

## Letter from the Interim Director



*Daan Liang, Ph.D., P.E., Interim Director, NWI.*

Every four years, wind engineers and researchers from the U.S. and around the world gather together at the Americas Conference on Wind Engineering (ACWE) to exchange ideas and to promote collaboration. This month, the University of Florida hosted the conference at Gainesville and it was a great success! A large group from Texas Tech University attended, including both current faculty, students and alumni.

I was so pleased to meet with alumni and colleagues like Dr. Paneer Selvam of University of Arkansas (who graduated in 1985) and Dr. Marc Levitan of NIST (who graduated in 1993). It speaks to the longevity of our wind program and its lasting impact in the research community.

During the conference, we submitted a proposal to host the next ACWE in 2021 and the board unanimously approved it! We are so excited about the opportunity and look forward to working with all of our faculty affiliates, staff, and students to bring this important conference home.

The National Wind Institute also had a big presence at AWEA Windpower 2017 at Anaheim, CA. You will find more details in this newsletter.

With three months left before the end of FY17, I'm happy to report that the total amount of our research awards stands at \$3.2m, exceeding the total for FY16 by 18%. All four major areas – wind energy, smart grid, severe storm, and wind engineering – are progressing well. The awards in wind engineering have more than doubled from last year.

As a side note, **Drs. Stephen and Audra Morse** will be leaving Texas Tech University for new positions at Michigan Tech University. On May 18<sup>th</sup>, NWI hosted a farewell BBQ for the Morse family where Dr. Stephen Morse was presented a plaque for his contributions and service to NWI over the past 18 years. Dr. Audra Morse was also recognized for her leadership while she served as Associate Dean of Undergraduate Studies in the WCOE and liaison to the NWI.

NWI staff, faculty, and students send our best through this transition and look forward to collaborating with MTU on future projects.

Thanks to all of our affiliates and staff who work so hard and make NWI successful.

**Go Raiders!**  
**Daan Liang, Interim Director**



*(Above L-R) - Dr. Stephen Morse (CECE) stands with NWI Interim Director Dr. Daan Liang at a farewell party for Drs. Audra and Stephen Morse.*

## NWI CO-FOUNDER NOMINATED FOR GLOBAL VISION AWARD



Above photo: (L-R): TTU Provost Dr. Michael Galyean and Dr. Kishor Mehta stand with TTU President Dr. Lawrence Schovanec during the award ceremony.

National Wind Institute (NWI), was recently nominated for the Global Vision Lifetime Achievement Award presented annually by the TTU Office of International Affairs.

According to the award letter, the award is "in recognition of an individual who has made extraordinary contributions to the internationalization of TTU through his or her many years of leadership in promoting international scholarship and teaching."

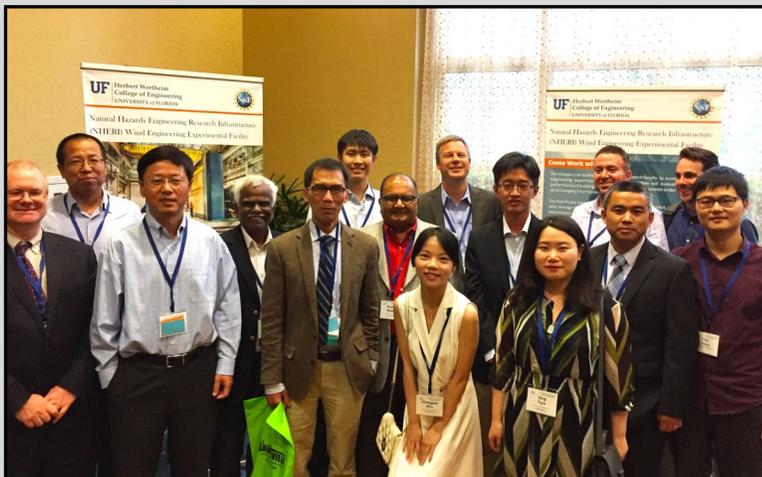
"Over the years at Texas Tech, I have been fortunate to be surrounded by excellent and caring colleagues, staff, and students," Dr. Mehta said. "This award is really for the team."

