



# deep drilling

The ice sheets of Greenland and Antarctica comprise snow that fell in the distant past, carrying chemicals, dust

particles, and samples of atmospheric gas along with it. By drilling out cores of ice, scientists can analyze the chemical and gaseous samples locked away in the ancient snow to improve our understanding of how and why climate changed in response to natural processes long before humans began significantly altering the gasses in the atmosphere during the past 150 years. This, in turn, will allow researchers to make better predictions of how climate will change in response to future human impact.

For 15 years, environmental researchers have been talking about obtaining a deep ice core from Antarctica so that they can study greenhouse gas concentrations and climate change in the southern hemisphere during the past 100,000 years. There are several ice cores from Greenland that have high time-resolution records for the last 100,000 years, but none from Antarctica. Thanks to a 5-year grant from the National Science Foundation, ice core researchers in the U.S., led by Ken Taylor, a researcher at the Desert Research Institute of the University of Nevada, will obtain a deep Antarctic ice core with the high time resolution required to compare northern and southern hemisphere climate changes. The drilling will be performed by the Ice Coring and Drilling Services group at the University of Wisconsin—Madison, whereas the science will be conducted by about 10 research teams consisting of dozens of investigators and a bevy of post-docs, graduate students, technicians, and undergrads.

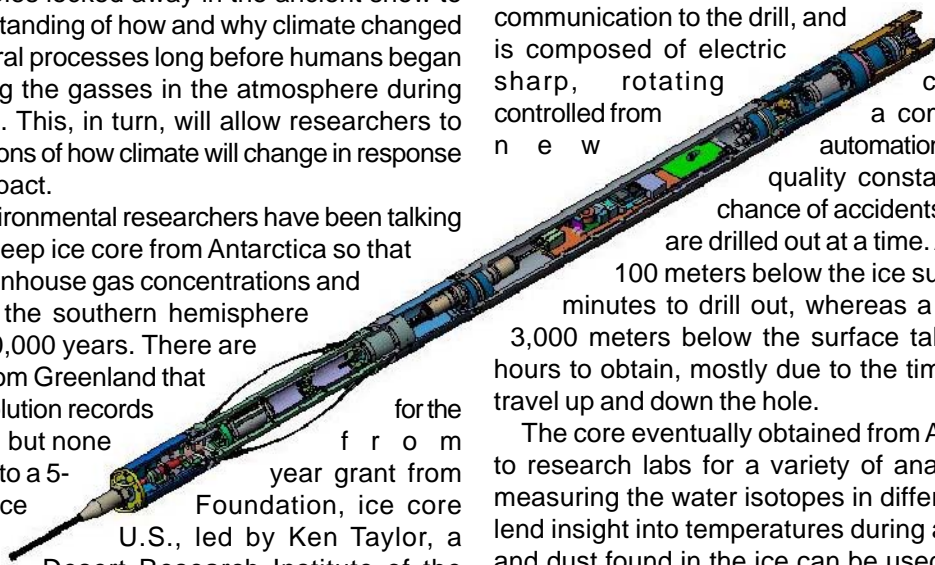
During the summers from 2007 to 2011, researchers will collect a 3,450-meter-long ice core from the West Antarctic ice sheet. Before they can do this, however, they need to test a new drill that is being built for this project. “The mechanical properties of the ice at Summit, Greenland, are similar to our site in Antarctica, but operations at Summit are less expensive than in Antarctica. We will test the drill and optimize our procedures at Summit, which already has a lot of infrastructure, before we go to our really remote site in Antarctica,” says Taylor.

Ice coring drills are completely different than drills used for water or oil wells. The new ice drill represents a major advance in ice core drilling technology, because it includes the best features of other ice coring drills and adds a few new features as well. Taylor says that next year’s test of the drill in Greenland is really a research project on drilling technology within a research project on climate change: “This

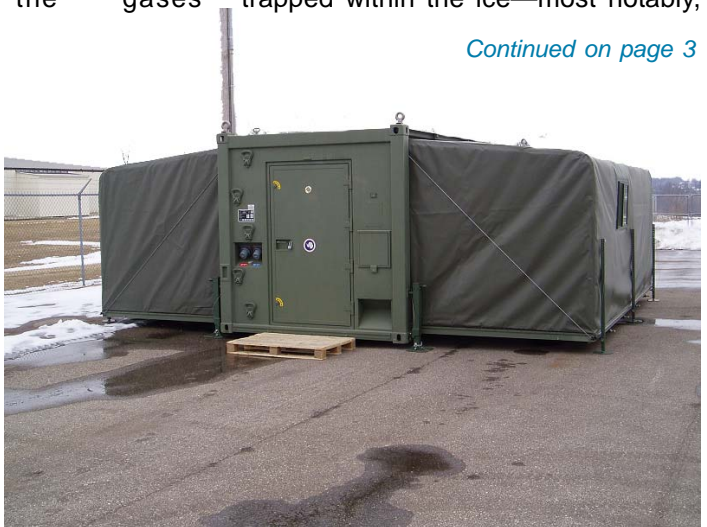
is the first time we can conduct experiments to improve the drilling process without having to worry about damaging ice that we will use for scientific studies. We will experiment to find out what combination of drill speed, drill weight, and cutter type yields cores that have the least number of fractures.”

