

Peak vehicle performance in extreme climates

Heavy vehicle manufacturing and operation is a cornerstone of Manitoba's economy. Cold-weather and climate testing are an essential need for this sector. The Red River College Polytechnic (RRC Polytech) MotiveLab meets this need and is the sole testing facility of its kind in Western Canada.

The research team

The research program manager for the MotiveLab **All Weather Climatic Chamber and Chassis Dynamometer test facility** is Jojo Delos Reyes. He is also the technical and business lead for the Vehicle Technology & Energy Centre (VTEC) research team and is responsible for managing the centre's CFI-funded research infrastructure. He works with a team of experts and consultants, all of whom have worked extensively on applied research projects at RRC Polytech.



The research

The successful **operation of medium to heavy vehicles in extreme temperatures** represents an ongoing challenge for Manitoba's heavy equipment manufacturing industry. The MotiveLab climatic chamber was built to **provide manufacturers access to a vehicle testing facility** as well as to the expertise and practical knowledge offered by RRC Polytech experts, instructors, technologists and students, and external consultants. Here, equipment manufacturers develop and test new and improved heavy vehicle products with the ultimate objective of enhancing performance in extreme climates.

The research infrastructure

In 2016, the CFI awarded RRC Polytech **\$1 million** in funding to convert an existing facility to a climatic chamber, which is capable of creating temperatures ranging from -40°C to $+50^{\circ}\text{C}$. The climatic chamber features:

About the Canada Foundation for Innovation

Since its creation in 1997, the CFI has committed more than \$10.5 billion in support of more than 13,000 research infrastructure projects in all disciplines at 174 institutions in 81 municipalities across Canada.

- A 1,000-horsepower, three-axle dynamometer on the floor of the chamber, which allows vehicles to drive and turn as they do outside on regular roads
- Space to accommodate vehicles such as transit buses, fire engines and other large vehicles up to 45 feet long
- A rapid charger for electric vehicles connected to the chamber from the outside.

Thanks to this and other federal and provincial funding, the climatic chamber was completed in July 2020. MotiveLab has attracted companies from Manitoba (such as New Flyer and Frontiers North Adventures) and outside the province (such as General Motors in the United States).

The impacts

The work conducted in the pioneering MotiveLab testing facility is producing demonstrable and immediate impacts, and it promises to continue having longer-term impacts on the local, national and international vehicle manufacturing sector.



Achieving environmental benefits

MotiveLab is uniquely positioned to **help the federal government achieve its targets** with respect to **greenhouse gas emissions reductions**, vehicle electrification and replacement of diesel fuel with hydrogen fuel. For example, the MotiveLab partnership with New Flyer has helped the company largely replace its regular fuel models with the improved electric buses. Winnipeg Transit ordered 16 zero-emission buses manufactured by New Flyer in 2023, an example of how the technology is being adopted locally.



Creating economic value at the local, regional and national levels

MotiveLab provides research and development support to **large industry partners** operating in Manitoba and throughout Canada as well as the United States. The research and testing activities that take place at the facility move numerous **products through development** so they can be **manufactured for commercialization across Canada**. MotiveLab also creates a variety of skilled jobs in the local economy — for graduates of RRC Polytech, for technicians in partner organizations and for researchers at the testing facility itself. Companies that have used the climatic chamber to improve their products have experienced **cost savings, increased sales** of their products, **production time savings** and **job creation**.

For example, New Flyer is MotiveLab's largest industry partner. Its proximity allows the company to test its products locally instead of relying on out-of-province facilities. One research project with New Flyer focused on improving the efficiency of electric buses by identifying areas of heat loss and air leakage. As a result of these tests, New Flyer has begun 10 additional research projects as part of its engineering roadmap to **stay on top of the competitive electric bus market**.

The projects with New Flyer also directly resulted in a new collaboration with Frontiers North Adventures, the company that operates the Tundra Buggy Adventure. The Tundra Buggy Adventure is an all-terrain vehicle designed for tourism in the Arctic. Frontiers North collaborated with VTEC and used the testing area at MotiveLab to prove how the vehicles function in extreme Arctic conditions. This proof-of-concept project involved the reuse of batteries previously tested for New Flyer projects. Due to the success of this project, Frontiers North has doubled its workforce.



Adopting innovative technologies

MotiveLab has been approached by companies from outside the heavy vehicle sector, including from **agriculture, entertainment, construction, police services** and **healthcare**. These sectors asked MotiveLab researchers to test equipment used by paramedics needing to perform their activities outside in low temperatures and to test cinderblock walls for construction in extreme negative temperatures.

A tourism company in Alberta, intrigued by the Tundra Buggy project, approached VTEC to assess the feasibility of testing an electric buggy in MotiveLab. **Interest** in and **demand** for the climatic chamber for unintended and innovative experiments **is growing**, and the research team is considering ways to support expansion of its portfolio through new uses of the facility.



Engaging in new research valuable to industry

Using the climatic chamber to conduct experiments on existing products and to potentially develop new ones allows partner companies to show credible evidence to their customers that their **improved products perform better** than their previous versions, whether in terms of cost, efficiency, safety or other parameters. The majority of the **knowledge** gained (e.g., test results) through work using the climatic chamber is **transferred directly from the research team to industry partners** — often through confidential technical reports to protect trade secrets and other information. This intellectual property policy is a significant incentive for commercial partners to collaborate with MotiveLab. For example, International Truck Body Inc. conducted research at MotiveLab on a new polystyrene foam to replace traditional spray foam in its refrigerated truck bodies. The project provided confidential data and evidence the company needed to change its production to the new technique and product in all its refrigerated trucks. This new foam offers myriad benefits: it is less labour-intensive to produce, creates less environmental runoff, mitigates the safety risks inherent to using spray foam and reduces production costs.



Training new generations of technical experts

VTEC proactively engages and trains RRC Polytech students through mentorship, guidance and opportunities to propose their own research plans and design their own products. This experience equips students with **valuable technical skills** that subsequently give them an **advantage in the job market**. According to Reyes, most students land a job that is well matched to their skills following graduation thanks to their practical experience working with VTEC. As part of a collaboration with Winnipeg Transit, which identified knowledge gaps among transit technicians who work with electric buses, RRC Polytech has developed training modules to upskill technicians in preparation for an intensive e-bus course delivered by New Flyer.