The Antarctic Sun

Published during the austral summer at McMurdo Station, Antarctica, for the United States Antarctic Program

November 2, 2003

Breaking berg news

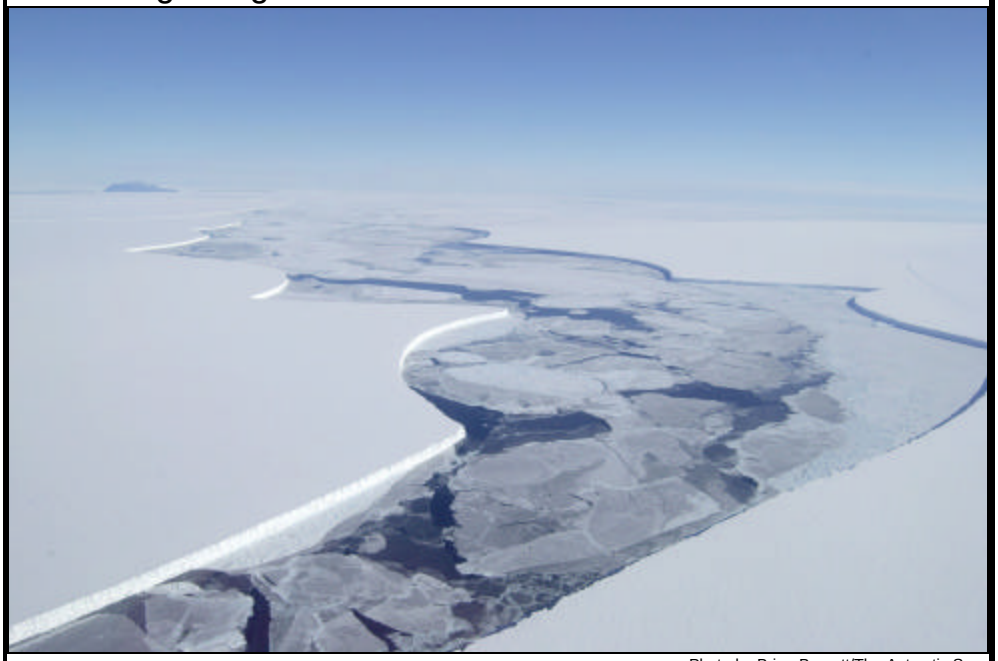


Photo by Brien Barnett/The Antarctic Sun

Ross Sea ice jams the channel where the mighty B15A iceberg broke apart earlier this month. The iceberg on the right retains the name B15A, while the iceberg on the left is now B15J. Barely visible is iceberg C16 and Beaufort Island. A research team from McMurdo choppered out to B15A Friday to set up gear to track the berg to its demise. B15A has been blamed for clogging McMurdo Sound with ice and disrupting penguin colonies along the north coast of Ross Island. The breakup signals significant changes may be ahead.

See story page 9

Long haul to the Ice

By Kristan Hutchison
Sun staff

Except for astronauts, few people have as long a commute to work as those headed to jobs in Antarctica.

For most, the trip to Antarctica begins with at least 12 hours on planes and in airports, from their home in the U.S. to Christchurch, New Zealand, or Punta Arenas, Chile. Despite the efforts of flight attendants, the many bags of pretzels and endless supply of drinks and meals served on plastic trays, the seats are still uncomfortable and the flight is still long.

But those first 10,000 km are the easy part of getting to the Ice. It's the last 1,500 to 3,800 km most people write home about, using descriptive phrases like "sardines in a can" and "tossed like a salad." Which phrase

See Commute on page 13

Science all night long

By Brien Barnett
and Kristan Hutchison
Sun Staff

Stations hunker down during the long, cold Antarctic winter, but there is still science going on.

Winter hits hard at the South Pole, with temperatures often dipping below –60 C. The cold and long continual night might dampen spirits, but it makes for good astronomical observations. Over the summer, astronomical data is processed, instruments are fine-tuned and preparations are made for the next winter. Scientists have reported a few successes from the winter season:

The AST/RO project (Antarctic Submillimeter Telescope and Remote Observatory) explores the Galactic Center, the inner 500 light years of the Milky Way. Over the winter, Chris Martin and Karina Leppik explored the submillimeter-wave of the region and discovered the Milky Way has explosive star formation episodes, or starbursts, every 400 million years, according to Antony Stark of the Smithsonian Institution and head of the project. The team plans to publish the results in the Astrophysical Journal Supplements in January.

William Holzapfel reports that his team has published the results from high-resolution observations in 2002 of the cosmic microwave background (CMB) radiation using the ACBAR program (Arcminute

See Winter on page 16

Inside

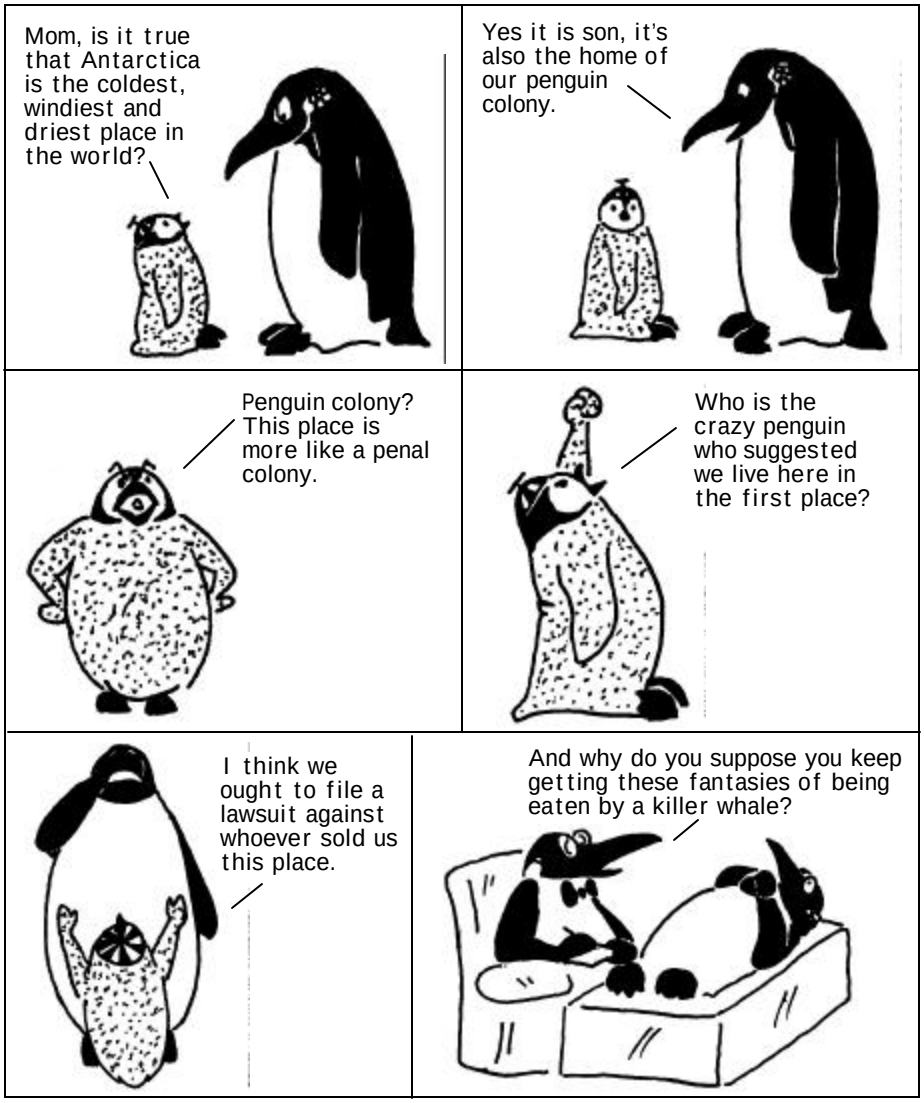
Ozone hole reinvents itself
Page 7

Current science probes Drake Passage
Page 15

Quote of the Week

"Driving it is like driving the Snoopy float in the Macy Day parade. Everyone smiles and waves."
- "Ivan the Terra Bus" driver

Ross Island Chronicles By Chico



Cold, hard facts

Science

Grantees for 2003/2004 season: **728 listed**

Aeronomy and Astrophysics projects: **31**

Biology and Medicine projects: **54**

Geology and geophysics projects: **25**

Glaciology projects: **14**

Oceans and Climate projects: **17**

Artists and Writers: **8 projects**

Clever acronym: **POTATOE MOAT** - Production Observations Through Another Translatitudinal Oceanic Expedition: Alaska to Antarctica; the Mother Of All Transects

Source: NSF Science Planning Summary

The Antarctic Sun is funded by the National Science Foundation as part of the United States Antarctic Program (OPP-000373). Its primary audience is U.S. Antarctic Program participants, their families, and their friends. NSF reviews and approves material before publication, but opinions and conclusions expressed in the *Sun* are not necessarily those of the Foundation.

Use: Reproduction and distribution are encouraged with acknowledgment of source and author.

Senior Editor: Kristan Hutchison
Editors: Brien Barnett
Kris Kuenning
Copy Editors: Geoff Jolley, Wendy Kober, JD Menezes
Publisher: Valerie Carroll, Communications manager, RPSC

Contributions are welcome. Contact the *Sun* at AntSun@usap.gov. In McMurdo, visit our office in Building 155 or dial 2407.

Web address: www.polar.org/antsun

Medevac patient home and well

By Kristan Hutchison
Sun staff

If Barry McCue hadn't gotten sick, he'd be waiting with the rest of the South Pole winter crew for flights to carry them to New Zealand.

Instead, his flight came a month early. It was the third winter medevac from the Amunden-Scott South Pole Station in four years.

"You can tell they're getting better at the planning of it," McCue said. "For me it was just take the plan off the shelf, blow the dust off and then just figure out what the people should do."

McCue, 51, had to be medevaced after a gallbladder problem in late August spread to his kidneys. South Pole Dr. Will Silva diagnosed the problem, and after several telemedicine consultations with doctors in Galveston, Tex., Denver, Boston and Baltimore, it was agreed that McCue needed to be flown back to the United States for surgery.

