

Vehicle Testing, Simulation and Modeling

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National Research Council Canada

At a glance

Three key roles:

Business innovation

Federal policy mandates

Advancing knowledge

- 3,700 scientists, engineers, technicians, and other specialists, including 255 SME technology advisors.
- Manages 178 buildings (equivalent to 354 NHL hockey rinks) in 72 locations.
- ~\$1B annual expenditure in addition to ~\$400M in funding for SMEs.

Last year we worked with

- 11,000 SMEs (advice)
- 3,400 SMEs (funding)
- 1,000 companies (R&D collaborations)
- 152 hospitals
- 72 colleges and universities
- 34 federal departments
- 39 provincial/municipal governments
- 36 countries



NRC in Manitoba



Thompson - Global Aerospace Centre
for Icing and Environmental Research
(GLACIER)



Winnipeg – New Advanced
Manufacturing Facility (*Opening in 2021*)

The Transportation Revolution



Toyota's \$13 billion US investment and Tesla's new \$2 billion US Giga-factory exemplify capital commitment of OEMs towards **electrification**. Full electric powertrain development also growing in specialized vehicle and buses for examples where transit authorities are starting to switch to electric buses and replacing fossil fuels.



Connected technologies and digital security are key elements in automotive design with an annual growth rate 45% over the past 5 years. Advanced navigation, driver-assistance systems and vehicle-to-vehicle communications are now essential to the connected car.



The rapid development of some disruptive technologies have had a game-changing impact on the automotive value chain which is shifting to include new entrants that are impacting today's digital (Autoliv), **shared** mobility (Uber) and **autonomous** goals (Waymo).

Global Automotive Testing, Certification Market

Country	2019	2021	2023	CAGR
USA	2,691.8	3,067.6	3,480.6	6.69%
Canada	611.1	675.1	742.6	5.05%
Mexico	793.9	887.7	987.7	5.68%
Total	4,096.9	4,630.4	5,210.9	6.26%

(\$US Billion)

Automotive Application	2019	2020	2022	2024	CAGR
Electrical Systems and Components	2.91	3.18	3.8	4.52	9.20%
EVs, Hybrid EVs, and Battery Systems	3.09	3.31	3.79	4.33	7.01%
Telematics	1.19	1.23	1.32	1.4	3.25%
Fuels, Fluids, and Lubricants	1.02	1.06	1.13	1.21	3.39%
Interior and Exterior Components	2.58	2.72	3.04	3.37	5.55%
Vehicle Inspection Services (VIS)	4.59	4.95	5.74	6.62	7.59%
Homologation Testing	2.18	2.3	2.54	2.8	5.12%
Others	0.9	0.97	1.1	1.21	6.11%
Total	18.47	19.73	22.46	25.47	6.64%