NWI Interim Director Dr. Daan Liang adds, "Dr. Mehta has made extraordinary contributions to the field of wind engineering and helped elevate the international reputation of Texas Tech University. I'm pleased with him being a finalist for this award."

Nominated by his peers, Dr. Mehta was one of two finalists selected by the members of the International Affairs Council, and the final selection occurred at the prize ceremony held on Monday, May 01 in the International Cultural Center's Hall of Nations.

## LARGE NWI TURNOUT AT ACWE 2017

Photo credit: Dr. Panneer Selvam.



(Above L-R): [Back row] NWI Interim Director Dr. Daan Liang, Dr. Panneer Selvam, Changda Feng (Ph.D. student), Dr. John Schroeder, Dr. Frank Lombardo (WiSE 2009), and Dr. Scott Gunter (WiSE 2017). [Middle row] Dr. Arn Womble (WiSE 2005), Dr. Xingzhong Chen, Dr. Delong Zuo, Dr. Kishor Mehta, Liang Wu (Ph.D. student), Dr. Zhuo Tang and Yan Jiang (Ph.D. student). [Front row] Chengjun Zhu (Ph.D. student) and Jingying Tian (Ph.D. student). (Not pictured are Dr. Marc Levitan and Dr. Richard Krupar III (WiSE 2015).)

There was a large contingent of faculty affiliates, students and alumni were in attendance at the recent Americas Conference on Wind Engineering (ACWE2017) May 22-24 in Gainesville, FL.

According to the website, the ACWE provides an opportunity for scientists, engineers, architects, educators and practitioners to discuss wind science & engineering. ACWE provides an opportunity for scientists, engineers, architects, educators and practitioners to discuss wind science and engineering.

NWI was represented by a large group of old and new faculty and students, and we were happy to reconnect with friends and colleagues once again.

# RESEARCHER RECOGNIZED WITH INNOVATION AWARD

*Text by George Watson, Office of Marketing and Communications, TTU.*

One of the biggest concerns when running parallel power electronic converters is to ensure the loads carried by the generators are shared in proportion to their power ratings.

**Beibei Ren**, an assistant professor in the Department of Mechanical Engineering at Texas Tech University, has been recognized with the 2017 National Innovation Award for the patent pending, “Robust Droop Control for Parallel Operated Inverters.”

The TechConnect Innovation Awards select the top early-stage innovations from around the world through a review process with rankings based on the potential positive impact the submitted technology will have on a specific sector of the industry.

“I am very pleased and honored to receive this innovation award, which recognizes the potential values of our technology disclosure in grid modernization with high penetration of renewable energy sources,” Ren said.

At Texas Tech, Ren leads the [Dynamic Intelligent Systems, Control and Optimization \(DISCO\)](#) research group. DISCO focuses on pushing the boundaries of control theory for systems with model uncertainties and external disturbances, and also exploring the impacts of control in broad applications, such as grid integration of renewables and unmanned aerial vehicles.

“Dr. Ren’s outstanding research and professional achievements demonstrate her exceptional breadth in the theory and applications of controls engineering and her multidisciplinary expertise in the development of power electronics and microdevices for mechanical systems,” said Oliver McGee, professor and chair of Texas Tech’s Department of Mechanical Engineering. “Providing a strategic way forward for Texas Tech’s academic and research quality requires exciting technological innovations disclosed by Dr. Ren, which serves to collectively raise the public’s understanding of the societal impact of science, engineering and technology not only across the Texas Tech community but also across the state of Texas, the nation and around the world.”

The popularity of renewable energies, such as wind and solar, and the ability to distribute them along the power grid, is growing at a very rapid rate. Normally, power inverters are adopted in these applications to interface with the utility grid, or microgrid. However, with the growing capacity of renewable energies, such as megawatt-level wind turbines and large-scale solar farms, power electronic devices face big challenges with the need for high current and high power.

Power inverters are required in parallel operation due to current and cost limitations of power electronic devices. Another reason for the need of parallel operation of inverters is to provide system redundancy and high reliability from the requirements of critical customers.

