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The Antarctic Sun

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

Photo by Melanie Conner/The Antarctic Sun

Jason Neely, Tom Piwowarski and Jason Hunter place a footing for the new South Pole Station.

BUILDING UP

THE GROWING PAINS OF MODERNIZATION

By Melanie Conner
Sun staff

Puffy, human-sized creatures operating heavy machinery resemble a scene from "Star Wars" on the frozen planet Hoth. Then suddenly one chucks a snowball at another in what turns out to be a momentary distraction by a bundled-up carpenter during his long workday at the South Pole.

Carpenters, cooks and scientists alike at Amundsen-Scott South Pole Station find cheerful anecdotes during the busy austral summer while the station is swimming in construction.

Many aspects of daily life, construction and science must function together as inhabitants coordinate schedules, plan workloads and maintain happiness at the bottom of the world. But when the new building is complete, the dome removed and communications systems online, the new building will expand the reach of science and make life more comfortable for all.

South Pole Area Manager Katy Jensen said one of the most challenging areas for current resident workers is logistics. It takes a lot of flights from October to February for construction cargo alone. This summer 348 flights are scheduled to arrive at the South Pole, of which 151 are construction cargo for the new station. The flights arrive from McMurdo Station, where cargo is often held up for months.

"Last year we got behind in November because of weather and we're trying to get caught up," said Jensen.

According to Jensen, another challenging issue during this period is a high station population.

See Growing on page 11

Photo by Melanie Conner/The Antarctic Sun

New station dwarfs old dome at Pole.

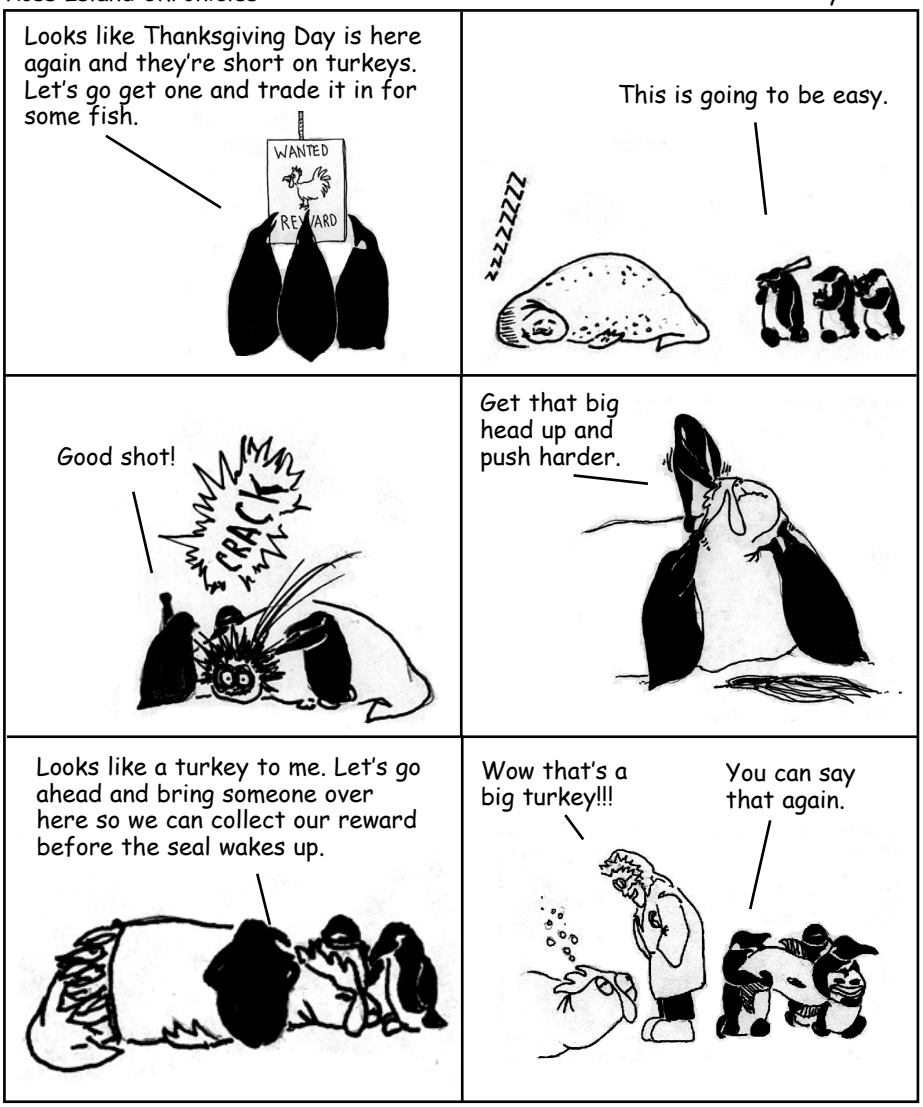
INSIDE

Quote of the Week

"It's pretty weird when you have to heat a place enough to call it a fridge."

- South Pole kitchen worker

Ross Island Chronicles By Chico



Cold, hard facts

Taking the cold

Number of beams in the silver dome: 1,129

Number of panels: 952

Maximum weight of any dome part: 50 lbs. (110 kg.)

Total weight of material for new station: about 20 million lbs. (4.5 million kg.)

Size of dome: 164 feet (50 meters) in diamter; 50 feet (13 meters) tall

Size of new station: 80,000 square feet (7,430 square meters)

Room size in the new station in winter and summer, respectively: 9 feet 8 inches by 8 feet (3 meters by 2.5 meters); 9 feet 8 inches by 6 feet (3 meters by 1.8 meters)

Number of flights to carry materials of the silver dome: 5

Number of flights to carry materials for the new station this season alone: 151

Sources: Temcor manual, *Civil Engineering*, *Engineering News*

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Web address: www.polar.org/antsun

Sayings from the South Pole

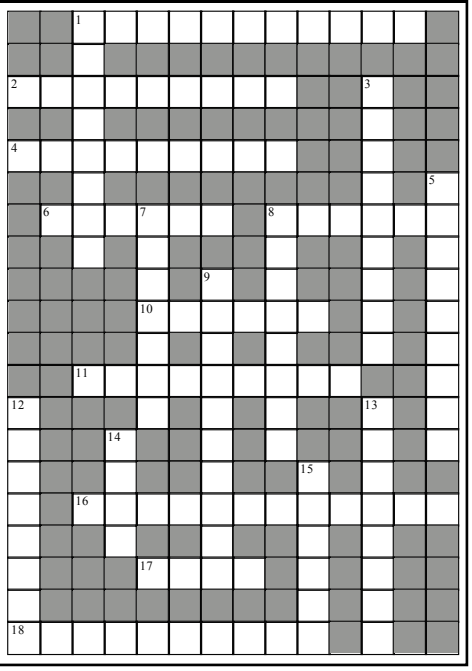
Answer on p. 6

ACROSS

2) Snow formations resembling sand dunes
6) You get two per week of two minutes each
7) This, not cold, is called the biggest danger
8) Despite all the white, very little of this
11) South Pole Remote Earth Observatory (abv.)
14) Pole, Sahara share this classification
16) First person to land a plane at the Pole
18) A Pole night is made for this scientist
19) This deceptive measurement can make you feel low

DOWN

1) The Pole's official time zone
3) Where the only growing plants are found
4) A month of this before sunset and sunrise
5) "Great God, this is an _____ place."
6) The type of clouds that form during winter
9) For $25,000 you can be in this racing first
10) The only clothing in the "300 Club"
12) Huts used by summer workers
13) The only 90-degree reading you'll get outdoors
15) The time of year the sun rises and sets
17) The Pole's dominant structure - for now



"Pristine"

REVIEWING the Ross region

"LITTERED"

Environmental 'report card' treated vastly different by editor, some in media

By Mark Sabbatini
Sun staff

They're about as opposite as headlines get: "Antarctica's Ross Sea Region - In Pristine State" and "Antarctic sea floor 'littered with junk.'"

