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Icy air reveals human-made methane levels higher than previously believed

By Lindsey Valich, University of Rochester

Vasilii Petrenko and collaborators from several US and international laboratories set up camp on Taylor Glacier in Antarctica. The ice cores they extract here date back nearly 12,000 years. –Credit: University of Rochester photo / Vasilii Petrenko

IN 2011 A TEAM OF RESEARCHERS led by Vasilii Petrenko, an assistant professor of Earth and environmental sciences at the University of Rochester, spent seven weeks in Antarctica collecting and studying 2,000-pound samples of glacial ice cores that date back nearly 12,000 years. The ancient air trapped within the ice revealed surprising new data about methane that may help inform today's policymakers as they consider ways to reduce global warming.

In a new paper published in *Nature*, the researchers report two important findings regarding methane, a powerful greenhouse gas and large contributor to global warming:

- First, the risk that warming will trigger methane release from large natural reservoirs of ancient carbon seems to be low.
- Second, humans are probably contributing more methane to the atmosphere through fossil fuel use and extraction than scientists previously believed.

Reducing methane emissions from fossil fuels may therefore be an even more important factor in reducing global warming.

"Our results are suggesting that anthropogenic (man-made) fossil fuel methane emissions are even larger than previously thought," Petrenko says. "This means we have even more leverage to fight global warming by curbing methane emissions from our fossil fuel use."

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Today's atmosphere contains methane that is emitted naturally — from wetlands, wildfires, or ocean and land seeps — and methane emitted from human activities like fossil fuel extraction and use, raising livestock, and generating landfills, with human-emitted methane accounting for 60 percent or more of the total.

Scientists are able to accurately measure the total methane level in the atmosphere and how this has changed over the last few decades.

The challenge? Breaking down this total into the specific sources.

"We know rather little about how much methane comes from different sources and how these have been changing in response to industrial and agricultural activities or because of climate events like droughts," says Hinrich Schaefer, an atmospheric scientist at the National Institute of Water and Atmospheric Research (NIWA) in New Zealand, where a key part of the sample processing took place. "That makes it hard to understand which sources we should target specifically to reduce methane levels."

Scientists can use measurements of different isotopes of methane (methane molecules with atoms of slightly different mass) to fingerprint some of the sources. But even this approach doesn't always work because the isotope "signatures" of some sources can be very similar. For instance, fossil methane is methane emitted from ancient hydrocarbon deposits, typically found at sites rich in fossil fuels. Fossil methane that leaks naturally from these sites — "geologic methane" — has an isotope signature that is identical to fossil methane emitted when humans drill gas wells.

Separating the natural and anthropogenic sources and estimating how much humans emit has therefore proven difficult.

In order to better understand the natural and anthropogenic components of fossil methane, Petrenko and his team turned to the past.

As part of the University of Rochester's Department of Earth and Environmental Sciences and the Center for Energy and the Environment, Petrenko's lab is dedicated to understanding how both natural and man-made greenhouse gases respond to climate change. They analyze how past climate changes have affected greenhouse gases over time and the ways in which these gases might respond to future warming temperatures.

Vasilii Petrenko loading an ice core into the melting chamber for extraction of trapped ancient air. –Credit: Xavier Fain

In this case, Petrenko and collaborators from several US and international laboratories, with support from the National Science Foundation, studied past atmospheric records using ice cores extracted from Taylor Glacier in Antarctica. These cores date back nearly 12,000 years.

Every year that it snows in Antarctica, the current snow layer weighs on the previous layer, compacting over hundreds or thousands of years to eventually form layers of ice. These ice layers contain air bubbles, which are like tiny time capsules; using vacuum pumps and melting chambers, researchers are able to extract the ancient air contained within these bubbles and study the chemical compositions of the ancient atmosphere.

