October 29, 2006

The Antarctic Sun

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

Ozone hole breaks two records

Peter Rejcek / *The Antarctic Sun*

Jennifer Mercer, left, and Wiesje Mooiweer prepare ozonesondes for a balloon flight in the Crary Science and Engineering Center before a launch on Oct. 15. The devices profile the concentration of ozone in the atmosphere, particularly the stratosphere, where scientists measured record depletion this year.

Season marks 20th anniversary since first Antarctic visit to study depletion

Peter Rejcek
Sun staff

It's not the sort of record you like to see broken, particularly if you live in the Southern Hemisphere.

Scientists from various agencies and universities measuring ozone depletion over Antarctica say this year's annual ozone hole not only matches the largest hole in area on record, but it is also the deepest that's ever formed. On Sept. 24 of this year, the Antarctic ozone hole reached a one-day record of 29.5 million square kilometers, an area that spans the entire continent and spills over into parts of Australia and South America. That's roughly the same size as the record-setting hole that appeared over the region in 2000.

But the vertical disappearance of ozone is even more pronounced than in previous years, particularly between about 14 and 22 kilometers above the Earth in the mid-

See COLDER on page 8

Book brings Deep Freeze, IGY to life

"... thanks to the military who provided an infrastructure and the diplomats who crafted a political peace, as well as the scientists whose appetites were only whetted, the IGY in Antarctica never ended."

By Peter Rejcek
Sun staff

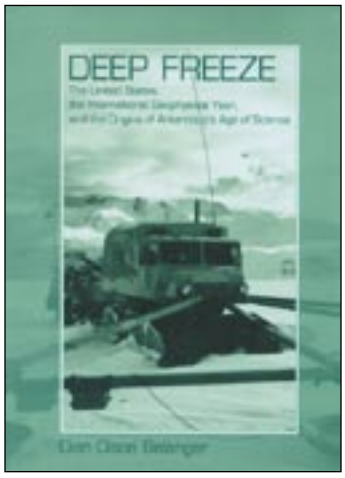
The closing sentence in Dian Olson Belanger's seminal history book on Operation Deep Freeze and the International Geophysical Year (IGY) is a reminder to readers that understanding the past makes one appreciate today a little bit more.

In fact, throughout Belanger's nearly 500-page historical ode to the men she dubs Antarctic pioneers, she repeatedly conveys the importance of that half-century-old legacy.

During a phone interview in August, as the first proof copies leaked out, Belanger said she wanted her readers to appreciate the scope and effort it took to open the continent for scientific research.

"I want people to understand that it mattered," she said of Operation Deep Freeze

See IGY on page 10



The cover of "Deep Freeze."

Quote of the Week

"Antarctica is great, except for all the lines."

— McMurdo resident disconcerted about the growing station population as weather delayed flights to South Pole.

Inside

Going to new heights

Peter Rejcek / *The Antarctic Sun*

Cecelia Mortenson, left, Field Safety Training Program supervisor, leads a class Oct. 23 in McMurdo on travel to high altitudes. The class includes practicing the use of a Gamow bag, a device used to help a person suffering from symptoms associated with altitude sickness. In The Antarctic Sun *next week, there will be a story on a study the Mayo Clinic is conducting on the causes and effects of altitude-related illness in people traveling to the South Pole.*

Cold, hard facts

USAP helicopters

Total program helicopters:
4 (two Bell 212s and two AS350s)

Maximum range of helicopters:
about 3 hours and 15 minutes

AS350 features:
- three-bladed rotor
- outfitted for five passengers, plus one pilot
- 680 kilograms load and fuel capacity
- burns 150 liters of fuel per hour

Bell 212 features:
- two-bladed rotor
- outfitted for nine passengers, plus one pilot and one technician
- 1600 kilograms load and fuel capacity
- burns 340 liters of fuel per hour

Results of a *Sun* staff poll as to whether the new helicopter paint jobs are better than the old style:
3 for, 0 against

Source: Jack Hawkins, Manager of PHI Antarctica

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.
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Level 1 Comix **Matt Davidson**

New lab shows USAP from a different angle

By Steven Profaizer
Sun staff

In a land where boxy, military-style buildings rule, the triangular TerraLab at Palmer Station is a dramatic departure from the architectural roots of the U.S. Antarctic Program. And with 12 different science projects compiling data in the 134-square-meter building, it also represents one of the highest concentrations of science on the continent.

"The initial spec was that TerraLab was just going to be big enough to house the new International Monitoring System equipment [for detecting nuclear detonations and seismic activity]," said Rob Edwards, who was laboratory supervisor at Palmer Station during the early planning stages of the facility. "But it then got enlarged so that it would include existing geophysical projects at Palmer."

This new plan allowed for the geophysical experiments contained in two older labs — T5 and Clean Air — to be consolidated with the International Monitoring System (IMS) equipment under one roof.

"T5 was dilapidated and needed some work done to it anyway," said Cara Sucher, laboratory manager at Palmer Station at the time of construction.

The Clean Air Lab was in no better shape.

"Calling it a laboratory is a misnomer because it's really just a shack," Edwards said. "TerraLab replaced two very old facilities that were really just hanging together."

The new laboratory was constructed over the austral winter of 2005. It now serves as home for most of Palmer's year-round projects, which measure and record everything from seismic vibrations to air composition. TerraLab is also the workplace of the station's research associate, who runs and maintains the mostly autonomous devices.

The consolidation of the projects also means the associates spend a lot less time running between buildings.

Steve Dobbs, a former Palmer research associate, said he was responsible for projects in four different buildings before the TerraLab transition was complete, which can make a simple daily task like backing up data onto DVDs a real challenge. He would have to get one disk burning, leave the building to do work elsewhere and keep coming back to change DVDs throughout the day.

Life is much more centralized for the stations' newest research associate, Christina Hammock. Not only does the TerraLab create less legwork for her, it allows Hammock to keep a much closer eye on the projects for which she is responsible.

Christina Hammock / Special to *The Antarctic Sun*

TerraLab sits on a hill overlooking Palmer Station. The new building now houses the science equipment that was contained in two older labs, as well as new monitoring equipment.

The National Science Foundation reviewed several different conceptual ideas for the new facility, which included rebuilding the T5 laboratory, constructing a very simple square building to replace T5, and choosing the triangular design that ultimately became the TerraLab.

"We thought if we could build something that is unique, then it would help demonstrate a more mature attitude to visitors about how we're treating the program," Edwards said.

The building is divided into two near-equal sections. One of the rooms contains the new IMS equipment that uses air sampling and seismological data to contribute to a global network of 321 other nuclear activity and seismic monitoring stations. Regulations require the IMS equipment be kept in a separate, lockable room from the remaining 11 projects.

