Punta Arenas, Chile. The main focus of their work will be to deploy two gliders. Both gliders will sample the continental slope and the continental shelf in the western Bellingshausen Sea, and then from the western edge of the Belgica Trough before flying westward towards the eastern side of the Amundsen Sea. Each deployment will take approximately six hours. The gliders will sample for a period of roughly six weeks before being recovered by the NBP on its return route back to Punta Arenas. The team will also collect high-resolution Conductivity Temperature Depth (CTD) and Lowered Acoustic Doppler Current Profiler (LADCP) measurements to map the structure of the Antarctic Slope Front between the Bellingshausen and Amundsen seas. This project is a continuation of work that was begun on cruise NBP19-01.

Program Director
Dr. Peter Milne

ASC Points of Contact
David Rivera / Bruce Felix

Wave glider observations of surface fluxes and mixed-layer processes in the Southern Ocean

O-202-L

NSF/OPP Award 1853291
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Research Locations
near Palmer Station, near Livingston Island

Supporting Station/Vessel
ARSV *Laurence M. Gould*

Dates in Antarctica
Late October and mid February to mid March

Project Description
Surface and upper-ocean processes in the Antarctic Circumpolar Current (ACC) play an important role in ocean heat transport, air-sea gas fluxes, and in sea-ice formation. The net of these in turn modulate global climate, sea-level rise, and global circulation. This project continues the field development of the Wave Glider (an autonomous surface vehicle) to better study these processes in the Southern Ocean, where continuous time-series measurements are otherwise difficult to obtain because of sea state and other factors. The study includes the addition of new measurement capabilities, an (upper mixed) layer profiling CTD, a high frequency acoustic Doppler turbulence system, and a biogeochemical chlorophyll fluorescence sensor. This augmented instrumentation will be used for a set of Austral summer experiments observing ocean-shelf exchange, along with frontal air-sea interactions in the West Antarctic Peninsula vicinity.

Field Overview
The Wave Glider will be deployed offshore of the ice edge just prior to the ARSV *Laurence M. Gould* (LMG) arriving at Palmer Station on the LMG19-09 cruise. Deployment will take up to an hour of ship time. The science team will evaluate initial vehicle performance and data quality during the Palmer Station port call. If the data indicate that the glider is malfunctioning, then it will be recovered as soon as feasible, likely as the LMG leaves Palmer Station. The science team will remotely program and guide the Wave Glider to conduct surveys west of the Antarctic Peninsula. In January, the glider will head north to survey in the Drake Passage. The glider will be recovered during the last days of the LMG20-02 cruise, ideally north of Tierra del Fuego within the Argentina Exclusive Economic Zone (EEZ). As a contingency, if recovery of the Wave Glider is not possible on LMG20-02, it could be recovered during LMG20-04.

Program Director
Dr. Peter Milne

ASC Points of Contact
Rachel Shackelford / Bruce Felix

Investigating biogeochemical fluxes and linkages to climate change with multi-scale observations in the Drake Passage

O-214-L

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Research Locations
Drake Passage

Supporting Station/Vessel
ARSV *Laurence M. Gould*

Dates in Antarctica
Instruments operate year around.

Project Description
The Southern Ocean plays a key role in modulating the global carbon cycle, but the size and even the sign of the global ocean flux in terms of the atmospheric burden of man-made carbon dioxide is still uncertain. This is in part because of lack of measurements in this remote region of the world ocean. This project continues a multi-year time series of shipboard chemical measurements in the Drake Passage to detect changes in the ocean carbon cycle and to improve the understanding of mechanisms driving natural variability and long-term change in the Southern Ocean.

Field Overview
This project supports ongoing surface measurements of the partial pressure of CO_2 (pCO_2) from aboard the ARSV *Laurence M. Gould* (LMG). In addition, discrete measurements will be made from water samples collected underway.

Program Director
Dr. Peter Milne

ASC Points of Contact
Rachel Shackelford / Bruce Felix

Measurement of stratospheric aerosol to altitudes above 35 km in Austral autumn

O-241-M

NSF/OPP Award 1745008
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Research Locations
Ross Ice Shelf

Supporting Station/Vessel
McMurdo Station

Dates in Antarctica
Early November to early December; mid April to late June

Project Description
Particles in the atmosphere play key roles in controlling the earth's hydrologic, chemical, and radiation balances. In the troposphere, aerosols provide surfaces for cloud formation, for the absorption of trace gas pollutants, and they either warm or cool the earth depending on their optical properties. In the stratosphere, they provide surfaces for the conversion of chlorine from a passive to an active state, which will catalytically destroy ozone, crucial as a filter against damaging UV radiation. Stratospheric aerosols also contribute to increasing the solar albedo, and to the absorption of terrestrial infrared radiation. Particles are self-limiting through the formation of new particles, growth through diffusion, coagulation, condensation of trace gases, and ultimately sedimentation and deposition or capture by clouds.

Field Overview
Two team members will deploy in late October 2019 to recover payloads from balloons launched during winter 2019. Quick recovery of the instruments and return to the home institution is essential for refurbishment and return to McMurdo Station for the winter 2020 launches. A four person team will then deploy to McMurdo Station to launch up to nine balloons between April and June 2020.

Program Director
Dr. Peter Milne

ASC Points of Contact
John Rand / Elizabeth Kauffman

UV measurements at McMurdo Station for the NOAA/Global Monitoring Division (GMD) Antarctic UV network

O-257-M

NSF / NOAA agreement

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Research Locations
Arrival Heights

Supporting Station/Vessel
McMurdo Station, South Pole Station

Dates in Antarctica
Early January to early February

Project Description
The National Oceanic and Atmospheric Administration (NOAA) Earth System Research Laboratory (ESRL) GMD will continue long-term measurements of ultra-violet (UV) radiation that influences climate and the ozone layer. The McMurdo Station work is in conjunction with ongoing worldwide measurements of carbon dioxide, methane, carbon monoxide, aerosols, water vapor, surface and stratospheric ozone, chlorofluorocarbons, and the ozone layer. The measurements will be used for time-series analysis of multi-year data focusing on stratospheric ozone depletion; trans-Antarctic transport and deposition; interplay of the trace-gases aerosols with the solar and terrestrial radiation fluxes on the polar plateau; the magnitude of seasonal and temporal variations in greenhouse gases; and the development of polar stratospheric clouds over Antarctica.

Field Overview
One field team member will spend seven days at McMurdo Station servicing the UV instrument located at Arrival Heights. The McMurdo Station research associate (RA) will subsequently support the instrument with daily checks, routine calibrations, and troubleshooting (as needed). Training of the RA on the UV system is requested with five training days in Boulder, CO or at BSI in San Diego, CA prior to deployment. Cargo, mail, and communications support are required as described in the appropriate sections. One field team member may require five days (continuous and not inclusive of arrival and departure days) on station to accomplish objectives. During the site visit, the RA may be needed for no more than two hours/day to aid in performance of the visit activities including training updates. Other operational requirements may exist which will be described in the appropriate sections of this SIP.

Program Director
Dr. Peter Milne

ASC Points of Contact
John Rand / Elizabeth Kauffman

UV measurements at McMurdo Station for the NOAA/Global Monitoring Division (GMD) Antarctic UV network

O-257-S

NSF / NOAA agreement

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Research Locations
Atmospheric Research Observatory

Supporting Station/Vessel
McMurdo Station, South Pole Station

Dates in Antarctica
Late October to late September

Project Description
The National Oceanic and Atmospheric Administration (NOAA) Earth System Research Laboratory (ESRL) GMD will continue long-term measurements of ultra-violet (UV) radiation that influences climate and the ozone layer. The McMurdo Station work is in conjunction with ongoing worldwide measurements of carbon dioxide, methane, carbon monoxide, aerosols, water vapor, surface and stratospheric ozone, chlorofluorocarbons, and the ozone layer. The measurements will be used for time-series analysis of multi-year data focusing on stratospheric ozone depletion; trans-Antarctic transport and deposition; interplay of the trace-gases aerosols with the solar and terrestrial radiation fluxes on the polar plateau; the magnitude of seasonal and temporal variations in greenhouse gases; and the development of polar stratospheric clouds over Antarctica.

Field Overview
For South Pole, NOAA will maintain a year-round presence to assist in the sampling with air flasks, balloon launch of ozone-sondes, and maintenance of the other suite of instruments in and around the Atmospheric Research Observatory (ARO).

Program Director
Dr. Peter Milne

ASC Points of Contact
John Rand / Paul Sullivan

The Drake Passage high-density XBT program

O-260-L

NSF/OPP Award 1542902
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Research Locations
Drake Passage

Supporting Station/Vessel
ARSV *Laurence M. Gould*

Dates in Antarctica
Instruments operate year around.

Project Description
In collaboration with Chereskin (O-217-L), this project continues a long-term study of ocean properties and variability in the Antarctic Circumpolar Current (ACC) by repeat transects across the Drake Passage from Punta Arenas, Chile to Palmer Station. This aspect of the project measures the seasonal to interannual variability of upper-ocean temperature and geostrophic transport through the Drake Passage with closely spaced eXpendable BathyThermograph (XBT) deployments.

Field Overview
ARSV *Laurence M. Gould* (LMG) personnel and passenger volunteers will hand launch about 70 XBTs at predetermined locations on each of six Drake Passage crossings of the LMG. All data and log sheets are to be archived on CD along with thermosalinograph (TSG), meteorological, and navigation data from each cruise. The CD should be mailed to the principal investigator (PI) upon cruise completion.

Program Director
Dr. Peter Milne

ASC Points of Contact
Rachel Shackelford / Bruce Felix

Collection of atmospheric air for the NOAA/GMD worldwide flask-sampling network

O-264-P

NSF / NOAA Agreement
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Global Monitoring Division (GMD)
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Research Locations
Terra Lab

Supporting Station/Vessel
Palmer Station

Dates in Antarctica
No deploying team members

Project Description
NOAA's Global Monitoring Division (GMD) team will continue long-term measurements of trace constituents that influence climate and the ozone layer. The work done at Palmer Station is in conjunction with the ongoing worldwide measurements of carbon dioxide, methane, carbon monoxide, aerosols, water vapor, surface and stratospheric ozone, chlorofluorocarbons, and the ozone layer. This is part of NOAA's effort to determine and assess long-term buildup of global pollutants in the atmosphere. Measurements will be used for time-series analysis of multi-year data records that focus on the stratospheric ozone depletion; trans-Antarctic transport and deposition; interplay of trace-gas aerosols with polar plateau solar and terrestrial radiation fluxes; magnitude of seasonal and temporal variations in greenhouse gases; and polar stratospheric cloud development over Antarctica.

Field Overview
Air sampling will be conducted by the research associate at Palmer Station and sent as samples back to the NOAA/GMD network stateside for analysis. This project supports GMD and the Halocarbon and other Atmospheric Trace Gasses (HATS) air-sampling components.

Program Director
Dr. Peter Milne

ASC Points of Contact
John Rand / Jamee Johnson

Southern Ocean Carbon and climate Observations and Modeling (SOCCOM)

O-271-N

NSF/OPP Award 1936222
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Research Locations
Bellingshausen and Amundsen seas

Supporting Station/Vessel
RV/IB *Nathaniel B. Palmer*

Dates in Antarctica
Early August to early October

Project Description
The Southern Ocean is the primary window through which the intermediate, deep, and bottom waters of the ocean interact with the surface and thus the atmosphere. In the past 20 years, observational analyses and model simulations have transformed understanding of the Southern Ocean, suggesting that the ocean south of 30° S, occupying just 30% of the total surface ocean area, has a profound influence on the Earth's climate and ecosystems. The SOCCOM project is implementing sustained observations of the carbon cycle, together with mesoscale eddying models linked to the observations. The deployment of autonomous profiling floats with biogeochemical sensors and sea-ice avoidance software will extend current seasonally limited observations of biogeochemical properties into nearly continuous coverage in time, with horizontal spatial coverage over the entire Southern Ocean and vertical coverage to 2000 meters.

Field Overview
One participant will sail on the RV/IB *Nathaniel B. Palmer* (NBP) to deploy biogeochemical (BGC) Argo floats, collect water samples from the conductivity-temperature-depth (CTD) rosette for validation of the floats' BGC sensors, and collect underway surface measurements.

Program Director
Dr. Peter Milne

ASC Points of Contact
David Rivera / Bruce Felix

Antarctic automatic weather station program

O-283-M

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Research Locations
On Station / WAIS Divide

Supporting Station/Vessel
McMurdo Station

Dates in Antarctica
Late October to mid January

Project Description
The Antarctic Automatic Weather Station (AWS) network has been making meteorological observations since the early 1980s. This continent-wide network is positioned to observe significant meteorological events and increase understanding of the Antarctic surface climate, helping researchers observe and learn about the Antarctic in a warming world. Numerous studies of surface climatology in regions around the continent, like the Ross Ice Shelf, have been possible because of the long duration of the AWS project and regular AWS maintenance. This AWS-based climatology also aids in other studies such as winter warming events.

Field Overview
A science team of up to three participants will deploy from mid November to mid January. Team members will visit the AWS sites on Ross Island by helicopter, in West Antarctica and the Ross Ice Shelf by Twin Otter, and Williams Field, Phoenix airfield, and Windless Bight near McMurdo Station using ground transportation. Antenna rigger and vehicle support will be provided at Alexander Tall Tower AWS. The team will repair any AWS stations that develop problems during the austral winter and will make upgrades if time allows. One McMurdo Station research associate (RA) provides support year around. Some team members of O-283-M will also deploy under Cassano (O-400-M) to Byrd station. Ideally, a few AWS stations would be serviced from Byrd.

Program Director
Dr. Peter Milne

ASC Points of Contact
Samina Ouda / Elizabeth Kauffman

Southern Ocean current observations from the U.S. Antarctic research vessels

O-317-L

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Research Locations
Drake Passage

Supporting Station/Vessel
ARSV *Laurence M. Gould*

Dates in Antarctica
Instruments operate year around.

Project Description
The Antarctic Circumpolar Current (ACC) is the strongest ocean current in the world, with a flow rate more than 100 times greater than all the rivers on earth combined. This project continues a long-term study of ocean properties and variability in the ACC by repeat transects across the Drake Passage from Punta Arenas, Chile to Palmer Station. This project will provide information about long-term trends and variability in Southern Ocean fronts, surface water mass properties, heat, and salinity budgets. This study will contribute to understanding the ACC response to atmospheric forcing on climate-relevant time scales, and its role in driving the Southern Ocean's meridional overturning circulation. This aspect of the project focuses on collecting acoustic Doppler current profiler (ADCP), thermosalinograph (TSG), fluorometer, and meteorological data on all ARSV *Laurence M. Gould* (LMG) cruises.

Field Overview
This science event collects ocean current and acoustic backscatter measurements from hull-mounted acoustic Doppler current profilers (ADCPs) onboard the LMG. Data are collected on all cruises with support from the shipboard electronics technicians (ETs). The ETs will start and stop data acquisition and monitor and archive data while at sea. During cruises, contractor support may be required, as time allows, in the event that system maintenance or software changes need to be made while underway.

Program Director
Dr. Peter Milne

ASC Points of Contact
Rachel Shackelford / Bruce Felix

Surface Energy Balance on West Antarctica and the Ross Ice Shelf

O-325-M

NSF/OPP Award 1744954
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Research Locations
Siple Dome

Supporting Station/Vessel
McMurdo Station

Dates in Antarctica
Early December to late January

Project Description
Atmospheric warming has been a major factor in the loss of ice shelves on the Antarctic Peninsula. In West Antarctica, oceanic warming is presently regarded as the largest source of stress on both the ice-shelves and at the grounding lines of the ice sheets. The loss of ice shelf buttressing and grounding line retreat may have already induced irreversible loss of Thwaites Glacier. To advance predictive models more data is needed regarding both water-induced fracturing on an ice shelf and marine ice cliff instability near the grounding line. This project will help advance understanding of atmospheric circulation and solar radiation over West Antarctica and the Ross Ice Shelf that lead to surface melting.

