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Wind energy research and economic development will be made possible through the Great Plains Wind Test Facility at Reese Technology Center, run by Andy Swift and Jamie Chapman.

A WORD from THE WISE

Texas Tech University is poised to take a leadership role in the development of wind power systems through research, economic development, job creation and education. Congressionally earmarked funds of $1.5 million will establish the Great Plains Wind Test Facility at Reese Technology Center. The funds allow the expansion of the Wind Science and Engineering Research Center's facilities for testing, characterization and improvement of wind turbines and wind-driven water desalination systems.

The money will be used to create applications that will integrate wind energy into municipal power grids; to pump and desalinate water using wind energy; and to develop the software needed to interface the variable power supplied by wind with water pumping and desalination facilities. Community colleges, such as Texas State Technical College, will benefit from curriculum development in implementation in the training of wind technicians, or "windsmiths."

The Wind Science and Engineering Research Center will upgrade its facilities at the Reese Technology Center for detailed atmospheric measurements. "We are establishing a unique, world-class wind measurement facility. We are looking into advanced wind measurement systems, such as Doppler radar and other advanced, sophisticated measurement systems," says WISE Director Andy Swift. "Our objective is to carefully characterize the wind, with a focus on extreme wind events and feed that high fidelity wind data in real time into an advanced wind turbine computer model that will provide the performance and structural loads that result.

The demonstration aspect of the project is for the integration of wind turbines and water desalination mechanisms in a West Texas community. Texas Tech will begin with a 5-kilowatt wind turbine, and then will move to 50-kilowatts, 500-kilowatts and eventually to the utility-scale 1,500-watts. Each megawatt is enough power to provide electricity to approximately 300 homes. "We will start with a 5-kilowatt wind – water system, which will provide about the output of a small garden hose. Using this bench scale system, we will develop the integration technologies leading to larger utility scale systems," Swift says.

The 12 states that reach from the Dakotas to Texas have the most potential wind energy than all the other contiguous United States, and Texas soon will surpass California as having the largest installed wind power capacity in the country. "In Lubbock, we are in the middle of several large wind farm installations. Texas is very progressive and business-friendly, and the people generally have a can-do attitude," says Jamie Chapman, senior research faculty member with WISE.

> "We are establishing a unique, world-class wind measurement facility."

Chapman also notes that Texas Tech University is working with the University of Houston in the early stages of a consortium that will deal with offshore wind turbines in the Gulf of Mexico. "We have the offshore oil expertise here in terms of materials, logistics and a population that is not averse to the energy infrastructure. The economics of wind are attractive. When we look at the economics of reverse osmosis water purification systems, we find a symbiotic relationship in that wind and water feed into one another," Chapman says. "A third component is that municipalities that are dealing with a depleted Ogallala Aquifer already have water distribution, pre-treatment and water storage systems in place." •

CENTER showCASE

Years of hard work and a plethora of research paid off in a big way for Texas Tech University's Electrical and Computer Engineering Department and Associate Professor James Dickens, Ph.D., as Dickens was one of only two recipients of the Texas Tech Chancellor's Council Distinguished Research Award. The honor, which entails a $10,000 cash award, is a reflection of the quality of the Texas Tech University faculty and the impact of the engineering research that was completed last year.

Dickens is internationally renowned in his research efforts that are focused primarily on pulsed power and high powered electronics. The area of pulsed power research involves storing, shaping, transmitting, and measuring high voltage, high current pulses of electrical energy measured in time scales of billions of a second. Pulsed power research at Texas Tech began in the early 1970s under the leadership of Horn Professor Magne Kristiansen with studies in controlled thermonuclear fusion. These early investigations led the way for a more advanced understanding of the physical phenomena of pulsed power technology. In the past couple of years, Dickens has used his knowledge in the pulsed power field to aid research with military improvised explosive devices, or IEDs. The technology essentially can disable and render the IEDs useless through very short and powerful bursts of electrical power.