Only slightly larger than a standard apartment, TerraLab would be considered a small building for most locations but is actually rather large for Palmer Station.

To help with the tight quarters, a lot of work has gone into ensuring the available space was used as efficiently as possible, said Joe Pettit, Palmer's manager of operations. Everything from the available computer network hookups to the shelving and even the pitch of the roof was designed to meet the needs of the projects that are now housed there.

"For the [ultraviolet ray] project, for example, we had to make sure nothing was blocking or shadowing their sensor," said Sucher, who is now the Crary Science and Engineering Laboratory supervisor at McMurdo. "The sensor was planned to be one of the highest points on the roof, so it could receive the full amount of radiation."

Following the building's construction, the daunting process of moving all the projects housed in the outdated buildings began.

Dobbs was the research associate in charge of most of the relocation effort, which he said lasted from early November 2005 to the end of April the following year.

The task required careful planning to ensure that projects' data were not compromised during the transition. And due to space restrictions, extra effort was taken to contain each project to its smallest possible footprint.

For such a small building, TerraLab was a huge project — especially for Palmer Station.

"If this [building was constructed] at McMurdo, it would have been a very small project," Edwards said. "But at Palmer, without the kind of [infrastructure] McMurdo has, building a brand new building is a pretty big deal, even if it's only a relatively small one."

Perspectives

Home is where the ice is

By Peter Rejcek
Sun Staff

I heard something my first day back at McMurdo that made me think that the speaker should perhaps reconsider some life choices.

The exclamation went something like this: "Ooooh, boy! It's good to be home."

Home?

I've always subscribed to the cliché that Antarctica is a nice place to visit, but I wouldn't want to live here. Certainly, it's a wonderful and unique respite from the modern world and all its trappings. And you can rarely find a similar sense of community anywhere else. However, I've never considered contacting my real estate agent about seaside opportunities on Ross Island.

But recent events forced me to reassess my view of those who hang "Home, Sweet Home" signs in their dorm rooms.

I'm referring to the spate of school shootings in the United States.

A certain irrational guilt can wash over you when you learn about such a tragedy while feeling perfectly content and safe. I guess there's really a cocktail of emotions that leave you with the worst hangover: helplessness, fear, anxiety and anger. In the end, it seems like all we can do is shake our heads and await the next tragedy, hoping that it won't break any body count records.

Once upon a time, as a young reporter working at small dailies in Texas, part of my job was to tease out the lurid details of these horrid crimes. Not fun stuff, and I don't miss it. The September school shooting in my hometown of Bailey, Colo., just reinforced my relief to be out of the "cop shop" reporting business.

But while I might be relieved at not being directly involved in those eruptions of violence, a bigger, more personal question comes up: how do you defend yourself against transient brutality? It's like being mugged in a big city: random yet intensely personal and the only way to avoid it from happening is to lock yourself away.

I guess another alternative is to fly halfway across the world to Antarctica.

I'm not suggesting those of us who head south every year or two or 20 are trying to escape the so-called real world for a frozen utopia. We all have our reasons for being here, and no place is without its problems.

Alison Lord / Special to *The Antarctic Sun*

Peter Rejcek and his wife, Andrea Dixon, lie on the sea ice in front of Mount Erebus last October. Rejcek has made McMurdo his home for the last two austral summers, working as a journalist for The Antarctic Sun.

However, I think one common thread that draws many of us back is familiarity.

We enjoy cruising through Christchurch en route to the Ice and visiting many of our favorite restaurants and pubs. Strolling through that city's vibrant botanical gardens for a few last, deep, fragrant breaths of earth and flowers has become a ritual every visit. Wandering through the university-turned-arts center and picking at the free samples of chocolate at the Fudge Cottage is also a habit I look forward to before each deployment.

On the Ice, I've already signed up to volunteer with the recreation department, joined the Mount Terror rugby team, and will again try to help with the mass casualty medical team. I'll even admit that I gain a certain satisfaction from complaining about the same things each season like the chronic lack of freshies (fresh fruit and vegetables) and the infrequent arrival of package mail. Of course, who doesn't like to rummage through a skua bin, that fount of free secondhand goodies, at least a couple of times a day?

I used to live in another remote location before joining the U.S. Antarctic Program. It was a tiny island called Kwajalein in the Marshall Islands, site of a famous World War II naval battle.

I lived there about three-and-a-half years and made lifelong friendships, the kind where you may not see someone for years but can immediately pick up the threads, no matter how bare, and rehash old times. One such friend died earlier this month from heart complications. We weren't the best of friends, but in a way, she was still family, if only for the fact that we shared the same familiar home for a while.

That brings me back to the fellow who was so enthusiastic about returning to McMurdo during the shuttle ride from the Sea Ice Runway. I think that maybe I understand his point: We pass through many places without really seeing them or the people who inhabit them. But home is a place that is — and should be — safe and familiar, where family is always waiting for you.

Thinking back on those first few moments of bouncing around in the rear of the Delta shuttle from the Sea Ice Runway, seeing the familiar faces flushed red from the cold and adrenaline of returning to Antarctica, watching Mount Erebus belch its plume of smoke, I guess I too should say: it's good to be home for a while.

Have an excellent and safe season, everybody.

Peter Rejcek is the lead journalist for The Antarctic Sun. *Contact him at extension 2407 if you are interested in contributing a "Perspective" to the* Sun.

around the continent

SOUTH POLE

A no show at the South Pole

By Tom Lohr
South Pole correspondent

The South Pole is expecting guests.

On Oct. 21, a gargantuan cleanup effort had Amundsen-Scott South Pole Station shining like a new penny. Residents expended their two-minute allotment of shower time to temporarily ward off that Polie-specific scent, and the Dean Martin CD was blaring in the galley in anticipation of a glorious pasta feast.

But no one pulled into the driveway.

Our guests remained ghosts of salvation as Antarctic weather dealt South Pole the cruel card of isolation and flights were canceled. Of course, in times as desperate as these, when you can almost taste that fresh banana, there is only one thing you can do: have a Techmo-Bowl marathon.

Take cutting-edge, big-screen technology and combine it with a low-resolution, early-1990s Nintendo football game (in which all of the players have long since retired). Now, add button-mashing madness into the wee hours of the morning, and you have the South Pole's first Techmo-Bowl Marathon.

While some were basking in electronic nostalgia, others took the delay of the summer season's first flight to take in the solitude one last time. Now that the sun never sets, and with only 64 people on station, one can soak up the tranquil polar moonscape and enjoy being swallowed up by its emptiness.