The drilling equipment includes a winch about the size of 2 pick-up trucks, a cable that runs down the hole that lifts the drill and provides electrical power and fiber optic communication to the drill, and the drill itself, which is composed of electric sharp, rotating cutters. The drill is controlled from a computer outfitted with automation that will improve core quality constancy and reduce the chance of accidents. Four meters of core are drilled out at a time. A core extracted from 100 meters below the ice surface takes about 20 minutes to drill out, whereas a core extracted from 3,000 meters below the surface takes approximately 2 hours to obtain, mostly due to the time it takes the drill to travel up and down the hole.

The core eventually obtained from Antarctica will be sent to research labs for a variety of analyses. For example, measuring the water isotopes in different layers of ice can lend insight into temperatures during a given period. Salts and dust found in the ice can be used to infer wind speed that blew seawater and dirt from distant locations. Studying the gases trapped within the ice—most notably,



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*Top: Drill design graphic. Bottom: The portable machining and electrical shop that travels with the ice coring drill.*

For more information about this research, check out the following links:  
<http://www.dri.edu/People/kendrick/>  
<http://www.ssec.wisc.edu/icds/projects/waiscores.html>

# GREENLAND News From the Field...

**Kangerlussuaq** The Kanger crew enjoyed several days of strong winds this week that drove down the omnipresent mosquitoes (Yippee!!) VPR construction manager Mark Begnaud is currently at the helm of VPR's Kangerlussuaq operation, with the able assistance of carpenter Dave Ricke, while Greenland logistics manager Robin Abbott and cargo coordinator Ed Stockard spend a bit of time stateside. The office is busy coordinating support for two big remote field projects, handling resupply requests for Summit, and preparing for the upcoming frenzy of activity in July.

This week saw the Kangerlussuaq arrival of Severinghaus co-PI Ed Brook, en route to the team's field site at Pakitsoq via Ilulissat. Also on his way to Ilulissat was BBC cameraman John Atchinson, heading there to film an interview with the project's field coordinator Paul Rose. More on the Severinghaus/Brook project at [http://www.vecopolar.com/arlss\\_reports/arlss\\_projectsdetail.asp?cbPropNum=0221470](http://www.vecopolar.com/arlss_reports/arlss_projectsdetail.asp?cbPropNum=0221470).

A Lemoine/Darwent team member also traveled through Kangerlussuaq on her way to meet up with her teammates in Qaanaaq. Early next week the group will embark on a month-long field expedition to conduct a systematic archaeological survey of the Inglefield Land area. More at [http://www.vecopolar.com/arlss\\_reports/arlss\\_projectsdetail.asp?cbPropNum=0328773](http://www.vecopolar.com/arlss_reports/arlss_projectsdetail.asp?cbPropNum=0328773).

On Thursday the Kangerlussuaq police department used the KISS facility for a training activity during which fifteen policemen and their police dogs came through the building. We're happy to report that no VPR employees were bitten, arrested, or otherwise injured during the event.

Visit the following web sites for more information about research and operations at Summit Station:  
<http://summitcamp.org> <http://www.geosummit.org>

**Summit Station** Some actual drilling in support of the DISC (Deep ice Sheet Coring) project got underway after the tent was finished off and the gantry crane put in place. The drill team completed a density core to give them an idea of how well the snow layered during pad construction. They also conducted tests to determine how far down they will have to encase the hole before the ice is sufficiently dense to contain the ISOPAR-K drilling fluid in the hole. They discovered that 70m is not dense enough and are now targeting 100m. Finally, the drillers reached 100m with the two ECLIPSE drills they are testing at Summit. More at [http://www.vecopolar.com/arlss\\_reports/arlss\\_projectsdetail.asp?cbPropNum=0003289](http://www.vecopolar.com/arlss_reports/arlss_projectsdetail.asp?cbPropNum=0003289) and [http://www.vecopolar.com/arlss\\_reports/arlss\\_projectsdetail.asp?cbPropNum=0230396](http://www.vecopolar.com/arlss_reports/arlss_projectsdetail.asp?cbPropNum=0230396)

In preparation for the Big House lift in late July, Summit enabled remote control of the VSAT (the satellite dish that brings Summit its wonderful internet connection). This remote control will allow service provider Harris to reposition the dish from their Florida operations center as needed to maintain the satellite signal as the building is raised.



*Never too many cooks in the kitchen: The crew gives the camp cooks a well-deserved night off.*

Summer solstice made its way through town last week, arriving on the 21<sup>st</sup> and sticking around all day. In celebration almost the entire camp paired up for the first annual horseshoe tournament. Team 'Nick and Bride' took home the imaginary trophy after many an hour fighting off the mid-summer night's chill... Congratulations!

On Saturday evening the Summit crew gave the cooks a 'night off' by making their own pizzas. A handful of expert dough tossers showed up making everything from cheese stuffed crust to blueberry pizzas... hip-hip hooray! This was followed by a delicious Thai dinner courtesy of ICDS head driller, Terry, served up to all who made it out of bed Sunday.

