ANNUAL REPORT 2014

Powering Engineering Education and Research

COLLEGE OF ENGINEERING

UNT

MESSAGE FROM THE DEAN

Dear friends of UNT Engineering, welcome to our 2014 annual report.

Our Engineering programs have a long history of exploring issues related to the environment and to energy, so, this year we have decided to focus our report on related activities that are taking place in our College: from organizing an outreach event for girls grades 6 to 12 that included solar and fuel efficient car projects to a senior-designed solar boat that participated in the Solar Splash Competition; from research in low-power electronics to work in Stirling engine technology; and from projects in environment-energy relations to advances in renewable biocomposites. You will read about these and many other projects from our students and our faculty in this annual report.

You will also learn about two of our alumni, who graduated years apart and were both engaged in energy-related projects, demonstrating the continuity of UNT's commitment to sustainability: Lee Palmer, a 1990 graduate from the then Department of Industrial Technology (now Engineering Technology), who was part of a team of UNT students who built and raced a solar-powered vehicle in the 1,800-mile GM Sunrayce in 1990; and Jared Fiorentine, a 2011 graduate from the Department of Mechanical and Energy Engineering, who upon graduation received a Fulbright grant to study concentrated solar power systems in Chile.

Energy is not only a fertile research area for our faculty, but it is also what permeates the College of Engineering and fuels its continuing growth. While reading this report, you will learn about the new Department of Biomedical Engineering that offers BS and MS degrees, the recently established Ph.D. in Mechanical and Energy Engineering, the five faculty members who joined us last year, the brand new nanofabrication cleanroom and the 30,000 square feet of new wet and dry labs that go with it, our latest student to receive the prestigious Graduate Research Fellowship from the National Science Foundation, and many other accomplishments.

The UNT Dance Team stopped by the College of Engineering tent for a group picture before the UNT vs. Southern Methodist University on Sept. 6, 2014.

The Solar Foundation's 2014 National Solar Jobs Census states that the solar industry is expected to exceed growth expectations, and the U.S. Department of Energy's Wind Vision Report foresees a robust wind energy future. These reports indicate that these industries are on track to create thousands of new, highly skilled jobs throughout the country. The College is ready to be a part of this growth through education, partnerships with industry, and collaboration with energy research leaders across the globe. I look forward to hearing your ideas on how we can work together to meet our nation's current and future energy needs.

WHAT'S INSIDE

UNDERGRADUATE EDUCATION

FEATURED UNDERGRADUATE RESEARCHERS

From June 15-28, 2014, four Mechanical and Energy Engineering students – Anirudh Nagasimha, Brittani Powers, Richard Roberts and Stephen Watts – went to China with Dr. Yong Tao, Chair of the Department of Mechanical and Energy Engineering as part of their summer course requirement to study alternative energy and sustainable building technologies. This China Learning Program, which was offered for a second time at UNT, included guest lectures from leading faculty at UNT's partner institutions of Tongji University in Shanghai, Beijing University of Technology in Beijing, and Southeast University in Nanjing. In addition, students visited and toured research facilities at the North China University of Science and Technology in Hebei Province and the International Center for Bamboo and Rattan in Beijing. Students engaged with local Chinese students in completing their lab projects related to solar energy utilization, green campus data monitoring and analysis, and occupant-behavior-influenced building energy consumption patterns.

Human-powered transport is often the only type available in underdeveloped or inaccessible parts of the world, and if well designed, can be an increasingly viable form of sustainable transportation. Two Senior Design teams worked on building a vehicle to compete in the Human Powered Vehicle Challenge hosted by the American Society of Mechanical Engineers (ASME) in April 2014. One of the teams, consisting of students Oscar Angulo, Folabi Daramola, Matt Linn, Stafford Milton, and Thiri Mon, built a test platform with the ability to fine tune key design elements based on customer needs. The second team, consisting of Eric Ryan, Craig Seykora, Samir Essiyad, Jordan Grazden, and Aboubakre Benhaddou, decided to design a tadpole like vehicle, with two wheels in front and one drive wheel in back.

Brothers Casey and Jesse Stauffer seek to reinvent social networking with their new app Bitzy. Casey, a junior, and Jesse, a sophomore, are both studying computer science and with their fourth venture into social networking, the two are seeking to return social networking back to what it is imitating – actual human interaction. Bitzy is unique in that the status updates and pictures uploaded to a user's profile expire within a set time, between 5 seconds and 5 weeks at the user's discretion. This feature is what keeps all of the information on a profile new and relevant. In another effort with the help and funding from Dallas Mavericks owner Mark Cuban, Jesse recently released Xpire, an application for iOS devices that helps users manage their digital footprints on social media.

"We put two semesters into this project, so it is really great to see it working. Even after Senior Design Day, we'll still continue to develop the system."

– Adriana Blanco
Electrical Engineering undergraduate

Beginning in 1994, the Solar Splash Competition involves racing solar powered boats designed by interdisciplinary groups at the university level. Participants come from around the world to compete in this race. The Mean Green Solar Team, representing the University of North Texas, constructed a solar powered boat for the competition.

To successfully construct a solar powered boat, the following electrical systems needed to be included: solar panels, battery system, motors, data acquisition, communication system, and an effective energy management system. In addition to the electrical system, mechanical systems, such as the hull, propellers, drive-train, and steering, had to be developed simultaneously to create a working solar boat system.

The team presented their work on April 25, 2014, during Design Day. Representing the Mean Green Solar Team were (from left to right in the photo) Adriana Blanco, Emma Zemler, Thomas Deshefy, Josh Brittain, Glenn Sapien, Leonel Mendez, Thomas Tracy, Keith Rommel, and Bernardo Rivera.

"This team has put together an awesome craft," Zemler said during Design Day. The team "has come together to race in the competition."

The University of North Texas competed at the 2014 Solar Splash Competition, June 11-15, 2014, in Dayton, Ohio. The team placed 4th for its technical report, 9th place overall and received the Design Achievement Award for the team's system integration with super capacitors.

GRADUATE EDUCATION

FEATURED GRADUATE RESEARCHERS

Jessica Rimsza, a graduate student from the Materials Science and Engineering Department (MSE), won first prize in student poster contest at the U.S.-Germany joint conference on glass and optical materials held in Aachen, Germany, in May. At the conference, she presented findings on water/nanoporous silica interactions from ab initio molecular dynamics simulations. The results provide fundamental understandings of glass-water interactions and reactions that are critical to the corrosion and chemical durability of glass materials for various technological applications.