Current Landscape

Aerodynamics / Acoustics

Climatic Effects

Crash Testing

Dynamics

Electromagnetic Interference/Compatibility

Fire Safety

Performance

Modelling / Simulation

Current Landscape

Aerodynamics / Acoustics



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Current Landscape

Climatic effects



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Current Landscape

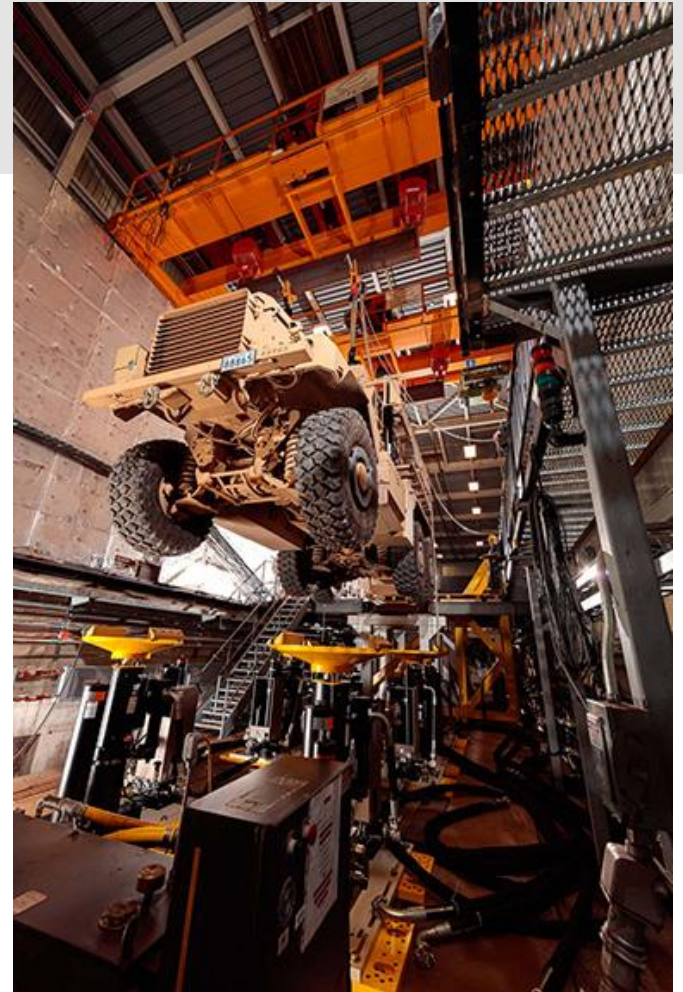
Crash testing



Transport
Canada

Transports
Canada

Current Landscape Structural Dynamics



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Current Landscape

