From Destruction, Creation:
Texas Tech Researchers Build Upon Devastation from Deadly Lubbock Tornado

It seemed like a beautiful spring day on the South Plains of Texas. Warm and clear, no one expected or forecasted the life-changing atmospheric events that quietly brewed in the skies that May 11, 1970.

Clouds built. Rain and then hail, followed by an 8 p.m. tornado watch. By 9:47 p.m., a mile-wide F-5 twister landed in the downtown area of Lubbock and cut an eight-mile swath of destruction toward the Hub City’s airport.

More than 500 people suffered injuries. In total, 13 women, nine men, three boys and one girl died from that tornado. Some estimated $250 million in damage.

As city, state and federal officials surveyed the area, so too did professors at Texas Tech University Faculty representing the university’s civil engineering department and atmospheric sciences group began thinking of ways to minimize the effects of severe wind events such as tornados and hurricanes on lives and structures.

For more than four decades, the study of wind at Texas Tech grown exponentially. Researchers have continued to examine how to mitigate the danger and devastation caused by severe winds. They’ve seen an idea for an above-ground storm shelter grow into a reality and an industry. Texas Tech created the first doctoral program in wind science and engineering and offers a Bachelor of Science in Wind Energy as well as a variety of graduate and professional development certificates. Faculty and staff provide leadership in technical, managerial and professional education for the future of the wind industry.

Groundbreaking research led to the development of the Enhanced Fujita (EF) scale, the measure now used to determine the strength of a tornado. Cutting-edge technology continues to be developed to study the impact of wind on structures. In the last decade, Texas Tech has expanded into the wind energy sector applying knowledge gained in wind hazard research to study how wind interacts with energy-generating wind turbines.

The National Wind Institute (NWI) continues its strong focus on the inherent link between engineering and atmospheric science in its wind energy research NWI’s wind research areas include engineers and scientists studying everything from the detailed characteristics of turbine inflow and wake flow, response, loading and performance to gearbox failure, power electronics and grid integration, as well as meteorologists improving wind power forecasting and resource assessment.
The NWI operates a 67-acre facility at Reese Technology Center. The institute’s director Daan Liang said that Texas Tech has focused on economists, lawyers, engineers, policy experts, cybersecurity experts and business professionals to broaden the organization’s expertise.

“NWI is a tremendous institute with a large collection of collaborative faculty, a unique suite of technical capabilities and facilities, a growing list of impressive public and private partners and educational opportunities that are unmatched anywhere,” Liang said. “NWI has an opportunity to significantly and positively impact society through innovative research, education and outreach focused on all things wind.”

Wind research includes areas of wind hazard mitigation, wind-induced damage, severe storms and wind-related economics. Work has improved building codes in hurricane-prone areas on the coast.

NWI houses some of the most innovative research labs in the country and has become the leading research facility of its kind, with a focus on testing wind speed resistance in relation to storm shelters.

Texas Tech’s debris testing facility was named to Popular Science’s “10 Most Awesome College Labs of 2013.” The facility consists of a pneumatic cannon capable of producing simulated wind speeds higher than 250 mph. The cannon launches different types of simulated wind-born debris in a controlled environment to provide valuable impact-resistance data. The cannon was instrumental in devising above-ground storm shelters for use in homes and other structures and was used to develop safety standards for above-ground shelters.

Another NWI facility is the VorTECH simulator, which uses eight large fans to suck up approximately 160,000 cubic feet of air each minute, while 64 strategically placed vanes surround the simulator to create rotation. VorTECH is able to simulate tornadic winds in the mid-EF3 range or lower. The force of the wind is measured by dozens of pressure sensors applied to structural models.

Texas Tech wind researchers took part in both phases of the collaborative nationwide project exploring the origins, structure and evolution of tornadoes called Verification of Rotation in Tornadoes Experiment2 (VORTEX2). This was the largest and most ambitious attempt to study tornadoes in history and involved about 100 scientists and 40 research vehicles, including 10 mobile radars.

