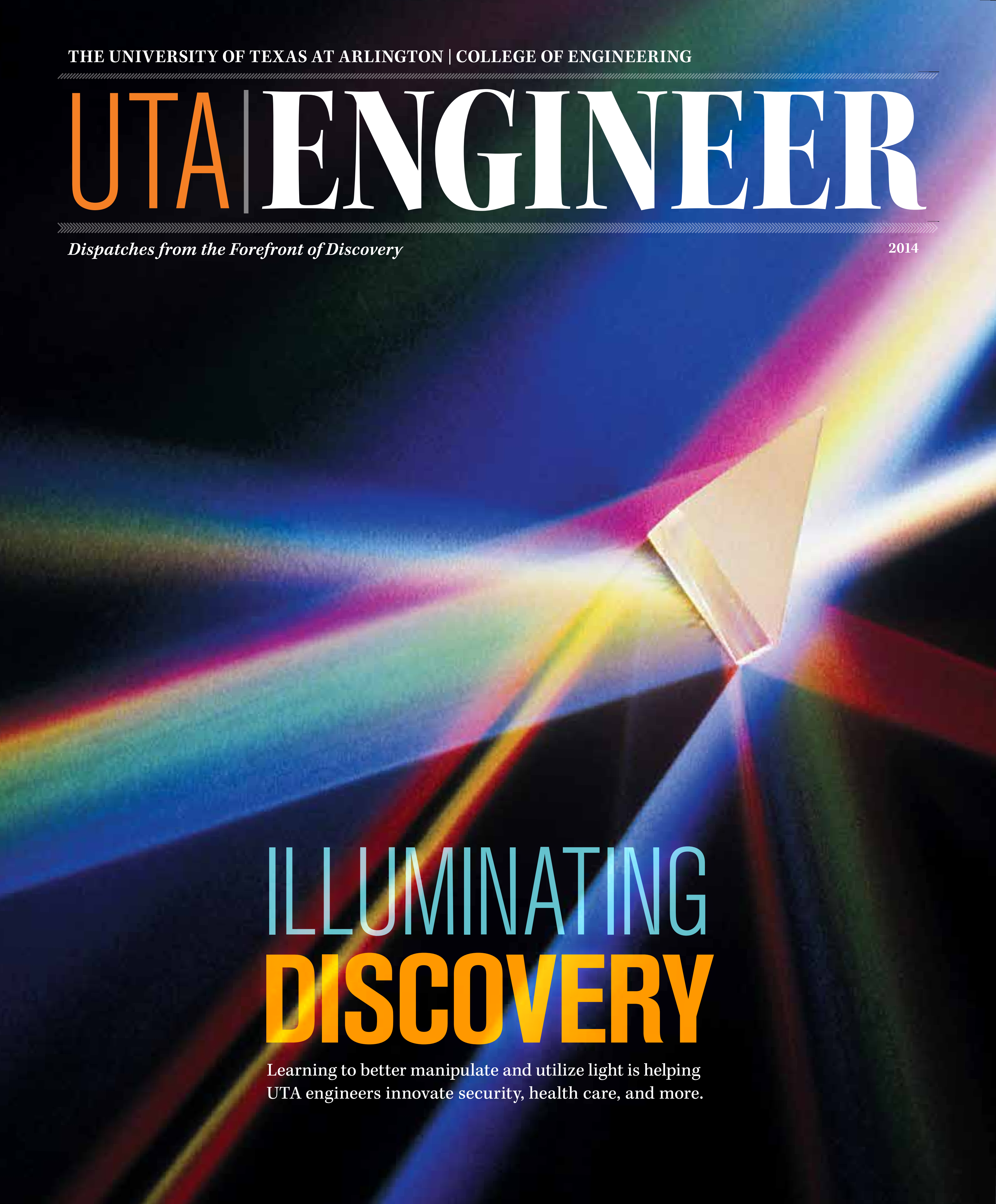
THE UNIVERSITY OF TEXAS AT ARLINGTON | COLLEGE OF ENGINEERING

UTA | ENGINEER

Dispatches from the Forefront of Discovery

2014



ILLUMINATING DISCOVERY

Learning to better manipulate and utilize light is helping UTA engineers innovate security, health care, and more.

CONTENTS

2014
VOLUME III

UNIVERSITY OF TEXAS ARLINGTON

UTA Engineer is published by University Communications.

College of Engineering
UT Arlington Box 19019
Arlington, TX 76019

817-272-3682

agor@uta.edu

www.uta.edu/engineering

Cover Image by Comstock/Getty

MIX Paper from responsible sources FSC® C022085

FEATURES

DEPARTMENTS

Dr. Khosrow Behbehani was named dean of the College of Engineering in spring 2013. The bioengineer is a progressive and innovative leader who is dedicated to aiding the University in its goal of attaining Tier One status.

Growing Larger, Stronger, and Smarter

In this issue, you will read about the College of Engineering's exciting work in the area of unmanned vehicle systems. Our new certificate programs in unmanned aerial vehicles (UAVs) let students take specific courses from any of four departments—computer science and engineering; electrical engineering; industrial, manufacturing, and systems engineering; and mechanical and aerospace engineering—that will give them the skills they need for a career in this growing field. The UT Arlington Research Institute (UTARI) has obtained permission from the FAA to test UAVs on its grounds, which is providing our researchers with a valuable opportunity to test their vehicles locally.

In addition, UT Arlington has entered into a consortium with several institutions and corporations led by Texas A&M-Corpus Christi, which recently received one of the nation's six major FAA site designations for unmanned vehicle systems testing. With this designation, our faculty and students will be able to participate in exciting UAV-related engineering research and education.

Growth is a theme at the College of Engineering. This year, we are adding a Master of Construction Management degree program in civil engineering. This degree will equip graduates with the skills needed to manage a wide variety of projects ranging from transportation systems to large-scale urban buildings to major industrial and utility projects. It is one more way that UTA's College of Engineering can continue to be the most comprehensive engineering school in the region.

The University of Texas System has challenged us to double our enrollment by the year 2020. To do so, we will need more faculty and support staff members. Further, additional classroom and laboratory space must be built, and we must increase our student recruiting efforts. The return on these efforts promises to be great, and we are delighted to play a major role in meeting the demand for engineers, especially in Texas.

Khosrow Behbehani
Dean, UT Arlington College of Engineering

LAB NOTES

THE LATEST DEVELOPMENTS FROM THE COLLEGE, ITS FACULTY, AND ITS STUDENTS

Paul Componation is the new industrial, manufacturing, and systems engineering chair.

New Chair Brings New Ideas

The College of Engineering recently introduced Paul Componation as chair of the Industrial, Manufacturing, and Systems Engineering Department.

Prior to coming to UTA, Dr. Componation was a professor at Iowa State University and the director of graduate education for engineering management in its Industrial and Manufacturing Systems Engineering Department. His research interests include the development and optimization of complex systems in aerospace, transportation, and energy; decision analysis in distributed engineering design teams; utilization of technical and qualitative data in parametric cost modeling for aerospace systems; adaption of value-driven design in the systems engineering enterprise; and the use of lean principles as an agent for organizational transformation.

Componation has also served in various roles at the University of Alabama in Huntsville, BDM Federal, Sonoco Products Company, the Marshall Space Flight Center, and the U.S. Air Force.

BIO-ENGINEERING TURNS 40

In spring 1974, UT Arlington and the UT Health Sciences Center at Dallas (now UT Southwestern) launched a joint bioengineering program that was unique to the state. Forty years later, it has grown into a full-fledged department at UTA, one that offers both graduate and (as of 2012) undergraduate degrees.

Throughout the years, the bond between UTA and UT Southwestern has proven essential to the program's success. The original agreement between the two noted that each had its own unique capabilities to contribute: UTA in engineering and the physical sciences and UTSW in the medical sciences.

"I am very proud of the Bioengineering Department and how far it has come in 40 years," says Dean Khosrow Behbehani. "Every faculty member, staff member, and student involved has made a positive contribution. The growth of the department was made possible because of them."

Return to Rail

The future of Texas transportation may lie in high-speed rail, if the state acts on a feasibility study spearheaded by UT Arlington civil engineering Associate Professor Steve Mattingly.

The University evaluated potential rail routes between DFW and Houston, DFW and San Antonio, San Antonio and Houston, and Houston and Waco. What it found is that train trips between most city pairs that use existing Texas Department of Transportation right-of-way could be made in less than two hours, which is competitive with air travel and superior to highway driving. Further, containing the high-speed rail within that right-of-way would greatly reduce the capital cost of building the system.

"Using existing right-of-way helps bring down the total cost of the project and shortens the time in which the rail can realistically be built," Dr. Mattingly explains.

The case study didn't pinpoint the exact cost of building a high-speed rail system in Texas, but it did outline possible funding mechanisms to support construction, including federal involvement, state and local funds, tax increment financing districts, and public and private partnerships.


UT Arlington's feasibility study on high-speed rail could radically change intrastate transportation in Texas.

WALKING FOR DIABETES

An often-quoted proverb states that a journey of 1,000 miles starts with a single step. Civil engineering Professor Sia Ardekani proved that true, albeit on a smaller scale, when he walked from Arlington to Austin over spring break to raise money for the American Diabetes Association.

