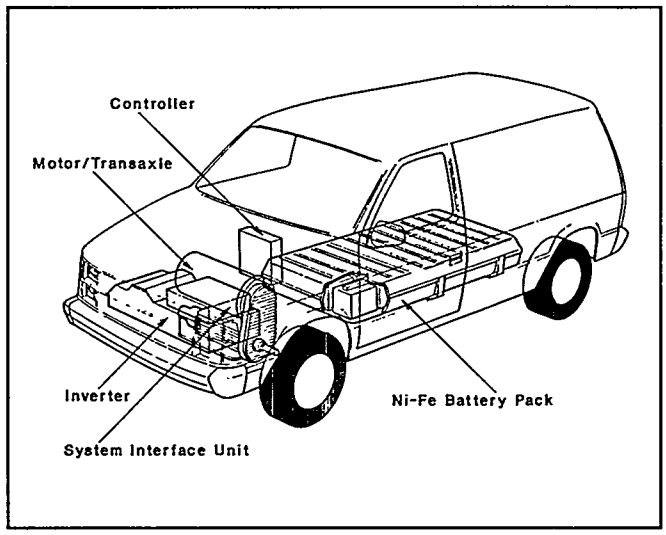
tivities have focused on materials development, fabrication processes, ceramic-to-metal joining processes, and nondestructive evaluation techniques. While research is yet to be completed for full-scale gas engine applications, major automobile manufacturers have incorporated DOE research program results into the production of ceramic turbocharger rotors. A ceramic turbocharger rotor application, the Nissan 300 ZX with a ceramic turbine supplied by Garrett Corporation, was first commercially available in 1986. Estimates of the turbocharger market potential exceed 6 million units worldwide by 1992, with ceramic turbocharger rotors projected to capture in excess of 75 percent of that market. Typically, turbocharging results in 5 percent efficiency improvements in spark ignition engines and 10 percent in diesel engine applications. Projections of fuel savings attributable to the use of advanced design turbochargers equipped with ceramic rotors range from 0.63 to 1.0 billion gallons of motor fuel annually, equivalent to 87 to 145 trillion Btu per year.

Electric Vehicle Site Operations Program

DOE has supported a wide range of electric vehicle-related research activities in conjunction with academic institutions, other federal agencies, and the private sector. These research activities are consistent with directives contained in the Electric and Hybrid Vehicle Research, Development and Demonstration Act of 1976. The DOE Electric Vehicle Site Operations Program provides a means of testing and evaluating the effectiveness of electric vehicle (EV) technology research products, primarily in the areas of advanced electric vehicle systems, subsystems, and vehicle components. Numerous EV technological developments have occurred since the initiation of DOE-sponsored research activities. Since its inception, this program has evaluated over 20 electric vehicle types and 16 specific product improvements. The results of testing indicate that research objectives are being met and often exceeded. EV energy consumption has been reduced by over 50 percent, reliability levels have increased by 78 percent, maintenance costs reduced by 60 percent, and overall life cycle costs reduced by 67 percent. The EV Site Operations Program provides design validation and unbiased information on specific applications for EVs to potential private sector investors.

Dual Shaft Advanced AC Propulsion System

Market studies have determined that the development of a commercial van would provide the first market niche for electric vehicles. The Dual-Shaft Electric Propulsion System Program (DSEP) is developing electric vehicle technology through the use of subsystem technologies developed by the Eaton Corporation and Eagle-Pitcher Industries, Inc. under contract to DOE. The major emphasis of the DSEP research is to advance existing battery and powertrain subsystem technologies in the context of an overall propulsion system technology. Industry is provided with an advanced electric vehicle propulsion system technology that is not only practical for light-weight van applications in the near term, but quite sensible from the standpoint of the overall system technology. An important achievement of this program was the completion of the first test-bed



Major system components in the Chrysler T-115, test vehicle for the development of light-weight, battery-powered commercial vans.