# Going to the moon, while staying on Earth

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To the uninformed, you would have sworn the group of almost 30 students and graduate students huddled in the close confines of Western's science building basement labs were part of a real planetary exploration mission.

While they weren't actually roaming the rugged terrain of the South Pole–Aitken (SPA) basin on the Moon, for two weeks earlier this month these students prepared and tested operational, scientific and technological concepts as if they were. These simulation missions are known as 'analogue missions' because they run scenarios similar to those that will occur during the real planetary exploration mission.

The Impacts Lunar Sample Return analogue mission, funded by the Canadian Space Agency, is focused on the investigation of the formation processes and resource potential of impact craters. Impact cratering is one of the most important geological processes in the solar system and is the dominant surface process not only on the Moon but also on Mars, Mercury, and most terrestrial planetary bodies, notes Western professor Gordon Osinski, NSERC/MDA/CSA Industrial Research Chair in Planetary Geology at Western.

"This is a contract from the Canadian Space Agency. They are paying us to do this and will learn valuable lessons from it," says Osinski, Deputy Director of the Centre for Planetary Science and Exploration and the Team Lead for the Canadian Lunar Research Network.

"They are very focused on operations and interested on how the process goes; what are the tools needed and what is the decision making process. How do you choose the sample? What works; what doesn't work?"

This latest mission was a robotic sample return assignment conducted in Sudbury, Ontario, with 'mission control' based here at Western. The Sudbury basin is the second largest impact crater discovered on Earth, while the Moon's SPA basin is the second largest known impact crater in the solar system, with a diameter comparable to the distance from Ottawa to Calgary, or 2,900 kilometres.

Studying impact craters is important because craters are the most common physical feature on planetary bodies in the solar system, and because impacts puncture the surface of planets, they can provide information about the material beneath the surface without drilling.

Osinski says conducting analogue missions like this allows scientists to practice doing remote scientific analysis. Using a variety of remote robotic instruments, and communicating with 'astronauts' during the final deployment, the students were in charge of making decisions on what data to collect and what samples to return from the field site.

To create a sense of realism, and since the real target location is located on the far side of the Moon, direct communication is only possible when a relay satellite passes overhead of the rover, approximately every two hours. This was mimicked during the analogue mission by allowing communication only during scheduled intervals.

Data transmission was also limited as the rover's capability to upload information is limited by a smaller bandwidth. With all these restrictions, 'mission control' has to be organized and ready to deal with unanticipated scenarios quickly and efficiently.

"We have a scenario which is realistic for a current moon," says Osinski. "You really want to this before you do get put in charge of running an actual mission. Learning those surprises now and simply training people and giving them experience in mission operations is a big part of it to, especially in Canada we don't have many opportunities."

This analogue mission will help create instructions that will be used by the Canadian Space Agency in future mission control environments. For PhD (Engineering) student Raymond Francis, the experience was more "rich and positive" than he could have expected.

"I'm getting a lot of great experience in operations, in learning how to work with scientists - since I'm an engineer - and learning how they interpret geology and make decisions about that," he says. "This is a valuable experience and if I want to go and work on real missions this is what it will be like. Its' been a very positive experience and I've learned a lot. As we completed tasks we anticipated a lot of challenges, but we met them and worked through them with the entire team."

By the end of the two weeks, the team has collected 18 samples, executed over 180 separate tasks, acquired more than 2GB of data and traversed approximately 2.22 km with the rover.

Graduate student Emily McCullough says the mission was about looking for evidence of impact cratering, obtaining high resolution photos, and using a Raman spectrometer to identify minerals in the rocks, among other activities.

"Every day is different, and the things we're getting excited about are some things that are even operational, such as which camera gets the best textural information when you look at a rock," says McCullough, science programming manager for the mission. "And without being able to pick it up, how do you choose what is a good sample. It's overwhelming at times, but it's good, and that fact that everything that goes wrong now, that we can fix, won't go wrong on the next mission down the road."

Another analogue mission is scheduled for this fall at the Mistastin Lake impact structure in Labrador.

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