Dickens also specializes in research involving high power microwaves (HPMs), where he experiments with microwave sources up to and exceeding one gigawatt of power. In his work with compact explosive pulsed power, he and his team use explosives to produce high powered bursts of radiation. This research is important to many fields, including nuclear fusion, electromagnetic mass drivers, nuclear weapons effects, lightning simulations, laser drivers, high power microwave generators, particle accelerators and industrial manufacturing technology.

Dickens' research is funded by the Department of Defense, the Department of Energy, and many major U.S. defense contractors. In 2005, Dickens exceeded $1 million in funding levels, and in the six years he has been at Texas Tech, he has received more than $5 million in research grants. Dickens racks up a significant list of research contributions to the university including numerous publications in national journals. His work with seven graduate students also helped him gain recognition in 2005. Each of his graduate students assists in various sectors of his research from pulsed power to microwave communication systems.

In 1966, the Center for Pulsed Power and Power Electronics, also known as the P³E Center, started as a plasma research group at Texas Tech. The work of the research group, which began with harmonic ion cyclotron resonances in small mirror machines, laser heating of magnetized plasmas, and pellet injection in hot plasmas, since has evolved into a heavily interdisciplinary program and involves faculty members from several academic departments across the campus.

James Dickens was awarded the Chancellor's Research Award for his work in pulsed power and high powered electronics.

Transportation engineering teams are directed by Frank Liu (center).

NEW faculty SYNOPSIS

The very basis of the transportation infrastructure within a country depends on highway engineering that makes the movement of people and goods safer and efficient. Hongchao (Frank) Liu, assistant professor of civil engineering, is directing the transportation engineering program at Texas Tech University, addressing subjects such as highway engineering and water, rail and air transportation. The field involves highway design, highway safety, operations and management, and public transportation. "In recognition of its important role in the nation's economy, transportation has been heavily funded by the government," Liu says. "The proposed funding for improving our present highway system and making it safer and more efficient is $244 billion over the next five years."

With several projects underway, Liu has received funding from the Texas Department of Transportation. Liu also is leading research in hardware-in-the-loop simulation in cooperation with the University of California, Berkeley, and the University of Arizona. "This research is particularly exciting to me because through these advanced simulations, we can learn and correct various common problems that burden our loop systems. We hope to generate adequate solutions to unique problems."

The project is funded by the California Department of Transportation. At the local level, Liu and his colleagues have been working closely with the city of Lubbock's Department of Traffic Engineering to install traffic detection devices at intersections for monitoring traffic conditions and for collecting data. Liu's goal is to find solutions to Lubbock's traffic problems and its number of fatal and serious automobile accidents.

With these achievements, Texas Tech is gaining recognition on federal, state and local levels for its research into transportation engineering. With support from the College of Engineering and the Department of Civil Engineering, Liu's TRANSTECH traffic engineering lab has grown since its inception in 2004 to a research entity with five full-time graduate students.

"Transportation engineering is a very significant field of study, and students need to realize the urgency and importance of making our roadways safer and more organized," says Liu. "Transportation plays an important role in our economy, environment, community and quality of life."

SPOTLIGHT on STUDENTS

With a program consistently ranked among the top in the nation for petroleum engineering, Texas Tech's College of Engineering has a valuable test oil well that helps to train students in an economy that demands such workers. Lloyd Heinze, professor and chair of petroleum engineering, says that Texas is the number one producer of oil in the United States.

"West Texas is crucial because the region produces 20 percent of all the oil produced in the United States. For our oil well to be situated on such a strategic plane is very exciting and convenient," he says. A dream of Chris Cox and James Lee, former faculty members in the college, the test oil well took years to plan and a great deal of time and patience to implement. Texas Tech University funded the entire project, while several major oil companies, such as Halliburton and UTI Patterson, provided equipment for the test oil well.

With Texas Tech suitably situated on the edge of the key oil producing Permian Basin, the test oil well sits 4,000 feet deep east of Loop 289 between 19th and 4th streets, just 20 minutes from campus. "This well is not like your conventional oil producing well," says Heinze. "It has more sophisticated equipment for data research and analysis, and we run several tests in this controlled environment to learn more about oil production and ways to improve it. Also, even though this well sits on a potential oil bed, that bed is still another 1,000 feet deep, and therefore we haven't as yet produced any oil in our well."