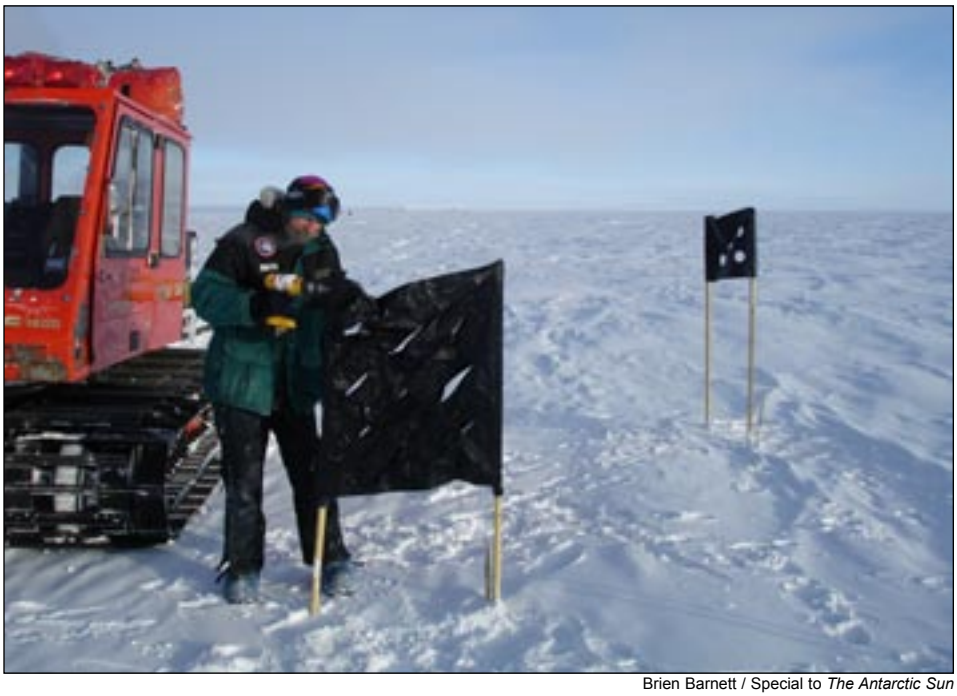
This is the second bonus weekend for the crew that stayed the winter, and the time off has allowed for a little rest from an extremely busy period of preparation for the arrival of the summer crew. Skiway grooming, reheating outlying buildings, readying previously unoccupied berthing wings, turnover preparation and endless other assignments outside our normal routine took an enormous amount of energy.

Minus 50 degrees Celsius is the magic number required for the LC-130 Hercules aircraft to bring the much-anticipated summer crowd and the first load of fresh fruit in eight months.

You are sending fresh fruit, aren't you?

Aren't you?

Editor's note: Flights to the South Pole continued to be delayed due to weather through press time on Oct. 28. Temperatures dipped below negative 61 degrees Celsius on two consecutive days, breaking the previous records for Oct. 22 and Oct. 23.



Brien Barnett / Special to *The Antarctic Sun*

Carpenter Mike Hole screws down an approach flag near the skiway at South Pole Station on Oct. 17. The approach flags help planes line up for landing at the bottom of the world. Problematic weather at Pole has kept the summer crews stranded in McMurdo for the last week.

PALMER

Summer science gets started

By Kerry Kells
Palmer correspondent

Summer season at Palmer Station began with the arrival of the first *R/V Laurence M. Gould (LMG)* shuttle on Sept. 20. Sixteen wintering personnel greeted us and some stayed for the three-week turnover.

Fast ice — sea ice fixed into position near the coastline — was considerably weaker upon our arrival compared to last year. (Winter weather reports recorded wind gusts up to 65 knots and a low average snowfall of just two centimeters a day.) The first penguins arrived at nearby Torgersen Island during the first few days of October.

Principal Investigators Maria Vernet with the phytoplankton and marine optics team and Hugh Ducklow with the biogeochemical component of the Long Term Ecological Research (LTER) were among the arrivals at the station.

The LTER group, as the name implies, studies long-term trends in the marine ecosystem in the Palmer Station region,

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the week in weather

McMurdo Station
High: 15F / -10C
Low: -14F / -26C
Max. sustained wind: 31 mph / 50 kph
Min. wind chill: -45F / -43C

Palmer Station
High temperature: 42F / 5C
Low temperature: 21F / -6C
Max. sustained wind: 48 mph / 78 kph
Melted precipitation: 18 mm

South Pole Station
High: -58F / -50C
Low: -78F / -61C
Peak wind: 24 mph / 39 kph
Max. Physio-altitude: 3,426 m

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focusing on sea ice variability and how it affects the region.

Vernet, who works in conjunction with Raymond Smith, concentrates on the abundance, composition, rates of reproduction, growth factors, and mortality of phytoplankton, single-celled plants that float in the ocean. Smith's bio-optics group looks at how ocean color remote sensing can detect phytoplankton concentration. Ducklow leads research on dissolved organic matter and bacterial dynamics. Both will conduct bi-weekly sampling at Stations B and E, set locations on the water near Palmer.

Team members also arrived with Vernet and Ducklow and began regular sampling as winds allowed. Bill Fraser's field team leader, Jen Blum, along with team member Kristen Gorman, began recording snow transect data and conducting censuses of the Adélie and cormorant populations on the local islands. Fraser leads the sea bird ecology component with continued research on Adélie, gentoo and chinstrap penguins as well as giant petrels, brown and South Polar skuas, and blue-eyed cormorants.

LTER Principal Investigators Langdon Quetin and Robin Ross Quetin continue their work on krill, an important component of the Southern Ocean food web. Some LTER principal investigators will return to Palmer for part of the summer season this year.

A new research grant brings James Hollibaugh's research to Palmer Station and will involve studying the ecology of ammonia-oxidizing bacteria.

Team member Nicole Middaugh will take water samples from 150 meters and incubate the bacteria at seven different temperatures to determine the temperature response of ammonia oxidation rates.

Christina Hammock / Special to *The Antarctic Sun*

A rainbow arches over Palmer Station on Oct. 21. The station's summer season began Sept. 20 with the arrival of the R/V Laurence M. Gould*, which transports personnel to Palmer.*

Later in the season, Palmer will greet the return of Richard Lee and his research team with the polar entomology (insect) study. Lee investigates the microclimatic conditions of *Belgica antarctica* (a flightless midge, a sort of fly) and its ability to survive under extreme weather fluctuations.

Artist and writer David Ruth, a glass sculptor who will use water and ice as inspiration, arrives in November. Beginning in February, Chuck and Maggie Amsler, Bill Baker and Jim McClintock return to station for research in chemical ecology. They will dive and collect sessile organisms, such as sponges and anemones.

Bruce Sidell's research team will collect and compare the physiology of ice fish to other fish.

Dan Costa's team will research the uses of the Southern Ocean habitat by crabeater and elephant seals during the months of April and May.

