The PEARL Ridge Lab, near Eureka, Nunavut, is seen in the pre-sunrise glow.
PHOTO BY PIERRE FOGAL

Working on top of the world

Guelph's Pierre Fogal leads a team of researchers monitoring climate change in the Arctic

BY ANDREW VOWLES

The "spring" 2012 science campaign on Northern Canada's Ellesmere Island in Nunavut was infamous for a couple of reasons, both out of Pierre Fogal's control.

One was the mid-February weather at the Polar Environment Atmospheric Research Laboratory, known as PEARL. It is the country's northernmost research station, located 1,100 kilometres from the North Pole. That month was especially brutal, with near gale-force winds howling around the lab, as well as -45 C temperatures that burst pipes, knocked out several scientific instruments and fused breakers in the main PEARL research facility. Maybe worse, the sewage system in the lab building conked out.

As the project's site manager, Fogal enlisted the research station crew to do what was needed to conduct the customary spring campaign. They installed heaters in a crawl space to thaw and patch up a pipe. They covered sophisticated equipment inside the lab with blankets, and declared the suite of monitoring devices on the treacherous, wind-whipped rooftop as a no-go zone.

As for the sewage system, researchers spent only short periods with their instruments at the lab building before heading back to

Pierre Fogal poses in the living room of his Guelph home. The artwork in the background, purchased at the Aurora Emporium gallery in Yellowknife, is by Canadian aboriginal artist Angus Beaulieu.
PHOTO BY DEAN PALMER

CLOCKWISE FROM LEFT: The main building at Eureka Weather Station provides accommodation and meals for PEARL scientists and other visitors; Russian ship Kapitan Khlebnikov in Slidre Fjord, near Eureka; a Eureka wolf pack howls a greeting – a sound like no other; a pair of muskox not far from the Eureka Weather Station.

PHOTOGRAPHY BY PIERRE FOGAL

home base – including the washrooms – at the nearby Eureka weather station run by Environment Canada.

"You have to come to grips with the situation quickly," says Fogal, who travels to the station from his Guelph home three times a year. "You decide on the best action and act. I try to be logical and straightforward about it and not waste energy on things that are out of my control."

The other challenge that year for Fogal and PEARL's worldwide members and users had nothing to do with Arctic weather. The project had run out of federal funding, and the scientists worried that the then Stephen Harper federal government had little sympathy for a far-off northern research station whose work included monitoring for effects of climate change. The project cut back from full-time operations. Then it got lucky.

In late 2012, Ottawa announced a fresh five-year infusion worth $3.5 million for PEARL, part of funding for several projects under the Climate Change and Atmospheric Research program. Along with funding from other sources, including the Canadian Space Agency and the International Polar Year, that funding allowed university and government researchers within the Canadian Network for the Detection of Atmospheric Change to continue operating PEARL instruments tracking everything from ozone levels to pollutants travelling northward from forest fires and volcanoes.

That kind of information feeds into global atmospheric models maintained in centres worldwide, including the United States National Oceanic and Atmospheric Administration. Taneil Uttal, team lead for polar observation and processes at that organization's Earth systems research lab in Boulder, Colo., contrasts atmospheric research stations with weather stations. The latter, she says, look at the state of the atmosphere

but that "doesn't tell you anything about why the atmosphere is in that state. It says nothing about environmental change."

Uttal says studying atmospheric properties touches everything from long-term climate, to sea ice and Arctic transportation, to pollutant transport and Inuit diets: "The PEARL data set is a national treasure for Canada."

Fogal and his colleagues were feeling the funding crunch again a few months ago as he prepared for his fall visit to PEARL. The project, which also receives in-kind support from various agencies, costs more than $1 million a year to operate and the federal government had not yet committed to funding beyond January.

By the time Fogal returned home in the middle of November, however, Ottawa had announced it would reallocate $1.6 million to keep the facility operating until the fall of 2019. By that time it is hoped a longer-term approach to funding will be established.

Fogal, 55, says other High Arctic research facilities exist, including projects in Norway and Greenland, but none has the full suite of instruments found at PEARL.

"We are the only Canadian High Arctic research station with this breadth of atmospheric measures," says Fogal. "You can't plan policy 20 years down the road without solid science. To decide what Canada should do to mitigate climate change, you need to be making measurements now and in the upcoming year."

He and other scientists say tracking changes in factors such as climate and ozone – and particularly human causes and impacts – requires long-term monitoring.

Kaley Walker, a University of Toronto physicist and PEARL collaborator, says, "The problem with the atmosphere is you can't make yesterday's measures today – you need a time series."

Adds Kim Strong, a physics professor in Toronto and a founding member of the Canadian Network for the Detection of Atmospheric Change: "The Arctic influences weather down south. It's important to understand what happens in the Arctic. Everything's interconnected."

