ECE NEWS

Spotlight

DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

COLLEGE OF ENGINEERING

NORTH CAROLINA STATE UNIVERSITY | FALL 2014

POWERING UP

President Barack Obama announces NC State will lead new advanced manufacturing institute.

NC STATE Engineering

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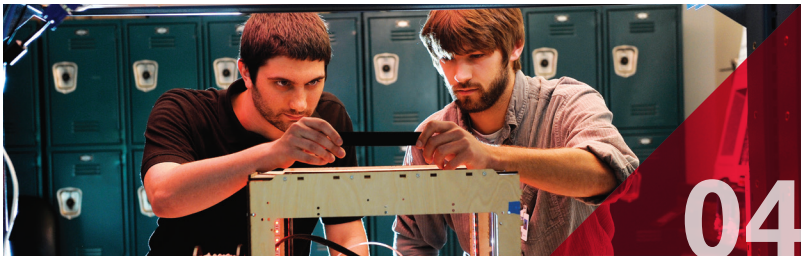
The legendary ECE professor joins the ranks of radio pioneer Guglielmo Marconi and microchip co-inventor Robert Noyce.



STUDENTS TAKE INVENTIONS TO MAKER FAIRE PAGE 04

NC State students and recent graduates get a chance to show off their inventions.

ECE ALUMNA IS ASTRONAUT CANDIDATE PAGE 06

Christina Hammock has long dreamed of a trip to outer space. Her ECE degrees are helping make that dream a reality.

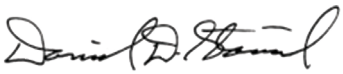
A MESSAGE FROM THE DEPARTMENT HEAD

Three of the principal societal challenges of our time are providing adequate Security, flexible and sustainable Energy, and improved Healthcare. Each of these is complex and interdisciplinary with major political, economic, and social dimensions. These interdisciplinary dimensions place critical requirements and constraints on the solutions to the challenges, but the solutions themselves must be provided by engineers. In particular, Electrical and Computer Engineering is core to any high technology process, product, or system, and is essential for meeting these 21st century challenges. These three themes run through the fabric of research in the ECE Department, with Energy and Healthcare having the most visible "faces" owing to the leadership of two NSF Engineering Research Centers.

Building on decades of strength in electric power systems and power electronics, the NSF Engineering Research Center for Future Renewable Electric Energy Delivery and Management (FREEDM) Systems Center was established at NC State in 2008. The success of this Center has been a major factor in the establishment of the Research Triangle as one of the largest concentrations of smart grid activity in the country. This success, in turn, led to the announcement by President Obama earlier this year of a National Manufacturing Innovation Institute focused on wide bandgap semiconductors to be led by NC State.

NC State's interdisciplinary strengths are also being focused on improving Health through a new NSF Engineering Research Center established in 2012: the Nanosystems Engineering Research Center for Advanced Self-Powered Systems of Integrated Sensors and Technologies (ASSIST). The Center envisions "a paradigm shift in health informatics enabled by wearable nanotechnologies that monitor individual health parameters and environmental exposures." As one example, consider an inconspicuous, self-powered wearable device that alerts parents to environmental factors that can trigger a child's asthma.

This issue of the *ECE Spotlight* highlights some of the recent major stories about ECE's research and impact. I hope you enjoy this glimpse into the dynamic environment that is NC State Electrical and Computer Engineering.



Daniel D. Stancil
ECE Department Head

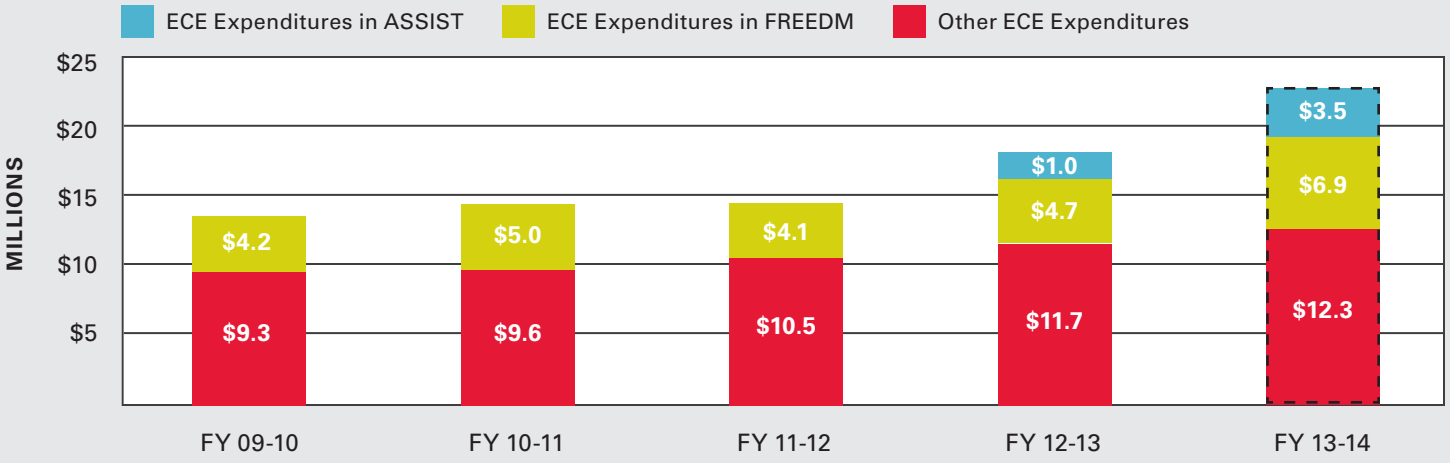
BY THE NUMBERS | A look at some of the facts and figures that shape ECE at NC State