Electromagnetic Interference/Compatibility



Increased focus on suppressing electronic emissions of more electric vehicles and high voltage systems



Current Landscape

Fire safety



Current focus on risk analysis of ICE vehicles

Future shift toward battery and hydrogen fuel cell systems

Current Landscape

Performance



<https://www.avl.com/-/avl-roadsim-chassis-dynamometer>




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McMaster
University 


Westest


PAMI

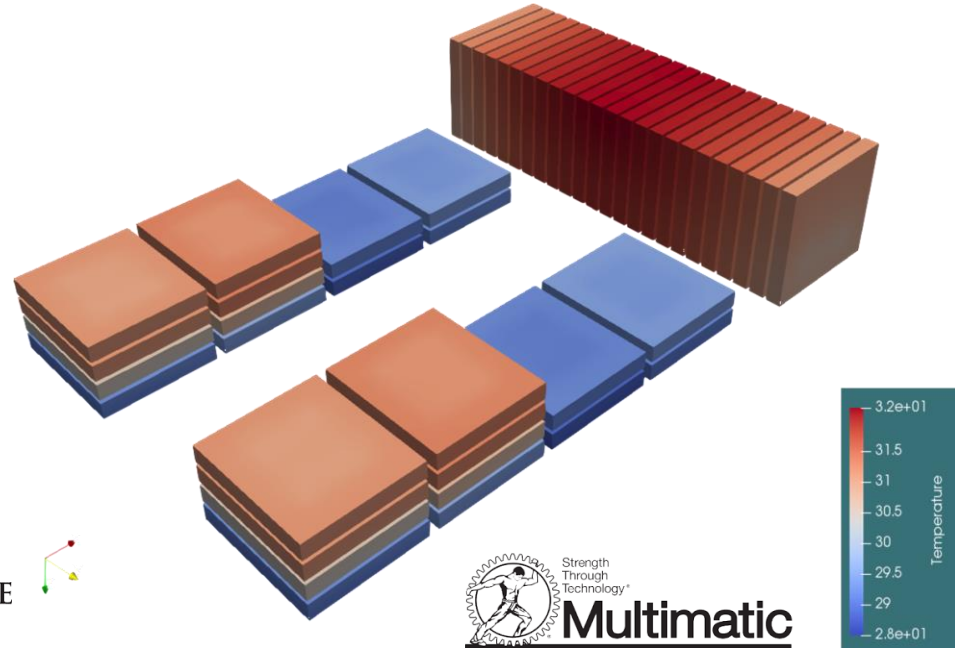
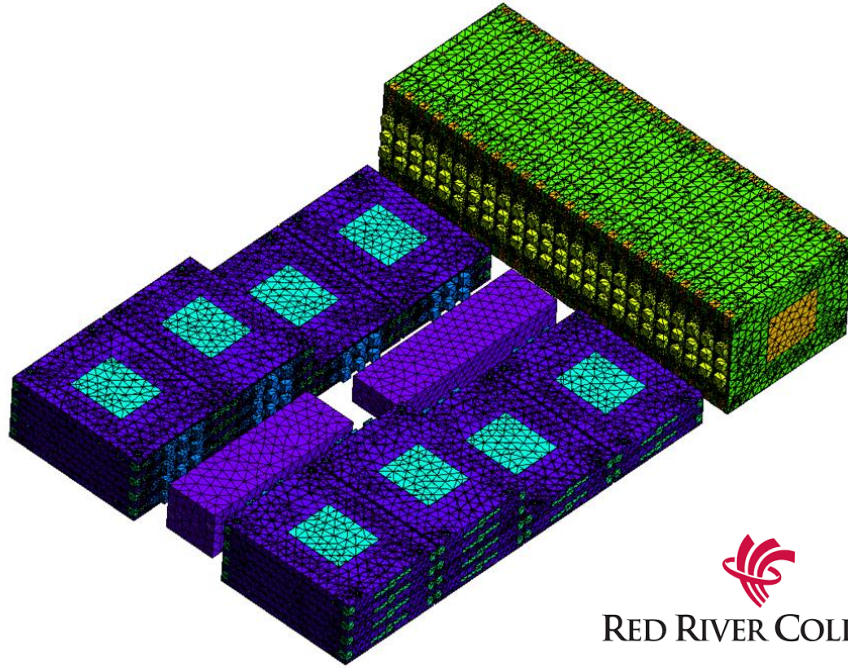