Humans did not begin using fossil fuels as a primary energy source until the Industrial Revolution in the 18th century. Because of this, 12,000-year-old ice cores contain no fossil methane originating from human activities; fossil methane levels are based solely on methane emitted from natural sources. Natural geologic methane emissions of the past are thought to be comparable to natural emissions today, so studying ice cores allows researchers to very accurately measure these levels, separate from their

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Upcoming Meetings

2017 AGU Fall Meeting
11-15 December 2017
New Orleans, Louisiana, USA
http://fallmeeting.agu.org/2017/

Scientific Drilling in the Polar Regions - AGU Town Hall Meeting
12 December 2017
AGU Fall Meeting, New Orleans, LA, USA
http://fallmeeting.agu.org/2017/

14th International Conference on the Physics and Chemistry of Ice (PCI- 2018)
8-12 January 2018
Zurich, Switzerland
http://indico.psi.ch/conferenceDisplay.py?confId=5120

International Symposium on Cryosphere and Biosphere
14-19 March 2018
Kyoto, Japan
https://www.igsoc.org/symposia/2018/kyoto/

European Geosciences Union General Assembly 2018
8-13 April 2018
Vienna, Austria
https://www.egu2018.eu/

35th SCAR Open Science Conference
15-27 June 2018
Davos, Switzerland
http://www.polar2018.org/

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anthropogenic counterparts.

"Going back before any anthropogenic activities — before the Industrial Revolution — simplifies the picture and allows us to estimate natural geologic sources very accurately," Petrenko says.

The natural geologic methane levels the research team measured were three to four times lower than previously estimated numbers. If the natural geologic methane emissions are lower than expected, the anthropogenic fossil methane emissions must be higher than expected — Petrenko estimates by 25 percent or more.

The study also suggests that the risk of methane release from natural ancient carbon reservoirs is lower than previously thought. Scientists have raised the possibility that global warming could release methane from very large ancient carbon reservoirs such as permafrost and gas hydrates — ice-like forms of methane in the sediments at the bottom of the ocean. These become less stable as temperatures increase. If climate change from burning fossil fuels were to trigger large emissions of methane to the atmosphere from these old carbon reservoirs, this would lead to even more warming.

"The ancient air samples reveal that these kinds of scenarios regarding natural methane emissions are not as important to take into account for future planning," Petrenko says. "In contrast, anthropogenic fossil fuel emissions seem to be even larger than we previously thought so reducing these levels has more leverage to mitigate global warming."

This article originally appeared at http://www.rochester.edu/newscenter/man-made-methane-emission-levels-larger-previously-believed-263912/

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The U.S. National Ice Core Laboratory (NICL) is a facility for storing, curating, and studying meteoric ice cores recovered from the glaciated regions of the world. It provides scientists with the capability to conduct examinations and measurements on ice cores, and it preserves the integrity of these ice cores in a long-term repository for current and future investigations. NICL is funded by the National Science Foundation and operated by the U.S. Geological Survey. Scientific management is provided by the University of New Hampshire.

In-Depth is published semi-annually by the **National Ice Core Laboratory - Science Management Office (NICL-SMO)**. We are interested in project stories and news from the ice coring community. Please contact us if you are interested in submitting a story or news item to *In-Depth*.

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A summer job in sub-zero temperatures

By Ula Chrobak, CU Boulder Today

THE THERMOSTAT MAY READ 90 DEGREES Fahrenheit outside the sprawling federal research complex in Lakewood, Colorado, but inside, CU Boulder undergraduate student Casey Vanderheyden is donning a bulky winter coat, gloves and boots as though she is headed to the South Pole.

In a sense, she is. Vanderheyden is reaching the end of her six-week summer work stint at the National Ice Core Laboratory (NICL), one of the country's most prominent storage facilities for ice samples collected from around the world. Inside the deep freeze room — which is kept as cold as a crisp minus-36 degrees Celsius — cylindrical tubes of ice cores line the shelves in a vast archive that, cumulatively, represents a sizable amount of U.S. polar research dating back decades.

Vanderheyden's job is to chop up these ice cores. Inside the work room (itself about minus-20 degrees Celsius), she saws slices off a 3-foot-long piece, creating many thinner cores of varying sizes. The cores, which were taken from the South Pole ice core project, will be divvyed up and sent out to other institutions nationally, including CU Boulder's Institute of Arctic and Alpine Research (INSTAAR). Vanderheyden takes frequent breaks to rest and eat snacks in the break room (since working in such cold temperatures burns more calories). At the end of the day, she sometimes sports both an ice burn and sunburn on her face.