He had an infection in his gallbladder that was probably caused by blockage with a gallstone, said Dr. Ron Shemenski, medical director for Raytheon Polar Services. If the infection from the gallbladder had gotten into the liver, it would probably have been fatal.

As Environmental Health and Safety officer for the Pole, McCue is quick to point out he didn't ruin the station's perfect safety record for the season. Like the previous two winter medevacs, McCue was suffering from a medical condition rather than the result of an accident. The 57-person community went eight months without a reportable injury, setting a record.

"They embraced the idea that you wanted to come out the way you went in and I'm the one they had to bail out," McCue said.

The Twin Otter plane tht flew McCue was back at the South Pole last weekend on its way to McMurdo for the summer. Sean Loutitt, the chief pilot for Kenn Borek Air, said he thought the workers at the Pole were happier to see them last month, perhaps because the medevac flight brought down 45 kg of tomatoes, avocados and oranges. For the winter crew, the fresh fruit was their first since running out in mid-April.

Photo by Iain Airth/Rothera Station

A Kenn Borek Twin Otter heads to the South Pole from Rothera Station on Sept. 21 to pick up Barry McCue.

This time the flight was easier, partly because in the summer there are more aircraft in Antarctica to respond if something goes wrong.

For the winter flight, a second Twin Otter was flown to Britain's Rothera Station on the Antarctic Peninsula as backup and the McMurdo runway was prepared in case a C-141 had to fly in from Christchurch.

"You plan around those possible scenarios. You check for everything," Loutitt said. "In the end, I think it's a pretty safe operation."

Loutitt and the other two pilots, Brian Crocker and Rob Forbes, waited six days for the window of good weather they needed to fly to the Pole and back to Rothera.

"I was packed, boxed and ready to go," McCue said. "Whenever it looked good I would shower so I would smell good."

On Sept. 21 one of the Twin Otters took off, while the second stayed at Rothera as a backup.

The temperature was almost –60 C when they landed and the sun was edging its way to the horizon for the first time since March.

"It wasn't dark, but because it was cloudy you couldn't really see the sun," Loutitt said.

The pilots parked the plane on bamboo to prevent the skis from freezing to the ice, then turned on heaters in the engines and blanketed them with insulated covers. They brought the battery inside during the 10-hour crew rest. Before refueling, the pilots ran the plane around on the runway to warm the skis again so they wouldn't stick to the snow. The extra caution worked well and the pilots only needed half the runway, about 900 meters, for take off.

Coming straight from the South Pole winter, McCue felt some culture shock as soon as he reached Rothera, on the Antarctic peninsula.

"Walking in Rothera it got to me, feeling a breeze in my face and it didn't hurt," McCue said. "It's the first time I didn't have to put my long johns on."

Photo by Kristan Hutchison/The Antarctic Sun

Barry McCue waits to board the air ambulance in Punta Arenas.

From Punta Arenas he was ambulanced in a Lear jet to Galveston, Texas, where his gall bladder was removed.

"I was sicker than I thought. By the time I got to Galveston I was pretty wiped out," McCue said.

When he arrived home in Chicago his daughters didn't recognize him. He was 22 kg thinner and had grown a graying beard. He still needs frequent naps and hasn't gained the weight back yet, but he has had enough energy to visit family on his motorcycle and give some interviews.

McCue plans to apply for a job in Antarctica again for the 2005 season.

As he said a day after leaving the South Pole, "I miss it."

Perspectives

Adventure and tragedy in the early Antarctic

By Charles Bevilacqua

Christmas 1955 found us within the Antarctic Circle, in very rough, stormy waters - the roaring 60's. I was one of the Seabees who had volunteered to go to Antarctica on Operation Deep Freeze I with Admiral Richard Byrd.

Approaching McMurdo, we soon found a very bad ice year. Our ship was held up more than 60 km from Hut Point, where we were to construct the first buildings for the new station beside Scott's Discovery Hut.

By early January 1956, the situation was desperate. Summer was rapidly going by. Ninety-three of us Seabees were supposed to stay the winter and nothing had been built yet to house us. Heavy tractors and sleds were lowered over the side of the ship and we began hauling building supplies miles over very treacherous and deteriorated ice. It was very unsafe, but we had to start.

On January 6, 1956 my small advance group was hauling about four miles northeast of Cape Evans. We had passed over many small ice cracks, but here we came upon a very large crack with open water, too large to cross with tractor and sled, heavily loaded.

The next day we built a timber bridge and pushed it across the crack. My fellow Seabee Construction Driver Third Class Richard Williams and I took a D-8 tractor up and over the bridge without a sled in tow, to test the bridge. Petty officer Williams was the driver while I was the lookout and guide. We crossed the bridge successfully. Then, about 15 meters beyond, the D-8 broke through the weak ice without any warning. The D-8 pulled Willy and me under the ice.

Somehow I managed to claw my way through the broken ice to the surface. I immediately began pushing the broken ice aside, looking for Willy. I could not find him. I was pulled out of the water. I removed my heavy outer clothing and boots and jumped back into the water again.

I had to push more broken ice aside, make a hole and find Willy. Try as I may, my efforts were to no avail. I was again pulled from the water and went into slight shock and hypothermia. I was put into another D-8 with the heat full on to try to revive me.

Willy was our first loss on Deep Freeze I. "Williams Field" or "Willy Field" is now named in his memory. We would lose six more before we left for home in February 1957.

I removed my heavy outer clothing and boots and jumped back out onto the broken ice, into the water again.

Eventually, the icebreakers broke in closer to Hut Point and we began, with much hardship, to build the first building at McMurdo. We worked through the winter improving the station and preparing to go to the South Pole.

No one had been there since Amundsen and Scott in 1911-12. We flew there in a small, underpowered R4D-8 aircraft with flimsy skis in late November 1956. Because we were the first there, there was no landing field. The plane touched down but could not stop or the skis would stick to the snow. We had to jump out the door and dive under the tail as it flew by.

We did not even know the location of the pole when we arrived. It took Lt. Dick Bowers a few days to pinpoint the exact location of the geographic South Pole.

After completing most of Pole station, we turned it over to the new group coming in, but not before we were able to celebrate a most memorable Christmas, complete with an airdropped New Zealand Christmas tree and plenty of good cheer. It's good to be young!

I came back to McMurdo early January 1957, in time to dedicate the shrine of volcanic stones and the Virgin Mary to Willy.

Because Deep Freeze II was taking over, those of us in Deep Freeze I had little to do. A few of us went over to help Sir Edmund Hillary and the New Zealanders put up the original Scott Base. We stole much from our own Americans to help put in Scott Base. Who could resist those jolly Kiwis. It was a pleasure to work with them and to have a close association with Hillary.

As I look back on a most memorable, rewarding and cherished experience, it's amazing how many of us remain in contact. We have reunions and I still make frequent presentations on Antarctica "then and now."

Charles A. Bevilacqua was a 25-year-old chief petty officer in the U.S. Navy Seabees when he first went to Antarctica as chief builder. He now lives in Meredith, New Hampshire.

This space reserved for your words

There are lots of words for Antarctica: Cold Science White Research Glacial Adventure Remote

Every Antarctic experience is different. Share yours on this page.

Send submissions up to 800 words or queries to MCM-Antarctic Sun.

around the continent

SOUTH POLE

Eight month winter ends

By Tracy Sheeley
South Pole correspondent

Transition is the name of the game at South Pole Station this week, in a variety of ways.

The summer season opened on an overcast Oct. 25 with the arrival of 84 passengers on two flights. The end of winter ceremony was held later that afternoon. Winter Site Manager Bill Henriksen called each individual to receive his or her awards, which were presented by Al Sutherland, the National Science Foundation Representative in McMurdo. The 57 people who spent the long winter night here were recognized for their dedication to Amundsen-Scott South Pole Station. They also made it through the entire eight-month winter without a single injury.

This winter was an historic one. For the first time, residents, instead of work crews inhabited the Elevated Station. Berthing areas and the new dining facility have been in use since last March – and what a change it is! The rumor from the winter crew is that the cooks were up to the challenge of the new space, and created fantastic meals all winter.

Summer crews are busy completing turnover with the winter crew before they take off for greener pastures. It's a chaotic but exciting week as we all try to catch up with old friends, make new ones and settle in for a busy summer season. New folks are taking it all in – absorbing all the nuances of this spot at the bottom of the world.

The Pole staff greeted some early visitors in the form of Kenn Borek Twin Otter crews. Seven Otters stopped in at the Pole for a good night's sleep and to refuel themselves and their planes for their trip on to McMurdo. We have an ambitious flight schedule lined up – 332 LC-130 flights to bring us everything from construction materials and science equipment to the occasional shipment of freshies.

In science news, the ICECUBE project begins preparations this year. ICECUBE is the next phase of the AMANDA (Antarctic Muon And Neutrino Detector Array) Neutrino Telescope project. This is a multiyear project destined to bring lots of activity to the South Pole.

Many of the 2003 winter crew will depart their yearlong home this week. Those of us who remain salute each one, and wish them safe and happy travels until our paths cross again.

Photo by Kris Kuenning/The Antarctic Sun

"Cookie" Jon Emanuel, head chef at Amundsen-Scott South Pole Station, with a Dissostichus mawsoni, which was filleted for eating after scientific work was carried out on it. The fish was filleted, sauteed, and served to the South Pole winter crew when the summer crew arrived.

PALMER

Science teams return

By Kerry Kells
Palmer correspondent

Summer began at Palmer Station with the arrival of six of our eight science groups. Five of these groups are part of the Long Term Ecological Research Project (LTER), a collaborative project focusing on changes in the climate and how the ecology responds in an ice-dominated environment. Established in the fall of 1990, Palmer LTER is just one of 24 LTER sites in the United States and Antarctica. Near McMurdo, LTER researches the Taylor Valley ecosystem. Here at Palmer, the represented science groups are Bill Fraser, Maria Vernet, Robin Ross and Langdon Quetin, Raymond Smith and Hugh Ducklow.