Statistic	Rank Among all ASEE-listed EE/ECE Departments*	Rank Among US Public EE/ECE Departments*
Total Research Expenditures	16th	9th
Number of Faculty	17th	12th
Number of PhD Students Enrolled	20th	13th
Number of Undergraduates Enrolled	19th	13th

NC State is the only university in the US whose ECE faculty is **currently leading two NSF Engineering Research Centers.**

*Source: ASEE data for 2013

EXTERNAL RESEARCH EXPENDITURE TRENDS



Figures for FY 13-14 are estimated and subject to final close-out corrections.

President Barack Obama flashes the "wuf" sign after speaking on the NC State campus.

NC State tapped to lead Department of Energy institute

Engineers at NC State University have long been leaders in the development of leading-edge energy technology, and now they are leading a new U.S. Department of Energy advanced manufacturing institute.

During a visit to Raleigh on Jan. 15, President Barack Obama announced that NC State will lead the Next Generation Power Electronics Innovation Institute, a $140 million project that aims to further development and manufacturing of wide bandgap semiconductors.

The College of Engineering at NC State is at the forefront of research on wide bandgap semiconductors, which have higher temperature and voltage capacity than the silicon semiconductors that have been widely used for the last 50 years. That greater efficiency will make everything from household electronics to the nation's power grid more efficient.

"I believe the wide bandgap semiconductor technology is the next big step in power electronics," said Dr. Jayant Baliga, Distinguished University Professor in the Department of Electrical and Computer Engineering at NC State and one of the world's preeminent researchers in the area of power semiconductor devices.

Baliga is founder of the university's Power Semiconductor Research Center and is the inventor of the Insulated Gate Bipolar Transistor, an innovation credited with saving consumers more than $15 trillion in energy costs.

College researchers have been working on wide bandgap semiconductors since the early 1980s. Engineering faculty members have been part of two Multidisciplinary University Research Initiatives focused on conducting research into wide bandgap semiconductors. As part of those efforts, NC State engineers have worked with other universities and the U.S. Naval and Air Force Research Labs.

The National Science Foundation FREEDM Systems Center, an Engineering Research Center that was awarded in 2008, is headquartered on NC State's Centennial Campus. FREEDM is developing the next-generation power grid that will be more efficient and will incorporate renewable energy. Wide bandgap semiconductor technology will play a major role in making that new power grid work.

Dr. Louis Martin-Vega, dean of the College of Engineering at NC State, said the College's work in semiconductors and the devices they power has been a long process that has paid off.

"As we often say, there's no such thing as an overnight success," Martin-Vega said. "There's been so much work that has gone on over the years to build up the capacity and the expertise that allows NC State to be the leader in an effort of this nature."

Learn more about the Next Generation Power Electronics Innovation Institute and NC State's role at **www.ncsu.edu/power.**

Inventor, electronics innovator Baliga wins IEEE's highest award

Dr. Jayant Baliga, a Distinguished University Professor of Electrical and Computer Engineering at NC State and founding director of the university's Power Semiconductor Research Center, has received the Medal of Honor from the Institute of Electrical and Electronics Engineers (IEEE). Previous winners of the award include radio pioneer Guglielmo Marconi and microchip co-inventor Robert Noyce.

IEEE is the world's largest professional association for the advancement of technology, and the Medal of Honor is the institute's highest award.

Baliga is most famous for inventing, developing and commercializing the insulated gate bipolar transistor (IGBT), an energy-saving semiconductor switch that controls the flow of power from an electrical energy source to any application that needs energy.

Dr. Jayant Baliga traveled to Amsterdam to receive the IEEE Medal of Honor.