Dr. Ardekani, who was a mountain climber until he was 26 years old, began his nearly 200-mile journey on March 8 and arrived in Austin on March 15, averaging 25 miles per day. Along the way he encountered friendly dogs, strong winds and rain, and plenty of highway construction.

In all, Ardekani's walk raised $1,800 for the American Diabetes Association. Photographs and a daily account of his trip can be viewed on his blog at ar2aus.wordpress.com. The blog has garnered thousands of page views, mostly from the United States, but also from Mexico, Australia, Iran, Costa Rica, Canada, Spain, Germany, and Botswana.

PROVING NEWTON RIGHT

Some laws can't be broken, even when they are inconvenient.

In an attempt to reduce the run times for conventional simulations of nano-sized objects—which can sometimes take months—researchers in the past have omitted the mass terms in their models. While that does yield faster run times, it also violates Newton's Second Law of Motion, upon which the conventional model was based. To account for this paradox, scientists have argued that mass is unimportant at the nano-scale.

But Alan Bowling, assistant professor of mechanical and aerospace engineering, has now proved that idea wrong. His research shows that the effect of mass is important, can be measured, and has a significant impact on any calculations and measurements done at the sub-micrometer scale.

Dr. Bowling's findings help researchers better understand the movement of nano-sized objects in fluid environments. The new model retains mass, predicts unexpected motion of nano-sized objects in fluids, and runs faster than both the conventional and massless models.

ILLUSTRATION BY ROBIN MACDOUGALL/GETTY

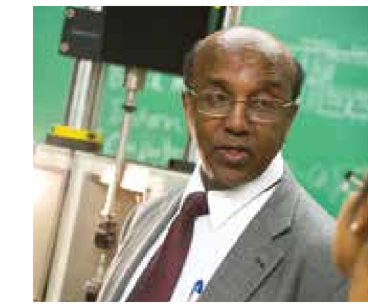

Stathis Meletis' new computer-based genome will enable the development of new, incredibly resistant materials.

SPOTLIGHT

A Genome Revolution

Materials science and engineering Chair Stathis Meletis is developing a computer-based "genome" that will aid in the design and development of advanced new materials that are super-hard, can resist extreme heat, are highly durable, and are cost-efficient. The genome could be used in things like turbine blades, hypersonic vehicles, and thermal barrier materials designed to withstand temperature and radiation extremes in space. "We will combine methods for designing and attaining these materials on computers first, then synthesize and test them," says Dr. Meletis. "This could revolutionize future engineering."

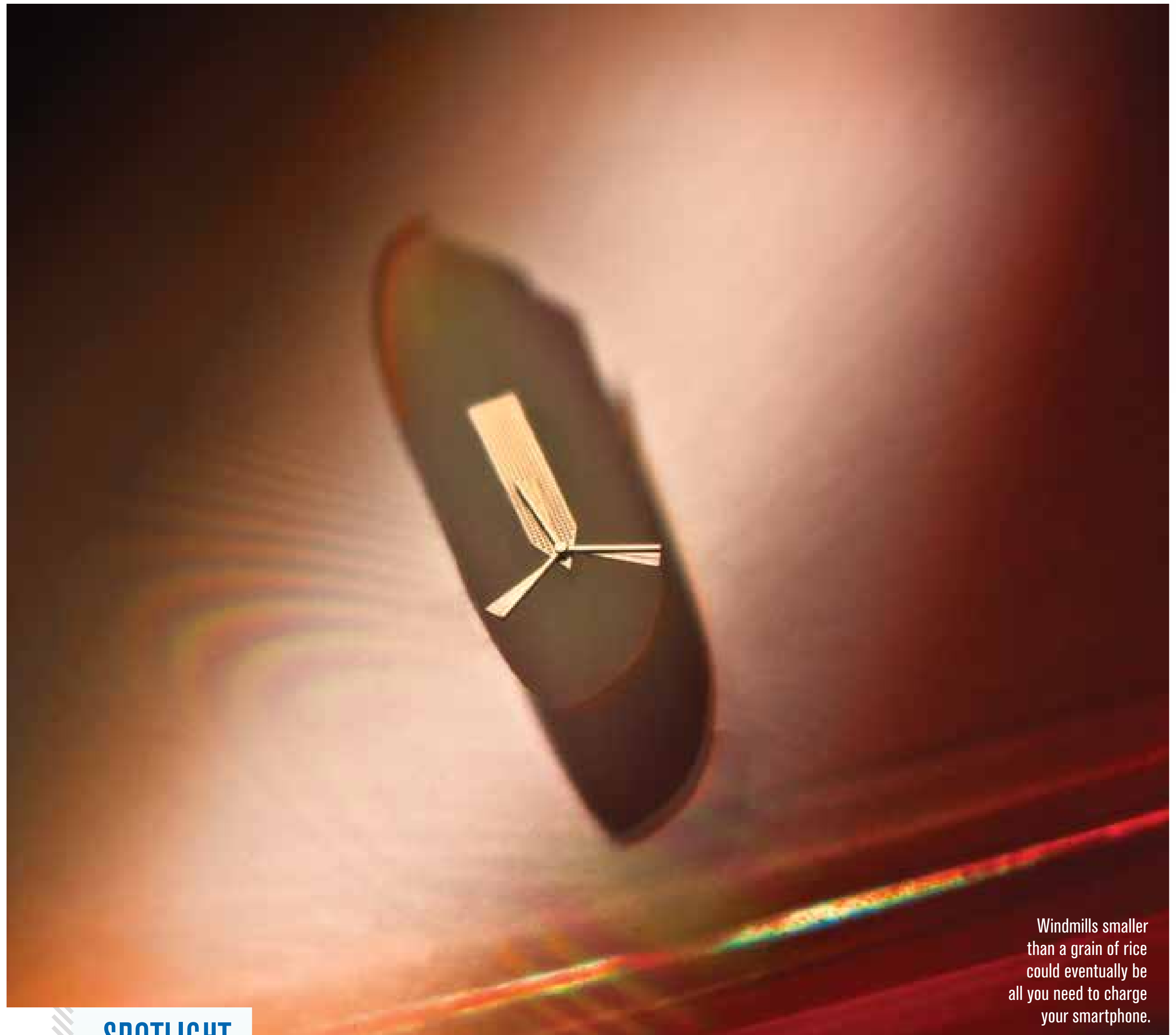
AGONAFER GIVEN GOLDEN TORCH



Dereje Agonafer's influence on the African-American community has not gone unnoticed among his peers. He was recently selected as the 2014 National Society of Black Engineers' (NSBE) honoree for the Golden Torch Legacy Award, the highest given at the annual NSBE conference.

Dr. Agonafer, the Jenkins Garrett professor of mechanical engineering, has a broad range of research areas, thanks to his work as the director of two centers: the Electronics MEMS and Nanoelectronics Systems Packaging Center and the National Science Foundation's Industry University Collaborative Research Consortium (I/UCRC) in the area of energy-efficient systems.

He is currently advising 12 doctoral and 25 master's students and has published more than 190 papers and holds nine issued patents. His recent research focuses on how to best cool data centers so companies such as Facebook (a member of the I/UCRC) can increase their efficiency and potentially save millions of dollars in energy costs.

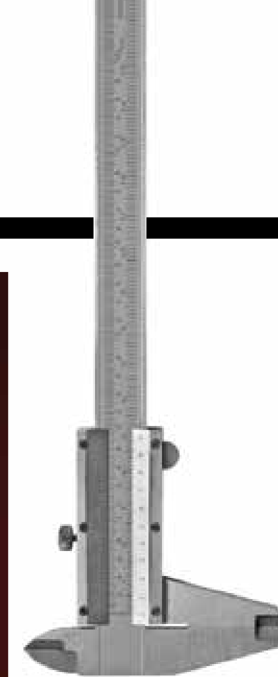


Windmills smaller than a grain of rice could eventually be all you need to charge your smartphone.

SPOTLIGHT

Tiny Wind Wonders

Need to charge your cellphone battery? The solution may be found in an unexpected place: microscopic windmills. Electrical engineering researchers Smitha Rao and J.-C. Chiao have designed and built the tiny devices, which are so small that a single grain of rice could hold about four of them. Despite their size, the micro-windmills are proving to be an innovative solution to powering items like cellphone batteries and even generating home energy. Dr. Rao's designs blend origami concepts into conventional wafer-scale semiconductor device layouts. That way, complex 3-D movable mechanical structures can be self-assembled from 2-D metal pieces using planar multilayer electroplating.



ENSURING CONSISTENCY ON THE MICRO-SCALE

When a machine shop needs to manufacture 6-inch pipes, it uses quality-control processes to ensure that each product it produces is exactly that size. But when it comes to manufacturing at the nano- and micro-scale, the job gets much more difficult. This is a major problem for researchers, as experiments conducted at those scales rely on uniformity throughout the procedure.

Assistant Professor Li Zeng is using a $142,223 National Science Foundation grant to develop a mathematical method of ensuring consistency in the manufacturing processes that produce complex data. The work focuses on "profile data," which is far more complex than typical data produced in a quality-control operation.