The Palmer LTER focuses on three areas of marine ecology of the Southern Ocean, with specific objectives for each subgroup. The study of physical forces helps to understand how the atmospheric, oceanic and sea ice processes affect the local ecosystems. What are the connections between the changes of the climate and the response of the ecosystem? What are the time and space scales on which the different ecological levels operate?

To researchers examining the local ecosystem on most levels of the food chain, emphasis is placed on certain points of the food chain, beginning with the primary producers like phytoplankton, the plants that survive in the Southern Ocean. Feeding on them are krill, the secondary producers. Krill are prey for the penguins and other seabirds known as the apex predators. And the microbes wait to break down and recycle the waste. Within each of those, a variety of parameters are monitored, from distributions of species populations to levels of nutrients in the water to patterns and disturbances of the research sites. For example, how does climate warming affect changes to snow deposition, and how does this affect Adelie penguin populations? Research is also conducted on the links of ecosystem processes to environmental variables and tracked by satellite data. The U.S. LTER Network web site explains that physical, optical, chemical and biological models build these links.

See Palmer on page 6

the week in weather

McMurdo Station
High: 25F/-4C Low:-8F/-22C
Wind: 28 mph/45 kph
Windchill: -54F/-48C

Palmer Station
High: 38F/3C Low:27F/-3C
Wind: 60 mph/90 kph
Windchill: 12F/-11C

South Pole Station
High: -38F/-39C Low:-61F/-52C
Wind: 25mph/40kph

Palmer

Over the course of the summer, I hope to interview the researchers at Palmer Station to convey more in-depth information on the research conducted in our area. With just the briefest introduction to Palmer LTER, we can see how each question generates many more. What is now discovered? What milestones are passed? Long Term Ecological research itself is dynamic like the ecosystems that surround us here at Palmer Station.

SHIPS

Nathaniel B. Palmer

By Kristan Hutchison
Sun staff

The *Nathaniel B. Palmer* is on its way to the Ross Sea after a two-week port call in Lyttelton, New Zealand. The port call was a chance for the ship and crew to recover from a cruise to the other side of the world and back. Last spring, the *NB Palmer* was called upon to support an arctic research project after the *Polar Sea* lost a five-ton blade from the starboard propeller last summer while breaking ice in McMurdo. The *Polar Sea* had been scheduled for the arctic cruise, but had to go into dry dock instead. The other Coast Guard icebreakers were already busy and the Canadian Coast Guard's icebreaker was unavailable because of unscheduled maintenance. Since the *NB Palmer* was available, arrangements were made.

The *NB Palmer* arrived in Dutch Harbor, Alaska, in time to celebrate July Fourth in the midnight twilight, then continued up to Barrow. The main purpose of the cruise was to collect measurements of temperature, salinity and depth at numerous predetermined locations, done using a probe called a CTD for Conductivity, Temperature and Depth. During the cruise 329 CTDs were deployed, an all-time record for the ship, said marine technician Jesse Doren. The measurements will help researchers in the Shelf-Basin Interactions field program understand the exchanges of heat, salt, nutrients and other organic matter between the continental shelf and the Arctic Ocean.

Photo provided by *NB Palmer* crew

Polar bears seen from the Nathaniel B. Palmer *while cruising off Barrow, Alaska.*

In the arctic, the crew saw a couple hundred walrus, seals and about a dozen polar bears.

"Other than seeing the wildlife, we saw nothing," Doren said. "It was really foggy, cloudy, overcast, just gray."

They stopped in Barrow, which reminded both Doren and Ashley Lowe of McMurdo, except more expensive. Lowe paid $17 for a burrito.

The voyage back to New Zealand took a month and a half, doing seismic trials and taking measurements along the way. Designed to insulate rather than cool, many areas of the *NB Palmer* became uncomfortably hot crossing the equator, Lowe said.

The *NB Palmer* arrived back in Lyttelton on Oct. 13 and is now headed toward the Ross Sea where it will support six projects this season.

Laurence M. Gould

Compiled from Sitreps by Steve Ager

The research vessel *Laurence M. Gould* will be at dock in Punta Arenas until Nov. 7. The ship and crew recently completed a cruise to drop off the penguin researchers and supplies for Copa field camp on King George Island and at Palmer Station.

With the seas going their way and light winds, the trip there went great, wrote Marine Projects Coordinator Steve Ager. Passengers sighted a dozen penguins on the way. They arrived in the morning Oct. 14 and ran two Zodiacs most of the day unloading gear. By 2 p.m., it was all ashore. The base commander and a few others from Polnearby Arctowski Station came over to greet the Copa scientists, and the ship crew delivered to them some much-appreciated freshies.

The *Gould* made another stop at the Argentinian Jubany Station to pick up a passenger and deliver another "happily received freshies order" to the Argentines. They still had time to duck into Deception Island for a quick shore visit at Whaler's Bay before continuing to Palmer Station.

A few days later, the *Gould* returned to Copa with additional supplies of frozen food, double A batteries, 96 rolls of toilet paper, some medicine, and a few other odds and ends.

On the return trip to Punta Arenas, the *Gould* got clobbered by 7.5 meter seas and 35 knot winds crossing the Drake.

Continental Drift

What surprised you most when you first arrived in Antarctica?

"Shackelton's hut and emperor penguins. … It's surprising how well the hut is preserved and the artifacts are all there."

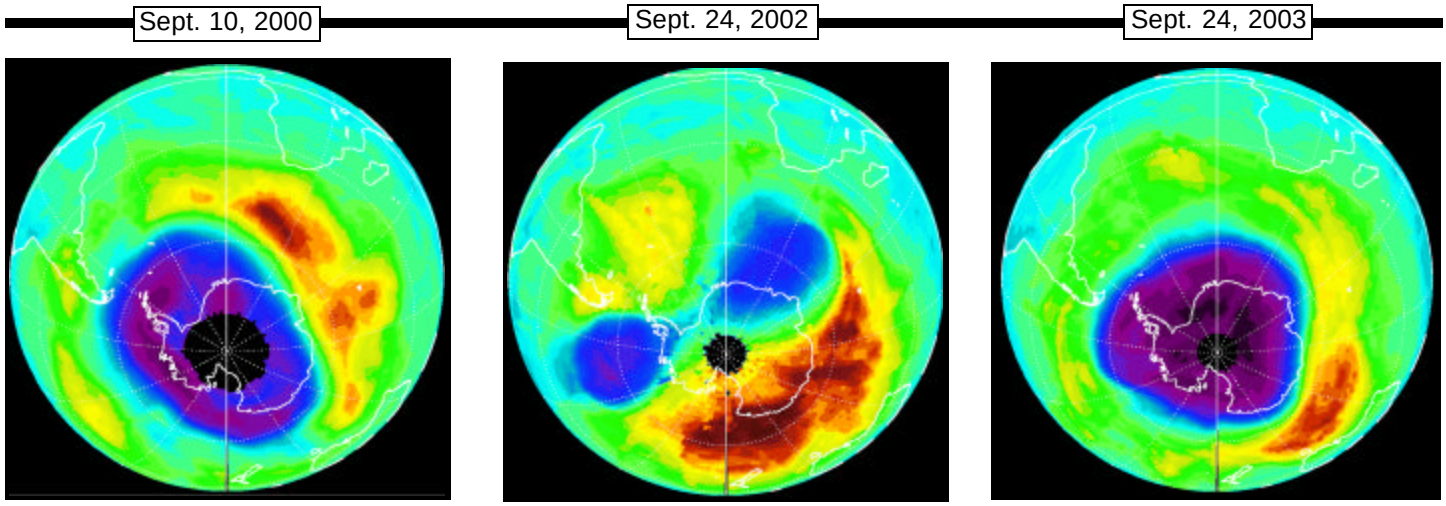
Steve Jackson
South Pole electrical foreman from Creed, Colo.
first season

"The first thing I did was stand next to the tire [of Ivan the Terrabus] and take a photo. That was awesome. I expected a van."

Frank Rinaldo
McMurdo Janitor from Sherrill, New York
first season

"I did not expect that so many different countries would be conducting research with us on King George Island."

Dave McWethy
COPA seabird biologist from Victor, Idaho
first season



Ozone hole follows Antarctic weather trends

By Kris Kuenning
Sun staff

Like a fickle pop star, the ozone hole reinvents itself each year. Thanks to a global clean-up act, the world's most famous atmospheric trend is already going out of fashion. But in the meantime, the great gap is simply a slave to polar weather patterns.

Last year, the hole in the ozone layer surprised researchers by being small and fragmented. This year, it's just short of the largest recorded size. But these variations are not related to the amount of ozone-depleting chemicals in the environment. Earth's protective layer of ozone is on track for a full recovery, but scientists expect a hole to appear around the polar regions once a year for at least the next 10 years. While the number of ozone-destroying chemicals in the atmosphere gradually begins to decline, variations in the size of the ozone hole are determined annually by polar weather.

Ozone serves the planet by filtering the dangerous spectra of ultraviolet light. Ultraviolet-B light causes sunburn and skin cancer in humans. It also has the ability to change the genetic makeup of plants and therefore alter the food chain.

This year, with the ozone hole exceeding the size of the Antarctic continent and even exposing the southern tip of South America, its effects will be tangible for people living in southern latitudes. While weathermen alert Chileans to dangerous levels of ultraviolet light, Australians and New Zealanders should be spending another spring under a thick paste of sunscreen.

Antarctica, in summer, is the temporary home for more than 2,000 sun-conscious people. Among them are scientists who track the levels of ozone above the continent. Terry Deshler of the University of Wyoming has been overseeing ozone research in Antarctica since 1986, one year after the ozone hole was first discovered.

Ozone is made up of three oxygen molecules (O_3), brought together by the energy of the sun. From its equatorial breeding ground, ozone travels through the upper level of the atmosphere, the stratosphere, and some of it is transported towards Earth's poles.

When the sun sets on the Antarctic summer, the dark air cools, causing a low pressure center called the polar vortex. Because of the Earth's rotation, warm air at the boundary can't get in to the low-pressure center. Inside the vortex, temperatures plummet to below –79 C.

It is in this vortex that the systematic destruction of ozone occurs, so the size of the vortex determines the size of the hole in the ozone layer.

