DOUBLE ISSUE
SEASON FINALE

The Antarctic Sun

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Titanic iceberg

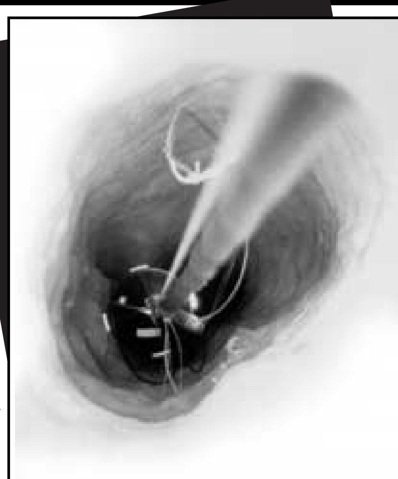
Pushing its weight around the sea, iceberg B-15A floats within miles of Ross Island. Undulating tides combined with the Earth's rotational force have brought this massive chunk of the ice shelf almost to the edge of McMurdo Sound. The size of the original berg was estimated to be 480 cubic miles (2,000 cubic kilometers) of ice, which if melted would be more than 528 trillion gallons of water (enough to meet the domestic and public water needs of the United States for several years). Researchers from the University of Chicago and the University of Wisconsin traveled by the Coast Guard Cutter *Polar Sea* and helicopters to the middle of B-15A, where they installed weather and GPS instruments. It's the first time an iceberg has been monitored like this, and the data will allow an unprecedented understanding of how giant bergs make their way through the waters of Antarctica and beyond. Researcher Doug MacAyeal will talk about the project tonight in the galley at 8:15 p.m. Photo by Josh Landis.

Quote of the week

"If you want to end a conversation with someone, let's say someone sitting next to you on an airplane, you say, 'astrophysicist.'"

- South Pole astronomer and astrophysicist on his job title

INSIDE



The AMANDA telescope is buried deep in holes melted in the ice cap.

fishing at the Pole

By Beth Minneci
Sun staff

Astrophysicist Albrecht Karle kneels gingerly beside an ice hole at the South Pole twice his width and more than a mile deep. On the surface it looks like nothing other than what it is – a darkening gape in the ice.

But buried deep inside is a cutting edge of astronomy. A long chain of orb-like sensors is

see Space on page 10

Nuclear test ban sensors going online

By Josh Landis
Sun staff

On a quiet stretch of snow off the southern slope of Ross Island, engineers from the University of Alaska are setting up a device that will listen for explosions on the other side of the world.

With its tentacles of plastic tubing, the instrument looks like a space-age Hydra. But this super-sensitive creation will be the nemesis of anyone who tries to test a nuclear weapon. It's an infrasound sensor, and it's the newest addition to a global monitoring network aimed at keeping tabs on any new weapons of mass destruction.

The Comprehensive Test Ban Treaty Organization (CTBTO) is extending its reach onto the Ice by including Antarctica in its vast network of sensors. CTBTO is an international organization with the goal of monitoring, and eventually eliminating, the testing of all nuclear weapons.

Based in Vienna, the treaty has been signed by 160 countries since it came into existence in 1996. President Clinton signed it in '96 but Congress has not yet approved it. So far, 30 of the 44 key countries that must ratify the treaty before it can enter into full force have done so.

Central in the effort to eliminate large-scale, nuclear weapons testing is the ability to detect explosions wherever they may happen. To this end, CTBTO monitors hundreds of sensors around the world.

In all, there are 170 seismometers to measure subsurface explosions, 80 radionuclide detectors to sniff minute amounts of fallout in the air, 11 hydroacoustic units that can detect underwater blasts, and 60 infrasound sensors able to sense subtle pressure waves that result from explosions on or near the surface of the Earth.

Until recently, the network was lacking in the southernmost reaches.

"Antarctica was a big hole in the global coverage," said Brian Stone, National Science Foundation representative and CTBTO program manager. "So having (monitoring) stations here is advantageous."

Dan Osborne heads the University of Alaska team that's installing the new infrasound detector at Windless Bight. Hurrying around his makeshift office in Bldg. 165, the bearded, brown-haired, bespectacled engineer spliced various computer wires to get his laptop to communicate with a sensor on the floor.

Dr. Charles "Buck" Wilson, a professor emeritus of geophysics at the University of Alaska, attaches plastic pipes to an infrasound sensor, which can detect atmospheric pressure changes from a blast on the other side of the world. Photo by Kay Lawson.

Having monitoring stations here is very advantageous.

- Brian Stone, representative, National Science Foundation

Jagged lines leapt across the screen each time a door somewhere in the building was opened.

"It's just like a barometer," explained Osborne. "It reacts to changes in atmospheric pressure."

The array of infrasound detectors on the ice shelf just off Ross Island will be able to sense a one-kiloton blast that goes off above-ground or just under the surface. Osborne said the technology is so sensitive that when Mount St. Helens erupted in Washington in 1980, similar sensors here on the Ice detected the blast each time its shock wave encircled the Earth. After a while, he lost count.

It's that kind of sensitivity the CTBTO relies upon. In addition to the infrasound station at Windless Bight, there is one at Palmer Station. Traditional seismometers will be listening to the ground at the Dry Valleys, South Pole and Palmer, where a radionuclide detector will also be on line.

The CTBTO had to make some concessions when installing a device in Antarctica. For starters, sensors on the network are normally required to have a near-perfect performance record. The "up-time requirements" only allow a sensor to be off-line for about three days a year. There is no way to guarantee that kind of reliability in Antarctica. If the system would go down in the middle of the winter, for example, it could potentially take more than a day just for someone to go check it out.

It's not the ideal scenario for CTBTO, but Stone says the organization will mostly likely accept the Antarctic standards, because that's the only way they will get the data.

"There was nobody in that group who had experience in Antarctica," said Stone. "They wanted to make it happen, but there was a lot of reality-checking. The specifications for station up-time were not written with Antarctica in mind."

The organization also had to allow someone else to transmit the data from the sensor site. Normally the link goes through a satellite uplink CTBTO supplies. That wasn't feasible here, so they agreed to let Raytheon carry the data back to the States, where it will be redistributed to the rest of the world.

"We convinced them it's better to consolidate things in Denver," said Mitch Lasky, Raytheon point-of-contact for the project.

The sensors are all now either in the installation or testing phase. If they pass muster they will be officially incorporated into the CTBTO monitoring network. It's an ideal scenario and fits well with the overriding philosophy of science in Antarctica: share the data. CTBTO is conveniently, and efficiently, co-opting the same instruments that would be used for scientific purposes.

Still, monitoring nuclear weapons testing around the world from Antarctica is an odd twist on the continent's position as an area of peaceful, scientific pursuit. Antarctica has drawn researchers and explorers from the most powerful countries in the world.

"Now the science really is being used for a peaceful purpose," said Osborne. "It's a perfect fit." ■

Antarctica Marathon

Results from the Jan. 28 race

Full marathoners	**Times**
Hiram Henry	2:44:48
John Hoppe	2:49:10
Thai Verzone	3:40:06
Amy Beyerlein	3:48:11
Julie Aurand	3:48:11
Stefan Vogel	3:52:00
Amy Brennan	4:03:26
Jeanelle Parrott	4:19:54
Karen Joyce	4:21:37
Jennifer Kemper	4:31:48
16 milers	
Wanda Myers (ski)	1:41:03
Joe Heil	2:14:03
Forrest McCarthy	2:49:27
Justin Gibbons	3:02:33
Don Bowen	4:32:00
Half marathoners	
Steffan Freeman	1:06:00
David Koepke	1:24:06
Laura Hamilton	1:24:11
Ted Dettmar	1:25:27
Steve Willey	1:28:15
Full skiers	
Doug Wing	1:55:49
Lisa Ferber	2:33:20
Kris Perry	2:33:33
Derek Dalrymple	2:37:57
Erik Paulsrud	2:44:08
Jess Barr	2:55:23
Larry Coats	2:56:12
Jared Blanton	3:22:43
Full marathon biker	
Cary Marger	1:52:59
Full marathon walkers	
Mary Elizabeth Andrews	8 hrs.
Michelle Waknitz	8 hrs.

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LETTERS to the editor

Seeing McMurdo 43 years later

Upon reaching McMurdo Station aboard the Russian icebreaker *Kapitan Khlebnikov* on January 9 this year, little did I realize that the decoration of LAL – a Living Antarctic Legend – was about to be bestowed upon me.

"What, you lived here in 1958?!" exclaimed the young lady in the coffee shop. "That's all of 43 years ago." She appeared to stare hard, to make sure I was still breathing. "Why, I don't think my mom was born then!"

"And I was here again in 1962," I added for good measure, attempting a puff-out of my parka-enclosed chest. "And again in 1964."

"Unbelievable," she gasped, as one would on hearing a voice from the tomb. And after a respectful pause, and deciding it was time to hurry away, lest this LAL started unburdening his life story, she said, "I guess the place has changed somewhat … sir?"

Ah, yes, young American lady, I could have added, it has changed somewhat … and then a lot somewhat more. Approaching the pad on a Russian helicopter, a miniature city appeared to reveal itself through the fog. Row upon row of three-story buildings! A network of pipelines! Massive fuel tank emplacements! Parking lots crammed with heavy vehicles! Could this LAL be excused from asking the pilot, "Are you sure we're landing at the right place?"