Dan Weaver, a PhD student working with Strong, undertook research trips to PEARL between 2012 and 2015. He says: "The Arctic is fascinating because it's so distant from where most of us live, but it's so important for many of these big global environmental issues – climate change, ozone depletion, pollution, our changing planet. This is a piece of the global puzzle that Canada can offer."

Fogal has been PEARL's site manager since the Canadian Network for the Detection of Atmospheric Change was established in 2005. The project occupies three locations on Ellesmere Island, including the main Ridge Lab built in the early 1990s for an earlier science project. (That project had involved Fogal, then a researcher at the University of Denver, who installed one of the first scientific instruments at the site for infrared studies of the atmosphere's composition.)

The nearby Eureka weather station run by Environment Canada serves as home for visiting PEARL researchers and a contingent of eight workers, who operate and maintain the equipment used to run experiments for nearly 100 atmospheric change scientists, mostly from Canada.

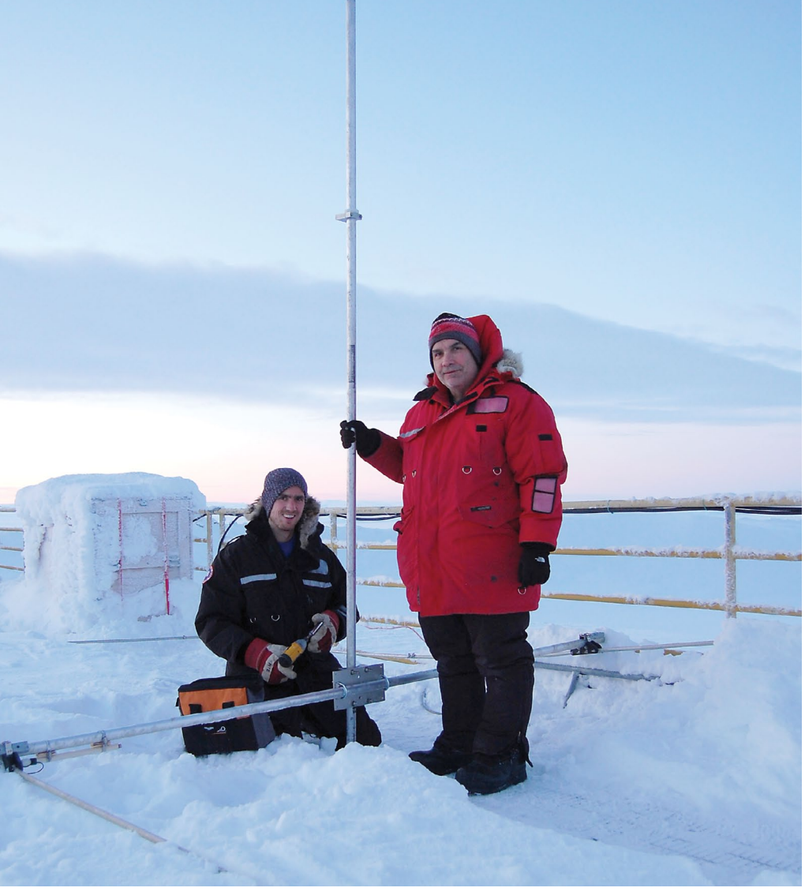
Referring to his colleagues on Ellesmere, Fogal says, "They are the hands and eyes and ears of the scientists who place the instruments there." Does that make him the "brain?" He hesitates, then smiles and nods.

For most of the year, Fogal monitors activity from his Guelph home office and his office at the University of Toronto, where he's a research associate in the physics department. Three times a year he heads north for a month at a time.

"He basically runs the site," Jim Drummond, who leads the Canadian Network for the Detection of Atmospheric Change from Dalhousie University in Halifax, says of Fogal. "Most scientists believe their experiment is the most important one. He's good at dealing with three important experiments at once. He's easy to work with. He gets on well with people. You need that in the Arctic. A lot of the time in the Arctic, you are reliant on other people."

Describing Fogal's methodical approach to problem-solving, Weaver says, "A lot can go wrong in the Arctic. You're cut off from the rest of the world and you have to solve problems yourself. Pierre's the one person you want there. He really grounds any discussion of a problem. When things are difficult, he stays level-headed, analytical: 'OK, here's what we're going to do.' He's a very calm, grounded voice in a place that needs it."

Fogal normally visits the site in mid-summer, and in the Arctic spring and fall. After months of winter darkness, the sun appears above the horizon at Eureka for the first time at noon on Feb. 20. The days lengthen until early April, and then the High Arctic remains under round-the-clock sunlight until September. Fall sunset – the last day when the sun appears in the sky over Eureka – occurs on Oct. 20.



Pierre Fogal with Peter McGovern, working outdoors on a high-frequency antenna.

PHOTO BY ALEXEY TIKHOMIROV

Those shoulder-season trips are critical times for PEARL scientists, who monitor chemical changes in the atmosphere triggered by the annual arrival and departure of sunlight in an effort to better understand and predict larger changes affecting the entire planet.