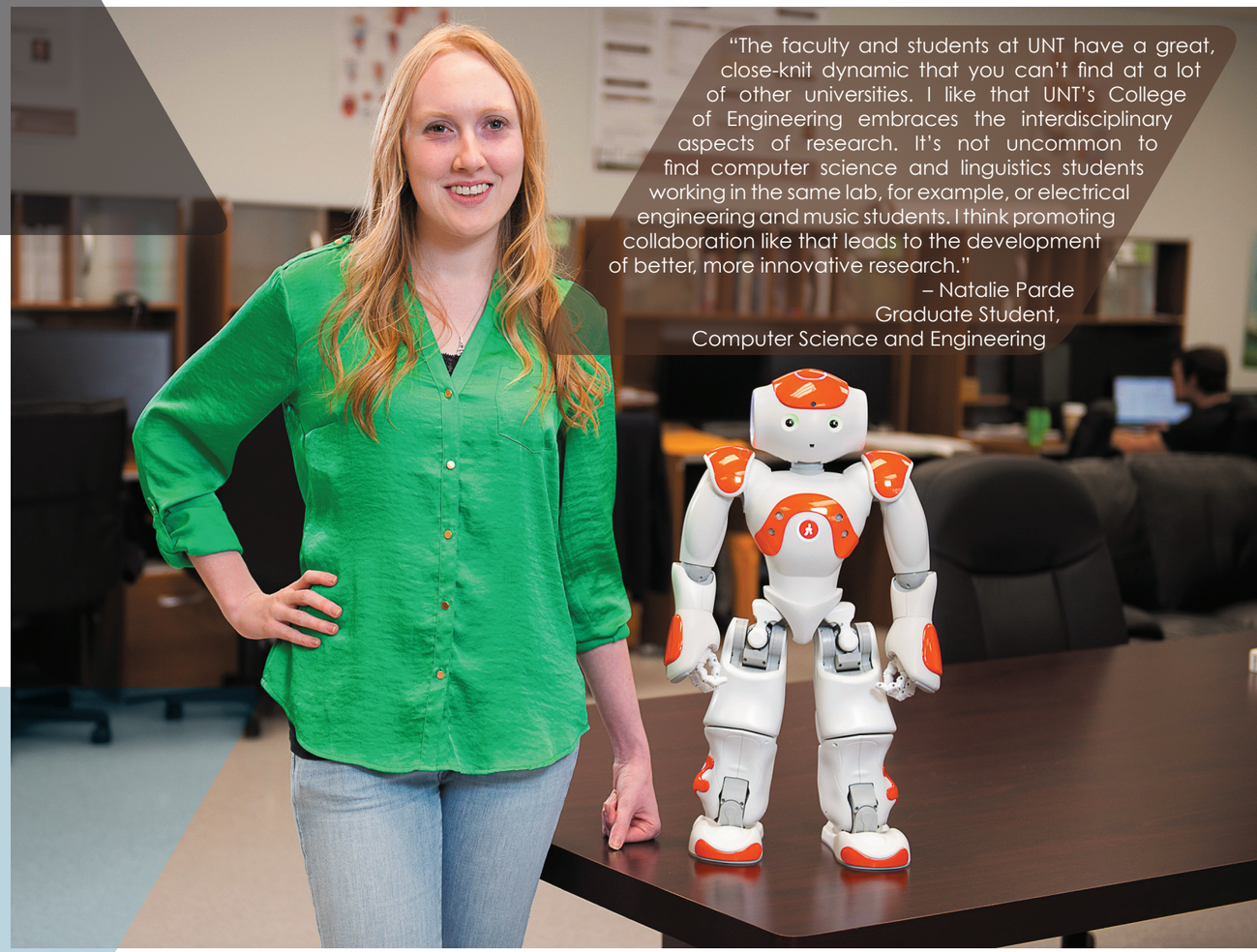
Working under the direction of Dr. Marcus Young, graduate student Matthew Carl is working with Dallas Museum of Art characterizing objects from the Jewel Stern American Silver Collection by means of nondestructive testing.

The museum has more than 400 American silver and silver-plated pieces from the late 19th century and 20th century. The makers often kept their manufacturing processes closely guarded secrets, and many are no longer in business.

To help the museum and current manufacturers know more about these processes, Young and Carl developed a novel technique using a focused ion beam system, which allows for the examination of a microscopic cross-section of the object.

Two UNT Computer Science and Engineering graduate students and one undergraduate student reaped awards at the first-ever LeadingAge HackFest Oct. 25 - 27, 2013, in Dallas for designing technological tools that can be used to improve the lives of older adults.

David Adamo Jr., a doctoral student in computer science, and his four teammates from other universities clinched first place with a videoconferencing app that allows seniors to connect with others even if they can't leave their homes. Quentin Mayo, a student working on a doctoral degree in computer science, and Mahsa Kia, an undergraduate studying computer engineering, served on the four-person team that earned the People's Choice Award for creating a tool that sends a text message when a senior takes his or her medication.



"The faculty and students at UNT have a great, close-knit dynamic that you can't find at a lot of other universities. I like that UNT's College of Engineering embraces the interdisciplinary aspects of research. It's not uncommon to find computer science and linguistics students working in the same lab, for example, or electrical engineering and music students. I think promoting collaboration like that leads to the development of better, more innovative research."

– Natalie Parde
Graduate Student,
Computer Science and Engineering

Natalie Parde, a graduate student in the Department of Computer Science and Engineering, won a National Science Foundation Graduate Research Fellowship for her work researching natural language processing.

Parde will receive $32,000 per year for up to three years as part of the research fellowship, which also includes three years of NSF support, a $12,000 cost-of-education allowance to UNT for each supported year, access to the XSEDE Supercomputer, and international research and professional development opportunities.

"This fellowship is huge for me," Parde said. "It'll let me pursue my research interests with the amount of freedom and flexibility not normally afforded to researchers still working on their doctoral degrees, and it will allow me to have a deeper understanding of the overall research process, from the proposal to planning experiments and submitting progress reports to the National Science Foundation."

Natural language processing makes it possible for computers to understand how humans talk and write. Parde's research involves tapping into the educational side of natural language processing to develop tools that teachers, students and others can use to learn more while using computers.

Parde attended UNT for her undergraduate degree as well, and plans to continue researching natural language processing in the future, she said.

OUTREACH

COMMUNITY AND INTERNATIONAL OUTREACH

The UNT Division of Community Engagement and the Colleges of Arts and Sciences, Education and Engineering hosted two "UNT STEM Nights" at LaGrave Field, home of the Fort Worth Cats. The support of Lockheed Martin enabled UNT alumni, students, faculty, staff, and friends to enjoy two fun evenings of Cats baseball and networking on July 19 and Aug. 1, 2014.

A group of UNT faculty and staff traveled to Mexico for an enriching time of discovery and professional growth through the 2014 Faculty Abroad Seminar (FAS). FAS, a 10-day professional development seminar, is sponsored by UNT-International in collaboration with the Office of the Provost and the Office for Faculty Success. Faculty participants included Drs. Peter Collins, an Assistant Professor in the Department of Materials Science and Engineering, and Nandika D'Souza, a joint Professor in the Departments of Mechanical and Energy Engineering and Materials Science and Engineering.