The IGBT improves energy efficiency by more than 40 percent in products ranging from cars and refrigerators to light bulbs, and it is a critical component of modern compact cardiac defibrillators. The improved efficiency of IGBT-enabled applications has saved consumers money — more than $2.7 trillion in the United States and $15.8 trillion worldwide — while also reducing carbon dioxide emissions by 35 trillion pounds in the U.S. and 78 trillion pounds worldwide. In addition, IGBT-based compact portable defibrillators are estimated to have saved nearly 100,000 lives in the United States.

Baliga continues to work on innovative power technologies through NC State's Power Semiconductor Research Center and the university's FREEDM Systems Center, a National Science Foundation-sponsored Engineering Research Center that seeks to improve the nation's distribution and management of power. His recent work includes research into wireless communication technology and technologies that use silicon carbide to create energy-efficient high-power devices.

In 2011, President Barack Obama awarded Baliga the National Medal of Technology and Innovation, which is the nation's highest honor for technological achievement.

IEEE has more than 425,000 members in more than 160 countries and includes professionals involved in all aspects of the electrical, electronic and computing fields and related areas of science and technology.

The IEEE Medal of Honor was established in 1917. According to IEEE, the Medal of Honor "is presented when a candidate is identified as having made a particular contribution that forms a clearly exceptional addition to the science and technology of concern to IEEE." •

Kyle McKenzie and Corey Meade work on a 3D-printed audio bracelet.

A Makers' place

Maker Faire, the nationwide network of do-it-yourself showcases, is a celebration of all things made. And NC State is the university where ideas become reality.

The two came together in June at Maker Faire North Carolina, which brought 10,000 thinkers and doers to the North Carolina State Fairgrounds.

Among them was a group of NC State students and recent graduates who have turned plywood, simple circuits and plastic into tools for creation, expression and personal safety.

FULL BODY 3D SCANNING

Two recent ECE graduates — Austin Carpenter and Jonathan Gregory — showcased their 3D scanner at the Maker Faire. The project, spurred by a request from the leaders of the Makerspace at Hunt Library, exposed the pair to a process they'll likely repeat in their engineering careers. They spent the first semester of the 2013-2014 school year designing a fullbody 3D scanner, a trial-and-error effort that saw them abandon designs for being too big or otherwise impractical.

In the spring, they connected with a team of industrial design students who built the scanner based on their specifications. Constructed of tile and plywood, the scanner looks a bit like the teleportation system from the old Star Trek television show. A person stands on a rotating platform as the scanner takes continuous photos. The 90-second scan — about two rotations long — produces a file that a 3D printer can read and turn into an action figure.

What can you do with a 3D scanner? According to Carpenter, one emerging application of the technology is in medicine: 3D scans are being used to print casts that conform precisely to a broken limb and use ultrasound technology to spur bone growth.

But utility wasn't the primary reason Carpenter and Gregory chose to build the scanner.

"It's cutting-edge," Carpenter said. "Ten years ago, this wasn't really a thing. So it's just really exciting to be on the cutting edge of technology."

EMERGENCY ASSISTANCE, AT THE PUSH OF A BUTTON

In an emergency, even a quick phone call or text message may take too long. That's why recent electrical engineering graduate Tia Simpson and electrical and computer engineering senior Bradford Ingersoll have developed a wearable system that enables emergency notification at the push of a button.

At Maker Faire North Carolina, Simpson and Ingersoll demonstrated the Konnect, a Bluetooth-enabled simple circuit that triggers a text message with a user's GPS coordinates.

Simpson and Ingersoll worked through several iterations of the Konnect in the Entrepreneurship Initiative Garage on NC State's Centennial Campus. They considered building a version that used voice-recognition software to identify a user in distress, but they dismissed it as impractical because of power and reliability concerns.

But the wearable concept they came up with has tested well and has drawn positive feedback from judges in campus entrepreneurship contests, Simpson said. The current Konnect prototype houses the circuit inside a plastic bracelet, but the system's size — a little bigger than a watch battery — would make a wristwatch or other accessory a possibility.

Student Bradford Ingersoll (left) and recent grad Tia Simpson (right) show off the Konnect, a one-button emergency notification system they built.

MESSAGE IN A BRACELET

For new graduates Corey Meade (computer engineering) and Kyle McKenzie (electrical engineering), their Maker Faire project came from the unlikely intersection of two trends: the emergence of 3D printing and the popularity of Silly Bandz, the bracelets children compulsively exchange at school. These seemingly disparate items gave rise to McKenzie and Meade's 3D-printed audio bracelet.

For their senior engineering design project, Meade and McKenzie sought to make a tradable 3D-printed bracelet that communicates. Meade developed a Web app that converts audio data — words spoken into a microphone — into a file readable by a 3D printer. The printed bracelet, which looks like a QR code come to life, can then be read, decoding the original spoken message.

Meade and McKenzie envision Web and smartphone apps that would let kids encode messages in plastic, print them and trade them with friends. They've experimented with different types of plastic for the bracelet itself and have applied for a provisional patent for their work.

