Getting Ready for the Finals

John Kruckenberg

The Ohio State University EcoCAR team is making last tuning and aesthetic changes before the final EcoCAR competition, to be held June 6-16 at General Motors' Milford Proving Grounds in Michigan and in Washington, D.C. After March emissions testing and tuning at the EPA, the main concerns for finishing the vehicle relate to fabrication of new interior panels, adjustments for improved vehicle reliability, and validation testing to ensure that design goals are met.

The OSU team has been performing on-road and dynamometer testing at the Transportation Research Center (TRC) automotive proving ground in East Liberty, OH, to ensure that the team meets their design goals in the broad range of performance specifications scored in the EcoCAR competition. The closed track environment is ideal for testing acceleration and braking performance, as well as validating torque output from powertrain components to ensure smooth and efficient operation. Dynamometer testing at TRC is also helpful to validate consistent emissions improvements since testing took place at the EPA.

OSU EcoCAR Testing at TRC.

The OSU EcoCAR vehicle technical specifications (VTS) include acceleration and braking performance, towing capacity, electric range and total range, fuel economy, and emissions metrics. These specifications were developed considering various factors. First, the EcoCAR vehicle was expected to exceed the original vehicle fuel economy without reducing performance. This goal set the OSU team's minimum allowable acceleration, towing, and braking performance. A second factor was the availability of significant R&D support for plug-in vehicles at the OSU Center for Automotive Research (CAR), where the vehicle would be designed and built. The OSU SMART@CAR program's current research projects and industry partnerships are well aligned with the goal of

developing a plug-in vehicle that would have a significant all-electric range and could be recharged from a plug-in connection. A third consideration was the desire to drastically lower petroleum consumption. The last factor considered in setting the VTS goals was that the EcoCAR project be sufficiently ambitious to educate students on current and future technology.

The factors and goal outlined in this brief introduction helped to mold the architecture and design, which were then used in simulation to set the VTS goals that would be achieved by the final vehicle designed and built by the team. Once the design constraints were determined for the vehicle design, the team used computer simulation tools including PSAT, GT-Power and the OSU-developed simulator EcoSIM, built in Simulink and MATLAB, to demonstrate the best performance achievable with available components while meeting the minimum performance requirements. These initial simulations involved simple longitudinal vehicle models for energy analysis and testing vehicle power requirements and range capabilities.

Based on results from the EPA and TRC, the OSU EcoCAR vehicle exceeds nearly all specifications of the originally donated platform and is on track to perform to specifications at the final competition.

John Kruckenberg is a graduate student at Ohio State dedicated to the EcoCAR project. Kruckenberg is the leader of the Controls/Hardware in the Loop development team. He is currently pursuing a master’s degree in electrical engineering and writing a thesis on fault diagnostic topics for the EcoCAR vehicle.

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