"In looking at this complex data, we can gain insight into what happens in the process," says Dr. Zeng. "But we're not really checking the process—we're checking the data. Then the researchers who use it can adjust their variables for a more consistent system."

PREDICTING EPILEPTIC SEIZURES

Shouyi Wang, an assistant professor in the Industrial, Manufacturing, and Systems Engineering Department, has developed a computational model that can predict future seizures by analyzing an individual's electroencephalography (EEG) readings.

"The challenge with seizure prediction is that every epileptic is different," Dr. Wang explains. "But if we use the EEG readings to build a personalized data profile, we're better able to understand what's happening to that person."

Early indications are that Wang's model could provide 70 percent accuracy or better and give about 30 minutes' warning before an actual seizure occurs.

Shouyi Wang

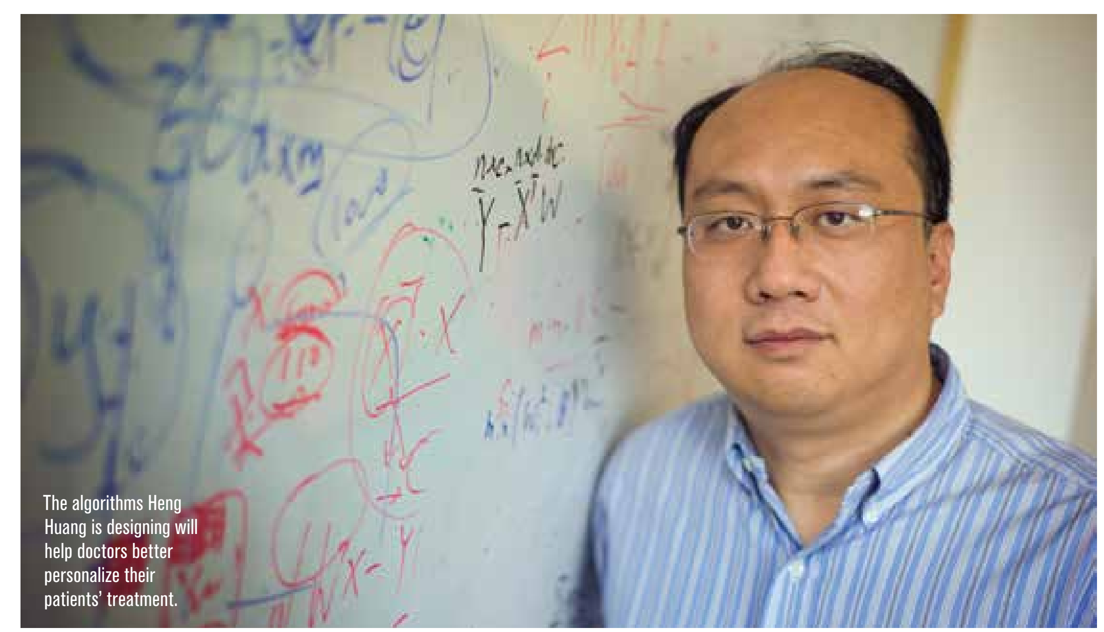
The current model collects data through a cap embedded with EEG wires, but Wang's team is also developing a less obtrusive version that records and transmits readings to a box for easy data download.

Big Data, Big Potential

Medical records contain a treasure trove of information that can help doctors identify trends and treat patients in a personalized fashion. But is there a way for researchers to access it while maintaining patients' privacy? Heng Huang, associate professor of computer science and engineering, is trying to find out, thanks to a pair of National Science Foundation grants worth $1.6 million.

He is using the first to design big-data mining algorithms that can sort through electronic records, enabling physicians to personalize treatment, predict needs, and identify risks that can lead to readmission. The second project tackles how to keep that data both accessible and confidential.

"It's a fine line we're walking," says Dr. Huang. "We're trying to preserve and protect sensitive data, but at the same time allow pertinent information to be read."



The algorithms Heng Huang is designing will help doctors better personalize their patients' treatment.

Kytai Nguyen

HELPING ARTERIES HELP THEMSELVES

Kytai Nguyen, associate professor of bioengineering, received a four-year, $1.4 million National Institutes of Health grant to improve procedures like angioplasty or stents, which open blocked blood vessels.

"We have discovered a way to use nanoparticles to heal arteries," she explains. "This process will reduce complications that can occur in the vessels following surgery and may extend opportunities for patients to live longer, healthier lives."

With Dr. Nguyen's new system, a surgeon would insert nanoparticles after an angioplasty or stent that would attach to the arterial wall of the affected site and then recruit stem cells, which can regenerate the weakened cells naturally. The nanoparticles would dissipate once cell regeneration is under way.

The process addresses concerns that arise when a person's underlying smooth muscle cells migrate to the weakened arterial walls and blood cells attack the damaged site.

"Your body naturally sends smooth muscle cells to the vulnerable walls, creating a host of problems the body doesn't need," Nguyen says. "It could cause re-narrowing of an artery, leading to a heart attack."

UTA's Formula SAE racing program has a long history of international success.

Need for Speed

The continued success of UT Arlington's Formula SAE racing program over the past three decades has earned it well-deserved recognition and a top-five ranking in the world.

"This is a confirmation of our leadership in Formula SAE and recognition of a job well done by Professor Robert Woods and his teams throughout the years," says Mechanical and Aerospace Engineering Department Chair Erian Armanios.

The completely voluntary team is made up of students from all majors and classifications. Together, they build a car from the ground up each year to compete against other programs. UTA was ranked fifth of 513 teams around the world in the 2014 Formula Student Combustion World Rankings. The program was the top-ranked of those based in the United States.

Life-Saving App

Texting while driving is dangerous—and all too common. In response to the widespread practice, a team of UT Arlington undergraduate students developed a cellphone app that temporarily blocks, but saves, text messages when the receiving mobile device is traveling above 15 mph. It also silences text alert sounds that could potentially distract the driver. Anyone trying to contact him or her would receive an autoreply letting the sender know that the receiver is on the road.

The project won first place and a $10,000 prize in the second annual AT&T Coding Contest. The team included James Fielder, Keyurkumar Patel, Zedd Shmais, Kevin Chung, and Andrew Toscano, all computer science and engineering majors. Senior Lecturer David Levine served as an adviser. This is the second year in a row that UTA has won.

"A lot of people, especially young people, text and drive every day," Fielder says. "It was great to work on a project that can make a difference in peoples' lives."

SPOTLIGHT

Student Space Adventure

A team of UT Arlington students had the experience of a lifetime when they hitched a ride on a NASA aircraft for a series of parabolic flights. The purpose of the outing was to test a research project from the University's engineering labs—a wireless strain sensing system in space application—in a reduced-gravity environment. "This device could help engineers determine if they need to abort a mission or make repairs to a spacecraft," says team member Monica Hew.

Students experienced weightlessness while doing research on a NASA aircraft.

NEW MASTER'S DEGREE OFFERED

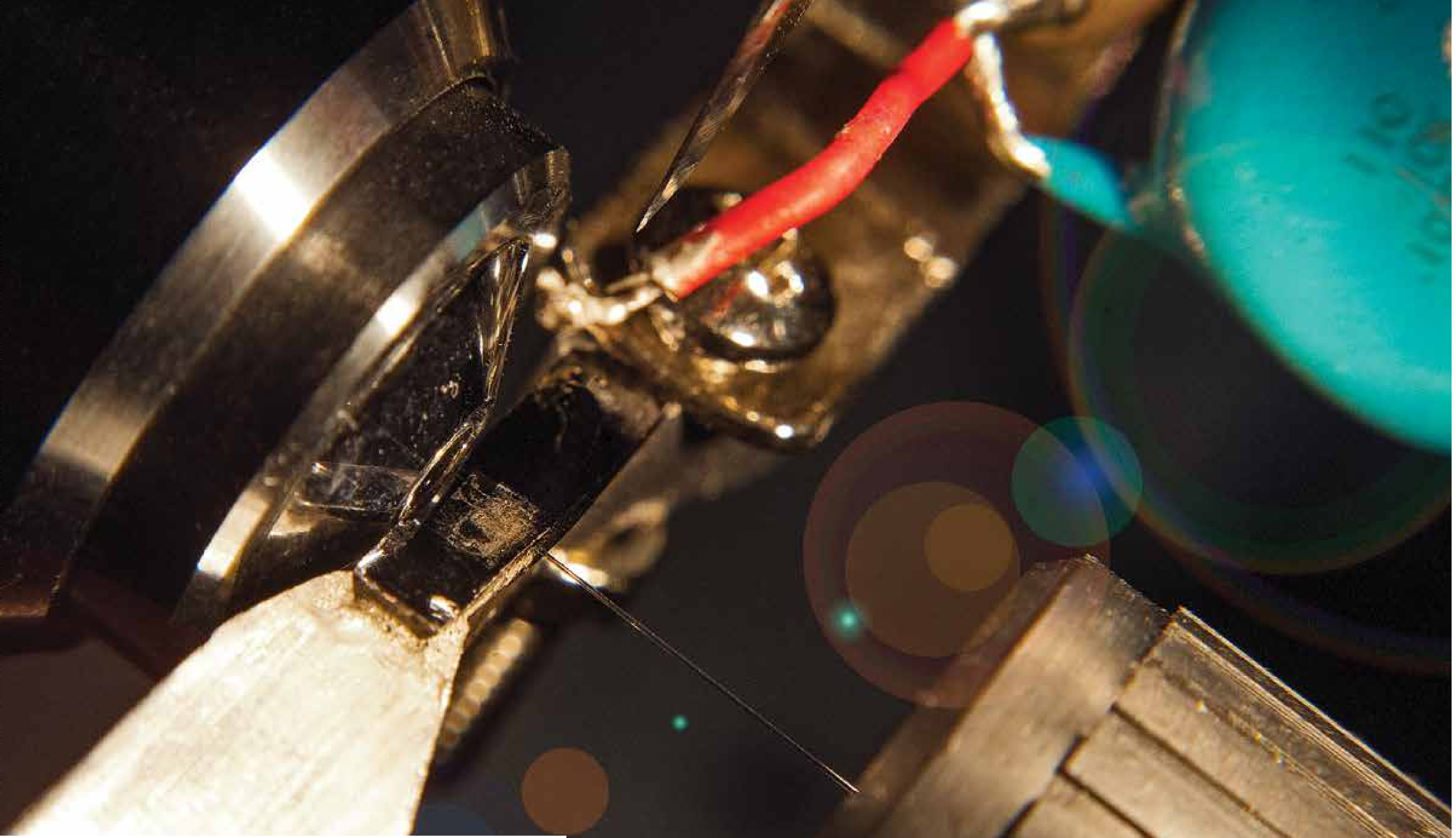
Soon, construction sites across North Texas will have a UTA flavor, thanks to a new Master of Construction Management degree offered by the Civil Engineering Department.