Where is Burke Boulevard (named after the chief of naval operations, not me)? What's happened to Honey Bucket Lane and its unique toilet shack that was reverse air-conditioned through holes in the floor? (And it wasn't much fun staring through those holes either.) Who stole our pint-sized PX store? And who turned around the Chapel of the Snows? It used to face us at the Observation Hill-end of the little dirt road fronted by a rather fragile row of Quonsets and Jamesways that seemed to have come from a second-hand lot. The Jamesways were prone to blizzard battering and waking up with the sleeping bag encased in snow put a new zip into one's frozen feet to start the day.

Yes, this LAL can honestly report: McMurdo has changed!

- David Burke,
Burradoo, Australia

the week in weather

around Antarctica

McMurdo Station
High: 26F/-3C
Low: 7F/-14C
Avg. temp: N/A
Wind: N/A

Palmer Station (Saturday)
High: 35F/2C
Low: 32F/0C
Avg. temp: 37F/3C
Wind: 30 mph/48 kph

South Pole Station
High: -17F/-27C
Low: -34F/-37C
Avg. temp: -24F/-31C
Wind: 21 mph/34 kph

around the world

Saturday's numbers

Jaipur, India
High: 76F/24C
Low: 44F/7C

Guyang, China
High: 28F/-2C
Low: 6F/-14C

Suva, Fiji
High: 89F/32C
Low: 75F/24C

Bainbridge Island, Wash.
High: 46F/8C
Low: 37F/3C

Harleysville, Pa.
High: 42F/6C
Low: 24F/-4C

Pigeon Falls, Wis.
High: 9F/-13C
Low: 3F/-16C

EXTREME efficiency

In its early developmental stage, an echinoderm larva is the model of biological efficiency. This stage of growth is exhibited by the type of Antarctic sea urchin discussed here. Photo by Michael Berger.

By Amanda Haag
Special to the Sun

Imagine owning an automobile that performs like a Ferrari, but has the gas efficiency of a Geo Metro. Or consider getting by on only 100 calories per day, less than what's packed into a soda pop or a half of a Hershey's bar. Studying life in the cold reveals organisms that exhibit such high performance.

About 80 percent of life on Earth exists and flourishes at temperatures between 35.6 and 39.2 degrees F (2 to 4 C), which is the temperature inside our refrigerators. Since life on land comprises only a tiny sliver of the biosphere, we have a lot to learn from life in extreme environments. In the icy cold waters around Antarctica, organisms have developed intricate adaptations to life in "freezing" water (28.8 degrees F, or –1.8 C) and for survival for long periods without a food source.

For nearly twenty years, Donal Manahan of the University of Southern California has been researching the processes that enable life to persist in the extremes. Manahan presented his findings at a recent science lecture at Crary Lab. By studying the biochemical and physiological "tricks" of marine invertebrates, he and his research group stumbled across an elegant survival story. The larvae of *Sterechinus neumayeri*, a rose-pink, spiny sea urchin that dwells in shallow Antarctic waters, are proving to be a model of metabolic efficiency in the cold.

Sea urchins have been a classical model for biologists for hundreds of years. Spawning and fertilizing eggs from a single female results in approximately 50 million offspring that can be reared for development, compared to the 1 to 2 eggs hatched by an emperor penguin, for example. This fecundity provides scientists with huge numbers of research specimens and facilitates laboratory study.

Manahan chose the urchin as a means to examine what physiological processes are involved in growing up in the cold. In an Antarctic field season, adult urchins are induced to spawn in the laboratory between October and December. The larvae are reared through development for days to weeks at a time. At each stage of development, larvae are harvested to analyze synthesis and breakdown of proteins, respiration rates, and energy costs of development.

In most organisms including mammals, building and maintaining proteins accounts for approximately one-third of caloric expenditure. Proteins are molecules built from chain links of amino acids and are the primary components of muscles. They also shuttle nutrients into and out of cells and catalyze almost every biochemical process of life. Manahan thinks that the Antarctic urchins have a metabolism for building and breaking down proteins that requires 20 times less energy than anything found before in biology.

The exceptional efficiency of the metabolic "engine" discovered in the urchins may help explain how organisms survive months at a time in the oftentimes nutrient-deprived Antarctic waters. The spawning season for most marine invertebrates begins in August, still months away from the algae blooms that turn the waters rich with life. To put this into perspective, imagine arriving during winfly and not eating for the first time until Christmas.

IMAGINE ARRIVING DURING WINFLY AND NOT EATING FOR THE FIRST TIME UNTIL CHRISTMAS.

The incredible adaptations in Antarctic organisms may hold clues to biological function far beyond life in the extremes.

"We want to start to generalize and learn about the mechanisms of metabolic efficiency," said Manahan.

Now we know that the urchins are extraordinarily efficient, but we don't understand the nuts and bolts of how they work. Further exploration of such unique systems will help build an understanding of metabolism in all organisms.

Learning about how life prevails at the extreme bounds of possibility is inherently fascinating. On the flipside, it may even help shed light on whether "It's not my fault I'm fat! It's in my genes." It may be a helpful defense the next time you bypass a trip to the gym for a heaping dish full of Mr. Frosty. ■

Amanda Leigh Haag is a research technician with the University of Southern California, and is with Donal Manahan's biology lab.

Polies in paradise?

By Beth Minneci
Sun staff

Each summer, McMurdo Station employees who pick up winter contracts go to New Zealand for a week of rest and relaxation. The South Pole winter worker comes to the less crowded beaches of Ross Island.

McMurdoites pity the poor Polies who live summers in subzero temperatures then before six months of extreme cold and darkness spend a week at McMurdo, a place many locals by now find nauseating.

"Let's go bowling," McMurdoite Brian Barry said, chuckling about McMurdo Station's simple recreational opportunities. "Well, at least it's not an expensive vacation," Barry pointed out.

Field safety instructor Brennen Brunner led a pack of Polies in Happy Camper school, a two-day outdoor survival training course the vacationers underwent for recreation. What struck Brunner was the pleasure his campers found in the upper 30-degree temperatures.

"They kept commenting on how warm it was," Brunner. "They'd take their gloves off, wave their hands and laugh," said Brunner, fanning both his hands in the air like Liberace.

Even though McMurdo Station wouldn't make a list of dream vacation spots, most Polies aren't complaining. While here, they visit local boondoggle sites such as the camp, penguin pool and a nearby crevasse that is safe to explore.

Some even say that if given the chance, they would not fly farther north to New Zealand.

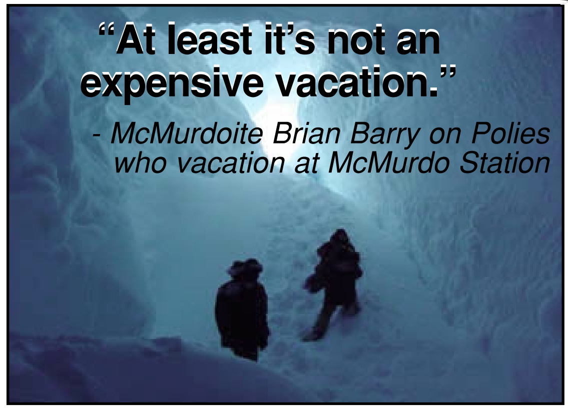
"I wouldn't even want to go to Christchurch," said South Pole meteorologist Nathan Tift, who recently took in the sights in and around MacTown. "I knew I was going to spend a year in Antarctica."

Carpenter Kurt Sarkiaho lives in a South Pole Jamesway where he can freeze a six-pack of soda just by leaving it on the wooden floor. Three weeks ago he walked into his temporary dorm room in Bldg. 155. His jaw dropped as he let go of his bags.

"The carpet on the dorm floors, telephones in the rooms… it's nice," Sarkiaho said. "I walked into that room and I thought, If they had let me go to New Zealand, I might have just gotten on a plane and gone back to the U.S. That would have been a distinct possibility."

Don't laugh, McMurdoites.

Polies take pride in their South Pole community. But visiting McMurdo – its mountain and dark rock-covered surroundings, free-flowing showers and selection of three bars – is a happy reprieve from flat, white scenery and more rustic living.



Polies on vacation explore a crevasse. Photo provided by Aaron Coy.

"It's so much more vast," said Jake Gibbons, a veteran South Pole worker who recently passed through town on his way to the Pole. "You come here and it's – Whoah! There's power lines and cars and dust and rocks. I could just sit in a cloud of dust all day and be happy as a clam."

It's not all love, though.

Right away Polies nicknamed McMurdo Station "The Land of Don't," because they were given a lengthy list of rules to follow while on vacation.

And McMurdo Station, some Polies say, with its transient population hovering around 800 seems to be the karmic opposite of the parochial Pole's 220-person community. One Polie tried to peg the McMurdo vibe by comparing it to image-conscious populations in coastal cities such as Miami or Los Angeles.

At least one person wintering at the South Pole spent his vacation where the stripes are – home at the Pole. Carpenter David Benson passed over a week at McMurdo to burn CDs, watch movies and play guitar.

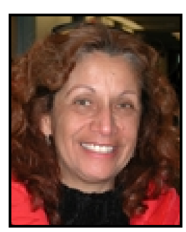
"I've done exactly what I wanted to do," Benson said, adding that MacTown wasn't appealing but that Christchurch might be.

"I've heard people say though, 'If I went to Christchurch from here I wouldn't come back.' I think people come back, but still, why torture yourself?" ■

Highway one

What's the first thing you'll do when you get off the Ice?

"Lie outside and look at the stars. It's the last thing I did before I came here too."
Jeff Inglis
housing



"Being alone, having time to myself, going to the beach. A whole lot of nothingness."
Jean Chance

"To say the three words I've been waiting six months to say. 'Excuse me, waiter?'"
Bill Meyer
recreation

SOARing below Vostok

By Kristan Hutchison Sabbatini
Sun staff

At first glance Lake Vostok is just flat and white, but Tom Richter had three weeks to look at it more closely.