Field Overview
Two researchers from SIO will deploy to Siple Dome, a location representative of the West Antarctic Ice Sheet (WAIS) surface environment for one month. The team will set up the surface energy balance measuring equipment by mounting temporary tower assemblies about two meters tall. One tower will hold a Campbell Scientific weather station. A second tower will hold a Campbell Scientific Eddy Correlation system. A third assembly, likely a pair of towers with a crossbeam, will hold a set of upward and downward facing pyranometers and pyrgeometers. A fourth assembly will hold a StellarNet shortwave spectroradiometer, all-sky camera, and a datalogger for snow-temperature sensors. The team will remain on site to maintain continuous operation of all equipment, including optical cleanliness and level, and possible repairs after bad weather. Equipment will be recovered from the field by late January.

Program Director
Dr. Peter Milne

ASC Points of Contact
John Rand / Dean Einerson

Observing the atmospheric boundary over the West Antarctic ice sheet

O-400-M

NSF/OPP Award 1745097
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CIRES
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Research Locations
Byrd Camp

Supporting Station/Vessel
McMurdo Station

Dates in Antarctica
Mid November to late December

Project Description
The near surface atmosphere over West Antarctica is one of the fastest warming locations on the planet. This atmospheric warming, along with oceanic forcing, is contributing to ice sheet melt and hence rising global sea levels. An observational campaign, focused on the atmospheric boundary layer over the West Antarctic ice sheet, is envisioned. A robust set of year-round, autonomous, atmospheric and surface measurements, will be made using an instrumented 30-meter tall tower at the West Antarctic ice sheet divide field camp. An additional unmanned aerial system field campaign will be conducted during the second year of this project and will supplement the West Antarctic ice sheet tall tower observations by sampling the depths of the boundary layer.

Field Overview
This project will conduct an observational campaign focused on the atmospheric boundary layer over the West Antarctic Ice Sheet (WAIS). The measurements will be made using an instrumented 30-meter tall tower (TT) at Byrd field camp (Byrd TT). The dataset will be used to elucidate the processes that modulate the energy exchange between the ice sheet surface and the overlying atmosphere, to assess the relationships between near-surface stability, winds, and radiative forcing, and to compare these relationships observed at the Byrd TT to those in other areas of Antarctica. Two team members will deploy to Byrd Camp for two weeks, ideally alongside the riggers who will install the tower. The timing of their trip will be dependent on the Byrd Camp opening and rigger availability. A camp staff member will be trained in the process of cleaning and maintaining the net radiometer, which will be located in close proximity to the ground.

Program Director
Dr. Peter Milne

ASC Points of Contact
John Rand / Dean Einerson / Chad Naughton

Implementing low-power, autonomous observing systems to improve the measurement and understanding of Antarctic precipitation

O-456-M

NSF/OPP Award 1543377
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Research Locations
Williams Field / Phoenix Airfield / Alexander Tall Tower! / Lorne AWS

Supporting Station/Vessel
McMurdo Station

Dates in Antarctica
Early November to early December

Project Description
This project's objectives focus on improving measurement of precipitation in Antarctica, advancing understanding of precipitation processes, and using this knowledge to evaluate weather and climate models. Precipitation measurement in Antarctica is inherently difficult because of the small amount of annual precipitation and the challenge of distinguishing falling snow from blowing snow. However, accurate measurement is critical for calculating Antarctica's mass balance and contribution to global sea-level rise, interpreting ice-core records, and providing benchmarks for promising model- and satellite-based precipitation estimates.

Field Overview
The plan for the 2019-20 field season is to remove the four Antarctic precipitation system (APS) sites in the northwest corner of the Ross Ice Shelf. The Williams Field and Phoenix Field locations will be accessed via truck. The Tall Tower! site will be accessed via Twin Otter and the Lorne site will be accessed via helicopter. The APS project was scheduled to operate for two years. This season marks the end of the second year of observations. All instruments and platforms will be removed from the field and retrograded to the principal investigator's home institution.

Program Director
Dr. Peter Milne

ASC Points of Contact
Samina Ouda / Elizabeth Kauffman

Antarctic Technical Events

(Presented in order of science event number)

T-150-M	Albert, Mary	T-904-M	Gooseff, Michael
T-295-M	Pettit, Joseph	T-913-M	Heine, John
T-299-M/S	Nikolaus, Kevin	T-927-M	Harris, Mark
T-312-M	Nikolaus, Kevin	T-933-L/N	Hummon, Julia
T-396-M	Szuberla, Curt	T-943-M	Melendy, Renee
T-434-M	Morin, Paul	T-961-M	Munley, William
T-524-M	McManis, James	T-998-P	Hosticka, Bouvard

For more information, and for a complete list of deploying participants, go to www.usap.gov/sps

Ice Drilling Program Office (IDPO) - McMurdo

T-150-M

NSF Agreement
Dr. Mary Albert, Principal Investigator
Dartmouth College
Thayer School of Engineering
Hanover, New Hampshire

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Web: www.icedrill.org

Research Locations
Around station

Supporting Station/Vessel
McMurdo Station

Dates in Antarctica
Late November to mid January

Project Description
The Ice Drilling Program Office (IDPO): (1) provides community leadership in ice drilling research and development; (2) identifies new technology needs and plans technology development and funding; (3) acquires new drilling technology to support science objectives for new discoveries; (4) provides the drills, equipment, and drilling expertise needed by the science groups; (5) enhances communication and information exchange related to ice coring and drilling science and technology; and (6) establishes activities in collaboration with the polar science and engineering community to contribute to NSF's strategic goals for desired societal outcomes.

Field Overview
The team will focus on the continued retrograde of IDPO cargo associated with the WAIS Divide drill program.

Program Director
Dr. Michael Jackson

ASC Points of Contact
John Rand / Dean Einerson

UNAVCO GPS, TLS, UAV survey support

T-295-M

NSF/ EAR Award 1724794
Mr. Joseph Pettit, Principal Investigator
UNAVCO, Inc.
Boulder, Colorado

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Web: www.unavco.org

Research Locations
McMurdo Station / Union Glacier

Supporting Station/Vessel
McMurdo Station

Dates in Antarctica
Mid October to mid February

Project Description
UNAVCO provides geodetic observations support and equipment. Survey-grade GPS, terrestrial laser scanners, unmanned aerial vehicles (UAVs), power and communications systems for high-precision campaign surveying and continuous data collection are available. UNAVCO operates a network of Global Navigation Satellite System (GNSS) stations on Ross Island and in the Dry Valleys. Support infrastructure includes a real-time kinematic differential GPS broadcasting station covering McMurdo Sound, a Mount Erebus repeater for GPS data retrieval from the Transantarctic Mountains, and an Iridium satellite hub in Colorado. Support is also provided for Palmer Station's GPS survey system. Operation and maintenance is provided for NASA's GNSS service stations MCM4 and PALM, POLENET (ANET), West Antarctic Ice Sheet Divide, South Pole GPS stations, and as-yet-unplanned support, as feasible.

Field Overview
Field team members will reside at McMurdo Station for much of the field season to provide UAV/UAS support, and technical and field engineering support, as well as to manage the UNAVCO equipment pool. They will occasionally travel into the field as support requirements dictate. One team member will support G-079-M POLENET at Union Glacier this season. They will access the camp via Punta Arenas, Chile. Team members will assist IRIS PASSCAL (T-299 and T-312) as needed.

Program Director
Dr. Michael Jackson

ASC Points of Contact
John Rand / Elizabeth Kauffman

IRIS/PASSCAL seismic support

T-299-M/S

NSF EAR/OPP Award 1724509
Mr. Kevin Nikolaus, Principal Investigator
New Mexico Institute of Mining and Technology
IRIS/PASSCAL
Socorro, New Mexico

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Research Locations
Mount Erebus

Supporting Station/Vessel
McMurdo Station, South Pole Station

Dates in Antarctica
Mid October to mid February

Project Description
The IRIS Program for Array Seismic Studies of the Continental Lithosphere (PASSCAL) Instrument Center supports NSF-funded projects. PASSCAL provides support through: 1) equipment testing as it arrives and rapid deployment to the field; 2) training to researchers; 3) on-continent instrument troubleshooting, performance evaluation, and data QC; 4) assisting researchers with data backup and archiving; and 5) field support, including installation and maintenance as required. Each year, the facility provides instrumentation and support to NSF-funded seismological projects while also developing cold-station deployment strategies, collaborating with vendors to develop and test equipment rated -55° C / -67° F, building an equipment pool, and creating a cold-station techniques repository. The team has been tasked by NSF with installing and maintaining a five-station permanent network on Mount Erebus (see T-312).

Field Overview
The T-299-M/S team will support Wilson/POLENET (G-079-M), Tulaczyk/TIME (C-446-M), and any as-yet-unplanned support, as feasible. The T-299 managed sites on Mt. Erebus will be supplanted by the T-312 Erebus Backbone Network. The team will also service test stations at SPRESSO near South Pole, Castle Rock test area, and possibly Observation Hill. These test sites are to further prove and test developing technologies and current equipment used by PIs requesting seismic support in polar locations. Team members will assist UNAVCO (T-295) as needed.

Program Director
Dr. Michael Jackson

ASC Points of Contact
John Rand / Elizabeth Kauffman / Paul Sullivan

IRIS/PASSCAL: Erebus backbone network project

T-312-M

NSF EAR/OPP Award 1724509
Mr. Kevin Nikolaus, Principal Investigator
New Mexico Institute of Mining and Technology
IRIS/PASSCAL
Socorro, New Mexico

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Web: www.passcal.nmt.edu/content/polar

Research Locations
Mount Erebus

Supporting Station/Vessel
McMurdo Station

Dates in Antarctica
Late November to late January

Project Description
IRIS/PASSCAL has been tasked with the design, fabrication, and deployment of a near-real time backbone seismic network near the Mount Erebus summit. This infrastructure will support the scientific and hazard-monitoring objectives of the NSF Office of Polar Programs (OPP) community and supplant the temporary Erebus Interim project. The IRIS Program for Array Seismic Studies of the Continental Lithosphere (PASSCAL) Instrument Center at New Mexico Tech supports cutting edge seismological research into Earth's fundamental geological structure and processes and will use this expertise to install and maintain the network. The project scope does not include a directive for ongoing monitoring of resulting data, but data will be archived. The network will be comprised of five stations that will include broadband, strong motion, infrasound-sensing, and will be able to expand to other capabilities.

Field Overview
This field season will encompass the first phase of the network rollout. Utilizing portable drilling, hand auguring or digging, a broadband borehole seismometer will be drilled at each of the five proposed sites. At Cones (CONZ), Lower Erebus Hut (ELHT), and Nausea Knob (NAUS), the current shallow broadband seismometers will be replaced with new instrumentation. The team will add strong motion accelerometers and their associated enclosures as well as solar panels. Team members will install new sites at Hooper (HOO) and Mackintosh (MAC). These sites will field broadband, strong motion, and infrasound sensing capabilities. The team will also provide reconnaissance support for three seismic stations funded under OPP Award 1917149 (Grapenthin).

Program Director
Dr. Michael Jackson

ASC Points of Contact
Jenny Cunningham / Elizabeth Kauffman

Operation and maintenance of a CTBT class infrasound array at Windless Bight

T-396-M

NSF/DTRA IAA MOA
Dr. Curt Szuberla, Principal Investigator
University of Alaska Fairbanks
Geophysical Institute
Fairbanks, Alaska

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Research Locations
Windless Bite, Mount Newall, Bull Pass, Thwaites Glacier

Supporting Station/Vessel
McMurdo Station

Dates in Antarctica
Early November to late January; instruments operate year around.

Project Description
This project operates, maintains, upgrades, calibrates, and services the joint U.S. Comprehensive Nuclear Test Ban Treaty (CTBT) station at Windless Bight. Windless Bight's location on the Ross Ice Shelf is unique for its very-low wind levels, which makes infrasound detection possible. Infrasound can detect volcanic eruptions, winds over distant mountain ranges, large storms at sea, auroral and meteor events, earthquakes, avalanches, and human-caused events such as very large explosions.

Field Overview
The six-person field team, equipped with standard remote field equipment (including snowmobiles and Mattrack vehicles) will stay in a self-supporting field camp at Windless Bight, with trips made to McMurdo Station for resupply. The field camp consists of two Polarhavens and individual mountain tents. The USAP also provides year-round on-site support from a support contractor research associate (RA), who occasionally visits the site during winter months for maintenance and troubleshooting. Two team members will accompany the G-078-M AFTAC team to Bull Pass and Mount Newall for a familiarization trip. One team member will join the C-445-M (TARSAN) team at Thwaites Glacier in early December.

Program Director
Dr. Michael Jackson

ASC Points of Contact
John Rand / Elizabeth Kauffman

The Polar Geospatial Information Center: Joint support

T-434-M

NSF/OPP Award 1559691
Mr. Paul Morin, Principal Investigator
University of Minnesota
Geology & Geophysics
St. Paul, Minnesota

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Web: www.pgc.umn.edu/

Research Locations
On station

Supporting Station/Vessel
McMurdo Station

Dates in Antarctica
Mid October to late January

Project Description
The Polar Geospatial Center (PGC) was founded in 2007 as the Antarctic Geospatial Information Center (AGIC) and has since expanded to include both polar regions. PGC provides geospatial support in the form of mapping, data delivery, and geographic information systems (GIS) analysis to science and logistics communities of the NSF's Arctic and Antarctic research programs. PGC provides satellite imagery of aircraft landing sites, satellite radar, elevation models, mapping, GIS services, real-time surface imagery, and historical time lapse sequences of changing ice conditions.

Field Overview
Deploying team members will be based at McMurdo Station throughout the season and will provide cartographic assistance in the form of GIS data formats, maps, and paper documents to science-project grantees and other USAP entities.

Program Director
Dr. Vladimir Papitashvili

ASC Points of Contact
Jenny Cunningham / Elizabeth Kauffman

University of Nebraska, Lincoln (UNL) hot water drilling support

T-524-M

NSF Agreement
Mr. James McManis, Principal Investigator
University of Nebraska Lincoln
College of Engineering
Lincoln, Nebraska

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Research Locations
On station

Supporting Station/Vessel
McMurdo Station

Dates in Antarctica
Late October to mid December; Instruments operate year around.

Project Description
The Subglacial Antarctic Lakes Scientific Access (SALSA) hot-water drill was operated at Subglacial Lake Mercer (SLM) last season. The University of Nebraska, Lincoln (UNL) drill team will prepare the drill for retrograde this season.

Field Overview
Team members will deploy to McMurdo Station to prepare individual containers and drill components for northbound transport to Lincoln, Nebraska. Several items will remain on ice for use by the heavy science traverse and IceCube Generation 2. The heavy science traverse will assist the UNL team.

Program Director
Dr. Jennifer Burns

ASC Points of Contact
Judy Shiple / Matthew Kippenhan

McMurdo LTER site review

T-904-M

Dr. Michael Gooseff, Principal Investigator
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Institute of Arctic and Alpine Research
Boulder, Colorado

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Research Locations
McMurdo Station, McMurdo Dry Valleys, Cape Royds

Supporting Station/Vessel
McMurdo Station

Dates in Antarctica
Last week of January

Project Description
The McMurdo Dry Valleys Long-Term Ecological Research (MCM LTER) project is an interdisciplinary study of the aquatic and terrestrial ecosystems in a cold desert region of Antarctica. Research in the area has been ongoing since 1992, and projects are funded for six-year periods. The MCM LTER mid-term site review brings together McMurdo Dry Valleys LTER scientists, students and field assistants, NSF program directors, and outside peer reviewers to conduct a three-day review of the ongoing progress the project has achieved in its current award period. This assessment will be used to help fine-tune plans for the remaining years of the current award, and to strengthen the 2022 submission of the renewal proposal.

Field Overview
MCM LTER scientists, students, field assistants, NSF program directors, and four outside peer reviewers will conduct an intensive, three-day study of the ongoing progress by the scientific team. The site review will include visits to MCM LTER study sites in the McMurdo Dry Valleys and at Cape Royds, tours of field camps and labs, and tours of Crary Laboratory and other McMurdo Station facilities. At the end of the review, an evaluative report will be provided to NSF and presented to the McM LTER team.

Program Director
Dr. Jennifer Burns

ASC Points of Contact
Jenny Cunningham / Elizabeth Kauffman / Jennifer Blum

OPP/USAP Diving Safety Officer (DSO) and Scientific Diving Control Board (SDCB) visit

T-913-M

Mr. John Heine, Principal Investigator
Jacksonville University
Marine Science Research Institute
Jacksonville, Florida

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Research Locations
McMurdo Sea Ice

Supporting Station/Vessel
McMurdo Station

Dates in Antarctica
Early October to mid November

Project Description
Project participants will participate in and evaluate scientific diving operations and dive locker activities and procedures. They will also interact with all of the science groups that are participating in diving operations for the season. The OPP/USAP Diving Safety Officer (DSO) will create an annual report, which is then presented to the Scientific Diving Control Board (SDCB) at the annual meeting in Washington, D.C. the following year. This visit assists the team members in making suggestions for improvements to the diving program.