"The size and stability of the polar vortex is determined by the amount of tropospheric storm activity," Deshler explained. "A year with a lot of storms around the periphery of the continent of Antarctica can cause the polar vortex to become unstable and make it smaller."

Bad weather is good for minimizing the ozone hole, while less stormy weather brings a larger vortex.

"In general, the vortex above Antarctica is quite stable and quite large," Deshler said. Last year's smaller hole was unusual. "Only two times in the last 15 years has the ozone hole been not as big as we were expecting."

Last year's vortex actually split in two, causing two small ozone holes to go careening towards the edges of the Antarctic continent. Deshler said the vortex was sent into oscillation and then split in two by energy from frequent polar storms.

This year, conditions conspired to make one big hole. Peaking at 28 million km square, it was the same size as the record hole in 2000, according to the World Meteorological Organization ozone bulletin in 2003. That's more than twice the size of Antarctica, its islands and ice shelves combined, or more than three times the size of the United States.

Inside the vortex

With the launch of balloons into the stratosphere, scientists are able to tell exactly where ozone is lost in the atmosphere's profile.

There may be a layer between 12 and 20 km above the earth where zero ozone is present, but above or below that, low levels of ozone still exist. The overall effect is more like a very thin layer of ozone than a true hole.

So why does the ozone hole appear at the poles and not over Jamaica? And why only in spring? The answers lie within the swirling polar vortex.

There are three factors that come together to wipe out ozone – naturally occurring polar clouds, human-released Chloroflorocarbons (or CFCs) and the

See Ozone on page 8

Ozone study goes global

By Kris Kuenning
Sun Staff

Study of the ozone hole continues to be some of the most important research coming out of the Antarctic, drawing the attention of the world and focusing international collaboration.

Even if the discovery of the ozone hole and its cause had been the only results to come from Antarctic research, that would be enough to justify all the money invested, said British Antarctic Survey Deputy director John Dudeney.

That research continues. In addition to the regular, annual spring research, Terry Deshler's team from the University of Wyoming participated this year in an international experiment to track and measure air parcels as they moved around the Antarctic continent. The project involved the coordinated release of measuring units known as ozone sondes from nine stations in Antarctica: South Pole (U.S.), Belgrano (Argentina & Finland), Dumont d'Urville (French), Marambio (Argentina & Spain), Neumayer (Germany), Rothera (UK), Syowa (Japan), Davis (Australia), and McMurdo (U.S.).

Post-doctorate research assistant Jennifer Mercer said, "We would get an e-mail that Belgrano launched a sonde four or five days ago and then we would launch ours."

The timing of the releases was coordinated by the Alfred Wegner Institute in Potsdam, Germany and 14 nations are involved in the measurement and analysis campaign.

The goal is to measure ozone in nearly the same air parcel from several locations and compare ozone changes in the air parcel with our understanding of ozone chemistry.

Coming this year...

Although gradual healing of the hole is expected, predictions indicate the recovery may be delayed by the impact of global warming. Frank Murcray, from the University of Denver, will be overseeing a project that aims to make measurements of some of the chemical components that are involved in ozone chemistry.

Satellite instruments don't take measurements as well in the darkness of winter so ground-based instruments can provide important additional data. This year, the team will install ground-based spectrometers at South Pole Station and McMurdo to study vortex-related chemical and dynamic effects.

"This will provide information on how the atmosphere has changed in intervening years. We are hopeful that the extension of time coverage and the comparison of current and historic measurements will give a fairly complete picture of the status of ozone chemistry and how it is changing since international treaties have reduced chlorofluorocarbon (CFC) emission," Murcray said.

Photo by Anthony Powell/Scott Base

Olivia Billett and Rebecca Batchelor launch a balloon to measure ozone.

Ozone From page 7

magic ingredient – sunlight.

Ozone depletion is a result of human release of chloroflorocarbons into the atmosphere. CFC's were first produced in the 1930s as a completely safe refrigerant. During World War II, they were used as propellants in insecticide spray cans.

In 1947, the first automobile air conditioner was developed using CFCs, and production picked up further in the '50s and '60s, when it reached 60 million tons. Up to 70 percent of that went directly into the air. Wind currents distribute CFCs around the stratosphere.

The chemical makeup of ozone is just one step away from the oxygen we breathe. When the CFCs get broken up by the sun's radiation, chlorine is released. The chlorine molecule then has the power to extract one oxygen atom from an ozone molecule, thus destroying ozone.

"Chloride is an unhappy molecule because it's missing an electron," explained post-doctorate research assistant Jennifer Mercer. "It works as a catalyst to the ozone, stripping off an O."

In polar regions, the particles of polar stratospheric clouds provide an especially fertile staging area to convert chlorine, trapped in benign molecules, into an active state ready to destroy ozone. Because polar stratospheric clouds exist only at the poles, 90 percent of ozone destruction occurs there, Mercer said.

The vortex forms in winter, but the destruction doesn't occur until the sun comes out in the spring. By mid-October the warmer weather is already weakening the vortex to release its contents.

Although a seasonal Antarctic ozone hole is a foregone reality for at least the next 10 years, the news is not all bad. By phasing out the production of CFCs, the Montreal Protocol agreement reduced atmospheric CFC levels by more than 86 percent in 13 years.

According to the World Bank's Montreal Protocol Status Report, released on Sept. 17, 2003, annual consumption of CFCs dropped from 1.1 million tons in 1986 to 150,000 tons in 1999.

Without the protocol, the report estimates consumption would have reached 3 million tons by 2010.

Deshler said the ozone story is a positive one.

"A global problem created by local human activities was identified, and reasonable solutions were adopted by the world's leading countries to reduce and eventually eliminate the problem."

Pop goes B15

Researchers hope to learn more from big berg's breakup

By Brien Barnett
Sun staff

Researchers tagged and bagged two important icebergs Friday, weeks after the giant B15A iceberg split in two earlier this month and mere days before a key member of the team was due to leave.

It was a Halloween treat for Doug MacAyeal, a glaciologist at the University of Chicago, who headed a team that erected a weather and global positioning tower on B15A. He returns to Chicago next week, though his team will remain at McMurdo conducting further research.

Another team set up a station on iceberg C16, which is to the southwest of B15A.

MacAyeal has wanted to track an iceberg through its phases until it disappears to write what he calls a "user's guide to icebergs." He expects the instruments will provide key information about the movement and disintegration of the massive objects.

The iceberg split into two pieces earlier this month after more than two years locked into position north of Ross Island.

While visiting the bergs Friday, MacAyeal spotted additional fissures he predicted may lead to further breakup of the berg this year.

On Oct. 9 Judy Shaffier, an analyst at the National Ice Center in Maryland, spotted the break in the B15 iceberg in a satellite photo and confirmed it using an infrared image from another satellite.

The ice center named the smaller, southern iceberg B15J. The larger, northern berg retained the name B15A. The last letter indicates the succession of "child" bergs the original B15 iceberg has spawned. B15 has broken into 10 smaller icebergs (including B15A), most of which have since floated away from the area and to the north.

According to MacAyeal, powerful winds of up to 120 kph during a storm on Oct. 7 played the primary role in snapping the berg.

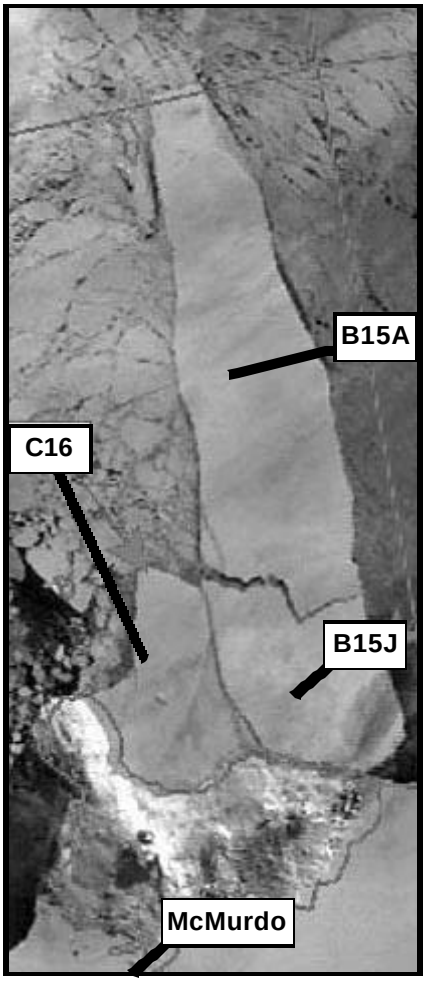
The process that broke B15A came in three stages. First, two cracks had worked their way from opposite sides of the berg toward the middle, but like a sawyer felling a giant tree, didn't exactly meet in the middle. That middle kept the berg intact, but now acted like a hitch on a truck.