The new interdisciplinary degree program will make its debut this year. It is designed primarily for students with an undergraduate degree in civil engineering, science, mathematics, architecture, engineering technology, construction management, or business.

"We are looking forward to this new interdisciplinary approach to planning for and helping shape the built environment," says Dean Khosrow Behbehani.

Instructors include professionals working as construction managers for top firms in the Dallas/Fort Worth Metroplex, who can offer insight into what it's like to work in the field.

Full-time students may complete the program in as little as one year. Courses are offered online and in the late afternoon and evening, allowing working professionals to continue their careers while quickly gaining the skills and certifications they need to compete in the growing construction management job market.

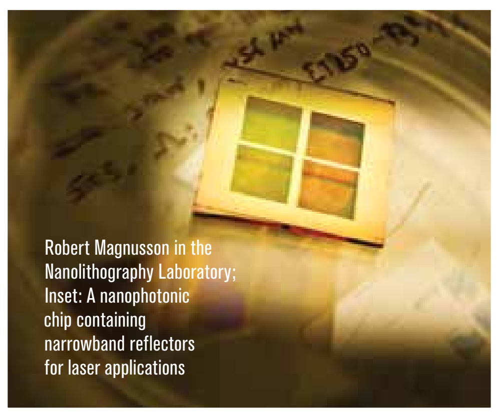


Laser beam coupling by a microscope objective into an optical waveguide (output from the waveguide is coupled into optical fiber); Inset: Professor Michael Vasilyev with research assistant Lu Li

Play of Light

Optics research in the Electrical Engineering Department is bringing new insights to data security, medical technology, and many other areas.

RESEARCH INVOLVING LIGHT—how it moves, propagates, affects, and is affected by objects—impacts a seemingly endless variety of fields. From health care to energy to security, projects involving optics touch on some of the most pressing topics of the modern era. Electrical engineers at UT Arlington are doing their part to advance this important work. Their research includes increasing the amount of data that can securely be transmitted over the Internet, integrating membrane lasers into neural activities to monitor bodily reactions, making large data centers more energy-efficient, and improving biosensors, among others.



Robert Magnusson in the Nanolithography Laboratory; Inset: A nanophotonic chip containing narrowband reflectors for laser applications

Sending Signals Securely

As savvy Internet users understand, security is a major concern with online transactions and transmissions. That's why Professor Michael Vasilyev has focused his research on increasing by tenfold both the amount of information that can be securely transmitted on the Web and the distance over which it can be sent. His work is part of an $8 million initiative funded by the Defense Advanced Research Project Agency (DARPA) that enlisted five universities and three companies to study advanced quantum communications.

With conventional, or classical, communication, information is transmitted via "bits" that take the value of either one or zero. In contrast, quantum communication uses quantum bits—"qubits"—which can be one, zero, or one and zero simultaneously (something called a "superposition" state). These qubits are represented by quantum-mechanical objects, such as single photons, that can provide a much higher level of protection from eavesdropping than classical communication signals.

"There are all kinds of personal information—both among private citizens and public governments—that require the utmost security," Dr. Vasilyev says. "Quantum communication offers the most rigorous solution for security because it employs the fundamental laws of quantum mechanics to enforce the exclusive linkage between the sender and the receiver, with no chance of other people intercepting."

He believes that one of the challenges with current technology is that secure and fast quantum communications can only be done over short distances—about 100 kilometers—before the signal breaks down. The reason is that qubits cannot go through optical amplifiers (commonly used in classical communications) without losing their quantum-mechanical security advantages.

To obviate the issue, Vasilyev's lab is encoding information in spatial features or pixels of the photons that can be sent through multimode fiber optic lines, thus dramatically increasing the amount of received data without jeopardizing its security. The new technology will be useful for classical communications as well.

"The Internet is facing a capacity crisis," Vasilyev says. "If the current rates of network traffic growth continue, we could be out of bandwidth by 2020 unless we start harnessing the spatial degrees of freedom of photons in a fiber."

In collaboration with the University of Vermont, he has also developed regeneration technology that restores the quality of optical signals at multiple wavelengths simultaneously without ever converting them to electrical signals. The project is part of his ongoing research to help dramatically reduce the cost of transporting data over the Internet backbone.

"The power of optics is in its capability to process many independent, high-speed data streams in parallel," Vasilyev says. "So far, we have been applying this power to multiple wavelengths. With all possible wavelengths exhausted, we're now turning to multiple spatial pixels to keep the capacity growing."

High Capacity, Minimal Energy

Instead of fiber optics and qubits, Weidong Zhou works with silicon chips and lasers. But his work could prove equally important to the tech industry. The electrical engineering professor is trying to reduce energy consumption through thermal-engineered structures by essentially controlling the direction of light.

Traditionally, computer and communications devices use low-cost silicon chips to efficiently store integrated electronic circuits for information processing. Lasers, meanwhile, are incorporated into compound semiconductor materials to engineer high-capacity optical networks. Silicon photonics seeks to integrate the two.

"Lasers on silicon remain a major roadblock toward making integrated silicon photonics work," Dr. Zhou says. "Integrating light or lasers on silicon chips has the potential to increase capacity, increase speed, and lower the energy consumption of what those chips do."

His technology uses photonic crystals to route laser beams in a way that increases the efficiency of the light on the integrated circuit. "It's like building construction vertically in New York City because there's nowhere to build horizontally," he explains.

The technology eventually could allow designers to place optical links on silicon chips with much less wasted material, time, and effort. One application is to replace metal wires in data centers with optics. Called optical interconnect, these new wires would allow for faster transfer and less loss.

"Data centers take a huge amount of power. Google puts theirs near power plants because of the energy draw, for instance," Zhou says. "Many companies and government agencies, such as DARPA, are working on this problem. The major challenge is to create very high capacity while using minimal energy."

Though Zhou's research in this area began with data centers, it has many other applications, including optical imaging, sensing, bio-integrated electronics, signal processing, and bioimaging. For the latter, the engineer is exploring how a membrane laser can be integrated into neural activity to monitor functions and measure response to stimuli.

"The computing power of the human brain is similar to a high-performance PC, but the energy consumption is many times lower than anything man-made, around 20 watts," he says. "The ultimate dream would be to reach that level of power consumption while keeping the same quality."

Zhou's work with silicon photonics has helped in this quest. He uses nanoscale-structured photonic crystals as a mirror to form a laser cavity on silicon. Then, using a stamp-assisted printing transfer process, he integrates compound semiconductor structures and silicon cavities. These cavities are very small and use little energy, which also limits temperature rise.

"Sometimes, as long as we know the direction is right, we can see that the applications of our work are unlimited," Zhou says. "This is engineerable technology for many applications."

> "The power of optics is in its capability to process many independent, high-speed data streams in parallel."

Building for the Future

Like a certain former United States defense secretary, Robert Magnusson likes to talk about "known unknowns" and "unknown unknowns" when discussing his research process.

"I encourage my graduate students to avoid the first category and invent fearlessly within the second," he says. "This philosophy will lead to the greatest discoveries."