Field Overview
One team member will deploy to McMurdo Station to conduct dives at various sites with the science groups and dive supervisors. They will also hold meetings and conduct inspections of the dive locker and hyperbaric chamber.

Program Director
Mr. Jon Fentress

ASC Points of Contact
Jenny Cunningham / Rob Robbins

NASA / McMurdo Ground Station (MG1)

T-927-M

NSF / NASA Agreement
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National Aeronautics and Space Administration
Wallops Flight Facility
Wallops Island, Virginia

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Research Locations
On station

Supporting Station/Vessel
McMurdo Station

Dates in Antarctica
Early October to mid August

Project Description
NASA's McMurdo Ground Station (MG1) is a 10-meter antenna housed in a radome visible on the hill above McMurdo Station. It is used primarily for data recovery from polar-orbiting science satellites. MG1 also provides launch and early operations phase (LEOP) support for Vandenberg Air Force Base launches of satellite missions that require downrange telemetry support; telemetry and command for satellite housekeeping, and recovery from satellite operational emergencies; and, in collaboration with the National Oceanic and Atmospheric Administration (NOAA) National Environmental Satellite and Data Information Service, data recovery for EUMETSAT MetOp polar weather satellites. NASA also has a McMurdo Tracking and Data Relay Satellite (TDRS) Relay System (MTRS) ground terminal at Crater Hill for high-speed data transfers of MG1 data. MTRS uses high-inclination TDRS satellites visible above the local horizon.

Field Overview
The MG1 activity is a year-round effort for which two NASA technicians are deployed to McMurdo Station to operate and maintain the systems. During the austral summer, additional personnel deploy to support special projects, perform systems and infrastructure checks, and conduct crew turnovers.

Program Director
Mr. Pat Smith

ASC Points of Contact
Samina Ouda / Elizabeth Kauffman

University of Hawaii Data Acquisition System (UHDAS) support

T-933-L/N

NSF Agreement
Dr. Julia Hummon, Principal Investigator
University of Hawaii Manoa
Joint Institute for Marine and Atmospheric Research (JIMAR)
Honolulu, Hawaii

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Research Locations
Drake Passage

Supporting Station/Vessel
ARSV *Laurence M. Gould*,
RV/IB *Nathaniel B. Palmer*

Dates in Antarctica
Instruments operate year around.

Project Description
This project maintains the Acoustic Doppler Current Profiler (ADCP) computer system on the RV/IB *Nathaniel B. Palmer* (NBP) and ARSV *Laurence M. Gould* (LMG). These computer systems are used to manage and post-process data from the ADCP sonars on the NBP and the LMG. On the LMG, the ADCP data are specifically collected and managed under the Chereskin (O-317-L) project, but are available to all cruise participants. On the NBP, the systems are maintained for general grantee requests.

Field Overview
This project will provide software and support for the ADCP computer systems on the LMG and NBP. Approximate biennial upgrades will occur during scheduled port calls. During these maintenance port calls, the system is tested extensively, which requires the ability to active ping the sonars in port to ensure proper system function. Testing these systems requires activating the sonars at the pier for four or five cycles of up to 10 minutes each.

Program Director
Mr. Tim McGovern

ASC Points of Contact
Rachel Shackelford / Bruce Felix

CRREL McMurdo Shear Zone route move site selection and preparation

T-943-M

Ms. Renee Melendy, Principal Investigator
US Army Cold Regions
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Hanover, New Hampshire

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Research Locations
Ross Ice Shelf Shear Zone

Supporting Station/Vessel
McMurdo Station

Dates in Antarctica
Late October to late December

Project Description
This project supports the relocation of the South Pole Traverse route through the nearby shear zone of the Ross Ice Shelf.

Field Overview
Fieldwork will be conducted at a spot about 5 km south of the current waypoint "GAW" of the South Pole traverse route. Two GPR operators will remain at the Shear Zone camp to assist with crevasse location and mitigation, for a total of 60 days in the field. One GPR expert may depart prior to the end of the project to conduct GPR surveys at WAIS Divide.

Program Director
Ms. Margaret Knuth

ASC Points of Contact
Samina Ouda / Bob DeValentino / Curt Labombard

The Joint Polar Satellite System Common Ground System (JPSS/CGS) annual maintenance and equipment upgrade

T-961-M

Mr. William Munley, Principal Investigator
Charlotte, North Carolina

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Research Locations
On station

Supporting Station/Vessel
McMurdo Station

Dates in Antarctica
Late October to mid December

Project Description
The Joint Polar Satellite System Common Ground System (JPSS/CGS) annual maintenance and equipment upgrade project provides support to the Raytheon IIS team with the upgrade, testing, and annual maintenance of the JPSS-CGS Receptor antenna and radome at: (1) the T-Site (MC1) located near Building 221; (2) the Fines Sites (MC2 and MC3) located above McMurdo Station near Building 071; and (3) with any updates to their equipment on 1st and 2nd floor Building 189.

Field Overview
This project has three major tasks for this season: (1) routine maintenance of the NOAA/JPSS receptors; (2) a major technical refresh of the ground equipment for the original receptors (designated MC1 and MC2); and, in conjunction with ASC support, the installation and commissioning of a third new receptor (designated the MC3). This work is to be accomplished in advance of a planned move of the NOAA/JPSS ground systems, currently located in Building 189, into the new Information Technology and Communication (IT&C) Primary Facility during early 2020-21 season.

Program Director
Mr. Pat Smith

ASC Points of Contact
Sheryl Seagraves

Operation and maintenance of a CTBT radionuclide monitoring station at Palmer Station

T-998-P

NSF/DTRA IAA
Mr. Bouvard Hosticka, Principal Investigator
University of Virginia
Charlottesville, Virginia

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Email: bh@virginia.edu

Research Locations
Terra Lab

Supporting Station/Vessel
Palmer Station

Dates in Antarctica
Mid April to mid May

Project Description
This project services and calibrates the automated radionuclide air-particulate monitoring system in the International Monitoring Station (IMS) building (Terra Lab) at Palmer Station. The IMS continuously collects and automatically analyzes daily air samples for radiation. The collected filter media samples from the Radionuclide Aerosol Sampler/Analyzer (RASA) are sent to Vienna, Austria for archiving on a quarterly basis. Additionally, single samples are shipped, upon request, to various laboratories elsewhere in the world.

Field Overview
The project operates, maintains, upgrades, and sustains the RN73 RASA monitoring instrument. Extensive upgrades to the RASA air-sampling system are planned for 2020, including replacing the main frame and cabinet as well as the inlet ducting. This will require additional shipments and two engineers to deploy in 2020. The USAP provides year-round, on-site support via support contractor research associate (RA). The RASA continuously collects and automatically analyzes daily air samples for radiation. The RA sends the collected filter media samples from the RASA to Vienna, Austria for archiving on a quarterly basis.

Program Director
Mr. Tim McGovern

ASC Points of Contact
John Rand / Jamee Johnson

Antarctic Artists and Writers

NSF/OPP Program Director: Ms. Valentine Kass

(Presented in order of science event number)

W-221-M	Anderson, Todd	W-223-M	Airriess, Sarah
W-222-M/P	Doherty, Orla	W-468-M/S	O'Boyle, Shaun

For more information, and for a complete list of deploying participants, go to www.usap.gov/sps

Ice core time capsules: The art and science of US Antarctic glacier research

W-221-M

NSF/OPP Award 1745429
Mr. Todd Anderson, Principal Investigator
Clemson University
Department of Art
Clemson, South Carolina

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Email: ToddAndersonArtist@gmail.com

Research Locations
Allan Hills

Supporting Station/Vessel
McMurdo Station

Dates in Antarctica
Mid November to mid December

Project Description
Ice Core Time Capsules is a two artists plus scientists collaborative and interdisciplinary project. This project focuses on ice coring and climate study on the continent. The project involves the documentation of science in action, portraits of scientists, and the larger Antarctic landscape as artistic muses for helping explain US Antarctic Program science to the public. Ice Core Time Capsules will result in individual artworks, traveling exhibits, and a monumentally scaled limited edition artist book, plus art-based educational outreach materials that will meet Next Generation K-12 science education standards.

Field Overview
The artists will deploy to and be based out of McMurdo Station. The artists will visit and observe developed and undeveloped sites in the vicinity of McMurdo Station including historic huts, the sea ice, and publicly accessible areas of McMurdo Station and areas accessed by the Ross Island roads and trail system. During this time, the artists will informally interview scientists and support staff about their experiences living and working on the continent while otherwise focusing their attention on the larger McMurdo community and Antarctic landscape. The artists will additionally visit with scientists and document scientific work during overnight stays at remote camps including sites in the Allan Hills and the Dry Valleys. The artists will be photographing and sketching throughout their stay.

Program Director
Ms. Valentine Kass

ASC Points of Contact
Judy Shiple / Elaine Hood

Frozen Planet II

W-222-M/P

NSF/OPP Award 1852771
Ms. Orla Doherty, Principal Investigator
British Broadcasting Corporation
New York, New York

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Research Locations
Sea Ice, Dry Valleys, South Pole Station, Palmer Station boating area

Supporting Station/Vessel
McMurdo Station, Palmer Station, South Pole Station

Dates in Antarctica
Early October to late January

Project Description
Frozen Planet II, a new television series from the British Broadcasting Corporation (BBC), is a celebration of the raw beauty of our last true wilderness. The series will introduce viewers to the extraordinary magic and critical importance of our frozen planet. Due to be broadcast in the UK in late 2021 and the US in early 2022, it will air ten years after the original Frozen Planet series, giving a critically-timed insight into the fastest-changing part of our planet. While connecting with the greatest global audience possible, it will bring to the fore the challenges these frozen worlds face and the global consequences that could arise from their demise. Building on the hallmarks of the original series, Frozen Planet II is intent on advancing knowledge and understanding of the natural world by showcasing environmental change and its consequences on wildlife.

Field Overview
Three teams will cover a range of stories for inclusion across the television series and in digital and social output. The first team will be divers based at McMurdo Station for an eight-week period, who will focus on Weddell seals and benthic invertebrates. The second field team will film the Dry Valleys, South Pole, and whales in the Ross Sea Ice Leads. The third team will film aerial footage from a helicopter of the Dry Valleys, Mount Erebus, and the Ross Sea area. One cameraman will deploy at Palmer to film at selected field sites.

Program Director
Ms. Valentine Kass

ASC Points of Contact
David Rivera / Judy Shiple / Elaine Hood

The Worst Journey in the World – graphic novel

W-223-M

NSF/OPP Award 1839483
Ms. Sarah Airriess, Principal Investigator
Cambridge, United Kingdom

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Research Locations
Capes Evans and Crozier, Beardmore Glacier

Supporting Station/Vessel
McMurdo Station

Dates in Antarctica
Mid November to early December

Project Description
The artist will produce, in partnership with the Scott Polar Research Institute in Cambridge, UK, a serialized graphic novel adaptation of The Worst Journey in the World, Apsley Cherry-Garrard's memoir of the Terra Nova Expedition. While in Antarctica, she plans to visit several of the important locations of the expedition, most notably Cape Evans, Hut Point, and Cape Crozier, with visits to or flights over the Beardmore Glacier and the environs of One Ton Depot, if weather and operations allow. The aim is to get as full a sense as possible of the environments in which history played out – both topographically and experientially – to depict the action as truthfully and evocatively as possible to a wide audience. After returning, the trip will be fully documented and shared on the artist's social media. The books will be produced in Cambridge and the first volume will be released in late 2020, with succeeding volumes in following years.

Field Overview
The artist will be based at McMurdo Station, and from there make day trips to Cape Evans, Cape Crozier, and the Ross Ice Shelf, and potentially fly over the Beardmore Glacier on a return flight to the Pole. She aims to thoroughly document, through photography and sketches, a variety of locations in the McMurdo Station area, including the historic huts at Cape Evans (ASPA 155), Hut Point (ASPA 158), and Cape Crozier (ASPA 124), and will also visit Arrival Heights (ASPA 122). She will also use photography and video to document from the air. Travel to Cape Evans and the Ross Ice Shelf will be via snowmobile and to Cape Crozier via helicopter if feasible. Some flights to further destinations may be via fixed-wing aircraft, as opportunity arises.

Program Director
Ms. Valentine Kass

ASC Points of Contact
Jenny Cunningham / Elaine Hood

Portraits of place at Amundsen-Scott Station

W-468-M/S

NSF/OPP Award 1839455
Mr. Shaun O'Boyle, Principal Investigator
Dalton, Massachusetts

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Research Locations
South Pole

Supporting Station/Vessel
McMurdo Station, South Pole Station

Dates in Antarctica
November

Project Description
This project is a photographic study of the station buildings, infrastructure, and landscapes of the South Pole. The goal is to advance knowledge about this remote location and scientific research taking place there. The project's emphasis is on the scientific hardware at the Pole. By giving an overall picture, and capturing details of the station, this project will provide a window for the public to understand the physical aspects of living and working at the South Pole: not only the weather, the extreme cold, and the infrastructure required to live there, but the instruments deployed for the various major science projects and the researchers who operate and maintain them. Seeing the physical objects that make the science possible makes the science more tangible and illustrates the depth of science and engineering required to accomplish research that is unique to the Pole.

Field Overview
The artist will deploy for two weeks from mid- to late-November 2019. He will spend about a week at South Pole to photograph the station, infrastructure, and installed science. The artist will be escorted throughout his South Pole visit. Photographing of science installations and interviews with scientists will be at the discretion of the scientists. While at McMurdo Station, if time permits, the artist will visit the Long Duration Balloon (LDB) camp.

Program Director
Ms. Valentine Kass

ASC Points of Contact
Judy Shiple / Michael Lucibella

Other Science Events

(Presented in order of science event number)

X-590-N	Jenkins, Adrian
X-591-L	Krause, Douglas
X-592-L/N	Dolk, Shaun
X-594-M/S	Brunt, Kelly
X-595-N	Takahashi, Taro
X-599-M	Jordan, Tom
X-600-M	Spangelo, Sara

For more information, and for a complete list of deploying participants, go to www.usap.gov/sps

BAS Thwaites Moorings

X-590-N

NSF / BAS Agreement
Dr. Adrian Jenkins, Principal Investigator
Columbia University
Lamont Doherty Earth Observatory
Cambridge, United Kingdom

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Research Locations
Trough E / Trough W

Supporting Station/Vessel
RV/IB *Nathaniel B. Palmer*

Dates in Antarctica
Early August to early October

Project Description
The goal of this project is to use long-term in-situ measurements of ocean-heat delivery to understand the major drivers of ice loss in some of the most rapidly retreating parts of the Antarctic ice sheet. The outcome from this research will inform projections for future ice-sheet stability and global sea-level projections. The oceanographic moorings in the eastern Amundsen Sea were originally deployed as part of the UK iSTAR (ice sheet stability) program. Some of these moorings have now been continued as part of the NERC-funded project, Ocean Forcing of Ice-Sheet Change, funded through 2023. These moorings are also considered a supporting dataset for the International Thwaites Glacier Collaboration (ITGC), and are particularly relevant to the MELT and TARSAN projects. At present, there are five moorings deployed. One has been in the water since 2014, and four have been deployed since 2016.

Field Overview
The team aims to recover and redeploy as many of the moorings as possible in the allocated time. It also intends to deploy a mooring to replace the one that was found to be missing in 2019. First priority is to service the two shelf-edge moorings, Trough_E and Trough_W. Both would be recovered and redeployed with a CTD cast taken at each site. The next priority would be to service the two moorings in Pine Island Bay. First, PIG_N would see a deployment and CTD cast. The mooring at PIG_S has not been located in 2019, but the team would use instrumentation from the recovered PIG_N mooring to put something in place. Lastly, if time allows, the team will service the mid-shelf mooring and conduct a search for the missing PIG_S mooring.