"We hope there's a future for it," McKenzie says. "We're not sure if there's a market right now because the printers aren't available everywhere. But there are some professors we've shown this to who said, 'My kids would totally take this to school, and all their friends would be super-excited about it.'" •

Christina Hammock working at a remote science lab in Greenland.

ECE alumna selected as astronaut candidate

For as long as she can remember, Christina Hammock has wanted to be an astronaut. She doesn't recall any specific childhood moment when the thought first occurred to her. It was just always there — through middle school and high school in Jacksonville, N.C., and then through her years at NC State, where she earned bachelor's degrees in physics and electrical engineering in 2001 and a master's degree in electrical engineering in 2002.

"It's literally been as long as I can remember," she says. "I'm sure I heard about it when I was really young, but it's been a lifelong dream."

So Hammock, 34, was ready when the call came from NASA to let her know if she had been selected as one of eight new astronaut candidates out of a pool of more than 6,000 applicants. At least she thought she was ready.

"When I got the call, I started the speech I had prepared for the person giving me the bad news," she says. "Instead, they gave me good news. I was dumbfounded. I had no idea how to react to that news."

That news — that Hammock has a chance to realize her lifelong dream — means two years training to be an astronaut. Assuming she passes all the physical and mental challenges of training, Hammock will become an astronaut. What her specific mission would be is not clear at this point, but NASA Administrator Charles Bolden said in an announcement of the eight new astronaut candidates that they could do research on the International Space Station or lead the first human mission to an asteroid or to Mars.

"I just hope to represent the goals of the space program in whatever way I can," Hammock says. "I'm very excited about just about every direction NASA is going in. I'm personally very excited about the research on the International Space

Station, given my background in science."

We spoke with Hammock from American Somoa, where she was station chief of the climate observatory for the National Oceanic and Atmospheric Administration. She had been there for about 10 months, the latest in a series of far-flung work locations that include the South Pole and the ice caps of Greenland. She once worked in minus 105-degree weather at the South Pole.

"If you have the right clothing, it's actually doable," she says. "It takes many, many layers."

Hammock says she typically runs the instruments for research being conducted at remote sites. That experience required her to be able to think on her feet and handle the physical aspect of working in extreme conditions — attributes that may have contributed to her selection as an astronaut candidate. But she says she was drawn to that work naturally, not as a means to become an astronaut.

Christina Hammock

"There's a whole list of check boxes that people who are interested in becoming astronauts can try to fill," she says. "I decided early on that I was not going to live my life according to those check boxes. I was just interested in being my best and following my own dreams. If those skills I acquired made me into a good candidate, then I would apply."

Among the skills Hammock will have to acquire are how to fly a jet (although, given her background, she says she will eventually serve as a flight engineer rather than a pilot) and how to speak Russian (to help her work with Russian astronauts serving on the International Space Station). The two-year training regimen began in August 2013 in Houston and will take her all over the globe.

"NC State prepared me really well," Hammock says. "NC State is kind of where everything got started."

During her time at NC State, Hammock did an internship in the astrophysics department. She credits physics professor Stephen Reynolds and engineering professor Cecilia Townsend with encouraging her.

"They were instrumental in me believing I could follow my dreams," she says.

Those dreams included being one of the few women working in a field like electrical engineering. Now, Hammock is one of four women — half of the group — selected as astronaut candidates.

"It's just demonstrating that women are in a position now to follow their dreams," she says. "There may be a wider variety of what's acceptable for women to study and go into professionally. I was often the only girl in my engineering classes, but I never experienced any discrimination. Everyone was just really encouraging." •

Hammock at her first job after college, working at the Laboratory for High Energy Astrophysics at NASA's Goddard facility in Greenbelt, Md.

VitalFlo project creates technology to help manage asthma

VitalFlo, a small handheld spirometer about the size of an iPhone that helps consumers monitor their breathing, is garnering awards and recognition.

The VitalFlo project, led by ECE alumnus (BSEE '10) and current ECE graduate assistant James Dieffenderfer, won the Medical Design category at the NASA Tech Briefs Create the Future Contest in October 2013, placing first among over 80 entries submitted by engineers from around the world.

In August 2014, VitalFlo won the first prize of $150,000 from the Center for Integration of Medicine and Innovative Technology Student Technology Prize in Primary Healthcare competition.

VitalFlo's project focuses on developing a very low-cost, compact, handheld spirometer, with high dynamic range that communicates to a cell phone and server to enable an ecosystem for patient, caregiver, and physician to collaborate in the management of asthma or COPD.

VitalFlo is a small handheld spirometer about the size of an iPhone that helps consumers monitor their breathing.

