There's no place like dome

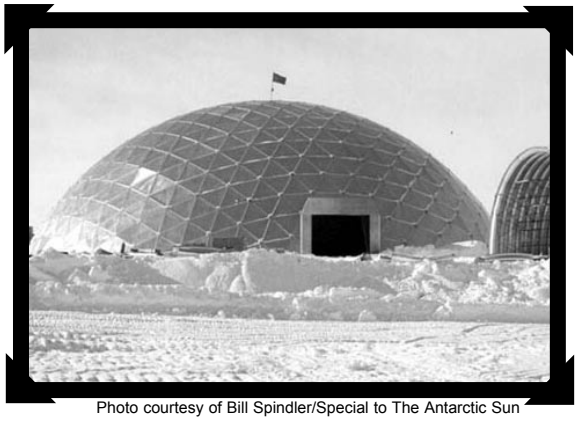

Photo courtesy of Bill Spindler/Special to The Antarctic Sun

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.

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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.