A University of North Texas delegation visited Mexico Feb. 3-7, 2014, to develop faculty research collaborations and to explore student exchange programs. The delegation visited the Centro de Investigación y Estudios Avanzados in Saltillo, the Instituto Tecnológico de Saltillo, the Instituto de Innovación y Transferencia de Tecnología of Nuevo León, and the Centro de Ingeniería y Desarrollo Industrial (CIDESI) of Querétaro.

On March 29, 2014, girls in grades 6 through 12 conducted robotics and solar car experiments, learned to solve crimes, and met engineering professionals at the Design Your World conference at the University of North Texas.

The conference, designed to help girls determine how they fit into science, technology, engineering and mathematics (STEM) fields, took place at UNT's Discovery Park campus. The event was organized by the UNT Society of Women Engineers and Dallas Society of Women Engineers.

The conference drew 90 girls from 6th to 8th grade and 30 girls from 9th to 12th grade. Starting off the event was a keynote address by Nancy Shugart, UNT alumna and author of the book "Prove Them Wrong: The Kids Who Refused to Quit." Conference participants could choose three activities from seven offerings:

- Renewable Energy Activity (solar car)
- Mechanical Engineering (Rube-Goldberg team design)
- Electrical Engineering (robots)
- Computer Science (Alice debugging)
- Materials Science (strength to weight considerations for fuel efficient cars)
- Construction Engineering Technology (house construction)
- Forensic Science (technologies and tools for solving crimes)

The Design Your World Conference series, launched in 2012, is a collaboration among several non-profit organizations including the Society of Women Engineers, Women in Technology International and the American Institute of Aeronautics and Astronautics. Design Your World received the 2014 SWE Outreach Award for Parent and Educator events.

"Girls are unfamiliar with how they fit in STEM fields. It is our goal to communicate how creativity and innovation are core parts of engineering. The hands-on experience and interaction with engineers from Raytheon, Lockheed, AT&T, and Halliburton are what girls have through the Design Your World Conference."

– Nandika D'Souza
Faculty advisor for UNT Society of Women Engineers

ALUMNI

Jared Fiorentine (2011, B.S., Mechanical and Energy Engineering) received a U.S. Student Fulbright Research Grant that allowed him to travel to Chile after he completed his studies at UNT and to participate in a project involving concentrated solar power systems (CSP).

Sponsored by the U.S. Department of State, the Fulbright is the largest U.S. international exchange program allowing students to undertake international graduate study, to conduct advanced research, or to teach in a country of their choice. The grant includes round-trip transportation to the host country, a stipend for the academic year based on living costs in the host country, tuition reimbursement, health insurance, book and equipment allowances, and language study programs. The Fulbright Program is one of the most prestigious awards programs worldwide, operating in more than 155 countries.

Fiorentine said he chose Chile because it has the Atacama Desert in the north, an ideal place to test concentrated solar systems. He worked with Dr. Humberto Vidal, professor of civil and mechanical engineering at the Universidad de Magallanes (UMAG) and a specialist in solar energy.

By partnering with Dr. Vidal, Fiorentine participated in a Comisión Nacional de Investigación Científica y Tecnológica (CONICYT) funded research project in collaboration with Pontificia Universidad Católica de Chile in Santiago titled "Net energy analysis of concentrated solar power in Chile: Applications to power generation in parabolic trough plants." He also visited an elementary school in Puerto Williams where he gave a short presentation about his project.

After UNT, he attended Arizona State University (ASU) where he received a professional science master's degree in Solar Energy Engineering and Commercialization. At ASU, he worked on projects such as distributed photovoltaic plant design and high voltage electricity transmission line design.

Lee Palmer (1990, Department of Industrial Technology (now Engineering Technology)), who is a Senior Vice President with Hitachi Consulting and sits on the University of North Texas (UNT) College of Engineering Advisory Board, initially enrolled at UNT to earn a business degree. However, after taking an Industrial Arts course and conversing with those professors, he adjusted his goals and charted a course that would lead him to compete in a solar-powered vehicle race.

Palmer said that he and a group of students had conversations about what more they could accomplish while at UNT and how to advance the UNT brand. That calling was answered in the form of a request for proposals (RFP) from General Motors (GM), which was organizing a solar-powered vehicle race, the GM Sunrayce, in an effort to promote automotive engineering and solar energy advancement among college students across the country.

Palmer was appointed team leader and selected by the team to lead the RFP response, which required fund raising activities with local DFW corporations and compliance with strict GM RFP guidelines all being done while taking a full load of required classes. UNT was one of 32 teams that were selected to compete, and the students traveled to GM headquarters to accept a $5000 initiation award funded by the Department of Energy.

"When you look at the competitive landscape, it really was a David vs. Goliath situation," Palmer said. "We were competing against MIT, Cal Poly, University of Texas, Dartmouth, and Stanford among many other heavy engineering schools."

What followed next was a year and a half of advancing from a conceptual computer model to deploying a car that was race-ready. While the team was able to raise funds to procure the key drive train components, a majority of the vehicle was hand crafted by the team. Along the way, the team was able to incorporate solar car related efforts into their classroom projects. "Across the board, all of the faculty were extremely supportive of this and got behind the solar car efforts," Palmer said.

The team had 3 defined objectives: 1) aggressively compete in the event and finish in the Top 20 teams, 2) create a positive Design/Manufacturing learning experience, and 3) ensure that national attention was brought to the university, to the Industrial Technology Department (now Engineering Technology), and to faculty members such as Dr. John Dobson, Dr. Philip Foster, and Dr. Rollie Schafer, who all fully supported the team. In honor of the University's 100 year anniversary, the team named the car Centennial.

The 1990 GM Sunrayce race covered over 1,800 miles from Orlando, Florida to GM's headquarters in Detroit, Michigan. Mid-day and overnight stops were designed into the race route for vehicle charging, car repairs, and to take advantage of media coverage for the university. Overall, the UNT team placed 18th in a field of 32 schools.

Palmer explains that this opportunity, and his participation in the event, was a turning point in his personal and professional life. This opportunity provided these team members a "game changing" college experience that was impactful for all the team members and the university. In his professional career, it was the variety of skills and experience that led him to a career in consulting.

Palmer is a founding member of Hitachi Consulting's multi-billion dollar consulting practice. As Hitachi Consulting's Senior Vice President responsible for the Products industry, Palmer's responsibility spans clients ranging from Industrial, High-tech, Process, Chemical, Energy and Automotive and the Aerospace sectors.

FACILITIES

The College of Engineering celebrated the opening of 30,000 square feet of state-of-the-art research laboratory and teaching space at a ribbon-cutting ceremony on March 25, 2014, at Discovery Park.

The primary focus of the labs will be in the areas of alternative energy, renewable bio-composite materials, data visualization in computational fluid dynamics, friction stir processing with metallic alloys, and advanced manufacturing. The new labs include the Experimental Mechanics and Rheology Laboratory, Chemical Scale-Up Laboratory, Computational Modeling Lab, Energy Storage Lab, and Biofuel Engineering Lab.