On the social scene, Palmer volunteers continue to teach Spanish, Photoshop and exercise classes, with a Palmer ecology reading and discussion group meeting as well. Weekly science lectures are under way along with slide shows on travel and on science research in other parts of the world.

We say a warm "hello" to former Palmer community members who are now researching or working at McMurdo or South Pole Stations this year. And good luck to all at McMurdo and South Pole!

SHIPS

While most science at McMurdo Station slumbers during part of the year, the U.S. Antarctic Program (USAP) research vessels operate nearly year-round. This past week finds the *R/V Nathaniel B. Palmer* (*NBP*) and the *R/V Laurence M. Gould* (*LMG*) both resting at port. The *NBP* is in Lyttleton, New Zealand, while the *LMG* crossed the Drake Passage more than a week ago for Punta Arenas, Chile.

The *NBP* has been conducting science surveys off Cape Adare and the *LMG* returned to Chile after transferring passengers and cargo to Palmer Station.

Continental Drift — What did you miss most about the Ice?

"All the safety meetings."

Chris Wisniewski
McMurdo
materialsperson
from Lander, Wyo.,
second season

"The sparkling personalities of the people at Palmer."

Nicole Middaugh
Palmer research
technician from
Anchorage, Alaska,
third season

"The great folks at Pole and Genie the forklift."

Kari Nester
South Pole FEMC
materialsperson
from Radford, Va.,
second season

IVARS puts focus on food web changes

By Steve Martaindale
Sun Staff

As Walker O. Smith Jr. looks back at his five-year research project, he talks about how much the research team learned, how much scientists still need to know and about how a large number of people who took part in the study are now spreading knowledge of Antarctic research.

The study, Inter-annual Variability in the Ross Sea (IVARS), began in December 2001 and collected its last samples in February 2006. Its purpose was to learn more about how phytoplankton productivity varies from year to year. Phytoplankton are plant-like plankton, organisms that drift in the water column and form the basis of the marine food web.

Significant variations concerning ice, the makeup of herbivore communities and the lives of birds and marine mammals in the Southern Ocean have been well studied, according to Smith. But little is known about how phytoplankton production varies from year to year, even though it plays a central role in the food web.

IVARS set out to chronicle the amount of phytoplankton during the peak of its growing season in the Ross Sea. Using U.S. Coast Guard ice breakers and the research support vessel *Nathaniel B. Palmer*, researchers collected samples of phytoplankton each December and placed moorings to continue collecting data. Every February, they collected the moorings while performing another sampling.

The study concentrated on the two major phytoplankton groups that live at the top of the water column in the Ross Sea: diatoms and *Phaeocystis antarctica*. These two single-celled, photosynthetic algae nourish fish, marine mammals and penguins. During photosynthesis, they take up atmospheric carbon dioxide that has dissolved in seawater. If the algae then sink to the deep sea, that carbon may be removed from the atmosphere for thousands of years, potentially reducing the greenhouse effect that creates global warming.

"The data suggest very strongly that the variations between years or among years are really much larger than I ever would have predicted," Smith said by telephone from his office at the Virginia Institute of Marine Science.

He said the large variations suggest the factors that control phytoplankton production also change from year to year.

The IVARS Web site says that understanding ecosystems such as the Ross Sea is "key to detecting and understanding the significant physical and biological changes predicted to occur in polar areas as the global climate warms."

And on that topic, Smith easily moves into his educator's role.

Walker O. Smith Jr. / Special to *The Antarctic Sun*

A mooring is in the process of being deployed during an IVARS research expedition. The instrument in the foreground is a time-series sediment trap, which collects sinking particles over set time intervals. The ball is a float that keeps the mooring taut in the water column.

"Some of the people who have gone with us are actually teachers and, if we can get the word to younger kids and get them fascinated about the ocean and Antarctica, ultimately it will be a tremendously positive benefit."

He gave the example of a recent presentation he gave to a Lions Club in Topping, Va., where a man asked about the reality of global warming.

"I always tell people that there is no scientific question anymore about the increase in atmospheric temperatures and that it is tied to CO_2. It's just not debatable anymore; but the problem is the media keep debating it and making it like there is a controversy when in fact there is no controversy."

The lack of scientific debate about the reality of global warming fails to mean, however, that solutions are at the ready, according to Walker.

Iron enrichment is one remediation strategy undergoing analysis. The idea is that seeding microscopic iron particles into iron-poor regions of the ocean may promote phytoplankton growth. With more phytoplankton in the ocean, it will consume more carbon during photosynthesis and reduce atmospheric levels of carbon dioxide, the primary greenhouse gas.

Smith said IVARS produced plenty of data to suggest that iron is incredibly important and that the variations of phytoplankton among years are tied to iron availability, but the increases do not occur as rapidly as in warmer climates.

"That's not to say that it might not be in effect," he said, "but the problem is that a response time in cold water is pretty long, so it's actually longer than we have the availability to make the observations."

However, he said he does not carry a lot of optimism about iron enrichment as a viable means for preventing CO_2 from returning to the atmosphere and reducing the overall greenhouse effect.

"I'm not hopeful at all. In fact, I believe that the large-scale engineering of the Southern Ocean is, I hope, beyond our capability.

"The iron experiments that have been done are very small. I mean, we're talking about 15 by 15 kilometers at most and, to scale that up to huge areas is, I think, impractical. And so I just don't see that happening."

Too much is not known, he said, to attempt large projects.

"There's really so much that we don't know about any large-scale ocean engineering like that and I think that the fears are serious enough that no one really wants to see it happen."

He said he sees advances in reducing carbon dioxide resulting from economic pressures.

