DaimlerChrysler Develops Innovative HEV Vehicles for Future Markets

In early 1996, Chrysler Corporation and the U. S. Department of Energy (DOE) signed a cost-shared contract to develop a production-feasible hybrid propulsion system vehicle that meets EPA emission standards, features high fuel economy, and satisfies consumer requirements for cost, safety, comfort, and performance. In 1998, Chrysler merged with Daimler. The Hybrid Electric Vehicle (HEV) contract continues and the target is to support Partnership for a New Generation of Vehicles (PNGV) goals.

Benefiting Tomorrow's Vehicles

DaimlerChrysler is harnessing industry/government teamwork, technology advancements, and a customer focus to develop and produce efficient hybrid propulsion components with production feasibility. DaimlerChrysler is focusing its technical development efforts on electric motors, controllers, and compression-ignition direct-injection (CIDI) diesel engine systems. In addition, DaimlerChrysler is developing and improving models to predict the behavior of hybrid propulsion systems in order to reduce design time. The validation of these models against a development vehicle helps to speed the progress toward a production vehicle. DaimlerChrysler's development of a hybrid propulsion system will be integrated in a prototype aluminum Dodge Neon.

Using advanced technologies, DaimlerChrysler is developing a lightweight aluminum Dodge Neon Vehicle (shown) and the ESX2 hybrid vehicle. The DaimlerChrysler team includes supplier/partners, expert in chosen scientific areas.

DaimlerChrysler Project Planning Includes Four Phases

The **Concept Definition Phase** included the evaluation of existing hybrid systems, assessment of current technology and suppliers, and the development of specifications for power train components and subsystems. In the **Design & Development Phase**, DaimlerChrysler focused on Generation 1 components and integration of the propulsion system into a parallel configuration test bed vehicle (an aluminum Neon). In the **Vehicle Integration Phase**, the first version of the Generation 2 hardware is being developed. In the **Vehicle Demonstration Phase**, the refined Generation 2 hardware will be integrated into the prototype test vehicle.

What Are the Successes to Date?

The program objective is to design and develop a hybrid electric vehicle propulsion system that provides high energy efficiency and low emissions. Recently, DaimlerChrysler completed the Generation 1 stage of its HEV Program, which includes a 1.5L 3-cylinder diesel engine (developed in cooperation with Detroit Diesel Corporation), a 15kW peak power electric motor and power controller, a lead acid battery pack, and a battery charge equalization system. In addition, the Generation 1 hardware has been successful in demonstrating a viable control system strategy.

DaimlerChrysler has chosen a mild parallel hybrid configuration to support (PNGV) goals. In a parallel vehicle, the engine and the electric motor each have a direct connection to the wheels of the vehicle. For example, a parallel vehicle configuration may use the power created from the engine for highway driving and the power from the electric motor for accelerating. In DaimlerChrysler's prototype, the battery pack and alternator are sized to capture braking energy and return this energy to power only the accessories and limited torque assist. The electric motor alone is not intended to drive the vehicle in forward gear but will drive the vehicle in reverse gear, thereby eliminating the need for a reverse gear in the transmission, which helps reduce the transmission cost. Electronic shifting will be employed to automatically shift the 5-speed manual transmission, thereby giving the feel of an automatic transmission but getting the efficiency of a manual.

What Are Tomorrow's Goals?

The Generation 2 goals of lighter weight and more integrated packaging of future state-of-the-art technologies include the following advanced technologies:

- A 15kW peak power permanent magnet electric motor in a highly integrated, liquid cooled package that closely couples bus structures, power transistors, and gate drive circuits.
- A diesel engine with lightweight block and structural components that will incorporate a variable geometry turbocharger.
- Technologies with improved emission system performance, developed within several Cooperative Research and Development Agreements, which will be incorporated as they become available.
- A Li-Ion battery pack, which is being designed by SAFT America Inc.

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