Both are interpreting the same report.

A first-ever "state of the environment" report on the region concludes the area remains pristine, with a few concerns expressed mostly about settled locations. But that isn't necessarily what's being portrayed to the world in news articles.

The 280-page report released earlier this month by the New Zealand Antarctic Institute examines how science, fishing and tourism are affecting the Ross Sea region, along with global factors such as ozone depletion. It contains no new research or data, instead presenting a summary of existing information and assessments of the area's air, water, land and wildlife.

"It is a picture of a largely pristine region where, despite over 100 years of human occupation, most significant impacts have been restricted to the immediate areas around scientific stations and small field camps," a preface in the report notes. "On a regional scale, it is the global influences of climate change and ozone depletion that have the biggest potential to cause large-scale changes in the region's environment in the future."

In contrast, a story by The Associated Press, the world's largest news agency, begins "Antartica's outwardly pristine seascapes are contaminated with untreated sewage and parts of the seabed are littered with junk, from dumped vehicles to beer cans, a New Zealand report says … In some stretches of the seabed, close to New Zealand and U.S. bases, discarded beer cans outnumber natural sponges." The article was used by CNN and other news organizations.

The story, along with a similar account published in the British publication *The Guardian*, also focuses on the "thousands of liters" of sewage dumped into McMurdo Sound every day. Both stories do refer to Antarctica being the planet's most pristine continent and note remediation efforts are underway, such as sewage treatment plants at McMurdo Station and Scott Base by 2003.

Photo by Mark Sabbatini/The Antarctic Sun

Emma Waterhouse of the New Zealand Antarctic Institute works at Scott Base during a visit to Antarctica on Tuesday. The report she edited is on her desk.

Emma Waterhouse, editor of the report, said most news stories from New Zealand she has seen focus on the "pristine" element. She said the study is intended to summarize scientific knowledge of the area and provide a report card on the impact of human activities on the environment.

"Obviously some media have picked up the sewage issues ... (but) it's not a big part of the report," she said. "Other news stories, such as a recent one from the BBC, have focused on the big knowledge gaps the report identifies, and the implications that has for future management of activities such as fishing and tourism."

Among the report's findings:

• The impact of science and other human activities is mostly localized around permanent research stations. Contamination of marine and land areas, plus disturbance to wildlife, are ongoing problems, but considered minimal by global standards.

• Significant progress has been made in areas such as waste handling, fuel storage, environmental impact assessments and visitor education. But there is a lack of monitoring and contingency planning for potential problems such oil spills from ships at sea and tourism impacts in relatively high-use areas.

• There are "significant gaps" in current understanding of how the region and Antarctica in general respond to human disturbances and other changes. "The identified lack of information about the environment hampers the development of effective management decisions," the report notes.

• Fishing and tourism are low-level activities, but it is unknown how they might develop and affect the environment in the future.

• Climate change and ozone depletion - factors caused outside Antarctica - represent the biggest long-term threat to the ecosystem in the Ross Sea region. The impacts of both are likely to be greater than elsewhere in the world, with many of the potential effects unknown.

The conclusions in the report - including the critical ones - are not new, said Joyce Jatko, environmental officer for the National Science Foundation's Office of Polar Programs. But she said the negative aspects may be the natural thing for some commercial media to pick up on.

"I think that sometimes the press like to sensationalize the situation, and certainly there are things that are in McMurdo Sound or are in Winter Quarters Bay and do represent contamination," she said. "But as New Zealand has noted, and as we have decided, the best thing to do environmentally is to leave that stuff where it is and allow the area to recover naturally, because to do otherwise would do more damage."

Jatko said she is not aware of any requests from U.S. or foreign media organizations to NSF seeking comment about the report, noting it was only recently released and is largely of interest to New Zealand.

Nations participating in the Antarctic Treaty have discussed state of the environment reports for several years, but none acted until New Zealand decided in 1997 to do one for the Ross Sea region, Waterhouse said. More than 20 authors contributed to the report, which was reviewed by scientists in the U.S., Italy, Germany, Australia and other countries.

The report, published in a full-color book format, will be sold for $80 Kiwi (about $40 U.S.) within a few weeks, Waterhouse said. Copies are expected to be available at Scott Base. The findings will also be eventually posted on the institute's Web site at www.antarcticanz.govt.nz.

speaking of science...

Microbes, genomics and the Southern Ocean

Attempts to learn about who's out there and how they thrive in their frigid environment

By Alison E. Murray, Ph.D.
Earth and Ecosystem Sciences

Winter wasn't quite over when the first science group arrived at Palmer Station for the spring season on Sept. 25. This microbiology-oriented project is led by myself, with the help of technicians Brandon Carter and Alison Kelley. Our mission is to capture literally billions of unassuming marine microbes and store them for gene expression analyses back at the Desert Research Institute in Reno, Nev.

Funded under the National Science Foundation's Life in Extreme Environments research program, our project is titled "Gene expression in extreme environments: extending microarray technology to understand life at its limits." No doubt with a title like that, a little explanation is needed.

Why study the microbes?

Marine microorganisms are the most abundant life form in the Southern Ocean. Their activities are essential to the ebb and flow of the Southern Ocean ecosystem. Let me explain...

The focus of our project is a diverse group of organisms inhabiting the plankton and sea ice that are known as the marine prokaryotes (cells without membrane-bound nuclei). These microorganisms fall into two distinct groups, the Bacteria and the Archaea.

In most of our minds, and as far as our eyes can tell even with the best of microscopes, these two groups of microbes would both be called bacteria. It turns out that the archaea are actually very different biochemically and genetically than the common "bacteria" that we associate with the term. Archaea are those life forms one might associate with thermal pools at Yellowstone, or deep-sea hydrothermal vents. They are often referred to as the extremophiles.

Archaea were only recognized to exist in oceans worldwide as recently as eight years ago, yet their shear biomass (upwards of 40 percent of the cells in the deep ocean), indicates that they are likely quite important to carbon cycling in the marine ecosystem. The details of their exact roles remain to be discovered as of yet. Oceanographers, however, are quite familiar with the critical roles that bacteria play in the oceanic food web, many of which can only be performed by prokaryotes. For example, only prokaryotes can fix nitrogen, use inorganic chemicals as energy sources, transform reduced iron to a biologically available form and return degraded carbon otherwise falling to the seafloor back to the food chain.

Both bacteria and archaea are plentiful in Antarctic seawater, where you can generally find around 200,000 cells per milliliter (1 cubic centimeter or .03 fluid ounces). In sea ice, densities are more variable. Near Palmer Station over the past month we found densities ranging from 10,000 cells per milliliter of melted surface ice to 500,000 cells per milliliter in melted ice from the bottom layer. Defining the distribution of archaea in sea ice is part of our current work.

Environmental microbiology challenges

One of the most challenging, though essential, requirements for the study of life in extreme environments is investigating organisms in their natural habitat. While it may be simpler to study cultured microorganisms in a laboratory, it's not always possible. At most, only 1 percent of these organisms have been successfully cultivated. By looking at the microorganisms in situ - that is, in their natural environment - we not only bypass the problem of cultivating them, we also get a far more accurate picture of what reactions and adaptations enable them to thrive in the environments they inhabit. It's these reactions, which can't literally be "seen" in such small organisms, that hold the key to understanding their survival techniques, and it's here that the genomic approach becomes useful. Molecular biology has revolutionized what we can learn about these microbes. We're utilizing technology that has largely been developed in biomedical research and learning to apply it to environmentally-oriented questions.

Photo courtesy of Alison Murray/Special to The Antarctic Sun

Alison Murray's microbiology team pulls sleds full of equipment and samples across the sea ice.