"It's gotten a lot of interesting inquiries," she said about her job. "Everyone's like 'what are you doing?'. . . I've always wanted to bring my friends and be like 'step in the freezer, it's really cool!'"

Why work in a freezer during the heat of summer? Vanderheyden and seven other CU Boulder students are contributing to a national effort to collect and analyze ice cores to create a record of past atmospheric conditions. They are preparing the ice samples now and will later monitor them as they are melted and analyzed for their oxygen isotope levels — a chemical signature that can tell us about temperatures dating back hundreds of thousands of years. Not only are the students creating a climate record, they are gaining valuable research experience and insight into their own future goals.

Most of the students at NICL are geology, environmental science or environmental engineering majors. They found out about the job through department postings or class tours of the Stable Isotope Lab. Vanderheyden's a bit of an outlier — a senior in chemical and biological engineering (her roommate shared the job posting with her).

"I figured it would be a really different kind of opportunity from things that I've done in my major, and I've found it to be incredibly educational and I've learned so many things," she said.

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A summer job in sub-zero temperatures

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From May to late June, Vanderheyden and the other students worked at NICL chopping up the ice cores, which are up to 50,000 years old. The ice cores, she said, are like fossils that store ancient climate information. Researchers have analyzed ice from Antarctica dating back over 800,000 years. Each meter of ice holds the history of snowfall from where it was collected – a time capsule of trapped gases from thousands of years ago. Variations in the ice's chemistry, dust and trapped air bubbles tell a story about past climates, plant life and volcanic eruptions.

A few weeks later, Vanderheyden arrives at INSTAAR's Stable Isotope Lab to — quite literally — watch the ice melt. The core rests vertically in a clear tube, its end located on a warm metal plate. The ice slowly melts and the water is transferred through a tangle of tiny tubes, filtered and "de-bubbled" and sent to a device that vaporizes the sample and shoots lasers through it. The process reveals the amounts of O^{16}, O^{17} and O^{18} isotopes, which are illustrated on an adjacent computer.

The isotope data helps build a detailed record of past temperatures in Antarctica, and is central to all other ice core analyses, like dust, volcanic events and trapped gases. The amount of these isotopes is directly proportional to the temperature at the time when the snow fell on the ice sheet. During warmer periods, O^{18} levels are higher. Therefore, by knowing the age of the sample and the isotope ratio, researchers can tell what the climate was like thousands of years ago.

"Casey are her undergraduate colleagues are a really critical part of our research operation here," said INSTAAR Bruce Vaughn, who manages the Stable Isotope Lab. "I feel fortunate to be able to offer this kind of experience to the undergraduates because it really takes over where the classroom leaves off."

"I see myself as part of the legwork that goes into this end goal of a map of information that is used to make future decisions or analyze how things are changing in the world," said Vanderheyden. "I feel like I'm part of a team that's getting information for the future."

While much of her job seemingly consists of rote tasks and monitoring, she must be prepared to act quickly and decisively in the event of an emergency. The ice cores are irreplaceable and the equipment is expensive. If, for example, a tube carrying the melted ice were to get clogged or the small freezer containing the core were to fail, ancient climate information may be lost forever.

"The name of game is basically to keep the machine running," said Owen Van De Graaf, a senior majoring in geology who works alongside Vanderheyden. "Very few bad things happen, but when they do, it's terrible and you have to work really hard."

Vanderheyden and Van De Graaf worked as team for the first week at INSTAAR, putting in a daily shift from 8:30 a.m. to 2:30 p.m. But soon, now that she is trained up, she'll be "melting" alone. "It's scary, the thought you could lose some of it if you mess up," she said.

But, with careful monitoring, the worst-case scenario is that she'll have to stop the experiment and return the ice to safety in the freezer.

The students are excited about their futures. Vanderheyden

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A summer job in sub-zero temperatures

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always imagined herself getting into medical research, working with tissue and cells. But she was surprised how relevant her knowledge in chemistry was for studying ice cores.

"It's definitely given me a better idea of the sorts of things that are out there," she said.

Vanderheyden said that she definitely wants to pursue some type of research in the future, although not necessarily atmosphere-related.