The team also tracks specific atmospheric changes in the Arctic linked to human activity elsewhere. In early 2011, PEARL researchers were among scientists who recorded a massive ozone hole twice as big as Ontario opening for the first time over northern Canada, Europe and Russia. Ozone in the upper atmosphere normally protects Earth from the sun's harmful ultraviolet rays. Project scientists spotted signs of chemical breakdown of ozone and predicted higher-than-normal radiation for southern Canada that spring and summer.

"We had a pretty good idea," says Fogal. "I was there with the team at PEARL when we measured that ozone depletion. Lack of ozone factored into extra sunscreen and hats."

The station's instruments have detected pollutants drifting into the High Arctic, including the fingerprint of British Columbia wildfires in early 2017. Referring to the Arctic's normally pristine conditions, Drummond says, "PEARL is way up north, but we still see low-latitude pollution fairly regularly."

Fogal's most recent journey for the fall science campaign started in October with a four-hour flight from Toronto to Calgary, followed by a two-hour flight to Yellowknife, and concluded after another five hours aboard a twin-engine turboprop plane from the Northwest Territories capital to Eureka.

Upon landing Oct. 14 in total darkness, he had time to exchange quick greetings with his station colleagues before donning cold-weather gear. Mid-October temperatures at the site usually hover around minus -20 or -30 C. Next, he helped unload the plane, including the latest shipment of provisions for the team, before moving his belongings into the station, his home for the next month under the coming polar night.

During the trip, Fogal expected to fire up the "nighttime" equipment and repair several instruments. He also planned to reinstall an instrument connected to a telescope that tracks fluctuations in starlight as another way to measure particulates in the atmosphere.

Fogal has been building and rebuilding things all his life, even as a youngster growing up in east-end Guelph.

"I thought I was going to be an engineer," he says. "I had a typical kid's fascination with techy things. I'd take things apart – and sometimes put them back together. Electronics, toys, bikes: anything I could get my hands on."

After graduating from Bishop Macdonell high school, he studied physics at the University of Waterloo. On a co-op placement, he worked for Environment Canada and saw how atmospheric science incorporated topics from electricity and magnetism to statistics.

"I thought that was pretty neat. It tied together a lot of things I had learned as an undergraduate. I'm still doing that – putting things together. Now it's more enabling other people to do their work."

He went to the University of Denver for grad studies and stayed on to work there. That's where he met his wife, Theresa. They were married in 1993, and came back to Canada in 2005.

This past fall, Alex – the eldest of their three children – began studying physics at the University of Waterloo. Alex says his dad never tried to steer him toward a particular course but did offer advice: If you like math and you like solving problems, the only place you're going to be able to do that is physics.

"I've always held in awe the work that my dad does, going cool places, doing cool things," Alex says.

An early childhood educator, Theresa confesses to some nervousness about Pierre's Arctic sojourns. "It always crosses my mind that something could happen. But it's part of his work. He loves his work. He really likes that research side."

Pierre is also well-attuned to potential hazards. He is certified for first-aid training and looks after emergency equipment at Eureka. Along with two other staffers, he does most of the driving among the PEARL lab sites.

"It's a real physical challenge, especially in winter," he says. "Safety is the single most important thing. You're constantly thinking about what you're doing and what you're about to do."

Not that it's all nail-biting. Before Fogal's first trip, for instance, he had expected the small turboprop plane would encounter turbulence on the flight to Eureka. But the air over much of the North is uniformly cold and dry – so dry that it's semi-arid – making for smooth flights.

Temperatures reach about 20 C in summer, a favourite time for Fogal to hike the countryside with his camera, encountering everything from Arctic poppies and mini-willows to wolves, muskox and caribou – even a polar bear with two cubs.

"Eureka is a beautiful spot," he says. "It's referred to as the 'garden spot of the Arctic.' "

By late September 2017, some 15 centimetres of snow had collected at Eureka. Fogal says he finds a kind of austere, quiet beauty in the cold and snow of the Arctic.

"There's certainly an impact and a connection to the vastness there – understanding that you may be standing someplace no one else has ever stood. You can walk 100 metres off the path and see something that has only ever been seen by you." That experience is "humbling," he says. "You don't move through something like that and think about how important you are."

That sentiment is heightened when the sun winks out for the last time before the polar night sets in. "It's kind of a cold and lonely feeling," Fogal says.

Spring sunrise lasts for only about 40 minutes on Feb. 20, but "when you see the sun for the first time, it has a kind of visceral effect – kind of like, all is right again, a sense of moving forward maybe."

Having prepared the instruments for the spring campaign by noontime on that day, he normally takes a few minutes to stand and take in the sunrise.

"There's a connection there with the natural progression. You know the sun is going away and that it's coming back. It's an acknowledgment that this is right and proper. There's a connection to the universe but the universe doesn't really care. It's the normal operation of God's creation."