Texas Tech used two observing platforms. The first, StickNet, represents an array of 24 durable tripoded observation stations, individually deployed in the path of tornado-producing storms to measure the temperature, pressure, humidity and wind. Originally put into the projected path of landfalling hurricanes, data collected from StickNet have had an impact on building codes in hurricane-prone coastal areas.

The second platform includes the two TTUKa mobile Doppler radars that make remote measurements of the horizontal and vertical structure of tornado cyclones.

Following the deadly tornado that hit El Reno, Oklahoma on May 31, 2013, Texas Tech research professor Ernst Kiesling testified before the House Science, Space and Technology Subcommittee on Research about the importance of stamping out the myth that only underground shelters are effective to escape tornadoes.

“Having to be underground to survive an EF-5 tornado is simply a falsehood that should be squelched,” Kiesling said. “We have all types of shelters available today that meet standards and guidelines, and provide near-absolute occupant protection from extreme winds, even an EF-5.”

Wind scientists at NWI pioneered work in above-ground storm shelters, such as the one pictured here that devastated parts of Moore, Oklahoma, in 2003. Beginning in 1974, researchers developed the first “safe rooms” that could be built into a closet. Texas Tech’s shelter work led to the development of specific criteria for constructing above ground shelters that are endorsed by FEMA. Texas Tech also was instrumental in the formation of the National Storm Shelter Association (NSSA) to ensure the highest quality storm shelters to protect people against tornadoes and hurricanes. Kiesling is the executive director of the NSSA.
Engineering Professor Serves 50 Years at Texas Tech University

A Texas Tech engineering professor was honored this April for devoting 50 years of service to Texas Tech.

Kishor Mehta's research of wind damage from tornado impact led directly to changes in the Fujita scale used to measure tornadoes, resulting in the Enhanced Fujita, or EF, scale. He was also part of the group that helped found what is now known as the National Wind Institute, known around the world for its research on wind energy and impact.

Mehta, a Horn Professor of Civil Engineering, arrived at Texas Tech in 1964 after earning his doctorate from the University of Texas and was immediately drawn to wind research.

A West Texas dust storm in 1968 put him and others on the path toward Texas Tech becoming a world leader on the subject of wind and wind damage. That dust storm, Mehta said, collapsed some of the light standards on the east side of Texas Tech’s Jones Stadium. Mehta began doing tests on the standards to determine their load, or how much wind force they could withstand.

Two years later, the event that changed Lubbock furthered their research when the tornado of 1970 swept through the city. That led Mehta to begin testing the wind load for various buildings.

“A lot of buildings collapsed or were severely damaged,” Mehta said. “Though we had no control over it, we thought it would be worthwhile to assemble the data to see if there could be more damage and the extent of the damage.

Today, in conjunction with his work at Texas Tech, Mehta is working for the National Science Foundation in Washington, D.C., as program director for Hazard Mitigation and Structural Engineering.

West Texas Mesonet Celebrates Opening of New Station

From its creation in 1999, the West Texas Mesonet (WTM) project recently celebrated the opening of Station No. 85 in the network.

The project provides free real-time weather and agricultural information for residents of the South Plains region of western Texas and eastern New Mexico.

WTM is an independent project started by Texas Tech, with a mission to provide accurate meteorological data for distribution across West Texas, including operational meteorology, agriculture, research and media.

The network provides meteorological observations from weather stations that provide real-time data including wind speed and direction at different levels, air temperatures at different levels, humidity and dew point, solar radiation, rainfall, barometric pressure and climate histories. Agricultural data include soil temperature and moisture.

SOnic Detection And Ranging (SODAR) units have been integrated with WTM to provide elevated measurements for high-resolution, short-term ensemble wind forecasts. SODAR is acoustic radar used to evaluate low-level atmospheric stability and wind characteristics.
“Following the chaos, parts of the city lay in ruins.”

National Wind Institute
www.depts.ttu.edu/nwi/index.php
nwi@ttu.edu

Daan Liang, Ph.D., P.E.
Interim Director, NWI
daan.liang@ttu.edu

Ernst Kiesling, Ph.D.
Research Professor, Executive Director of the National Storm Shelter Association.
ernst.kiesling@ttu.edu