Power sharing based on droop characteristics is widely used in parallel operation of inverters. The conventional droop control is not able to achieve accurate power sharing among parallel units due to the mismatched output impedance. Also, system uncertainty and disturbances such as large or fast changes of the load, variations of output impedance and fluctuating DC-link voltage, often affect the power sharing performance.

All these challenges will be addressed by the technology -- Uncertainty and Disturbance Estimator (UDE)-based Robust Droop Control for Parallel Operated Inverters. It will provide a modification to the conventional droop control with advanced control algorithms.

The TechnConnect World Innovation Conference and Expo selected six submissions from TTU to be showcased by the TTU Office of Research Commercialization in Washington, D.C., a list that included representatives from TTU, TTUHSC-El Paso, GLEAMM technologies from the TTU Whittaker College of Engineering. The Office of Research Commercialization and GLEAMM were technology development partners of the conference.

The submission list also included work from **Dr. Stephen Bayne** (with Shelby Lacouture and Argenis Bilbao) about their start-up company, Energerix Engineering. This was also selected as a “TechConnect National Innovation Awardee” and the group presented their findings at the *Electronics and Innovation Spotlights with Panasonic, LG, and Energizer* session at the conference.

For more information on the TechConnect National Innovation Awards, visit its [website](#).



*(Above) - Dr. Beibei Ren, Assistant Professor in the Department of Mechanical Engineering.*

*Used with permission.*

## NWI HOSTS ELEMENTARY SCHOOL STUDENTS



NWI understands and supports the growth of young local scientists and researchers by leading tours through our innovative research facilities, including a recent visit from Lubbock's Bayless Elementary School (co-sponsored by the TTU Honors College).

More than 60 5th graders were able to share their enthusiasm and learn something new, thanks to the help of the whole NWI team, including Research Assistant Professor Larry Tanner who demonstrated the impressive Debris Impact Facility (which is always a fan favorite). Many thanks to the Bayless Elementary teachers and to Stacy Potet (TTU Honors College) for helping to make the visit a success.

## NWI CO-HOSTS PROBABILISTIC PROGNOSTICS AND HEALTH MANAGEMENT OF ENERGY SYSTEM WORKSHOP



NWI was recently proud to co-sponsor the 2nd Workshop on Probabilistic Prognostics and Health Management of Energy Systems (PPHMES 2017) from May 15-16 at the International Cultural Center on the TTU campus.

Focused on bringing international expertise together in order to address the prevailing issue of premature failure of energy systems and enhancing the prediction tools of remaining useful life (RUL), the conference brought world class researchers and scientists together from several different countries for superb networking opportunities, and a detailed tour of NWI's research facilities out at Reese Technology Center.

The conference covered four main topics: PHM for Off-Shore Energy Systems,

Internet-of-Things for PHM, Vibration-Based PHM, and Emerging Technologies on Sensing and Filtering.

The two-day conference was well organized by **Dr. Stephen Ekwaro-Osire**, Professor in Mechanical Engineering at TTU.

Thank you to all who were involved in making the event a success.



*If you are interested in having your latest scholarly endeavors featured in the next NWI newsletter, please forward your information (publications, proceedings, conference/workshop attendance, or other news etc.) to Liz Inskip-Paulk (email: [Elizabeth.paulk@ttu.edu](mailto:Elizabeth.paulk@ttu.edu)).*

## NWI GRANTS AND CONTRACTS — June 2017

*(NWI) CAREER: Thunderstorm Electrical Energy Structure, Dissipation, and Visualization*

National Science Foundation

<b>Eric C. Bruning</b> (Geosciences)	100%	\$107,794
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*NWI: TTU/Sandia National Laboratories Wind Farm 01/01/2017-12/31/2017*

DOE Sandia National Laboratories

<b>John L. Schroeder</b> (Geosciences)	45%	\$33,750
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<b>Ann Thomas Young</b> (National Wind Institute)	45%	\$33,750
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<b>Daan Liang</b> (Civil, Environmental and Construction Engineering)	10%	\$7,500
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*NWI: Benchmark Study of Tornado Wind Loading on Low-Rise Buildings with Consideration of Internal Pressure*

National Science Foundation

<b>Delong Zuo</b> (Civil, Environmental and Construction Engineering)	75%	\$262,501
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<b>Darryl L. James</b> (Mechanical Engineering)	25%	\$87,500
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*NWI: Pampa, TX, Climate Study*

Burns & McDonnell Engineering Company, Inc.