He spent four hours a day flying back and forth over the frozen lake. The best views weren't out the window of the Twin Otter plane, but in data from instruments that "see" through the ice sheet, measuring the depth and altitude of the ice, gravitational attraction, and magnetism of the earth.

"You could just look and see there was something interesting going on," Richter said. "There's rough, regular, rocky ground and then all of a sudden you could see some flat lake surface."

Richter was at Vostok with the rest of the SOAR team, the Support Office for Aerogeophysical Research, to gather data for scientists trying to better understand the hidden lake, which is the size of Lake Ontario.

"Why the lake's there nobody knows and that's why we're there," Richter said. "I don't know if we're going to be able to find out either."

Researcher Michael Studinger thinks he will find an answer in the 30 gigabytes of data SOAR collected in 36 flights.

"It's the first detailed image of the lake itself," Studinger said. "We are most interested in getting the geologic setting of the lake and also the depth of the lake."

Every second the equipment recorded the gravitational attraction, six radar readings and 10 measures on the magnetometer. The altimeter gave the altitude of the ice to within 10 to 20 centimeters. Radar showed the terrain below the flat ice changed from rolling plains on one side of the lake to mountains on the other. The lake itself appeared to be in a basin, below two miles (three to four km.) of ice.

The findings will help scientists decide between two theories for the creation of the lake. One scenario is that the lake was created by erosion. The second possibility, and the one Studinger said preliminary data supports, is that changes in the earth's crust formed the lake.

The evidence is a huge magnetic anomaly on the east coast of the lake's shoreline. As the first SOAR flight crossed over to the lake's east side, the magnetometer dial swung suddenly. The readings changed almost 1,000 nanotesla from the normal 60,000 nanoteslas around Vostok. A tesla is

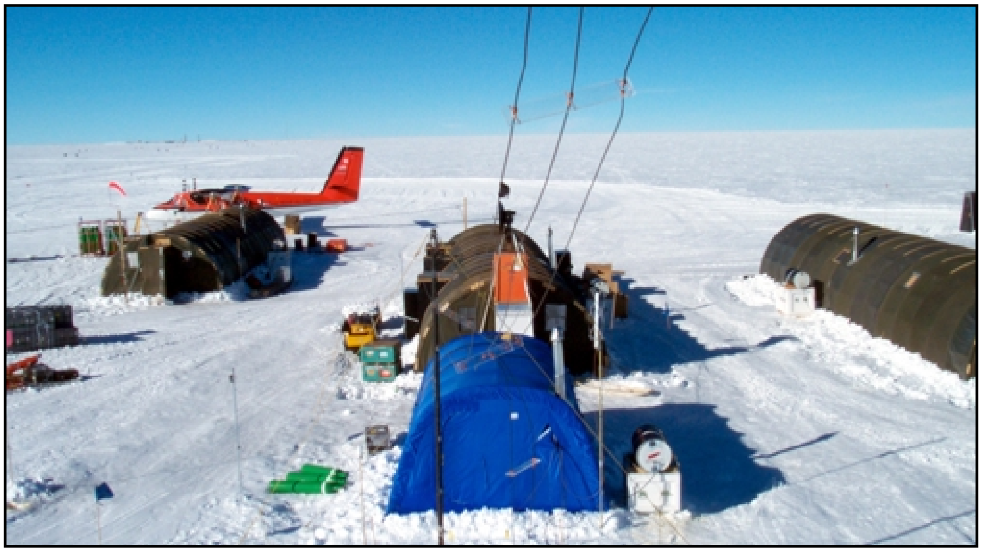
see next page

The Twin Otter SOAR uses to fly data collection missions waits outside their Jamesway. Photo provided by SOAR.

The SOAR team loads equipment into a Twin Otter plane. The equipment is used to measure changes in magnetism, gravity, altitude and ice depth, which will help scientists map and understand Lake Vostok. Photo provided by SOAR.

"Why the lake's there nobody knows and that's why we're there."

- Tom Richter, Support Office for Aerogeophysical Research



The American camp at Lake Vostok, above, surrounded by flat, white terrain. At right Tom Richter plans SOAR flights along a grid to gather data about the landscape beneath the ice. Scientists will use data collected during the flights to determine where they should drill into the lake for samples of the water. Photos provided by SOAR.

from previous page

the standard measure of magnetism. Studinger typically finds anomalies of 500-to-600 nanotesla in places where volcanic material has poured out of the ground

"When we first saw this huge magnetic anomaly, that was very exciting," Studinger said.

Usually magnetic anomalies are much smaller and it takes some effort to distinguish the anomaly from normal daily changes in the magnetic field. In this case there was no confusion.

"This anomaly is so big that it can't be caused by a daily change in the magnetic field," Studinger said.

The anomaly was big in another way, encompassing the entire Southeast corner of the lake, about (65 b 46 miles) 105 km by 75 km. The size and extremity of the magnetic anomaly indicated the geological structure changes beneath the lake, and Studinger guessed it might be a region where the earth's crust is thinner.

To create the type of topography found at Lake Vostok, the earth's crust was probably stretched, thinning one to three percent as it pulled taut, Studinger said.

While the SOAR team flew, charting the lake from above, Studinger set up seismic stations to study the lake through the ground. He'll learn more about the crustal structure under the lake from the way seismic waves travel from earthquakes around the world travel through the lake. In 22 days the sensors recorded eight earthquakes, including a 6.9 magnitude quake near Kodiak, Alaska.

Researchers are also interested in the interaction between the ice sheet and the water beneath. The ice sheet moves over the lake at about four meters a year. As it moves, it scrapes the ground and carries particles into the lake.

"That's a way to get nutrients into the lake, which would be important for the ecosystem," Studinger said.

Insulated beneath the ice, the water is warmed by the earth itself. The warm water at the bottom of the lake then rises and melts the bottom of the ice sheet in places, so small currents circulate through the lake.

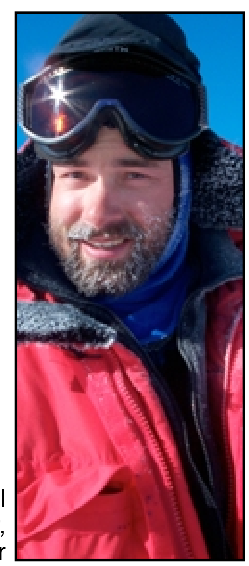
"What we observe is there are regions where there's melting going on and regions where there's refreezing," Studinger said.

But all these observations are done through the ice. Nobody has actually sampled the lake water itself yet, though Russian scientists have drilled to within a few hundred feet.

SOAR was really just scouting out the area for that next step, touching the water itself. Studinger and his colleagues at Lamont-Doherty Earth Observatory of Columbia University will spend the next two years analyzing the data SOAR collected and writing up the results. Once fully analyzed, the data will show where the sediments are in the lake bottom, how thick they are and where there are upwellings of water.

"One of the important things with this data is it will help to make a decision on a drilling location," Studinger said. ■

> "When we first saw this huge magnetic anomaly, that was very exciting."
>
> *- Michael Studinger, Lamont-Doherty Earth Observatory*



Michael Studinger, researcher

our Antarctic week

4
Antarctic Golf Professionals Association driving tournament, 11 a.m., derelict junction

4
Meeting to decide where charitable contributions will be donated, noon, Chapel

4
Science lecture "Sleeping Giants of the Ross Sea," by Doug MacAyeal, 8:15 p.m., galley

Have a great winter!

6
Pot Party to glaze abandoned pottery, sign up on rec board, 7 to 9 p.m., ceramics room

Climbing wall and bouldering cave certification, page Keith at 622 to set up a time

Check the bulletin board outside the Recreation office for activities throughout the winter

