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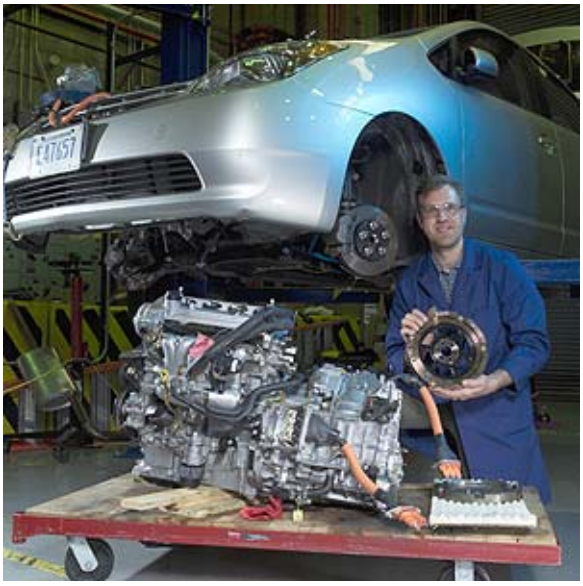
SPRING 2004 — Vehicle Systems

Testing Under Way on Hybrid 2004 Prius

Researchers continue to test and evaluate a hybrid 2004 Toyota Prius in the CTR's Advanced Powertrain Research Facility (APRF). They are mapping the vehicle's major components and exploring the advanced controls used to achieve high fuel efficiency in its Hybrid Synergy Drive.



CTR researcher Ted Bohn holds the new engine torque sensor installed in Argonne's 2004 Prius. With this new design, no vehicle modifications are required, saving almost $20k in custom brackets and vehicle work.

To date, just over 4,000 miles of over-the-road driving on the Prius have been accumulated. The vehicle was instrumented for collecting current and voltage. In January, it was tested (FTP and highway) in the APRF to benchmark emissions and fuel economy before researchers applied more extensive instrumentation. During February, tests were conducted on both the 2004 and 2001 Prius vehicles for a side-by-side comparison. Substantial effort was directed at reducing noise and cross-checking data for quality. Acquiring clean, accurate data in the hybrid electric vehicles' high-voltage, electromagnetic interference-filled (EMI) environment is a significant challenge. However, progress in this area is encouraging and will be applied to both model-year vehicles.

In April, CTR researchers installed a newly developed zero-clearance torque sensor between the engine and electric drivetrain. A similar in-situ torque sensor was installed in the previous generation 2001 Toyota Prius with several limitations. The off-the-shelf torque-sensing element previously used had temperature limitations (requiring external cooling), was susceptible to damage from torque spikes, and required an additional 3" of powertrain length to accommodate the sensor. A custom spacer between the engine and transmission was also required, as well as modification of the vehicle frame rail. These modifications limited the vehicle to off-road or dynamometer operation.

The new engine torque sensor installed in the Argonne 2004 Prius is a much more elegant and robust solution. With this new design, no vehicle modifications are required, saving almost $20k in custom brackets and vehicle work, allowing the vehicle to be driven normally on public roads.

Similar non-contact axle torque sensors are also used to measure torque to the wheels. Using the engine and axle torque sensors in conjunction with conventional speed sensors, power from the engine, electric motors, and power to the road can be mapped for various operating conditions. On-road "real world" testing is also planned for this vehicle to compare lab test results with less controlled but more realistic test conditions.

Sponsor

U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, FreedomCAR and Vehicle Technologies Program

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