NRL researcher ventures to the Antarctic in search of cosmic dust

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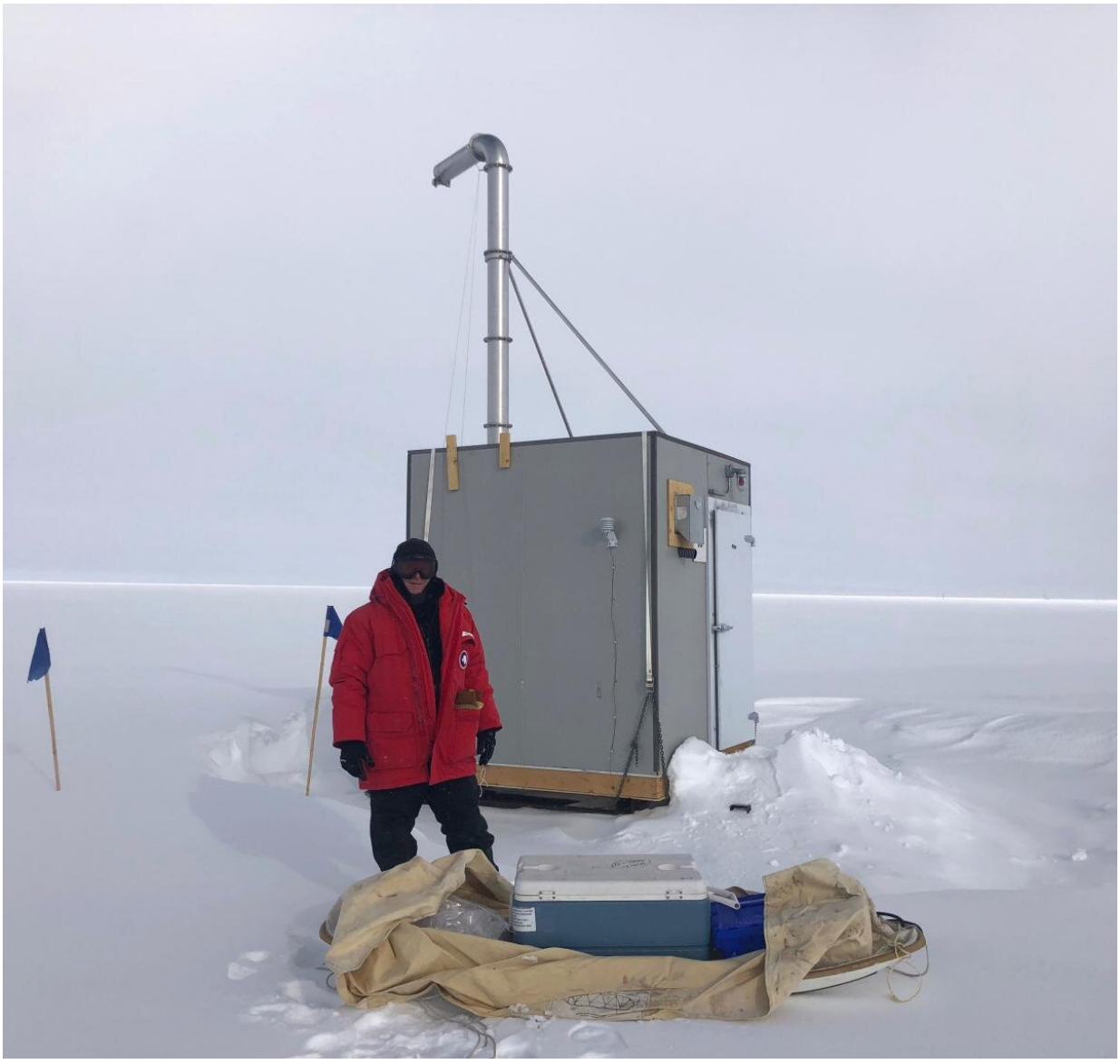

Credit: Naval Research Laboratory

After arriving at McMurdo Station on the unforgiving continent of Antarctica, it still took Dr. Rhonda Stroud two days of safety training and a four-hour flight before she was finally where she needed to be: the bottom of the world.