WWW.POLAR.ORG/ANTSUN

COLD, HARD FACTS

People

Total Antarctic population last summer: **3,687 people**

Number of acres per person in Antarctica last summer: **938,297**

Number of ice-free acres per person: **18,765**

Ratio of men to women on the Ice this season: **1.8 to 1**

Best odds for guys: Palmer station with **13 women to 18 men**

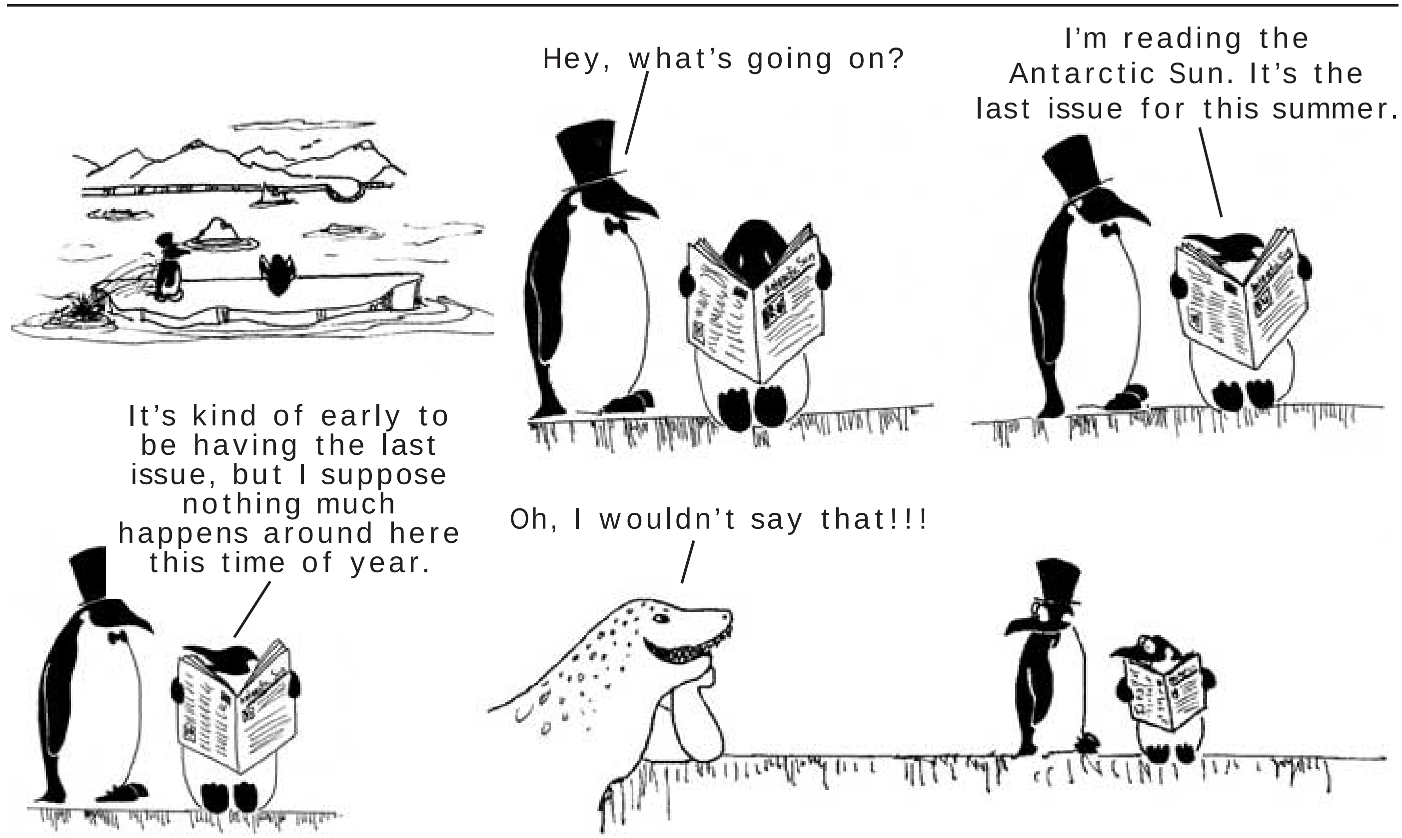
Best odds for gals: South Pole with **105 men to 44 women**

Odds at McMurdo: Almost 2 to 1, with **414 men to 237 women**

Percent of respondents to a McMurdo smoking survey who never smoke: **81**

Percent who smoke daily: **13**

Ross Island Chronicles — By ChicO



Gearing UP to power DOWN

By Kristan Hutchison Sabbatini
Sun staff

Just by watching dials at the power plant, supervisor Al Richter knows what McMurdo residents are doing. "You can almost set your wristwatch by watching my power usage down here," said Richter, the power and water plant supervisor. "You can see when everybody gets up, when the laundry starts up, when the heavy shop starts up."

Keeping the dials a little lower is one of the goals of a newly formalized energy conservation program Raytheon Polar Services Company developed at the request of the National Science Foundation. The goal is to "burn less fuel, drive fewer miles, put fewer people in the Antarctic, but still get the same amount of science," said Richard Boehne, Director of Operations for Raytheon.

In the past, the U.S. Antarctic Program conducted a number of studies and implemented several facility projects to reduce the use of fuels for heating and electricity. Not as much was done, though, to emphasize the human factors and operational aspects that can contribute to energy conservation, until now.

As part of a more deliberate approach to energy management and conservation, a plan is being developed that will include goals for conserving fuel and water, reducing the greenhouse gas emissions, and expanding the use of solar, wind and other renewable energy sources in the U.S. Antarctic Program.

"No matter what we do we have to conserve any resources we bring down here, because any dollar we use on that is less we can use on science," said NSF representative Erick Chiang said. "It's just really one component of streamlining the program."

Raytheon is trying to enlist everyone's help to meet those goals. An energy management committee will gather suggestions on ways to save energy and guide the implementation of conservation measures.

"We're going to put more emphasis into soliciting ideas from individuals within the Antarctic," Boehne said, "and not just individual people, but getting ideas from work centers."

Some of the conservation has to be done on a personal level, Richter said. Doing laundry and taking long showers drain most of the water, while forgetting to turn off space heaters, lights and other equipment uses up electricity.

"It's the small things like that," Richter said. "It doesn't seem like much, but when you collectively take it across 1,000 people it adds up a bit."

The overall goal is to reduce energy consumption by 20 to 30 percent from what it was in 1990. Comparing Jan. 12, 1991 to the same day this year, there has already been a drop in the peak usage, from 216 amps ten years ago to 202 amps now. Those numbers don't reflect the 18-month-old heat recovery system, which is saving fuel by heating several dorms and the Crary Lab with excess heat created in the power plant, Richter said.

Waste heat is also used to preheat water before it goes through the reverse osmosis system, saving about 1,600 gallons of fuel a week, Richter said. More buildings will be added to the heat recovery system in coming years.

"That is just saving a tremendous amount of fuel," Richter said.

Two wind generators and a solar panel array charge batteries near Arrival Heights. Photo by Kristan Hutchison Sabbatini.

More fuel will be saved when the 20-year-old generators in the power plant are replaced with newer, more efficient generators in two years, Richter said. The power plant burns about 25,000 gallons of fuel a week in three generators.

Specific changes like tracking and reducing vehicle idle times will also save fuel, and engine wear and tear, said operations manager Bill Haals. When Haals first came to the Ice in 1988, most vehicles ran all day, idling when they weren't in use. Now the policy is to warm vehicles up if it's cold, but always turn them off when stopped.

"Those little things add up into big things," Boehne said.

The Antarctic program already depends on wind and sun power for many field camps and the communications network. Most of the radio repeaters are solar-powered and the seismic monitoring station at Mt. Newall runs off wind, sun and backup generators.

Mt. Newall is just a mini-version of the much larger setup at Black Island, said communications supervisor Bill Nesbit. On Black Island, four windmills and an array of solar panels feed a wall of batteries 30 feet long and seven feet tall.

The Black Island satellite relay station was set up with windmills in 1984. In 1990 solar power was added. Without the alternative energy, the 20,000-gallon fuel tank running the backup generator would run out of fuel mid-year, when there is no way to get to Black Island. As it is, Black Island is only refueled once a year in October or November, and even then there are usually about 8,000 gallons of fuel left in the tank.

Antarctica has an abundance of wind and sun in the summer to power everything. The challenge is that often there is too much. Winds at Black Island sometimes whip by at 200 mph. The 600-pound windmills are built to withstand gale forces and have broken down in windstorms only twice in 13 years.

"This is perhaps the most pristine environment left on the planet. It is our duty to preserve it," said Tracy Dahl, alternative energy specialist for the U.S. Antarctic Program. "Alternative energy does not pollute nor alter the environment. It harnesses the energy that is already there." ■

Space

from page 1

catching the faint flashes of light produced by high-energy subatomic particles traveling through Earth and colliding in the ice.

The neutrino-seeking telescope is called AMANDA, an acronym for what Scientific American magazine called one of "seven wonders of modern astronomy," and described as "the weirdest telescope in the world," said Karle. He laughs out loud about the distinction.

The telescope is a $10-million dollar, international project that scientists are hoping will teach them about violent events such as black hole collapses and supernova explosions. It's tracking high-energy particles that are one million times more energetic than anything coming from the sun.

"We're trying to see things far away," said co-spokesperson for the project Steve Barwick. "We hope to find out why they're so powerful. There's too many guesses and not enough answers."

What's unique about AMANDA is that it is a telescope tracking neutrinos rather than photons, which are light particles.

Unlike optical telescopes, in which light transmits a picture to the viewer, AMANDA focuses on the paths of neutrinos – the residue left by decaying radioactive elements and particles – which can draw a picture of the early universe.

"We know everything about every energy range of photons but no one ever used neutrinos to monitor the sky," said Marcus Hellwig, a graduate student from the University of Mainz in Germany working with AMANDA.

Monumental is the potential to trace cosmic history back to the big bang 15 billion years ago.

"This comes down to understanding the fundamental processes of how the universe works, where these particles come from," Karle said.

Neutrinos are abundant and can pierce the Earth but are hard to detect because they are invisible, have no electric charge, virtually no interaction with matter and either no mass or are nearly without mass.

"We call them poltergeist particles because they are so ethereal," Barwick said.

At the South Pole station, in the field of ice holes is a two-story blue building about a half-mile from the Pole's silver dome. Inside, a team of astrophysicists watches busy computer screens for neutrino hits in the ice.

At any time around the globe, at certain universities and research stations, scientists with AMANDA are analyzing mounds of data and planning upgrades to the system.

The project employs about 70 people from 16 institutions in Germany, Belgium, Sweden and the United States.

"There are lots and lots of computers involved," said physicist Jodi Lamoureux. "It's a lot of work to actually do these measurements, but it will pay off."

The project is labor intensive because the scientists must analyze each hit to separate neutrinos from the millions of other cosmic rays hitting the sensors each day.

For one million particles that light up a screen, only about four are neutrinos, Karle said.

Scientific American magazine called AMANDA the "weirdest" telescope in the world.

Barwick described AMANDA as being four football fields deep, two wide. "It's bigger than the World Trade Center."

And AMANDA, 640 sensors in 19 holes, is just the prototype to a project with 10 times the number of sensors and, at $250 million dollars, 25 times its price. As sort of a practice run, AMANDA has been tracing atmospheric neutrinos. The next step, the much larger project called Ice Cube, will also detect neutrinos, but will focus on finding them from the farthest places in the universe. Its size – at a half-mile by a half mile – will boost the numbers of neutrinos being caught, scientists are hoping.