More than 60 percent of asthmatics own a peak flow meter (PFM); however, only about 35 percent actually use their PFM due to varying factors. Regular use of a reliable PFM and monitoring of one's respiratory vitals would create a better asthma management plan, and in turn, reduce the effects and severity of their asthma.

"VitalFlo actually spawned from the Product Innovation course offered at NC State and has had continued support from the NSF ASSIST Center," Dieffenderfer said. "Our team was specifically interested in asthma prevention because of the vast amount of people that suffer from asthmatic conditions. It wasn't until we were halfway through the design process that we discovered our device could also be used as a spirometer as well, opening up even more diagnostic opportunities."

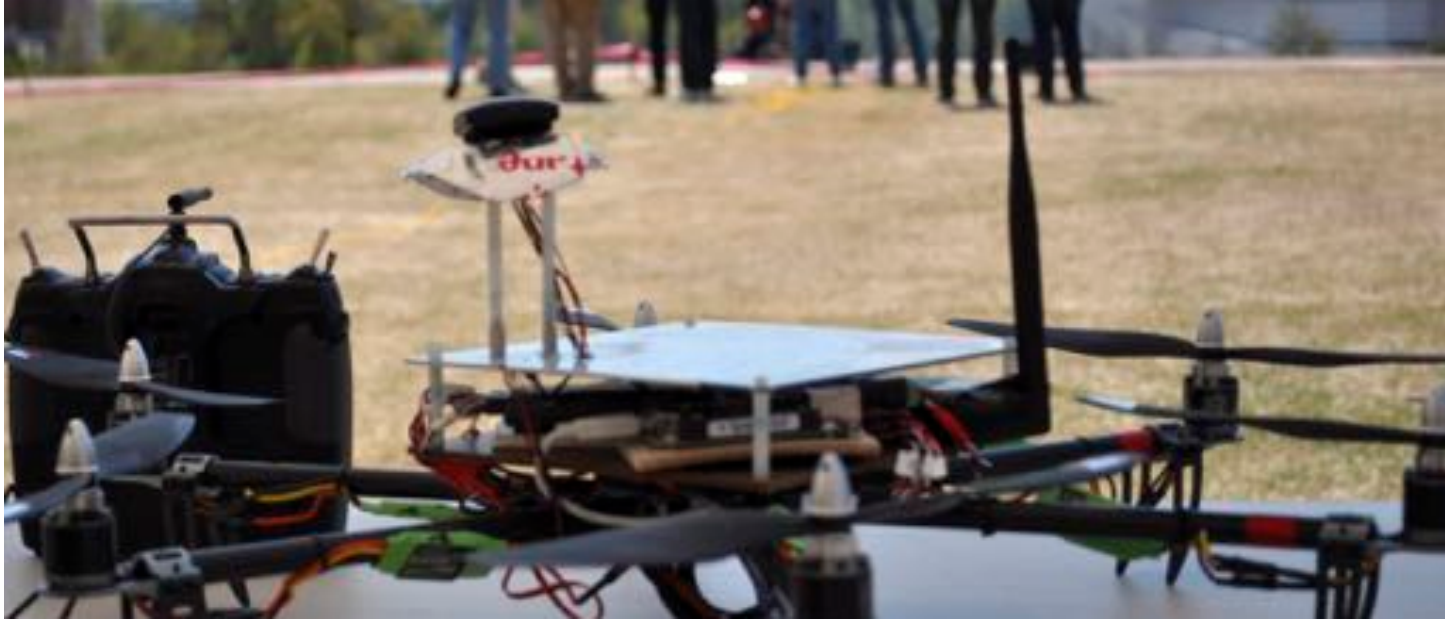
The Product Innovation course at NC State is a project-based course that is cross disciplinary with teams that are made up of students in the Master of Business Administration, Industrial Design, and Engineering programs. Each team performs market research, listens to the voice of the customer and builds prototypes and a business case. The lab course is co-taught by MBA, Design and Engineering professors. The Vitalflo team was mentored by Dr. John Muth, professor of Electrical and Computer Engineering and deputy director of the NSF ASSIST Center.

The Create the Future Design Contest was launched in 2002 by the publishers of NASA Tech Briefs magazine to help stimulate and reward engineering innovation. The annual event has attracted more than 8,000 product design ideas from engineers, entrepreneurs and students worldwide. The contest's principal sponsors are COMSOL and Tech Briefs Media Group. With more than 190,000 BPA-audited subscribers and 400,000 monthly readers, NASA Tech Briefs is the world's largest-circulation design engineering magazine, distributed in both print and electronic formats.

The 5th Annual Student Technology Prize in Primary Healthcare — administered under the auspices of the Massachusetts General Hospital's "Ambulatory Practice of the Future," assisted by CIMIT, and sponsored by the Gelfand Family Charitable Trust — is a $400,000 competition for engineering students to help advance their winning clinically relevant, primary care solutions.

