

# Innovating the North

How tech innovation companies are building a stronger Yukon

By Sarah Williscraft

Technological innovators make our world a more liveable and accessible place. From the lights we switch on in our homes and the water coming out of our taps to the communications technology and video conferencing that keeps us all connected, we are surrounded by new and innovative infrastructure every day.

With the Sustainable Development Goals (SDGs), the United Nations has made strong infrastructure a global priority. The SDGs were first put in motion at the 2012 UN Conference on Sustainable Development in Rio de Janeiro. Each of the 17 goals aim to eliminate poverty and injustice in all its forms.

Goal 6 identifies a worldwide need for sustainable water management and sanitation, while Goal 9 looks to "build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation."

## SDG # 6 : Clean Water SDG # 9 : Industry, Innovation & Infrastructure



The United Nations Sustainable Development Goal (SDG) #6 identifies a worldwide need for sustainable water management and sanitation, while SDG #9 looks to "build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation." For more information on the United Nations Sustainable Development Goals (UN SDGs), visit [www.un.org/sustainabledevelopment](http://www.un.org/sustainabledevelopment)

Yukon Territory is no stranger to innovation technology. The North has always presented its own unique challenges to Yukoners, whether it be high living costs, vast landscapes, harsh weather, unreliable telephone signals or clean water management.

The territory is full of brilliant minds working to make these challenges less and less prominent. Innovation and technology companies are making strides towards more sustainable resource development and better quality of life for Yukoners.

## Creating sustainable water management and resource development practices

Ethan Allen is an environmental geochemist with Core Geoscience Services Inc., a Yukon-owned company that provides environmental consulting to industry and resource developers in Yukon and B.C.

While supporting, managing, and implementing a variety of environmental projects in the North, Allen and Core Geoscience are developing innovative wastewater management strategies. Allen has a particular specialization in managing contaminated water from Yukon's mining industry.

The water treatment technology employs a cryopurification method which uses cold temperatures to filter out a wide variety of chemicals, physical particulates and metals.

Over the course of his career, Allen has observed several issues with today's water treatment technology. He says current practices use many chemical reagents and could benefit from a more energy efficient approach.

Particularly in the North, water treatment processes that rely on liquid flow of water become less effective as temperatures drop and water freezes. The process can become extremely expensive in winter months.

"The technology we're looking at wouldn't have this problem at all," says Allen. "In fact, it could be enhanced with cold temperatures."

For Allen, a cryopurification process – which requires fewer chemical reagents and less energy to purify water – can foster a more sustainable mining industry and can also be applied to domestic wastewater through municipal water treatment processes. With climate change and environmental degradation looming on the horizon, Allen says this technology would be a step forward in sustainability.

"It could be more broadly applicable to purify water which is a huge need in the world," says Allen. "Maintaining clean water is obviously pretty important to life on Earth."



**CoreGeo uses  
ingenuity  
and cold  
temperatures  
to clean water  
using less  
energy and  
fewer  
chemicals  
- a truly  
Northern  
solution**

## Enhancing the technological capabilities of industry

Award-winning product development company, Kryotek Arctic Innovation Inc. has been in the business of tech innovation and consulting in the climate change, engineering and exploration industries since 2007. Using knowledge gained in the field, Kryotek has created a number of innovative tools to solve problems they encountered.

Jim Coates, partner at Kryotek, says the company's involvement in geotechnical engineering has enabled them to identify gaps in the technical earth drilling market.

"We noticed there was no human-portable drill rig commercially available that could be used to measure permafrost for climate change monitoring and construction site assessment in remote northern communities," says Coates. "It might cost tens of thousands of dollars to mobilize a full-size drill rig out there."

Kryotek developed the Talon Drill System, a super-lightweight, battery-powered drill system that is designed for permafrost research and mineral exploration. The tool can drill through soil and rock 2 to 10 metres deep and can be flown as cargo on a commercial airline. The drill is commercially available and sold internationally.



### Yukon Seed & Restoration Inc.

Mayo, YT

Along with water treatment innovation, Core Geoscience has partnered with the Na-Cho Nyäk Dun Development Corporation (NNDDC) to create Yukon Seed & Restoration Inc – a company that aims to provide technical expertise and the seeds to rebuild natural ecosystems after resource development has taken place.

When a mine is planned to close, Yukon Seed & Restoration can create an environmental restoration plan with proponents. The company researches the natural vegetation of the area, assesses the environmental needs for vegetation to thrive, collects, banks and propagates local seeds and will then implement site-specific revegetation plans.