Genomics technologies to the rescue

Our current project applies technologies developed and utilized for the human genome project to address questions that remain poorly understood in the ocean. We're interested in developing the technology to detect gene expression in parallel for many different genes from Antarctic microbes collected directly from their environment. Genes that are actively expressed can be defined as those genes that are "turned-on," many of which are on all the time carrying out normal cellular functions.

A variety of other genes are expressed in response to changes in environmental conditions such as temperature, light, nutrient availability, or even other organisms. These are the genes we're interested in, and the ones that should help us develop a better picture of how Antarctic microbes adapt to their subzero environment. To identify which genes are expressed, we will construct DNA microarrays (i.e. genechips) which are specially designed microscope slides packed with anywhere from 500 to 10,000 different microbial genes robotically arranged in a grid pattern. With the help of an existing library of Antarctic microbial DNA prepared in an earlier field season by Ed DeLong, these microarrays will allow us to "match up" expressed genes from the Antarctic organisms we collected with known genes on the slides. This matching process will show which genes are being used to

See Microbes on page 6

around the continent

PALMER

Low tides, high winds

By Tom Cohenour
Palmer correspondent

It was a natural phenomenon. Not a freak of nature, to be sure, but certainly noteworthy. And according to the charts provided by Tony Amos of the University of Texas, it occurred at 4:07 p.m. on Sunday, Nov. 18. At 3 feet 3.6 inches below mean sea level, Palmer Station experienced the lowest tide of the month.

Low tide may not be significant to many people, and 3 feet 3.6 inches isn't all that dramatic, but at Palmer it has several implications. Now that the fast ice in the harbor has broken up and moved out, falling water levels cause the remaining ice shelves along the shoreline to crack and break off under their own weight. This means it will be easier and much safer for researchers to load and unload their field equipment from the Zodiacs.

Boaters tying up their Zodiacs at station or on one of the many islands take precautions so their boats aren't left high and dry, hung up on rocks when the water level drops. And maintenance workers keep a watchful eye on the seawater intake pumps because low water levels mean more strain on the pumps. "In the morning I only needed one intake pump running to get 49 pounds of water pressure," said Maintenance Specialist Gary Jirschele.

"An hour before low tide I was down to 30 pounds (of water pressure) and had to turn on the second pump," he noted.

Also spending time with the water were nine members of the 12-member Ocean Search and Rescue (OSAR) team. Leaving the station in sunny weather with relatively calm winds, members practiced starting the motor, maneuvering through brash ice, landing techniques, mooring principles and island familiarity.

Before the OSAR team completed their exercise, clouds moved in and strong winds developed. Team leader Jeff Bechtel decided the best course of action was to head back to station. The trip back was directly into the wind so it made for slow going. High wind whipped waves splashed cold water on everyone in the Zodiac. "It was a cold, wet experience, but a good one," commented one team member. "We know how our gear will perform in adverse weather."

Photo courtesy of Tom Cohenour/Special to The Antarctic Sun

The Palmer Station Search and Rescue Team participates in a training exercise that was cut short due to poor weather.

SOUTH POLE

Station nearing capacity

By Judy Spanberger
South Pole correspondent

We had a relatively quiet week here at Pole. Flights were cancelled on only one day due to a storm that swept through for about 24 hours. Our population is at 210: 10 away from our top-out number of 220. It's amazing how this station designed for 33 comfortably handles the increased population. Providing, of course, that you don't mind only two showers a week!

Science continues to ramp up with the majority of our new arrivals being scientists eager to begin their work. Notably, drilling for the SPRESO (South Pole Remote Earth Seismic Observatory) project will begin this week. This project will set highly sensitive seismometers deep below the surface to monitor our planet's earthquake activity. This season will be the preparation for next year's setting of the seismometers. The preparation involves creating two holes, each 12 inches (30 cm) in diameter and up to 275 meters (300 yards) deep. But because drilling 12-inch diameter holes and removing the cores would be extremely difficult, the drillers are going to drill 4-inch (10 cm) cores and then use three increasingly-sized reamers to create the 12-inch openings. Once the holes are done they'll pour a layer of sand into the bottom to level out the base, and the holes will be covered for the winter. The SPRESO camp is located eight kilometers (five miles) away from the station and will be populated by five people for the duration of the South Pole summer. We're hoping the drillers will make it in to "town" every now and then for a visit.

The construction crews are making visible progress on the Elevated Station as the steel begins to rise out of the snow for the third of eight pods. The interior of the first pod is moving along and it looks like people will be able to inhabit the new station during the upcoming winter. Construction of our new water well is underway, including the tunnel crew's successful "hole-through" at the intersection of the water well tunnel and the main tunnel. It was a sight to see as the tunneling machine punched through the snow wall to the main tunnel. More on the tunnel project in an upcoming article.

Operations had an interesting week both with the construction of the SPRESO road and with the discovery of a parachute which emerged 25 feet (7.7 meters) down into the trench dug for the tunneling project. The date on the parachute is 1952 - five years before the International Geophysical Year when South Pole Station was established. Once the tunnel is complete we hope to excavate the parachute and maybe find a cargo load attached. We'll keep you posted!

We Polies send our wishes for a delightful and "full-filling" Thanksgiving to you all.

the week in weather

McMurdo Station
High: 30F/-1C Low: 5F/-15C
Wind: 49mph/80kph
Windchill: -33F/-36C

Palmer Station (Nov. 10-16)
High: 37F/3C Low: -28F/-2C
Wind: 77mph/124kph
Precipitation: 1.24in/31mm

South Pole Station
High: -22F/-30C Low:-44F/-42C
Wind: 22mph/35kph
Windchill: N/A

Microbes

From page 4

help the microbes survive in their frigid surroundings. The functional genomics aspect of this work is taking place in the molecular microbial ecology lab at the Desert Research Institute, while the sample collections and experimental manipulations are based out of Palmer Station.

With spring near, it's time to sample

You never know what the sea ice conditions will be during late winter-early spring in the Antarctic Peninsula region. This time around, though, we saw no sea ice on the southbound trip through the Bransfield and Gerlache straits; we were surprised to find Arthur Harbor and the surrounding region covered in ice. The inclement late winter weather of September and early October delivered consistently high winds, averaging 30 knots (35 mph) with gusts up to 74 knots (85 mph) one night, and inches upon inches of new snow. Periods of warm weather in September raised fears that the ice would not be suitable for travel, but the warm spell only lasted three to four days and temperatures dropped to the all-season low at Palmer the following week.

Once convinced the sea ice was safe enough to transport not only ourselves, but also our large seawater samples (200 liters, or 400 lbs.) and requisite gear, we set up two sampling stations in Arthur Harbor and one off of Bonaparte Point. We collected 21 ice cores and concentrated cells from more than 4,000 liters (1,040 gallons) of seawater. We also sampled the seawater and ice for descriptive data to characterize the habitat by taking subsamples for salinity, nutrients, chlorophyll and cellular density, then harvested the rest of the cells for microarray-gene expression studies. We were able to perform some molecular analyses at Palmer Station on some of the samples to determine the presence of Archaea, and to determine whether we could detect specific genes being expressed by microbes that are involved in the nitrogen and carbon cycles. In addition, we performed a variety of diurnal (full daylight vs. complete darkness) and stress-induced experiments varying the temperature or light levels that the marine microbes were exposed to.

Our hope is to develop a better understanding of the ecological strategies the Antarctic microbes utilize to thrive in their dynamic, subzero environment. Understanding the responses of microbial gene expression to changes in environmental conditions depends on identifying which tools (or genes) are being deployed from the vast reservoir stored in this tool box called the "environmental genome." With some luck, technological advances and productive field seasons - as this one has been - we may start unraveling the secrets that are stored in the tool box.

The long-term applications of this work may help identify new genes for biotechnological or pharmacological use, contribute to a better understanding of the requirements for life on this planet - or on other planets - and in the end help draw a more complete picture of how these plentiful microbes are living and interacting with the inhospitable environments that they call home.