James Dieffenderfer is currently pursuing his PhD in biomedical engineering while continuing to perform research within the Department of Electrical and Computer Engineering.

The VitalFlo team also includes Mike Brown, a spring 2013 graduate of the industrial design graduate program and Leigh Johnson, a spring 2013 graduate of the Master of Business Administration program. •



Drones over Centennial Campus

An inaugural programming challenge on unmanned aerial computing platforms took place at NC State over the course of six months.

The challenge culminated in a daylong final challenge on April 12, when the finalist teams took turns running their programs on CentMesh drones to see if their code would fly. CentMesh, formally known as Centennial Mesh, is the wireless mesh network that covers NC State's Centennial Campus.

The programming challenge required teams to fly unmanned aerial vehicles, widely known as UAVs or drones, using the CentMesh wireless network.

Drones now have domestic uses for local governments, colleges and universities and private companies. The Institute of Next Generation IT Systems in the Department of Computer Science hosted the drone programming challenge with a goal of raising awareness of these platforms and increasing participation in drone-related activities.

"Computing and programming in the future will need to be carried out increasingly on such platforms, rather than traditional computers," said Dr. Rudra Dutta, professor in the Department of Computer Science. Dutta and Dr. Mihail Sichitiu, professor in the Department of Electrical and Computer Engineering, spearheaded the program.

The CentMesh network was created to support research and education on the design of wireless mesh networks, as well as IT systems and applications.

Wireless mesh networks expand the reach of traditional Wi-Fi networks, which rely on access points with wired access to the Internet that allow them to communicate wirelessly with laptops, smartphones and other devices.

While mesh networks also use multiple access points, they can communicate with each other as well as with these devices. One or more of the mesh access points are "root nodes" that have a wired connection to the Internet. Other mesh access points have access to the Internet through these root nodes. Eliminating the need to have all access points wired gives a mesh system greater flexibility.

This allows network designers to place access points in spots that can't be wired, such as some outdoor settings or military situations.

The challenge proceeded in phases, with participants who qualified in one phase moving on to the next. The first phase included three initial challenges of increasing difficulty, each with a time limit.

Twelve teams registered for the challenge. Each team was required to clear the initial challenge by March 31, the day the final challenge problem was revealed.

All the code submitted by the finalist teams performed admirably on the final challenge day.

Team YOLO, comprised of Konstantinos Christidis and Yun Wang, and Team Splash Brothers, made up of Hong Xiong, Fengyuan Gong and Miguel Báguena Albaladejo, tied for first place. Each team won a $1,000 prize.

Abhijeet Deshpande and Neha Gholkar, calling themselves Team Garuda, placed third and received a $500 prize.

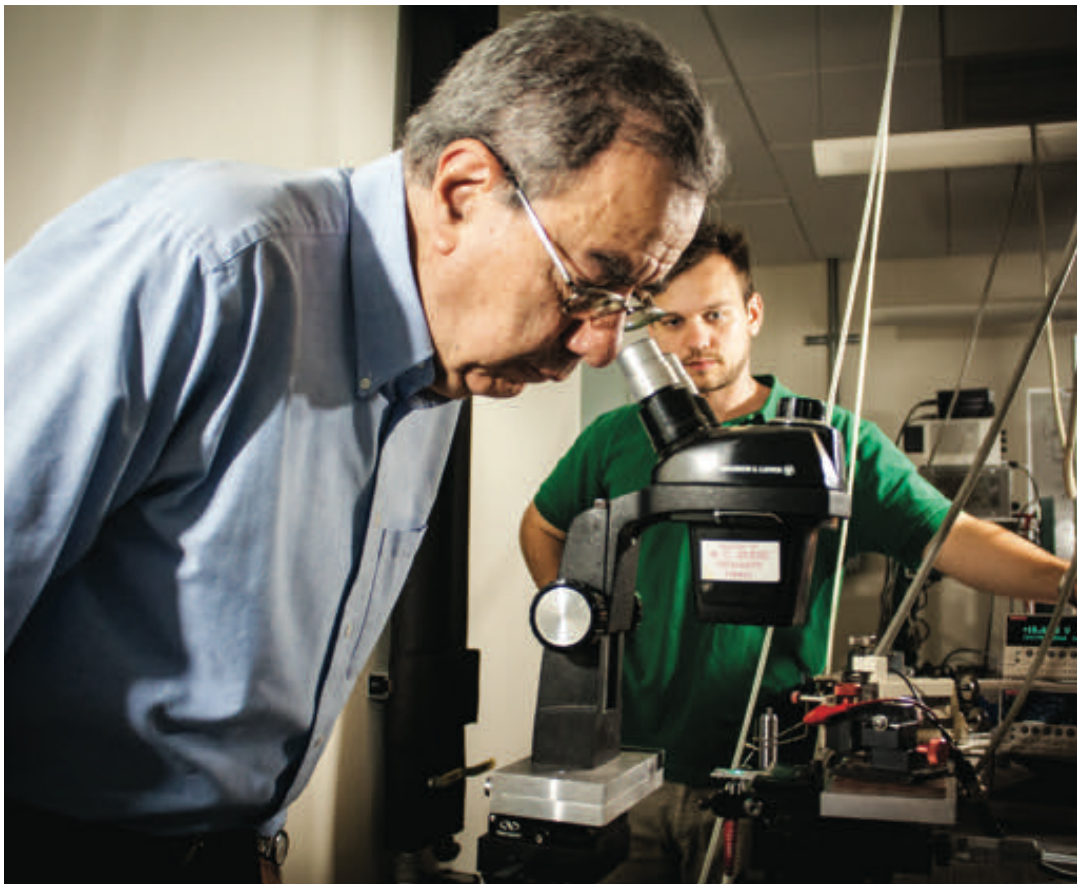
The day saw only one crash (forced landing), which turned out, upon examination of the logs, to have been the fault of a firmware bug and not the code submitted for the challenge.