For Van De Graaf, the experience helped him narrow down his options in the field of geology, where people study many things like water, oil and gas, and the atmosphere. He's excited to keep helping the Earth by studying the climate and contributing to a detailed record that can aid in future policy. He's also made connections with climate researchers from many universities.

The two now encourage their fellow students to apply for research jobs. They point out that the lab welcomes students of all class years, including freshmen. Both appreciated the opportunity to get involved with world-class research as undergraduates.

"A lot of times, you feel like as a freshman, there's no way I'm going to be able to work with professors or researchers. But it really is something you can do," said Vanderheyden.

To her, working in a freezer is worth it to be at the forefront of climate change research.

"I'm not just standing back and watching the research, I'm actually contributing and learning what the research is going towards."

This article originally appeared at http://www.colorado.edu/today/2017/08/15/summer-job-sub-zero-temperatures

The South Pole ice core project is funded by the National Science Foundation under grant numbers 1142517, 1141839, and 1142646. The National Ice Core Laboratory is funded by the National Science Foundation through an Interagency Agreement (PLR-1306660) to the U.S. Geological Survey.

Massive Antarctic volcanic eruptions linked to abrupt southern hemisphere climate changes near the end of the last ice age

New findings explain synchronous deglaciation that occurred 17,700 Years Ago

By Joe McConnell, Roger Kreidberg, and Justin Broglio, Desert Research Institute

NEW FINDINGS PUBLISHED in the *Proceedings of the National Academy of Sciences of the United States of America (PNAS)* by Desert Research Institute (DRI) Professor Joseph R. McConnell, Ph.D., and colleagues document a 192-year series of volcanic eruptions in Antarctica that coincided with accelerated deglaciation about 17,700 years ago.

"Detailed chemical measurements in Antarctic ice cores show that massive, halogen-rich eruptions from the West Antarctic Mt. Takahe volcano coincided exactly with the onset of the most rapid, widespread climate change in the Southern Hemisphere during the end of the last ice age and the start of increasing global greenhouse gas concentrations," according to McConnell, who leads DRI's ultra-trace chemical ice core analytical laboratory.

Climate changes that began ~17,700 years ago included a sudden poleward shift in westerly winds encircling Antarctica with corresponding changes in sea ice extent, ocean circulation, and ventilation of the deep ocean. Evidence of these changes is found in many parts of the Southern Hemisphere and in different paleoclimate archives, but what prompted these changes has remained largely unexplained.

"We know that rapid climate change at this time was primed by changes in solar insolation and the Northern Hemisphere ice sheets," explained McConnell. "Glacial and interglacial cycles are driven by the sun and Earth orbital parameters that impact solar insolation (intensity of the sun's rays) as well as by changes in the continental ice sheets and greenhouse gas concentrations."

"We postulate that these halogen-rich eruptions created a stratospheric ozone hole over Antarctica that, analogous to the modern ozone hole, led to large-scale changes in atmospheric circulation and hydroclimate throughout the Southern Hemisphere," he added. "Although the climate system already was primed for the switch, we argue that these changes initiated the shift from a largely glacial to a largely interglacial climate state. The probability that this

Monica Arienzo, Ph.D., an assistant research professor of hydrology at DRI, loads an 18,000-year-old sample of the WAIS Divide ice core for continuous chemical analysis using DRI's ultra-trace ice core analytical system in Reno, Nevada. –Credit: DRI Professor Joseph R. McConnell, Ph.D.

was just a coincidence is negligible."

Furthermore, the fallout from these eruptions – containing elevated levels of hydrofluoric acid and toxic heavy metals – extended at least 2,800 kilometers from Mt. Takahe and likely reached southern South America.

How Were These Massive Antarctic Volcanic Eruptions Discovered and Verified?