<b>Delong Zuo</b> (Civil, Environmental and Construction Engineering)	50%	\$31,978
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<b>Stephen M. Morse</b> (Civil, Environmental and Construction Engineering)	50%	\$31,978
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## WELLMAN-UNION HIGH SCHOOL STUDENTS VISIT NWI



Underscoring our commitment to local and regional communities, NWI was proud to host a great group of students from the Wellman-Union Independent School District (image on left) on a tour of our unique combination of wind research facilities at Reese Technology Center.

Thank you to the great group of students who traveled to NWI, and thank you to NWI team members who helped to make the tour a success!

*(Left) - Wellman-Union students and NWI DIF team members **Tanner Pletcher** (far left) and **Research Assistant Professor Larry Tanner** (far right).*

## NWI HOSTS U.S. FOREST SERVICE GROUP FOR FACILITY TOUR

NWI was proud to host a group of representatives from the U.S. Forest Service who were interested in learning more about wind turbines in the field to become more familiar with them in case of wildfire or another natural catastrophe.

Special thanks to **Mr. Jeff Livingston**, Assistant Director of Operations, and to **Research Assistant Professor Larry Tanner** for taking time to explain and demonstrate some of the intricacies of NWI's innovative wind research at Reese Technology Center.



# NWI MOVERS AND SHAKERS

- NWI co-founder and Horn Professor **Dr. Kishor Mehta** was recently featured in an episode of *Communicators in a Cart*, KTTZ's ongoing web series.

According to the website, the series takes its inspiration from Jerry Seinfeld's *Comedians in Cars Getting Coffee* and has a simple plot: Chris Cook, Managing Director of the Office of Communications and Marketing at TTU, straps into a little golf cart, grabs an influential communicator, and takes them out for a campus drive, sometimes to chat over coffee.

- NWI has now added a Giving button on to the Contact Us page to streamline the process for donations from our supporters, both here and abroad.

If you are interested in financially supporting NWI, please feel free to check this out or, for further information, please call **806-742-3476** and an NWI team member will be happy to assist you further.



- (Left image L-R) - **Drs. Kuangmin Gong** (WiSE alumni, 2014) and **Jason McNeill** (WiSE alumni, 2012), both now working for ABS Consulting, recently worked on the certification of the Block Island Rhode Island, the first offshore wind farm in the U.S.

The image shows both wind researchers on top of the GE Haliade wind turbine.

Dr. McNeill was recently in town to attend the 2nd Workshop on Probabilistic Prognostics and Health Management of Energy Systems held in May at the International Cultural Center on campus and co-sponsored by NWI.



Photo Credit: Dr. Jason McNeill.

- Dr. Maribel Martinez** (WiSE alumna 2009) has transferred to be the Director over the City of Fort Worth Emergency Management Program, and will start later this summer. She had previously been working in Consolidated Nuclear Security and Enterprise Emergency Management at Pantex near Amarillo. Congratulations, Dr. Martinez!
- NWI had a great turnout at the recent 13 Americas Conference on Wind Engineering held in Gainesville, FL during May 21-24.
- NWI has been so fortunate to have found and hired some great Student Assistants over the past few months. Three SAs recently graduated the other day at TTU's commencement exercises, and have moved on to other adventures.



Congratulations to all on another successful year of working and study. Have a good summer.

Image on right) - **Nestor Mancha** (B.S., Mechanical Engineering), **Claudia Dell Polla** (B.A., PR), **Eric Garcia** (B.S., Wind Energy), and **Alicia King** (who we're happy to have stay another year to complete her degree work in PR and Dance!)