Program Director
Dr. Paul Cutler

ASC Points of Contact
Samina Ouda / Jamee Johnson

Cape Shirreff

X-591-L

NSF / NOAA-AMLR Agreement
Dr. Douglas Krause, Principal Investigator
National Oceanic and
Atmospheric Administration
NMFS, Southwest Fisheries Science Center
La Jolla, California

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Research Locations
Livingston Island

Supporting Station/Vessel
ARSV *Laurence M. Gould*

Dates in Antarctica
Late December to late March

Project Description
Cape Shirreff is located on Livingston Island in Antarctic Specially Protected Area (ASPA) 149. The facility at this site, also referred to as Cape Shirreff, is owned by the National Science Foundation but maintained and operated by the National Oceanic and Atmospheric Administration (NOAA), specifically under the Antarctic Marine Living Resource (AMLR) program of NOAA's Southwest Fisheries Science Center (SWFC). Cape Shirreff currently supports a NOAA-funded project conducting marine-mammal research. The facility was built in the 1996-97 austral summer at NSF direction by Antarctic Support Associates, the NSF Antarctic contractor at that time. Since then, it has been NOAA-occupied with USAP support limited to personnel transport and camp openings and closings.

Field Overview
Each season, the ARSV *Laurence M. Gould* (LMG) supports Cape Shirreff camp opening and closing. Cape Shirreff is scheduled to open in early- to mid-December and close around mid March. USAP support includes small boat operations, ASC ship personnel, and science volunteers to help open and close the camp, and cargo transport for camp supplies and waste. The team will need vessel laboratory space for drying project-specific gear and equipment during the closeout cruise. The POC will work with the marine laboratory supervisor to discuss storage of approved temperature-sensitive samples on northbound transits. There will be no mid-season participant turnover in 2019/20 as there has been in the past.

Program Director
Mr. Tim McGovern

ASC Points of Contact
David Rivera / Cara Ferrier

NOAA's Global Drifter Program (GDP)

X-592-L/N

NSF / NOAA Agreement
Dr. Shaun Dolk, Principal Investigator
National Oceanic and
Atmospheric Administration
Physical Oceanography Division
Miami, Florida

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Email: shaun.dolk@noaa.gov

Research Locations
Drake Passage

Supporting Station/Vessel
ARSV *Laurence M. Gould*,
RV/IB *Nathaniel B. Palmer*

Dates in Antarctica
Early August to early October

Project Description
The Global Drifter Program (GDP) is the principal component of the Global Surface Drifting Buoy Array, a branch of NOAA's Global Ocean Observing System (GOOS) and a scientific project of the Data Buoy Cooperation Panel (DBCP). Its objectives are: (1) to maintain a global 5x5 degree array of 1,250 ARGOS-tracked surface drifting buoys to meet the need for an accurate and globally dense set of in-situ observations of mixed-layer currents, sea-surface temperature, atmospheric pressure, winds, and salinity; and (2) to provide a data processing system for scientific use of these data. These data support short-term climate predictions as well as climate research and monitoring.

Field Overview
For ARSV *Laurence M. Gould* (LMG) cruises, one drifter will be deployed by staff technicians during each crossing of the Drake Passage (one southbound and one northbound). Staff will also deploy drifting buoys while underway onboard the RV/IB *Nathaniel B. Palmer* (NBP) during various cruises throughout the year.

Program Director
Dr. Peter Milne

ASC Points of Contact
Rachel Shackelford / Bruce Felix

88S traverse: GPS survey for calibration and validation of ICESat-2 altimetry data

X-594-M/S

NSF / NASA Agreement
Dr. Kelly Brunt, Principal Investigator
National Aeronautics and Space Administration
Marshall Space Flight Center
Greenbelt, Maryland

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Research Locations
East Antarctic Plateau

Supporting Station/Vessel
McMurdo Station, South Pole Station

Dates in Antarctica
Mid December to late January

Project Description
This project will conduct a high-precision GPS survey based out of South Pole Station, along the 88 degrees south line of latitude. The goal is to produce a large-scale dataset for the calibration of airborne and space-borne altimetry, and to validate ICESat-2 elevation measurements. The traverse along the ICESat-2 ground track convergence zone represents the only large-scale, ice-based validation effort on a cold, relatively stable part of the ice-sheet interior.

Field Overview
The project will perform a third PistenBully traverse associated with a ground-based GPS survey for the validation of NASA's ICESat-2 elevation and elevation-change data products. The 750 kilometer traverse route is along the 87.979° S line of latitude, approximately 224 kilometer from South Pole. The traverse will have two NASA participants, one ASC mountaineer, and one ASC mechanic. Participants will first spend one week at McMurdo Station to gather field gear and attend training. Once at South Pole, the team will acclimatize and prepare the two PistenBully vehicles and sled platforms for the traverse. Each vehicle will have a GPS receiver operating at all times, and a third GPS antenna and receiver will be available for instrument redundancy. The team will collect GPS data and reoccupy their deployed LiDAR cornercube reflectors. The traverse is estimated to again take approximately 15 days to complete.

Program Director
Dr. Michael Jackson

ASC Points of Contact
John Rand / Jennifer Blum / Paul Sullivan / Chad Naughton

Underway pCO_2 measurements on the RV/IB *Nathaniel B. Palmer*

X-595-N

NSF / LDEO / NOAA Agreement
Dr. Taro Takahashi, Principal Investigator
Columbia University
Lamont-Doherty Earth Observatory
Palisades, New York

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Research Locations
Southern Ocean

Supporting Station/Vessel
RV/IB *Nathaniel B. Palmer*

Dates in Antarctica
Early August to early October

Project Description
The Southern Ocean plays a key role in modulating the global carbon cycle, but the size and even the sign of the global ocean flux in terms of the atmospheric burden of man-made carbon dioxide is still uncertain. This is in part because of lack of measurements in this remote region of the world ocean. This project continues a multi-year time series of shipboard chemical measurements in the Drake Passage to detect changes in the ocean carbon cycle and to improve the understanding of mechanisms driving natural variability and long-term change in the Southern Ocean.

Field Overview
This project supports ongoing surface measurements of the partial pressure of CO_2 (pCO_2) from aboard the RV/IB *Nathaniel B. Palmer* (NBP). In addition, discrete measurements will be made from water samples collected underway. One participant may attend a vessel port call and one participant may sail on a cruise to perform maintenance on the system.

Program Director
Dr. Peter Milne

ASC Points of Contact
Rachel Shackelford / Bruce Felix

Low Power Magnetometer (LPM) network - British Antarctic Survey (BAS)

X-599-M

NSF/BAS Agreement
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British Antarctic Survey
Cambridge, United Kingdom

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Research Locations
Polar Plateau

Supporting Station/Vessel
McMurdo Station

Dates in Antarctica
Mid January to mid February

Project Description
The International Thwaites Glacier Collaboration is joint UK-US research program to improve the understanding of processes affecting ice sheet stability. Its central goal is predicting the future impact of sea-level rise from the largest glacier in West Antarctica, Thwaites Glacier. Underpinning much of this effort will be new data on the sub-ice topography, geology and basal conditions, together with new information about bathymetry hidden beneath the adjacent ice shelf. Collected data will provide the highest-resolution view of the glacier extending from the ice surface, through the internal ice sheet structures, to the bed conditions and geology beneath. After the field season these data will be shared with all involved in the International Thwaites Glacier Collaboration, allowing better predictions of Thwaites Glacier evolution.

Field Overview
Much of these new data will be collected by BAS using an aerogeophysically equipped Twin Otter. This system collects data from an instrument suites including lidar, shallow-snow radar, deep depth-sounding radar, and gravity and magnetic sensors. In December, the team will spend 10 days at Rothera Station equipping the BAS Twin Otter VP-FBL for survey and calibrating systems. The team then transits via Sky Blue to Lower Thwaites Glacier field camp where they will fly five to seven flights over the next month. This first field period will include the first C-444-M (Holland-Nicholls/MELT) radar flight. In February, the team will also spend three days at Rothera Station to equip the Twin Otter for survey and calibrating systems. They then transit via Sky Blue to Lower Thwaites Glacier field camp and will fly one-to-two flights for MELT only. The team will pack equipment for transport back to the UK and US via the USAP cargo system.

Program Director
Ms. Jessie Crain

ASC Points of Contact
Judy Shiple / Leslie Blank

Swarm Technologies

X-600-M

NSF/OPP Award 1758752
Undefined Sara Spangelo, Principal Investigator
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Mountain View, California

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Web: www.swarm.space

Research Locations
Comms Building

Supporting Station/Vessel
McMurdo Station

Dates in Antarctica
November

Project Description
This project centers around further development on the world's smallest two-way communications satellites and associated ground hardware. The broader impact of this Small Business Innovation Research (SBIR) Phase II project spans commercial, scientific, and humanitarian applications by extending IoT (Internet of Things) connectivity to remote regions without cellular coverage and where satellite data is prohibitively expensive for vital application such as shipping and weather. The satellites and ground hardware being developed have been driven towards miniaturization and power reduction to enable a broader range of customers to take advantage of the network by allowing easy integration into their devices and easy-to-install autonomous ground solutions. The unique launch economics afforded by the miniaturized satellites enable IoT sensing and data return at a cost 1/10th to 1/100th that of incumbent satellite data providers.

Field Overview
Two participants will deploy to McMurdo Station in mid November 2019. They will stay on-station for one week to install their two ground stations and will then redeploy. Each ground station is a 4.5-foot tall omni VHF antenna connected via cable to a 6" x 6" x 3" terminal box that requires 110-Volt AC power and Internet (Ethernet or WiFi) connection. ASC antenna riggers will assist with installation of the ground stations, which will be mounted on Building 159 (Comms Shop). The stations will remain in operation for two years.

Program Director
Ms. Jessie Crain

ASC Points of Contact
Jenny Cunningham / Elizabeth Kauffman

Antarctic Education and Outreach

(Presented in order of science event number)

Y-604-L	Scowcroft, Gail	Y-610-E	Virginia, Ross

For more information, and for a complete list of deploying participants, go to www.usap.gov/sps

EAGER: Antarctic Broadcasts: Broader Impacts Through Telepresence (ABBITT)

Y-604-L

NSF/OPP Award 1755475
Ms. Gail Scowcroft, Principal Investigator
University of Rhode Island
Office of Marine Programs
Kingston, Rhode Island

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Research Locations
Drake Passage transit

Supporting Station/Vessel
ARSV *Laurence M. Gould*

Dates in Antarctica
Mid October to early November

Project Description
The ABBITT project's goal is to improve education activities related to NSF-funded Antarctic research. The project will test technologies that have been developed for ship-to-shore transmissions in a region where they have not been used, the extreme southern latitudes, and test the technology while at-sea onboard the *ARSV Laurence M. Gould* (LMG) and from Palmer Station. The Inner Space Center (ISC) at the University of Rhode Island develops ship-to-shore telepresence technologies—communications technology that optimizes live video, audio, and data transmissions via satellite and terrestrial networks that link remote locations to the rest of the world. The ISC facility includes a broadcast studio for producing professional quality broadcasts. The grantees will produce live, interactive broadcasts from the LMG and Palmer Station to the Smithsonian Institution's National Museum of Natural History (NMNH).

Field Overview
This season the project will design, install, and test mobile telepresence units (MTUs) on the LMG during a transit to Palmer Station. The MTU is a portable system that allows multiple audio/video inputs for routing, switching, mixing, and encoding for transmissions. The closed circuit television (CCTV) cameras already on the LMG will feed into the MTU system. All of these content sources become part of the system that will allow for engaging programming to be delivered live from the ship during the pilot broadcasts to the NMNH. The broadcasts are intended to increase public awareness and understanding of the changing Antarctic region; increase public understanding about Antarctic research and the scientific process as viewers learn what Antarctic scientists are doing and about techniques and tools they use; and to extend the LMG's capacity to make connections between polar scientists, students, and educators.

Program Director
Ms. Elizabeth Rom

ASC Points of Contact
Samina Ouda / Bruce Felix / Elaine Hood

Joint Antarctic Science Expedition (JASE)

Y-610-E

NSF/OPP Award 1550503
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Hanover, New Hampshire

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Research Locations
King George Island

Supporting Station/Vessel
Special Project

Dates in Antarctica
Early January to late February

Project Description
The Joint Antarctic Science Expedition (JASE) program is designed to promote polar science education and cross-cultural exchange, and is run in parallel with the Joint Science Education Project (JSEP), currently led by faculty at Dartmouth College. Dartmouth has a lead role in the JASE program, a collaborative venture of NSF's Office of Polar Programs (NSF/OPP) and the Chilean National Antarctic Institute (Instituto Antártico Chileno (INACH)). INACH has invited the United States to participate in an expedition to King George Island that will provide high-school students and teachers the opportunity to gain hands-on experience with ecosystems research in Antarctica.

Field Overview
Dartmouth College is responsible for assembling the US team to participate in JASE. The team will consist of a team leader, a teacher, a graduate student, and four high school students. Dartmouth will coordinate logistics for the trip, including travel to and from Punta Arenas, and lodging and meals while there. Ross Virginia (Dartmouth College PI) and Lauren Culler (Dartmouth College Co-PI) are the project's points of contact (POCs) and will have primary responsibility for management and oversight of the US JASE participants. They will work closely with designated representatives of the USAP and INACH to provide a high level of coordination required to ensure a safe program that meets the educational goals of JASE. ASC will provide ECW gear for all participants.

Program Director
Ms. Elizabeth Rom

ASC Points of Contact
David Rivera / Cara Ferrier

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Principal Investigators (by Institution)

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Columbia University	Takahashi, Taro	X-595-N
Dartmouth College	Albert, Mary	T-150-M
Dartmouth College	LaBelle, James	A-128-S
Dartmouth College	Virginia, Ross	Y-610-E
GATS, Inc.	Fritts, David	A-382-E
Georgia Institute of Technology	Schmidt, Britney	B-041-M
Georgia Institute of Technology	Weissburg, Marc	B-198-L/P
H.T. Harvey & Associates	Ainley, David	B-031-M
Harvard University	Kovac, John	A-149-S
Incorporated Research Institutions for Seismology	Anderson, Kent	G-090-M/P/S
Jacksonville University	Heine, John	T-913-M

Institution	Principal Investigator	Event Number
Johns Hopkins University	Chartier, Alex	A-100-M/S
Lehigh University	Yu, Zicheng	G-094-L
Louisiana State University Baton Rouge	Doran, Peter	C-511-M
Montana State University Bozeman	Priscu, John	C-505-M
Montana State University Bozeman	Priscu, John	C-533-M
Montana State University Bozeman	Rotella, Jay	B-009-M
NASA Ames Research Center	Smith, David	A-454-M
National Aeronautics and Space Administration	Brunt, Kelly	X-594-M/S
National Aeronautics and Space Administration	Harris, Mark	T-927-M
National Oceanic and Atmospheric Administration	Butler, James	O-257-M
National Oceanic and Atmospheric Administration	Butler, James	O-257-S
National Oceanic and Atmospheric Administration	Butler, James	O-264-P
National Oceanic and Atmospheric Administration	Dolk, Shaun	X-592-L/N
National Oceanic and Atmospheric Administration	Krause, Douglas	X-591-L
National Oceanic and Atmospheric Administration	Watters, George	B-006-L
New Jersey Institute of Technology	Gerrard, Andrew	A-111-M/P/S
New Jersey Institute of Technology	Gerrard, Andrew	A-112-M/S
New Mexico Institute of Mining and Technology	Nikolaus, Kevin	T-299-M/S
New Mexico Institute of Mining and Technology	Nikolaus, Kevin	T-312-M
New York University	Holland, David	C-444-M
Ohio State University	de la Pena, Santiago	D-553-S
Ohio State University	Lyons, W. Berry	G-183-M
Ohio State University	Wilson, Terry	G-079-E
Oregon State University	Pettit, Erin	C-445-M/N