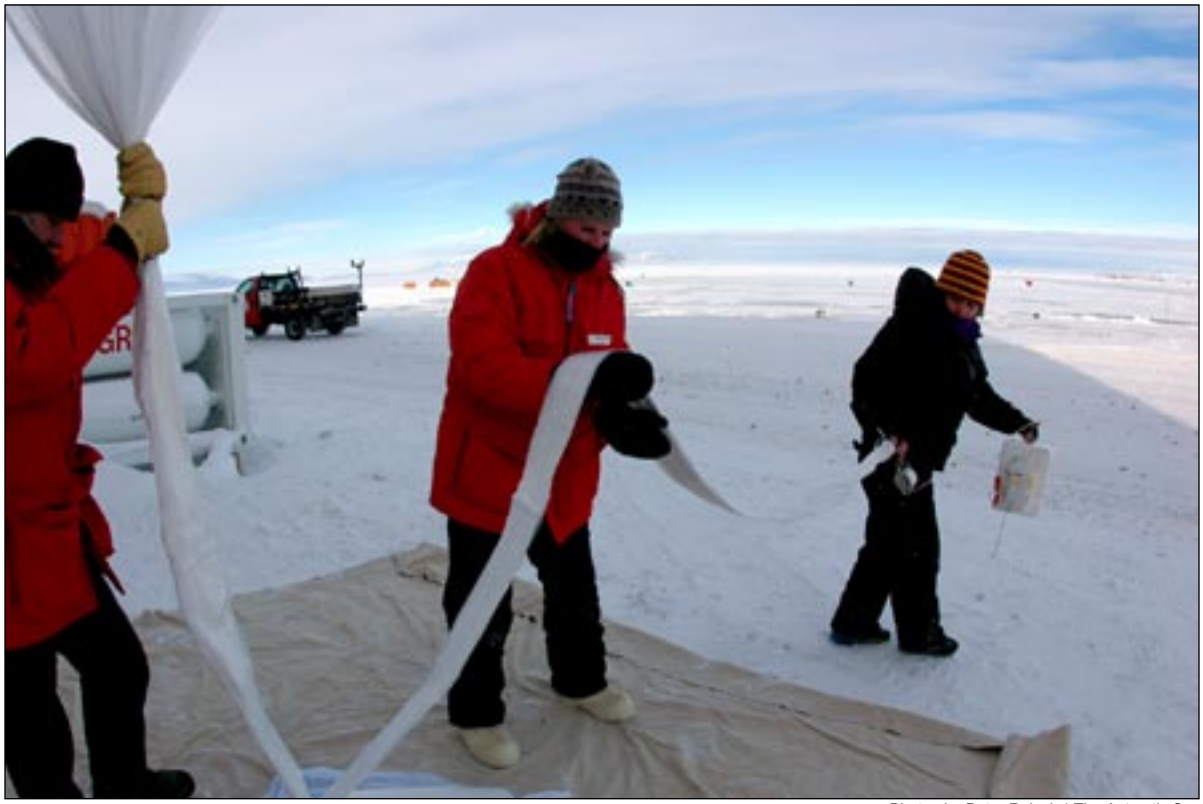
"I don't know if you're aware of the price of gas in Virginia, but I think now it's down to less than $2 per gallon and unless there's a huge economic incentive to reduce CO_2 concentrations, I just don't see it happening in terms of engineering the ocean."

While IVARS has ended its five-year run, Smith said he would like to see the study renewed, as "almost any scientist" would. Regardless, he continues attempting to get others fascinated about oceans and Antarctica.

"One of the incredible benefits of IVARS has been that we've been able to take a relatively large contingent [of researchers] for short periods every year and so it may be a woman from Kentucky that goes down and starts talking to her peers in Kentucky — and that's a real example — or it might be another person from Santa Cruz," Smith said.

"The point is that we've actually been very successful in seeding people throughout the United States [who bring] back knowledge about the Antarctic and the research that goes on and then convey that to other people. And that's something you can never measure, but I firmly believe that it is a real outcome and a very valuable one."

NSF-funded research in this story: Walker O. Smith Jr., Virginia Institute of Marine Sciences, http://www.vims.edu/bio/ivars/.



Steve Dobbs, Wiesje Mooiweer and Jennifer Mercer uncoil an ozonesonde balloon for launch in front of the Wastewater Treatment Plant on Oct. 15. The balloon carries instruments to profile the stratosphere, where the ozone hole is located about 14 to 22 kilometers above the surface of the Earth.

Photos by Peter Rejcek / *The Antarctic Sun*

Colder-than-normal stratosphere affects ozone hole

At right, Mercer watches the balloon-borne instrument stream away into the atmosphere. Below, the initial release. The researchers closely monitor the wind speeds prior to launch to ensure the balloons carry away from the buildings.

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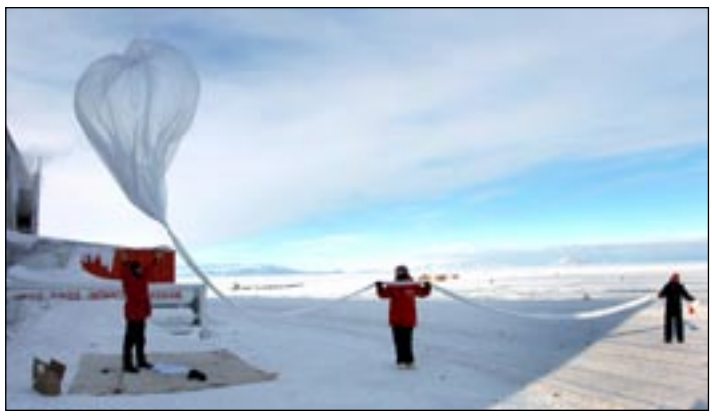
section of the atmosphere known as the stratosphere, according to researchers.

"There is a huge section this year that is completely depleted to zero," said Jennifer Mercer, co-principal investigator (PI) from the University of Wyoming, who is leading the group carrying out balloon-borne and laser measurements of the annual ozone depletion event. The ozone hole, a region in the lower stratosphere centered more or less over the Antarctic continent, has suffered nearly total depletion in previous years but never to this vertical extent.

Terry Deshler, also from the University of Wyoming, is the PI for the team, which deploys each year to McMurdo Station from roughly mid-August to early November. The group will launch between 25 and 30 balloons with instruments to take ozone and aerosol profiles, and other measurements.



The University of Wyoming was one of two universities, in addition to NASA and the National Oceanographic and Atmospheric Administration (NOAA), which first came to Antarctica 20 years ago to find the cause behind the ozone hole after its initial discovery in 1985. State University of New York at Stoneybrook rounded out the team.

That group — the National Ozone Expedition — eventually determined through balloon-borne, surface-based and laboratory measurements that chlorine released from chlorofluorocarbons (CFCs) was the main culprit responsible for stealing ozone from the atmosphere.

David Hofmann was the PI for the University of Wyoming in 1986. Today, he's the director of the Global Monitoring Division at NOAA's Earth System Research Laboratory in Boulder, Colo. In that role, he's the PI for a South Pole project that measures atmosphere constituents, including ozone-depleting chemicals. Balloon-borne instruments are launched from South Pole station year-long.

During a phone interview from his office in Boulder, Hofmann said that he never expected to still be involved in ozone depletion studies and research two decades later. Back in 1986, when he and colleagues arrived at McMurdo and South Pole stations to begin their measurements, the process

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NOAA: Recovery of ozone hole pegged at 2065

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causing the ozone hole was not understood very well. In fact, there was some doubt whether a chemical or dynamic process, such as a meteorological event, caused the hole. However, it soon became apparent that a chemical reaction was to blame.