The hope is that the challenge will become an annual event that can be expanded to include students from outside NC State. In future years, other mobile computing aspects, other than drones, may be added. •

Dr. Bedair honored as a winner of the Kuwait Prize

The area of specialization for the Kuwait Prize for Applied Sciences varies each year. When it was announced that the 2012 award would be in the area of energy, **DR. SALAH M. BEDAIR**, Distinguished Professor in the department, was contacted by Dr. Salah E. Elmaghraby, NC State University Professor Emeritus, about submitting for the prize.

Elmaghraby, a former winner of the Kuwait Prize, worked with Bedair to submit the necessary packages needed in order to be considered. Bedair was awarded the prize for 2012 and received the award at a formal ceremony in Kuwait in December 2013.



Dr. Bedair in his lab.

"This is a very competitive award, because it's the Nobel Prize for people of Arab origin," explains Dr. Bedair. "There are 450 million people of Arab origin throughout the world and some of them are leading scientists in their fields, including Energy. So to be awarded this award is very prestigious."

> "This is a very competitive award, because it's the Nobel Prize for people of Arab origin."

In fulfillment of the objectives of the Kuwait Foundation for the Advancement of Sciences (KFAS) in supporting scientific research and encouraging scholars and researchers in Kuwait and all other Arab countries, KFAS awards prizes in the fields of Sciences, Arts and Letters, Economic and Social Studies, and the Arabic and Islamic Scientific Heritage. The Kuwait Prize is designed to recognize intellectual achievements that serve the interest of scientific advancement and support efforts to raise the standard of culture in various fields. Two awards are awarded annually — one for Kuwaiti citizens and one for citizens of Arab countries. Dr. Bedair was born in Egypt in 1938.

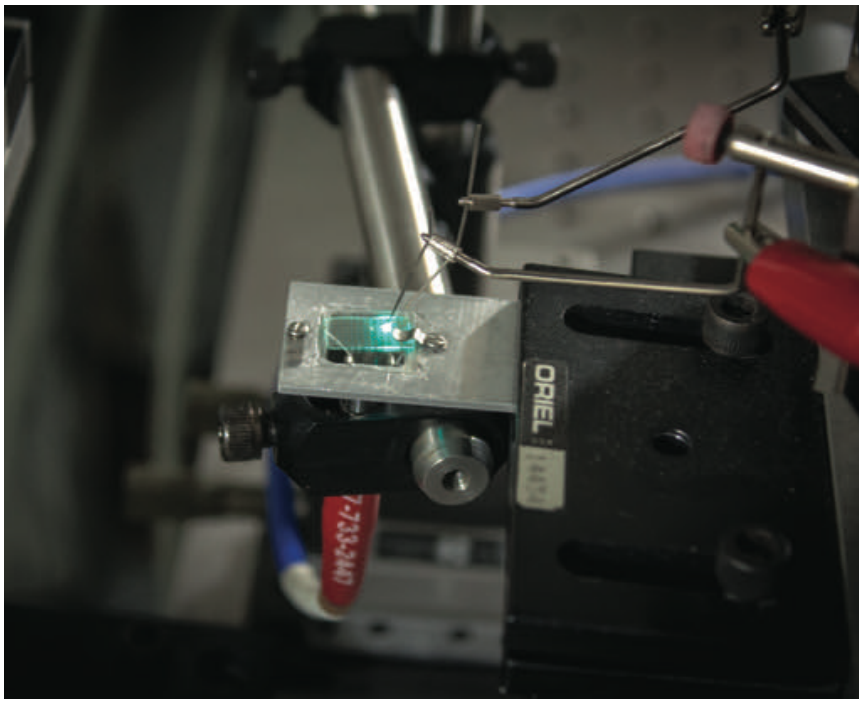
"Winning this award will allow me to interact more in the area and location where the potential of solar application is tremendous," says Dr. Bedair. This area is a belt that extends through the southern part of Egypt, Libya, and Saudi Arabia. The solar influence is the highest of any region in the world.