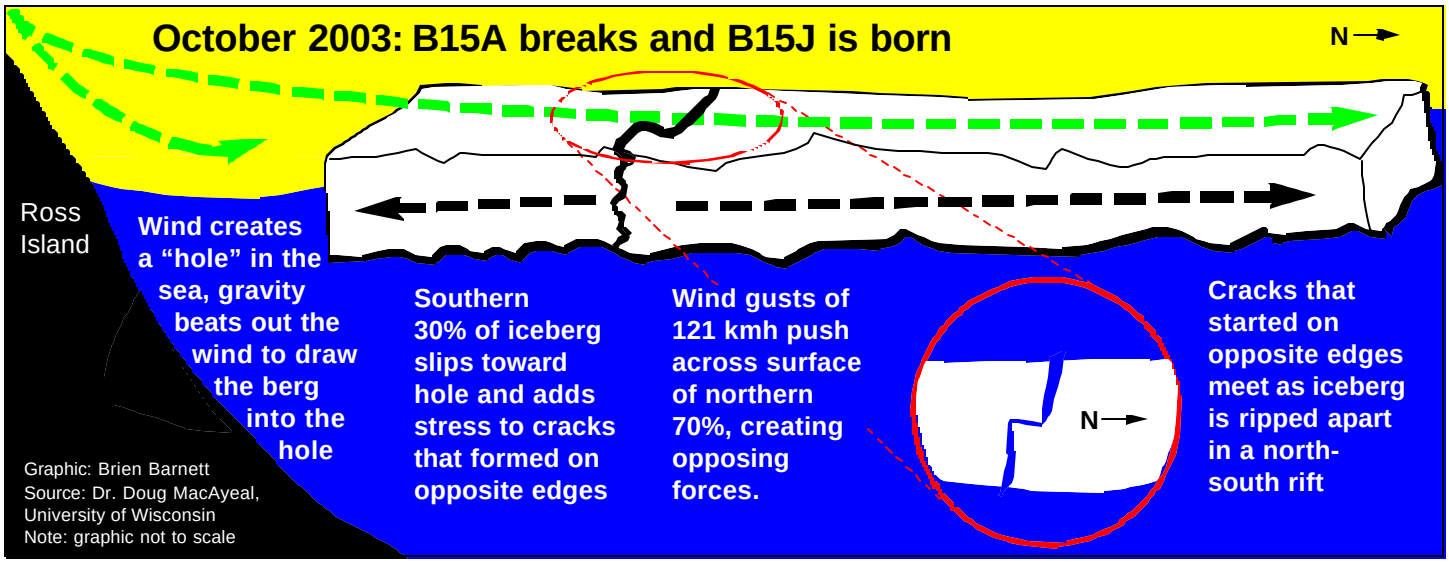
Next, the strong winds generated by the storm blew north-northeast, pushing the iceberg. However, the wind also pushed the surface of the water between Ross Island and the southern edge of the berg north. That created a slight depression of perhaps just a few centimeters over several kilometers – "an inclined plane," as MacAyeal put it.

The final act was the pull of gravity as the southern third of the berg slipped back toward the hole and ripped free from the more massive northern portion. Once the storm subsided, the bergs drifted close to one another, but were now separate. Even though it is still immense, at 3,496 sq. km, B15A is not the world's largest iceberg. That title goes to C19A, which, at 5,659 sq. km is residing in the so-called "iceberg graveyard" near Durmont D'Urville, west of the Ross Sea.

MacAyeal, who has studied B15 from the time it calved, or broke away from, the Ross

See Berg on page 10





Berg

From page 9

Ice Shelf in March 2000, predicted the breaking point some two years ago, but B15A was quite resilient.

And despite his nearly constant attention over the last few years, MacAyeal learned about the split second-hand. He was on his way to McMurdo when word was forwarded.

"It was like watching a pot of water come to a boil," MacAyeal said. "We watched it for more than two years and it cracked when we looked away."

Nevertheless, MacAyeal sees the now independent bergs as a big opportunity to study how icebergs live and die. There are now weather stations on all three bergs. MacAyeal said he hopes the newly installed weather and GPS station on B15A will remain with the iceberg until the end, eventually disappearing into the ocean with it.

He has identified at least four more cracks on the two icebergs that could cause them to further break up. But that doesn't mean there isn't valuable data to be gathered.

It will take a long time for the bergs to clear out and disintegrate, perhaps many years, MacAyeal said.

The bergs generally are locked into the same place they've been for the last few years.

That spot, against Ross Island to the south, C16 to the southwest and Franklin Island to the northwest, appears to be an avenue for ocean currents that sweep annual sea ice out of McMurdo Sound.

Photo by Brien Barnett/The Antarctic Sun

Iceberg expert Doug MacAyeal adjusts wires on the weather and GPS station that was installed Friday on B15A, which will be tracked until it disintegrates.

McMurdo sea ice outlook

B15 is the prime suspect as the cause of thick fast, or attached, ice around Ross Island. It is thought the iceberg interrupts the normal ocean currents, according to working theories. Several years of thick ice required two U.S. Coast Guard icebreakers to clear the channels.

The sea ice forecast from the National Ice Center for this year estimates only about 30 km of annual fast ice, compared with nearly 90 km last year. However, near McMurdo Sound and Hut Point the second- and third-year ice is expected to be as thick as last year. According to the Oct. 20 McMurdo sea ice report, this year's ice depth ranges from 1.5 m at the edges to 4.2 m under the sea ice runway,

Two icebreakers, the *Polar Star* and the *Polar Sea*, are scheduled to leave Seattle in November and arrive in the area around Christmas, National Science Foundation Representative Al Sutherland said.

Sutherland said TERASCAN satellite images clearly show where the channel was cut last year, but said it doesn't mean the ice is thinner.

"The ice in the channel is more rugged and busted up than the surrounding fast ice," he said. "Boulders the size of buses and locomotives have frozen back together again. Even though the annual sea ice is much less in extent than it was last year, the breaking of the channel, through very thick ice, will remain a challenge. Unless there is a dramatic natural breakout of the multi-year fast ice, ice-breaking this year may not be appreciably easier this year when compared to last."

The primary question now is what will the icebergs do this year. It's anybody's guess, said MacAyeal, the iceberg researcher. Additionally, another iceberg-to-be seems looming on the Ross Ice Shelf. A stress fracture near 177W (the western edge of the original B15) has become more pronounced during the past few years and is being monitored, Shaffier said.

There is a chance B15A will move north quickly and follow the normal iceberg track to Cape Adare, both MacAyeal and Shaffier said. However, Shaffier has noticed B15A and B15J are moving in roughly the same pattern as the original B15 and she doesn't expect the cork to pop quickly.

What B15 split means for Crozier's emperor penguins

By Brien Barnett
Sun staff

The iceberg B15 has made life confusing and sometimes deadly for the penguins of Cape Crozier.

Over the last two years B15 wreaked havoc on the emperor penguin colony at Cape Crozier, which depends on stable sea ice to incubate their eggs. On the other hand, the increased fast ice west of iceberg C16, adjacent to B15, lead to better conditions for the emperor penguins at the much larger Beaufort Island colony.

Penguin researcher Gerald Kooyman of Scripps Institution of Oceanography estimates nearly 75 percent of the emperor penguins previously counted at Cape Crozier are no longer around. On a visit to the area this year, Kooyman and his team found few emperors remaining and many bodies of adults buried in ice, as well as unhatched eggs and dead hatchlings.

"I felt that there is a pretty high level of adult mortality," Kooyman said. "If there wasn't much, then I would think that the colony would bounce right back."

Kooyman said he believes the destruction caused by B15A is not normal, but he isn't completely sure of the birds' fate. Certainly many adult emperor penguins and all chicks died, but even annual population counts were next-to-impossible this year given the amount of ice debris and the danger in attempting to reach the area.

"Most of the damage is already done," Kooyman said. "All of the trash bergs and trash ice that's in there are still causing problems."

David Ainley and Grand Ballard, who study the smaller Adelie penguins at the Ross Island colonies, said those birds seemed to adapt well to B15, even if they were a bit confused at first. As well, the Adelies breed much later in the year in summer and are not dependent upon stable fast ice, as are the emperors.

The main effect of B15, Ainley said, is that the Adelies from Cape Crozier had to move farther east to find food, and that fortunately the staples of the food chain also moved east, likely due to the changes in ocean currents brought by the bergs.

Ainley and Ballard soon will be in Antarctica to continue their research, again focusing on birds that previously nested at Cape Royds and Cape Byrd on Ross Island's western edge.

In the past two seasons, many of the Royds and Byrd penguins opted for Cape Crozier, because there was no fast ice there, and all the fast ice in McMurdo Sound out to Beaufort Island had discouraged them from their normal routine. Kooyman and Ainley both said more research, and time, will tell what the effect of B15 will be.

Drake's revenge

Waves of nausea on the open sea

Photo by Kristan Hutchison/The Antarctic Sun

Waves off the back of the Laurence M. Gould *as it crosses the Drake Passage. The ship's captain referred to the waves, which reached 4.5 meters and caused the ship to roll up to 30 degrees, as moderate.*

By Kristan Hutchison
Sun staff

Just going to work makes Barbara Watson sick. It's a common problem among her fellow commuters, who pitch and puke with the waves during the 1,500-km ship trip from Punta Arenas, Chile to Palmer Station, Antarctica.

"You're the little rubber ducky in the bathtub," said Watson after returning to Palmer in September for her third season as an instrument tech. "The crossing probably is the hardest part of the job."

The only way to Palmer is across the Drake Passage, where currents and storms meet in a tumult of wind and waves. At first, the rocking of the boat is lulling, making passengers sleepy. Then that thick feeling in the brain turns to pain, followed by an increasingly queasy stomach. The misery usually builds with the seas.

"You get this knot in your stomach and you know if you don't lie down in the next 15 seconds you're going to be violently ill," Watson said. "The worst part is, once you've started being ill, it's all over unless you go to sleep and start over."

Marine projects coordinator, Skip Owen, has made more than 50 crossings and dealt with his share of seasick passengers. He says the illness has two stages.

"The two stages of seasickness are when you are afraid you'll die," Owen said. "and then become afraid that you won't."

Death is rarely a risk, though the nausea and inability to keep food or drink down can cause severe dehydration, said Dr. Kristin van Konynenburg.

"That can become life threatening very fast," said Owen, who was aboard once when a passenger became so seasick they required an IV. He keeps an eye on all the passengers in bad weather, noting who is up and about, and who may be lying in their bunk in misery.

Causes

People who think motion sickness is all in the head are right. More precisely, it's caused by confusion between what we feel in the inner ear and what we see.

As humans, we keep our balance with the help of three angled tubes in the inner ear. Fluid in the ears sloshes against tiny hairs, triggering signals sent back to the brain to tell us where we are in relation to the ground. On boats, planes or other situations where people get motion sickness, the inner ear says one thing while the eyes see another.

"It's a miscommunication between the visual information you're getting and the inner ear cues," van Konynenburg said.

Everyone has a threshold at which they will get motion sickness, according to studies. But some people have a lower threshold than others.

"I've seen some people that just sitting on the dock they get seasick," said *Gould* third mate James Bellanger.

Women are more prone to motion sickness than men and the symptoms often decline with age. In studies, Asians have also shown a higher tendency to get seasick than Caucasians, and more intense symptoms, indicating a possible genetic susceptibility. People also can adapt to motion with constant exposure, as seasoned sailors demonstrate. Bellanger was frequently sick his first three years at sea.