For references, and newsletters prepared on the Ice, please visit my Web site: http://www.dri.edu/DEES/Faculty/Murray.html, or contact me at alison@dri.edu, or Earth and Ecosystem Sciences, Desert Research Institute, 2215 Raggio Parkway, Reno, NV 89512 if you have any questions.

Photo courtesy of Allison Murray/Special to The Antarctic Sun

Alison Murray's field team and other scientists sample the ocean and its krill inhabitants at a sea ice station in Arthur Harbor. Pictured from left to right are Alison Kelly, Brandon Carter, Brett Pickering and Dan Martin.

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Solution to crossword from page 2

Continental Drift

What is the best Antarctic souvenir (not necessarily from the store)?

"Glacier water in a fancy bottle"
Barb Watson,
Palmer Station instrument tech, from Raleigh, N.C.

"When I was at Palmer Station I thought it was neat to have pieces of the granite rock. Some of it has pieces of fool's gold in it."
Bruce Kegel
McMurdo plumber, from Pleasant Grove, Utah.

"Scott's bag of rocks."
Rob Carlson
South Pole employee, Salt Lake City.

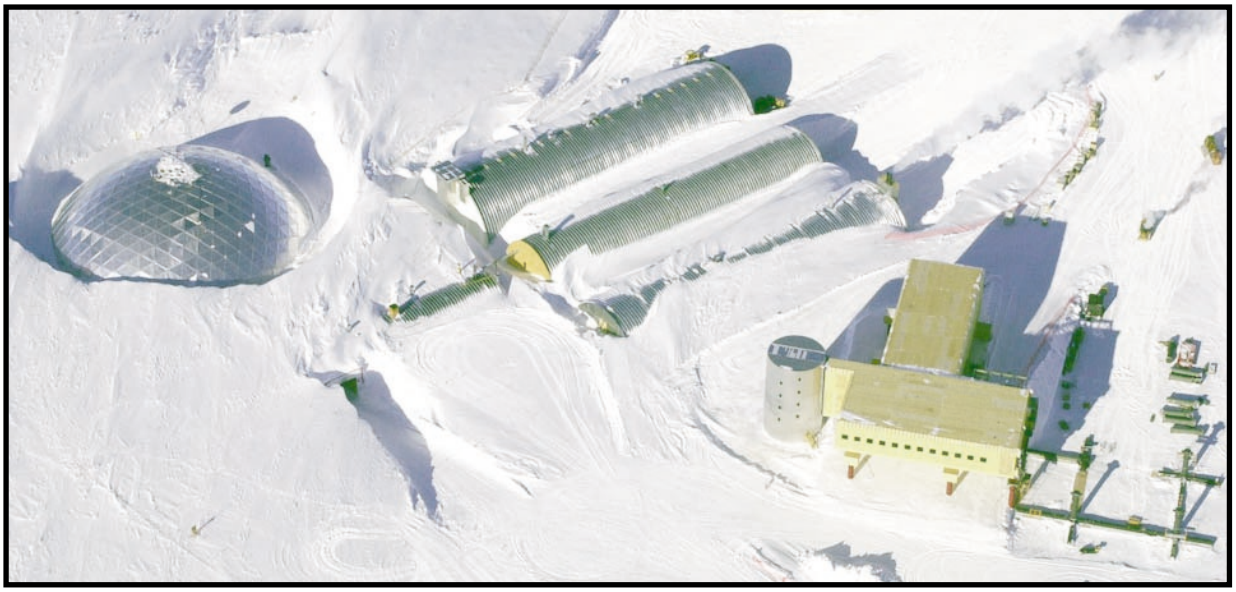

Photo by Kristan Hutchison/The Antarctic Sun

The first section of the new elevated station and recently finished arches for the garage, shop, cargo, warehouse and powerplant stand out in the landscape beside the familiar silver dome in this aerial photo taken Nov. 20.

Third time's a charm

New South Pole building to improve science and life

By Melanie Conner
Sun staff

As the first two South Pole station buildings succumb to the snow, the third and biggest is rising above it.

Snow drifts and a short life expectancy were the fatal flaws of the dome and an earlier station. The new $153 million station will be the largest elevated building ever built in Antarctica and is expected to have a longer life than its two predecessors by delaying the fatal effects of snowdrift. It is the pinnacle of the South Pole Redevelopment Project (SPRP), a modernization plan designed to support 21st century science and technology while meeting the day-to-day station operational needs of an increasing population.

The new building contains the infrastructure of a small city and will also improve the quality of life for those who live and work at Amundsen-Scott South Pole Station.

The new station building resembles two Cs with a connecting link. It is designed to thwart snow accumulation by allowing the wind to blow the snow under the building and through the 20-foot columns. To help this process, the windward side of the building is designed with an angle to allow prevailing winds to blow out the accumulating snow underneath the structure. As a backup solution to drifting, the station's columns are extendable, meaning the structure can be lifted twice during its predicted 45-year life span.

The heart of the new station is a new three-generator power plant which came online Jan. 20. It is already pumping heat through the old and new station. The old generators will serve as backup during the operational testing year and then will remain on station for support of future science needs.

The new power plant is more efficient and computerized.

"We are no longer using a wrench, but a computer," said National Science Representative Jerry Marty.

The generators will be capable of meeting increased energy needs ranging from more laptop computers brought by researchers to large-scale science data processing.

"Having a new station will be very nice. The new power plant will help meet new demands of power to support science," said Chris Martin, a post-doctoral fellow from Boston, Mass., who is working with the Antarctic Sub-millimeter Telescope/Remote Observatory (AST/RO). The observatory studies the formation of stars with the Harvard-Smithsonian Center for Astrophysics.

Another improvement, a new maritime satellite connection, is now online to improve station, continental and overseas communications. The MARISAT communications system will allow scientists to send more collected data faster and in real time.

"Science will be able to move a tremendous amount of data per day," said Nick Powell, sustaining engineer for the new MARISAT/GOES Earth Station. "Nobody has ever put a system

See New on page 8

1911, Dec. 14 Roald Amundsen is first to reach the South Pole

1912, Jan. 17 Robert Scott reaches South Pole. He and his compatriots die on the way back

1929, Nov. 29 Richard Byrd flies over the South Pole

Photo by Melanie Conner/The Antarctic Sun

Photo by Melanie Conner/The Antarctic Sun

Bruce Richardson of Colorado Springs, Colo., above, works inside section A-1 of the new building at the South Pole Station At right, workers survey the steel and timber footings which spread the weight of the elevated building.

New

From page 7

in, in an environment like this before."

Growth and modernization are top topics of conversation in the science communities this year.

"The station is busier now than it was in 1998 and 1999, and there is an overall feeling of growth," said Eric Sandberg of Puyallup, Wash., who works as an electrical engineer for Degree Angular Scale Interferometer (DASI), a science project that studies the future of the universe by looking at microwave emissions from the Big Bang. However, DASI will not live to see the entire station, as researchers are in the third year of a four-year mission.

"Then there will be new theories and the station will help install any new telescope or technologies that follow DASI," Sandberg said.

Life will also improve for the science support crews, as will the view from the new galley windows. The old galley under the dome is cramped and windowless. Large windows will give the new galley natural light in the summer and expansive views of miles of continent. Purchased art will add a touch of class.

Lines should be shorter in the new dining room, with seating for approximately 100 instead of the current 68. There will also be new, more functional equipment. Food Service Supervisor Sally Ayotte helped in the design of the new dining facility and looks forward to having more counter space, refrigerators and an indoor freezer to replace the outside ambient freezer. The outdoor freezer causes food to overfreeze, making it difficult to thaw in time for cooking.

The dining room will also have a multimedia system that will allow for more high-tech science lectures and better noise separation between the kitchen and dining room.

NASA designed the new greenhouse, or growth chamber, which will produce more fresh vegetables for South Pole residents

"It's supposed to be a pilot for their Mars and lunar mission," said Joe Ferraro of Ferraro Choi Associates, a Honolulu-based architecture firm responsible for designing the new station.