Institution	Principal Investigator	Event Number
Point Reyes Bird Observatory	Ballard, Grant	B-040-M
Polar Oceans Research Group	Fraser, William	C-013-L/P
Princeton University	Higgins, John	I-165-M
Princeton University	Sarmiento, Jorge	O-271-N
Rutgers University	Kohut, Josh	B-005-N/P
Rutgers University	Schofield, Oscar	C-019-L/P
Scripps Institution of Oceanography	Lubin, Dan	O-325-M
Scripps Institution of Oceanography	Ponganis, Paul	B-197-M
Scripps Institution of Oceanography	Sprintall, Janet	O-260-L
Space Science Institute	Hartinger, Michael	A-129-E
Swarm Technologies	Spangelo, Sara	X-600-M
Temple University	Sanders, Robert	B-303-N
Tulane University	Goehring, Brent	C-448-M
Tulane University	Goehring, Brent	C-443-M
UNAVCO, Inc.	Pettit, Joseph	T-295-M
United States Air Force	Kemerait, Robert	G-078-M
United States Air Force	Swindle, Thomas	A-368-S
University of Alabama Birmingham	McClintock, James	B-027-P
University of Alabama Tuscaloosa	Yan, Stephen	I-554-M
University of Alaska Fairbanks	Bristow, William	A-369-M/S
University of Alaska Fairbanks	Conde, Mark	A-343-M/S
University of Alaska Fairbanks	Szuberla, Curt	T-396-M
University of California Davis	Todgham, Anne	B-207-M
University of California Irvine	Barwick, Steven	A-127-M/S
University of California San Diego	Chereskin, Teresa	O-317-L
University of California Santa Cruz	Costa, Daniel	B-232-L
University of California Santa Cruz	Friedlaender, Ari	C-024-L/P
University of California Santa Cruz	Tulaczyk, Slawek	C-446-M
University of California Santa Cruz	Tulaczyk, Slawek	I-157-M
University of Chicago	Carlstrom, John	A-379-S
University of Chicago	Vieregg, Abigail	A-340-S
University of Colorado Boulder	Banwell, Alison	I-151-E
University of Colorado Boulder	Cassano, John	O-400-M

Institution	Principal Investigator	Event Number
University of Colorado Boulder	Chu, Xinzhao	A-123-M
University of Colorado Boulder	Deshler, Terry	O-241-M
University of Colorado Boulder	Gooseff, Michael	C-504-M
University of Colorado Boulder	Gooseff, Michael	C-506-M
University of Colorado Boulder	Gooseff, Michael	C-509-M
University of Colorado Boulder	Gooseff, Michael	T-904-M
University of Colorado Boulder	Munro, David	O-214-L
University of Colorado Boulder	Palo, Scott	A-284-M
University of Colorado Boulder	Scambos, Theodore	I-344-E
University of Colorado Boulder	Seefeldt, Mark	O-456-M
University of East Anglia	Heywood, Karen	C-445-M/N
University of Hawaii Manoa	Hummon, Julia	T-933-L/N
University of Hawaii Manoa	Moran, Amy	B-307-M
University of Houston	Wellner, Julia	C-447-N
University of Kentucky Lexington	Teets, Nicholas	B-046-L
University of Minnesota	Goodge, John	D-551-M
University of Minnesota	Goodge, John	D-552-M
University of Minnesota	Morin, Paul	T-434-M
University of Nebraska Lincoln	McManis, James	T-524-M
University of New Mexico	Takacs-Vesbach, Cristina	C-508-M
University of Oregon	Cziko, Paul	B-195-M
University of Pennsylvania	Devlin, Mark	A-147-M
University of Rhode Island	Scowcroft, Gail	Y-604-L
University of Virginia	Hosticka, Bouvard	T-998-P
University of Washington	Christianson, Knut	I-175-M/S
University of Washington	Girton, James	O-202-L
University of Washington	Wilcock, William	G-437-E
University of Washington	Young, Jodi	B-234-N
University of Wisconsin Madison	Halzen, Francis	A-333-S
University of Wisconsin Madison	Hanson, Kael	A-334-M/S
University of Wisconsin Madison	Lazzara, Matthew	O-283-M
University of Wisconsin River Falls	Seunarine, Surujhdeo	A-118-S

Institution	Principal Investigator	Event Number
US Army Cold Regions Research & Engineering Lab	Melendy, Renee	T-943-M
Utah State University	Taylor, Michael	A-119-M/P/S
Virginia Institute of Marine Sciences	Steinberg, Deborah	C-020-L/P
Virginia Tech	Clauer, Robert	A-106-M/S
Washington University	Krawczynski, Henric	A-115-M
Washington University	Rauch, Brian	A-142-M
	Airriess, Sarah	W-223-M
	Munley, William	T-961-M
	O'Boyle, Shaun	W-468-M/S

ARSV *Laurence M. Gould* Projects

(by PI Last Name)

Principal Investigator	Science Event Number
Chereskin, Teresa	O-317-L
Costa, Daniel	B-232-L
Dolk, Shaun	X-592-L/N
Ducklow, Hugh	C-045-L/P
Fraser, William	C-013-L/P
Friedlaender, Ari	C-024-L/P
Girton, James	O-202-L
Hummon, Julia	T-933-L/N
Krause, Douglas	X-591-L
Martinson, Doug	C-021-L
Munro, David	O-214-L
Schofield, Oscar	C-019-L/P
Scowcroft, Gail	Y-604-L
Sprintall, Janet	O-260-L
Steinberg, Deborah	C-020-L/P
Teets, Nicholas	B-046-L
Watters, George	B-006-L
Weissburg, Marc	B-198-L/P
Yu, Zicheng	G-094-L

RV/IB *Nathaniel B. Palmer* Projects

(by PI Last Name)

Principal Investigator	Science Event Number
Dolk, Shaun	X-592-L/N
Hummon, Julia	T-933-L/N
Jenkins, Adrian	X-590-N
Kohut, Josh	B-005-N/P
Pettit, Erin	C-445-M/N
Sanders, Robert	B-303-N
Sarmiento, Jorge	O-271-N
Takahashi, Taro	X-595-N
Thompson, Andrew	O-124-N
Wellner, Julia	C-447-N
Young, Jodi	B-234-N

McMurdo Station Projects

(by PI Last Name)

Principal Investigator	Science Event Number
Adams, Byron	C-507-M
Ainley, David	B-031-M
Airriess, Sarah	W-223-M
Albert, Mary	T-150-M
Anderson, Kent	G-090-M/P/S
Anderson, Todd	W-221-M
Ballard, Grant	B-040-M
Barwick, Steven	A-127-M/S
Bristow, William	A-369-M/S
Brunt, Kelly	X-594-M/S
Butler, James	O-257-M
Butler, James	O-257-S
Cassano, John	O-400-M
Chartier, Alex	A-100-M/S
Christianson, Knut	I-175-M/S
Chu, Xinzhao	A-123-M
Clauer, Robert	A-106-M/S
Conde, Mark	A-343-M/S
Cziko, Paul	B-195-M
Deshler, Terry	O-241-M
Devlin, Mark	A-147-M
Doherty, Orla	W-222-M/P
Doran, Peter	C-511-M
Franco, Hugo	A-145-M
Gerrard, Andrew	A-111-M/P/S
Gerrard, Andrew	A-112-M/S
Goehring, Brent	C-448-M
Goodge, John	D-551-M

Principal Investigator	Science Event Number
Goodge, John	D-552-M
Gooseff, Michael	C-504-M
Gooseff, Michael	C-506-M
Gooseff, Michael	C-509-M
Gooseff, Michael	T-904-M
Hanson, Kael	A-334-M/S
Harris, Mark	T-927-M
Harvey, Ralph	G-058-M
Heine, John	T-913-M
Higgins, John	I-165-M
Holland, David	C-444-M
Johnson, Joanne	C-443-M
Jordan, Tom	X-599-M
Kemerait, Robert	G-078-M
Krawczynski, Henric	A-115-M
Lamp, Jennifer	G-055-M
Lazzara, Matthew	O-283-M
Liwanag, Heather	B-030-M
Lubin, Dan	O-325-M
Lyons, W. Berry	G-183-M
McManis, James	T-524-M
Melendy, Renee	T-943-M
Moran, Amy	B-307-M
Morin, Paul	T-434-M
Munley, William	T-961-M
Nikolaus, Kevin	T-299-M/S
Nikolaus, Kevin	T-312-M
O'Boyle, Shaun	W-468-M/S
Palo, Scott	A-284-M
Pettit, Erin	C-445-M/N
Pettit, Joseph	T-295-M
Ponganis, Paul	B-197-M
Priscu, John	C-505-M

Principal Investigator	Science Event Number
Priscu, John	C-533-M
Rauch, Brian	A-142-M
Rotella, Jay	B-009-M
Schmidt, Britney	B-041-M
Seefeldt, Mark	O-456-M
Smith, David	A-454-M
Spangelo, Sara	X-600-M
Szuberla, Curt	T-396-M
Takacs-Vesbach, Cristina	C-508-M
Taylor, Michael	A-119-M/P/S
Todgham, Anne	B-207-M
Tulaczyk, Slawek	C-446-M
Tulaczyk, Slawek	I-157-M
Yan, Stephen	I-554-M

Palmer Station Projects

(by PI Last Name)

Principal Investigator	Science Event Number
Anderson, Kent	G-090-M/P/S
Butler, James	O-264-P
Doherty, Orla	W-222-M/P
Ducklow, Hugh	C-045-L/P
Fraser, William	C-013-L/P
Friedlaender, Ari	C-024-L/P
Gerrard, Andrew	A-111-M/P/S
Hosticka, Bouvard	T-998-P
Kohut, Josh	B-005-N/P
McClintock, James	B-027-P
Schofield, Oscar	C-019-L/P
Steinberg, Deborah	C-020-L/P
Taylor, Michael	A-119-M/P/S
Weissburg, Marc	B-198-L/P

South Pole Station Projects

(by PI Last Name)

Principal Investigator	Science Event Number
Anderson, Kent	G-090-M/P/S
Barwick, Steven	A-127-M/S
Bristow, William	A-369-M/S
Brunt, Kelly	X-594-M/S
Butler, James	O-257-M
Butler, James	O-257-S
Carlstrom, John	A-379-S
Chartier, Alex	A-100-M/S
Christianson, Knut	I-175-M/S
Clauer, Robert	A-106-M/S
Conde, Mark	A-343-M/S
de la Pena, Santiago	D-553-S
Gerrard, Andrew	A-111-M/P/S
Gerrard, Andrew	A-112-M/S
Halzen, Francis	A-333-S
Hanson, Kael	A-334-M/S
Kovac, John	A-149-S
LaBelle, James	A-128-S
Nikolaus, Kevin	T-299-M/S
O'Boyle, Shaun	W-468-M/S
Seunarine, Surujhdeo	A-118-S
Swindle, Thomas	A-368-S
Taylor, Michael	A-119-M/P/S
Vieregg, Abigail	A-340-S

Projects Not Supported by a USAP Station or Vessel

(by PI Last Name)

Principal Investigator	Science Event Number
Banwell, Alison	I-151-E
Fritts, David	A-382-E
Hartinger, Michael	A-129-E
Scambos, Theodore	I-344-E
Virginia, Ross	Y-610-E
Wilcock, William	G-437-E
Wilson, Terry	G-079-E

Antarctic Astrophysics and Geospace Sciences

(by PI Last Name)

Principal Investigator	Science Event Number
Barwick, Steven	A-127-M/S
Bristow, William	A-369-M/S
Carlstrom, John	A-379-S
Chartier, Alex	A-100-M/S
Chu, Xinzhao	A-123-M
Clauer, Robert	A-106-M/S
Conde, Mark	A-343-M/S
Devlin, Mark	A-147-M
Franco, Hugo	A-145-M
Fritts, David	A-382-E
Gerrard, Andrew	A-111-M/P/S
Gerrard, Andrew	A-112-M/S
Halzen, Francis	A-333-S
Hanson, Kael	A-334-M/S
Hartinger, Michael	A-129-E
Kovac, John	A-149-S
Krawczynski, Henric	A-115-M
LaBelle, James	A-128-S
Palo, Scott	A-284-M
Rauch, Brian	A-142-M
Seunarine, Surujhdeo	A-118-S
Smith, David	A-454-M
Swindle, Thomas	A-368-S
Taylor, Michael	A-119-M/P/S
Vieregg, Abigail	A-340-S

Antarctic Organisms and Ecosystems

(by PI Last Name)

Principal Investigator	Science Event Number
Ainley, David	B-031-M
Ballard, Grant	B-040-M
Costa, Daniel	B-232-L
Cziko, Paul	B-195-M
Kohut, Josh	B-005-N/P
Liwanag, Heather	B-030-M
McClintock, James	B-027-P
Moran, Amy	B-307-M
Ponganis, Paul	B-197-M
Rotella, Jay	B-009-M
Sanders, Robert	B-303-N
Schmidt, Britney	B-041-M
Teets, Nicholas	B-046-L
Todgham, Anne	B-207-M
Watters, George	B-006-L
Weissburg, Marc	B-198-L/P
Young, Jodi	B-234-N

Antarctic Integrated System Science

(by PI Last Name)

Principal Investigator	Science Event Number
Adams, Byron	C-507-M
Christoffersen, Poul	C-446-M
Doran, Peter	C-511-M
Ducklow, Hugh	C-045-L/P
Fraser, William	C-013-L/P
Friedlaender, Ari	C-024-L/P
Goehring, Brent	C-443-M
Goehring, Brent	C-448-M
Gooseff, Michael	C-504-M
Gooseff, Michael	C-506-M
Gooseff, Michael	C-509-M
Heywood, Karen	C-445-M/N
Holland, David	C-444-M
Johnson, Joanne	C-443-M
Johnson, Joanne	C-448-M
Larter, Robert	C-447-N
Martinson, Doug	C-021-L
Nicholls, Keith	C-444-M
Pettit, Erin	C-445-M/N
Priscu, John	C-505-M
Priscu, John	C-533-M
Schofield, Oscar	C-019-L/P
Steinberg, Deborah	C-020-L/P
Takacs-Vesbach, Cristina	C-508-M
Tulaczyk, Slawek	C-446-M
Wellner, Julia	C-447-N

Antarctic Instrumentation and Technology Development

(by PI Last Name)

Principal Investigator	Science Event Number
de la Pena, Santiago	D-553-S
Goodge, John	D-551-M
Goodge, John	D-552-M

Antarctic Earth Sciences

(by PI Last Name)

Principal Investigator	Science Event Number
Anderson, Kent	G-090-M/P/S
Harvey, Ralph	G-058-M
Kemerait, Robert	G-078-M
Lamp, Jennifer	G-055-M
Lyons, W. Berry	G-183-M
Wilcock, William	G-437-E
Wilson, Terry	G-079-E
Yu, Zicheng	G-094-L

Antarctic Glaciology

(by PI Last Name)

Principal Investigator	Science Event Number
Banwell, Alison	I-151-E
Christianson, Knut	I-175-M/S
Higgins, John	I-165-M
Scambos, Theodore	I-344-E
Tulaczyk, Slawek	I-157-M
Yan, Stephen	I-554-M

Antarctic Ocean and Atmospheric Sciences

(by PI Last Name)

Principal Investigator	Science Event Number
Butler, James	O-257-M
Butler, James	O-257-S
Butler, James	O-264-P
Cassano, John	O-400-M
Chereskin, Teresa	O-317-L
Deshler, Terry	O-241-M
Girton, James	O-202-L
Lazzara, Matthew	O-283-M
Lubin, Dan	O-325-M
Munro, David	O-214-L
Sarmiento, Jorge	O-271-N
Seefeldt, Mark	O-456-M
Sprintall, Janet	O-260-L
Thompson, Andrew	O-124-N

Antarctic Technical Events

(by PI Last Name)

Principal Investigator	Science Event Number
Albert, Mary	T-150-M
Gooseff, Michael	T-904-M
Harris, Mark	T-927-M
Heine, John	T-913-M
Hosticka, Bouvard	T-998-P
Hummon, Julia	T-933-L/N
McManis, James	T-524-M
Melendy, Renee	T-943-M
Morin, Paul	T-434-M
Munley, William	T-961-M
Nikolaus, Kevin	T-299-M/S
Nikolaus, Kevin	T-312-M
Pettit, Joseph	T-295-M
Szuberla, Curt	T-396-M

Antarctic Artists and Writers

(by PI Last Name)

Principal Investigator	Science Event Number
Airriess, Sarah	W-223-M
Anderson, Todd	W-221-M
Doherty, Orla	W-222-M/P
O'Boyle, Shaun	W-468-M/S

Other Science Events

(by PI Last Name)

Principal Investigator	Science Event Number
Brunt, Kelly	X-594-M/S
Dolk, Shaun	X-592-L/N
Jenkins, Adrian	X-590-N
Jordan, Tom	X-599-M
Krause, Douglas	X-591-L
Spangelo, Sara	X-600-M
Takahashi, Taro	X-595-N