"Most of the time I wouldn't wait to get sick. I'd go into the bathroom and make myself get sick so I'd feel better," said

See Seasick on page 12

"It has this motion where you kind of feel like you're circling the drain the whole time,"

- Dr Kristin van Konynenburg

Chris Vitry and Wendy Beeler get some fresh air on the deck of the Laurence M. Gould *as it cruises away from Punta Arenas Sept. 22, 2003 on the way to Palmer Station.*

Photo by Kristan Hutchison/The Antarctic Sun

Seasick

From page 11

Bellanger, who hasn't been seasick in recent years. The chances of seasickness increase with speed, wave frequency and the motion of the ship. While seasickness has sometimes been pinned on a ship's heave, or up-down motion, the most nauseating voyages involve a combination of up-down, side-to-side and forward-back motions, according to studies. The *Gould*'s design is famous for inducing sickness.

"It has this motion where you kind of feel like you're circling the drain the whole time," van Konynenburg said.

Cures

The treatment van Konynenburg usually gives out on the *Gould* is meclizine, which reduces the sensitivity of the inner ear. Many people bring their own, but Owen also leaves a bottle out on his desk for anybody who needs it.

"The meds allow you to keep food down," said van Konynenburg.

Other antihistamines work to stop the nausea, including promethazine, Benadryl and Dramamine. They leave people drowsy and dry mouthed, but sleeping through the trip is better than being miserable, say those who take it. Watson swallows Phenergan when she boards, then goes to bed for the rest of the trip.

"It tends to put you to sleep, which is not a bad thing being on the ship," said Watson, who left her cabin only briefly during her voyage in September.

"Being in bed you feel better," said Wendy Beeler, who took meclizine for her nausea on the trip to Palmer. "That's part of why you stay in bed."

Other people come on board wearing dime-sized patches behind one ear. The patches administer low doses of scopolamine, a narcotic that helps prevent nausea, but can also trigger hallucinations, depression and dry mouth.

"In the 20s it was used in large doses during childbirth," van Konynenburg said. "It was called twilight sleep because the woman wouldn't remember anything."

She tried it on one voyage, but found the side effects too disturbing. She couldn't focus enough to read or knit.

"I got so tired of being out of it all the time and being sleepy," said van Konynenburg, who decided to try herbal remedies on her most recent voyage. She put an herbal oil called Motion-eaze behind her ears and took a homeopathic remedy called Trip-Ease. After meals she drank ginger tea to settle her stomach.

"All I have to say is I can enjoy the side effects and I feel great," van Konynenburg said a day into the trip. "I've had two meals today."

When the seas got worse a day later, she resorted to meclizine, which she'd packed just in case.

On his first voyage, Steve Barten wore acupressure bands on his wrists to prevent seasickness.

"I have drugs too, but I'm not taking them yet," he said. "I just step out when I'm feeling a little dizzy."

Fresh air and looking out at the horizon can help recalibrate the inner ear with the outer world if the symptoms are mild. Breathing slowly and deeply can also ward off motion sickness.

If you must be inside and away from windows, it's best to be at the most stable point on the ship, at the center of the axis. On the *Gould*, that tends to be low and toward the middle.

It's also better to keep food in the stomach, even if all passengers can handle are crackers and water.

Then there are the really strange cures. An old Chilean sailor swore putting a cross on his stomach with electrical tape prevented seasickness,

"Sometimes they'll get so desperate they'll try anything," said Captain Robert Verret. Like many seamen, he never gets sick, though he did occasionally get queasy when he started.

If the ship's crew does get sick, they have to tough it out.

"I'm not allowed to be sick," said Rudy Lucas, the cook on the *Gould*. "Sometimes I feel sick, but then I just come outside, get some fresh air. That's the best thing."

He puts out crackers for the passengers when the ride gets rough and isn't surprised to see the galley empty at mealtimes.

There is one guaranteed cure for seasickness – land. Most people are only sick for the two days that the *Gould* is actually crossing the rougher waters of the Drake Passage. And if they have been sick, they're more than happy to stay in Palmer for several months before making the crossing again.

"I crawl out of bed every 12 hours, eat and then go back," said Jeff Kietzmann of his trip to Palmer. "I don't like it."

Photo by Kris Kuenning/The Antarctic Sun

Boarding a U.S. Air Force C-141 for a flight to McMurdo.

There's no comparison

PLANE	SHIP
5 to 8 hours	4 days
boomerangs	rarely turns back
see water from above	see sky from below
no inflight movie	movie marathon
brown bag lunch	all-you-can-eat buffet
only one bathroom	full bath, with jacuzzi
sleep if you can	sleep for days
airsickness rare	seasickness common
nowhere to go	lots to explore
summer only	yearround

Commute

From page 1

applies depends on whether they are waiting in Christchurch to squeeze into a nearly windowless plane for the flight to McMurdo Station or waiting to board a ship in Punta Arenas for the tumultuous ride across the Drake Passage to Palmer Station.

The first stop for everyone is the clothing department to try on the clothes they will need in Antarctica. Those destined for the mainland try on thick parkas, green for Pole or red for McMurdo, and insulated boots. Only those deploying on the ships to Palmer Station are given rubber rain boots and slickers to keep off the waves and wet weather. Everyone packs several layers of long johns, Carhartts, hats and gloves.

"You instantly gain 200 pounds. You have to have a really good sense of humor about it," said Carly Waude, a first-year employee in the retro department. "I couldn't wait to get on the plane so I could start taking stuff off."

By air

This year, about 13,400 Antarctic personnel will fly from Christchurch to McMurdo, some on their way to the South Pole, according to Lynn Dormand, manager of the Raytheon Polar Service deployment specialists group. For them, half the story of flying is in waiting. There's waiting at the terminal for the flight when it's delayed. Then waiting back in Christchurch when it's canceled.

Photo by Kris Kuenning/The Antarctic Sun

Joe Yarkin weighs in at the U.S. Antarctic Program passenger terminal in Christchurch and is given further instructions.

Each year, roughly 40 to 75 of the scheduled flights are delayed by a day or more, usually due to weather, according to Antarctic Program Transportation Planner Ray Gabriel. Other flights take off, then boomerang, turning around midway and landing back in Christchurch.

The U.S. Antarctic Program uses four kinds of planes to fly people to McMurdo. The smallest, oldest and slowest of these are LC-130 Hercules, which take eight hours to make the trip. The larger and faster C-141 Starlifter, C-17 Globemaster and C-5 Galaxy can all make it in about five hours. Because the LC-130 has skis and is able to fly to the South Pole and other points on the polar plateau, it generally stays on the continent during the summer season.

The aging C-141s will be replaced by C-17s in the next couple of years, according to Gabriel. Most passengers will be happy with the switch.

"The C-17 was much nicer; you've got room to move. You're not packed in there too tight," said Drew Merritt, a second-year ironworker. "I'd take a C-17 over a C-141 anyday."

Being military aircraft, the planes are more utilitarian than aesthetic inside, with exposed struts and wiring. The décor is military green, with only one true bathroom and a couple windows. On the LC-130 and C-141, passengers fly strapped into red webbing benches facing each other rather than facing forward. The in-flight meal comes in an oversized brown-bag - two sandwiches, juice, water, fruit and snacks.

Most people wear earplugs to protect themselves from the noise of the engines,

See Commute on page 14

Photo by Kristan Hutchison/The Antarctic Sun

Mike Jayred, Palmer Station waste management specialist from Livingston, Mont. , aboard the Laurence M. Gould *as it cruises through the Straits of Magellan Sept. 22 on its way to Palmer Station.*

Commute

From page 13

which also puts an end to conversation. Instead, passengers try to read or sleep in their seats. A few manage to knit or work on laptop computers.

"It's like sardines packed in marshmallows on a flying tin can," said Damien Henning.

After five hours or more, the passengers sense a slow descent without being able to see what's outside. The plane comes to a stop, the door opens and a bright white light spills into the dim interior. Filing out of the plane onto sea ice 4 meters deep, the newcomers blink and look around like moles in the noontime sun.

"They can be like deer in the headlights. They just start wandering around. It's almost like they're drugged. You have to go tap them on the shoulder and take them to the bus," said Tim Dye, a volunteer "Ivan The Terra Bus" driver. "It's kind of like herding cats. There are people wandering around all over the place, taking photos of the plane, the bus, the mountains."

Then those continuing to the South Pole get to start the waiting all over again.

By sea

For the nearly 500 Antarctic participants traveling through Punta Arenas each year, there's less waiting on shore and more time on board the ship. Most people spend just one night on shore before moving into bunks on the *Laurence M. Gould* the night before it's set to sail. Unlike the flights where every bag and passenger is weighed, the crew loads luggage without worrying about the weight. Passengers help carry the fresh fruit and vegetables.

The ship usually leaves on schedule and passengers come out on deck to watch the yellow, blue, red and green painted buildings of Punta Arenas dwindle.

"This feels more like you're really going somewhere," said Tim Kramer, a second season solid waste technician. "This isn't your quick little jump across in a plane to another continent. It's like this epic journey that starts in the States and goes five days and hasn't stopped. It actually feels farther away."

> No matter how hard the ride, by boat or plane, everyone ends up in Antarctica

Though the voyage by ship is slower than the flight to McMurdo, the passengers also have more to do. Kramer spent much of the voyage on the deck or the bridge, watching the waves grow and feeling the temperature drop. Often the passengers have the opportunity to help with science during the voyage, deploying probes from the back deck of the ship to measure temperature and salinity of the water.

The trip starts relatively smoothly, then gets rougher when the *Gould* reaches open water the second day. Passengers know they are entering the infamous Drake Passage because the ship starts rocking in earnest.

"There's nothing to stop the wind, and it's channeling through a very narrow passage there," said Janet Sprintall, an oceanographer at Scripps Institute of Oceanography in San Diego.

When the seas get really rough, some chairs fall over and drawers slide open as the ship rocks back and forth 30 degrees or more. Many people retreat to the lounge to watch movies for the rest of the ride or to their bunks to wait for the waves and nausea to pass.