Speakers at the ceremony included Neal Smatresk, President of the University of North Texas, Dr. Warren Burggren, Provost and Vice President for Academic Affairs, and Dr. Tom McCoy, Vice President for Research and Economic Development.

After the ribbon-cutting ceremony, guests toured the new lab areas, and university and industry officials visited the construction site for a new facility. The 16,000-square-foot building was completed in the summer of 2014 and now houses the Nuconsteel Materials Testing Lab, a laboratory for structural testing of cold-formed steel for Dr. Cheng Yu, associate professor in the Department of Engineering Technology and coordinator of the Construction Engineering Technology Program.

The building also houses the new Bioproducts Manufacturing Laboratory, managed by Dr. Sheldon Shi, associate professor in the Department of Mechanical and Energy Engineering.

OTHER RECENT LABORATORY ADDITIONS

The **UNT Nanofabrication Cleanroom** supports the research needs of faculty and students from a broad range of engineering and science disciplines. The cleanroom occupies approximately 3000 square feet of clean space and includes a Class 100 lithography area and a Class 10,000 wet and dry processing and characterization area. Initial capabilities will emphasize nano/micro device development, photomask fabrication, organic light-emitting diode device fabrication and thin film techniques.

The **Center for Advanced Research and Technology** (CART) recently moved to its new 5500 square feet space that integrates it with the cleanroom and technology incubator.

CART is a research center and service facility that supports scientific research activities through its wide array of sophisticated characterization and processing instruments. UNT is among an elite group of public institutions nationwide that offer this complement of facilities. In addition to UNT-affiliated researchers, CART collaborates with other universities and industries. Researchers use the more than two-dozen machines at CART to analyze materials from the micro to atomic level. Projects span numerous areas of expertise in disciplines such as engineering, materials science, physics, chemistry, and biology and are at the cutting edge of cross-disciplinary analysis, characterization, and synthesis.

The **Zero Energy Laboratory** is designed specifically to test and demonstrate various alternative energy generation technologies in order to achieve a net-zero consumption of energy. The net-zero energy philosophy is based on a combination of different renewable energy technologies in a building, such as solar, geothermal and wind systems, which leads to produce enough energy to power a building and in many cases even create excess energy to return back to the power grid. Thus the net energy consumption over a period or year becomes zero.

INTRODUCING NEW FACULTY

Eduardo Blanco

Assistant Professor, Computer Science and Engineering

Ph.D.: Computer Science, University of Texas at Dallas, 2011

Expertise: computational semantics, including semantic relation extraction and inference, extra-propositional aspects of meaning (negation, modality, uncertainty, etc.), probabilistic semantic inference and customization of relation inventories.

Blanco previously had been a Research Scientist at Lymba Corporation and Adjunct Faculty at Southern Methodist University. He is the co-director of UNT's Human Intelligence and Language Technologies lab and is co-organizing the Workshop on Extra-Propositional Aspects of Meaning (ExProM) in Computational Linguistics.

Kyle Horne

Assistant Professor, Mechanical and Energy Engineering

Ph.D.: Mechanical Engineering, Utah State University, 2014

Expertise: computational science and engineering, with a strong emphasis in heat transfer and fluid flow.

His research has included work at the Centre for Advanced Diffusion-Wave Technologies (CADIFT) at the University of Toronto and as a Chateaubriand Fellow at the Ecole Centrale de Paris in France. He has received funding from the U.S. Department of Energy and NASA.

Michael Shenoda

Senior Lecturer, Engineering Technology

Ph.D.: Civil Engineering, University of Texas at Austin, 2006

Expertise: traffic control for high-volume work zones, intelligent transportation systems infrastructure, community engagement in roadway projects, and pavement management.

Hassan Takabi

Assistant Professor, Computer Science and Engineering

Ph.D.: Information Sciences, University of Pittsburgh, 2013

Expertise: advanced access control models; role-based access control and role mining; security, privacy, and trust issues in cloud computing environments and online social networks; privacy enhancing technologies; trust management, usable security and privacy; and insider threats in cloud computing environments.

Takabi is a member of UNT's Center for Information and Computer Security and is the director of UNT's Secure Software Testing for Web and Mobile Applications REU (Research Experiences for Undergraduates) Site.

Mark Thompson

Lecturer, Computer Science and Engineering

Ph.D.: Computational Analysis and Modeling, Louisiana Tech University, 2013

Expertise: telecommunications and networks, cyber security, computer forensics, programming and algorithms, and data mining.

Honors and awards he has received include the BellSouth Endowed Professorship for Telecommunications, 2013–2014, and Outstanding Contribution to the Introduction of the Global Services Platform, Nortel Networks, Richardson, Tx., 1997.

INTRODUCING DEPARTMENT OF BIOMEDICAL ENGINEERING

The Department of Biomedical Engineering (BMEN) has become the College of Engineering's sixth department, with focus areas including biomedical instrumentation, bio mechanics and bioinformatics. The department currently is open to undergraduate students and will soon offer a master's degree.

The U.S. Labor Department expects biomedical engineering to become the fastest growing engineering field over the next decade. According to Labor Department data, biomedical engineering jobs have experienced growth rates of more than 70 percent in recent years.