"We're hoping to see the neutrino sky the way we see the photons," Barwick said. "The main goal of AMANDA was to establish this technique." ■

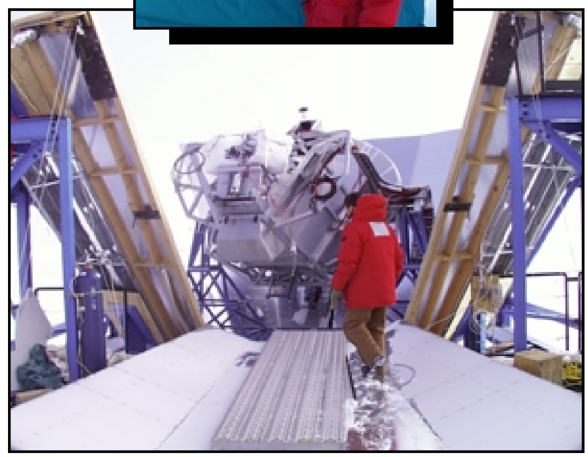
Steve Barwick holds a neutrino detector. About 640 of these are buried in the two-mile thick ice cap at the South Pole.

By Beth Minneci
Sun staff

On the cusp

"We'll have answers to the big questions in, I would say, five years."

- Erik Leitch Astronomer



Top: Erik Leitch and the DASI telescope. Above: John Ruhl approaches ACBAR. Both telescopes are surrounded by radiation reflectors.

For decades astronomers struggled to prove the geometric of the universe. So when images captured from a balloon over Antarctica last year confirmed that the cosmos was flat, the news provided splashy headlines around the world.

In the United States, "Science Snags Front-Row Seat to Infant Universe," read The Washington Post. "Baby pictures of universe show it’s flat," said the Baltimore Sun.

"Just last year there was no consensus with geometry of the universe," said astronomer Erik Leitch. "Now we know with good certainty that it is flat."

The balloon project, called BOOMERanG, was the first experiment to provide evidence of the universe's geometry with high-resolution maps of the big bang's afterglow. The radiation is called the cosmic microwave background, and it is the closest astronomers have come to a visual image of cosmic history.

Technological developments in the last few years indicate that history and news will be made again, soon.

The cosmic microwave background is radiation that scientists use to trace the universe's history to 300,000 years after the big bang, which is believed to have happened 15 billion years ago. Just after the big bang, particles in the universe were scattered through the cosmos like snow in a blizzard that light could not penetrate. But about 300,000 years later, scientists believe, the universe cooled. Its particles had altered to a state that allowed light, or radiation, to pass between them. The particles left an imprint on the radiation that scientists are able to detect in finer detail than ever before.

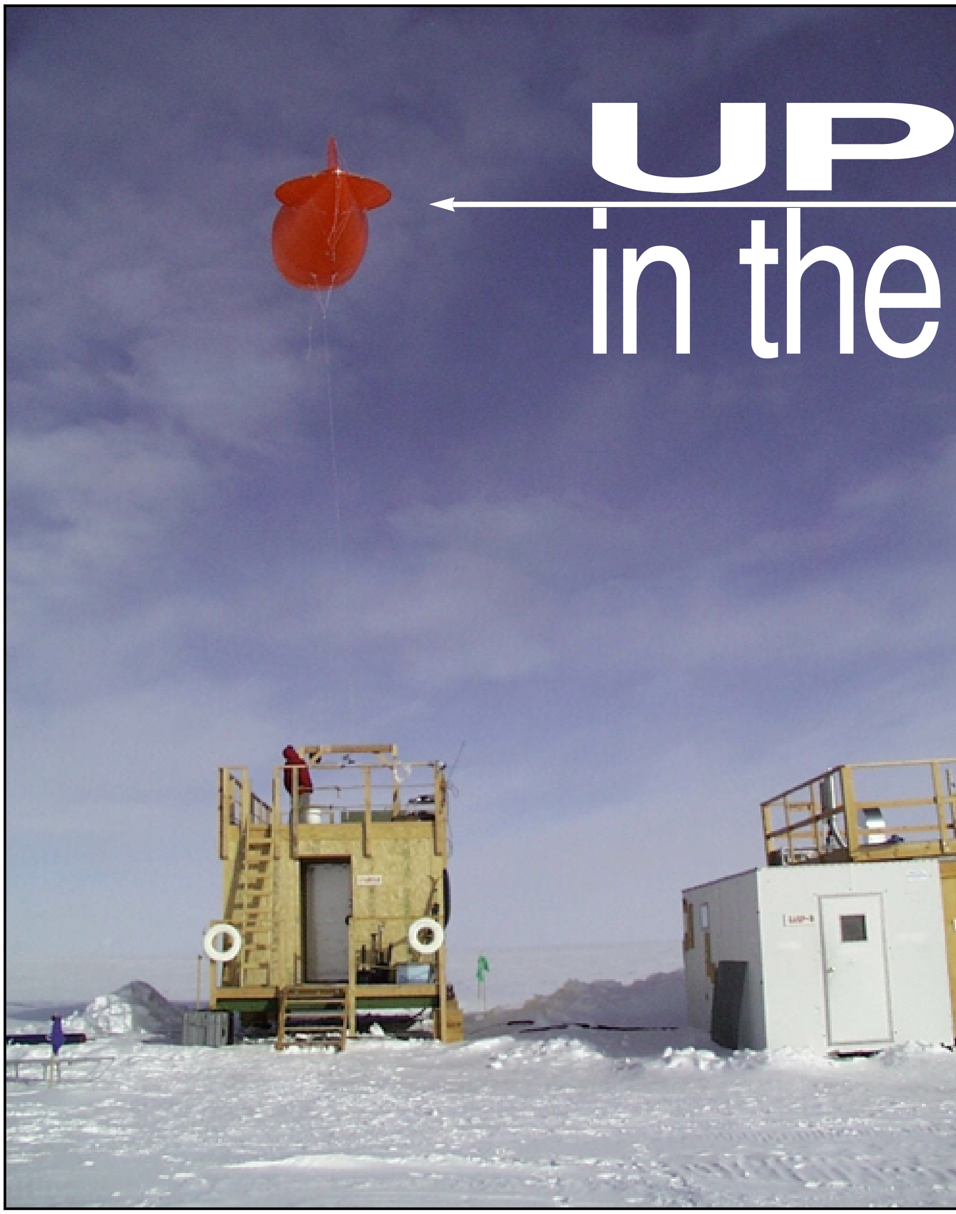
"It’s like a fossil of an earlier universe," said Leitch, who works with the South Pole station radiation telescope project Degree Angular Scale Interferometer, or DASI. "It’s the oldest fossil around."

The cosmic microwave background's potential as a learning tool is far-reaching for astronomers seeking answers to fundamental questions: Is the universe expanding? If so, how fast? What is it made of? And

see DASI on page 13

Ben Reddall tests one of DASI’s radio telescope receivers.

UP in the sky



Left: Mike Town gets the balloon ready for a launch. Top right: Steve Warren inspects instruments the balloon will carry into the clouds. Right: Steve Hudson prepares computers that will show pictures of cloud particles the instruments beam down to the lab while in the air.

By Beth Minneci
Sun staff

A torpedo-shaped orange balloon looms over what appears to be a houseboat resting on a frozen, white sea.

Stairs lead to the roof that is roped off around the perimeter. Two Styrofoam Os painted with the letters SS SPARCLE, an acronym for South Pole Atmospheric Radiation and Cloud Lidar Experiment, hang out front like life preservers on a ship.

The wooden building is actually a South Pole climatology lab. The carpenters made it this way just for kicks.

"This ought to last through the winter," said lead scientist Steve Warren, scanning the walls inside.

Warren won't be here during the six months of darkness. Graduate students Mike Town and Steve Hudson will steer the lab's dark season of experiments in the clouds, studying snow and analyzing greenhouse gases.

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"We're trying to explain why the climate is like it is."

- Steve Warren
University of Washington

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The greenhouse gases – ozone, carbon dioxide and water vapor – act as a blanket warming the Earth. Some scientists say the gases are insulating the planet to the point of causing unnatural climate warming. Even changes in climate by a few degrees could have a long-term effect.

Warren's group isn't trying to save the world from extreme weather events. But it is investigating the climate of the Antarctic plateau in an effort to improve climate models.

"We're trying to explain why the climate is like it is," Warren said.

Clouds may be just as important as greenhouse gases, he said.

"In winter here, it's always warmer under a cloudy sky than under a clear sky," said Warren.

On the roof what looks like a green utility box is packed with instruments that measure radiation emitted by snow and greenhouse gases.

In March the box will be brought inside for the winter to be used as a telescope.

From a circular hole cut in the lab's side it will transmit a beam out to an array of mirrors to determine the absorption of radiation by water vapor.

The measurements are an expansion of an experiment Warren conducted in 1992, the year he spent a winter at the Pole.

Together with water vapor and air temperature measurements recorded during the balloon launches, the researchers will make conclusions.

"That will tell us what we're looking for," said Hudson, "how water vapor absorbs the infrared radiation and how that changes with different temperatures."

The roof is where the climate measuring instruments are launched as a dangling appendage to the balloon. Cloud properties such as height and crystal sizes are also explored during the launching of the balloon. To take a look at ice crystals a camera is sent into the clouds where the crystals are caught on film, literally. The film is leader film with no emulsion a supplier in Hollywood sold to one of the project's participants.

"They were quite amused when they found out what he was going to use it for," Warren said.

Ice crystals are sucked into the top of the camera and land on a sticky coating. The image is beamed to a screen inside the lab.

