

Wall of Wind Full-Scale Testing

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Full-Scale Testing for Hurricane Wind-Rain-Debris Effects Wall of Wind Project: International Hurricane Research Center, FIU

The U.S. economy loses an average of \$4 billion a year to tropical cyclone impacts and an additional of \$1.3 billion to other extreme effects. Florida has been hit by eight hurricanes in the past two years, resulting in 2.9 million claims and \$31.3 billion in insured losses. On September 29, 2006, the National Science Board released a draft report entitled: *Hurricane Warning: The Critical Need for a National Hurricane Research Initiative*. The report recommended an increase of about \$300 million per year over current federal hurricane research funding levels. "The present federal investment in hurricane science and engineering research relative to the tremendous damage and suffering caused by hurricanes is insufficient," the report found. "Time is not on our side. The hurricane warning for our nation has been issued and we must act vigorously and without delay." NSF is accepting comments on the report until Oct. 29, 2006 (Press Release 06-138).

Damages during extreme wind events such as hurricanes highlight the weaknesses inherent in current building construction and underscore the need for improving the structural performance of typical buildings. Conducting research to better understand ***simultaneous hurricane wind/rain/debris-induced effects*** on the built environment will lead to innovative design technologies that mitigate hurricane wind damages. Current research at the International Hurricane Research Center (IHRC) at Florida International University (FIU) aims at *understanding extreme wind effects on low-rise buildings through full-scale, destructive testing by Wall of Wind apparatus*, which will lead to the development of hurricane mitigation technologies much the same way as the *automobile industry tackled the crash worthiness issue or the earthquake engineering community approached the general concept of full-scale shake table experiments*.

The successful testing with the Phase I Wall of Wind (WoW) (Figure 1a) funded by the *Florida Division of Emergency Management (FDEM)* has demonstrated proof-of-concept of full-scale destructive testing. This 2-fan system Wall of Wind can generate up to 120 mph winds and includes a water-injection system to simulate horizontally-flowing rainfall under hurricane conditions. FDEM research work includes *testing of soffits and roof tiles* (Figure 1b) under hurricane induced wind-rain effects. Industry has already recognized the enormous potential of the full-scale testing capability of the Wall of Wind. *Renaissance Reinsurance Holdings Ltd. (RenaissanceRe)*, which is the largest re-insurer

of hurricane-prone areas in the world, has provided funding to IHRC to build a more powerful, *6-fan Phase II WoW* that can generate up to a *140-mph wind field*. Currently the IHRC research team is assembling the Phase II WoW (schematic shown in Figure 1c) that consists of six fans powered by fully assembled Chevrolet ZZ502 Big Block Crate Engines. The wind field for this Phase II system will be 24 feet wide and 16 feet high, thus it can engulf a full-scale low-rise residential building. The Phase II apparatus is going to be commissioned in January 2007 and *testing will begin in February 2007*. The final phase for Wall of Wind with an 18-fan array (Figure 1d), will generate *up to a 160 mph wind field* (45 feet wide and 25 feet high) associated with rain and flying debris.

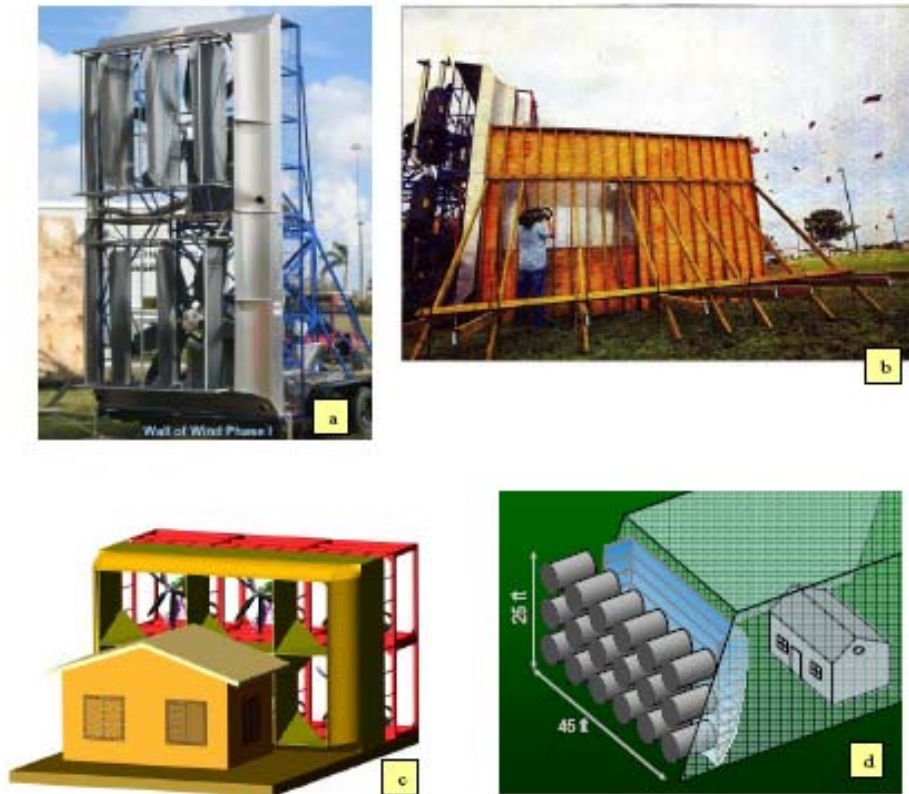


Figure 1. (a) Phase I Wall of Wind Apparatus, (b) Full-Scale Roof Tile Testing, (c) Phase II Wall of Wind Apparatus (RenaissanceRe WoW), (d) Phase III Wall of Wind Apparatus