The medical facility will also see many improvements.

"In the new building, everything won't roll that direction," said Tim Pollard, the South Pole's physician, as he pointed to the other end of the room and explained the floor slopes to one side. "It also gives us a chance to upgrade our equipment and get rid of outdated equipment."

In the new station, everyone will have his or her own private room with its own data port. Scientists will be able to work from their rooms, while residents will be able to e-mail and browse the Internet from their laptop computers.

The corridor walls will be a checkerboard of black, red, green and yellow squares.

"It's going to be a little flashy maybe," said Doug Forsythe, the station's construction coordinator. "It'll be interesting to see people's reaction."

In 2006, the new station will be completed. People will no longer work three rotating shifts or shiver in cold corridors on their way to the bathrooms. No longer must people walk outside to go to medical facility, the library, the store or the dining room.

"The new building will make life easier," said Area Manager Katy Jenson. "It will certainly be a lot safer. It will meet current fire, life and safety codes, and will be less crowded."

1947-48 Buckminister Fuller invents the geodesic dome

1956 George Dufek becomes the first person to stand at the South Pole since Scott's expedition.

1956, Nov. 20 First construction crew arrives at the South Pole and construction begins on the wood and canvas Amundsen-Scott South Pole Station. The station was expected to be temporary.

Polar Plans
From the tropics to the Ice

Photo by Melanie Conner/The Antarctic Sun

Chuck Speidel of Alaska discusses plans for construction of the new South Pole station inside a warming hut.

"We work slower (when it's colder). We resort to more primitive methods when equipment doesn't work."

- carpenter Chuck Speidel

Designed in Hawaii... Tested in Arkansas... Built in Antarctica...

By Melanie Conner
Sun staff

From where do drawings emerge for a self-contained, micro-city located in the coldest, driest, most desolate place on Earth? Hawaii.

In 1991, the National Science Foundation asked Ferraro Choi Associates, a Honolulu-based architecture firm, to survey the existing South Pole station. Ferraro Choi had already been designing buildings for the U.S. Antarctic Program for eight years.

Ferraro Choi developed a plan for a 150-person station - 90 more than the existing facility - with room for the increased communications and technology needs of the Pole's science projects. Based on their previous experience with the Albert P. Crary Lab at McMurdo Station, Ferraro Choi designed an elevated structure, capable of jacking, that could delay the long-term effects of snow drifting. Though the earliest designs included the old silver dome, it was soon dropped from the plans.

"As we looked at it closer we thought the dome, for a lot of reasons, was not a good choice," said Joe Ferraro, a partner in Ferraro Choi. "A lot of snow piles up on the dome. Even the bottom ring of the dome that holds it together had cracked. It's like putting Humpty Dumpty together again, so we proposed elevating the entire station."

The drifting snow that overwhelms the dome was one of the biggest design challenges for the new station to overcome. At the South Pole, wherever something blocks the wind, a drift grows.

"It's sufficient that you could bury a single-story building in a season if you didn't design them appropriately," said Colin Williams, a principal in Rowan Williams Davies and Irwin, the firm that did drift studies of the new building.

RWDI submersed a 2-inch (5 cm) tall model of the building into water tanks, simulating the movement of snow with sand. The resulting station has a slanted base to funnel wind and snow underneath the building. When the plateau finally rises up to the building, as it does 8 inches (20 cm) a year, the entire structure can be jacked up another 12 feet (3.7 meters).

The difficulty in the station design is that it is being built on a glacier which moves about 36 feet (11 meters) a year. The

See Design on page 10

1957 July, International Geophysical Year officially begins.

1959 Antarctic Treaty signed

1969 Pam Young, Terry Tickhill, Dr. Lois Jones, Eileen McSaveney, Kay Lindsay and Jean Pearson become the first women at the South Pole

A cargo crew struggles to remove the cargo aboard an LC-130 military aircraft after landing at the South Pole.

Photo by Melanie Conner/The Antarctic Sun

Design

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snow acts like water, so the station has to float above like a boat, Ferraro said. The columns holding up the building rest on platforms of perpendicular steel grade beams designed to bear and distribute the building's weight evenly.

"It looks like a woman's high-heel, like a stiletto, but underneath the snow it's really like a snowshoe, so underneath the snow there's a grid of steel," said Ferraro.

Another consideration was placement of the new building. Difficulty arose when they had to place the building and power plant downwind of air sampling. It also had to be out of scientific areas such as Dark Sector - a zone off-limits to artificial light and radio waves - Clean-air Sector, the Quiet sector and the weather-balloons launching area.

"After you put all that into the mix you realize that there's probably only one place that the station could be that would not disrupt the science," said Ferraro.

The new building will have window shutters to block artificial light from inside the building during the six months of darkness, as to not contaminate the Dark Sector, Ferraro said.

"The whole reason they're there is because the environment is so pristine," Ferraro said. "We didn't want to screw it up."

Designing the building was only the first challenge. In the northern summer of 1999, a crew traveled to Arkansas to do a test build of one section of the building and jacked it up four feet. There they were able to determine and resolve some design flaws in preparation for the Ice.

But Antarctica is different.

"Just about everything is unique about it. Every time you specify a material, there are no materials that were fabricated to meet the specifications for this station," Ferraro said. "Take something like glue or caulking - if you look at the specifications, most caulking the lowest they go down to is 50 below (Fahrenheit) and we're talking 150 below zero."

Purchasing the building materials and transporting them to the South Pole was the next challenge, a process that can take three to four years. The first-year materials were researched and ordered in the U.S. and sent to Port Hueneme, Calif. Next they were loaded in containers and shipped to Antarctica on the annual resupply vessel, arriving at McMurdo Station in mid-February. Materials needed for winter construction are then given priority on their continuing flight to the South Pole, along with a winter supply of goods and produce for those staying. Everything must fit in the 8-by-8-by-38 foot cargo hold of an LC-130 airplane.

"It's literally like building a space station, because everything must go like in a space shuttle," Ferraro said.

The window of opportunity for cargo movement is narrow because cargo planes are also needed to transport summer crews off the Ice before the first part of March. Other materials wait until the following October when the austral summer returns, cargo planes resume their flights and the summer cargo movement season begins.

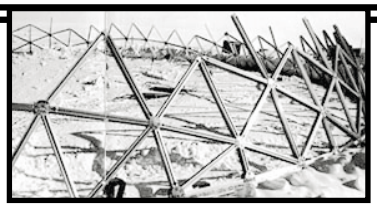
Backlogged construction materials have sometimes halted construction for days. Delayed flights last year caused construction crews to fall behind and stranded 1.4 million pounds of cargo at McMurdo. This year, the South Pole station has received 73 percent of their scheduled flights, a number that can improve or deteriorate depending on Mother Nature.

As long as the planes keep flying, the station is on track to be finished in 2006. By then many of the architects who designed it will be ready to retire. Ferraro said his beard has already gone from black to gray since he started the project. While the work is professionally satisfying, he doesn't expect the South Pole station will bring him any new clients in Hawaii.

"Who's going to want another one of these?" he said.

1969 Australians build Casey Station, the first elevated station in Antarctica.

1970-71 summer Construction of South Pole dome began. The dome was designed to last 10-20 years.



1974-75 summer Finishing work done on the South Pole dome.

Photo by Melanie Conner/The Antarctic Sun

A person enters the wide-mouthed dome entrance at the South Pole station, above. The walls of the dome, at right, provide a windshield for the buildings inside.

Photo by Melanie Conner/The Antarctic Sun

Growing From page 1

Fifty of the 220 beds at the South Pole are reserved for science teams throughout the construction, said Jerry Marty, National Science Foundation representative at South Pole station. He said they have been successful at maintaining science and even accommodating new projects.

