

Unique ice pier provides harbor for ships

By Emily Stone
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Every summer, an icebreaker, fuel tanker and resupply vessel arrive at McMurdo Station. They dock at what is essentially a huge, steel-cable reinforced, floating ice cube.

The ice pier is a one-of-a-kind creation. It was built for the first time at McMurdo in 1973 and has been perfected over the years so that it can last several seasons before having to be discarded.

Before 1973, ships either moored to the sea ice in McMurdo Sound and ferried cargo to land, or tied up along the fast ice — ice that's attached to land — along the shore of Winter Quarter's Bay. The first option was costly and dangerous and the second was wearing away at the fast ice. The ships' warm water discharge was melting the ice at a rate of up to three square kilometers of surface area a year.

So the Navy invented the floating pier as an alternative. Six piers have been built since then.

The process takes nearly a full year. It starts in early winter once the ice in the bay has become just over half a meter thick, making it strong enough to support equipment. The area is then surveyed and flagged, and depth gauges are placed. Then the surface is scraped free of snow.

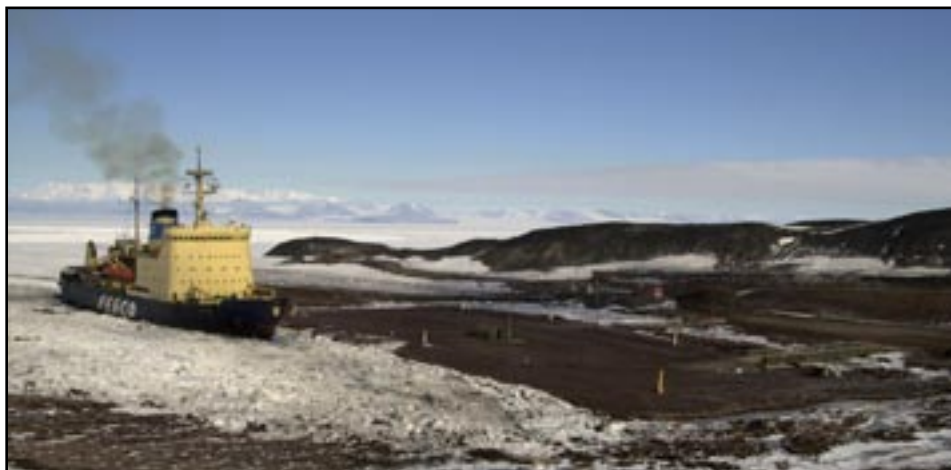
"Any amount of snow acts as insulation," explained Gerald Crist, supervisor of the station's fleet operations department, which builds the pier.

The problem with insulation is that it holds in the heat from the water during the winter. At just below zero degrees Celsius, that water might not sound so warm. But it's a relative hot tub compared to the air temperatures that can plunge to negative 30 or negative 40 degrees Celsius.

Fleet operations personnel use the cleared snow to build berms along the edge of what will become the pier. The berms are frozen to create a dam that will trap water on top of the pier as it is flooded and thickened.

The crew uses small pumps at first to flood the surface, Crist explained. Once the ice reaches a little more than a meter thick, fleet ops can install telephone poles along the pier. These poles carry the electrical wiring for the more sophisticated pumps. A cross brace between the poles supports the pumps, which hang into holes drilled through the ice.

Equipment operators squeegee the water to spread it around so it doesn't pool in any one area. This would be a problem because it would weigh down the pier around the pools and create unequal ice depth, making the pier potentially dangerous.



Emily Stone / The Antarctic Sun

The Krasin icebreaker pulls up to the McMurdo Station ice pier on Jan. 6.

The next major step comes when the ice reaches 2.7 meters thick. At this point, 2,500 meters of 2.5-centimeter-thick steel cable is crisscrossed on the surface to keep the sections together should cracks develop. Another layer of cable is set down after another meter or so of ice develops.

Divers periodically check the integrity of the pier to look for cracks and to make sure the pier hasn't gotten so deep that it will start hitting some of the higher parts along the bottom of the bay.

Once it's reached its full thickness for the season, the crew installs more steel cable as mooring lines to attach the pier to land. During the winter, the pier was held in place by the surrounding sea ice. But once the icebreaker arrives, the pier needs to be connected to land to keep it from floating away. A bridge is installed at this point so trucks and equipment can drive over the 15- to 18-meter wide moat. The moat is necessary to get the pier into deep enough water so the ships can dock there.

By this point, the pier needs to be insulated from the summer sun and temperatures as warm as 10 degrees Celsius. A layer of gravel is spread to keep the ice cold and to provide a wear-resistant surface for the trucks and heavy equipment used to load and unload the resupply vessel. Like the layers of water, the gravel must be spread evenly to make sure the pier stays balanced. In 1999, part of the pier that had cracked off the main section flipped over because it was weighted unevenly. There were no people or machines on it at the time and no one was injured.

A straight edge must be created along the outer edge of the pier so the ships can pull right up to the pier. On a first-year pier, this is done with explosives. Crist and his crew have come up with an alternate process for older piers. They now cut trenches along

the pier's edge and direct runoff water into them so there's a weak fault line running parallel to the edge. When the icebreaker comes in, it hits the pier and that section shears straight off along the even line.

"We're real tickled with that," Crist said, explaining that it was discovered "by trial and error, like most things down here." The method is less costly and more environmentally friendly, he added.

The final stages are putting up a warming hut and tower building, where operations headquarters are located. Then the ships arrive. Depending on the season, they can be here for a couple weeks or nearly a couple months.

Once they clear out, the National Science Foundation decides if the pier is strong enough to keep for another year. If it's deemed sound, winter maintenance is planned to improve and prepare the pier for the next season. If more depth is needed, the gravel will be scraped off and new water will be added over the winter. If the surface is uneven, it will be leveled by flooding low areas with fresh water.

If the pier has run its course, an icebreaker tows it out to sea. Cables are stitched through it with the help of divers and the ship hauls it out of the bay. In 1998, one chunk of the pier broke free and was loaded with so much gravel that it sank on the spot. The current pier, which dates back to 1999, had to be built in a slightly different spot because the water wasn't deep enough over the submerged chunk to build the pier above it, Crist said.

The current pier is very stable, Crist said. With the gravel on top, it extends more than seven meters below the water line, which is a safe two meters above the shallowest parts of the bay under it.

"We're ready," he said, a few days before the first ship was to arrive.