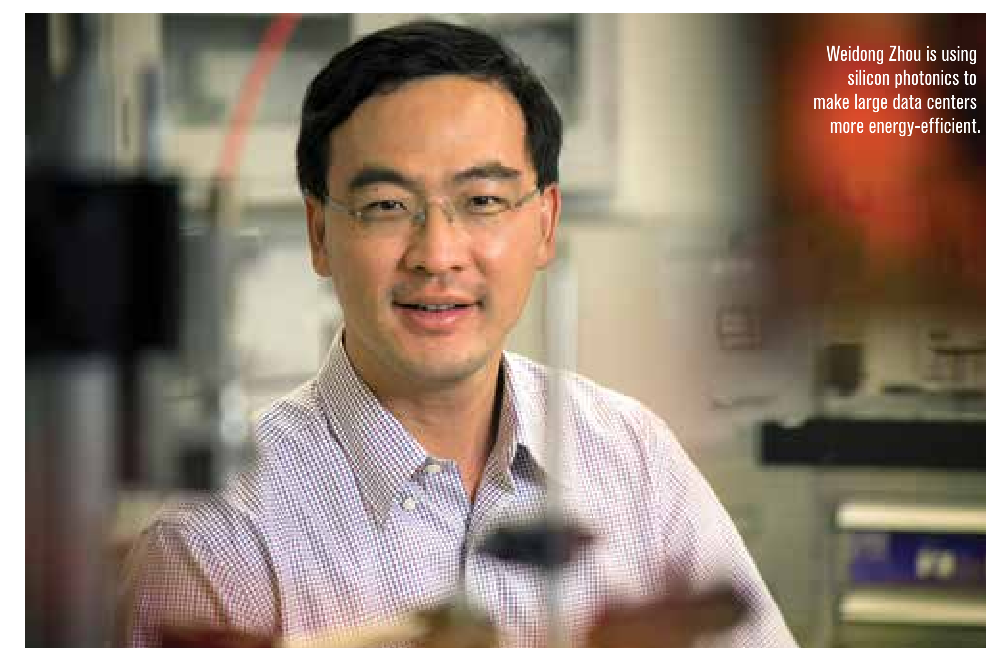
Dr. Magnusson, the Texas Instruments Distinguished University Chair in Nanoelectronics, works with optics on the nanoscale. His projects have applications in everything from telecommunications to energy to medicine to laser technology. He leads the University's Nanophotonics Device Group, which models, designs, fabricates, and tests a variety of nanotechnological concepts, including wavelength-selective laser mirrors, efficient broadband reflectors, compact and economic biosensors, wideband absorptive nanostructures, and tunable display pixels.

Many of these devices use films that are less than one micrometer thick and have been etched with nanopatterns (similar to the anti-reflective coating on some eyeglasses). According to Magnusson, input light resonates within the structure and is generally delayed, which in simple terms means the element temporarily stores the light.

"When this happens, a great concentration of light occurs inside the device and surrounds it. This then provides attached molecular layers, for example, with intense optical stimulation that can be very useful in the generation of new optical frequencies or in spectroscopy," he explains. "The combination of periodic layers and homogeneous films creates new effects that surpass ordinary thin-film effects."

The class of resonant bio- and chemical sensors invented by Magnusson and his team is of particular importance, as it is a "complete biosensor," meaning it produces the full parametric quantification of a bioreaction with a single incoherent beam of light. These sensors are now in commercial use.

Additional hot topics under study in the Nanophotonics Device Group include resonant focusing elements, total and wideband absorption in a nanolayer, efficient resonant color-filter displays, coherent perfect absorbers, and nanostructured metasurfaces. ✷



Weidong Zhou is using silicon photonics to make large data centers more energy-efficient.

The New Frontier of Flight

New research collaborations and educational offerings help propel UT Arlington to the forefront of unmanned vehicle systems technology.

It's the stuff of science fiction novels and Saturday morning cartoons: planes that make decisions on their own and operate independently of humans. Thanks to new research by UT Arlington faculty and students, fiction is becoming reality. Associate Professors Atilla Dogan and Kamesh Subbarao (aerospace engineering) and Brian Huff (industrial, manufacturing, and systems engineering) are at the forefront of this technology, having worked with unmanned aerial vehicles (UAVs) for more than a decade. The trio helped found UTA's Autonomous Vehicles Lab in 2003 to build UAVs and test technologies related to image-sensing and target-detection. Since then, the lab has diversified to add ground and water vehicles.

Botond Pal, captain of the University's UAS competition team, launches a plane.

"UAVs are the stars right now because ground and submersible vehicles are more difficult, as the latter are in such close contact with their environment that they require much better sensing ability," Dr. Huff says. "On the other hand, while flying a UAV is easy, the results can be catastrophic if you make a mistake. Driving a ground system may be harder because there are more things to avoid, but mistakes don't usually destroy the vehicle."

With unmanned vehicle systems (UVS), a distinction is made between autonomous vehicles—those that perform fully on their own without human input—and unmanned vehicles, which rely on human guidance, such as a remote-controlled airplane. While some autonomous capabilities exist (think of cars that parallel park themselves or enhanced cruise control that slows the vehicle when it senses an object that is too close), most current research favors unmanned systems as assistive technologies to perform tasks that are too boring or too dangerous for humans. In either case, they are designed for specific applications because, according to Huff, general-purpose robots have not worked well in the past and are expensive to produce.

The challenge, therefore, is to make systems that can effectively do the jobs for which they are designed while remaining inexpensive enough to mass-produce so they can be marketed to the public. One solution Huff has found is to re-engineer an existing platform and enhance it with assistive autonomy, rather than design an entirely new system.

"It's not about the vehicle—in the end, a truck is just a truck. It's about what science and engineering allow us to do to make the system perform in an environment in an efficient way," he explains. "There is value in redesigning a system to take the human operator out of it and make him the manager instead. In the case of an aerial vehicle, for example, you don't have to put in an oxygen system or seating for a pilot, so you can use that space for other things."

Ready for Liftoff

Unmanned aerial vehicles have gained more and more of the public's attention in recent years, as their use for military and governmental purposes increases. It's an industry set to expand rapidly—a recent study by the Teal Group predicts that annual UAV spending will more than double during the next decade to about $11.6 billion, with the industry generating over $89 billion and creating 100,000 jobs.

But before that can happen, much research

UAV Anatomy

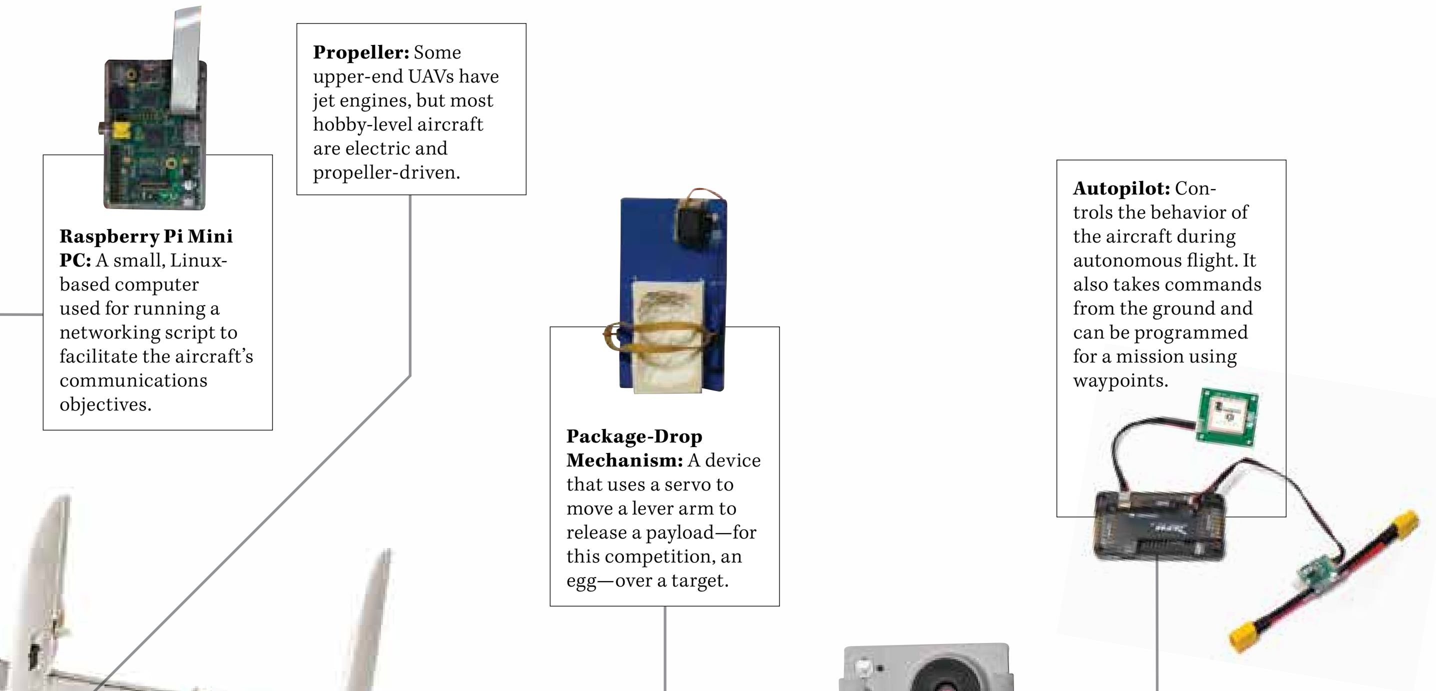
An up-close view of a student-built plane.