McConnell's ice core laboratory enables high-resolution

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Massive Antarctic volcanic eruptions linked to abrupt southern hemisphere climate changes near the end of the last ice age

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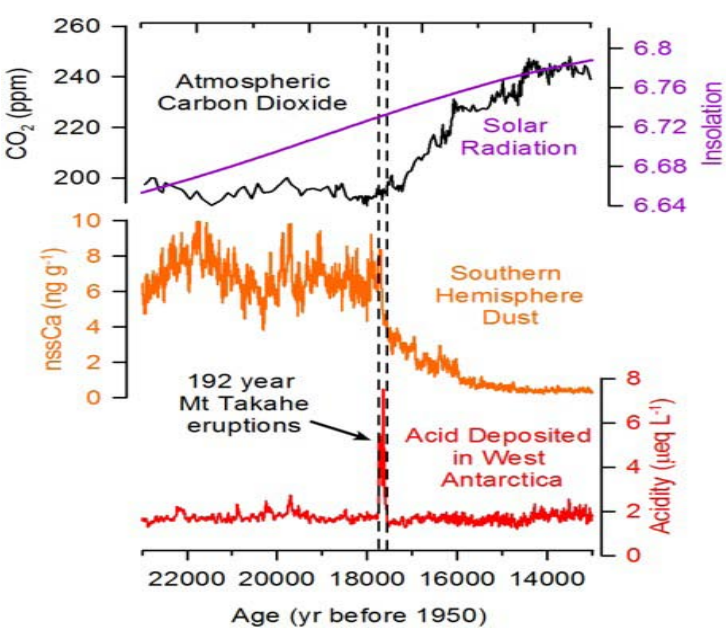
measurements of ice cores extracted from remote regions of the Earth, such as Greenland and Antarctica. One such ice core, known as the West Antarctic Ice Sheet Divide (WAIS Divide) core was drilled to a depth of more than two miles (3,405 meters), and much of it was analyzed in the DRI Ultra-Trace Laboratory for more than 30 different elements and chemical species.

Additional analyses and modeling studies critical to support the authors' findings were made by collaborating institutions around the U.S. and world.

"These precise, high-resolution records illustrate that the chemical anomaly observed in the WAIS Divide ice core was the result of a series of eruptions of Mt. Takahe located 350 kilometers to the north," explained Monica Arienzo, Ph.D., an assistant research professor of hydrology at DRI who runs the mass spectrometers that enable measurement of these elements to as low as parts per quadrillion (the equivalent of 1 gram in 1,000,000,000,000,000 grams).

"No other such long-lasting record was found in the 68,000-year WAIS Divide record," notes Michael Sigl, Ph.D., who first observed



This figure shows that the massive, halogen-rich eruptions of Mt. Takahe exactly coincided with onset of the most abrupt, widespread period of Southern Hemisphere climate change and increasing greenhouse gas concentrations during the end of the last ice age. –Credit: DRI Professor Joseph R. McConnell, Ph.D.

the anomaly during chemical analysis of the core. "Imagine the environmental, societal, and economic impacts if a series of modern explosive eruptions persisted for four or five generations in the lower latitudes or in the Northern Hemisphere where most of us live!"

Discovery of this unique event in the WAIS Divide record was not the first indication of a chemical anomaly occurring ~17,700 years ago.

"The anomaly was detected in much more limited measurements of the Byrd ice core in the 1990s," notes McConnell, "but exactly what it was or what created it wasn't clear. Most previous Antarctic ice core records have not included many of the elements and chemical species that we study, such as heavy metals and rare earth elements, that characterize the anomaly – so in many ways these other studies were blind to the Mt. Takahe event."

DRI's initial findings were confirmed by analysis of replicate samples from WAIS Divide, producing nearly identical results.

"We also found the chemical anomaly in ice from two other Antarctic ice cores including archived samples from the Byrd Core available from the University of Copenhagen and ice from Taylor Glacier in the Antarctic Dry Valleys," said Nathan Chellman, a graduate student working in McConnell's laboratory.

Extraction of the WAIS Divide ice core and analysis in DRI's laboratory were funded by the U.S. National Science Foundation (NSF).

"The WAIS Divide ice core allows us to identify each of the past 30,000 years of snowfall in individual layers of ice, thus enabling detailed examination of conditions during deglaciation," said Paul Cutler, NSF Polar Programs' glaciology program manager. "The value of the WAIS Divide core as a high-resolution climate record is clear in these latest results and is another reward for the eight-year effort to obtain it."

