

Title: Next Generation Vehicles: Development of Key Technologies and Full Vehicle Testing

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Industry Partner: General Motors Canada

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Vehicle electrification has been increasingly recognized as the most promising road transportation solution to both the global energy crisis and increasingly stringent requirements related to environmental protection and vehicle safety. However, electrification of automotive systems presents radical challenges, specifically related to drivetrain systems, chassis design and layout, multidisciplinary power management and optimization, system integration, and vehicle dynamics and safety, that cannot be resolved with well-established conventional automotive technologies. This proposal is a five-year project to develop and validate key EV enabling technologies, such as thermal management, health monitoring and charging control devices for batteries, vehicle stability and control systems, power management systems, and automotive software control platforms. Since these technologies will require innovative new design and optimization tools in the development phases, the team will also utilize advanced multi-disciplinary design and control optimization methodologies and model-based design techniques to develop a specialized software platform that will permit concurrent optimization of vehicle components and power management systems. Collectively, these advances will not only drastically reduce the time and cost of electric vehicle production, but will increase vehicle system reliability, which is a primary concern among companies that are increasingly integrating complex active safety systems in their vehicle designs. The main focus of the proposed research program will be in the following four thrusts:

- Model-based design of electric vehicles and components
- Battery modeling and on-line monitoring
- Combined battery and super capacitor energy storage systems
- Vehicle stability, control and software
- Multi-disciplinary design and control optimization
- Evaluation, prototyping and testing