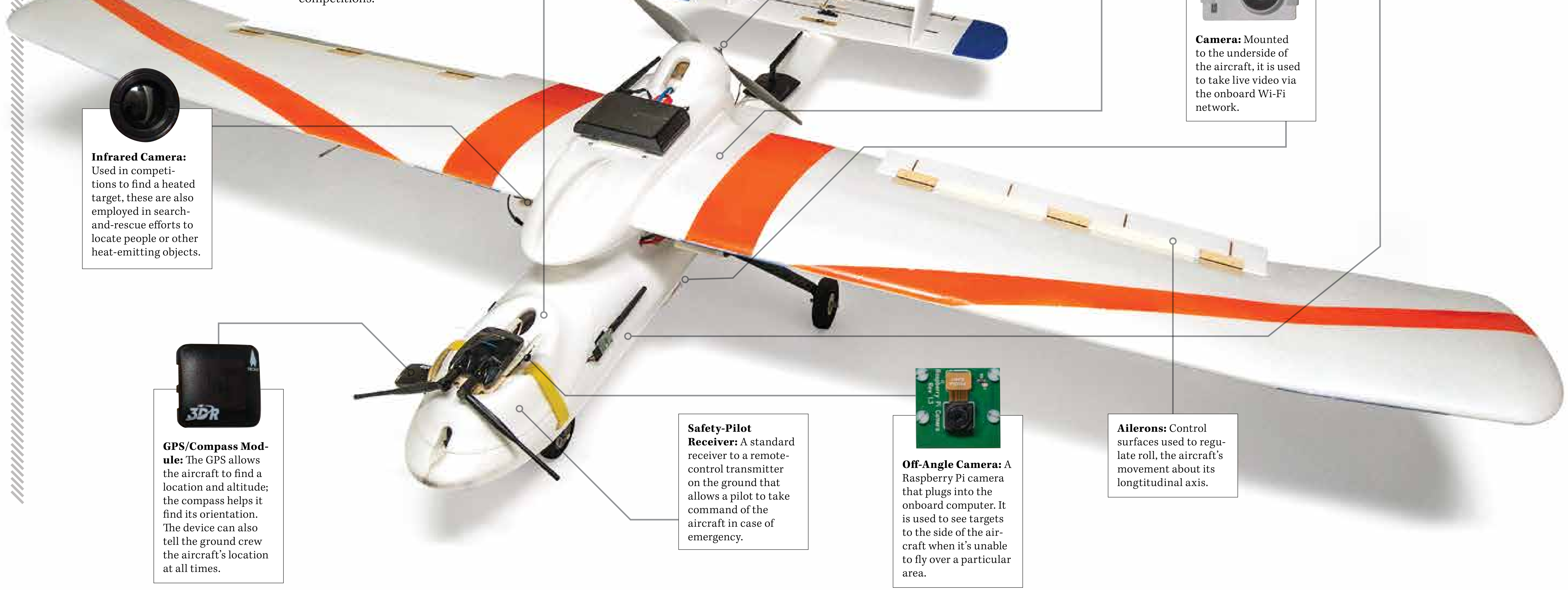
Students at UT Arlington aren't just learning about unmanned vehicle systems, they're also building and competing with their own.

At events like the 12th annual Student Unmanned Aerial Systems competition, held this past June, students must construct and program components that allow them to control UAVs (such as the one pictured at right) and then use them to complete different tasks—for example, dropping a plastic egg filled with flour on a target.

"At the competitions, we get to apply what we learn in class," says senior aerospace engineering major Michelle Ashmore. "For instance, the difference between theory and actuality—'this is what should happen, but this is what actually happened,' and how do we account for that. And since a lot of big-name companies sponsor and judge the competitions, they're a great place to make contacts."

UTA's team finished ninth overall and sixth in the flight competition. Past teams have also participated in the Intelligent Ground Vehicle and RoboBoat competitions.





and training must be done. Currently, the Federal Aviation Administration prohibits the launching of UAVs without permission and is still writing the official rules and regulations for their use.

To help with that process, the agency endorsed six major unmanned aerial system test sites at different locations around the country. One of these is Texas A&M-Corpus Christi, which serves as the leader of the Lone Star Unmanned Aircraft Systems Initiative, a research consortium that includes the UTA Research Institute (UTARI); Texas A&M Engineering Experiment Station; Camber Corp. of Huntsville, Ala.; the Southwest Research Institute in San Antonio; and other institutions and private-sector companies.

> "Our faculty members and student teams already are designing these systems, building them and programming them to perform tasks to aid humankind."

UTARI's research team includes Huff and Drs. Dogan and Subbarao, who will focus primarily on issues related to the high performance, human interactions, and safety of unmanned aircraft.

While the Corpus Christi site features several test ranges around south Texas, UT Arlington also was able to obtain its own certificate of authorization (COA) for test flights of fixed-wing aircraft.

"Our contribution to the unmanned aerial systems test site is research," Dogan says. "Given the distance to the test ranges under the Lone Star consortium's COA, we wanted to have our own. To do that, we had to outline specific research we'd be doing and why. There are also very strict regulations on who can fly the vehicles and the types of certifications required. It was great to get our COA so we can move forward with our research."

Dogan and Subbarao's work centers on problems concerning flight dynamics and control, including aerial refueling and formation flight for fuel-saving, conflict detection and resolution, and how multiple vehicles work together.

"We look at things like network latencies and delays in communication," Subbarao explains. "We've also investigated how multiple vehicles track a target and how they work together—for instance, what happens when connectivity issues cause some vehicles to drop out and then come back in."

The engineers previously developed a guidance algorithm that enables them to track a ground target with an aerial vehicle while still remaining aware of and avoiding threats to the UAV.

In addition to aiding research, UT Arlington's COA will allow students to explore the real-world applications of unmanned vehicle systems.

"That experience will give our students a distinct advantage in an incredibly dynamic and growing industry," says engineering Dean Khosrow Behbehani.

Training the Next Generation

But that's not the only opportunity available to students interested in UAV technology. Just this fall, the College of Engineering added undergraduate and graduate certificate programs in unmanned vehicle systems.

"This is a great chance for someone in the workforce to learn new skills and improve his or her résumé," Subbarao says. "For example, someone with an undergraduate degree in electrical engineering who is working on sensors may discover that it would be helpful to their career to understand how a UAV flies. Through the certificate, that additional background can be acquired in 15 credit hours. A student could even do multiple certificates or use it as a stepping stone to a master's degree."

For the programs, students progress through one of four tracks: computer science and engineering; electrical engineering; industrial, manufacturing, and systems engineering; or mechanical and aerospace engineering. All students take three classes in their track and two common courses, one at the beginning of the program and one at the end, taught by professors from each of the aforementioned departments. The first gives general information about components, subsystems, development, and operation. The second, project-based course requires students from all tracks to work in teams, reinforcing the multidisciplinary nature of the program.

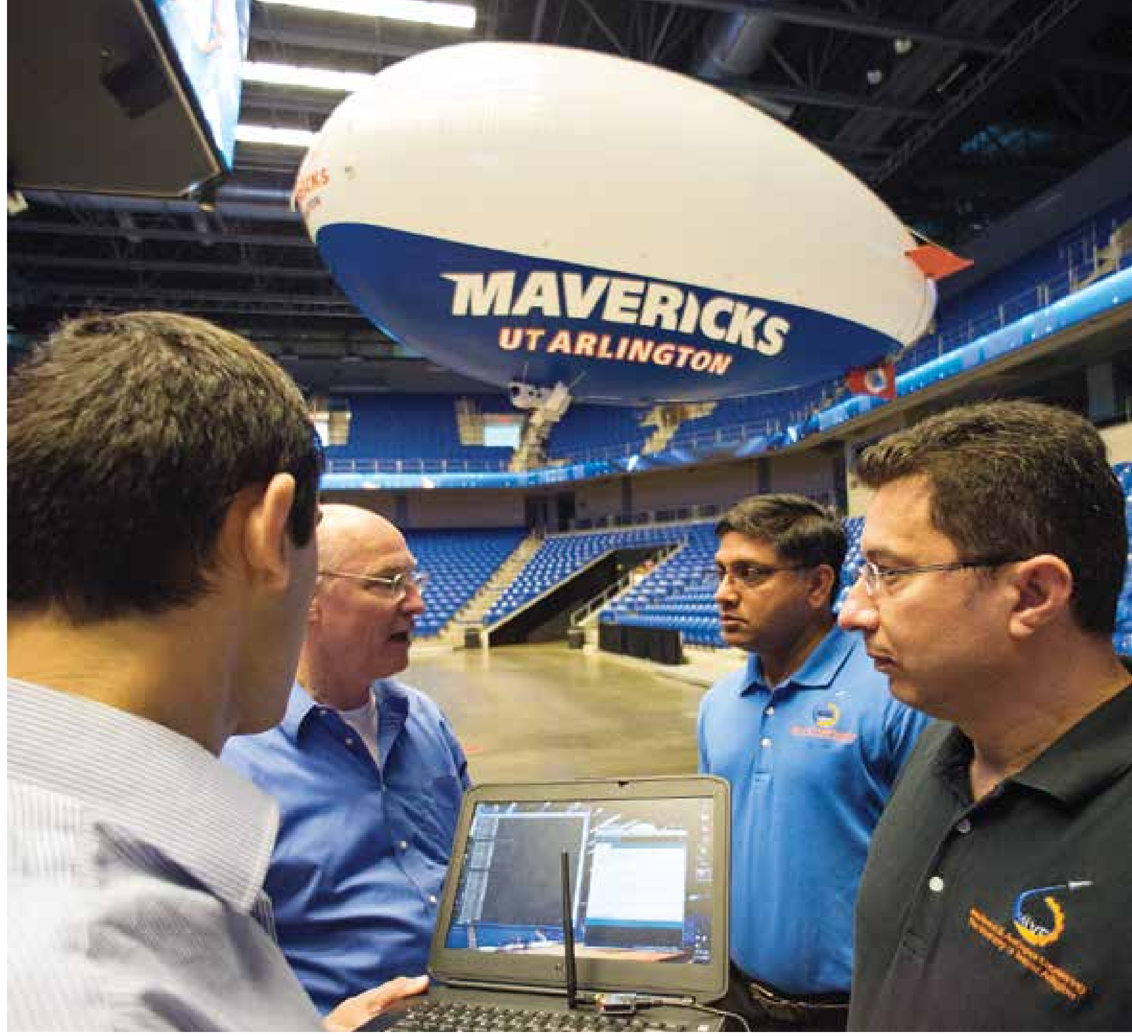
The graduate certificate program will also allow people who are already working in a certain specialty the chance to expand their knowledge and learn an entirely new facet of unmanned vehicle systems.

