



SwRI® develops vehicle component simulation equipment

([PRWEB](#)) November 22, 2002 -- For immediate release

San Antonio — November 19, 2002 — Engineers at Southwest Research Institute® (SwRI) have developed a test apparatus capable of simulating vehicle powertrain operations in the laboratory. The apparatus uses hardware-in-the-loop technology and a software-controlled simulator to determine how a powertrain or related component would perform if it were integrated into a vehicle.

SwRI engineers designed and constructed a test system that simulates the operation of a transmission under a wide range of real-world conditions. Similar test systems can be developed to test engines, electric motors, hybrid-vehicle battery packs, and other equipment under a variety of road and environmental conditions.

— This equipment can greatly reduce the development cost and the time to market for a new vehicle, — explained Gary Stecklein, director of the Vehicle Systems Research Department in SwRI's Engine and Vehicle Research Division. — Engineers can evaluate a prototype transmission, for example, while the engine is still being developed, reducing the vehicle's development cycle by a year or so. Using the SwRI internally developed RAPTOR — VSM powertrain simulation software, we can perform numerous driving cycles to simulate real-world driving conditions and eliminate some fleet testing. —

The apparatus has a unique capability to simulate such real-world conditions as stop-and-go traffic, roll and grade angle, heat rejection, aerodynamic drag, varying temperatures, and other parameters.

The equipment and test cell were developed as part of a program funded by General Motors Corporation to test transmissions in the laboratory using an electric motor to simulate an internal combustion engine. A second electric motor is used to provide road load, grade resistance, and vehicle inertia simulation on the output of the transmission.

A key component in the system is the input motor system, known as the engine simulator, which consists of a low-inertia, alternating current motor and a high-speed control system. This 442-horsepower electric motor can operate at speeds up to 9,000 revolutions per minute and has a tilt range of 45 degrees.

The electric motor functions as the engine of a vehicle, providing the speed and torque of a wide range of combustion engines. It also replicates the engine inertia that a transmission experiences during shifting as well as the engine torsional vibrations. The system can simulate numerous driving cycles required by national and international standards.

— In addition to supporting product development here at SwRI for General Motors, we expect to develop and market similar test systems for engines, electric motors, batteries, and accessories for automotive and equipment manufacturers and other service organizations, — Stecklein said.

RAPTOR — VSM (Rapid Automotive Performance SimulaTOR for Vehicle System Performance) is an Institute-developed, commercially available modular simulation tool for automotive designers to assess vehicle economy and performance.



The Institute has more than 50 years of experience in transmission testing and evaluation and test system development.

As an independent, multidisciplinary research, development, and testing organization, SwRI provides a nonbiased, third-party perspective. The SwRI Engine and Vehicle Research Division has achieved certification to ISO 9001, an internationally recognized quality standard, and is working toward ISO 14001 certification.

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SwRI is an independent, nonprofit, applied research and development organization based in San Antonio, Texas, with more than 2,700 employees and an annual research volume of more than \$319 million.

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