This article originally appeared at http://www.dri.edu/newsroom/news-releases/5566-massive-antarctic-volcanic-eruptions-linked-to-abrupt-southern-hemisphere-climate-changes-near-the-end-of-the-last-ice-age

Dr. Julie Palais awarded Richardson Medal

Dr. Julie Palais inside the drilling tent for the South Pole ice core project during the 2015-16 Antarctic field season.

THE INTERNATIONAL GLACIOLOGICAL SOCIETY (IGS) has [awarded the Society's Richardson Medal to Dr. Julie Palais](), a long standing member of the IGS.

Dr. Palais has made extraordinary contributions to glaciology through establishment and decades of facilitation of glaciological and ice core science in the U.S., and in addition she has facilitated the establishment and international leadership of the [International Partnerships in Ice Core Sciences (IPICS)]() in 2004, early in the planning for the International Polar Year. The glaciology and ice core science communities have produced groundbreaking discoveries that would not have been possible without the insightful and steadfast advocacy by Dr. Palais through her service at the [National Science Foundation]().

Dr. Palais began working in glaciology and ice core science during her graduate research at Ohio State. Her research for her Master's degree focused on depositional and diagenetic processes influencing firn stratigraphy at Dome C, Antarctica; this served as a catalyst for her PhD research at Ohio State, which focused on tephra layers and ice chemistry in the Byrd Station ice core. She continued in research and academia as faculty at the University of New Hampshire. Dr. Palais was productive in publishing a variety of discoveries that she made on the topic of volcanic records in ice cores from both the Antarctic and Arctic Ice Sheets. Her strong background in glaciology and ice core science became a key asset for the National Science Foundation when she began her work there.

For over 26 years, Dr. Palais served as a Program Director at the NSF, managing peer-review processes and reviews, coordinating interdisciplinary coalitions of scientists to encourage scientific collaborations, including serving as Antarctic Glaciology Program Director. In this

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Dr. Julie Palais awarded Richardson Medal

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Dr. Julie Palais (middle) with Dr. Kendrick Taylor (left) and Bruce Vaughn (right) outside of the arch for the WAIS Divide ice core project during the 2008-09 Antarctic field season.

capacity her scientific vision, collaborative style and personal influence served to nurture and grow the ice core science program in the U.S., and also she fostered international collaboration in ice core sciences. Not only was she successful in finding creative ways to make the most efficient and effective use of NSF resources, but Dr. Palais was always very responsive to, and an advocate for the scientific community. As a result, the Antarctic Glaciology Program that Dr. Palais led at NSF has been one of the most productive and impactful programs within the NSF. Through her service to the scientific community while at NSF, Dr. Palais fostered groundbreaking discoveries of importance to all society.

Dr. Palais has been recognized through a number of awards, including the Chateaubriand Fellowship by the government of France, the U.S. Antarctic Service Medal, and the Lowell Thomas Award from the Explorer's Club. In recognition of her prominence, Palais Bluff and Palais Glacier in Antarctica are named after Dr. Julie Palais. Dr. Palais is internationally recognized in glaciology.

As a productive scientist, as a senior NSF Program Director whose groundbreaking efforts established a strong, internationally-coordinated U.S. ice core research program, and as an internationally recognized glaciologist and ice core scientist, Dr. Julie Palais has made outstanding service contributions to the U.S. and international glaciological and climate science communities.

This article originally appeared at https://www.igsoc.org/awards/richardson/palais.html

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LC-130 Skibird aircrews train for polar operations

By Air Force Master Sgt. Catharine Schmidt, 109th Airlift Wing, U.S. Department of Defense News

An LC-130 Hercules "Skibird " from the New York Air National Guard's 109th Airlift Wing takes off from Raven Camp near Kangerlussuaq, Greenland, July 28, 2017. Raven Camp is used to train aircrews on LC-130 operations in arctic conditions. –Credit: New York Air National Guard photo by Senior Master Sgt. Willie Gizara

KANGERLUSSUAQ, Greenland, Aug. 2, 2017 — With 10 of the world's only ski-equipped LC-130 Hercules aircraft, commonly referred to as a Skibird, the New York Air National Guard's 109th Airlift Wing is able to provide the airlift needed to get to remote locations in Antarctica and Greenland in support of the National Science Foundation.