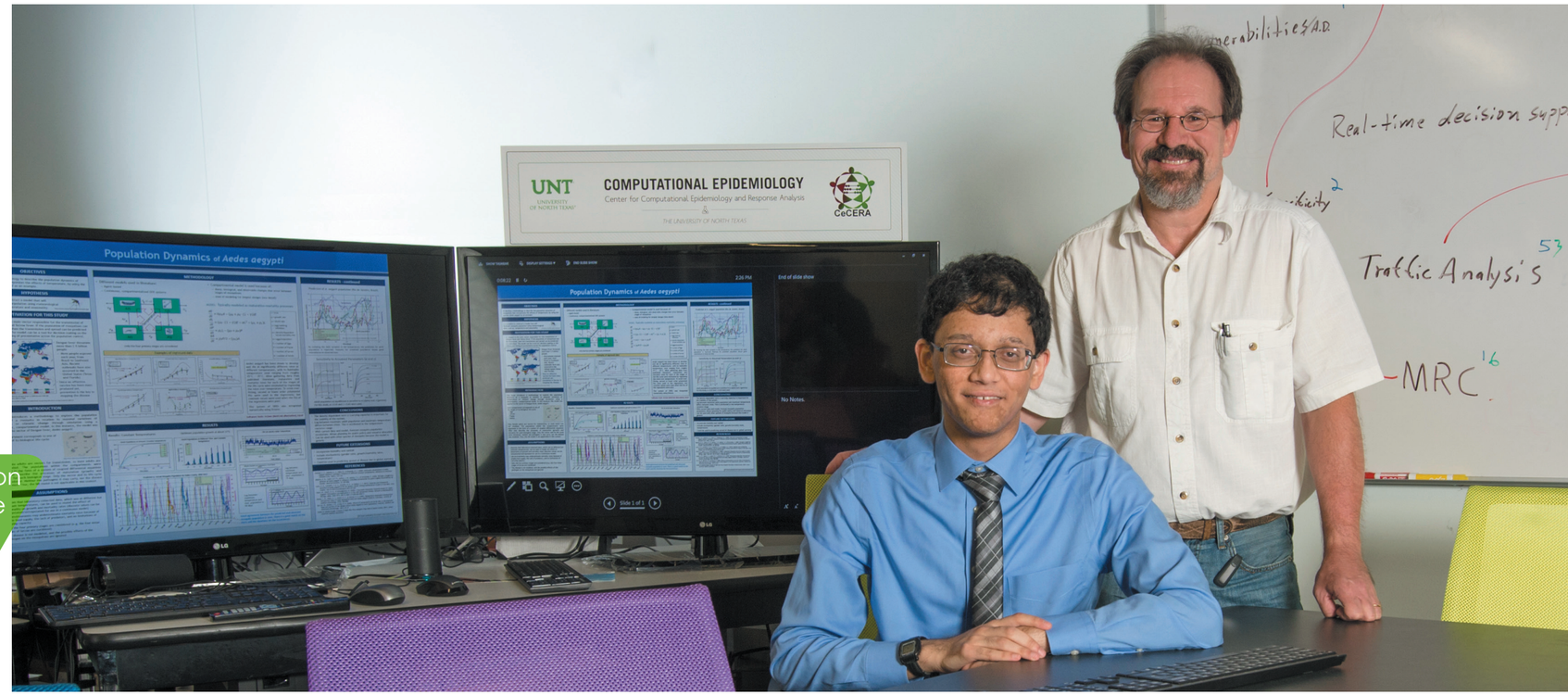
Aug. 25, 2014, was a special day for the College of Engineering. The first ever class in Biomedical Engineering (BMEN) met for the class "Discover Biomedical Engineering," a discovery course taught by the Associate Dean for Undergraduate Studies and Founding Chair of BMEN, Dr. Vijay Vaidyanathan. The class has 73 enthusiastic undergraduate students, all of whom were there for the historic occasion. Thirty-seven percent of the new students in BMEN are female.

The department also welcomed the Center for Network Neuroscience (CNNS). Dr. Guenter Gross, who heads CNNS, felt that the College of Engineering and BMEN would be a natural home for the CNNS.

CNNS was established January 1, 1987, to facilitate trans-disciplinary studies of the self-organization and electrophysiological dynamics of mammalian networks in cell culture. From the beginning, investigations have focused on exploration of basic mechanisms and strategies underlying the phenomena of pattern generation, recognition, storage, and fault tolerance in neuronal ensembles.

Vaidyanathan said that the addition of CNNS brings more opportunities for undergraduate and graduate students to work on exciting design projects and research areas.

COMPUTER SCIENCE AND ENGINEERING



"The Centers for Disease Control and Prevention mandates that all counties have to prepare for adverse events, and our RE-PLAN system can serve as a very useful interface for identifying problem areas and better preparing for emergencies."

– Armin Mikler
Department of Computer Science and Engineering

Officials in charge of organizing response plans and resource distribution strategies in preparation for major emergencies, such as terrorist attacks or disease outbreaks, will soon have a new resource for identifying problem areas and for strengthening response plans.

Dr. Armin Mikler, Professor in the Department of Computer Science and Engineering, received a grant from the National Institutes of Health to develop a computer-based system that will help emergency planners identify vulnerable populations, such as those with no access to vehicles or who cannot leave their homes, and modify response plans accordingly.

Mikler is working with Tarrant County Public Health on the project, which involves the use of a computer system named "RE-PLAN," (Response Plan Analyzer).

Tarrant County Public Health Preparedness Planner Mark Fulmer said the system offers a wide variety of interactive tools to help planners prepare for different scenarios, such as major highways becoming inaccessible and causing resource deliveries to reroute.

"Plans are most successful when plenty of data is available for research and testing," Fulmer said. "The RE-PLAN system's benefits really boil down to being a strong source of information that we can use to evaluate and test plans, which is essential before any incident actually occurs."

Mikler is working with Dr. Chetan Tiwari from UNT's College of Arts and Sciences; Dr. Renee Bryce from UNT's College of Engineering; and Dr. Suhasini Ramisetty-Mikler from the UNT Health Science Center on the project.

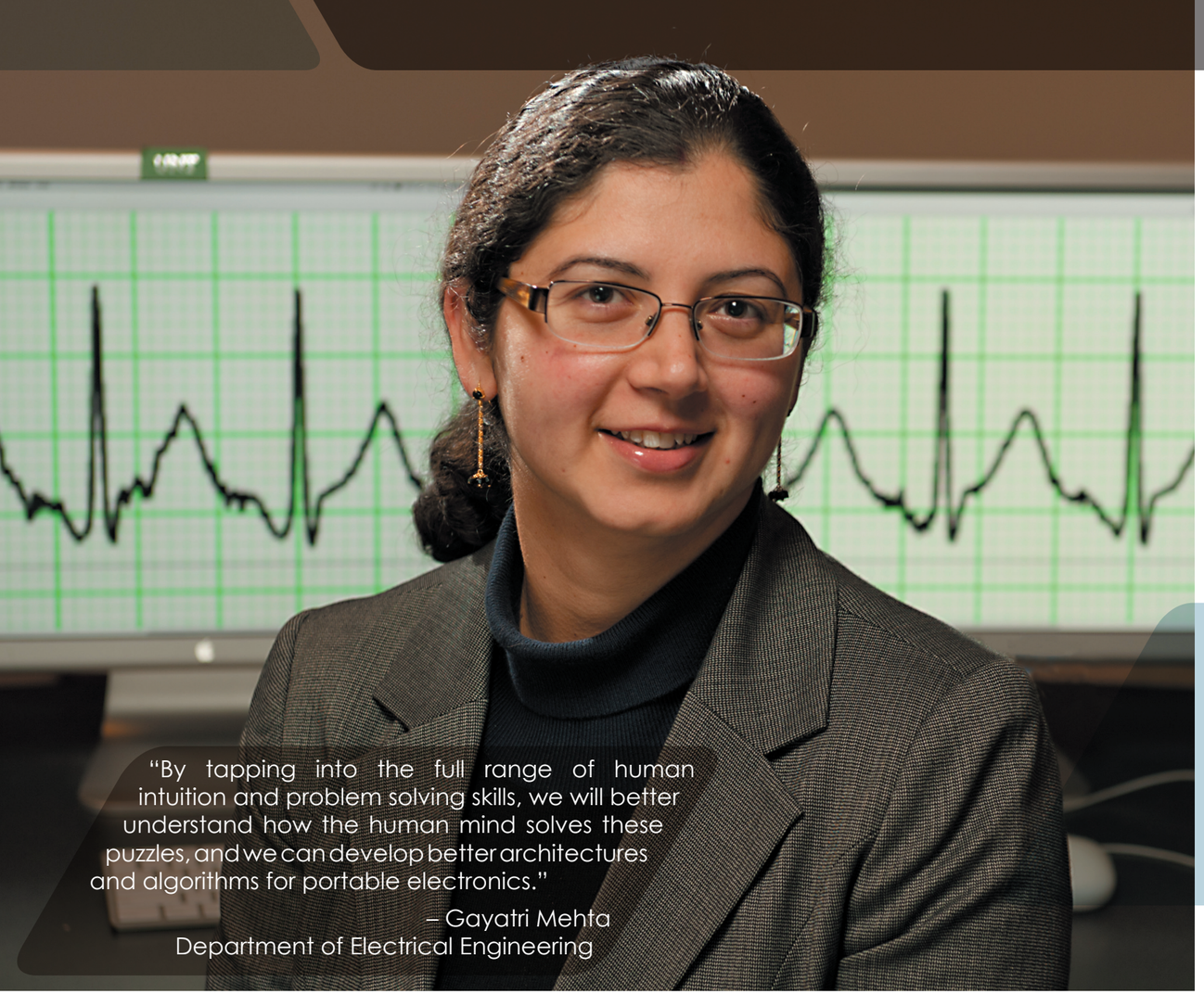
Mikler is director of the Computational Epidemiology Research Laboratory (CERL), which was established to conduct and promote research in computational epidemiology. Projects include outbreak modeling, visualization of complex data, geospatial analysis, and response plan design. Mikler also is working with Texas Academy of Mathematics and Science student Aditya Vaidya (sitting in the photo on the next page) who is conducting advanced engineering research that could help cities better manage mosquito-borne illness outbreaks. The student presented his research at the annual Association for Computing Machinery Conference on Bioinformatics, Computational Biology and Health Informatics in Newport Beach, Calif., on Sept. 23, 2014.