# ABSTRACT ART MEETS ATMOSPHERIC SCIENCE

*Text by Sally Logue Post, Office of the Vice-President for Research, TTU.*

Lightning is beautiful, deadly and not well understood. Lightning is part of every thunderstorm, but meteorologists don't know where it forms in a cloud or how it acts once it has formed. **Eric Bruning**, Texas Tech associate professor of atmospheric science, has been chasing storms and answers to those questions for several years.

Bruning joined Texas Tech's Atmospheric Science Group in the Department of Geosciences in 2010. He believes that understanding how lightning works could help scientists predict where and when a massive thunderstorm could turn dangerous – a prediction that could save lives on the ground.

In 2014 he received a prestigious CAREER Award from the National Science Foundation (NSF). But his grant application wasn't all science, he turned to an artist to help him make his work more interesting and understandable to the lay person. The end result of the collaboration will be an exhibition at the Museum of Texas Tech University.

"An important part of the grant, from NSF's point of view, is how you will do active outreach and education, and I was interested in doing something a little bit outside the box," he said. "I've always enjoyed data visualization and looking at our data in graphical form. So I figured it would be interesting to work with someone who has a lot of experience working visually."

That desire to look at his science through a different lens led him to Tina Fuentes, professor of art at Texas Tech and nationally known artist.

Fuentes was director of the School of Art when Bruning first contacted her about finding an artist interested in working with him. When her first message to her colleagues went unanswered, she invited the scientist to her office to see if she could determine how best to help him.

"When Eric came into my office he started talking about lightning and he used words like color, line and texture," Fuentes said. "I thought to myself 'wait, you are describing art, you're using my vocabulary.'"

His use of vocabulary wasn't a coincidence. He suspected that Fuentes would respond to the word texture, a word used by artists more than scientists, and he was right.

"I think my charts and graphs and videos are pretty interesting, at least to me and other scientists," Bruning said. "But Tina's art demonstrates what lightning looks like when it fills a cloud in a very different way than my charts. She has stripped away the normal scientific trappings and captured the essence of the storm, and I think that's a very effective way to convey to the public what I as a scientist might not be able to get across in my ordinary scientific communication style."

With Fuentes on board, Bruning submitted his grant application, and within a few months was awarded funding for a five year project. With that notification it was time for the artist to enter the world of science.

"I looked at Eric's work, and I went to scientific meetings – I was the one who looked different," Fuentes said laughing.

"The first time I went to a meeting I thought 'oh my goodness,' but it was fascinating, though some people would look at me while I was at the back of the room taking notes."

Fuentes also sat in on Brunings' students' presentation and went storm chasing with them.

"I have looked at the heavens more than I ever have before," she said. "I bet I've taken more than 1,000 photos of cloud formations."



*(Above) - Abstract by Dr. Tina Fuentes.*

*Continued on page 8.*

## ART LIGHTNING COLLABORATION STORY *(cont'd from page 7)*

While her two-dimensional art is stunning, Fuentes wasn't quite satisfied.

"I was thinking: how can I best recreate the combustion I saw in the clouds? How can I make that visual? I really wanted people to see the stroke, not me making the stroke."

Inspiration hit one day when Fuentes was watching the weather on TV. She realized the green-wall technology used to project the image behind the meteorologist could work for her.

"I made a makeshift green wall in my studio and I wore a green suit," she said. "We were able to pull me out of the video and all you see are my paint strokes. Now that I had this idea, I didn't want to project the video on a flat wall. I had a small bundle of cotton in my office and one day I thought, that's it, I can use the cotton as a background for my video."

She visited Texas Tech's Fiber and Biopolymer Research Institute of the Department of Plant and Soil Science and asked them if they could give her some bags of cotton to build eight 5-by-4 foot panels.

"The cotton panels look gorgeous," Fuentes said. "The color of the cotton was a bit different from bag to bag."

Bruning is one of the few meteorologists who are studying lightning. Most scientists in that field are from a physics or electrical engineering background. Bruning is trying to describe how lightning fills a cloud.

"Everyone has seen lightning coming from the bottom of the cloud, but there is probably 10 times more lightning inside the cloud that you don't see," he said. "I'm looking at how the turbulence in the cloud ends up making very small flashes when it's really turbulent and very large flashes when it's smoother inside the cloud."