"There really isn't a reliable source of either Yukon native seeds or consulting services related to restoration," says Ethan Allen from Core Geoscience. "We're looking to fill gaps like that to make the mining industries and various others better in the Yukon."

Yukon Seed is 51 per cent owned by the NNDDC, which will co-host seed collecting workshops with Core Geoscience. The workshops began in summer 2020 to train local First Nation citizens in seed collection and restoration ecology, and to engage Indigenous communities in STEM endeavors.

Allen says it is imperative to partner with the First Nation of Na-Cho Nyäk Dun on this project.

"First Nations peoples were here long before we were and they have an extremely important role in ensuring the health of the land," says Allen.

“We realized that it was applicable to many other parts of the world where access is a problem, not just the North but anywhere that there are high mountains and poor road networks,” says Coates.

The drill makes it easier for scientists to measure permafrost in remote areas and for remote communities to plan and build infrastructure that is appropriate for and more resilient to the underlying conditions.

The FrostLink sensor is another of Kryotek’s innovations. The sensor provides instant notification of ground thaw or freeze. It can be deployed beneath buildings, along roads, pipelines or other infrastructure to warn of impending permafrost thaw, which is an increasing concern due to climate change. This can prevent or reduce major damage to important infrastructure.



“While there were other sensors and software available, none of them provided easily understood, real-time information, so we built one that did,” said Coates. “We follow that same process with all our projects, just looking for a gap in an industry that we currently work and then try to develop something that fills that need.”

Astrid Grawehr, a partner at Kryotek, says much of the company’s success has come from adapting to changes in industry needs.

When the COVID-19 pandemic hit Canada in March 2020, Kryotek was in the middle of developing new technology. As business began to change, Grawehr said she knew the company needed to move on to other endeavors while global markets stabilized.

Grawehr said the team decided to placer mine over the summer.

“We spent four months this summer using our geological and mining background that we gained through being an exploration contractor for miners over the years,” said Grawehr. “We took to the dirt ourselves and went gold mining.”

Having a flexible business model without focusing on one industry alone has been crucial for Kryotek in building up the company. Because Yukon does not always present an abundance of opportunities in a specialized field, Grawehr said it helps to be a successful tech innovation company by being active in a multitude of sectors.

Currently, Kryotek is one of the only companies in the North that is innovating fire suppression technology. The company is working to create sensors and machine-learning software that can identify approaching wildfires. The technology can then activate automatic extinguisher systems, alert homeowners or call the nearest fire department.

**“Having a business model that is as flexible as possible has been the key to our success. It’s really about being malleable.”**

Astrid Grawehr, Partner,  
Kryotek Arctic Innovation Inc.



## AirView Yukon Whitehorse, YT

Nicky Rosenberg was watching a television show about air crash investigations when he learned there was a significant technological issue in today's aircraft industry: current technology has not provided pilots with sufficient spatial awareness of what's around them when visibility conditions are poor. This shortcoming has resulted in many fatal aircraft crashes across the world.

Aircraft are currently equipped with terrain awareness systems which act as a GPS for the sky – the technology tells the pilot exactly where they are on Earth.

“The problem is that these systems are not very reliable,” says Rosenberg. “The GPS signal is sometimes blocked by weather and terrain maps are not always updated regularly or are unavailable for some places.”

For pilots flying at high altitudes, there are few problems because there is less air traffic. When pilots are near an airport, they have some guidance from air traffic controllers on how to find the right landing strip. For Rosenberg, the problem lies in the time in between, when the pilot is ascending or descending.

Rosenberg likened current navigation technology to someone driving a car by listening to their GPS blindfolded. In poor weather conditions, there is nothing to give the pilot a visual understanding of what is in front of them.

“So, I came up with a technology which takes different sensors and can provide the pilot with a visual confirmation of what's ahead,” says Rosenberg. “It doesn't matter if they are in clouds or if it's nighttime, the pilot can see what's in front of them.”

Rosenberg says this innovation can prevent plane crashes caused by poor visibility and insufficient data. It can therefore save lives.

Creating and testing this technology was a challenging process but the first step was to start small. Rosenberg created a small scale and low range system he could test in at home.

“I started to test it in my room and tried to simulate mountains and valleys with objects in the room,” he says.

When the first tests were successful, he built a slightly larger scale system which he could mount to the roof of his car. This test simulated an aircraft flying through valleys and was able to identify and convey information about obstacles in the car's path.