College of Engineering undergraduate students are involved with the test oil well research through a junior-level class in drilling and pumping. "Through field expeditions, students gain valuable experience, and along with their class work, they come to understand petroleum engineering concepts better," says Heinze.

Researchers currently are investigating sucker-rod pumping. "The majority of oil wells in the world are on sucker-rod pumping, and the electric bill to run this setup is literally millions of dollars a month," Heinze says. "With our research, we hope to make improvements on the efficiency of sucker-rod pumping and to try to save these companies some percentage of their electrical costs." •

Lloyd Heinze (center) and his students work at the test oil well facility.

FEATURE faculty PROFILE

A woman in a male-dominated field, Jharna Chaudhuri, professor and chair in the Department of Mechanical Engineering, came to Texas Tech University in January 2005 after serving for 20 years as faculty and the last three and a half years as chair of the mechanical engineering department at Wichita State University in Kansas. Chaudhuri has received the competitive National Science Foundation Grant that supports her research, which includes the exploration of defects in electronic materials including wide band gap semiconductors using high resolution transmission electron microscopy.

The next generation of DVD players, the Blue Ray Disc, uses lasers based on wide band gap semiconductor materials. The blue-ray disc is a high-capacity, rewritable optical disc that holds two hours of high-definition video or 12 hours of standard video, she explains.

Jharna Chaudhuri is encouraging women to enter into the mechanical engineering field.

Mechanical engineering, the largest department in the College of Engineering, consists of 800 undergraduate students and 50 graduate students. Chaudhuri was attracted to Texas Tech because of the university's and department's sizes and aims to uphold the already established undergraduate program and to improve the graduate program and research. She would like to see Texas Tech's department recognized as a top research and graduate program and to become the preferred university of mechanical engineering students throughout Texas.

Mechanical engineering graduates might pursue careers in higher education, but many other options are available for exploration including jobs in aerospace, automotives, petroleum production, electrical power, manufacturing, and production, among others. "Our students get excellent job placement throughout Texas," she says, "mostly in Houston and Dallas, but they also get jobs in surrounding states."

Chaudhuri ultimately would like to see the participation of women in mechanical engineering increase and has begun her efforts by planning to visit local schools. "I would like to see 50 percent women students and more women faculty members," she says. "My plan is to go to middle schools and high schools to educate students about science and engineering, especially young girls.

Jamie Armstrong, a graduate student, explains that a Go Girl Engineering Fair involves activities like building a model of Scandium Nitride. •

Graduates at a Glance

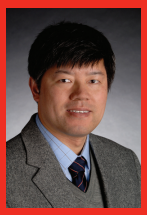
Graduate students Robert Watson and Justin Blount are working with computer science researchers and NASA to produce software that is particularly important to space flight because the distances involved in traveling are detrimental to the communication with mission control. Johnson Space Center's Guidance, Navigation and Control organization has teamed up with Texas Tech University's College of Engineering to develop an onboard shuttle abort flight management system for its new Crew Exploration Vehicle. Daniel Cooke, Ph.D., professor of computer sciences, began 15 years ago the design of a very high-level language, named SequenceL, which serves as the framework for the Crew Exploration Vehicle's Onboard Abort Executive software prototype. Watson has relocated to Houston for the six-month period to collaborate with NASA researchers. "Robby is really playing a key role in uncovering this detailed information that is ultimately impacting some revisions we're making to the language," Cooke said.

The shuttle abort flight management system will help determine the best abort method for the crew as well as the most suitable landing site for the vehicle. •

New Doctoral Degree

Texas Tech University is pleased to announce the recent approval of a doctoral degree in Systems and Engineering Management (Ph.D. SYEM). The program builds on a very successful Master of Science in SYEM program begun in 1998. Both programs are designed to meet the needs of engineering management professionals in the state of Texas and are offered both by distance and in-residence on the Texas Tech campus. The programs, administered through the Graduate School, College of Engineering and Department of Industrial Engineering at Texas Tech, are directed by Mario Beruvides, Professor of Industrial Engineering. •

New faculty members



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