Department of Communications/News Bureau
22 Davis Hall, 10 Lippitt Road, Kingston, RI 02881
Phone: 401-874-2116 Fax: 401-874-7872

URI researchers simulate explosions in 23-foot 'shock tube' to test materials for homeland defense

Media Contact: Todd McLeish, 401-874-7892

KINGSTON, R.I. -- August 19, 2004 -- People are just as likely to be killed, or property damaged, by the shock wave from an exploding bomb as from flying debris or flames. The rush of gases emanating from a bomb can travel more than 10 times the speed of sound, destroying everything in its path.

Two University of Rhode Island engineers have constructed a "shock tube" to simulate this rush of gas so they can test the ability of various new composite materials to withstand these extreme forces.

"What we're creating is a controlled explosive effect so we can test materials for their resistance to explosions," explained Carl-Ernst Rousseau, assistant professor of mechanical engineering. "When chemicals react and burst in a bomb, they create a pressure pulse in the air that expands. That's what we're creating in the shock tube."

Rousseau and Arun Shukla, professor and chairman of the URI Department of Mechanical Engineering, received grants from the U.S. Army ($150,000), the U.S. Office of Naval Research ($170,000), the URI Transportation Center ($80,000) and 3Tex Corp. ($86,000) to construct and test the 23-foot long, 6-inch diameter, aluminum tube.

With a thin barrier placed 6 feet from the near end of the tube, the URI scientists pump helium into the tube until the pressure builds so high that it bursts through the barrier. The gas then speeds down the remaining 17-foot length of the tube at speeds of up to Mach 6 (six times the speed of sound) and slams into a material placed at the opposite end. Sensors attached to the material being tested monitor the pressure and strain exerted on the material during impact.

"This device has a wide variety of homeland security applications because the government is very interested in protecting people and equipment from the impact of blasts," said Shukla.

The first material the researchers are testing is a composite called 3-Weave developed by North Carolina-based 3Tex, a company Shukla has worked with for many years on other research applications. While most fabric is woven in two directions, 3Tex weaves its glass fibers in three directions to provide added strength. When applied to a ceramic backing, it is used as a lightweight armor for protecting military vehicles.

Rousseau and Shukla are testing the lightweight material without the ceramic backing to assess its effectiveness for other uses, like the side panels of trucks to protect the cargo from a bomb. Truck panels made of 3-Weave might also protect those outside the truck from an accidental explosion inside a truck carrying chemicals, propane or other volatile materials.

Several other companies have asked the researchers to test composite materials they have developed as well.

Rousseau also plans to test cow bones to evaluate the dynamic property of bone under explosive impact. "We obviously can't study how bombs impact human bodies, but the shock tube allows us to do the next best thing," he said.

The URI researchers will also test other materials that may be in the path of an explosion, like building materials, concrete and safety glass.

For Further Information: Carl-Ernst Rousseau 401-874-2542

Copyright © 2002
University of Rhode Island
(Disclaimer)