"It is challenging trying to provide for everyone and maintain a good spirit," said Jensen, referring to a station originally built for 33 people during the summer that now houses 220. In what resembles a hectic, extended-family Thanksgiving dinner, residents of South Pole station work around one another and create an atmosphere of camaraderie.

Dome living and summer sleeping

At breakfast one morning, the tunes of Johnny Cash blast throughout the dining facility. During lunch the cooks prepare Mexican food, and Salsa music plays loudly in the kitchen and dining area. The music is always played loud in the kitchen, the songs competing with the sounds of dishwasher fans and other industrial kitchen equipment. The dining facility, designed for 68 people, is crowded with long lines, tight seating and oversized bunny boots. One can't forget anything on his or her first trip through the line; otherwise it might be a difficult negotiation back to his or her original seat.

"Excuse me. Excuse me. Excuse me," said one person as he returned to his seat after leaving it briefly to refill his water glass.

"This place is tiny, very small. It's a bit more stressful to work around each other," said Mike Toomey, a dining assistant. "Here, you must sit down with people you don't know. You can't quarter yourself off."

The crowded family-style seating area, a public "leftovers" refrigerator and the absence of a wall separating the cooks from the eaters make the galley a community gathering point. Here they plan parties, drink hot drinks to warm themselves and volunteer to do dishes on Sundays, the stationwide day off.

"People work hard here and must pitch in to the community," said Jensen. "The new station will still be the same to an extent, but they will never have to go outside. It will be like being in a space station - people would be encapsulated."

"Nowhere (else) in the world are people living and working in buildings under a dome," said Hailaeos Troy, a communications technician. "Going outside between buildings is a reminder that you're in Antarctica."

Although the buildings are situated under a massive, snow cave-like aluminum dome, they are not isolated from the cold. Instead, the dome's thin, frozen, aluminum wall provides only a windshield for the buildings inside, whose exteriors remain iced-over year-round.

The current station is situated so that even inside the dome, people must go outside from building to building, each time donning their heavy down parkas - although, on occasion a person

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1975 January South Pole dome dedicated. A month later the old station was abandoned, already buried below 8 meters of snow.

1982-83 Settling under dome has caused its foundation to tilt 2 feet.

1989 Tension rings holding dome together snap because of tilt in foundation. "Year of inception for new South Pole station."

Photo by Melanie Conner/The Antarctic Sun

The lunch crowd, at right, lines up for a meal at the South Pole galley. Below, Sous Chef Jon "Cookie Jon" Emanuel, foreground, makes gravy while Jon T. Brack of Boulder, Colo., adds seasoning.

Growing

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will speed to the next destination in a T-shirt.

Few people actually live in the dome, which is too small for the Pole population. Most live in dormitories a short walk from the dome.

Inside under-insulated dorm rooms, cold-weather adjustments must be made, especially in rooms located on the windward side. For example, a water bottle placed on the floor overnight can freeze. Likewise, when getting out of bed in the morning, the walk to the toilet is a snowy journey down a frozen corridor.

Sleeping can be interrupted and difficult in rooms separated only by accordion-style curtains. Daylight never ends. Snow removal machines drone on. Three rotating shifts per day keep alarm clocks and personal schedules in constant conflict with one another.

Construction-related personnel work fast and furious throughout the day and darkless night building the new South Pole station as they enter a three-year peak-construction period.

The workers are the nucleus of the project. They come to the Ice from Alaska, Montana, Colorado, Utah, Iowa and New Hampshire, to name a few locations, and bring with them a variety of skills from cabinet making, painting and flooring to sheet rocking and framing.

Some workers remain among the lucky ones tasked to work on the building's interiors during this unusually warm summer.

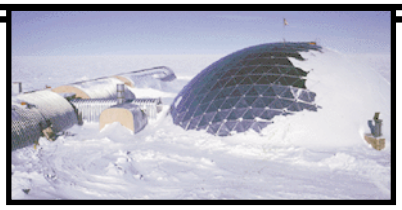
See Growing on page 13

Photo by Melanie Conner/The Antarctic Sun

"It's a tiny place.
In general, size is the biggest challenge...
...The new galley will be slick."

- Sous Chef "Cookie Jon" Emanuel

1990 The dome is jacked up and the tension rings replaced; an engineering firm, Metcalf & Eddy, studies the future needs of the South Pole Station



1991 June South Pole design retreat leads to conceptual design using old dome and additional elevated, jackable component

Photo by Melanie Conner/The Antarctic Sun

A coffee station for carpenters, right, will be the location for a table in the new dining room at the South Pole station. From the window it is possible to see the South Pole marker and the vast ice field beyond. Below, Daniel Lindberg and others work outside in minus 40F temperatures with a minus 88F wind chill factor. The carpenters keep working even when their machinery fails to do so.

Growing

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Most of these returning crew members worked outside last year on the Marisat satellite dish during an unusually cold summer.

Sub-zero summer temperatures can immobilize cranes, snap power cords and cables, and freeze hydraulic fluids. Yet working men and women are more resilient. Last year it took a wind chill of minus 112F (-80C) with whiteout wind conditions for the crews to retreat indoors. Equipment failures, cold weather, high altitude and layers of clothing can double the time it takes to complete even simple tasks at the Pole.

"We work slower (when it's colder)," said carpenter Chuck Speidel. "We resort to more primitive methods when equipment doesn't work."

Outside, goggles fog frequently when exhaled breath steams their insides. Hard hats jammed on top of other outdoor gear often fall from the heads of busy workers.

Bundling up and maintaining body heat for 10-hour shifts outside is a skill people develop quickly at the Pole. Like layers of paint on a wall, workers don carefully planned articles of clothing, occasionally inserting hand-warming heat packets into their gloves or shoes. The layering starts with a thin liner - even on the hands - progress toward bulkier layers in the middle and finish with an exterior shell to provide a protection from prevailing winds. At each break in the warming shelter, the workers shed layers, drink water and eat a snack or meal, only to repeat the layering process and return to work outside.

Food is the final key to keeping warm.

One particular worker eats two steaks, a heaping-pile of potatoes, cookies and a peanut butter and jelly sandwich before his shift. The benefit: A sure weight-loss program while eating 5,000 calories a day.

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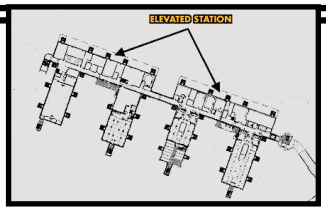
Photo by Melanie Conner/The Antarctic Sun

1991 National Science Foundation asked Honolulu-based Ferraro Choi Associates to survey the existing South Pole station.

1994 Ferraro Choi Associates complete a conceptual design for the new station.



1996 National Science and Technology Council review affirms the need to replace the South Pole Station and recommends it be built by 2005.

Photo by Melanie Conner/The Antarctic Sun

Light rays scatter through the contrails of a tractor, left. Kristi Moore of Denver, Colo., below, steers a forklift while others guide steel grade beams into place.

Photo by Melanie Conner/The Antarctic Sun

"I enjoy touching the (ceremonial) Pole and thinking about the role I'm playing in polar history."

- Leana Downs, carpenter

Growing

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Food Service Supervisor Sally Ayotte tries to plan for extra food costs added by construction workers and others who work long days outside.

"Construction workers will eat 5,000 calories a day," said Ayotte. "I have to make sure they are getting what they need. Like butter. They can't have margarine on their toast. They work outside and they need real butter."

Workers have to keep their food intake high, go into the warming hut when feeling cold and maintain constant awareness of their immediate surroundings.

"The most common injuries for workers are sprained ankles and backs," said Tim Pollard, the South Pole's physician. He said he is often concerned about the use of saws and heavy steel by physically stressed workers.

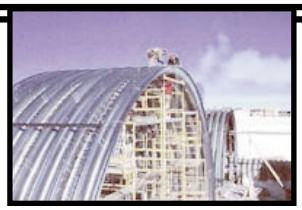
"The times they get injured on site is not when they are doing big things," Pollard said. "It is when they go up there for one small task and don't harness in, for example."