**EXTRA EXTRA...** NOAA science tech Jason Siefert was accepted to flight school in Florida to pursue his dream of flying instrumented planes through hurricanes... Go NOAA Corps!

**Raven** The first half of the week was fair, while the second half was comprised of one storm squall after another. Raven gained a few inches of new snow on the flat. Most of the week was cloudy with little blue sky and marginal visibility. A good week to work inside and give the machines a rest.

## In the NEWS...

■ North Pole 33, Russia's drifting research station, must move to a new floe due to unexpectedly rapid drifting: <http://en.rian.ru/science/20050621/40556535.html>

■ VPR-supported researcher Kenji Yoshikawa was recently profiled in the Fairbanks Daily News Miner: <http://www.news-miner.com/Stories/0,1413,113~7244~2940726,00.html>

■ TREC participant John Sode recently discussed his upcoming Greenland field work with Jeff Welker's team in the Lebanon, MO Daily Record: [http://www.lebanondailyrecord.com/articles/2005/06/26/local\\_news/news07.txt](http://www.lebanondailyrecord.com/articles/2005/06/26/local_news/news07.txt)

# ALASKA News From the Field...

**Fairbanks** Fires burning in the Interior means the Fairbanks office is once again in the haze, and the advent of the midsummer solstice means the light will now start ebbing to winter. The crew is also preparing for a very busy July.

Equipment coordinator Tom Pi delivered a truck to Anchorage for the Terry Pavlis – led STEEP collaboration, whose field season kicks into gear on July 3<sup>rd</sup> with a month of fixed wing and helicopter flying to support an intensive field campaign studying the evolution of the St. Elias Mountains. Project manager Naomi Whitty will travel to Cordova to start off the season. More on STEEP at

[http://www.vecopolar.com/arlss\\_reports/arlss\\_projectsdetail.asp?cbPropNum=0409009](http://www.vecopolar.com/arlss_reports/arlss_projectsdetail.asp?cbPropNum=0409009)

This fall, the VPR Fairbanks office is moving to a new site that will be co-located with our warehouse. In preparation for the move, the Fairbanks crew met with the contractor to discuss plans.

**Toolik/Prudhoe Area** Breck Bowden completed his hyporheic survey work at Green Cabin Lake, the Toolik River thermokarst, and other area sites.

[http://www.vecopolar.com/arlss\\_reports/arlss\\_projectsdetail.asp?cbPropNum=0327440](http://www.vecopolar.com/arlss_reports/arlss_projectsdetail.asp?cbPropNum=0327440)

Science writers and editors participating in the Marine Biological Laboratory's Science Journalism Fellowship Program are at Toolik this week assisting Bowden and other science groups with their field research. For more about the program go to

[http://www.mbl.edu/inside/what/news/sci\\_journal/](http://www.mbl.edu/inside/what/news/sci_journal/).

Mark Potosnak was recently funded for a Small Grant for Exploratory Research (SGER) through NSF's Atmospheric Chemistry Program. In support of his work studying volatile organic compounds emitted by plants, Mark used VPR helo support to install an instrument at the Imnavait Creek watershed that he will monitor for two weeks. For more on Potosnak's research interests visit:

<http://www.dri.edu/People/Mark.Potosnak/>

Doug Kane and Ken Irving visited their hydrological and meteorological monitoring sites in the upper Kuparuk basin and installed a new repeater in the White Hills, west of Sagwon. They also did some work at their West Kuparuk met station located approximately halfway between Toolik and Deadhorse. More at

[http://www.vecopolar.com/arlss\\_reports/arlss\\_projectsdetail.asp?cbPropNum=0335941](http://www.vecopolar.com/arlss_reports/arlss_projectsdetail.asp?cbPropNum=0335941)

**Seward Peninsula** VPR staff arrived in Nome to prepare for the large upcoming field effort that will conduct an interdisciplinary Traditional Ecological Study of King Island. More on this project at

[http://www.vecopolar.com/arlss\\_reports/arlss\\_projectsdetail.asp?cbPropNum=0328234](http://www.vecopolar.com/arlss_reports/arlss_projectsdetail.asp?cbPropNum=0328234).

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carbon dioxide—allows researchers to understand how changes in the earth's atmosphere affect climate. Previous ice core studies have determined that carbon dioxide levels are higher now and are increasing faster than at any other time in the past 700,000 years. Hence, the ice core that will be obtained in the West Antarctic, and the test of the drill in Greenland leading up to the Antarctic drilling, are vital steps along the way to enabling researchers to better understand past climate change so that we may better predict the occurrence and impact of climate change in the future.

—Kara Nyberg, PhD

*Many thanks to Ken Taylor and Alex Shturmakov for providing information and photos.*



*Lael Rogan (UAF) doing GPS work in support of the Arctic Hyporheic Project at the Toolik Thermokarst.*



*The Deep Ice Sheet Coring tower (under construction) that will provide the infrastructure to lower the drill down the borehole.*