Robots Address Risk Conducting Investigations In Tailings Facilities

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Thursday, January 12, 2023, 6 AM MST

A robot about the size of a golf cart reduces risk during investigations commonly conducted by oilsands operators, says the Edmonton technology firm behind it.

Copperstone Technologies Ltd. has developed robotic vehicles that can be sent into challenging sites for investigation and sampling purposes. A unique propulsion system lets these units access soft ground environments.

In Alberta, that includes muskeg and tailings facilities, such as those in the oilsands.

“There are lots of places in the backwoods of Alberta, that are just challenging to get to,” Craig Milne, chief executive officer at Copperstone told the *DOB*.

"… Laying a pipeline, you're doing ground investigation — being able to understand the geophysical properties of the earth before laying a pipeline, and you're doing an investigation after the pipeline has been down. Our robots can provide access to those environments without putting people in harm's way."

Copperstone's amphibious robots are the 400 kg HELIX Neptune and 800 kg HELIX AR2.

"The robots are able to be armed with different payloads," said Milne, comparing them further to interchangeable packages of sensors and sampling gear. "A lot of the work that we do is in geotechnical investigations.

"We can do all sorts of sampling campaigns, being able to access fairly soft deposits, typically, and retrieve samples for off-site analysis."

He also singled out the technology's ability to carry sonar gear.

The aforementioned hard-to-reach environments sometimes need routine investigation. And while there are ways of accessing them today, such as putting people in amphibious equipment or use of an eight-wheel drive Argo, for example, these methods have limitations.

"There is always risk to that person whenever they go out to these challenging environments," Milne said. "Whenever there is risk to people, that always drives cost and access challenges."

Copperstone came to market in 2019. It has worked with Canadian oilsands operators, including (https://www.imperialoil.ca/en-ca/news/imperial-stories/operations/local-robot-brings-big-safety-wins-for-kearl-tailings-reclamation) Imperial Oil Limited (/company/imperial-oil-limited/). These robots have also been deployed in the U.S., and the company now has a South American client.

"Every project is quite different," said Milne. "From the perspective of a water investigation, if you send three people out into a boat to do a sonar survey of a lake, for example, you'll also need a couple of people onshore with rescue gear, just in case anything goes wrong with those three on the boat.

“So, you’ve got five people, basically, to do a sonar survey. We can do that with a robot, theoretically, with zero people on-site.”

Typically, there are one or two people used to supervise the operations, but the whole process can be done remotely.

“Even just when you do the headcount of people and cost of people, that is an easy metric to show you are saving several thousands of dollars in people time,” Milne said.

From downtown

This technology is often operated several hundred metres or even a few kilometres away, which corresponds with the size criteria of tailings facilities.

“We can drive them from, basically, any internet-connected computer, so it is not a stretch for us to be able to drive or monitor robots from a head office in Edmonton or Calgary and see what is happening in a remote location,” said Milne. “We tend to not do that just because of the liability of driving at that type of distance and to avoid communication lags, but it is possible.”

The communication aspect, he added, is continuously improving. There is a cleantech advantage to these robots, as well.

“The robot is entirely electric-powered. It is battery operated,” Milne said. “There are no fluids on the rover — so there really is no risk to the environments operated in. There are no emissions from the robot directly. As long as you have a clean source of power and charge the battery, it is an entirely clean solution.”

The base intellectual property (IP) by Copperstone is around the propulsion system, which uses a screw-drive.

They have an issued patent on the screw drive on the robotic concept, and have other IP that they have developed and continue to develop around the control systems and how it operates together as an integrated system.

Copperstone announced in December 2022 that it had secured $3.5 million in

growth capital from Boston-based WindSail Capital Group. This investment led to an additional $2.3 million support from the Alberta Jobs & Growth Program and the Mining Innovation Commercialization Accelerator.

Looking ahead

Work to potentially improve these robots is ongoing, including in the areas of both reliability and reach.

“There [are] lots of improvements to be made in terms of the scale at which we can operate,” said Milne. “To do heavier geotechnical work and sampling work, the machine size matters — so to have a machine that can be several tonnes in size allows us to start carrying heavier sampling gear or small drill platforms.

“There is a lot of interest from the industry in that so that is the direction we are headed with that.

“A lot of our clients, especially in the resources industry, they have deep deposits, they have lots of challenges underground that they are asking us to help investigate. So, that drives the need for us to build bigger machines that we can help them with.”

The company got started almost nine years ago by students who attended the University of Alberta.

“They were doing a project with one of the oilsands operators, and recognized that there was really a challenge to deploy sensors in tailings facilities and so they purchased a robot to access tailings — and it got stuck,” said Milne.

“They realized the real challenge was around accessing soft deposits,” he added. “So, they scoured the literature and old concepts and discovered this idea of the screw-drive tractor. It has been around for about 100 years — first developed as a snow machine, really.”

An old version of this idea is currently displayed in a mining museum in Montana, Milne noted.

“They dusted off that concept and brought it forward into the modern age with robotics and built a prototype vehicle to access the oilsands tailings,” he continued. “With some success, they realized there was actually applicability outside of simply oilsands tailings — but all mining and all sorts of environmental monitoring, and also coastal construction.”