Smart Vehicle Concepts Center
Research for Industry

www.SmartVehicleCenter.org

Engineering researchers at the Smart Vehicle Concepts Center (SVC) are bringing lighter, more intelligent materials to vehicle design—thanks to a multi-year grant from the National Science Foundation Industry-University Cooperative Research Centers program. The mission of SVC is the development of active material based devices that will achieve superior force, motion, noise & vibration control performance goals, with applications to ground and aerospace vehicles.

The Center, led by mechanical engineering professors Rajendra Singh, director of the center; Marcelo Dapino, associate director of research; and Gregory Washington, interim dean for the College of Engineering has over 12 research projects in the works—collectively they could influence almost every aspect of the operation of a vehicle with the smart materials based devices being conceived.

Smart material actuators and sensors have significant advantages over conventional devices. Because these devices have fewer moving parts and are multi-functional, they could lead to a reduction in cost, weight and size. Putting lighter materials in cars makes them less heavy—and more energy-efficient.

The smart material applications investigated at SVC could improve the efficiency, safety, reliability and functionality of vehicles by improving the static and dynamic performance, acoustics and vibration features in cars and airplanes. Smart materials could also be used in sensors that can configure the safety systems after detecting certain characteristics in a component or system.

The work being done at the Smart Vehicle Concepts Center is supported and monitored by a consortium of companies and government laboratories with international influence. Center sponsors like The Boeing Company, Honda R&D Americas Inc., NASA, Army Research Laboratory, and Edison Welding Institute all share responsibilities in evaluating current research, suggesting new opportunities, and matching Center capabilities with unfilled research needs. Members of the consortium—which has surpassed NSF's fundraising goals for the first year—pay an annual membership fee, allowing them to have representatives on the Industrial Advisory Board.

"The key to innovation is the partnership between industry, government and academia and in fact the SVC implements this paradigm very well," adds Singh. "We are focusing on pre-competitive technology and on R&D problems of common interest. This is a win-win for all concerned as cutting edge research problems are being addressed in a collaborative manner."

Research at the Center covers a range of thrust areas including interfacial mechanisms, adaptive noise vibration and harshness, safety, and energy. The center works collaboratively with researchers at Texas A&M University and other engineering disciplines at Ohio State to focus on active material based composites, piezoelectric and magnetostrictive materials, ferromagnetic shape memory alloys, and magnetorheological fluid based devices.

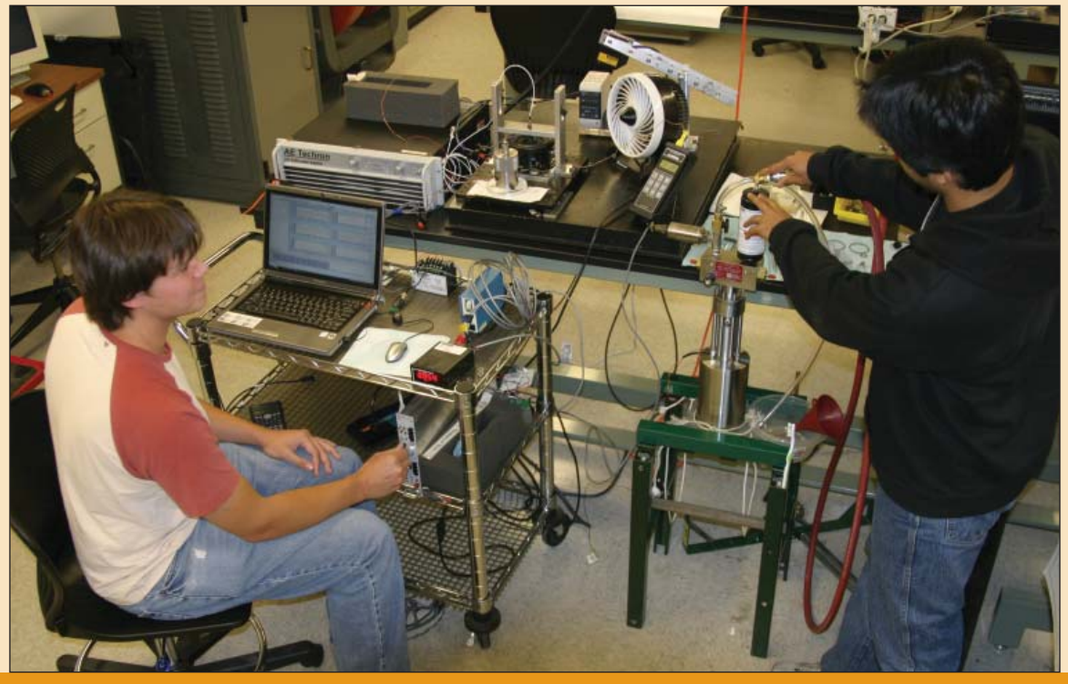
Some projects currently under way include work on development of interfacial force sensing systems using experimental and computational methods, multifunctional composites with embedded actuators, sensors and stiffness control, and critical assessment of active noise and vibration technology for rotorcraft gearboxes and airframes.

The Center held its first annual conference this past August. In addition to conducting relevant research, the Center provides advanced industrial education (short courses, web based tutorials and conceptual demonstrations) to improve the knowledge and skill base of practicing engineers.

"The SVC will be the only major center in the U.S. that can provide to industry and other educational institutions world-class information on smart materials applied to transportation applications, thereby enabling the forces and motions necessary for 21st century automotive and aerospace systems," adds Singh. "By providing not only technical results and solutions but also being a major educational and training source, the SVC will help the U.S. automotive and aerospace industries to remain competitive in an increasingly difficult global economy."

To learn more about the Center visit:
www.smartvehiclecenter.org

Ryan Hahnlen (left) and Suryarghya Chakrabarti (right) setup a test pump in one of the SVC labs that uses Terfenol-D, a magnetostrictive material, driven at a high frequency to produce significant volumetric displacement of hydraulic fluid. The fluid is rectified by reed valves and drives a hydraulic cylinder that can be used to actuate, for example, control surfaces on an airplane wing.



Current and future projects at the Smart Vehicle Concepts Center will focus on the following areas:

Interfacial Mechanisms: Advanced electro-hydrostatic actuators, adaptive powertrain mounts, interfacial force sensors, torque sensing and actuation, etc.

Adaptive Noise Vibration and Harshness (NVH): Active micro and nano-composites, gear noise control, vibration control of vehicle systems, acoustic micro-sensors, panels with tunable stiffness, etc.

Safety: Distributed force sensors, air bag sensors, adaptive seat belt systems, advanced energy absorbing foams, etc.

Energy: Energy harvesting devices, adaptive fuel management concepts, powertrain breathing systems, friction control, efficiency enhancement, etc.