It's a mission unique to the wing and one that requires specialized training. While upstate New York, where the unit is based, is known to have some brutal winter weather, it still isn't enough to get these aircrews trained to land and take off on snow and ice.

That's where Raven Camp comes in. Located 108 miles southeast of Kangerlussuaq, Greenland, on the Greenland ice cap, the is where aircrews get the specialized training required to fly in and out of some of the world's most austere locations. It's also the location of Kool School's field portion -- three days to learn arctic survival skills.

Practice, Practice, Practice

With 50 training missions already completed since the Greenland season began in April, the aircrews are well on their way to being ready to fly in Antarctica.

"We'll get them out to that snowfield, and we'll work on our takeoffs and landing," said Air Force Maj. Justin Garren, 139th Airlift Squadron's Greenland Operations chief. "We'll work on special procedures on the ground for the loadmasters to load and unload on the snow."

Air Force Maj. Dia Ham, a ski mission co-pilot student with the 139th Airlift Squadron, is no stranger to flying the traditional C-130 Hercules, but flying the Skibird is something new. She transferred to the unit after about 10 years on active duty, and flew her first Skibird training mission on the ice cap July 27.

"There's a level of nervousness," she said about her first time flying to Raven Camp. "You plan for it and you hear the stories, but it was so exciting to finally see it myself with my own eyes and be in the seat."

Ham went on to say that while pilots learn the procedures and steps to follow for landing an aircraft in snow, nothing compares to actually doing it for the first time.

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LC-130 Skibird aircrews train for polar operations

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A cargo pallet lands in the snow behind an LC-130 Hercules "Skibird" as New York Air National Guardsmen assigned to the 109th Airlift Wing deliver supplies to scientists at the East Greenland Ice Core Project, July 29, 2017. –Credit: New York Air National Guard photo by Senior Master Sgt. William Gizara

"There's no way to change the steps that we follow or the procedures or the sequence of events -- but you can't prepare for landing on skis," she said.

Loadmaster Training

While aircrews are training on the flight deck, loadmasters are training in the back of the aircraft.

Because of the remote locations for some of the camps the wing supports, loadmasters must be able to perform combat offloads -- unloading cargo while the aircraft is moving with the ramp lowered just 18 inches above the snow.

"It's very important to learn the technique and get it right," said Air Force Master Sgt. Randy Powell, a loadmaster instructor who has been training students this season.

"There's a lot you have to learn really quickly," said Air Force Airman 1st Class Taylor Richards, a student loadmaster who is on his second trip here this season. "The stuff that we do, they can't teach you in loadmaster school because it's only stuff that we do [in this unit]. There are only about 60 loadmasters in the unit, and we're the only ones in the world who do this, so there's a little bit of a learning curve."

"[Raven Camp] is where we do a lot of our practice and learning," Ham said. "Antarctica is all missions -- there's no time to do multiple landings or try things out. The training here is so valuable."

The unit is currently on its fifth rotation of the Greenland season, which began in April and will end in September. About 80 airmen and three to four Skibirds are here for each rotation throughout the summer.

This article originally appeared at https://www.defense.gov/News/Article/Article/1264863/lc-130-skibird-aircrews-train-for-polar-operations/

109th takes off to support 30th ODF season

By Staff Sgt. Stephanie J. Lambert, 109th AW Public Affairs, 109th Airlift Wing News

An LC-130 Skibird takes off from Stratton Air National Guard Base, Scotia, N.Y., to begin the journey to McMurdo Station, Antarctica, on Oct. 17, 2017. This is the 30th season that the unit will participate in Operation Deep Freeze, the military component of the U.S. Antarctic Program, which is managed by the National Science Foundation. –Credit: U.S. Air National photo by Senior Master Sgt. William Gizara

STRATTON AIR NATIONAL GUARD BASE, N.Y. --

The hum of an LC-130 Skibird taking off on a crisp upstate New York morning marked the 109th Airlift Wing's annual migration south on Oct. 17.