PROFILES IN ENERGY RESEARCH

Dr. Robert Akl, associate professor, has designed, implemented, and optimized both hardware and software aspects of several wireless communication systems. His work includes analysis of reference broadcast synchronization and timing-sync protocol for sensor network energy consumption. The project includes designing a hybrid algorithm that focuses on conserving energy and maintaining the network's topology for as long as possible.

Dr. Song Fu, assistant professor, directs the Dependable Computing Systems Lab, which seeks to explore in-depth understanding of reliability, energy efficiency, and performance in high-performance computers, distributed systems, and cloud systems, and develop innovative system technologies. The research has been supported in part by funding from the National Science Foundation, Los Alamos National Laboratory, Amazon, Nvidia, Xilinx, and the University of North Texas.

Dr. Saraju Mohanty, associate professor, researches low-power high-performance nanoelectronics, working on performance modeling of nanoelectronic circuits and systems and incorporating the models in design optimization methodology. Recent work with Mahadevan Gomathisankaran, assistant professor, includes "TSV: A novel energy efficient Memory Integrity Verification scheme for embedded systems" and "MEM-DnP: A Novel Energy Efficient Approach for Memory Integrity Detection and Protection in Embedded Systems."



"By tapping into the full range of human intuition and problem solving skills, we will better understand how the human mind solves these puzzles, and we can develop better architectures and algorithms for portable electronics."

– Gayatri Mehta
Department of Electrical Engineering

ELECTRICAL ENGINEERING

The research of Dr. Gayatri Mehta, assistant professor, is in the areas of electronic design automation, reconfigurable computing, low-power very-large-scale integration design, system-on-a chip design, embedded systems, portable/ wearable computing, and energy harvesting.

Mehta is the director of the Reconfigurable Computing Lab at UNT. She has designed an interactive mapping game called UNTANGLED used to uncover human mapping strategies. UNTANGLED received the People's Choice Award in the Games & Apps category of the 2012 International Science & Engineering Visualization Challenge conducted by the publication *Science* and the National Science Foundation. She has also developed a highly visual design environment called SmartBricks used to design and explore custom domain-specific architectures

As the demand for smaller and more energy-efficient electrical devices continues to grow, electrical engineers are faced with the challenge of figuring out how to best fit new designs for electrical components into the devices. In 2014, Mehta and her team invited the public to compete for prizes in the latest version of UNTANGLED II: Unbound. As an added component to the 2014 version, players will get to build their own puzzle platforms and essentially set the rules for the game. Mehta and her team will use the data to explore how electronics can be designed to use less energy.

PROFILES IN ENERGY RESEARCH

Dr. Miguel F. Acevedo is a Regents Professor, and his research interests include integrating modeling and monitoring applications to sustainability, particularly environment-energy relationships, and land-use change in rapidly urbanizing areas. His research focus is in the area of water-energy nexus and sustainability. He has worked on projects related to environmental impact of energy development plans, reservoirs and industrial activities.

Dr. Xinrong Li, associate professor, is interested in digital and statistical signal processing, real-time embedded system design, and wireless systems and sensor networks. Projects he has worked on include "An energy-efficient link quality monitoring scheme for wireless networks" and "Energy efficient map interpolation for sensor fields using Kriging."

Dr. Yan Wan, assistant professor, is interested in dynamical network design and control motivated by wide applications in biology, air traffic flow management, and sensor networking. She has worked on developing an analytical model that would account for the uncertainty of weather and traffic demand and would allow for greater automation in air traffic flow management, which would mean more efficiency and fewer delays.

"Enabling UNT undergraduate students from construction engineering technology and electrical engineering technology to work collaboratively will be an exceptional educational vehicle."

– Zhenhua Huang
Department of Engineering Technology

ENGINEERING TECHNOLOGY

Undergraduate construction engineering technology and electrical engineering technology students will benefit from the interdisciplinary teamwork and hands-on learning experiences under coursework that will be developed under a National Science Foundation Transforming Undergraduate Education in Science, Technology, Engineering and Mathematics (TUES) award.

The goal of the NSF TUES project, titled "A New Interdisciplinary Technology Education Strategy Using State-of-the-art Wireless Sensor Networks," is to create a model course that will involve hands-on construction of a wireless sensor network and onsite structural testing of UNT's Apogee Stadium, the first newly constructed collegiate football stadium in the nation to achieve the highest level of LEED certification.

The project will be undertaken by Dr. Zhenhua Huang, assistant professor in the Department of Engineering Technology and principal investigator of the project, Dr. Elias Kougianos and Dr. Shuping Wang, also of UNT's Department of Engineering Technology.

Undergraduate students from construction engineering technology and electrical engineering technology will work collaboratively on projects throughout the duration of the class, including wireless sensor network construction, laboratory validation testing, on-site structural testing, instrument troubleshooting, and test data processing and analysis.

The anticipated outcome of this project is that by working with other disciplines on collaborative, hands-on projects, students will learn not only how to apply theoretical knowledge to practical applications but also the communication skills needed to be a contributing team member or a leader in an interdisciplinary project.

PROFILES IN ENERGY RESEARCH

Dr. Huseyin Bostanci, assistant professor, recently received a UNT Research Opportunity Program (ROP) Grant for the project "Advanced Thermal Management of Hybrid Vehicle Electronics." Bostanci has led and participated in various projects mainly focused on the cooling of high power lasers, electronics onboard military tactical platforms, and hybrid electric vehicles for the U.S. military, government agencies and prime defense contractors.

