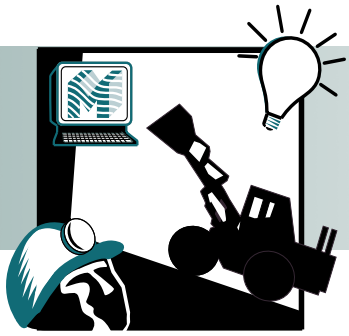
MINING

Project Fact Sheet



Advanced Power and Control for Fuel Cell Mining Vehicles

Benefits

- Energy savings from more efficient fuel source
- Elimination of diesel exhaust fumes in underground mines
- Operational cost savings due to decreased ventilation requirements in underground mines
- Improves safety and health in an underground mine

Application

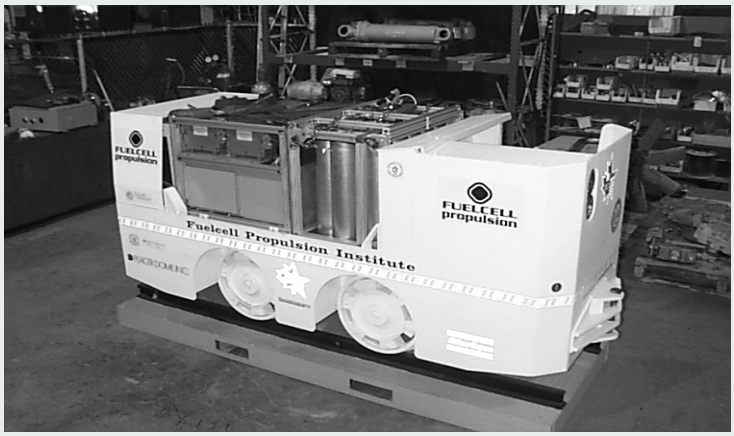
Fuel cell mining vehicles are more energy efficient and have many safety and environmental benefits for use in all types of underground mines.

Hydride fuel cell mining vehicles offer the mobility and energy capacity of a diesel vehicle but the environmental characteristics of an electric vehicle

This project lays the engineering-design foundations for fuel cell power and automated control in several important classes of underground mining vehicles such as loaders, trucks, locomotives, and robotic vehicles. Underground mining faces serious transportation problems, because conventional power technologies are not capable of simultaneously providing acceptable worker health and safety and high vehicle productivity. Tethered vehicles have an operational range limited by their tether. Shuttle cars, key production vehicles in coal, for reasons of safety are prohibited from crossing paths, a constraint that limits operational efficiency. Diesel vehicles have the power density and mobility for high productivity, but emissions regulations and health and safety considerations limit their use. The high system complexity of underground diesels results in high maintenance such as daily emissions test. Battery vehicles were introduced in coal mining to overcome the mobility limitations of tethered vehicles. However, except for locomotives, battery vehicles have no presence in hardrock mining because of low energy capacity, which limits power and grade-climbing.

The fuel cell vehicle promises the mobility and energy capacity of a diesel unit but the environmental characteristics of the electric vehicles. This project will determine the quantitative duty cycles of a mining loader, shuttle car, locomotive and robotic vehicle.

Locomotive with Fuel Cell Power Plant



Fuel cells can give mining locomotives such as the one above the mobility and energy capacity of a diesel vehicle but the environmental characteristics of electric vehicles.

Project Description

Objective: To lay the foundation for the development of underground vehicles powered by fuel cells that will increase mine safety and productivity.

Progress and Milestones

This project includes the following milestones:

- Conduct planning committee for duty cycle studies.
- Measure duty cycle for a diesel loader at Inco experimental mine.
- Measure duty cycle of an electric drive shuttle car at Joy Mining Machinery.
- Measure duty cycle of fuel cell and battery robotic vehicles at Sandia National Laboratory.
- Measure duty cycle of fuel cell and battery locomotives at Holt-McDermott mine.
- Conduct hybridity analysis of each vehicle class.

Foreign Project Partners

Barrick Gold Corporation, Matheson, ON

Canada Centre for Mineral and Energy Technology (CANMET), Ottawa, ON

Hydrogenics Corporation, Mississauga, ON

Inco Ltd., Copper Cliff, ON

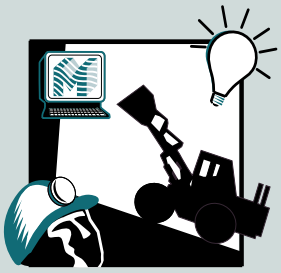
Mining Technologies International, Sudbury, ON

Noranda, Inc., Toronto, ON

Placer Dome, Inc., Vancouver, BC

R.A. Warren Equipment, North Bay, ON

Sandvik Tamrock Corp., Tampere, Finland



PROJECT PARTNERS

Fuelcell Propulsion,
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Atlas Copco Wagner
Portland, OR

Bituminous Coal Operator's Association
Washington, D.C.

Joy Mining Machinery
Warrendale, PA

Long-Airdox Company
Blacksburg, VA

Sandia National Laboratories
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