Dr. Behbehani believes the two certificates will help meet business demand for highly educated employees in the rapidly developing and important field.

"Our faculty members and student teams already are designing these systems, building them and programming them to perform tasks to aid humankind," he says. "Whether they are used for aerial photography, security, transportation, product delivery, or outer space exploration, unmanned vehicle systems will be integral to the future of engineering."

With the new certificates, UT Arlington becomes the only university in the state of Texas to offer an unmanned vehicle systems program at any level. Subbarao and Dogan are confident that UTA's graduates will make an impact.

"Unmanned vehicle systems is a rapidly growing area," Dogan says. "As a university, our mission is to provide the best education and best job opportunities for our students that we can, and the programs and facilities we have in place will do just that." ✴



Clockwise from top: Brian Huff, Kamesh Subbarao, and Atilla Dogan test UTA's airship with graduate student Onur Daskiran (foreground); Dogan and post-grad researcher Haki Sevil work on sense-and-avoid technologies; Subbarao discusses a wing design prototype with his students.

BEYOND THE LAB

THE LATEST DEVELOPMENTS FROM THE COLLEGE'S ALUMNI AND DONORS

LEGACY OF A LEADER

Former UT Arlington President and engineering Professor Jack Woolf died Tuesday, June 10, at age 90.

Dr. Woolf started his tenure at what was then called Arlington State College (ASC) in 1957 as dean. He was named acting president following the death of E.H. Hereford, then officially became ASC's second president in 1959. Over the next decade he guided the school to four-year status, led the transition to the UT System, and helped secure the University's first graduate programs. During his presidency, enrollment more than doubled, the campus site expanded dramatically, and the faculty size increased.

After he stepped down from the presidency in 1968, Woolf served as a professor in the Mechanical and Aerospace Engineering Department until his retirement in 1989.

The University's new Strata 400 FE-SEM will aid many research projects.

New Equipment, Endless Possibilities

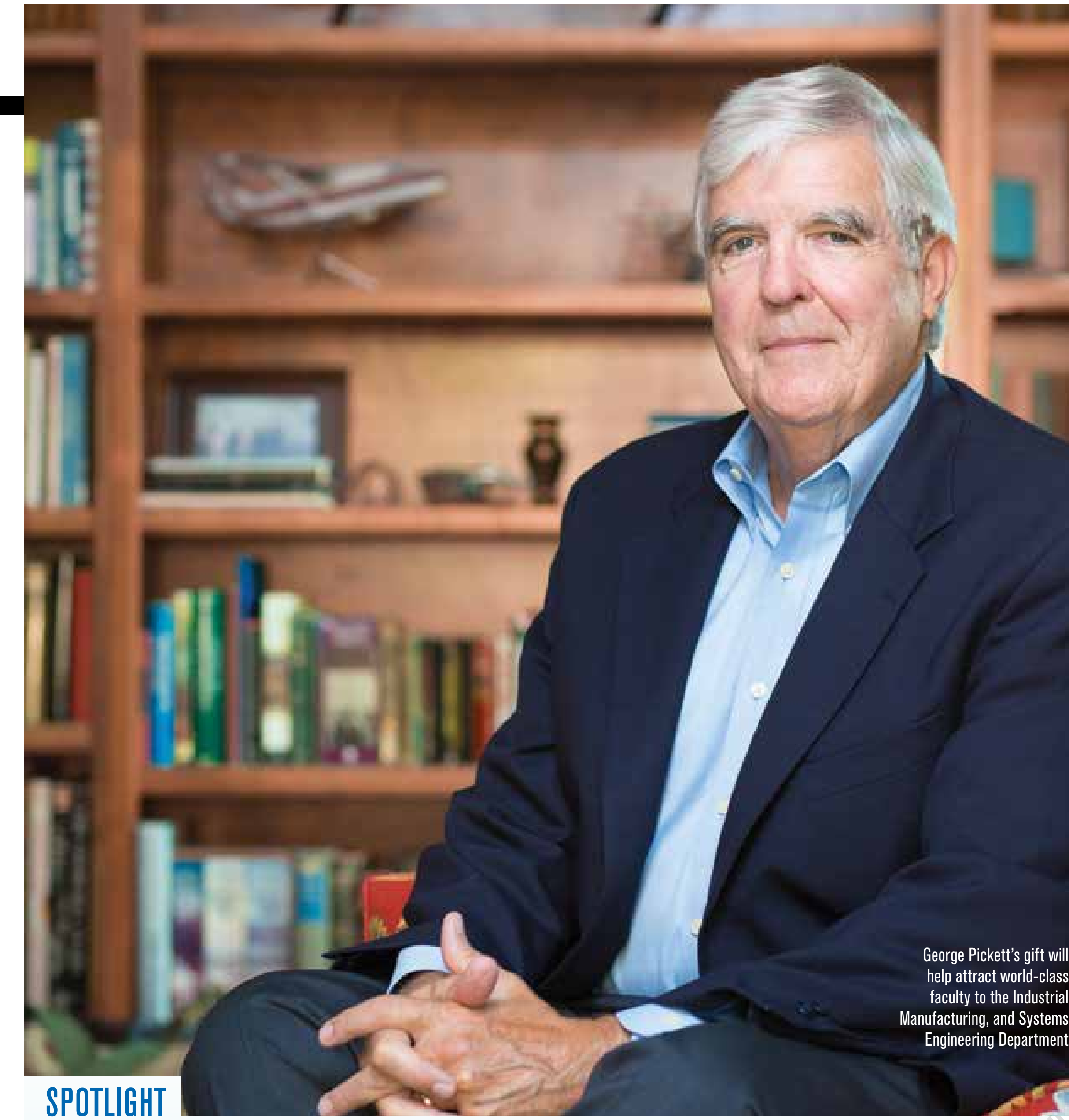
Two new pieces of high-technology equipment in the Materials Characterization Facility will advance state-of-the-art research on campus.

The first is a Hitachi S-4800 field emission scanning electron microscope (FE-SEM) with a backscattering electron detector. The device allows researchers to view fine surface detail. It is an ultra-high-resolution SEM with sub-nanometer resolution that is capable of handling large specimens of a variety of sample types, such as semiconductor cross-sections, powders, and biological thin sections.

The second device is a Strata 400 FE-SEM with dual-beam-focused ion beam (FIB) technology. (FIBs are often used in the semiconductor industry or to etch or pattern surfaces.) It can be used for structural analysis and material and defect analysis. Together, the two devices are valued at more than $1 million, but were donated to the University at deep discount.

"These new, cutting-edge materials with characterization capabilities will be available to UTA faculty and students," says materials science and engineering Chair Stathis Meletis. "They will provide new educational and research opportunities, especially in nanoscience and nanotechnology."

PHOTOGRAPH BY TROY STAINS



George Pickett's gift will help attract world-class faculty to the Industrial, Manufacturing, and Systems Engineering Department.

SPOTLIGHT

Promoting Faculty Excellence

The Industrial, Manufacturing, and Systems Engineering Department can now attract more faculty, thanks to a gift from George F. Pickett ('67 BS), a UT Arlington Distinguished Alumnus and retired airline executive. He and his wife, Elizabeth, recently donated $250,000 to the department to create the George and Elizabeth Pickett Professorship. It is the department's first endowed professorship. "This gift will play an important role in raising the visibility and reputation of the Industrial, Manufacturing, and Systems Engineering Department," says Professor Victoria Chen, who worked with the Picketts to secure their gift. "It is a prestigious honor that will enable us to recruit outstanding faculty."