On the ground, under microscopes, the researchers examine the shapes and sizes of the crystals.

"It tells us something about the conditions in which they were formed," Hudson said. "By knowing what's up there we can better interpret the radiation data we're receiving." ■

DASI

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most recently, is the universe's geometry flat, in which two parallel lines will never meet? Or does it curve in on itself like a sphere, or expand outward, like a saddle?

Since the 1960s scientists have known that the cosmic microwave background existed.

In 1991 they were first able to see temperature fluctuations in it. They say this is key because the distribution and sizes of hot and cold spots tell of the early universe's density of matter. Their new telescopes make maps that show the variations. As astronomer Kim Coble put it: "The distribution of the spot sizes tells you everything you want to know about the universe."

As evidenced by the balloon's message, prodding past our galaxy into the microwave background is a way to churn out relatively quick answers to long-standing questions about the universe's origin and fate.

But there is a side effect.

The more precise technology has fueled a race among academics to make the most efficient telescopes and radio receivers and to come up with earth-shattering conclusions. The scientists are exhilarated to quickly synthesize their data and publish their findings. But they're also feeling pressure from the scientific community to rush to conclusions.

"We are working on questions that are so fundamental they really want to know the answers," Leitch said. "They're just beating down your door."

Impressions from the cosmic microwave background are widely accepted as reliable paths for tracing cosmic history. But astronomer John Ruhl takes the race in stride: "If you look at the history of science, there's always people on the forefront of knowledge, and there are times when the rate of knowledge accelerates until a standard is turned over. This is a fantastic time to be doing cosmic background work. The 1970s weren't."

In Europe and Russia scientists are pursing the answers to astrophysical questions via the cosmic microwave background.

In Antarctica, at the South Pole, new multi-million dollar telescopes and radio frequency receivers are cropping up.

The DASI project is actually 13 telescopes aimed to detect temperature fluctuations in the early universe. DASI is designed to record high-resolution images of the cosmic microwave background.

Technology has fueled a race to come up with earth-shattering conclusions.

A NASA satellite MAP, Microwave Anisotropy Probe, is scheduled to be deployed this year. The long duration balloon TOPHAT launched from Williams Field early in January circled Antarctica recording radiation and recently returned home.

At the South Pole this season, a high-frequency radio receiver was deployed with the Viper telescope. Ruhl and Coble work on the receiver, called ACBAR, an acronym for Arcminute Cosmology Bolometer Array Receiver, which extends Viper's observations to higher frequencies.

Together the telescopes, balloons and satellite are hunting for answers to the origin and fate of the universe.

"We'll have answers to the big questions in, I would say, five years," Leitch said.

But Ruhl is more cautious: "I'm more of a wait-and-see type." ■

speaking of science...

We suck ancient air, that is

The “firnsuckers” science group goofs off with their giant vacuum hose. Photo courtesy of Jay Kyne.

By Jay Kyne
Special to the Sun

Our radio handle, it was decided, would be the "firn-suckers." It was an attempt, I think, by the scientists in our group to let people know what we were about, since everyone at South Pole Station with a radio would hear us checking in twice a day. We’d be tenting it outside the station, splitting up and working around the clock.

Our goal was to collect old air from the snow at various depths that would be sampled later for various constituents. The South Pole was chosen because the snow is cold and the accumulation is low, thus allowing for a deep "firn/ice transition" and therefore older air. Firn is porous, i.e. breathable, snow. Its transition to ice is at the depth where the pressure causes the pores to close off into bubbles which at first look like tiny peanuts that, with depth, turn into spheres.

Here’s how it works. We would drill to a certain depth with an ice coring drill (saving the core for other scientists for other studies), then remove the drill from the cable and attach in its place a cylindrical bladder. This we would lower to the bottom of the hole and inflate, sealing off the hole from surface air. Then air would be drawn from below the bladder and collected in flasks. This procedure would be repeated with greater frequency as depth of the hole increased until no more air could be drawn. At South Pole Station, that depth is around 394 feet (120 meters) which is, of course, the depth of the firn/ice transition. At that depth, the air is about 100 years old and the ice is about 1,000 years old.

The six people in our group represent two different science groups. Mark Battle (Once I saw him being introduced to someone as Dr. Battle; he extended his hand and said, "Hi, I’m Mark") and his undergrad associate, Jesse Bastide (paid only in experience and knowledge) are collecting samples for one set of studies. Mark has done his research at a variety of schools but is presently at Bowdoin College in Brunswick, Maine, as is Jesse.

The pressure causes the pores to close off into bubbles which at first look like tiny peanuts that, with depth, turn into spheres.

Then there’s the NOAA, National Oceanic & Atmospheric Administration, group. Jim Butler is an atmospheric chemist (Jim brought a good selection of CD’s to play at minus 30 C – a bunch of blues, a couple of The Eagles and a great Buffalo Springfield). He and Andy Clarke (Andy is just out of his second consecutive South Pole winter-over for NOAA, a snow boarder who once told me that between himself and his roommates, their garage contained 16 pairs of skis, 9 bikes and whatever else) work in the Climate Monitoring and Diagnostics Lab (CMDL) in Boulder. They study greenhouse gases and ozone depleting gases. Their lab maintains a year-round air sampling site at the South Pole Station, as well as three other remote sites around the globe.

Finally, there are the drillers, Tony Wendricks and myself, of the Ice Core Drilling Services, ICDS. ICDS recently won the National Science Foundation drilling contract and is part of the Space, Science and Engineering Center of the University of Wisconsin. (Tony is new to this kind of work, but apparently decided to jump in with both feet. He is a true Cheesehead – a diehard Packers fan whose annual deer hunting trips he describes as a "pilgrimage." I think he and his buddies and their sons have all but forgotten about the deer part). I’ve been a driller for much

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longer than I care to admit. Suffice it to say that this is my fourth firn air sampling project.

The history of firn gas sampling isn't very old at all. Let me go back briefly to its beginnings. The first paper on this subject came out in 1989, written by Jacob Schwander who believed that the air found in the firn would be of great value in the study of atmospheric history. His results, however, didn't add up. Enter Michael Bender, principal investigator for this project and the scientist under whom Mark began his study as a post doc. Bender recognized that the air sample containers were reacting with the air, yielding skewed results, and that indeed Schwander's hypothesis was true. Bender recruited disciples and the science of firn air study blossomed.

So how do scientists actually know how old the air really is? Well, first of all, atmospheric carbon dioxide has been sampled since the 1960's, so we have that record. Then, one goes to a location where the ice is warmer than South Pole and the accumulation is much more. At this location, the firn/ice transition is much shallower and the air is much younger at the transition.

Now, realize that beyond the firn/ice transition, the air is trapped in bubbles and therefore as the ice gets a year older, the air trapped within its bubbles also get a year older. They age together from that point on. Then realize that at such a location, the annual layers of ice are readily distinguished. The location is chosen so that the time the air is first trapped was before the 1960s, when the carbon dioxide levels of the atmosphere are known. Then one samples the air from the bubbles, stating the year of the ice and recording the levels of carbon dioxide . Voila! the carbon dioxide record for our planet has been extended back many years before actual atmospheric sampling began.

The person who was able to do this was David Etheridge and the place was Law Dome, Antarctica just a few seasons ago. Ice bubble air sampling has extended our carbon dioxide records vastly: The Vostok core, for example, has given us data extending back hundreds of thousands of years, beautifully mimicking the ice temperature records throughout four ice ages.

But what about the last hundred years? Jim tells me about his work and the ozone depleter methyl bromide. It is used in agriculture for soil preparation. It also exists naturally. Once it was recognized as potentially harmful to our atmosphere, it was measured. That measurement only began in the 1990s and the use of methyl bromide as an agricultural chemical began in 1960s. With the air we are sampling from the South Pole firn, Jim and Andy's lab can put together the history of methyl bromide from 1900 to now, and possibly reveal what part agricultural use plays in the destruction of the ozone layer.

The same applies to nitrous oxide, an agricultural tool, and chlorofluorocarbons, those nasty refrigerants. Atmospheric monitoring of their levels began in the 1970s. Soon, Jim and Andy will have established a record of these ozone depleters extending back many years before people began introducing them into the atmosphere.

Mark's object of study is quite different. By studying oxygen levels of the past one hundred years, Mark is able to put a value to a couple of very illusive global questions: How much carbon dioxide is absorbed by the oceans and how much is absorbed by the land plants? Here's how that works.

The change of the earth's oxygen levels can be accounted for by two things: The amount given off by land plants and the amount consumed by the burning of fossil fuels. Well, we know how much fossil fuel is consumed because we monitor oil production. What we don't know is how much oxygen plants give off. What we do know is the ratio of oxygen given off by plants to carbon dioxide absorbed. Plus, we also know the ratio of oxygen consumed by fossil fuel burning to carbon dioxide given off. That leads to the next equality. The change of the earth's carbon dioxide levels can be accounted for by three things: the amount absorbed by land plants, the amount given off by the burning of fossil fuels and the amount absorbed by oceans. So, by studying the change of oxygen in the South Pole firn air, Mark plugs in the numbers to these equalities and gets the most reliable measurement yet in science.

Mark is able to put a value to a couple of very illusive global questions: How much carbon dioxide is absorbed by the oceans and how much is absorbed by the land plants?