For two years, Stroud, a physicist with the Naval Research Laboratory, had been working on an experiment to collect atmospheric dust, also known as cosmic dust, at the South Pole. Now the experiment was wrapping up, and she had embarked on a three-week stay to collect the samples, and dismantle the collection apparatus. According to Stroud, the South Pole is an ideal spot for cosmic dust collection because it has some of the purest air on our planet.

The information obtained from her research will provide researchers with clues to the origins of our solar system: the formation of planets, the composition of comets and asteroids, and the evolution of the primordial gas and dust into the Earth and life as we know it today.

"Cosmic dust is entering our atmosphere at about 40,000 tons enter per year, and it's coming from asteroids and comets," Stroud said. "So this cosmic dust is the preserved fragments of building blocks from the start of the solar system."

At the South Pole, Stroud collected her samples using a machine aptly named a "comic dust sucker." She described the device much like a vacuum cleaner or air purifier—but unlike the refuse collected by those household devices, the dust this device collects is invaluable—not just to Stroud but to researchers around the world.

"The "Dust Sucker" is housed in a small hut, with a pipe that looked like a stove vent pipe pointed out from the hut into the clean air sector," she

explained. "We used a big fan and blower to suck air through the pipe. The dust was deposited on filters similar to those you might find in a home air purifier."

During her stay at the South Pole, Stroud braved wind chill temperatures as low as 40 below zero to collect her research samples, and eventually, deconstruct the cosmic dust sucker. Her carefully collected samples were then wrapped, stored, and transported to project partners at the Army Corps of Engineers' Cold Regions Research and Engineering Laboratory (CRREL).

Once the samples and Stroud were back stateside, Stroud's job was far from over. She and her project partners still had to undertake a microscopic analysis of the samples to find the cosmic dust hidden inside. In addition to collecting cosmic dust, the filters can pick up particles of aluminum from the collection pipe itself, among other things.

"The cosmic dust particles themselves are tiny, maybe 10 microns, about one-tenth of a human hair," she said. "You can't see them with your eye. We often use an electron microscope because that lets us see things in great detail and measure their composition."
Among the more surprising finds they came across during their analysis was particles of talc, a mineral composed of hydrated magnesium silicate that Stroud said researchers don't expect to derive from a comet or asteroid.

"We couldn't rule out it as a strange and new component of a comet…until I saw a weather balloon that they released at the South Pole," Stroud said. "They do climate monitoring there and release balloons twice a day. Those latex balloons are covered in talc so when they're packaged they don't stick together."

While the discovery of talc hadn't amounted to anything, countless possibilities are still waiting to be discovered in the dust, according to Stroud, and thousands of people in the planetary science community are curious to know the results.

"Some [researchers] would like to make isotope measurements that would tell them where in the solar system or when the particles formed," she said. "They might make noble gas measurements, measure the amount of helium or argon to tell how long [the particles] were exposed in space."

"Others will want to know what minerals were formed there," she added. "So they would look at the elemental competition and crystal structure."

Over the next several months, other project collaborators will inspect the two years' worth collection of cosmic dust. The principal investigator for the project is Susan Tailor at CRELL laboratory, and the project is funded by the NASA planetary science division. Partners include academic and research institutions.

"We will continue to do some preliminary work to figure out how many particles we have, and then those will become available for anybody who wants to study them," Stroud said.

She notes that Ken Farley at Cal Tech has already measured some of the helium content from the particles, ensuring that researchers had collected plenty of cosmic dust from the filters. NRL geologist, Dr. Kate Burgess, is conducting most of the electron microscopy on the samples.

While the grant for the collection of cosmic dust is ending, Stroud remains excited for the new possibilities this research will reveal.

"Now we have the opportunity with those collections to do new science,"

she said.

More information: For more information on NRL visit www.nrl.navy.mil/

Provided by Naval Research Laboratory