Antarctic Outreach and Education

(by PI Last Name)

Principal Investigator	Science Event Number
Scowcroft, Gail	Y-604-L
Virginia, Ross	Y-610-E

Deploying Participants (by Science Event Number)

Science Event Number	Participant
A-111-M/P/S	Burch, Hunter
A-111-M/P/S	Gerrard, Andrew
A-111-M/P/S	Moore, Robert
A-112-M/S	Gerrard, Andrew
A-112-M/S	Jeffer, Gilbert
A-112-M/S	Melville, Robert
A-112-M/S	Stillinger, Andrew
A-115-M	Peterson, Zachary
A-118-S	Rosen, Laura
A-118-S	Seunarine, Surujhdeo
A-119-M/P/S	Pautet, Pierre-Dominique
A-119-M/P/S	Taylor, Michael
A-123-M	Chu, Xinzhao
A-123-M	Jandreau, Jackson
A-123-M	Li, Xianxin
A-123-M	Lin, Ying-Tsen
A-123-M	Steckel, Amanda
A-127-M/S	Bakken-French, Nicolas
A-127-M/S	Gaswint, Geoffrey
A-127-M/S	Glaser, Christian
A-127-M/S	Paul, Manuel
A-129-E	Coyle, Shane
A-142-M	Akaike, Yosui
A-142-M	Bose, Richard
A-142-M	Braun, Dana
A-142-M	Buckley, James
A-142-M	Crabill, Robert
A-142-M	Hughes, Zachary

Science Event Number	Participant
A-142-M	Rauch, Brian
A-142-M	Sakai, Kenichi
A-142-M	Simburger, Garry
A-142-M	West, Andrew
A-142-M	Zober, Wolfgang
A-145-M	Anderson, Aaron
A-145-M	Bath, Brian
A-145-M	Battaion, Scott
A-145-M	Beange, Alexander
A-145-M	Brasfield, Paul
A-145-M	Breeding, Garrison
A-145-M	Cooper, Dewell
A-145-M	De Luna, Juan
A-145-M	Fox, Larry
A-145-M	Frazier, Curtis
A-145-M	Gregg, Gerald
A-145-M	Hadley, Scott
A-145-M	Hamilton, Andrew
A-145-M	Henderson, Randall
A-145-M	Hogg, Derek
A-145-M	Hynous, Andrew
A-145-M	Johnson, Arlo
A-145-M	Jones, Caleb
A-145-M	Jones, Joseph
A-145-M	Jones, Michael
A-145-M	Marchant, Gary
A-145-M	McDonald, Randall
A-145-M	Millan, Robyn
A-145-M	Morgan, Lauren
A-145-M	Mullenax, Robert
A-145-M	Richard, Jacob
A-145-M	Richard, Mitchell
A-145-M	Sample, John

Science Event Number	Participant
A-145-M	Schwantes, Christopher
A-145-M	Shumko, Mykhaylo
A-145-M	Stelly, Robert
A-145-M	Sullivan, David
A-145-M	Villasana, Cesar
A-145-M	Webb, David
A-145-M	Weber, Corey
A-145-M	Wooten, Curtis
A-147-M	Aguirre, James
A-147-M	Coppi, Gabriele
A-147-M	Corso, Anthony
A-147-M	Devlin, Mark
A-147-M	Fissel, Laura
A-147-M	Gordon, Samuel
A-147-M	Lourie, Nathan
A-147-M	Lowe, Ian
A-147-M	Mauskopf, Philip
A-147-M	Nati, Federico
A-147-M	Novak, Giles
A-147-M	Romualdez, Javier
A-147-M	Sinclair, Adrian
A-147-M	Wheeler, Caleb
A-147-M	Williams, Paul
A-149-S	Basu Thakur, Ritoban
A-149-S	Cheshire IV, James
A-149-S	Cornelison, James
A-149-S	Crock, Paula
A-149-S	Crumrine, Michael
A-149-S	Cukierman, Ariel
A-149-S	Dierickx, Marion
A-149-S	Fatigoni, Sofia
A-149-S	Hall, Grantland
A-149-S	Kovac, John

Science Event Number	Participant
A-149-S	Lau, King
A-149-S	Mohamed, Ahmed
A-149-S	Moncelsi, Lorenzo
A-149-S	Nichols, Erik
A-149-S	Palladino, Steven
A-149-S	Precup, Nathan
A-149-S	Pryke, Clement
A-149-S	Schillaci, Alessandro
A-149-S	Schmitt, Benjamin
A-149-S	Schwarz, Robert
A-149-S	Steinbach, Bryan
A-149-S	Young, Edward
A-149-S	Yu, Cyndia
A-149-S	Zhang, Cheng
A-284-M	Kingsbury, Ryan
A-284-M	Marino, John
A-284-M	Palo, Scott
A-333-S	Argueta, Jocelyn
A-333-S	Auer, Ralf
A-333-S	Brostean-Kaiser, James
A-333-S	Glowacki, David
A-333-S	Hardin, John
A-333-S	Kauer, Matthew
A-333-S	Kelley, John
A-333-S	Koehler, James
A-333-S	Makino, Yuya
A-333-S	Oehler, Marie
A-333-S	Plum, Matthias
A-333-S	Pollmann, Anna
A-333-S	Schroeder, Frank
A-333-S	Sclafani, Stephen
A-333-S	Shultz, Andrew
A-333-S	Tosi, Delia

Science Event Number	Participant
A-333-S	Tung, Chun Fai
A-333-S	Zernick, Michael
A-334-M/S	Abrams, Richard
A-334-M/S	Birrittella, Barbara
A-334-M/S	Duling, Dennis
A-334-M/S	Edwards, Jeanne
A-334-M/S	Ejdepalm, Erik
A-334-M/S	Folmer, Brent
A-334-M/S	Gibson, Dar
A-334-M/S	Hamilton, Darrell
A-334-M/S	Hanson, Kael
A-334-M/S	Kalin, Jonas
A-334-M/S	Laundrie, Andrew
A-334-M/S	Nesbit, Jacob
A-334-M/S	Oxborough, Alexis
A-334-M/S	Roberts, Graham
A-334-M/S	Roth, James
A-334-M/S	Tosi, Delia
A-334-M/S	Wisniewski, Paul
A-334-M/S	Zernick, Michael
A-340-S	Deaconu, Cosmin
A-343-M/S	Elliott, John
A-343-M/S	Itani, Rajan
A-368-S	Gulledge, Deborah
A-368-S	Jefferies, Stuart
A-368-S	Murphy, Neil
A-368-S	Nayak, Michael
A-368-S	Shaw, Cody
A-368-S	Shurilla, Christopher
A-368-S	Swindle, Thomas
A-369-M/S	Bristow, William
A-369-M/S	Klug, Bryant
A-379-S	Bender, Amy

Science Event Number	Participant
A-379-S	Benson, Bradford
A-379-S	Diggles, Steele
A-379-S	Ferguson, Kyle
A-379-S	Foster, Allen
A-379-S	Gambrel, Anne
A-379-S	Guyot, Ronald
A-379-S	Holzapfel, William
A-379-S	Hood, John
A-379-S	Kim, Junhan
A-379-S	Lowitz, Amy
A-379-S	Padin, Stephen
A-379-S	Pernic, David
A-379-S	Rahlin, Alexandra
A-379-S	Rouble, Maclean
A-379-S	Stephen, Judith
A-379-S	Young, Matthew
A-382-E	Hocking, Wayne
B-005-N/P	Glenn, Scott
B-005-N/P	Hann, Ashley
B-005-N/P	Kohut, Josh
B-005-N/P	Maisch, Jordan
B-005-N/P	Oliver, Matthew
B-005-N/P	Statscewich, Hank
B-005-N/P	Steinke, Kirsten
B-005-N/P	Veatch, Jacquelyn
B-006-L	Cossio, Anthony
B-006-L	Cutter, George
B-006-L	Reiss, Christian
B-009-M	Brown, Heather
B-009-M	Cunningham, Kaitlin
B-009-M	Davis, Brandon
B-009-M	Litt, Andrea
B-009-M	Petch, Shane

Science Event Number	Participant
B-009-M	Rotella, Jay
B-009-M	Tuers-Lance, Holly
B-009-M	Villalobos, Victor
B-027-P	Amsler, Charles
B-027-P	Amsler, Margaret
B-027-P	McClintock, James
B-027-P	Oswalt, Hannah
B-027-P	Schram, Julie
B-030-M	Brodie, Erin
B-030-M	Harris, Heather
B-030-M	Liwanag, Heather
B-030-M	Pearson, Linnea
B-030-M	Ward, Bridget
B-030-M	Weitzner, Emma
B-030-M	Whitmer, Emily
B-031-M	Aguilar Clapés-Sagañoles, Virginia
B-031-M	Ainley, David
B-031-M	Ballard, Grant
B-031-M	Dugger, Katie
B-031-M	Elrod, Megan
B-031-M	Jongsomjit, Dennis
B-031-M	Lescroel, Amelie
B-031-M	Levinson, Parker
B-031-M	Pennycook, Jean
B-031-M	Schmidt, Anne
B-040-M	Shah, Kunal
B-041-M	Hurwitz, Benjamin
B-041-M	Lawrence, Justin
B-041-M	Meister, Matthew
B-041-M	Quartini, Enrica
B-041-M	Washam, Peter
B-046-L	Gantz, Josiah
B-046-L	Harner, Beborah

Science Event Number	Participant
B-046-L	Idec, Jacob
B-046-L	Potts, Leslie
B-195-M	Robbins, Rob
B-195-M	Rupp, Steve
B-197-M	Czapanskiy, Max
B-197-M	John, Jason
B-197-M	Ponganis, Katherine
B-197-M	Ponganis, Paul
B-197-M	St. Leger, Judy
B-197-M	Williams, Cassondra
B-198-L/P	Fields, David
B-198-L/P	Garayev, Kuvvat
B-198-L/P	Murphy, David
B-198-L/P	Weissburg, Marc
B-207-M	Frazier, Amanda
B-207-M	Hardoy, Denise
B-207-M	Mandic, Milica
B-207-M	Naslund, Andrew
B-207-M	Todgham, Anne
B-232-L	Costa, Daniel
B-232-L	Crocker, Daniel
B-232-L	Goebel, Michael
B-232-L	Kanatous, Shane
B-232-L	Kienle, Sarah
B-232-L	Trumble, Stephen
B-234-N	Carpenter, Shelly
B-234-N	Cooper, Zachary
B-234-N	Dawson, Hannah
B-234-N	Rundell, Susan
B-234-N	Young, Jodi
B-303-N	Carnivale, Christopher
B-303-N	Grattepanche, Jean-David
B-303-N	Harris, Leila

Science Event Number	Participant
B-303-N	Jeffrey, Wade
B-303-N	Millette, Nicole
B-303-N	Sanders, Robert
B-307-M	Lobert, Graham
B-307-M	Moran, Amy
B-307-M	Osborne, Amy
B-307-M	Toh, Ming-Wei
C-013-L/P	Cimino, Megan
C-013-L/P	Fraser, Donna
C-013-L/P	Fraser, William
C-013-L/P	Roberts, Darren
C-013-L/P	Roberts, Megan
C-013-L/P	Schaefer, Anne
C-013-L/P	West, Leigh
C-019-L/P	Ackleson, Steven
C-019-L/P	Diou-Cass, Quintin
C-019-L/P	Faller, Kelly
C-019-L/P	Hudson, Katherine
C-019-L/P	Nardelli, Schuyler
C-019-L/P	Rosenthall, Gabrielle
C-019-L/P	Schofield, Oscar
C-019-L/P	Walsh, Kasey
C-019-L/P	Wiltsee, Laura
C-019-L/P	Young, Rachel
C-020-L/P	Conroy, John
C-020-L/P	Cope, Joseph
C-020-L/P	Corso, Andrew
C-020-L/P	Lorey, Courtney
C-020-L/P	Schrage, Kharis
C-020-L/P	Sharpe, Kristen
C-024-L/P	Friedlaender, Ari
C-024-L/P	Larsen, Greg
C-024-L/P	Nichols, Ross

Science Event Number	Participant
C-045-L/P	Cardenas, Pablo
C-045-L/P	Connors, Elizabeth
C-045-L/P	Kelly, Thomas
C-045-L/P	Nicholas, Charles
C-045-L/P	Patino, Natalia
C-045-L/P	Trinh, Rebecca
C-045-L/P	Yingling, Natalia
C-443-M	Johnson, Joanne
C-443-M	Woodward, John
C-444-M	Anker, Paul
C-444-M	Basinski-Ferris, Aurora
C-444-M	Clyne, Elisabeth
C-444-M	Davis, Peter
C-444-M	Dichek, Daniel
C-444-M	Holland, David
C-444-M	Mullen, Andrew
C-444-M	Nicholls, Keith
C-444-M	Riverman, Kiya
C-444-M	Schmidt, Britney
C-444-M	Smith, James
C-444-M	Spears, Anthony
C-444-M	Sylvester, Tom
C-444-M	Whetu, Mark
C-445-M/N	Boehme, Lars
C-445-M/N	Bortolotto de Oliveira, Guilherme
C-445-M/N	Fox, Douglas
C-445-M/N	Fyffe, Blair
C-445-M/N	Mortenson, Cecelia
C-445-M/N	Muto, Atsuhiro
C-445-M/N	Pettit, Erin
C-445-M/N	Pomraning, Dale
C-445-M/N	Roccaro, Alexander
C-445-M/N	Scambos, Theodore

Science Event Number	Participant
C-445-M/N	Truffer, Martin
C-445-M/N	Wallin, Bruce
C-445-M/N	Wild, Christian
C-446-M	Baum, Julie
C-446-M	Dawson, Eliza
C-446-M	McCarthy, Forrest
C-446-M	Veitch, Stephen
C-446-M	Walter, Jacob
C-446-M	Young, Tun Jan
C-447-N	Clark, Rachel
C-447-N	Garcia, Santiago
C-447-N	Graham, Alastair
C-447-N	Hillenbrand, Claus-Dieter
C-447-N	Hogan Pires de Matos, Kelly
C-447-N	Hopkins, Rebecca
C-447-N	Larter, Robert
C-447-N	Lehrmann, Asmara
C-447-N	Lepp, Allison
C-447-N	Marschalek, James
C-447-N	Minzoni, Rebecca
C-447-N	Nitsche, Frank-Oliver
C-447-N	Slack, Sarah
C-447-N	Wellner, Julia
C-448-M	Balco, Gregory
C-448-M	Boeckmann, Grant
C-448-M	Campbell, Seth
C-448-M	Goehring, Brent
C-448-M	Simmons, Christopher
C-448-M	Walden, John
C-504-M	Bergstrom, Anna
C-504-M	Gooseff, Michael
C-505-M	Lawrence, Jade
C-505-M	Priscu, John

Science Event Number	Participant
C-505-M	Robinson, David
C-505-M	Sherwell, Shasten
C-505-M	Wu, Naicheng
C-506-M	Beane, Samuel
C-506-M	Brandes, Henry
C-506-M	Welch, Kathleen
C-507-M	Adams, Byron
C-507-M	Adams, Marcella
C-507-M	Barrett, John
C-507-M	Brim, Jinna
C-507-M	Howkins, Adrian
C-507-M	Osburn, Ernest
C-507-M	Pothula, Satyendra
C-507-M	Power, Sarah
C-508-M	Devlin, Shawn
C-508-M	Morgan-Kiss, Rachael
C-508-M	Priscu, John
C-508-M	Reynebeau, Emily
C-508-M	Sheldon, Parnell
C-508-M	Takacs-Vesbach, Cristina
C-509-M	Darling, Joshua
C-509-M	McKnight, Diane
C-509-M	Schulte, Nicholas
C-511-M	Doran, Peter
C-511-M	Gutterman, William
C-511-M	Myers, Krista
C-511-M	Sicard, Elizabeth
C-511-M	Stone, Michael
C-530-M	Brunt, Kelly
C-530-M	Hurford, Terry
C-530-M	Schmerr, Nicholas
C-533-M	Arndt, Philipp
C-533-M	Siegfried, Matthew