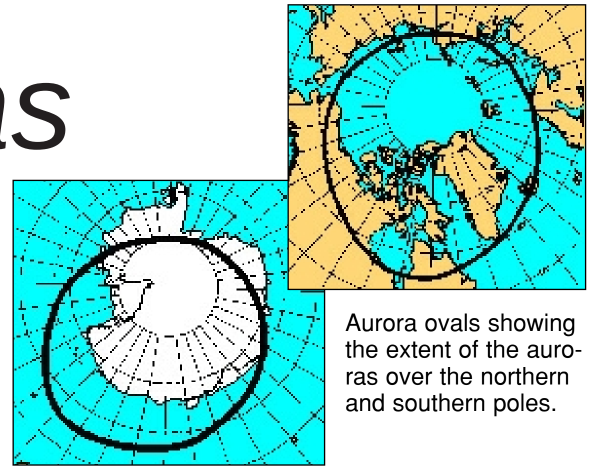
Jim and Andy are also collecting volumes to return for use as archives. Since we are constantly learning about our atmosphere and its many chemical occurrences and how they effect our lives, someone is going to figure out something else for which they want to piece together a history. So, onward science goes. For now, all six of us are present and accounted for… firnsuckers clear. ■

Jay Kyne is a driller with Ice Core Drilling Services.

High season for Auroras

speaking of science...

By John Bird
Special to the Sun



Aurora ovals showing the extent of the auroras over the northern and southern poles.

Some of nature's most beautiful displays are best seen at the South Pole - halos, sun dogs, sunsets and stars. The most spectacular is the aurora, a dancing light show of colorful bands in the night skies at high northern and southern latitudes. Auroral displays are the icebergs of the thermosphere, sculpted by solar wind, floating in waves of atomic oxygen, bestowing their alluring and ethereal brilliance. Robert Scott said, "It is impossible to witness such a beautiful phenomenon without a sense of awe, and yet this sentiment is not inspired by its brilliancy but rather by its delicacy in light and color, its transparency, and above all its tremulous evanescence of form."

This season will be an excellent one for the aurora because we are near the peak of the 11-year solar cycle. The best place to observe the aurora is under the auroral ovals, the donut shapes of the aurora around the north and south magnetic poles. These rings surround the north and south magnetic poles and may be easily seen from space. The auroral oval nearly goes over the South Pole, and also is near McMurdo Station. In the northern hemisphere, the auroral oval goes over Alaska and northern Canada. So if you are wintering, or heading back to Alaska as many people on the Ice are, you are very lucky.

Although auroral displays most frequently occur in northern latitudes of 65 to 70 degrees, they sometimes occur at lower latitudes. I've seen many excellent displays at 44 degrees north latitude.

People have always been curious about the aurora, citing it in folklore and mythology throughout the ages. For example, a famous display was seen in India and Egypt during 1872. Very low-latitude auroras are usually red. In 1938 such a display was chased by a fire brigade sent out to extinguish a fire at Windsor Castle in London. Scientific studies of the aurora also date a long way back, specifically to 1621 and a French scientist named Gassendi. He documented his observations in a physics book in which he referred to what he saw as the aurora borealis, meaning northern dawn.

In 1773 the corresponding phenomenon in the Southern Hemisphere, aurora australis (southern dawn), was first reported by Captain Cook. He observed it when he sailed the Indian Ocean. The aurora is popularly known as northern or southern lights. By 1873 the northern auroral zone was mapped and was found to be a ring around the north magnetic pole. Spectral measurements, that is, measurements of the component colors, were initially made in the early 1900s. An international campaign during 1957-58 was organized to study the aurora. This led to our current general understanding of the aurora, but there are still many unanswered questions.

The aurora appears in many different forms: arcs with rays, bands, pulsating surfaces, and draperies. One of the most common forms is a blue-green flickering drapery moving across the northern sky. Narrow, vertical, luminous columns with rapid fluctuations in intensity are common. The lower border is often intense and sometimes red. Typically, a display lasts a few minutes and occurs a few times per night. Strangely enough, there have been numerous reports of people hearing the aurora, although there is yet no scientific explanation or confirmation.

To understand the aurora, we must start at the Sun. Above the surface of the Sun, a complex interaction of radiation and convection maintains the gaseous region called the corona. At temperatures over a million degrees Celsius, the corona continuously gives off particles collectively forming the solar wind. When the solar wind reaches Earth, it interacts with Earth's magnetic field, causing electric currents to travel along the magnetic field lines. Much like a magnet, these field lines converge at the polar regions, directing the electric currents to the ionosphere in the polar regions.

The electrical power is converted to light in the ionosphere rather like a neon sign by exciting atomic oxygen and nitrogen into higher energy metastable states. When the electrons return to the ground state, the photons are emitted. The colors are characteristic of the components of the atmosphere and the altitude. Most auroras are from a form of atomic oxygen called singlet S, which describes the shape of the electron shell giving off the characteristic green color. A higher energy state of oxygen, singlet D, gives off red. Other colors are from nitrogen. The lowest part of the aurora is usually at about 62 miles (100 kilometers) in altitude.

The most spectacular auroral displays are caused by bursts of solar wind particles originating from magnetic storms on the Sun. These particles reach Earth directly from the Sun and from the far regions of the magnetosphere which streams beyond the Earth, away from the Sun, forming the magnetotail. Earth's magnetic and electric fields in space guide and accelerate particles toward the auroral regions. The power created by a magnetic storm hitting the ionosphere is about half due to particles and about half due to electric currents.

Here at the Atmosphere Research Observatory at the South Pole, the Aurora All Sky Imager experiment will operate an intensified optical, all-sky imager, operating in several wavelengths. The imager allows us to study waves in the atmosphere, to look at various altitudes, and to discriminate between types of electron precipitation. The principal investigator for the experiment, Gary Swenson of the University of Illinois, is a veteran of many auroral investigations around the world. ■

John Bird, B.Sc, M.A.Sc., Ph.D., P. Eng., FBIS, is wintering at South Pole Station to study the southern auroras.

speaking of science...

Looking long-term

Cruising scientists take measures for the future

By Don Atwood
Special to the Sun

At 66.5 degrees South latitude, along the Antarctic Peninsula, King and Queen Neptune were observed making a visitation aboard the USAP ice hardened vessel, *Lawrence M Gould*. They sat on the aft deck in regal finery and read a list of crimes to those who had never crossed the Antarctic Circle before. To do penance for their sins, the indicted were forced to entertain the regal visitors, were smeared with a pate of sauerkraut, eggs, and assorted sea creatures, and finally received a baptism by freezing cold seawater.

Such was a brief moment of fun in a three-week science cruise of the *Gould*. For 20 hours a day, seven days a week, researchers from University of Hawaii, Scripps Institute of Oceanography, U.C. Santa Barbara, and Montana State University supported this year's Long Term Ecological Research (LTER) summer cruise. The goal of this program is to observe the Antarctic environment over multiple seasons.

As Robin Ross, a LTER principal investigator describes it, "we must think about processes which occur over decades. Scientists need long-term data sets to provide a context for their experiments and to let them know where they are in the big picture. Scientists performing short-term observations operate in an invisible present; they may think they understand cause and effect, but their year may just be an anomaly. The real present can be invisible to your understanding without an understanding of the past."

The result of this desire to observe the big picture is the Long Term Ecological Research program. At McMurdo Station, LTER research is performed in the Dry Valleys. On the Antarctic peninsula, it is performed by the *LM Gould* along five transects, 62 miles (100 km) apart, from Anvers Island to Margarite Bay. Along each transect, the *LM Gould* plies patiently along from shallow coastal waters to ocean depths exceeding 1.8 miles (3 km), stopping to perform a series of experiments every 12 miles (20 km).

Crew aboard the *Lawrence M. Gould*, above, lower a Biofish, an acoustic fish finder which will be towed behind the ship. King and Queen Neptune, at right, hold court aboard the *Gould* as it crossed the Antarctic Circle.

"If you were a predator, how would you hunt?"
- Robin Ross, principal investigator

At each site, scientists perform a census of sea birds above the surface and lower instruments overboard to understand the biology below the surface. The instrument include sensors to measure the intensity of sunlight underwater, bottles to capture the tiny phytoplankton that form the bottom of the food chain for life in Antarctica, nets to capture the shrimp-like krill, and an acoustic Biofish (towed fish finder) that lets scientists "see" the distribution of life below it. In describing her robotic fish, Robin Ross says it gives clues about the biodensity and distribution of krill. "If you were a predator, how would you hunt? We can learn by understanding the aggregation of the prey."

Her prey, of course, is knowledge of the krill. The biofish sees them acoustically and her tow nets capture them, or at least tries to capture them. Net avoidance is a fancy way to say that krill are fast enough and wily enough to avoid the tow nets. The little crustaceans, which can grow to 2 inches (6 cm) in their 5-7 year lifespan, can "popcorn," whereby they move at 24 inches a second (60 cm/sec) to avoid capture.

Perhaps philosophically, Robin says that she is "after quality, not quantity." Each trawl might yield between 250-500 krill. The result is a collection of krill and other invertebrates, which must be carefully sorted by hand to understand "community composition." Unfortunate by-products of the catch are salps. These gelatinous little invertebrates "slime up your nets and smother the krill."

This painstaking search for the modest krill has big ramifications for the ecological health of Antarctica. The reason is that they are a principal food for most of the marine vertebrates. Whales, seals, sea birds, and penguins all eat the little animals either as the mainstay or an important part of their diet. Among the seals, the so-called crab-eater seals are in reality "krill specialists" and the little Adelie Penguins gorge themselves on krill in order to feed their growing chicks. So using krill as an indicator species enables scientists to forecast the long-term health of the continent.