The next step for will be to build a commercial prototype and test it on a full-sized aircraft. Rosenberg expects the commercial prototype will be able to spot obstacles for dozens of miles ahead of the aircraft – far enough to allow pilots enough time to alter course.

Rosenberg says it is most important to have this technology in the North because the GPS data here are less reliable. Companies updating GPS technology and terrain data focus on places with higher populations.

“Terrain maps are usually static, because mountains usually don't change location. But if suddenly there was a landslide, then a valley is filled with debris that a pilot doesn't know about from the terrain maps,” says Rosenberg. “My innovation can reflect instantaneously the terrain change and really save lives, and that is my motivation.”



## Generating employment and international trade

Icefield Tools Corporation is a Yukon-based company that develops directional steering technology for resource development around the world. Icefield's products help determine the wellbore location.

In 1991, the company started off small when Erik Blake was conducting research in the Kluane icefields and found himself in need of a simple inclinometer, an instrument used for measuring angles of slope, elevation or depression with respect to gravity's direction. The inclinometer would confirm the drill angle for Dr. Blake's samples.

When Blake could not find the tool he needed within his budget, he developed a device himself and created what would become the core product of Icefield Tools.

Now, the company employs 20 people at its Whitehorse facility.

**"We're proud that we're generating significant revenue that can provide high-quality, career positions. We have a group of people enjoying the workplace, being challenged, and developing industry leading technology."**

Lee Randell, COO, Icefield Tools

In a small tech innovation market like Yukon, Icefield Tools provides fulfilling employment to some of Yukon's most innovative engineers.

Icefield's team has helped the company build a strong international client base. Randell says Icefield Tools exports almost 100 per cent of its product.

"We develop a rare type of product which is supplied by only a few international competitors," says Randell. "It's so much easier today to do business globally."

Randell says Icefield Tools can ship product to the United States within two days or even to the Middle East within a week. The company's international clients and stakeholders have been crucial to identifying gaps in the market so Icefield can continue to develop niche products that are in high demand.



**Icefield Tools develops and manufactures specialized tools, employing a team in Yukon and exporting around the world**

For Randell, one of the biggest early challenges of being located in the North was a lack of timely access to capital. Because Icefield's products are unfamiliar and apply to such a specific market segment, traditional investment options are less available.

Early in Icefield Tools' development stage, the company was able to turn to Innovation and Entrepreneurship (I&E) at Yukon University.



"I&E provided a ton of support even before my time with Icefield and was an early supporter of some good ideas Dr. Blake brought forward," says Randell. "It's not an overstatement to say we wouldn't be here without that early support."

## Supporting innovation and commercialization

Innovation and Entrepreneurship (I&E) at Yukon University is an important supporter to tech innovation companies in the territory. Formerly the Cold Climate Innovation Centre (CCI), the institution has built lasting relationships with many of the Yukoners who are working to make the world a better place through new technology.

For over a decade, I&E / CCI has provided innovators with funding and connections to technical expertise, professional services, and business building support to explore promising ideas and develop businesses on those ideas.

I&E focuses on helping in the early stages of product and process development, when there is the greatest risk and the least access to more traditional supports, such as business loans. Support at this stage enables businesses to survive and grow to later successes and impacts – from employing Yukoners to saving lives.

Over the past decade and more, companies such as Kryotek Arctic Innovation Inc. have received funding from Cold Climate Innovation. Technologies developed through this funding helped Kryotek position themselves to be awarded the North's only federal Build in Canada Innovation Program contract. The company was contracted to install a permafrost monitoring network across Western Arctic National Parks.

I&E also provided funding for the research and development of Kryotek's most recent fire suppression technology – an innovation the company expects to save lives.

For Nicky Rosenberg at AirView Yukon, Yukon University's Innovation and Entrepreneurship was instrumental in getting his company up off the ground. Rosenberg says he was provided with valuable connections that have helped him secure a patent for his innovative visual technology.

**"If it were not for the support from I&E during this first stage of my project I would not be on the track to success I am now."**

Nicky Rosenberg, Inventor, AirView Yukon



[YukonU.ca/innovation/social-enterprise](https://YukonU.ca/innovation/social-enterprise)

I&E is one of several organizations that support innovators and entrepreneurs in Yukon. With backing from federal and territorial economic development bodies, these organizations emphasize the role of private enterprise as an important component of local economic development.