Ozone refresher

Ozone is a somewhat unstable molecule made up of three oxygen atoms instead of two. It's found throughout the Earth's atmosphere, with the highest levels occurring in the lower stratosphere, a region commonly referred to as the ozone layer, between about 10 and 30 kilometers above the planet's surface. (The layer just below that is the troposphere, where we live and breathe.) The ozone layer blocks harmful ultraviolet rays that have been linked to skin cancer.

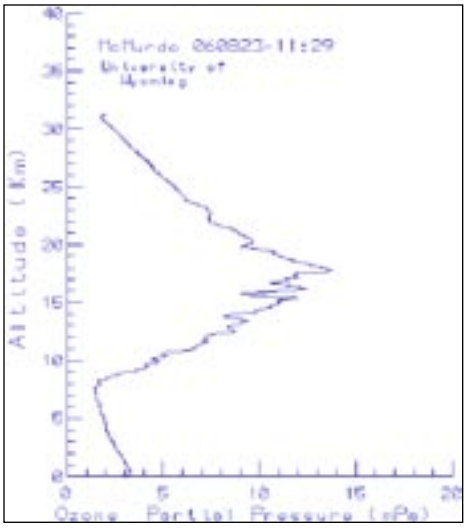
The ozone hole over the Antarctic waxes and wanes every year between August and November as the Antarctic summer begins. (A similar but far smaller hole occurs above the Arctic during springtime there.) The hole is the result of the input of CFCs and other chlorine- and bromine-containing gases that interact with two naturally occurring events. One is the polar vortex, a sort of atmospheric cyclone that is strongest in winter when temperatures are below negative 80 degrees Celsius. The other is polar stratospheric clouds (PSCs), or nacreous clouds when visible, that also form in the extreme polar winter.

The vortex is a closed system that can circulate the ozone-destroying chemicals quickly. The PSCs provide an excellent surface for setting chlorine and bromine free to run amok and destroy ozone in the presence of sunlight. So, the returning sun serves as the match to set this whole chemical pyre ablaze, beginning in August, breaking the free-floating chlorine molecules into their most reactive state.

The ozone hole eventually "closes" as the vortex weakens and dissipates by November with the warming temperatures. The atmospheric mixing that ensues then consumes the harmful chlorine and bromine in other reactions, but also causes a small percentage of ozone depletion throughout the southern hemisphere as the depleted Antarctic air mixes with mid-latitude air.

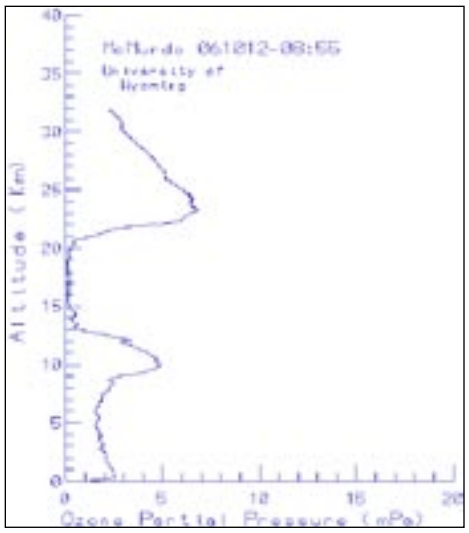
Recovery

Scientists say they expect these monstrous-sized ozone holes to continue for at least the next several years. Real improvements may not come until the year 2010, and continued variability may mask the healing process for quite some time. Estimates for recovery range from 2040 to 2080, though NOAA and NASA anticipate recovery by 2065.



Courtesy of Jennifer Mercer / Special to *The Antarctic Sun*

These two graphs illustrate ozone levels in the atmosphere. Above, a profile from Aug. 23 shows adequate amounts of ozone above the Antarctic. However, a profile of the atmosphere on Oct. 12, below, detected an ozone hole nearly eight kilometers deep.



Researchers are measuring slightly less ozone-destroying chemicals despite this year's record ozone hole.

"The chlorine maximum [in the stratosphere] was reached about the year 2000, so we should start to see improvements," Mercer said.

Hofmann said chlorine and bromine levels reached their maximum concentration at the Earth's surface around 1994. "It takes a long time for these gases to get into the stratosphere, especially to get into the Antarctic stratosphere," he said, adding that these molecules can take six years to travel here from the northern hemisphere.

… And regression

Whether the ozone layer can make a full recovery to pre-1980s levels when CFCs and other chemicals first started their assault is uncertain at this time. That's partly because not all production of ozone-destroying chemicals has ceased.

In fact, United States chemical companies have more than 20 million pounds of methyl bromide, a pesticide, stockpiled. In addition, the U.S. Environmental Protection Agency allowed production of another 15 million pounds this year, according to a *Los Angeles Times* article.

Hofmann noted that atmospheric measurements, such as those NOAA conducts at the South Pole, have found declining levels of these pesticide compounds in the last five or six years.

Global warming, while unrelated to ozone destruction, may play a role in the severity of the annual ozone hole and the ozone layer's eventual recovery. That's because greenhouse gases that trap heat in the troposphere slow the heat transfer to the stratosphere, causing it to remain colder for longer periods of time.

"If you have a colder stratosphere, then you could have much longer, colder polar vortices every year," Mercer explained. "This would allow for [a] larger or longer ozone hole because the ozone hole area is controlled by the size of that vortex."

The variability in climate change models makes it hard to predict how the greenhouse effect may impede ozone hole recovery, the scientists say.

A model solution?

Despite these apparent setbacks, scientists remain optimistic that the ozone layer will eventually heal. They credit the quick reaction of the international community, which adopted the 1987 Montreal Protocol. The agreement, and its subsequent amendments, provided for the protection of the ozone layer by phasing out the substances causing depletion.

The protocol is an example of how nations could cooperate on tackling a potentially more serious problem: global warming and the pervasive use of technologies that emit carbon dioxide, the key greenhouse gas, according to Hofmann.

"It's a good model for the global warming issue, that the international community can put together a set of regulations everybody can get along with," he said.

"The world economy is running on things that emit CO_2 now. Realization of a non-carbon economy is a long way off," he said.

NSF-funded research in this story: Terry Deshler and Jennifer Mercer, University of Wyoming; David Hofmann, NOAA, Global Monitoring Division, www.esrl.noaa.gov/gmd/.

Cast of Characters

Dave Grisez / Special to *The Antarctic Sun*

U.S. Navy Seabee Dave Grisez stands next to the washing machines located in the power house at the U.S. Naval Williams Air Operating Facility (McMurdo Station) in 1956.

Dian Belanger drew information and inspiration from a diverse cast of people based on about 70 oral history interviews she and others conducted. These pictures are of a few of the military personnel and scientists featured in the book.

