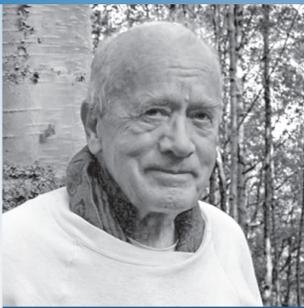


The Statewide Committee for Research honors Alaska's

# Northern Innovators



**Erwin "Erv" Long**

**Preserver of the Permafrost** *Northern Innovators Hall of Fame Member*

Thawing permafrost is a problem unique to those choosing to settle the far north. On this cold cap of the globe, in the most gradual of processes, buildings, roads and pipelines sag over what had been firm ground for thousands of years.

This curious engineering dilemma fascinated a young man named Erwin "Erv" Long, a student at the University of Minnesota who received a call from the Army Air Corps during World War II. Following his service, Long piloted his Stinson 10A Gullwing to Alaska. Here, he sniffed for a job as a Bush pilot, finding Alaska saturated with the types, most of whom didn't share his instinct for self preservation. He instead used his experience in college laboratories to land a job as soils engineer with the Army Corps of Engineers based out of Elmendorf Air Force Base in Anchorage.

It was then, according to Leslie Patton, her father showed that behind every unusual problem is a mind hungering to solve it.

"He'd say, 'There's always a way to do it,'" says Patton, who since 1982 has worked at the company started by her late father. "There's always a solution. Always."

As Long traveled the state with the Corps of Engineers, he saw tilted buildings, yawning pits in cleared fields and roller-coaster roads that were once flat as Kansas. The cause was one of the Corps' emerging issues after the construction boom of World War II: thawing permafrost, ground that had remained frozen through the heat of at least two summers. In Alaska, some of that ground has been concrete since before mammoths walked on it. On the North Slope, the relic of a colder time is two thousand feet thick.

In the 1950s, Long traveled with the

Corps of Engineers to Bethel, where most buildings sat on wooden pilings. Permafrost temperatures even in undisturbed sites in the southwest Alaska hub are around 32 degrees Fahrenheit. While looking over the tundra landscape covered with a modern town, Long pondered aloud to a co-worker why no one applied the thermosyphon principle — a heat-exchange system that works by convection and requires no electric power — to keep frozen foundations stable.

"That sounds too simple," his colleague told him. "Someone must have already tried it."

But this was Alaska, where much was undone. Long checked. No one had applied the principle to keep ground frozen. Feeling the flush of discovery, Long pulled out a drafting pad and sketched what he called a thermopile. With it, he envisioned a way to use the cold air of winter to pull heat from the ground and stop permafrost from thawing.

The thermopile device is a long metal tube filled with gas. In the early days, Long used propane, ammonia or Freon as the medium that boils at the relative warmth of ground temperature. When driven into ground, the thermopile pulls heat from the ground and releases it to the cold winter air through fins at the top.

When the air is colder than the ground, the air chills the thermopile. The vapor inside the pile condenses on the cold surface, much like the steam from a shower condenses on a bathroom mirror. The condensation lowers the pressure within the thermopile and the liquid in the bottom boils. Boiling absorbs heat from the ground while the condensation releases heat to the air. The condensate runs down the inside wall of the

pipe and re-evaporates whenever it comes in contact with a warmer surface. The cycle continues as long as the air is colder than the ground. In this way, the thermopile supercools the ground. Permafrost stays frozen.

By the late 1950s, Long had several experimental thermopiles of his design sticking like lawn darts from his Anchorage backyard. He applied for his first patents.

In 1960, Long Thermopiles allowed the construction of the Aurora and Glennallen microwave towers in the Copper River Valley, where permafrost exists only in patches. Those originals still work today, and thermopiles are now seen sticking from the ground in places throughout northern Alaska. In the late 1970s, workers for the consortium of oil companies building the trans-Alaska pipeline installed about 120,000 similar units as "vertical support members" that buttress aboveground portions of the pipe (about 400 of its 800 miles).

Arctic Foundations, Inc., the company Long founded with friend Sam Parsons in 1973, is thriving today, with an affiliate company in Canada. Much of its business is now coming from arctic Canada, Russia and Kyrgystan, places where people are developing marginal ground.

Patton remembers her father, who died in 2012 at the age of 91, as a man with a work ethic that came from being born into a dairy-farming family in Minnesota and a passion for tackling problems.

"The whole concept of vacation is something that eluded him until late in life," she said. "He just loved his engineering, number crunching and research."