

Dreams to Reality, The Life of Zoe Courville

By Jasper Breton

Lyme School

Interviewee: Zoe Courville

“If I won the lottery, and I had one million dollars... I’d probably want to do exactly what I do.”

- Dr. Zoe Courville

Every year Dr. Zoe R. Courville takes the 38-hour trip to McMurdo Station in Antarctica and proceeds to spend the next month-plus conducting various measurements on crevasses that enable sleds to travel from McMurdo to South Pole Station. She decides whether the crevasse is safe to cross or needs to be blown up and filled in with snow. People's lives rely entirely on her calculations and her capable use of ground-penetrating radar to ensure their safe passage. Despite the long flights, having to survive on the coldest place on earth, and conducting critical measurements, Zoe loves her job.

Zoe grew up in Fraser, Colorado, a small town east of Denver, where her parents ran a ski rental shop. Her father was also a carpenter and built the house where her parents live now. As she was growing up, she and her sister loved to watch their dad while he was building and listen to him tell them about the measurements he was making. In one particular incident, an elated young Zoe listened to her dad explain how he was measuring the supplies for the desks he was making for them, using the Pythagorean Theorem and square roots. Shortly after, Zoe explained what she had learned to her bemused third-grade teacher. In addition to a love of math, she also inherited her parents' love of the outdoors and was always outside. Her dad's friend was a carpenter in Antarctica, which inspired her dream of working in the cold regions.

Zoe's real love of math started in 6th grade and never stopped. In fact, while in middle school she would walk to the high school in order to take the higher level classes offered there. From 9th grade, Zoe took all the math-related classes she could. Though small, Middle Park High School in Granby CO offered AP calculus which Zoe eagerly enrolled in and succeeded at. Some of her favorite topics were geometry and spatial math, both of which she still loves today.

Zoe decided to go to the University of Denver, partly because of an offer from the school's nordic skiing coach, as well as the school's acceptance of Zoe's desire to major in engineering, math, and physics. After four years, she graduated with a BS in Mechanical Engineering. During that time, she worked closely with Marvin Hamstad, a researcher at the National Institute of Science and Technology. He gave her sage advice on how to be a scientist, such as how to properly conduct experiments, analyze measurements, and write papers. Also, he helped her choose her graduate school, the Thayer School of Engineering at Dartmouth College. There she pursued her master's, working on de-icing airplane wings. While getting her Ph.D.,

Zoe interned at the Cold Region Research and Engineering Laboratory (CRREL), drilling ice cores in Greenland and Antarctica, which she enjoyed thoroughly. This early work helped her make a smooth transition to working at CRREL.

While in Antarctica for a month or two at a time, Zoe travels to the most dangerous and heavily crevassed part of the South Pole Traverse and uses ground penetrating radar (GPR) to make sure it is safe for the heavy tractors. A simple way to describe GPR is this: shining a flashlight on a glass of water with a bubble in the center. Both water and air are translucent, so why are you able to see the bubble? The answer to this is that when the light waves hit the bubble, they speed up because air is less dense than water, causing the bubble to appear different from the water around it. In addition, some light will be reflected back up, causing a bright spot to appear on top of the bubble. A GPR uses radio waves to sense voids under the snow, calculating the time it takes for the wave to return, and its magnitude. These two factors, along with the strength of the snow, give Zoe information to decide whether a crevasse bridge will hold tractors driving over it, or if it needs to be blown up with dynamite and filled in with snow.

Some of her other projects deal with the properties of snow, especially how snow will react under certain conditions. Zoe says that what she likes about Antarctica is that every day is a new challenge to puzzle out. For example, while surveying the route in 2022, Zoe found the largest crevasse in ten years, that same season large amounts of ice floated out to sea from around McMurdo Station, differing from the usual total ice encapsulation in more normal years. Zoe's hypothesis is that the lack of sea ice allowed the glaciers to flow quicker, thus ripping larger crevasses. Zoe will use her data on previous years' ice, crevasse size, and temperature to prove or disprove this idea.

As for the future, Zoe is concerned about the safety of the traverse, due to rising temperatures and faster-flowing glaciers. However, she'll deal with that problem when she comes to it. For now, she will keep enjoying her job. At the end of my interview, she showed me some of the other projects that are ongoing in the CRREL cold rooms. One group was working on developing 3d printing for ice, making a bridge strong enough to hold a humvee. Another was studying the adhesion of ice to different surfaces, such as helicopter blades or plane wings. In particular, they were trying to keep ice off these surfaces, so that vehicles in Antarctica can run smoothly. Zoe enjoys her job working on the frontier of cold regions science, expanding humanity's understanding of the frigid places on Earth.

About the author: My name is Jasper Breton, and I live in Lyme with my family and dog, Nelli. When at school, I enjoy taking Algebra 1 as well as science and my other core classes. I find math interesting especially when it connects to the real world. I play lacrosse, and soccer, ride horses, and nordic ski. I also like reading, hiking in the White Mountains, and trying tricks on both my nordic and downhill skis.