"This takes it out of you," said Wendy Beeler, the Palmer cook. "Flying doesn't make you wretch your stomach muscles out."

The payoffs are also great. After two days with nothing to see but water in all directions, the *Gould* slips into the Neumayer Channel along the Palmer Peninsula. The rocking slows to a slight sway and passengers who have barely left their bunks for days come out on deck to watch the islands, icebergs and occasional penguins.

No matter how hard the ride, by boat or plane, everyone ends up in Antarctica.

"You've got this possibility to meet all these people you will be with," said Alejandro Nieto, a firefighter. "Depending on who you meet and how you feel, it can be very short."

Science under the waves

By Kristan Hutchison/*Sun staff*

The best view of the Drake Passage is below deck, in a room where computer screens draw a window into the world beneath the waves.

Above deck there's nothing to see except water for 20 km in all directions. But in the equipment lab, the sea floor and ocean currents become visible based on temperature and salinity measurements with depth, taken at regular intervals by instruments onboard the research vessel *Laurence M. Gould.* Other instruments sample the chlorophyll in the water and ultraviolet light from the sky.

"That's all what they call 'science of opportunity.' Everywhere we go we collect that," said Fred Stuart, marine computer instrument specialist.

More detailed data on temperature and salinity is collected six times a year by launching probes on copper threads off the back deck every 10 to 15 km. Together they create a two-dimensional map of the current speed in the infamously wild water.

The Drake Passage is a deep and narrow waterway connecting the Atlantic and Pacific oceans. The clockwise Antarctic circumpolar current squeezes between South America and the Antarctic Peninsula, creating eddies and currents as the water rushes eastward through the 1,000 km gap. About 130 million cubic meters pass through each second.

"It's important because it is global," said Janet Sprintall, an oceanographer at Scripps Institution of Oceanography. "It's the only ocean current that goes right around the world, so it plays a very important part in transferring heat and water from one ocean basin to the next."

As the ship travels south from Punta Arenas, the changes in the water are clear. On a September cruise the water temperature started around 7 C at the Straits of Le Maire at the tip of South America.

"It's quite warm, relatively speaking," said marine projects coordinator Skip Owen.

By latitude 56, the temperature was 3 C at the surface. It's the beginning of the three polar fronts that make up the Antarctic Circumpolar Current, where cold Antarctic water meets warmer water from the South Pacific.

The fronts drift north in the winter and south in the summer, but it's noticeable when the ship crosses them.

"You'll be watching and all of a sudden there's a dramatic change in temperature," Stuart said, standing in front of the screen tracking water temperature. On the other side of the polar fronts, the water is typically –1 C to –2 C, said Sprintall. Seawater freezes at –4 C.

The warmer northern water is also fresher than the Antarctic water to the south. Though the difference is only about 0.5 parts per thousand, it's enough to allow Sprintall to track the water currents based on their salinity and temperature.

On its southbound trip, the *Gould* first crosses the Sub Antarctic Front. It is the warmest and most northern, usually 3 C to 5 C. It is also the smallest and slowest of the three. Next comes the Polar Front, which ranges from 2 C to 4 C.

Photos by Kristan Hutchison/The Antarctic Sun

Above: *Marine science technician Mo Hodgins (left) and Jesse McGill process water samples in the lab on the* Laurence M. Gould. ***Left:*** *Marine projects coordinator Skip Owen replaces an XBT probe on the back of the Laurence M. Gould while crossing the Drake Passage.*

"The Polar Front tends to have a lot more water and it's stronger," Sprintall said.

Finally comes the Southern Antarctic Front, at a chilling 1.5 C. Most of the way around the continent, the fronts make separate and distinct bands, but the Drake Passage turns them into turmoil.

"They can separate widely around the southern ocean, but what happens in Drake Passage is they have to squeeze together," Sprintall said.

Changes in the ridges in the sea floor or the wind may speed up or slow down a portion of the water, causing a traffic jam in the flow through the Drake Passage. The water swirls into eddies from 100 to 150 km in diameter, usually between the Sub Antarctic and Polar fronts.

Sometimes visible from satellites, eddies are mixing zones where heat, salt and sea life are transferred.

The Drake Passage drops to 4,000 meters in places. The gully is not constant, but instead interrupted by underwater ridges topographically connecting the Andes to the Antarctic Peninsula. Though the currents extend to the bottom, the probes only reach to 800 meters and sometimes fail before that.

"There's a lot of the ocean I'm missing," Sprintall said.

At the very bottom, below the reach of the probes, the coldest and saltiest water in the world pools. Called Antarctic bottom water, this brine develops over the continental shelf as ice forms in the winter. It drops down and spreads along the seafloor, eventually seeping into all the ocean basins. Nearing the Antarctic Peninsula the seafloor rises again, swiftly reaching just 200 meters as the ship moves over the narrow continental shelf around Antarctica.

That's a signal to move back above deck, where the icy peaks and islands are about to appear.

Winter From page 1

Cosmology Bolometer Array Receiver) module mounted on the 2.1-meter Viper telescope. The module looks at CMB, essentially the radiation produced at the formation of the universe. As well as understanding CMB, the module can be used to detect other objects. Holzapfel said the module produced the highest resolution and sensitivity maps of the CMB ever recorded. His team returns this year to collect more data.

The All-Sky Imager project trained instruments at the winter night sky and made some fantastic observations. Yusuke Ebihara of the National Institute of Polar Research reports that during the 2003 winter season, the All-Sky Imager was operated with a new optical filter that allowed scientists to detect relatively weak proton aurora clearly and project it as a two-dimensional image.

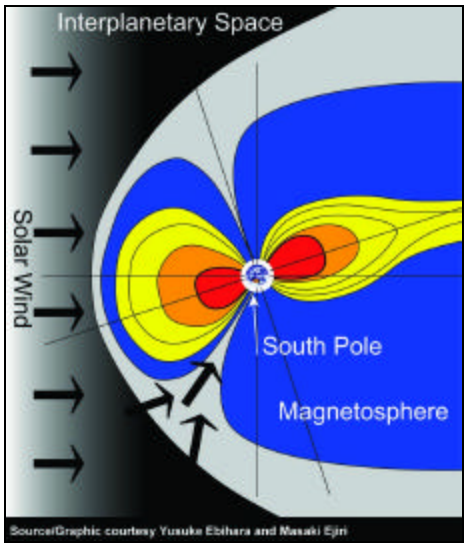
The work on this project will help researchers better understand auroras. Also, according to Ebihara, the team used the imager to monitor the interaction between the solar wind and Earth's magnetosphere and detected small-scale wavy structures from an airglow emission that appear to have been modulated by a gravity wave.

During the past winter, SPARO focused on regions of the galaxy where new stars and planets are being formed. SPARO, the Submillimeter Polarimeter for Antarctic Remote Observations, studies the Milky Way Galaxy — a huge structure comprised of billions of stars, one of which is our own Sun. Just as the Earth and Sun have magnetic fields, the galaxy also generates a magnetic field, and SPARO's goal is to map out the lines of force of this vast galactic field.

The SPARO experiment generated results that indicate the magnetic field lines in these stellar birthplaces tend to run parallel to the galaxy's flattened disk. This new result may help astronomers to understand how galactic magnetism influences star formation.

SPARO team member Huabai Li is working on the interpretation of this data in preparation for a presentation at the conference "Astronomical Polarimetry 2004" that will be held in Hawaii in March. The SPARO experiment was operated successfully at South Pole during Austral Winter 2003 by Paolo Calisse.

Compared to the South Pole, winter is gentler at Palmer Station, 197 km outside the Antarctic Circle on the Antarctic Peninsula. Temperatures stay around –10 C, and the sun makes a noontime appearance even during the winter solstice. Scientists continue to come and go through the winter on the *Laurence M. Gould*.



The graphic above demonstrates how the solar wind affects the magnetosphere to create auroras over the poles, captured by the All-Sky Imager.

Biologist Bruce Sidell prefers to work at Palmer Station in the winter because it is easier to keep the ice fish he studies within their sub-zero comfort range. Any warmer and they die. This year he was on the Antarctic peninsula from April to June. He and marine biologist Bill Detrich trawled for specimens on the *Gould*, then took their catch back to the laboratory at Palmer Station.

For 12 years Siddell has studied the *channichthyid* ice fish. He's interested in why some ice fish don't have myoglobin, a protein present inside oxidative muscle cells of most vertebrate animals. Myoglobin binds with oxygen, storing it until needed and facilitating oxygen into movement within the cells.

"This is a protein that's thought to be very important to the functioning of aerobic muscles, like heart cell tissue, and yet here is a group of animals that's getting along without it," Sidell said.

By studying how ice fish transfer oxygen without myoglobin, Sidell may gain a better understanding of the fundamental movement of oxygen through cells. That knowledge could lead to a better understanding of the same process in humans.

"There are biomedical implications to all of this, of course," Sidell said.

The 16 species of *channichthyid* ice fish lack red blood cells or hemoglobin. Of those, six of the species also have white-hearts and don't produce myoglobin. While at Palmer this winter, Sidell looked at 11 different red-blooded species of fish to see if any of them had also lost the myoglobin production.

"The jury's still out on whether we will find any examples of myoglobin loss among the red-blooded species," Sidell said.

Sidell's studies on ice fish have led to dozens of publications, including one published this year in the Journal of Experimental Biology and two more being submitted for Polar Biology and the Journal of Experimental Biology.

Sidell also collaborated with Timothy Moerland, from Florida State University in Tallahassee, on a second project related to parvalbumin, a protein involved in the relaxation phase of muscles.

"It works better at cold temperature, basically, and we're trying to figure out why," Sidell said.

He returned to the U.S. with enough frozen fish and preserved specimens to keep him busy doing biochemistry and microbiology analysis for the next 18 months. He hopes to return to Palmer in March 2005.

Biologist Chuck Amsler also finds February to June a particularly good time to go diving around Palmer Station for the seaweeds, sponges and other invertebrates he and his group study. Amsler, fellow biologist Jim McClintock and biochemist Bill Baker are studying how those creatures use chemical shields to protect themselves from predators.