All of these photos come from the online U.S. Antarctic Program Photo Library. The Web site can be found at *http://photolibrary.usap.gov*. Hundreds of high-resolution photos are available free at the site, including historical photos like these and all the images of penguins, seals and icebergs one could possibly imagine.

Check it out.

Dick Prescott / Special to *The Antarctic Sun*

U.S. Navy Lieutenant junior grade Dick Bowers, left, and Chief Scientist Paul Siple celebrate the first Christmas at the South Pole in 1956.

U.S. Navy Seabee Charlie Bevilacqua was one of the men who constructed the first permanent station at the South Pole.

Dick Prescott / Special to *The Antarctic Sun*

Dave Grisez / Special to *The Antarctic Sun*

Howard Wessbecher, U.S. Weather Bureau, gives U.S. Navy Commissaryman, 1st Class, Ray Spiers a haircut at the U.S. Naval Williams Air Operating Facility (now known as McMurdo Station) in 1956. (Spiers was not among the interviewees.)

IGY science bloomed despite Cold War shadow

From page 1

(the Navy's part of the IGY bargain to build and run the stations), the science that followed, as well as the amazing amount of international cooperation it took to pull off the entire feat. All of this, of course, took place in the very menacing shadow of Cold War politics and posturing.

The National Science Foundation-funded book "Deep Freeze: The United States, the International Geophysical Year, and the Origins of Antarctica's Age of Science" hits bookshelves and online stores this month. The timing couldn't be better, as the NSF and the rest of the international science community prepares to initiate another International Polar Year (IPY) in March 2007 to commemorate the 50th anniversary of the IGY.

John Behrendt, who was a 24-year-old geophysicist when he stepped onto the continent nearly 50 years ago, said Belanger's book does a particularly good job of evoking what life was like during the IGY.

"I think it's an excellent book," he said during an interview at his campus office at the University of Colorado-Boulder in August. "She had some interesting things that I hadn't known."

The book chronicles the events surrounding the first coordinated effort to gain a logistical foothold in Antarctica as part of a worldwide attempt to conduct science across the continent and around the world. Belanger sets the stage with a brief overview of the continent's history leading up to 1950, when scientists first began discussing the possibility of the IGY.

Two previous international efforts to unlock the scientific secrets of the seventh continent took place in 1882-1883 and 1932-1933. The early IGY science planners, inspired by those first two heroic but rudimentary forays and now armed with new technology developed out of World War II, felt that waiting another 50 years would be too long. Twenty-five years would also coincide with a period of major solar activity, further whetting scientists' appetite for a major geophysical analysis of the planet from pole to pole.

So what essentially began as a somewhat whimsical dinner party conversation in 1950 among colleagues would mobilize the U.S. Navy, assemble a cadre of mostly young, inexperienced but spirited scientists, and lead to a landmark agreement, the Antarctic Treaty, to preserve the continent for peace and science. Moreover, an 18-month expedition turned into 50 years and counting of polar science.

See DEEP on page 11

Deep Freeze built seven Antarctic stations

From page 10

Interestingly enough, Belanger's book also began with a conversation and certainly went beyond most original expectations.

It started when Dick Bowers, who as a young engineering officer during Deep Freeze I and II (1955-1957) had charge of constructing both McMurdo and South Pole stations, talked with Erick Chiang, head of the NSF Polar Research Support Section, in 1995. Bowers worried that an important period in history would soon be lost as the veterans of that era passed away.

"We had a strong feeling that we had done a great deal," said Bowers, 78, during a phone interview from his home in Indianapolis. The "we" he is referring to are the early Navy veterans who participated in Operation Deep Freeze. That group eventually formed the Antarctic Deep Freeze Association (ADFA), which now includes members of later Deep Freeze missions.

"All of these people were starting to die off," Bowers said. "We were very close to them. We felt it would be a very appropriate time to put something together to document them … trying to get the actual experiences as Dian has done so very well."

The original concept had been to do an oral history project, but that soon morphed to include a book. The NSF not only wanted to save these fading memories, Belanger noted, but ensure people would read about them as well.

"I took it as a challenge," she said, admitting to a scant knowledge of the continent's history prior to tackling the subject. She had assumed very little literature existed and that "Antarctica was a universe I could master."

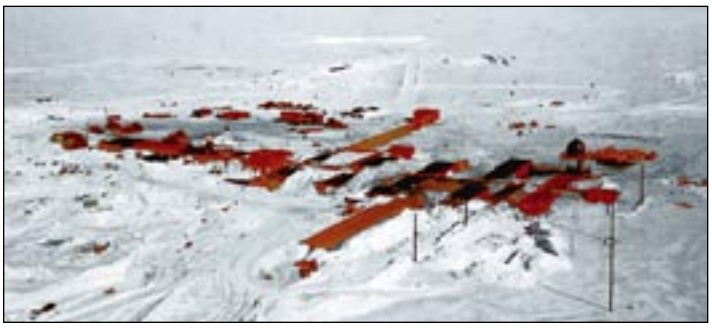
"I've been disabused of that," she said, laughing. Indeed, it's been eight years since Belanger first agreed to serve as the scribe for the project. During that time, she conducted more than 40 interviews around the country. Eventually, she populated her story with more than 70 people, supplementing her own work with oral history interviews conducted by the Byrd Polar Research Center's Polar Oral History Archival Program.

"Some of the most profound stuff came from people who weren't schooled to be profound, but they just had a way of looking at the world that just spoke true to me," she said. "The story to me is intrinsically interesting. ... I want people to catch that excitement that I found."

If the audience catches even a tenth of the passion Jerry Marty has for this project and Antarctic history, then Belanger can be assured of reaching that goal. A long-time Polie and the NSF South Pole station representative during the austral summer, Marty said he believed Belanger's volume on Deep Freeze should serve as a textbooks for students to understand not only history but the power of the human spirit.

"I think it's important for us to document the stories of these individuals who considered themselves ordinary people … and did something not done before," he explained. "It's a history book written by those folks who lived it. … They cared about [the mission], they had work ethic, they had esprit d' corps."

Getting the story right and evoking these themes took time, Belanger said, but she still regrets that the book wasn't published sooner. In the list of "human resources" at the back of the book, asterisks denote which of the people have died since the interviews took place.



Jim Waldron / Special to *The Antarctic Sun*

Little America V was one of seven U.S. Antarctic stations built by United States Navy Mobile Construction Battalion (Special) Task Force 43 for the International Geophysical Year. Little America V was built near Admiral Byrd's 1929 base (Little America I) on the east perimeter of the Ross Ice Shelf, near Kainan Bay.

"I take each one of these losses personally," she said. "I very much wanted all of them to read this story."

The process also involved difficult decisions on what to use and, in the end, what to cut. The first complete draft weighed in at 770 pages, nearly 300 pages longer than the final version.