Pollard said frostbite is rare for outside workers, who are experienced, prepared for weather and know which way the prevailing winds blow.

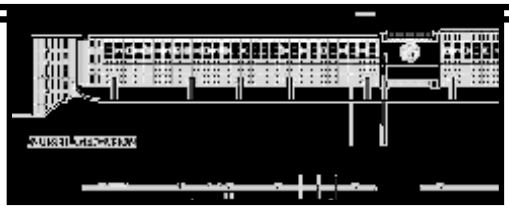
Cold toes, fogging goggles, falling hats and prevailing winds on miles and miles of ice are daily foes that might leave people in the Northern Hemisphere wondering why anyone is here at all.

However, as carpenter Leana Downs put it, "I enjoy touching the (ceremonial) Pole and thinking about the role I'm playing in polar history."

1997 The first $25 million is allocated to the new South Pole station to replace the garage/shop facility.



1998 Ferraro Choi awarded the design for the new South Pole station.



There's no place like dome

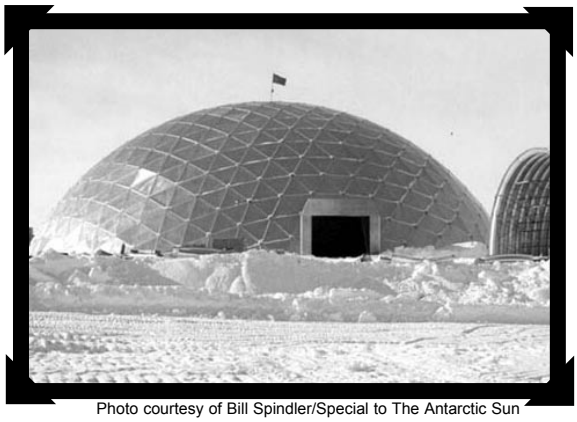


Photo courtesy of Bill Spindler/Special to The Antarctic Sun

The new dome in 1973.

Photo courtesy of Bob Nyden and Bill Spindler/Special to The Antarctic Sun

Seabees assemble the lower portion of the dome ring in 1972-73.

By Kristan Hutchison
Sun staff

What the National Science Foundation needed in 1970 was the biggest umbrella in the world to shield new buildings at Amundsen-Scott South Pole Station from blowing snow.

That's exactly what they got, a 65-foot-tall aluminum dome reflecting back sun or moonlight, depending on the season. The first, and in many ways only, structure of its kind, the South Pole dome outlasted its designers initial estimates by 20 years.

The NSF had already decided to build a dome when it contacted Temcor. The California company was co-founded by Donald Richter, who learned geodesic dome design from the inventor himself, Buckminster Fuller.

A dome shape provided the best ratio of strength and size to weight, Richter said. Because it was built from panels, the pieces could all fit within an LC-130 and took only five flights to transport. Each component weighed 50 pounds or less, making them easy to handle. Geodesic domes were also touted to be very fast and easy to put up, so it could be accomplished during the four-month summer.

Richter became the principal engineer on the new South Pole dome.

"It certainly was a challenging project for us, as it would be for anyone because of the conditions," Richter said. "It is a very special dome in some details that are specific to the Antarctic."

The dome was designed to stop the snow, but didn't need to be sealed against rain. The biggest difference between the South Pole dome and other domes was that instead of a foundation it sits on a pad of timbers on snow and ice. Changes in the ice below gave it an unreliable foundation and became the dome's downfall.

The South Pole dome was one of the first to use a multi-frame system, which has since been used in thousands of domes around the world, Richter said.

"It was one of the first of that kind," Richter said. "That was kind of a pioneer dome."

The South Pole dome was also the first to be analyzed by a computer, said Gary Curtis, an independent consultant hired by Temcor to work on the dome.

"The Navy wanted a full analysis done of the thing, so that's what we did," Curtis said. "Computers were just barely able to handle stuff like that."

Other features were changed after the South Pole dome, including smoothing out the exterior, said George Donaldson,

See Dome on page 16

1999 December New garage/shop/fuel storage building completed

2001 January New power plant goes online

Photo by Melanie Conner/The Antarctic Sun

The dome as it is now, sunken into the snow. Constant maintenance is needed to keep the entrances clear of drifts.

Dome From page 15

another Temcor engineer.

"If you would slide down the dome at the South Pole you'd probably rip up your clothing." Donaldson said.

Polar construction is never easy. Normally, geodesic domes are built from the top down, hanging from a central tower. The South Pole required a different technique because the LC-130s couldn't carry a tall enough tower, Mattis said. Instead, the top three-fourths of the dome was built down from a 65-foot tower and the bottom section was built up from the ground. Then the two parts were joined in the middle.

The dome was supposed to be done in one season, Mattis said. He arrived in December of 1971 to oversee preparation of the foundation, but the hydraulic equipment needed for the foundation and bolting together the dome froze up in the cold. The problems were ironed out in the off-season and Mattis returned in 1972. By mid-January the dome was done.

Bill Spindler was the winter-over manager in 1977, when the dome was just a few years old.

"The station was bright new and shiny and clean and the dome wasn't settling and there weren't any cracks," Spindler said.

Or was it? On closer inspection, snow was already drifting onto the downwind side of the dome, pushing down the platform of snow and timber beneath it.

"We actually first noticed what turned out to be the settlement in the winter 1977. There were some hairline cracks in the floor," Spindler said. "The floor of the utilidor tunnel did start to tilt downward."

By 1982 the tilt was severe enough that Temcor sent Curtis down to look at it. He found a big crack under the dome, which had settled two feet. The dome had tilted and deflected, but was still intact. Curtis recommended that snow be removed, but nothing was done at that time.

The snow kept piling up. In 1989 someone heard a loud bang in the dome and Curtis was called down again. He found the tension ring holding the dome together had snapped in two places under the strain of the foundation sagging and twisting.

"Normally that would be a disaster for a dome, but this time it wasn't a problem because it was trapped in all the ice that was around it," Curtis said.

The tension ring couldn't be fixed until the next summer, so Spindler had to stand up and explain to the winter-overs that the dome was safe for the winter.

Curtis came down again in 1990 with newly manufactured parts and 10 hand-operated jacks. Five of the jacks broke by the end as they lifted and evened out the dome.

"We completely rebuilt it until it was as good as new," Curtis said. "The dome was good for another 20 years."

But the NSF was already planning a new station. Snow continues to pile up against the downwind side of the dome, pushing down the foundation, so the dome is again skewed a foot, said NSF Facilities Engineer Projects Manager Frank Brier. Though early plans included the dome, the foundation problems led the NSF to drop the dome completely. Despite the problems, the silver dome has exceeded expectations, outliving its projected life several times over and becoming a symbol of the South Pole.

"Obviously it still impresses people," Spindler said. "Because when people think of the South Pole station they think of the striped pole in front of the dome."

2002 Twenty-six people winter over in the A1 section of the new building under a conditional residency permit.

2003 Medical and science sections of new building completed.

2004 Administrative, communications and housing completed.

Dome doomed

Photo by Melanie Conner/The Antarctic Sun

Snow drifts pile up around the dome, pushing down its foundation and causing it to warp.

By Kristan Hutchison
Sun staff

The silver South Pole dome may return in six-packs.

The structure, almost entirely aluminum, is scheduled to be recycled after operations move into the new elevated station.

"It will probably end up as scrap metal aluminum," said Frank Brier, the National Science Foundation's facilities engineer projects manager. "It'll end up as beer cans."

Though some people want the dome saved for sentimental reasons, the NSF determined it's more cost-effective and practical to demolish the dome and ship it back to the U.S. The dome can't be left where it is, as the previous station was, because the NSF now works under more stringent environmental standards.

Instead, starting in 2005, the aluminum panels will be ripped off the dome, chopped into pieces and shipped out. Explosives may be used to break apart the remaining metal frame, Brier said.