"Everything we're doing revolves around scuba diving collections. The advantage of going at that time is the phytoplankton bloom is over so the visibility is good," Amsler said.

The divers brought specimens back to the research aquarium at Palmer. Then Amsler and colleagues tried to feed pieces of the plants and animals to potential predators, frequently starfish. If the predator wouldn't bite, the researchers would take an extract of the prey they had turned down to see if there was a chemical reason for the picky eating.

"If a predator won't eat a prey item, we want to know why," Amsler said. Now the scientists have identified many of the chemicals the seaweeds and sponges are using to protect themselves. Next they want to learn how difficult it is for the plants and animals to create those defenses.

"We're interested in the biological currency, as in how much you invest in defense compared to how much you invest in growth," Amsler said.

This year was the first of two field seasons on the grant and much of the work involved setting the stage for experiments they will finish when they return this February.

"It was a very successful field season," Amsler said. "We got the data and got the things we need."

Amsler, McClintock and Baker continue to do chemical analysis with the samples they brought back to their university laboratories and prepare for the

See Winter on page 17

Winter

From page 16

next season. Results from previous field work were published this year in Marine Biology, vol. 143, and the Journal of Experimental Marine Biology and Ecology, vol. 290.

After the scientists left in June, science continued at Palmer. As at McMurdo and South Pole stations, many science projects are left in the hands of science techs all winter.

"I'm just the sample collector," said Sonja Wolter, the winter assistant supervisor of laboratory operations.

Every Friday she took a 60 ml glass jar to the pump house and filtered seawater to collect phytoplankton. Filling the same bottle in the summer sometimes takes two hours, because the water is so thick with phytoplankton.

In the winter the water clears up, leaving only a few speckles of phytoplankton on the filter. The rows of jars wait in the refrigerator to be shipped back to the scientists in the States for analysis, each containing a smudge of green. Scientists on the Long Term Ecological Research project track the levels of chlorophyll.

Science technician Zan Stine spent his winter listening for earthquakes, lightning, and nuclear attacks in a cabin-sized building up the hill from the rest of Palmer Station. The instruments work around-the-clock and so does Stine.

"I even sleep up here sometimes," said Stine. "I come down to break and I'm not very verbal, because it takes a while to get back into people mode."

Pages of squiggly lines hang on the back wall, dated and labeled with the location of the earthquake the seismometer readings were sensing. The big spikes were in Chile, Argentina and Indonesia.

"There was big stuff just this last week," Stine said in mid- September.

The Palmer seismometer picks up the quakes, but its data needs to be combined with at least two other seismometers in other locations to pinpoint the epicenter of an earthquake.

Photo by Kristan Hutchison/The Antarctic Sun

Palmer science technician Zan Stine removes the UV monitor calibration lamp to clean it before use. Over the winter, Stine was responsible for maintaining several science projects at Palmer Station.

"One station just looks like a bunch of waves," Stine said.

Scientists combine data from a network of 128 stations around the world to create an ultrasound of the Earth.

"You can actually make a map of the density structure of the Earth," Stine said.

The stations at Palmer and South Pole are particularly important because there are only three seismic stations in Antarctica.

"We get an angle on the Earth nobody else can get," Stine said.

He also gets an angle on the air and atmosphere. The very low frequency antenna stays tuned in to the Earth's upper atmosphere, recording a loud static for scientists to translate into a better understanding of space weather.

"You'll hear a whistle sometimes," said Stine, who records 15 gigabytes of data daily from the receiver. "The volume that's produced is pretty phenomenal."

Once a week, Stine changes the filter on an air sampling instrument. The filter looks like a super-thick paper towel. It is fed into a high frequency spectrometer that reads the radioactivity on the filter like a Geiger counter.

Most of the radioactivity is naturally made in the stratosphere. Scientists use the radioactivity levels to help calibrate carbon 14 dating, among other things. The filter would also record a spike in radioactivity caused by nuclear weapons, but none occurred on Stine's winter watch.

Back at McMurdo station, there were a few major projects and then the duty of collecting data and ensuring the equipment was functioning properly.

"Business as usual," said Seth White, winter science technician. White said the major projects at McMurdo this winter were:

- Long distance balloon launches to measure ozone loss and other atmospheric data. McMurdo station was one of nine sites designated to help detect the ozone vortex. Project QUOBI, which stands for Quantitative Understanding of Ozone loss, will help shape computer models for a better understanding of the ozone loss problem.
- The LIDAR atmospheric measurment project also assisted in detecting the presence of Polar Stratospheric Clouds which are the breeding grounds for ozone-destroying chemicals. LIDAR stands for LIght Detection And Ranging, and helps ozone researchers learn more about these clouds.

For more on the ozone story, see page 7 of this issue.

And that's the news from the polar night.

Antarctic Photo & Writing Festival

Four photo categories:

(One entry per category per person)

- **Scenic**
- **Wildlife**
- **People**
- **Other**

Photos may be digital or traditional, preferably at 300 dpi

Four writing categories

(One entry per category per person)

- **Poetry:** Up to 30 lines
- **Haiku:** Traditional 5-7-5 syllable poem
- **Micro-fiction:** Short stories; up to 300 words
- **Non-fiction:** Essays, letters home, e-mails, memos, journal entries, etc.; up to 300 words

More rules: One entry per category per person for both the photo and writing contests, so choose your best. The contest is for photography and art with an Antarctic theme. This will be broadly interpreted. You do not have to be on the Ice to enter. Winners will be printed in the Sun, on the Web and posted on Highway 1. E-mail staff for more info.

DEADLINE: 7 A.M. DEC. 14

Outlook users, e-mail entries to MCM-Antarctic Sun, others to antsun@polar.org, or stop by the Sun *office at Building 155.*

Profile

Bless her cotton socks

by Kris Kuenning *Sun staff*

Marlene McLennan's official title is assistant manager of the Clothing Distribution Centre (CD) in Christchurch. Those who know her well say the title Camp Mother is a better description.

Formally, McLennan's job is to make sure that everyone traveling to Antarctica has the right clothing for the job they'll be doing and the place they'll be doing it.

But the Southland-born New Zealander's generous and helpful nature finds her fulfilling all sorts of extraordinary roles.

McLennan wrote the book on above and beyond. And you don't have to take it from her. Researcher Nancy Chin remembers the horror of leaving her passport in an issue jacket. It was a Sunday, the CD was closed and she was due to fly back to the states the next day.

McLennan was there. She drove the 20 minutes from her home on her day off and helped Chin search through the mountains of dirty clothing until the passport was retrieved.

Still embarrassed by the trouble she caused, Chin remembers McLennan as the absolute savior of her day but, when questioned a year later, the event didn't even stand out for McLennan.

Deployment specialists group manager Lynn Dormand knows her as one of the critical factors that keep the U.S. Antarctic Program running.

She told of a recent problem averted for a group on their way to the Ice.

"The computer shows them going to McMurdo, but Marlene knows better," Dormand wrote in an email. "She fires off an e-mail and sure enough, she was right. These guys are also going to Pole. She quickly packed up the proper gear, and they were on their way. Good thing - don't want someone going to Pole without the proper gear! Computers are great, but intuition and fast human actions, like that of Marlene, save the day (and stave off frostbite!)"

At McMurdo, a group of women put on a charity function designed to say "thank you" to the gateway community in Christchurch. Organizer Liisa Talso said McLennan helps them by researching charities that might benefit from the donation.

"As busy as she is, she always sends us info on three or four organizations and then helps us get the money to that organization," Talso said.

After nine years in the CD, Marlene's enthusiasm is unfaltering. "I guess I'm a glutton for punishment," she said. "No. I truly love it. The people make the job. You develop relationships and they really do become family - an extended family. You become quickly involved in their lives."

Photo by Kris Kuenning/The Antarctic Sun

> "If I can add something and make the place a bit more jolly, then I feel like I've achieved something."
>
> - Marlene McLennan, CDC assistant manager

Her conversation is punctuated by classic Kiwi colloquialisms, delivered in her broad Southland accent. "Bless your cotton socks," she calls out to a sneezing colleague.

Among McLennan's personal favorite stories is the one about procuring glycerin for bagpipes. "A couple of seasons back, John, (who pipes in the new year at South Pole), arrived there to find that the New Zealand Ministry of Agriculture and Forestry had confiscated the bovine product he carried with him in order to clean the reeds on his bagpipes."

Receiving a desperate plea by email, Marlene not only found the product but also managed to get it to the South Pole in time for the celebrations.

"So, come New Year that season, folk at the South Pole were once again treated to the skirl of the "bagpipes", something we Scots hold dear to our hearts - and ears for that matter."

Coordinating a program of 2,000 people and helping prepare them for a continent of extremes is not without its challenges.

"The amount and the dyslexia of the hours are hard," McLennan admitted. "My friends ask why I keep doing it and the answer is that there has never been a day that I've woken up and thought 'I don't want to go to work today'. I know many people that trudge off to jobs they don't like."

Being part of such a major scientific research operation gives another element of meaning to McLennan's role.

"We're all here to make something happen. It doesn't matter how minor your part is in this big wheel, because every spoke is paramount."

Originally trained as a shorthand typist, McLennan said, "I loathed being stuck in the office. I'm a doer, a goer. Sometimes I think I've got too much energy for my own good."

CD manager for the last 17 years, Mike McIlroy made the decision to hire McLennan nine years ago.

"It had been a male domain in the warehouse for a long time, but Marlene slotted in well. She does a great job. She's out to help as many people as possible. That's why we call her Camp Mother. A lot of people would be lost if she wasn't here," McIlroy said.

It may be some of McLennan's particularly feminine traits that help her relate so well to the diverse group of people that flow through her department each season.

"People come in here, they've flown x amount of hours, some have never been out of the country," McLennan said. "When dealing with someone you have to put yourself in the same situation. I'm reasonably blessed in picking up vibes. I do often sense when people are a little down or amiss. If I can add something and make the place a bit more jolly, then I feel like I've achieved something.

A good attitude is McLennan's top-rated weapon. "Generally in life, I have a good attitude. I guess I've reached a certain point of maturity in my life where I do have some friends dying of cancer. So every day – if I wake up – it's a bloody fantastic day in my book."