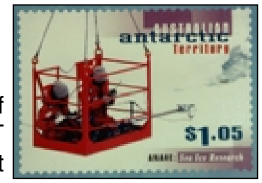
The success of LTER is dependent upon dedicated scientists, willing to come back to the ice, year after year, in both winter and summer. One such LTER researcher, returning for her seventh season, is Wendy Kozlowski, a staff research associate from Scripps. Besides her interest in the science, she returns because Antarctica is "beautiful, quiet, and full of interesting characters." When asked if she will return next year, she just smiles and says "Sure, I'm a lifer." ■

Don Atwood is Science Support Director for Raytheon Polar Services Company on board the research vessel Laurence M. Gould.

Acronyms

AMANDA ITASE SOFIA SOAR PICO DASI

What's your name?



Stamp of HOBART project

By Beth Minneci
Sun staff

Climate scientist Pat Zmarzly's decision to change the name of his RIDEX experiment was probably a good one.

"RIDEX is what gets rid of lice," Zmarzly said, referring to RID lice extermination products.

Fearing repercussions, he created a new title and acronym so that RIDEX, Remote Icing Detection Experiment, became AIRS, the Alliance Icing Regional Studies.

"But you could call that 'errors' if you became unhappy with the project," said Zmarzly, who fretted a bit but kept the revised title.

Acronyms might sound cute or whimsical but scientists put a lot of thought into them. They are a marketing strategy as well as a convenient way to summarize a project's description. A good one gets a project noticed and remembered.

"It's political," said Erik Leitch of DASI, Degree Angular Scale Interferometer, a group that traces invisible radiation to learn more about the universe. "The more memorable your project, the more likely it is to get funded."

Acronyms should describe a project and evoke an image, Steve Warren said. For example, his coworker Von P. Walden at first called their South Pole climatology project IRASP, Infrared Radiation at South Pole.

But another coworker insisted on something jazzier. "SPARCLE is nice because you can think about sparkling ice crystals," Warren said about his South Pole Atmospheric Radiation and Cloud Lidar Experiment.

Warren once came up with an acronym for a project that was featured on an Australian postage stamp.

In HOBART, Helicopter Operated Blue Antarctic Radiometer Thruster, Warren and Rich Brandt were pictured in a basket hanging from a ship's crane while they measure the sun's reflection off sea ice.

For some reason, scientists researching astronomy and the atmosphere are more likely than others to make a word out of the first letters of a string of words.

But acronyms haven't always identified science projects, scientists say. Only in the last 20 years or so have the catchy capital-lettered titles become the norm. Good ones generate financial support and camaraderie, said astrophysicist Giles Novak.

"It's political. The more memorable your project, the more likely it is to get funded."

- Erik Leitch, of DASI
Degree Angular Scale Interferometer

"In any astronomy project the important thing is to have group solidarity," Novak said. "You build a group where the goals are really defined and excellence is recognized, but it has to have a nice name to rally around."

Novak works for CARA, a woman's name and an acronym for Center for Astrophysical Research in Antarctica.

One of Novak's favorite acronyms sounds like another woman's name. The Stratospheric Observatory for Infrared Astronomy, or SOFIA.

"Isn't that great?" Novak said.

What's so great about it?

"Oh. It's a male-dominated field, I guess," said Novak. "When women take over science projects they'll be named DICAPRIO."

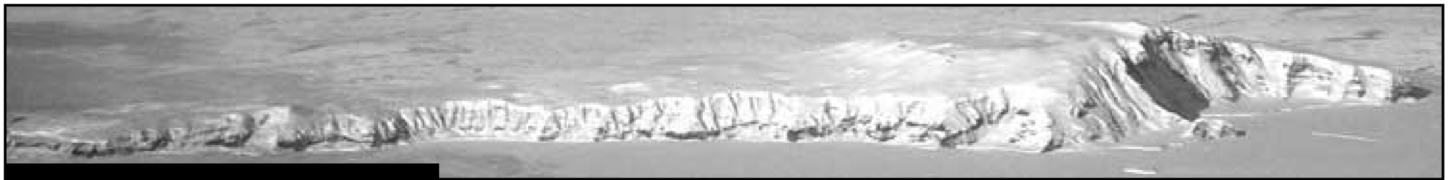
"I met an atmospheric researcher whose own name was an acronym," Warren said.

Koruwage Oswald Lakshman Fernando Jayaweera eventually changed his first name legally at an Alaska courthouse to Kolf after years of being called that.

In another instance, a much talked-about T-shirt illustrated two women in bikinis named CARA and AMANDA near the ceremonial pole. AMANDA is an acronym for Antarctic Muon and Neutrino Detector Array, a neutrino-hunting telescope.Some physicists love it. But for Novak, the shirt is a bit too "Fort Lauderdale."

"I know people who hate that shirt," he said.

A group of South Pole astrophysicists were talking at dinner recently about Alta Coma Large Meleneta Array. Initially, the scientists said, the project was called the Southern Hemisphere Interferometer Telescope. ■



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WHO SAYS IT'S BETTER ON THE BOTTOM?

Aaron Spitzer

By Aaron Spitzer
Special to the Sun

It's true that the Arctic and Antarctic are poles apart. But the chasm between Ultimate Thule and Terra Incognita is more profound than the easy-to-spot difference between polar bears and penguins.

For you Antarcticans who've never lived above the tree-line, what follows is a primer on the glaring disparities between the Great White North and the Deep, Deep South.

Food

Antarcticans are pretty prissified when it comes to food, fawning over freshies and kvetching when the soft-serve machine breaks down.

But up here, after a dizzying day of living on top of the world, nothing hits the spot like seal-nose alfresco. Eat the chunks by holding the whiskers like a toothpick. If desired, garnish with the gastric juices of a freshly slaughtered walrus. Serves four. If you're still peckish, boil caribou hooves into broth and drink it like a bracing tonic.

And if you're really starving you boil your boots. After that, you resort to qimmeq (dog). In the Arctic, meat is considered a vegetable.

In the summer, Northerners don't eat. We get all our nutrients from the squadrons of mosquitoes that accidentally fly down our throats.

Drink

Here's a category where the Ice definitely has the Arctic beat. In Antarctica, there's an entire office — the recreation department — dedicated to getting you knackered.

In most places in the North, booze is banned. Which means it's everywhere, in flavors ranging from rot-gut moonshine to party-kegs of anti-freeze. Bootlegging is a bull-market up here, where a plastic flask of vodka pulls down $150.

More than a few people are missing fingers from having passed out in the polar night on the way home from some homebrew-laced hoe-down. And some are missing life entirely, having chugged whisky super-cooled to 60 below.

Pets

Antarctica is a thin-lipped landlord. It blacklists Bowser and puts the kibosh on Kitty, even if you promise to clean up after them. Smuggle your animal-companion into your ECW bag and you risk being evicted from the continent.

The last pet most of you saw was the cop-dog that ratted out your stash at Bag Drag in ChCh. You rifle through the freshies, looking for a tick to call your friend. You loiter at the aquarium, patting a cod and trying to make it purr. You call home, asking your little brother to put Buddy on the line, and grinning beatifically at the sound of him (Buddy, not your brother) licking the receiver.

In the Arctic we live in a delicate balance-of-terror with our pets. Shackled by log-chains to every shattered Ski-Doo in the North is a slavering Cerberus, a wolf-dog just waiting for tykes to toddle into range. These curs work for us, occasionally pulling loads or scaring polar bears back onto the sea-ice. In exchange, every few weeks we'll feed them — to one another.

Children

Antarctica has no children. I never thought I'd miss bobbling a fresh-faced bambino on my knee, or cooing at an apple-cheeked infant. And I didn't.

The Arctic, on the other hand, is so thick with kids you can barely see where you're going. Around every corner there's a gas-huffing hellion trying to steal your snow machine or shooting holes in your honey bucket.

The average age above the tree-line is about 15. Babies abound. If the present growth-rate continues the empty Arctic will be more crowded than Calcutta in about 6,000 years.

Men and Women

At Thanksgiving in the Galley last year I shared a table with a dozen guys and a sole femme fatale. We suggested she make a toast. "Let's raise a glass," she said ebulliently, "to ratios!"

As everyone knows, there are almost no women in Antarctica. The same is true up here. Some things, dammit, are the same all over. ■

Honorary Sun staffer-for-life Aaron Spitzer summered in McMurdo last year. He now lives at another bad latitude: Iqaluit, Baffin Island, in the Canadian Arctic.

Building and burrowing

Left: A South Pole tunneler connects two halves of a 2,000-foot corridor. Photo by Katy Jensen. Right: Construction crews finished the exterior of the first two pods of the new station. This winter they'll complete the inside.

On Friday morning, South Pole tunnel foreman John Wright and his crew completed the season's work of connecting two parts of a 2,000-foot water and waste utility tunnel under Amundsen-Scott Station.

This summer the crew bored through 940 feet of hard, packed snow, creating a tunnel that will transport melted snow up and waste water down for disposal.

The U.S. Antarctic Program has met its construction goals this year despite severe weather that delayed flights to the South Pole. The National Science Foundation and Air National Guard made up many of the flights that had been cancelled.

However, 800,000 pounds of cargo and supplies still needs to be moved from the *Greenwave* to the South Pole.

Milestones this year included the installation of a satellite receiver to increase communication with the station; the activation of a new power plant; and the completion of the exterior of the first sections of the new, elevated station.

Thanks

See you next season!

To the many people who helped...

Bill Haals
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James Ross
Jim Scott
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Liz Connell
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There are many that helped in multiple ways, including the guys that installed a heat vent in our office, the folks that helped us skua everything from a hard drive to extra staples, the folks around the world that printed and distributed copies, the media and public for hundreds of comments and the National Science Foundation for supporting this publication.

From the staff of the Sun, published on the highest, driest, coldest, windiest, and emptiest continent on Earth.

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