Science Event Number	Participant
D-551-M	Goodge, John
D-551-M	Severinghaus, Jeffrey
D-552-M	Hall, Thor
D-552-M	Johnson, Jay
D-552-M	Kirkpatrick, Donald
D-552-M	Little, Owen
D-552-M	Lundberg, David
D-552-M	Martin, Raymond
D-552-M	Peone, Christopher
D-552-M	Stapleton, Shawntel
D-553-S	de la Pena, Santiago
D-553-S	King, Michalea
G-055-M	Balter, Alexandra
G-058-M	Angotti, Lauren
G-058-M	Caffee, Marc
G-058-M	Dunham, Emilie
G-058-M	Evans, Cynthia
G-058-M	Gerst, Alexander
G-058-M	Karner, James
G-058-M	Lunning, Nicole
G-058-M	Rougeux, Brian
G-058-M	Schutt, John
G-078-M	Griffin, Ethan
G-078-M	Helmericks, Jay
G-078-M	Lattimer, Scott
G-078-M	Long, Craig
G-078-M	Pomraning, Dale
G-078-M	Sherman, Justin
G-079-E	Baker, Michael
G-079-E	Matheny, Peter
G-079-E	Roberts, John
G-079-E	Wilson, Terry
G-090-M/P/S	Jones, David

Science Event Number	Participant
G-090-M/P/S	Kromer, Edward
G-090-M/P/S	Vallo, Gilbert
G-090-M/P/S	Voss, Nicholas
G-094-L	Beilman, David
G-094-L	Groff, Dulcinea
G-094-L	Parnikoza, Ivan
G-094-L	Yu, Zicheng
G-183-M	Calero, Adolfo
G-183-M	Diaz, Melisa
G-183-M	Gardner, Christopher
G-437-E	Castillo, Miguel
G-437-E	Diaz, Jordan
G-437-E	Dziak, Robert
G-437-E	Fuller, Jazymn
G-437-E	Gillette, Maureen
G-437-E	Hamid, Rua
G-437-E	Kane, Timothy
G-437-E	Kelly, Brian
G-437-E	Kidiwela Appuhamillage, Maleen Jayanath
G-437-E	Krauss, Zoe
G-437-E	Roche, Lauren
G-437-E	Schmahl, Lauren
G-437-E	Soule, Dax
G-437-E	Wilcock, William
I-151-E	Banwell, Alison
I-151-E	Stevens, Laura
I-151-E	Willis, Ian
I-157-M	Neuhaus, Sarah
I-165-M	Brook, Edward
I-165-M	Carter, Austin
I-165-M	Epifanio, Jenna
I-165-M	Higgins, John

Science Event Number	Participant
I-165-M	Kuhl, Tanner
I-165-M	Morgan, Jacob
I-165-M	Morton, Elizabeth
I-165-M	Nesbitt, Ian
I-165-M	Shackleton, Sarah
I-175-M/S	Christian, John Erich
I-175-M/S	Christianson, Knut
I-175-M/S	Hills, Benjamin
I-175-M/S	Hoffman, Andrew
I-175-M/S	Holschuh, Nicholas
I-175-M/S	Horlings, Annika
I-175-M/S	O'Connor, Gemma
I-344-E	Miller, Julie
I-554-M	Lilien, David
I-554-M	Steinhage, Daniel
I-554-M	Taylor, Ryan
I-554-M	Yan, Stephen
O-124-N	Dove, Lilian
O-202-L	de Klerk, Alex
O-202-L	Newell, Ryan
O-202-L	Snyder, Avery
O-202-L	Talbert, Joseph
O-214-L	Munro, David
O-214-L	Newberger, Timothy
O-214-L	Wolter, Sonja
O-241-M	Deshler, Terry
O-241-M	Dorey, Michael
O-241-M	Kalnajs, Lars
O-241-M	Reese, Thomas
O-241-M	St Clair, David
O-257-M/S	Booth, John
O-257-M/S	Gedney, Marisa
O-257-M/S	Kaiser, Benjamin

Science Event Number	Participant
O-257-M/S	McConville, Glen
O-257-M/S	Mowatt, Jennie
O-257-M/S	Sheridan, Patrick
O-257-M/S	Stierle, Scott
O-271-N	Rosso, Isabella
O-283-M	Norton, Taylor
O-283-M	Thorsland, Josh
O-283-M	Welhouse, Lee
O-325-M	Ghiz, Madison
O-325-M	Lubin, Dan
O-400-M	Mateling, Marian
O-400-M	Welhouse, Lee
O-456-M	Landolt, Scott
O-456-M	Seefeldt, Mark
T-295-M	Bayou, Nicolas
T-295-M	Niebuhr, Spencer
T-295-M	Nylen, Thomas
T-295-M	Pettit, Joseph
T-295-M	Williams, Keith
T-299-M/S	Arnell, Kirsten
T-299-M/S	Enochs, Stefanie
T-299-M/S	Lingutla, Narendra Naidu
T-299-M/S	Martin, Hilda
T-299-M/S	Meyers, John
T-299-M/S	Nikolaus, Kevin
T-299-M/S	Roth, Aurora
T-312-M	Arnell, Kirsten
T-312-M	Bierma, Ryan
T-312-M	Lingutla, Narendra Naidu
T-312-M	Miner, Jeremy
T-396-M	Helmericks, Jay
T-396-M	Merz, Dora
T-396-M	Pomraning, Dale

Science Event Number	Participant
T-396-M	Tytgat, Guy
T-396-M	Von Lintig, Matthew
T-396-M	Winkelman, Andrew
T-434-M	Crittenden, Charles
T-434-M	Foga, Steven
T-434-M	Husby, Erik
T-434-M	Kelleher, Cole
T-434-M	Loeffler, Shane
T-524-M	Duling, Dennis
T-913-M	Heine, John
T-926-M	Chandler, Joshua
T-926-M	Rothwell, Michael
T-926-M	Ward, Bradley
T-927-M	Cotten, Rex
T-927-M	Cox, Jennifer
T-927-M	Funk, Raymond
T-927-M	Kambarn, William
T-927-M	Sinkola, Nikolas
T-927-M	Wendell, Edward
T-943-M	Courville, Zoe
T-943-M	Lamie, Nathan
T-961-M	Brandt, Edgar
T-961-M	Collins, Bruce
T-961-M	Cwiklinski, Christopher
T-961-M	Dilallo, Cristen
T-961-M	Elgamiel, Khaled
T-961-M	Handy, Matthew
T-961-M	Herpich, Brett
T-961-M	Kilcoyne, Heather
T-961-M	Lutz, Stephen
T-961-M	Munley, William
T-961-M	Nay, Tyler
T-961-M	Sciacca, Steve

Science Event Number	Participant
T-961-M	Shah, Rasikh
T-961-M	Spring, Lucas
T-961-M	Vass, Nicholas
T-961-M	Walton, Douglas
T-961-M	Williams, Kate
T-998-P	Al-Alami, Noor
T-998-P	Hosticka, Bouvard
W-221-M	Anderson, Todd
W-221-M	van Coller, Ian
W-222-M/P	Beldam, Thomas
W-222-M/P	Bosiger, Yoland
W-222-M/P	Doherty, Orla
W-222-M/P	Hofman, Justin
W-222-M/P	McFadden, Erin
W-222-M/P	Meyrick, Sam
W-222-M/P	Miller, Hugh
W-222-M/P	Taylor, Dylan
W-222-M/P	Thompson, Andrew
W-222-M/P	Thurston, Gavin
W-223-M	Airriess, Sarah
W-468-M/S	O'Boyle, Shaun
X-590-N	Barham, Mark
X-591-L	Goebel, Michael
X-594-M/S	Brunt, Kelly
X-594-M/S	Wong, Gifford
X-595-N	Munro, David
X-595-N	Newberger, Timothy
X-595-N	Sweeney, Colm
X-595-N	Wolter, Sonja
X-598-M	Davies, David
X-598-M	Gillett, Nicholas
X-598-M	Thomas, Catrin
X-599-M	Jordan, Tom

Science Event Number	Participant
X-599-M	Robinson, Carl
X-600-M	Longmier, Benjamin
X-600-M	Spangelo, Sara
Y-604-L	DeCiccio, Alex
Y-604-L	Knowlton, Christopher
Y-610-E	Alarcon Macias, Victoria
Y-610-E	Culler, Lauren
Y-610-E	Flores Rosado, Evan
Y-610-E	Gutierrez, Grant
Y-610-E	Henry, Clarissa
Y-610-E	Tochimani-Hernandez, Ivan
Y-610-E	Wallstrom, Erica

Deploying Participants (Alphabetical)

Participant	Science Event Number
Abrams, Richard	A-334-M/S
Ackleson, Steven	C-019-L/P
Adams, Byron	C-507-M
Adams, Marcella	C-507-M
Aguilar Clapés-Sagañoles, Virginia	B-031-M
Aguirre, James	A-147-M
Ainley, David	B-031-M
Airriess, Sarah	W-223-M
Akaike, Yosui	A-142-M
Al-Alami, Noor	T-998-P
Alarcon Macias, Victoria	Y-610-E
Amsler, Charles	B-027-P
Amsler, Margaret	B-027-P
Anderson, Aaron	A-145-M
Anderson, Todd	W-221-M
Angotti, Lauren	G-058-M
Anker, Paul	C-444-M
Argueta, Jocelyn	A-333-S
Arndt, Philipp	C-533-M
Arnell, Kirsten	T-299-M/S
Arnell, Kirsten	T-312-M
Auer, Ralf	A-333-S
Baker, Michael	G-079-E
Bakken-French, Nicolas	A-127-M/S
Balco, Gregory	C-448-M
Ballard, Grant	B-031-M
Balter, Alexandra	G-055-M
Banwell, Alison	I-151-E

Participant	Science Event Number
Barham, Mark	X-590-N
Barrett, John	C-507-M
Basinski-Ferris, Aurora	C-444-M
Basu Thakur, Ritoban	A-149-S
Bath, Brian	A-145-M
Battaion, Scott	A-145-M
Baum, Julie	C-446-M
Bayou, Nicolas	T-295-M
Beane, Samuel	C-506-M
Beange, Alexander	A-145-M
Beilman, David	G-094-L
Beldam, Thomas	W-222-M/P
Bender, Amy	A-379-S
Benson, Bradford	A-379-S
Bergstrom, Anna	C-504-M
Bierma, Ryan	T-312-M
Birrittella, Barbara	A-334-M/S
Boeckmann, Grant	C-448-M
Boehme, Lars	C-445-M/N
Booth, John	O-257-M/S
Bortolotto de Oliveira, Guilherme	C-445-M/N
Bose, Richard	A-142-M
Bosiger, Yoland	W-222-M/P
Brandes, Henry	C-506-M
Brandt, Edgar	T-961-M
Brasfield, Paul	A-145-M
Braun, Dana	A-142-M
Breeding, Garrison	A-145-M
Brim, Jinna	C-507-M
Bristow, William	A-369-M/S
Brodie, Erin	B-030-M
Brook, Edward	I-165-M
Brostean-Kaiser, James	A-333-S

Participant	Science Event Number
Brown, Heather	B-009-M
Brunt, Kelly	C-530-M
Brunt, Kelly	X-594-M/S
Buckley, James	A-142-M
Burch, Hunter	A-111-M/P/S
Caffee, Marc	G-058-M
Calero, Adolfo	G-183-M
Campbell, Seth	C-448-M
Cardenas, Pablo	C-045-L/P
Carnivale, Christopher	B-303-N
Carpenter, Shelly	B-234-N
Carter, Austin	I-165-M
Castillo, Miguel	G-437-E
Chandler, Joshua	T-926-M
Cheshire IV, James	A-149-S
Christian, John Erich	I-175-M/S
Christianson, Knut	I-175-M/S
Chu, Xinzhao	A-123-M
Cimino, Megan	C-013-L/P
Clark, Rachel	C-447-N
Clyne, Elisabeth	C-444-M
Collins, Bruce	T-961-M
Connors, Elizabeth	C-045-L/P
Conroy, John	C-020-L/P
Cooper, Dewell	A-145-M
Cooper, Zachary	B-234-N
Cope, Joseph	C-020-L/P
Coppi, Gabriele	A-147-M
Cornelison, James	A-149-S
Corso, Andrew	C-020-L/P
Corso, Anthony	A-147-M
Cossio, Anthony	B-006-L
Costa, Daniel	B-232-L

Participant	Science Event Number
Cotten, Rex	T-927-M
Courville, Zoe	T-943-M
Cox, Jennifer	T-927-M
Coyle, Shane	A-129-E
Crabill, Robert	A-142-M
Crittenden, Charles	T-434-M
Crock, Paula	A-149-S
Crocker, Daniel	B-232-L
Crumrine, Michael	A-149-S
Cukierman, Ariel	A-149-S
Culler, Lauren	Y-610-E
Cunningham, Kaitlin	B-009-M
Cutter, George	B-006-L
Cwiklinski, Christopher	T-961-M
Czapanskiy, Max	B-197-M
Darling, Joshua	C-509-M
Davies, David	X-598-M
Davis, Brandon	B-009-M
Davis, Peter	C-444-M
Dawson, Eliza	C-446-M
Dawson, Hannah	B-234-N
de Klerk, Alex	O-202-L
de la Pena, Santiago	D-553-S
De Luna, Juan	A-145-M
Deaconu, Cosmin	A-340-S
DeCiccio, Alex	Y-604-L
Deshler, Terry	O-241-M
Devlin, Mark	A-147-M
Devlin, Shawn	C-508-M
Diaz, Jordan	G-437-E
Diaz, Melisa	G-183-M
Dichek, Daniel	C-444-M
Dierickx, Marion	A-149-S

Participant	Science Event Number
Diggles, Steele	A-379-S
Dilallo, Cristen	T-961-M
Diou-Cass, Quintin	C-019-L/P
Doherty, Orla	W-222-M/P
Doran, Peter	C-511-M
Dorey, Michael	O-241-M
Dove, Lilian	O-124-N
Dugger, Katie	B-031-M
Duling, Dennis	A-334-M/S
Duling, Dennis	T-524-M
Dunham, Emilie	G-058-M
Dziak, Robert	G-437-E
Edwards, Jeanne	A-334-M/S
Ejdepalm, Erik	A-334-M/S
Elgamiel, Khaled	T-961-M
Elliott, John	A-343-M/S
Elrod, Megan	B-031-M
Enochs, Stefanie	T-299-M/S
Epifanio, Jenna	I-165-M
Evans, Cynthia	G-058-M
Faller, Kelly	C-019-L/P
Fatigoni, Sofia	A-149-S
Ferguson, Kyle	A-379-S
Fields, David	B-198-L/P
Fissel, Laura	A-147-M
Flores Rosado, Evan	Y-610-E
Foga, Steven	T-434-M
Folmer, Brent	A-334-M/S
Foster, Allen	A-379-S
Fox, Douglas	C-445-M/N
Fox, Larry	A-145-M
Fraser, Donna	C-013-L/P
Fraser, William	C-013-L/P

Participant	Science Event Number
Frazier, Amanda	B-207-M
Frazier, Curtis	A-145-M
Friedlaender, Ari	C-024-L/P
Fuller, Jazymn	G-437-E
Funk, Raymond	T-927-M
Fyffe, Blair	C-445-M/N
Gambrel, Anne	A-379-S
Gantz, Josiah	B-046-L
Garayev, Kuvvat	B-198-L/P
Garcia, Santiago	C-447-N
Gardner, Christopher	G-183-M
Gaswint, Geoffrey	A-127-M/S
Gedney, Marisa	O-257-M/S
Gerrard, Andrew	A-111-M/P/S
Gerrard, Andrew	A-112-M/S
Gerst, Alexander	G-058-M
Ghiz, Madison	O-325-M
Gibson, Dar	A-334-M/S
Gillett, Nicholas	X-598-M
Gillette, Maureen	G-437-E
Glaser, Christian	A-127-M/S
Glenn, Scott	B-005-N/P
Glowacki, David	A-333-S
Goebel, Michael	B-232-L
Goebel, Michael	X-591-L
Goehring, Brent	C-448-M
Goodge, John	D-551-M
Gooseff, Michael	C-504-M
Gordon, Samuel	A-147-M
Graham, Alastair	C-447-N
Grattepanche, Jean-David	B-303-N
Gregg, Gerald	A-145-M
Griffin, Ethan	G-078-M