Two LC-130 aircrews, transporting supplies and equipment, began the first leg of a five-leg journey to McMurdo Station, Antarctica, to provide logistical support to the National Science Foundation.

The primary mission of the New York Air National Guard's 109th AW is to provide airlift within Antarctica to support science research.

The wing flies the LC-130 ski-equipped aircraft; the only one of its kind in the U.S. military, able to land on snow and ice.

The U.S. military provides logistics support with ships and aircraft to the National Science Foundation annually under the designation Operation Deep Freeze.

These aircraft were the third and fourth to depart from the base here. The first and second flew out on Oct. 13 and 16.

Flying in the Antarctic is challenging, according to LC-130 pilots.

“The weather is our biggest challenge there, if a storm rolls in you can't take off,” said Maj. Suzanne Nielson, LC-130 pilot.

“There's always something that comes up over the year but our training prepares us for anything,” said Col. Robert Donaldson, 109th Maintenance Group commander.

The start of this season coincides with the first week of Col. Michele Kilgore's command of the 109th AW. Kilgore took command of the wing during a ceremony Oct. 15.

“What a great way to start my first week,” said Kilgore. “It's great to be a part of such a unique mission.”

Kilgore is slated to go for the first time in support of ODF later on this season.

Approximately 120 Airmen will be deployed on the ice at any one time with about 500 Airmen deploying throughout the season. Five aircraft will provide support.

Throughout the ODF support season, which runs through February, the wing plans to fly between 200 and 250 missions.

During the 2016-17 season, the 109th flew an estimated 2,550 researchers and support staff plus about 3 million pounds of cargo and 2 million pounds of fuel to research stations across the continent.

Operation Deep Freeze is the military component of the U.S. Antarctic Program. The 109th has supported the National Science Foundation since 1988 and been the sole provider of this type of airlift since 1999.

This article originally appeared at http://www.109aw.ang.af.mil/News/Article-Display/Article/1345395/109th-takes-off-to-support-30th-odf-season/

National Science Foundation Projects Related to

Ice Cores or Ice Core Data

The table below shows projects related to ice core research that have been funded by the National Science Foundation (NSF) since the last issue of In-Depth was published. To learn more about any of the projects listed below, go to the NSF Award Search page (http://www.nsf.gov/awardsearch/) and type in the NSF Award Number. If you have a newly-funded NSF project that was omitted from this listing, please let us know and we will add it to the next issue of In-Depth.

Title of the Funded Project	Investigator	Award Number
A High Resolution Atmospheric Methane Record from the South Pole Ice Core	Brook, Ed	1643722
Collaborative Research: Borehole Logging to Classify Volcanic Signatures in Antarctic Ice	Bay, Ryan Talghader, Joseph	1644210 1643864
Collaborative Research: P2C2--Drivers for Past Variability in Tropospheric Reactive Halogens: Implications for Climate and Evaluation of Ice Core Proxies	Alexander, Becky Murray, Lee	1702266 1702106
Collaborative Research: P2C2--ICECAP (Ice Age Chemistry and Proxies) Phase 3: Investigating Fire Activity and its Implications for Climate Across Multiple Timescales	McConnell, Joseph Mickley, Loretta	1702830 1702814
Collaborative Research: Synchronizing the WAIS Divide and Greenland Ice Cores from 30-65 ka BP Using High-resolution 10Be Measurements	Caffee, Marc Welten, Kees	1644094 1644128
Collaborative Research: The Timing and Spatial Expression of the Bipolar Seesaw in Antarctica from Synchronized Ice Cores	Buizert, Christo Steig, Eric	1643394 1643355
Ethane Measurements in the Intermediate Depth South Pole Ice Core (SPICECORE)	Aydin, Murat	1644245
Inter-Hemispheric Climate Teleconnections in response to Massive Iceberg Discharge in the North Atlantic	Buizert, Christo	1702920
MRI: Acquisition of a Thermal Ionization Mass Spectrometer for High-Precision Geochronology and Isotope Geology	Schoene, Blair	1726099
Understanding the Integrity of Deep Ice in East Antarctica from Geophysical Data Sets and Physical Models	Creyts, Timothy	1643970

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Masthead photos courtesy of Lonnie Thompson and Michael Morrison