That's exactly what some dome-lovers fear.

"I don't think people really care what happens to it or where it goes as long as it's not just cut up and stuffed in some airplane and sent to some East Coast recycling plant," said Jeff Kietzmann, webmaster for savethedom.com.

The dome is more than just a structure to people at the South Pole. It's one of the top three most-visited and photographed attractions at the pole, close behind the geographic and ceremonial poles, said Kietzmann, who wintered-over at the South Pole as a communications technician. From inside the dome has a cathedral feel, with sun or moonlight beaming down from the five ventilation holes and illuminating the snow stalagtites that surround them.

From outside, the dome is a mirror for the sky.

"It has moods. However the continent's feeling, it reflects it," Kietzmann said. "I've seen it completely white and I've seen it completely black."

Kietzmann, like most people he's spoken with, supports the new station and understands the need to replace the dome. But after working seasonally at the South Pole for many years they become fond of the dome.

Jake Speed considers the dome home after living there most of the last two years. He jokes about starting his own station in the old dome or turning it into an ice rink, but his sentiments are serious.

"I do absolutely love the dome and I will live in it until it comes down," Speed said.

"I really hope it doesn't come down. There's a lot of good uses for that thing."

Though the dome has far outlived its expected life of 10 to 20 years, the original designers also say it could still be useful.

"I think they ought to leave it there and use it as a recreation covered area…maybe just for storage if nothing else," said Donald Richter, the principal engineer on the dome. "If they just kept that ground clear of deep snow drift it would last indefinitely."

Gary Curtis, who worked with Richter on the dome, also thinks the dome should be saved for practical and historic reasons. It would make a good storage area or emergency shelter, he said.

"It's fine to build a new station, it surely needs a new station, but don't knock the old dome." Curtis said, "It's a good symbol. I know at one point the NSF was very proud that this big dome was there."

Other organizations are interested in the symbol. For a while the Byrd Polar Research Center considered salvaging the dome and re-erecting it as part of an Antarctic museum. But the dome was designed for the desert-like Antarctic conditions and wouldn't withstand more temperate weather, Richter said. The joints were never sealed and soft pads were used at the connectors instead of watertight fittings.

"It would leak like a sieve anyplace that takes rain," Curtis said.

The cost of carefully dismantling and transporting the dome would also be prohibitive.

"It's a neat symbol at the South Pole, but I really can't see it being worth the money for somebody to bring it out and set it up someplace else," said Bill Spindler, winter-over manager at the South Pole in 1977.

In the end, even those who have been closest to the dome recognize demolition makes sense.

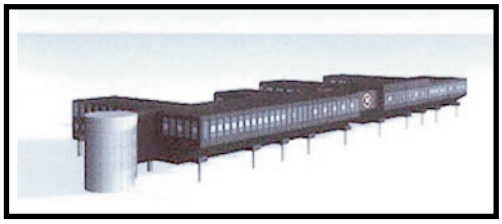
"It's too bad we're scrapping it, but it is not cost-effective to do anything else," said Area Manager Katy Jensen. "I'll miss it, but it's just a building."

"The PLACE - the South Pole - will always be special," she said.

2005 New station complete. It is expected to last 25 years or more. Old dome demolished.

2006 Transition to new station complete.

2031 Station will need to be jacked up 12 feet to stay above the snow level.



Profile

A life under the Antarctic sea

By Ben Murray
Special to The Antarctic Sun

Across McMurdo Sound, just a half turn of the head to the right of Mt. Discovery, is Robbins Hill, first mountain north of Blue Glacier. At the toes of the hill is the thick hide of the Antarctic ocean, and beneath its skin there is life; moving slowly, hunting deliberately - breathing compressed air through a regulator.

There's a strange creature below the ice of the Antarctic waters. Older than many of the local fish, with nearly as much underwater experience as some of the younger seals, it survives in a rubber suit, diving as deep as 130 feet and surfacing mainly to prowl the galley to feed. The creature is Rob Robbins, just Rob if you shake his hand in greeting, and he is the most experienced diver on the continent.

At 7:30 on a Friday night, the foremost diver in Antarctica is in Building 144, commonly known as the Dive Hut or Dive Shack, just a stone's throw from the edge of the ice. He's wearing a gold hoop earring, a thickly settled red beard and a teal T-shirt that reads, "Extreme Environment Diving; Antarctic Dive Team." Hanging around the computer where he sits are unidentified rubber tubes, ending in peculiar metal shapes that apparently aid in underwater respiration. The file cabinet behind his chair has stacks of drawers labeled "Y Valves," "D Rings," "Fin Straps," "Lanyards" and "Tubing." A U.S. Navy Diving Manual is in the bookcase above his head, near a sticker for the Diver's Alert Network. The place is all business.

In Rob's back pocket is a metal key chain. "That's from my BFC days," he says. Those BFC (Byrd Field Camp) days were some 20 years ago, when Rob was in his first few seasons at McMurdo, working his way up from an entry position as a General Field Assistant. Since then he has been constantly drawn back to Antarctica and its waters. This is Rob's 23rd consecutive season on the Ice, not counting winters, and he is only 46 years old. Nearly half his life on ice, and under it.

His diving days started "right out of high school," when he took a job as a lifeguard on Johnston Island, a speck of dirt half-a-mile wide and two miles long floating in the belly of the Pacific.

Photo by Melanie Conner/The Antarctic Sun

Rob Robbins surfaces after collecting samples during a dive Saturday in McMurdo Sound. This is his 23rd season working on the Ice.

"It was part of the Pacific missile range, where they keep nerve gas and defoliant," Robbins said. He learned to dive in the waters off Johnston Island, took time out to get a degree in Underwater Technology from the Florida Institute of Technology and then headed south at the age of 23. He remembers his first impressions of the Antarctic well.

"I thought, 'This is totally cool.' There's nowhere else like it. I really think it's … just a nice place to be," Robbins said.

After a few years of ramping up with work at Palmer and as a station manager for contract workers in McMurdo, Robbins began his underwater work professionally in the summer of 1985-86. Today the plaque on the wall outside his office reads "Rob Robbins Dive God," but his business card calls him the "Science Diving Coordinator," a full-time position with Raytheon Polar Services Company that has him overseeing diving operations at McMurdo, Palmer Station and all diving from the ships employed by the program.

"Rob knows more about diving here than anyone else," says Ben Hunt, a research assistant diving for Art DeVries. "He makes diving here easier than any other diving I've done."

Yet even as Robbins has become a semi-permanent fixture among the life under the sea ice, it doesn't mean he can be completely at home there. As soon as he's submerged he drops a few rungs on the food chain, and there's only one little hole through which to escape. Orcas roam these waters and Rob remembers his first time seeing them.

"They'd be this close to you," he said, reaching out to touch something at an arm's length. "But mostly they took no notice of us."

Mostly?

"One went past, then dove down under, came up from underneath me and blew a bubble at me. That was nerve-wracking."

Such experiences come with years swimming in the waters of the far south, and those years demand a unique lifestyle. Robbins has a house in Bend, Ore., that he admits he doesn't see much, nor does he visit the shore very often in the offseason.

"I don't go to the ocean that much, a couple of times at most," he said.

To make a career as an Antarctic diver, such sacrifices have to be made. Robbins' father passed away while he was on the Ice. But even with such occurrences, "the plusses far outweigh the minuses," he says.

"It's just kind of my life now. I really like coming down here, so it's kind of hard to see what the downsides are."

This season Robbins is diving frequently, supporting science in a dry suit, some goggles and a pair of three-fingered gloves. Rob says he's not a superstitious fellow, but admits there is one ritual that must be performed before each dive.

"We consult the Magic Eight-Ball," he says, giving the little round prophet a shake. "It's never been wrong." He waits for it to settle a moment. "Should we dive tomorrow?" he asks. Better ask later, the ball replies. The streak continues.