Environment
Canada

Environnement
Canada



Current Landscape Modelling / Simulation




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 Strength
Through
Technology[®]
Multimatic



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UNIVERSITY OF
WATERLOO


WestTest

 **OntarioTech**
UNIVERSITY



Future Trends

Batteries

Connected Autonomous Vehicles

Living Labs

Smart Cities

Future Trends

Battery performance and safety



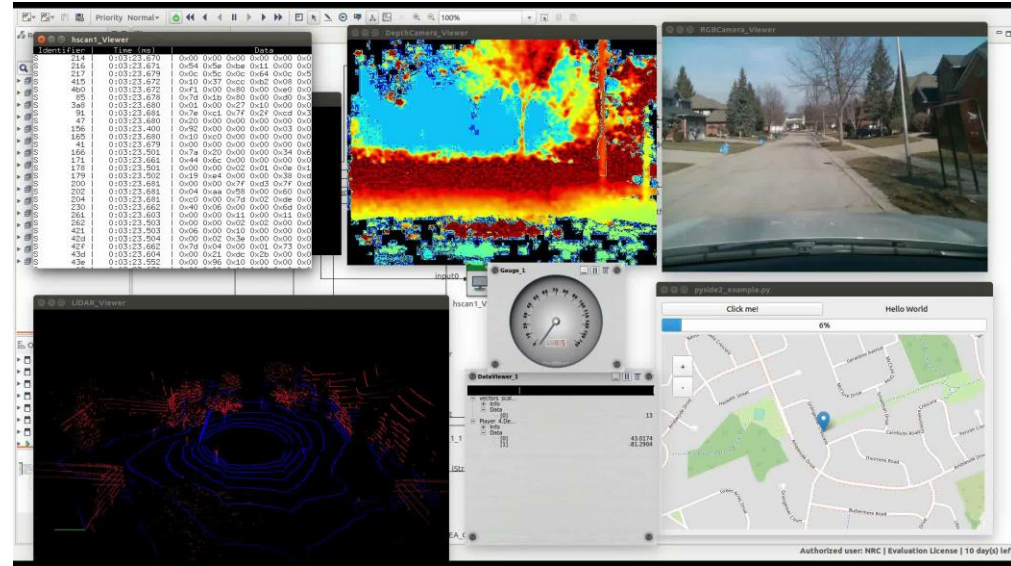
Future Trends

Vehicle-level battery abuse testing



Future Trends

Connected Autonomous Vehicles



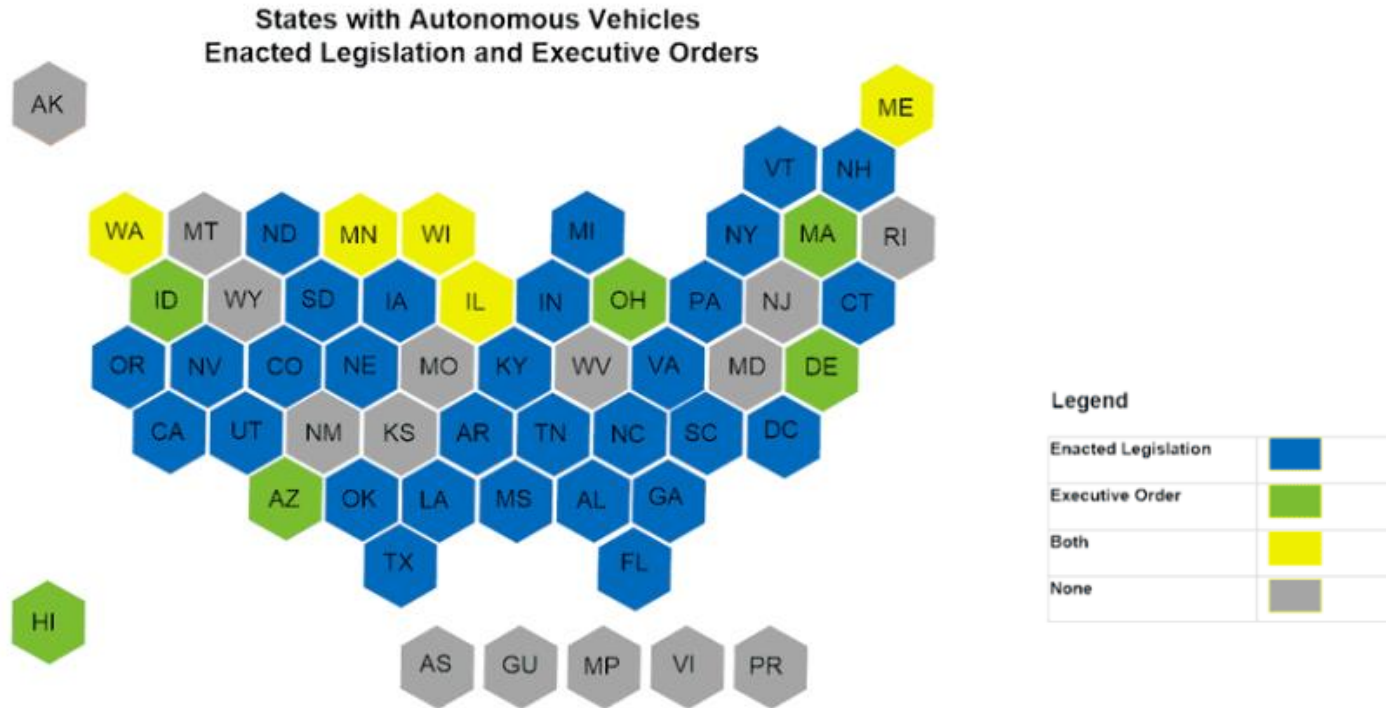
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Future Trends

Living Labs



Future Trends

Smart Cities



<https://www.investstratford.com/smart-city>



Conclusions

- The vehicle testing market is quite mature and will continue to evolve with technological advances in autonomous and alternative power vehicles
- Stratford and Calgary will be representative of the types of living labs expected to flourish in the next decade as real-time testing becomes more critical

THANK YOU

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