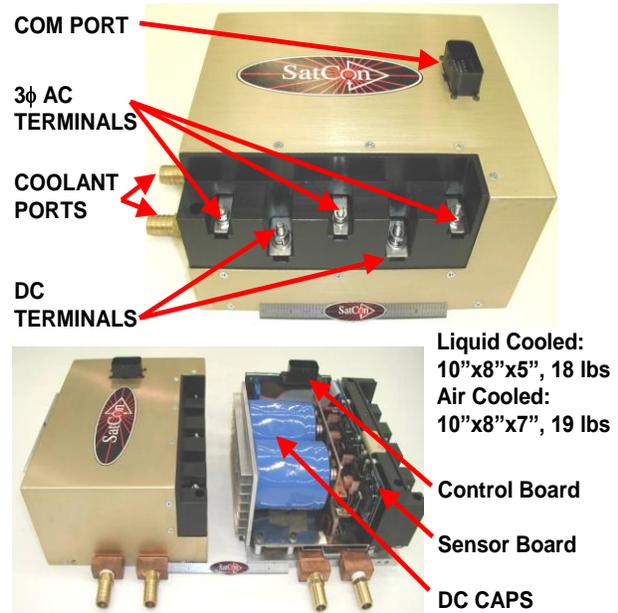


Vehicle Component Prototypes:

- **Advanced Integrated Power Module (AIPM)**
DOE PNGV \$10M program. Demonstrate a low cost (\$7/kW), lightweight 55kW AC motor converter module. Specification of 4.58L unit volume and 11 kg weight with a cost target of \$385/unit at 100,000 units per year.
- **DC/DC Converter for US Army HEV**
Vehicle oriented converter, high power density, patented internal fin cooling tube with 90°C fluid, modular and expandable by stacking in 10 kW increments.
- **Combat Hybrid Power System (CHPS) Components**
Military HEV System Integration Lab (SIL). DC/DC converter and power converter design and 92,500rpm/45 Kw generator prototype.
- **Electric Power Steering**
Automotive Tier 1 Manufacturer. Design and install a ball-screw type actuator for integration into manufacturer's steer-by-wire system. Also designed, fabricated, and tested an in-vehicle clutched electric motor for electric-assisted power steering.



- Inline Generator for HMWV (2002)**
 US Army CECOM. Hybrid PM/Homopolar generator for use as an in-line generator in a HMMWV. Installed between the engine and transmission and provides power while idling at 1200 rpm. Three phase, 120/208 V, 60 Hz @1200 rpm, 10 Kw rated power, 100 kg.



- Continuously Variable Transmission (CVT)**
 Army Research Lab. Demonstrated magneto-rheological CVT in laboratory demo for in-wheel motor transmissions.
- Multi-speed Mechanical Transmission**
 Army Research Laboratory. Multi-speed transmission and control unit for an in-wheel motor; 5 gear ratios attached to the output of a 50 Kw in-wheel motor with a 0 to 6000 rpm operating range
- POWER², Power Management and Storage Systems For Hybrid Electric Drives**
 Electricore/DOE. Flywheel-based hybrid drive control consisting of a flywheel energy storage unit, associated power electronics and flywheel controller, a system controller, and a cooling system. The Power² system has three critical functions: 1) balance the power flow in the drive system by appropriately controlling the flywheel, traction motor and heat engine, 2) use the flywheel to handle power flow transients to allow the heat engine to operate at steady power, high efficiency state and, 3) control the vehicle in a responsive manner desired by the operator. A Power² system demonstrated regulated power flows while supporting loads up through 27 kW and integrated with power electronics.
- Interior PM Machine 35kW Traction Motor**
 DOE. Developed wide constant power speed range (CPSR) traction motor using Interior PM (IPM) Machine type. Benefits of IPM technology are compact PM machine coupled with limited drive voltage requirements resulting in overall lower system cost, weight, and size.

- Automotive Switched Reluctance Traction Motor**
 Developed robust traction motor for automotive tier 1 manufacturer based on switched reluctance (SRM) machine technology. The SRM is particularly suited for severe environment applications because the steel rotor has no magnets or conductors. A 5-phase design is used to reduce torque ripple over a wide operating range.



- HEV Flywheel Motor/Generator**
 DOE. An inside-out (rotor on the outside) flywheel motor/generator was developed for HEV peak power energy storage. Halbach array magnets were mounted to the inside diameter of the high speed flywheel rotor to minimize magnetic material requirements.