BOARD OFFERS NEW ENDOWED PROFESSORSHIP

Last spring, the board of advisors established a new endowed professorship for the College of Engineering. Used to reward an outstanding faculty member or to recruit a new one, an endowed professorship is a monetary award that can be used for a variety of purposes, including graduate student support, salary enhancements, equipment, travel, and research expenses.

"The endowed professorship sends a great message about how we are demonstrating our commitment to and confidence in the college's faculty and students," says board development Chair Larry Stephens.

The College of Engineering Board of Advisors is a group of industry professionals, including some UT Arlington alumni, that helps the college's administration decide on the direction of research and teaching based on industry needs and trends.

Electrical engineering alum Arun Bhikshesvaran was named a UT Arlington Distinguished Alumnus.

SPOTLIGHT

Distinguished Alumnus Honored

Arun Bhikshesvaran ('95 MA) was honored late last year as a Distinguished Alumnus at the University's 48th Annual Distinguished Alumni Gala. Bhikshesvaran has more than 15 years of experience in the telecommunications industry and is currently the chief marketing officer at Ericsson. In this capacity, he is responsible for driving the company's global marketing strategy. Prior to becoming CMO, Bhikshesvaran was senior vice president of strategy and chief technology officer for Ericsson North America.

RAMPALLI NAMED QLOGIC PRESIDENT

Prasad Rampalli ('82 MS) was named president and chief executive officer of QLogic in February. He also was named to the company's board of directors.

Rampalli came to QLogic from EMC, where he was senior vice president of cross-business unit engineering. Prior to working there, he spent 27 years at Intel Corporation, most recently serving as vice president of the Intel Architecture Group, for which he drove IA platform differentiation for cloud and enterprise markets in deep collaboration with ecosystem partners and end customers.

Rampalli was named to *CIO Magazine*'s Top 100 Honoree List in 2001 and 2002. In addition to his UT Arlington degree, he holds a bachelor's degree in mechanical engineering from the Indian Institute of Technology in Kampur, India.

CLASS NOTES

UPDATES, NEWS, AND GOINGS-ON FROM ENGINEERING ALUMNI

1974

Bill Lane ('74 BS, '76 MS, Mechanical Engineering) is vice president of Emerging Technologies for Weatherford Artificial Lift Systems and a member of the Weatherford Unconventional Resources Team. He has been with Weatherford and the former EVI for 19 years in various executive positions.

1980

Leroy Caldwell (BS, Civil Engineering) had an article published in *The Structural Engineer Newsletter.* He has been a senior engineer with CMC Construction Services in Dallas since 2009 and spent nearly 29 years with Dayton Superior prior to that.

1981

Jim Green (BS, Electrical Engineering) was named CEO of EF Johnson Technologies Inc. in April. Previously, he was vice president at Flextronics, president and CEO of Digital Lightwave Corporation, and president and CEO of Trillium Industry. **Roger Krone** (MS, Aerospace Engineering) was named CEO of Leidos Holdings Inc. He was previously president of Network and Space Systems for Boeing. He joined McDonnell Douglas in 1992 and was vice president and treasurer of that company at the time of its merger with Boeing.

1982

Tim Eckersley (BS, Electrical Engineering) is senior vice president and president of the Americas region for Allegion. He previously worked for Ingersoll Rand's Security Technologies and for Nokia. **John Wright** (BS, Civil Engineering) was named director of public works for the city of Greenville, Texas, after 23 years with the Texas Department of Transportation.

1988

Mark Strauss (PhD, Biomedical Engineering) is owner and consultant of Impact Injury Analysis LLC. The company performs forensic accident reconstruction and injury analysis for vehicle accidents, as well as cases that involve amusement parks, fork lifts, loading docks, airport tarmacs, and elevators, among others. He is also an adjunct professor at the University of Illinois at Urbana-Champaign.

2004

Daron Evans (MS, Biomedical Engineering) was named to the Board of Directors of Nephros Inc. in November.

2007

Ryan Oliver ('07 BS, '08 MS, Industrial, Manufacturing, and Systems Engineering) is a visiting student in the Mechanosynthesis Group at the Massachusetts Institute of Technology. He is a doctoral pre-candidate in mechanical engineering at the University of Michigan. He and his adviser, John Hart, developed Robofurnace, an automated system for making carbon nanotube forests and studying their growth.

In Memoriam

1970s

Tommy Schmidt ('73 BS, '76 MS, Civil Engineering), 67, Aug. 16, 2013, in Fort Worth. Mr. Schmidt retired in December 2011 after 38 years of service with the Army Corps of Engineers, specializing in dam safety.

1980s

James Edward Doyle ('89 BS, Mechanical Engineering), 48, June 29, 2014, in Midlothian. He was an engineer at Lockheed Martin. **Robert Paul Paleschic** ('88 BS, Civil Engineering), 52, Oct. 4, 2013, in Mansfield. Mr. Paleschic was president of EnSien Tech, an engineering business in Burleson, and was involved in numerous area ministries.

FACULTY AND STAFF

Joseph W. "Winn" Dalley, 95, Sept. 22, 2013, in Fort Worth. Dr. Dalley was a faculty member from 1960-84. He was chair of the Department of Engineering Mechanics and later joined the Department of Mechanical and Aerospace Engineering.

50-Year Alumni Celebration

Four College of Engineering alumni were presented with special 50-year alumni pins at a luncheon held in their honor during Homecoming weekend last year.

Ellis Dawson (BS, Electrical Engineering) spent 40 years at General Dynamics as a system design and avionics engineer, working on special projects and the F-111, F-16, and F-22 airplanes. He progressed from engineer to director before retiring in 2000. He now lives in Fort Worth and is married with four sons.

Ernest Hedgcoth (BS, Civil Engineering) worked at the Texas Department of Transportation after graduating, then inspected dams and hydroelectric plants for the Federal Power Commission. In 1978 he opened Ernest Hedgcoth Consulting Engineers Inc., working on civil engineering, structural projects, and surveying. He still works and enjoys the opportunities that engineering has provided.

Johnny Vanlandingham ('63 BS, '72 MS, Mechanical Engineering) was one of the first students to study under Jack Woolf after he finished his tenure as UTA president and returned to the engineering faculty. After earning his master's degree, Vanlandingham spent a year in Waxahachie at Joy Petroleum, then left there for a career at Bell Helicopter, where he spent more than 30 years. He retired in 2008 as a senior fellow and chief of propulsion engineering.

Ellis Dawson, Ernest Hedgcoth, John Youngblood, and Johnny Vanlandingham

John Youngblood (BS, Electrical Engineering) earned his doctoral degree from Oklahoma State after leaving UT Arlington. He has worked in several industries and climbed the ladder to become CEO of a New York Stock Exchange company. Along the way, he was involved in two IPOs and one hostile takeover defense. He was recently elected president of a small company in southwest Louisiana, with the goal of restarting it and creating sufficient value to enable investors to succeed. The company has patented technology for micro-hydroelectric turbines.

RE-ENGINEERED
A NEW WAY OF LOOKING AT
THE OBJECTS OF EVERYDAY LIFE

A Warming Solution

Student design team builds a better heat pack.

EVERY SECOND COUNTS when paramedics are rushing to save a trauma patient's life. One mechanical engineering senior design project could make an ambulance crew's job even more effective.

Under the guidance of faculty mentor Raul Fernandez, UT Arlington students Arya Banait, Jeremy Smith, Gazendra Shakya, Kishan Thapa, and Josh Roden have developed an active warming device to regulate a patient's core temperature, allowing paramedics to focus on other important lifesaving techniques.

According to Banait, paramedics currently apply blankets and chemical heat packs to specific locations on the body—namely, the underarms, the back of the knees, and the groin—because that's where major blood vessels are located. Thus, if you heat the blood in those areas, you can warm the body faster. However, blankets and heat packs are passive and cannot regulate body heat or maintain a certain temperature.

The UT Arlington team, after consulting with medical students at UT Southwestern, designed heating packs that are made of a foam material and shaped to fit those areas of the body. The packs are covered with a heating element and a temperature-sensing device and are stored in a compact box that will easily fit in the back of an ambulance. To control them, paramedics simply use a controller that shows the body temperature and has two buttons, one to increase temperature and one to decrease it.

"With our device, EMTs can actively regulate body temperature; they don't just have to cover a patient and hope it works," Banait explains. "This way, they can take control of a situation and provide better patient care." ✷

UNIVERSITY OF TEXAS ARLINGTON
COLLEGE OF ENGINEERING
Box 19019
Arlington, TX 76019-0019

CAMPUS UPDATE

Bigger Is Better

Ensuring that skyscrapers are earthquake-resistant is an essential, but tricky task. Scale models can't give a true measure of how concrete beams will fare under the pressure. So Associate Professor Simon Chao builds his own full-sized beams instead. They're then shipped to a lab in Minnesota, where they can be tested for shear forces and other catastrophic stresses. "It's important to test these structures at full size to ensure their integrity," Dr. Chao says. "We have a unique ability to run these tests and help save lives through better design."