Dr. Phil Foster, associate professor and coordinator of mechanical engineering technology, recently received a patent for his liquid cooled Stirling engine with a segmented rotary displacer. Stirling engines convert heat energy into mechanical power rather than drawing power from the combustion of fossil fuels or from the power grid, which is heavily reliant on fossil fuels. Drs. Huseyin Bostanci and Cheng Yu, also of the Department of Engineering Technology, and graduate research assistant Amir H. Bagheri are working to improve Foster's Stirling Engine. Bagheri recently presented the proposal "Optimization of an Innovative Stirling Engine for Energy Recovery/Production" as one of the eight finalists in the US India Chamber of Commerce DFW "Spirit of Innovation Competition 2014" (SOIC).

Dr. Haifeng Zhang is an assistant professor with extensive research and teaching experience in mechanical design, engineering graphics, piezoelectric devices (resonators, energy harvesters, and actuators), and structure health monitoring.

The National Science Foundation (NSF) recently awarded a grant to Zhang as a principal investigator for his project titled, "Collaborative Research: Self-powered Dual-mode Piezoelectric Resonant Pressure/Temperature Sensors for Oil and Gas Field Explorations." The purpose of the project is to design and test a new type of sensor which will be especially resistant to extreme environments.

MATERIALS SCIENCE AND ENGINEERING

"The project has created both research and educational opportunities for the faculty and students working with my group."

– Jincheng Du
Department of Materials Science and Engineering

Dr. Jincheng Du, associate professor, was awarded a Department of Energy (DOE) grant to study the corrosion and chemical durability of glasses through the Nuclear Energy University Program (NEUP).

Understanding the corrosion of glasses is critical for a number of technological and engineering applications including long-term nuclear waste disposals and their geological storage. Dr. Du and his group will use sophisticated computer simulations to understand the bulk and interfacial structure of multicomponent oxide glasses, their interaction and dissolution in an aqueous environment, and diffusion behaviors in these materials. The study will generate reliable structural information and mechanistic understanding that can lead to predictive assessment of glasses for long-term geological storage.

Dr. Du is collaborating with Drs. Joe Ryan and Sebastien Kerisit of Pacific Northwest National Laboratory and Dr. Louis Criscenti of Sandia National Laboratories on this project.

Dr. Du brings to the project extensive experience in modeling glass structure and properties and in potential development. His work has been funded by National Science Foundation (NSF) including one project on dissolution behaviors of bioactive glasses and one NSF GOALI project on mixed glass former effect on industrially important glass systems with Corning Inc. He currently chairs the Technical Committee on "Atomistic Modeling and Simulation of Glass" of the International Commission of Glass (ICG). Ryan provides expertise in experimental characterization of the waste form glasses and a deep understanding of the experimental world of dissolution behaviors of glasses. Criscenti has led several projects on the study of the simulations of the structure and behaviors of glass waste forms in geological environments. Kerisit has extensive experience in atomistic modeling of mineral and mineral/water interfaces.

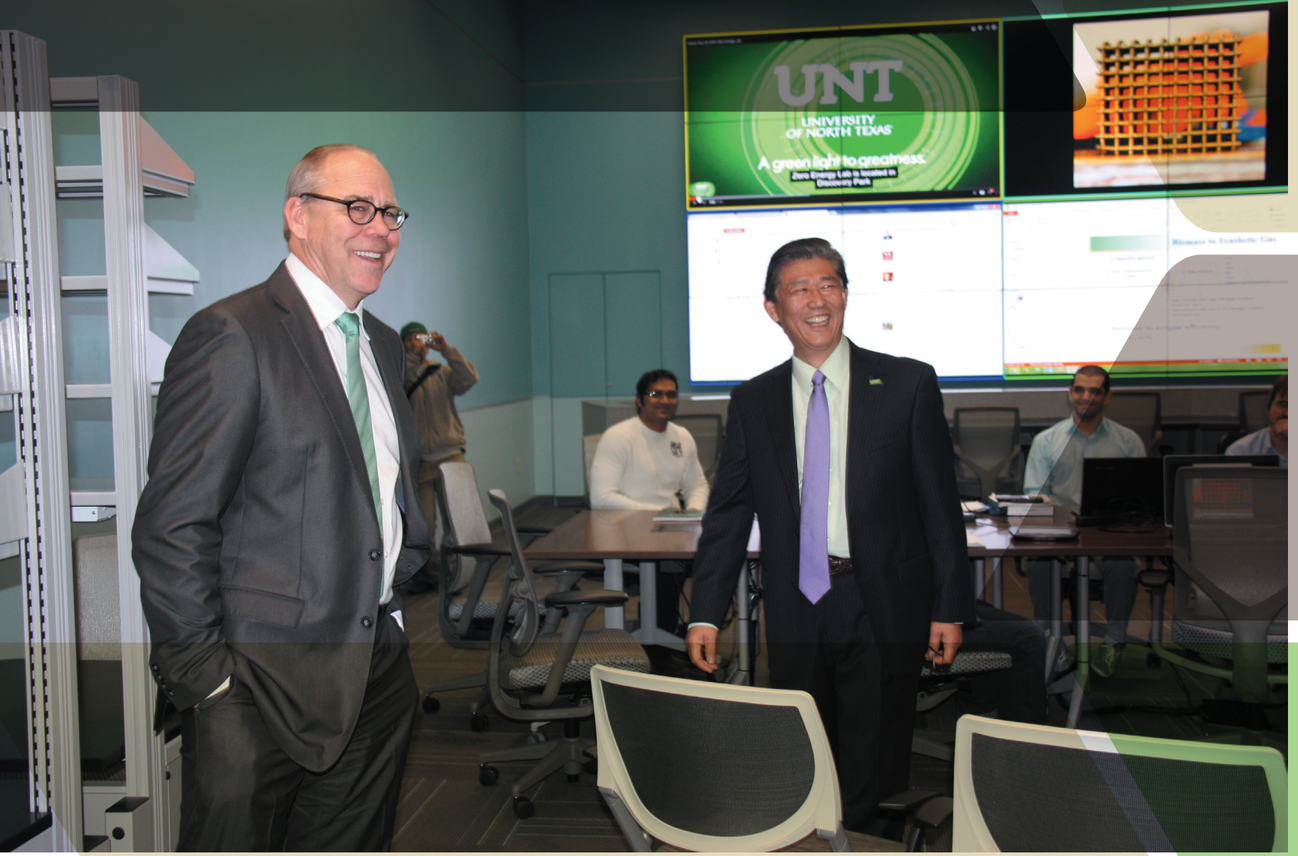
Dr. Du and his team have been making good progress of the project and focused on the study of the dissolution of complex nuclear waste glasses by combining computer simulations and advanced characterizations. Two Ph.D. students and one MS student have been supported by the project. Dr. Du hosted a workshop on glass corrosion at UNT in 2014. Jessica Rimsza, one of Dr. Du's students, presented results on ab initio simulations of water/glass interactions at an international conference in Aachen, Germany (see page 4). Rimsza and Lu Deng, another student, also presented their results on the project at Material Science and Technology (MS&T) 2014 in Pittsburgh, Pa. Additionally, Xiaonan Lu visited Pacific Northwest National Laboratory as a summer intern to work on the characterizations of nuclear waste glasses, which turned out to be great experiences for the student.