Turbulence is one of the most challenging scientific questions that remain unsolved, he said. Using lightning measures, which as of late have become much easier to obtain, Bruning believes that if he can relate how lightning behaves in a cloud to the turbulence in the storm, there is a possibility of addressing some of those long-standing questions.

"The more turbulent the storm, the smaller the lightning flashes because they are being stirred around more, like in a cup of coffee when you add creamer," he said. "You can see a texture to that, and the lighting channels follow that structure."

The result of Bruning's work could combine with the radar images scientists use now to predict severe storms and improve public safety warnings.



*(Above) - Eric Bruning's research focuses on understanding how lightning works within a thunderstorm and how that could help scientists predict when a storm will turn dangerous.*



*(Above) - Tina Fuentes hit upon the idea of using cotton as a background to stimulate clouds. Using green-screen technology, she removes herself from a video of her painting so that all remains is the image of her paint strokes over laid on cotton.*

The National Oceanic and Atmospheric Administration (NOAA) has recently launched a new weather satellite that for the first time has a lightning mapping instrument. Before coming to Texas Tech, Bruning worked with NOAA's satellite program.

"The new satellite allows meteorologists to see lightning flashes day or night," he said. "If there are a numerous thunderstorms in an area, the question becomes how to tell which one is the most dangerous. If we can better understand how the turbulence of the storm is affecting lightning, then maybe we can use that to determine which storm is the one that could become most dangerous by looking at what is happening with the lightning."

## ART LIGHTNING COLLABORATION PROJECT *(cont'd from p. 8)*

After a couple of years working together, the scientist is convinced that the artist is capturing what he is seeing in the clouds.

"There is a degree of realism in the texture Tina's capturing and how her brush strokes fill the space," he said. "Science is always trying to distill complicated things down to their essence and I think that Tina's doing that as well. She's distilling the clouds and the lightning into these sort of abstract forms that end up being very powerful because you have to focus on the essence of what's happening instead of focusing on the realistic look of it."

The art may not directly help Bruning answer scientific questions, but he hopes it will help lay people better understand the research.

"Tina has stripped away the normal scientific trappings and captured the essence," he said.

In addition to an exhibition at the Museum of Texas Tech University later this year that will combine his science with Fuentes' art, the two are setting up presentations to high schools in the South Plains area that will involve Bruning's graduate students.

Fuentes says she hopes the exhibit and the presentations will reach students in a new way and inspire some to look more seriously at the research within the arts. For Bruning, the collaboration has proven to be a new recruiting tool for graduate students.

"I think young scholars respond to the idea of interdisciplinary work, and it gives them one more reason to look at Texas Tech for graduate school," he said.

Both the artist and the scientist hope their collaboration spawns new partnerships.

"NSF loved the idea," Bruning said. "I think the program managers were excited, but also maybe a little bit nervous because this was a bit outside what they typically fund. Lightning is pretty and that's what's great about working with an artist, she can convey the beauty and help me communicate the science at the same time."

*For original story see [here](#). Used with permission.*

## AWEA WINDPOWER 2017



AWEA's WINDPOWER Conference was held recently in Anaheim, CA, from May 22-25. The leading wind energy conference was well attended by TTU NWI representatives included (above photo L-R) NWI's Associate Director for Education, **Dr. Andrew Swift**, advisor **Maggie Gilchrest**, BSWE instructor **Dr. Arquimedes Ruiz-Columbie**, BSWE undergraduate students **Emily Johnson**, **Giulio Danino**, and **Gavin Bigler**, BSWE Instructor **Andrew Buchok**, Not pictured: Interim Director **Dr. Daan Liang**, **Dr. Anant Jain** (WiSE 2014), and Ph.D. doctoral student **James Duncan**.

# RESEARCHERS RECEIVE NSF GRANT TO STUDY TORNADO DAMAGE ON LOW-RISE BUILDINGS

*Text by George Watson, Marketing and Communications, TTU.*



*(Above L-R) - Dr. Darryl James (ME) and Dr. Delong Zuo (CECE).*

Out of the Lubbock Tornado of 1970 grew what would eventually become the [National Wind Institute](#) (NWI) at Texas Tech, which has propelled wind-related research on a monumental scale both in terms of understanding wind and its potential impact on humans and structures.

