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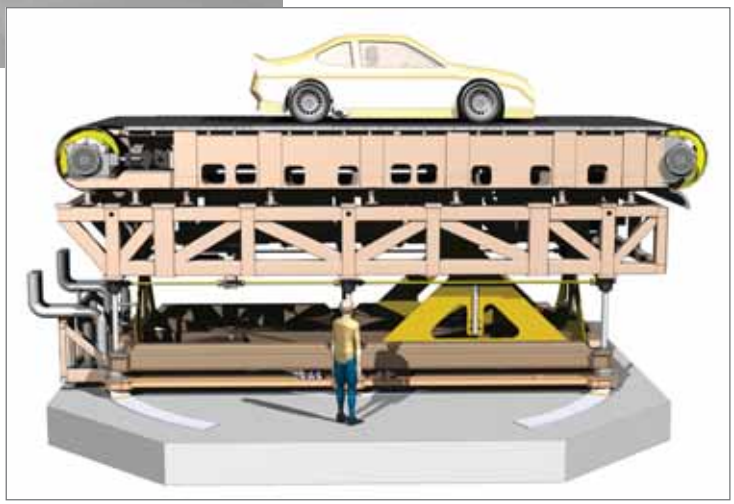
Running in Place Against the Wind

Wind tunnels vary in size and the amount of wind velocity they can generate. The most powerful one at NASA can actually produce Mach 3.5 supersonic wind speeds. A wind tunnel's wind velocity and size has a lot to do with what it is designed to test. Note that wind tunnels are just as likely to be used to test the structural integrity of a building design in hurricane winds as the aerodynamic shape of a land-, air-, or space shuttle-type of vehicle.

Photo 1 (above)

Photo 2 (right)



In the physical world, NASA has the largest wind tunnel, which can accommodate a full-size airplane. It is also reported to have the smallest wind tunnel, which can test a toothpick-sized object. In the virtual world, new software programs like the Java Virtual Wind Tunnel are now used to simulate wind tunnel forces over digitally built objects.

The newest type of wind tunnel combines wind velocity with a rolling road bed. (See Photo 1.) This new dynamic design allows for wind tunnel testing of a motor vehicle's aerodynamic shape, while at the same time examining the interaction of the separate wind currents created by the vehicle's rolling tires.

These separate wind vortexes interact with the wind currents hitting the vehicle's undercarriage and can affect the stability of the vehicle during a race. The new wind tunnel offers the best way today to secretly test a race car or vehicle prototype out of the visual range of the paparazzi.

In April 2007, WindShear, Inc., started building what it describes as the "world's first commercially available, full-scale, rolling-road wind tunnel." The facility, located in Concord, NC, will open for business by April 2008. Only two other facilities of this scale currently exist, one in the United Kingdom and the other in Switzerland.

The WindShear rolling road is a 1 mm-thick stainless steel belt that measures 10-1/2' wide × 29-1/2' long. The belt on this treadmill, just like the one on a home exercise treadmill, has a limited life span. It will be checked frequently for wear and replaced approximately every 200,000 to 250,000 equivalent miles of travel.

The treadmill that encases the belt (Photo 2) is designed to accelerate from 0 to 180 mph in less than one minute. Axis rotation of the rolling road will allow technicians to simulate crosswinds to see how they affect a vehicle's aerodynamics.

The treadmill has a computer-enabled measurement system that records force measurements directly through the belt. Note that a critical aspect of the aerodynamic design of a car involves keeping it securely pressed down against the pavement—the reverse of the aerodynamics of an airplane.

The main fan in the wind tunnel has a 22' dia. blade assembly that can spin at speeds up to 360 rpms. It can create a wind velocity equal to a category 5 hurricane as it moves almost 3 million cubic feet of air per minute around the wind tunnel part of the facility.

Recalling the Facts

1. Wind tunnels vary in size and in the amount of wind velocity they can generate. Why?
2. What information can be gathered in a rolling-road wind tunnel that cannot be gathered in a static vehicle test in a wind tunnel without a rolling bed?

Alan Pierce, Ed.D., CSIT, is a technology education consultant. Visit www.technologytoday.us for past columns and teacher resources.