PROFILES IN ENERGY RESEARCH

Dr. Narendra Dahotre, distinguished research professor, established the Laboratory of Laser Aided Additive and Subtractive Manufacturing (LAASM) at the University of North Texas. The state-of-the-art research facility houses multiple high-power infrared laser systems. One area of the lab's research is laser aided additive manufacturing of amorphous coatings. Energy savings has become a very crucial issue that has triggered an extensive research interest in developing new harvesting methods as well as minimizing the energy losses that occur during transmission of generated electricity. These losses can be greatly minimized by improving the efficiency of transformers. Laser processing can be utilized to achieve precise microstructural changes at the submicron to nano scale levels in magnetic materials to improve the efficiency of transformers.

Dr. Rajiv Mishra, professor, has been involved in research areas such as materials selection for alternative energy systems and hydrokinetic energy. His projects have involved a grant from the U.S. Department of Energy to develop high performance materials for use in high-temperature applications at coal-fired energy plants. Next generation materials would allow these plants to operate at higher temperatures, which makes coal combustion more efficient, and in turn, results in lower emissions. Mishra's research involves friction stir welding, a technology has taken off in a number of applications because of several benefits including reduced energy consumption in laser welds.

Dr. Zhenhai Xia, professor, has been researching how to improve clean-energy technology for cars and power plants. He was part of a team that had a breakthrough in fuel cell technology, discovering that nitrogen-doped carbon nanotubes are nearly four times better than platinum as a catalyst and could eventually replace platinum in fuel cells. These findings also were published in Science. Xia says the high cost of platinum is one of the major barriers for fuel cell commercialization. Since carbon is easy to find and is cheap to mass produce, it is a more renewable resource than platinum. Additionally, carbon nanomaterial is a better catalyst for oxygen reduction – a key chemical reaction that generates electricity in fuel cells – so clean technology can become better and cheaper. Xia is now working to better understand the catalytic mechanisms in fuel cells.



"The ability to offer an innovative Ph.D. program, in addition to bachelor's and master's degrees in mechanical and energy engineering at UNT, provides prospective students a unique opportunity to study and do research alongside the world-class faculty and to develop both broad and in-depth knowledge for solving energy problems."

– Yong Tao
Department of Mechanical and Energy Engineering

MECHANICAL AND ENERGY ENGINEERING

The College of Engineering now offers a Ph.D. in mechanical and energy engineering, the first degree of its kind in Texas and one of the only doctoral programs specializing in energy applications in the field of Mechanical Engineering in the United States. The degree program's first students will begin in Spring 2015.

The Department of Mechanical and Energy Engineering was established in 2007 and was the first of its kind in the nation. Faculty members in the department integrate the fundamentals of mechanical engineering with interdisciplinary, modern applications. Research topics include environmental sustainability, materials and manufacturing, and oil and gas.

Graduates with degrees in mechanical and energy engineering are valuable to a number of industries, including alternative energy, energy management and conservation, nuclear energy, advanced materials design, automotive manufacturing, pharmaceuticals, petroleum exploration and more. Texas is among the top three states with the highest employment of mechanical engineers, according to the U.S. Bureau of Labor Statistics.

PROFILES IN ENERGY RESEARCH

Dr. Nandika D'Souza, professor, researches the interactions and properties of heterogeneous materials, blends, alloys, composites and nanocomposites. Her teaching and research primarily focuses on mechanical properties, fracture, transport phenomena, viscoelasticity, rheology, and polymer characterization. She has been working on a new carbon fiber from plants that can replace common petroleum and coal-based products in a wide range of goods including parts for cars, aircraft, electronics and sports equipment. The new carbon fiber is made from C-lignin, which is the substance that makes plants woody and firm and helps plants stand upright.

Dr. Kuruvilla John, professor and associate dean of research and graduate studies, conducts research on sustainability and environmental impact assessment of the energy sector. His current focus is to evaluate the impacts of coal-fired power plants and shale gas development on air quality over the North Texas region. His research group uses UNT's high performance computing cluster (Talon2) to run complex photochemical models and simulates air quality events on urban, regional and continental scales. He teaches courses on oil and gas, combustion engineering, and air pollution control in the Department of Mechanical and Energy Engineering.

Dr. Sheldon Shi, associate professor, has research experience in the processing and evaluation of renewable biocomposite materials, including engineered wood-based products and natural fiber composites. His research interests also include nanocomposites, adhesives and adhesion. He is also involved in federal research projects funded by the U. S. Department of Energy, National Science Foundation and the U.S. Department of Agriculture. Shi has been working on developing charcoal and other carbon-based products with a higher absorption capacity, which will be useful for absorption after an oil spill.

SPONSORS

L-3 Mission Integration has donated equipment and materials to the University of North Texas College of Engineering including six unmanned aerial vehicles (UAVs) and ground station equipment, as well as specialized laboratory equipment.

Constructed of heavy-duty, reinforced materials, the UAVs contain autopilots, Global Positioning Systems, and video cameras that were used to demonstrate various applications as part of research studies. Students in the College of Engineering will be able to use the UAVs to develop base control software and routines to pilot the units.

With the on-board video capability, engineering students can also investigate algorithms for road following, terrain following, and other more complex behaviors. The college will use the donated UAVs as test beds for research projects in control of autonomous systems for various applications, including emergency response aerial communications networks. The units will also support teaching of control system courses in the electrical engineering and engineering technology programs.

The idea for the donation came from Adam Marlowe, a 2009 UNT graduate who works at L-3 as a systems integration engineer.

"I knew there were systems that L-3 was no longer using and I thought that they would have really helped me when I was in school," Marlowe said. "After a few emails, the company agreed to make a donation to the university."

THE COLLEGE OF ENGINEERING WOULD LIKE TO THANK THE FOLLOWING INDIVIDUALS AND ORGANIZATIONS FOR THEIR CONTRIBUTIONS, WHICH MAKE POSSIBLE EVERYTHING THAT WE DO.

Individuals

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Linda Jean Caton
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Engineering researchers at the University of North Texas have new, cutting-edge equipment and laboratory spaces to discover new biomaterials and to test the latest in energy-efficient products.

The primary focus of the labs will be in the areas of alternative energy, renewable bio-composite materials, data visualization in computational fluid dynamics, friction stir processing with metallic alloys, and advanced manufacturing. A ribbon-cutting ceremony was held on March 25, 2014. Read more about these new laboratories and other research facilities on pages 10-11.