"It hurts, that stuff that goes in the delete pile. It hurts," she said.

Still, Belanger was able to stick to the core story while peppering the narrative with the occasional aside to illustrate how polar research affected everyday lives. For example, bakers in high-altitude places like Colorado can thank the first chef at the South Pole, Chet Segers, for those handy cooking instructions on the back of cake boxes.

> "It was such a team effort and such a rewarding effort because of the long-term significance [of IGY]."
>
> — Dick Bowers,
> U.S. Navy engineer in charge of construction at McMurdo and South Pole

After every cake that he tried to bake failed to rise, he contacted "Betty Crocker" at General Mills for help via ham radio. In the book, Belanger quotes Segers as saying, "Some lady went up in a plane at 10,000 feet and baked a cake." Now we know how to adjust baking recipes at higher elevations.

However, Belanger never strays for long from her themes — the importance of teamwork, leadership and the peaceful, international endeavor that Antarctica has come to represent.

"I convinced myself, and I hope I will convince readers, that [Antarctica] *does* matter," she said. "It mattered then because of the Cold War, which was pretty scary. People just forget easily about how terrified we were of those horrible communists and how they were just going to blow us off the planet — and here they were cooperating scientifically in Antarctica, and it was just sort of a little miracle."

The veterans who made it happen — the military, the scientists, and the politicians and policymakers — appreciate the long overdue recognition.

"It was such a team effort and such a rewarding effort because of the long-term significance [of IGY]," Bowers said.

("Deep Freeze" is available at online stores; from the University Press of Colorado (www.upcolorado.com); or directly from the author for an autographed copy (Dian Olson Belanger, 5730 Avery Park Drive, Rockville, MD 20855.) Copies will also come down on the annual re-supply vessel for McMurdo Station, but likely won't be on shelves until the winter season.)

Profile Traveling without a hitch

By Peter Rejcek
Sun staff

Those who worked and lived at McMurdo Station last austral summer season probably remember seeing Ben Bachelder around. He's rather hard to miss.

Sure, he's tall and lanky, a head above the crowd. And his blondish orange hair, closely cropped into a chessboard pattern, probably turned a few heads. But the nearly garish, bright yellow jumpsuit, with reflective strips and the enormous thumb on the back that he wears while traveling, forces most people to put on the brakes.

That's exactly the reaction Bachelder wants as a "professional" hitchhiker.

"It's almost like a NASCAR suit," concedes the 29-year-old nomad, back at McMurdo Station for his second straight season, this time as a utility technician (UT) helper. "[I've] had a lot more people pick me up because they could see me."

Bachelder caught a particularly virulent strain of the travel bug while doing the backpacker thing around Europe at age 21, after graduating from the University of California-Berkeley. He was on the usual tourist routes, sleeping in smelly hostels and taking trains from one big city to the next, when he decided to hitch a ride from Dresden to Berlin. A German truck driver, who spoke no English, gave Bachelder his first ride. Despite the language barrier, there was still a "human connection" — Johnny Cash was playing on the radio.

Said Bachelder, "I thought, 'Right on. I can dig Johnny Cash.'"

In the last eight years, the San Francisco Bay area native has stuck his thumb out on the roadsides of 43 countries, six continents and every state but Alaska. He estimates that he's clocked at least 100,000 kilometers.

Quite a few of those kilometers came during an 18-month hitching odyssey back through Europe and India beginning in 2003. "I figured I would just go until my bank account ran out, and even beyond that," he said, adding that while thumbing a ride is certainly a way to stretch a trip, saving a buck on transportation is never his primary motive.

"Part of it is definitely about getting from point A to point B in a fairly timely manner, but it's just more about meeting whoever could be on the road," he explained. "It's definitely an exhilarating thing to have no idea what's going to happen, but to be pretty confident that whatever it is … it's going to be great."

It was during the same trip that he became a "professional" hitchhiker — people started giving him money. Even Indian truck drivers would insist on passing on a few rupees to ensure he didn't starve. He also began to earn a little cash as he turned his adventures into stories that he posted on the Internet, particularly Digihitch.com, a Web site devoted to recreational-style hitchhiking. Eventually, the founder of the site, Morgan "Salman" Strub, brought him aboard as a featured writer and commissioned Bachelder to write specific stories for the site.

Peter Rejcek / *The Antarctic Sun*

Ben Bachelder demonstrates the hitchhiking technique, replete with his unique yellow reflective jumpsuit, that has literally taken him around the world. A documentary about his life on the road will be released in May.

"Ben may very well be the world's most active promoter of hitchhiking culture," said Strub, who adds the purpose of the site is "simply to champion the spirit of hitchhiking and to promote people who are doing great things on the road."

The Web site brought Bachelder to the attention of two graduate students at the University of Florida Documentary Institute. Kathy Craven and Kimberly Cooke were looking for someone to feature in a film they were developing about hitchhiking.

"We wanted to explore a topic that people maybe had made assumptions about and bring a new perspective to that topic," Craven explained during a phone interview. They wondered: If hitching was so dangerous, every ride a potential homicide, why were so many people hooked on it?

In a serendipitous moment, Bachelder was kicking around his own film ideas at the time while traveling through Australia. He had become "fed up" with the fear mongering created by the media and movies about hitching. "It was really coincidental," he said of the e-mail proposal from the filmmakers that reached him while Down Under.

The yellow hitchhiking jumpsuit certainly intrigued the graduate students, but it was Bachelder's background that interested them more. He was a civil engineer, a vegetarian who didn't smoke or drink alcohol.

"This guy is so against what the stereotype is of hitchhiking," Craven said. "He's passionate about it to the point to where he has to have it in his life or he's not a whole person."

Filming took place in August and September, and included a six-day hitch from Durham, N.C., to the Grand Canyon, a place where the well-traveled Bachelder had never been. The documentary offers "a window into the world of hitchhiking," according to Craven, as well as insight into why someone leaves a "normal" life for the uncertainties of the open road.

Bachelder's answer, in part, is that he wants to test the ivory towers of his liberal academic background. "[The] world view that comes from that is very narrow," he said.

"It is continually surprising about how much people want to tell their stories," Craven added. "Ben is really excellent … at being able to talk with all kinds of different people. People feel at ease with him."

Some of those stories will make it into a book Bachelder plans to write in conjunction with the movie, set for release in May 2007 at the University of Florida. The filmmakers are also shopping the documentary at various film festivals.

Meanwhile, Bachelder will continue to add to his personal odometer, with plans to hit his seventh continent, South America, next June, just before his 30th birthday. His thumb will take him to Peru, Ecuador and Colombia. His verve and curiosity will undoubtedly propel him on to new adventures.

"It is definitely about the human connection for me," he said.