



Improved Control System Drives Home Honors for U-M Racing Team



Students from the University of Michigan (U-M) revamped their high-performance hybrid electric vehicle (HEV) with an enhanced controls system to create a truly impressive race car.

The Michigan Hybrid Racing Team took home fourth-place honors at the 2013 Formula Hybrid™ Competition and received a second place innovation award from Chrysler for its use of complex controls implemented with a dSPACE MicroAuto-Box® (MABX).

Team Captain Sam Haberl said the car has been an ongoing project

for the last two years, involving approximately 60 U-M students with various backgrounds ranging from mechanical and electrical engineering to energy systems and material sciences. Over the past several months, the team had been carrying out a heavy redesign effort focused on making improvements to the vehicle's control system.

"The most challenging aspect of our car design has been our controls system," Haberl explained. "We attempted to fully utilize the best aspects of both our electric drive train and our combustion engine. But with our powertrain, we have three separate drive systems to manage and balance. This created a unique controls problem to our vehicle."



The team's greatest challenge, turned out to be its greatest accomplishment. They were able to effectively manage the vehicle's power systems with the implementation of a CAN bus for communication between the MABX and the motor controllers.

Utilizing the MABX as the master-level controller for the whole vehicle, the team was able to take in all driver inputs (pedals, steering angle, gear selection, speed of the vehicle, etc.) and create power commands, which in turn are sent to all of the drive systems.

The MABX is also in charge of supervisory-level monitoring of the systems. It monitors temperature and SOC on the battery packs, the status of ground fault detection, and a few other important features. It can modify and shut down the car based on different events encountered.

Along with the MABX, Haberl said his team has been using dSPACE ControlDesk® to debug their control system.

"ControlDesk allowed us to quickly change inputs and constants while testing the results," Haberl said. "In addition, the ability to read sensor signals allows us to calibrate the vehicle easily. ControlDesk was especially useful when debugging CAN bus messages from the motor controllers."

In the months leading up to the next Formula Hybrid Competition in 2014, the Michigan Hybrid Racing Team plans to do a lot of testing to gather data that will help them continue to optimize their vehicle design.

"The most beneficial aspect of competing is always the ability to test the car in a true race setting," Haberl said. "

It is always validating to be able to see your ideas and your work take shape and come to life. We'll definitely be back to compete and win the Formula Hybrid Competition in 2014."

The Michigan Hybrid Racing Team will have its HEV on display at the dSPACE Ground Vehicle Testing Conference Oct. 8-9, 2013, at The Inn at St. John's in Plymouth, Michigan, USA. This two-day conference is free-of-charge and includes technical presentations and workshops related to embedded software development.