Thanks to the research efforts of those in the NWI, the Enhanced Fujita (EF) scale was developed to measure the destructive potential of wind from tornadoes. Researchers have also investigated the effects on buildings and how to make them safer and less susceptible to wind damage through the use of VorTECH, the second largest tornado simulator in the world. With the 47th anniversary of the Lubbock tornado approaching, researchers in

the NWI received a substantial grant from the National Science Foundation (NSF). The \$350,001 grant will allow [Delong Zuo](#), an Associate Professor in the Department of Civil, Environmental and Construction Engineering, and [Darryl James](#), a Professor in the Department of Mechanical Engineering, to study tornado loading on low-rise buildings.

“Tornadoes are among the most devastating natural hazards,” Zuo said. “This NSF grant allows us to use VorTECH to advance the understanding of tornado loading on low-rise structures, such as residential and school buildings. Results from the research can be used to develop more tornado-resistant building designs and potential mitigation strategies for existing buildings. This ultimately will lead to reductions in the damage and fatalities during tornadoes.” Zuo said recent tornado-related events across the country have resulted in tremendous damage to structures and fatalities. Much of the damage has been done to homes and other low-rise buildings. A critical factor contributing to that damage is the fact that many of those buildings are designed only for straight-line winds traveling along the earth’s surface and not the rotating winds from tornadoes that lead to severe damage.

He added there is also an inadequate understanding of tornadoes and tornado wind loading on structures. That is where this research comes into play. Zuo and James will attempt to formulate computational models that can be used to assess the impact rotating tornado winds could have on low-rise buildings, giving researchers a performance-based evaluation of low-rise buildings and their susceptibility to wind damage, thus showing them ways to reduce damage and fatalities.

“This award is built upon innovative ideas of Drs. Zuo and James as well as world-class facilities of the National Wind Institute,” said NWI Interim Director [Daan Liang](#). “It adds to an expanding list of externally funded projects focused on tornado characteristics and risks at Texas Tech University.”

Researchers also will use VorTECH to test models with different types of roofs in various tornadic conditions and the NSF-supported Natural Hazards Engineering Research Infrastructure (NHERI) facility at the University of Florida to test those models in simulated straight-line winds to provide two distinct base data sets. That will give researchers the ability to study the differences between tornadic and straight-line wind; the impacts each have and the best ways to enhance building construction to withstand those winds.

“Twisters have simultaneously instilled fear and fascination for decades,” said Guy Loneragan, Interim Vice President for research. “Yet despite the history of inquiry into this destructive weather phenomenon, solutions that improve structures and keep us safe are needed. The cutting-edge work of Drs. Zuo and James will provide transformative information that will ultimately lead to solutions that protect us all.”

The research and its findings also will be integrated into several educational and outreach programs, such as courses within the NWI’s [wind science and engineering doctoral program](#), the 4-H mentoring program, science camps and the annual Severe Weather Awareness Day in Lubbock, as a way to raise awareness of the impact of tornadoes and other natural disasters.

*Used with permission.*

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## CALENDAR — July 2017

### July 09-13, 2017

*Run on the Wind* (ROW) Summer Camp for Rising 6th-8th Grade Students. [On-line registration is here.](#)

Ensuring the growth of this clean energy source is largely dependent upon creating a competent well-education workforce, and *Run on the Wind* provides young scholars with an introduction to the field of wind science and an opportunity to consider wind science as a future academic pursuit. (This is a collaboration with TTU's IDEAL program.)

### July 09-14, 2017

*Generation Tech: Fuel the Future* Summer Camp for Rising 9th-12th grade students. [On-line registration is here.](#)

Ensuring the growth of clean, renewable energy sources is largely dependent upon creating a competent well-educated workforce. Generation TECH will provide young scholars an introduction to the field of renewable energy and an opportunity to consider renewable energy technologies as a future academic pursuit.



Photo Credit: The Daily Telegraph.