

# Research

## Condition monitoring being adapted for mobile underground equipment

### ■ Sensors to transmit data wirelessly

The Centre for Excellence in Mining Innovation (CEMI) in Sudbury is funding a research project aimed at developing a wireless condition monitoring system to detect faults and avoid catastrophic failures of fixed and mobile equipment in underground mines.

Advance knowledge of defects will help maintenance personnel schedule repairs before equipment fails, reducing production interruptions and maintenance costs.

The research is being carried out in partnership with Vale Inco and is being supervised by Dr. Markus Timusk, a mechanical engineering professor at Laurentian University.

Data from sensors monitoring equipment will be filtered and transmitted wirelessly to readers located throughout a mine,

alerting maintenance personnel to abnormal vibration, power usage or temperatures affecting gear boxes, bearings and motors.

Timusk, who completed his PhD thesis on condition monitoring applications in the oil sands industry, points to several challenges in applying the technology to mobile equipment in underground mines.

The biggest problem is what he refers to as a data bottleneck.

"You can't transmit vibration data wirelessly. It's too much information, so the idea is to put the intelligence onboard and then move small pieces of high-level data to maintenance staff so they can plan better and anticipate a catastrophic failure."

The system is also being designed to conform to the IREDES protocol, an electronic data exchange standard for mining and tunnelling equipment such as drill rigs, load-haul-dump vehicles or explosives handling.

The IREDES data exchange standard allows mining equipment and computers to talk to each other and share production



Dr. Markus Timusk, mechanical engineering professor at Laurentian University. Data from sensors monitoring equipment will be filtered and transmitted wirelessly to readers located throughout a mine.

and other information for process optimization.

"The strategy I'm interested in is novelty detection," said Timusk. "Instead of trying to define ahead of time all of the ways a machine can fail, we're collecting data that will represent normal operation. Any deviation from that can be used to indicate a failure, so it's another way of looking at it that has the practical implication that you're not dependant on defining faults."

"It's also easier to deploy something like this on a number of different pieces of equipment. The machine will learn itself how to recognize normal behaviour."

Underground production equipment operates in a range of different modes, making it more difficult to come up with a set of specific rules for defining normal behaviour, explained Timusk.

"That's why there really isn't anything out there for detecting faults on these pieces

of equipment. They are always accelerating, decelerating and operating under different loading conditions, all the while things are always degrading, so your baselines are changing. You really need a high level of intelligence to detect a fault in that imperfect data environment."

Condition monitoring can be used to detect faults in pumps, fans, crushers, hoists and other underground equipment. "There's no end to the applications."

Timusk is working on the project with Masters student Jordan McBain, who holds a Bachelor of Science in Computer Engineering from McMaster University and trained as a naval combat systems engineering officer with the Canadian Armed Forces.

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## BRIEFS

### Dynamic Earth receives mining sector donations

Dynamic Earth, a Sudbury science centre featuring earth science and mining exhibits, has received a number of donations from area mining and mining supply companies.

MacLean Engineering, a Sudbury-based provider of underground mining equipment, has donated \$100,000 to Dynamic Earth. The company has also donated a \$20,000 mini-mechanized bolter for display at the centre.

In return, a new 2,000-square foot special exhibits gallery at Dynamic Earth has been officially named the MacLean Engineering Gallery. Currently under construction, the

gallery will open in March 2009.

The first exhibit featured in the gallery will be Diamonds, an engaging exhibit currently under development by Dynamic Earth's sister centre, Science North.

Vale Inco has also announced it will be contributing \$100,000 over the next five years in support of educational programs at Dynamic Earth.

FNX Mining, HLS Hard Line Solutions, Mining Technologies International and the JP Bickell Foundation have also made contributions.

The money will be used to develop mining-themed school programs at Dynamic Earth for elementary and secondary school students, teacher training workshops and specialty programming for adults.