

Science Video

Man-Made Hurricanes

Civil Engineers Create High-powered Hurricane Simulator

September 1, 2008 — Engineers designed a portable hurricane simulator, powered by four marine diesel engines and equipped with a five thousand gallon water tank. It can create 125 mile per hour winds, subjecting real buildings or test structures to the power of a category three hurricane.

More hurricanes strike the U.S. in September than in any other month of the year. The best-built houses are more likely to survive these severe storms. Now, there's a new way to test how homes hold up -- and it's just like being in the eye of the storm.

With the wind, the rain and the destruction, hurricanes can wreak havoc on buildings. That's why civil engineers from the University of Florida built the largest portable hurricane simulator in the world. The idea was to find out what materials hold up best in a storm.

"There's no instruction manual on how to build one of these," says Forrest Masters, Ph.D., assistant professor of civil engineering at the University of Florida.

Eight industrial fans powered by four marine diesel engines run the system. A 5,000 gallon tank provides water and cools the engines.

The simulator can produce winds of up to 125 mph -- a strong category 3 hurricane force -- against a mock house. The entire system is portable.

"For the first time, we're actually able to directly observe water being forced through the action of pressure forced into your house," Dr. Masters says.

Scientists often use the simulator to experiment on windows.

"We're picking up new ideas on how to build better windows and how to do a better job for installation," Dr. Masters says. Though Masters and his colleagues run the simulator three times a day, it never loses its thrill for them. "Every time you hear 2,800 horsepower turn on, it's a blast," says Carlos Lopez, a graduate student at the University of Florida.

Every day, researchers are a little closer to understanding how to create a hurricane-proof home. Soon, researchers hope to take the simulator to actual neighborhoods to test it on older homes. The simulator costs about \$500 thousand to make.

WHY DO HURRICANES CAUSE SO MUCH DAMAGE? Hurricanes can be extremely violent storms. Intense winds, heavy rains and flooding can level a coastal town and cause significant damage even to inland cities. For instance, a major hurricane will dump dozens of inches of rain within a couple of days, creating inland flooding. The high, sustained winds cause

structural damage, and are capable of rolling over cars and felling trees, and even eroding beaches. The strong winds can also push a wall of water, called a storm surge, in front of the storm, which can cause flooding and beach erosion. And hurricane winds have been known to spawn tornadoes, smaller, more intense cyclonic storms that can cause even more damage.

ABOUT HURRICANES: A hurricane is a type of tropical cyclone, a low-pressure system that usually forms in the tropics and has winds that circulate counterclockwise near the earth's surface. Storms are considered hurricanes when their wind speeds surpass 74 mph. Every hurricane arises from the combination of warm water and moist warm air. Tropical thunderstorms drift out over warm ocean waters and encounter winds coming in from near the equator. Warm, moist air from the ocean surface rises rapidly, encounters cooler air, and condensed into water vapor to form storm clouds, releasing heat in the process. This heat causes the condensation process to continue, so that more and more warm moist air is drawn into the developing storm, creating a wind pattern that spirals around the relatively calm center, or eye, of the storm, much like water swirling down a drain. The winds keep circling and accelerating to form a classic cyclone pattern.

RATING HURRICANES: Hurricanes are categorized according to the strength of their winds according to the Saffir-Simpson Hurricane scale. They are rated from lowest wind speeds (Category 1) to highest (Category 5). But even lower category storms can cause a great deal of damage, mostly from storm surges and the resulting flooding. The worst devastation from hurricane Katrina, for example, occurred when flooding caused the New Orleans levees to fail.

The American Meteorological Society and the American Society of Civil Engineers contributed to the information contained in the TV portion of this report.