Participant	Science Event Number
Groff, Dulcinea	G-094-L
Gulledge, Deborah	A-368-S
Gutierrez, Grant	Y-610-E
Gutterman, William	C-511-M
Guyot, Ronald	A-379-S
Hadley, Scott	A-145-M
Hall, Grantland	A-149-S
Hall, Thor	D-552-M
Hamid, Rua	G-437-E
Hamilton, Andrew	A-145-M
Hamilton, Darrell	A-334-M/S
Handy, Matthew	T-961-M
Hann, Ashley	B-005-N/P
Hanson, Kael	A-334-M/S
Hardin, John	A-333-S
Hardoy, Denise	B-207-M
Harner, Beborah	B-046-L
Harris, Heather	B-030-M
Harris, Leila	B-303-N
Heine, John	T-913-M
Helmericks, Jay	G-078-M
Helmericks, Jay	T-396-M
Henderson, Randall	A-145-M
Henry, Clarissa	Y-610-E
Herpich, Brett	T-961-M
Higgins, John	I-165-M
Hillenbrand, Claus-Dieter	C-447-N
Hills, Benjamin	I-175-M/S
Hocking, Wayne	A-382-E
Hoffman, Andrew	I-175-M/S
Hofman, Justin	W-222-M/P
Hogan Pires de Matos, Kelly	C-447-N
Hogg, Derek	A-145-M

Participant	Science Event Number
Holland, David	C-444-M
Holschuh, Nicholas	I-175-M/S
Holzapfel, William	A-379-S
Hood, John	A-379-S
Hopkins, Rebecca	C-447-N
Horlings, Annika	I-175-M/S
Hosticka, Bouvard	T-998-P
Howkins, Adrian	C-507-M
Hudson, Katherine	C-019-L/P
Hughes, Zachary	A-142-M
Hurford, Terry	C-530-M
Hurwitz, Benjamin	B-041-M
Husby, Erik	T-434-M
Hynous, Andrew	A-145-M
Idec, Jacob	B-046-L
Itani, Rajan	A-343-M/S
Jandreau, Jackson	A-123-M
Jeffer, Gilbert	A-112-M/S
Jefferies, Stuart	A-368-S
Jeffrey, Wade	B-303-N
John, Jason	B-197-M
Johnson, Arlo	A-145-M
Johnson, Jay	D-552-M
Johnson, Joanne	C-443-M
Jones, Caleb	A-145-M
Jones, David	G-090-M/P/S
Jones, Joseph	A-145-M
Jones, Michael	A-145-M
Jongsomjit, Dennis	B-031-M
Jordan, Tom	X-599-M
Kaiser, Benjamin	O-257-M/S
Kalin, Jonas	A-334-M/S
Kalnajs, Lars	O-241-M

Participant	Science Event Number
Kambarn, William	T-927-M
Kanatous, Shane	B-232-L
Kane, Timothy	G-437-E
Karner, James	G-058-M
Kauer, Matthew	A-333-S
Kelleher, Cole	T-434-M
Kelley, John	A-333-S
Kelly, Brian	G-437-E
Kelly, Thomas	C-045-L/P
Kidiwela Appuhamillage, Maleen Jayanath	G-437-E
Kienle, Sarah	B-232-L
Kilcoyne, Heather	T-961-M
Kim, Junhan	A-379-S
King, Michalea	D-553-S
Kingsbury, Ryan	A-284-M
Kirkpatrick, Donald	D-552-M
Klug, Bryant	A-369-M/S
Knowlton, Christopher	Y-604-L
Koehler, James	A-333-S
Kohut, Josh	B-005-N/P
Kovac, John	A-149-S
Krauss, Zoe	G-437-E
Kromer, Edward	G-090-M/P/S
Kuhl, Tanner	I-165-M
Lamie, Nathan	T-943-M
Landolt, Scott	O-456-M
Larsen, Greg	C-024-L/P
Larter, Robert	C-447-N
Lattimer, Scott	G-078-M
Lau, King	A-149-S
Laundrie, Andrew	A-334-M/S
Lawrence, Jade	C-505-M

Participant	Science Event Number
Lawrence, Justin	B-041-M
Lehrmann, Asmara	C-447-N
Lepp, Allison	C-447-N
Lescroel, Amelie	B-031-M
Levinson, Parker	B-031-M
Li, Xianxin	A-123-M
Lilien, David	I-554-M
Lin, Ying-Tsen	A-123-M
Lingutla, Narendra Naidu	T-299-M/S
Lingutla, Narendra Naidu	T-312-M
Litt, Andrea	B-009-M
Little, Owen	D-552-M
Liwanag, Heather	B-030-M
Lobert, Graham	B-307-M
Loeffler, Shane	T-434-M
Long, Craig	G-078-M
Longmier, Benjamin	X-600-M
Lorey, Courtney	C-020-L/P
Lourie, Nathan	A-147-M
Lowe, Ian	A-147-M
Lowitz, Amy	A-379-S
Lubin, Dan	O-325-M
Lundberg, David	D-552-M
Lunning, Nicole	G-058-M
Lutz, Stephen	T-961-M
Maisch, Jordan	B-005-N/P
Makino, Yuya	A-333-S
Mandic, Milica	B-207-M
Marchant, Gary	A-145-M
Marino, John	A-284-M
Marschalek, James	C-447-N
Martin, Hilda	T-299-M/S
Martin, Raymond	D-552-M

Participant	Science Event Number
Mateling, Marian	O-400-M
Matheny, Peter	G-079-E
Mauskopf, Philip	A-147-M
McCarthy, Forrest	C-446-M
McClintock, James	B-027-P
McConville, Glen	O-257-M/S
McDonald, Randall	A-145-M
McFadden, Erin	W-222-M/P
McKnight, Diane	C-509-M
Meister, Matthew	B-041-M
Melville, Robert	A-112-M/S
Merz, Dora	T-396-M
Meyers, John	T-299-M/S
Meyrick, Sam	W-222-M/P
Millan, Robyn	A-145-M
Miller, Hugh	W-222-M/P
Miller, Julie	I-344-E
Millette, Nicole	B-303-N
Miner, Jeremy	T-312-M
Minzoni, Rebecca	C-447-N
Mohamed, Ahmed	A-149-S
Moncelsi, Lorenzo	A-149-S
Moore, Robert	A-111-M/P/S
Moran, Amy	B-307-M
Morgan, Jacob	I-165-M
Morgan, Lauren	A-145-M
Morgan-Kiss, Rachael	C-508-M
Mortenson, Cecelia	C-445-M/N
Morton, Elizabeth	I-165-M
Mowatt, Jennie	O-257-M/S
Mullen, Andrew	C-444-M
Mullenax, Robert	A-145-M
Munley, William	T-961-M

Participant	Science Event Number
Munro, David	O-214-L
Munro, David	X-595-N
Murphy, David	B-198-L/P
Murphy, Neil	A-368-S
Muto, Atsuhiro	C-445-M/N
Myers, Krista	C-511-M
Nardelli, Schuyler	C-019-L/P
Naslund, Andrew	B-207-M
Nati, Federico	A-147-M
Nay, Tyler	T-961-M
Nayak, Michael	A-368-S
Nesbit, Jacob	A-334-M/S
Nesbitt, Ian	I-165-M
Neuhaus, Sarah	I-157-M
Newberger, Timothy	O-214-L
Newberger, Timothy	X-595-N
Newell, Ryan	O-202-L
Nicholas, Charles	C-045-L/P
Nicholls, Keith	C-444-M
Nichols, Erik	A-149-S
Nichols, Ross	C-024-L/P
Niebuhr, Spencer	T-295-M
Nikolaus, Kevin	T-299-M/S
Nitsche, Frank-Oliver	C-447-N
Norton, Taylor	O-283-M
Novak, Giles	A-147-M
Nylen, Thomas	T-295-M
O'Boyle, Shaun	W-468-M/S
O'Connor, Gemma	I-175-M/S
Oehler, Marie	A-333-S
Oliver, Matthew	B-005-N/P
Osborne, Amy	B-307-M
Osburn, Ernest	C-507-M

Participant	Science Event Number
Oswalt, Hannah	B-027-P
Oxborough, Alexis	A-334-M/S
Padin, Stephen	A-379-S
Palladino, Steven	A-149-S
Palo, Scott	A-284-M
Parnikoza, Ivan	G-094-L
Patino, Natalia	C-045-L/P
Paul, Manuel	A-127-M/S
Pautet, Pierre-Dominique	A-119-M/P/S
Pearson, Linnea	B-030-M
Pennycook, Jean	B-031-M
Peone, Christopher	D-552-M
Pernic, David	A-379-S
Petch, Shane	B-009-M
Peterson, Zachary	A-115-M
Pettit, Erin	C-445-M/N
Pettit, Joseph	T-295-M
Plum, Matthias	A-333-S
Pollmann, Anna	A-333-S
Pomraning, Dale	C-445-M/N
Pomraning, Dale	G-078-M
Pomraning, Dale	T-396-M
Ponganis, Katherine	B-197-M
Ponganis, Paul	B-197-M
Pothula, Satyendra	C-507-M
Potts, Leslie	B-046-L
Power, Sarah	C-507-M
Precup, Nathan	A-149-S
Priscu, John	C-505-M
Priscu, John	C-508-M
Pryke, Clement	A-149-S
Quartini, Enrica	B-041-M
Rahlin, Alexandra	A-379-S

Participant	Science Event Number
Rauch, Brian	A-142-M
Reese, Thomas	O-241-M
Reiss, Christian	B-006-L
Reynebeau, Emily	C-508-M
Richard, Jacob	A-145-M
Richard, Mitchell	A-145-M
Riverman, Kiya	C-444-M
Robbins, Rob	B-195-M
Roberts, Darren	C-013-L/P
Roberts, Graham	A-334-M/S
Roberts, John	G-079-E
Roberts, Megan	C-013-L/P
Robinson, Carl	X-599-M
Robinson, David	C-505-M
Roccaro, Alexander	C-445-M/N
Roche, Lauren	G-437-E
Romualdez, Javier	A-147-M
Rosen, Laura	A-118-S
Rosenthall, Gabrielle	C-019-L/P
Rosso, Isabella	O-271-N
Rotella, Jay	B-009-M
Roth, Aurora	T-299-M/S
Roth, James	A-334-M/S
Rothwell, Michael	T-926-M
Rouble, Maclean	A-379-S
Rougeux, Brian	G-058-M
Rundell, Susan	B-234-N
Rupp, Steve	B-195-M
Sakai, Kenichi	A-142-M
Sample, John	A-145-M
Sanders, Robert	B-303-N
Scambos, Theodore	C-445-M/N
Schaefer, Anne	C-013-L/P

Participant	Science Event Number
Schillaci, Alessandro	A-149-S
Schmahl, Lauren	G-437-E
Schmerr, Nicholas	C-530-M
Schmidt, Anne	B-031-M
Schmidt, Britney	C-444-M
Schmitt, Benjamin	A-149-S
Schofield, Oscar	C-019-L/P
Schrage, Kharis	C-020-L/P
Schram, Julie	B-027-P
Schroeder, Frank	A-333-S
Schulte, Nicholas	C-509-M
Schutt, John	G-058-M
Schwantes, Christopher	A-145-M
Schwarz, Robert	A-149-S
Sciacca, Steve	T-961-M
Sclafani, Stephen	A-333-S
Seefeldt, Mark	O-456-M
Seunarine, Surujhdeo	A-118-S
Severinghaus, Jeffrey	D-551-M
Shackleton, Sarah	I-165-M
Shah, Kunal	B-040-M
Shah, Rasikh	T-961-M
Sharpe, Kristen	C-020-L/P
Shaw, Cody	A-368-S
Sheldon, Parnell	C-508-M
Sheridan, Patrick	O-257-M/S
Sherman, Justin	G-078-M
Sherwell, Shasten	C-505-M
Shultz, Andrew	A-333-S
Shumko, Mykhaylo	A-145-M
Shurilla, Christopher	A-368-S
Sicard, Elizabeth	C-511-M
Siegfried, Matthew	C-533-M

Participant	Science Event Number
Simburger, Garry	A-142-M
Simmons, Christopher	C-448-M
Sinclair, Adrian	A-147-M
Sinkola, Nikolas	T-927-M
Slack, Sarah	C-447-N
Smith, James	C-444-M
Snyder, Avery	O-202-L
Soule, Dax	G-437-E
Spangelo, Sara	X-600-M
Spears, Anthony	C-444-M
Spring, Lucas	T-961-M
St Clair, David	O-241-M
St. Leger, Judy	B-197-M
Stapleton, Shawntel	D-552-M
Statscewich, Hank	B-005-N/P
Steckel, Amanda	A-123-M
Steinbach, Bryan	A-149-S
Steinhage, Daniel	I-554-M
Steinke, Kirsten	B-005-N/P
Stelly, Robert	A-145-M
Stephen, Judith	A-379-S
Stevens, Laura	I-151-E
Stierle, Scott	O-257-M/S
Stillinger, Andrew	A-112-M/S
Stone, Michael	C-511-M
Sullivan, David	A-145-M
Sweeney, Colm	X-595-N
Swindle, Thomas	A-368-S
Sylvester, Tom	C-444-M
Takacs-Vesbach, Cristina	C-508-M
Talbert, Joseph	O-202-L
Taylor, Dylan	W-222-M/P
Taylor, Michael	A-119-M/P/S

Participant	Science Event Number
Taylor, Ryan	I-554-M
Thomas, Catrin	X-598-M
Thompson, Andrew	W-222-M/P
Thorsland, Josh	O-283-M
Thurston, Gavin	W-222-M/P
Tochimani-Hernandez, Ivan	Y-610-E
Todgham, Anne	B-207-M
Toh, Ming-Wei	B-307-M
Tosi, Delia	A-333-S
Tosi, Delia	A-334-M/S
Trinh, Rebecca	C-045-L/P
Truffer, Martin	C-445-M/N
Trumble, Stephen	B-232-L
Tuers-Lance, Holly	B-009-M
Tung, Chun Fai	A-333-S
Tytgat, Guy	T-396-M
Vallo, Gilbert	G-090-M/P/S
van Coller, Ian	W-221-M
Vass, Nicholas	T-961-M
Veatch, Jacquelyn	B-005-N/P
Veitch, Stephen	C-446-M
Villalobos, Victor	B-009-M
Villasana, Cesar	A-145-M
Von Lintig, Matthew	T-396-M
Voss, Nicholas	G-090-M/P/S
Walden, John	C-448-M
Wallin, Bruce	C-445-M/N
Wallstrom, Erica	Y-610-E
Walsh, Kasey	C-019-L/P
Walter, Jacob	C-446-M
Walton, Douglas	T-961-M
Ward, Bradley	T-926-M
Ward, Bridget	B-030-M

Participant	Science Event Number
Washam, Peter	B-041-M
Webb, David	A-145-M
Weber, Corey	A-145-M
Weissburg, Marc	B-198-L/P
Weitzner, Emma	B-030-M
Welch, Kathleen	C-506-M
Welhouse, Lee	O-283-M
Welhouse, Lee	O-400-M
Wellner, Julia	C-447-N
Wendell, Edward	T-927-M
West, Andrew	A-142-M
West, Leigh	C-013-L/P
Wheeler, Caleb	A-147-M
Whetu, Mark	C-444-M
Whitmer, Emily	B-030-M
Wilcock, William	G-437-E
Wild, Christian	C-445-M/N
Williams, Cassondra	B-197-M
Williams, Kate	T-961-M
Williams, Keith	T-295-M
Williams, Paul	A-147-M
Willis, Ian	I-151-E
Wilson, Terry	G-079-E
Wiltsee, Laura	C-019-L/P
Winkelman, Andrew	T-396-M
Wisniewski, Paul	A-334-M/S
Wolter, Sonja	O-214-L
Wolter, Sonja	X-595-N
Wong, Gifford	X-594-M/S
Woodward, John	C-443-M
Wooten, Curtis	A-145-M
Wu, Naicheng	C-505-M
Yan, Stephen	I-554-M

Participant	Science Event Number
Yingling, Natalia	C-045-L/P
Young, Edward	A-149-S
Young, Jodi	B-234-N
Young, Matthew	A-379-S
Young, Rachel	C-019-L/P
Young, Tun Jan	C-446-M
Yu, Cyndia	A-149-S
Yu, Zicheng	G-094-L
Zernick, Michael	A-333-S
Zernick, Michael	A-334-M/S
Zhang, Cheng	A-149-S
Zober, Wolfgang	A-142-M