Yukon businesses create employment opportunities across the territory, bring revenue in when they export their products and services, and develop new ideas that benefits Yukoners and the world.

Companies like Core Geosciences, Kryotek Arctic Innovations, AirView Yukon, Icefield Tools, and Ground Reflections demonstrate Yukoners' resilience, ingenuity, and capacity for world-leading innovation.

Through creative problem solving, businesses can address unmet needs and create new technologies that help move the world toward our shared goals.

## **Ground Reflections Electromagnetic Systems and Engineering Inc.** **Whitehorse, YT**

John Campbell, electrical engineer and founder of Ground Reflections Electromagnetic Systems and Engineering Inc., has developed innovations in electromagnetic technology that can benefit the North.

Power systems often have infrastructure, usually buried in the ground, to protect the system from electrical interference such as lightning, radio waves or other environmental effects. This interference is usually filtered out and put into the ground. The technology assumes the ground will act as conductor for waste energy. However, the North sits on a bed of permafrost which is resistant to electricity. This has caused many intermittent technology problems in the North.

Have you ever wondered why your Internet will crash suddenly or why you get unreliable cell phone signals out of nowhere? Campbell says this is often because of poor management of power quality. When electricity cannot be grounded in the North, it jumps on to other power lines and interferes with other systems, causing operational problems. With more and more households and businesses relying on Internet and communication systems, these issues have become more difficult to manage.

Campbell realized that there was no solution to this issue and got to work. He approached I&E in early 2019 with an idea that could improve the efficiency, reliability and safety of communications and power systems operating in permafrost regions. Based on his proposal, I&E provided funding, connections, and business advice. By early 2020, he had developed a solution for ground electrode systems in permafrost, along with designs and prototypes for related monitoring technologies.

"We've now taken these technologies to address larger problems," says Campbell. "What we're looking at is how to support infrastructure for renewable energy systems."

Ground Reflections' current project aims to create a technology that monitors wasted energy and finds ways to reuse it. The innovation is called the Virtual Earth Electrode Module (VEEM) and can be used to monitor power grids.

Campbell says one important application of the technology could be in agriculture. The VEEM can be installed in an electrical fence system to tell farmers and ranchers whether the entire system is working properly. If there is a fault in the fence, the system can tell a farmer exactly where it is."

"In the digital age, manufacturers have leveraged this idea of a digital illusion," said Campbell. "We've been encouraged to not look inside the black box and not to think about how things work."

With this technology, Campbell says he is asking people to look inside the box and learn how their power grids are working. "I'm asking people to unlearn that habit," says Campbell. "They don't have to start thinking deeply about it but we have to start thinking that this is something we need to manage."

Campbell says the North presented many challenges to his work, such as a small population spread over a vast landscape, but there is a real openness to innovation in Yukon that made his work possible.

"You have to have people with an open mind. I found that with Yukon University," says Campbell. "There was a lot of openness in terms of wanting to listen to me talk about something new that I think is important and people need to think about."

"I&E made it possible for Ground Reflections to dedicate engineering resources to this effort, purchase prototyping materials and test equipment and to access any additional technical support required by the project work," said Campbell.



#### About the writer

Sarah Williscraft is a journalist and multimedia storyteller based in Fort McMurray, Alberta. She focuses on climate change, the environment and arts and culture. Sarah has spent the last year reporting on rural and Indigenous communities in the Wood Buffalo region for *Fort McMurray Today*. In September 2021, she will be pursuing a Master of Journalism at UBC. Follow Sarah on Twitter @s\_williscraft or check out her website to learn more about her work: [sarahwilliscraft.com](http://sarahwilliscraft.com)

# #YukonBusinessesForGood

## About this storytelling series

#YukonBusinessesForGood stories highlight some of the many Yukon businesses who create benefits for their communities and environment. The stories show how business can play a positive role in addressing shared values that have long been held by many Yukoners and now form the United Nations Sustainable Development Goals (UN SDGs): global priorities from 2015 to 2030 for 192 countries, including Canada.

This series also showcases young writers in Canada's North and provides them paid experience as they begin journalism careers, thanks to funding from Employment and Social Development Canada (ESDC).

## About YukonU Innovation & Entrepreneurship (I&E)

We support Yukon-based innovators and entrepreneurs with funding, resources, expertise and incubation. For more information on how we can help you, visit [YukonU.ca/innovation](http://YukonU.ca/innovation) or email [innovation@YukonU.ca](mailto:innovation@YukonU.ca)