Bedair pioneered the development of multi-junction solar

cells and has made significant contributions to light emitting diodes — an important energy saving lighting technology. Bedair has also made an impact in the development of low power electronic devices.

After receiving a BS in electrical engineering from Alexandria University in 1960, Bedair received a MS in nuclear engineering and a PhD in engineering science from University of California Berkeley in 1965 and 1969 respectively.

"I have a very strange background, sometimes maybe a contradicting background," says Bedair, "I started my career as an electrical engineer and then I received my PhD in nuclear engineering. I then worked as a nuclear engineer for about 10 years. I then left nuclear engineering and worked in semi-conductors. And this has led me to work in solar cell light emitting diodes and other components of devices that can use energy and save energy." •



A LED from Dr. Bedair's lab.

Kudenov receives YIPs from both Air Force and Navy

Dr. Michael Kudenov

DR. MICHAEL KUDENOV, assistant professor in the department, has been awarded Young Investigator Program awards from both the U.S. Air Force Office of Scientific Research (AFOSR) and the U.S. Navy Office of Naval Research (ONR).

The award of $353,269 from the Air Force's Young Investigator Research Program (YIP) will support his research project "Passive Snapshot Remote Sensing of Object Velocity."

His current research for the Air Force is focused on developing novel imaging systems, interferometers, detectors, and anisotropic materials related to polarization and spectral sensing, for wavelengths spanning ultraviolet through the thermal infrared. The project's premise is based on observing the Doppler shift in absorption features that naturally occur in sunlight. Kudenov hopes to utilize information learned from Doppler shift to infer the velocity of distant satellites from the ground, making it possible to calculate the satellite's orbit with fewer measurements and with greater precision.

Kudenov has also been awarded $446,454 from the Office of Naval Research Young Investigator Program for his project entitled "Passive Standoff Super Resolution Imaging using Spatial-Spectral Multiplexing." The objective of this research with the Navy is to investigate and experimentally demonstrate diffraction unlimited super resolution imaging, at standoff distances, through the use of a novel Spatial Spectral Multiplexing (SSM) technique. Conventional imaging sensors rely on measuring spatial coherence by use of 2-dimensional (2D) detector arrays and imaging lenses. The lens takes a Fourier transformation of the scene's angular spectrum, projecting it onto a detector array, to create an image. However, lenses restrict the spatial resolution, resulting in the well-known diffraction limit. •

Trew and former students awarded Microwave Pioneer Award

Dr. Robert Trew

DR. ROBERT TREW, the Alton and Mildred Lancaster Distinguished Professor in the department and two of his former PhD. students have received the 2014 Institute of Electrical and Electronics Engineers (IEEE) Microwave Theory and Techniques Society Pioneer Award.

The Microwave Pioneer Award recognizes outstanding pioneering technical contributions that advance microwave theory and techniques, which are described in an archival paper published at least 20 years prior to the year of the award. Trew's paper co-written with Jing-Bang Yan and Phillip Mock, entitled "The potential of diamond and SiC electronic devices for microwave and millimeter-wave power applications," was published 23 years ago in *IEEE Proceedings*, vol. 79 in May 1991.

The IEEE recognizes Trew, Yan and Mock "For Pioneering Contributions to the Theory, Realization, and Application of Wide Bandgap Semiconductor Devices as Microwave and MM-Wave Power Sources and Amplifiers."

Trew received a BEE degree from Kettering University in 1968, an MS in electrical engineering from the University of Michigan in 1969 and a PhD. from the University of Michigan in 1975. He joined the faculty of the College of Engineering at NC State in 1976 and served as head of electrical and computer engineering at NC State from 2003 to 2008. •

Hopkins receives IMAPS Outstanding Educator Award

Dr. Doug Hopkins, right, is shown with Susan Trully. He received the award during a ceremony in Orlando, Fla.

DR. DOUG HOPKINS, research professor of electrical and computer engineering, has received the IMAPS Outstanding Educator Award. This award is presented by the Executive Council of the International Microelectronics Assembly and Packaging Society (IMAPS).

IMAPS is the largest society dedicated to the advancement and growth of microelectronics and electronics packaging. The society produces numerous publications, workshops, international conferences, professional development courses, and exhibitions bringing together the entire microelectronics supply chain. Their events and products focus on those technologies critical to the present and future of microelectronics: 3D integration, MEMS, flip chip, wafer level packaging, thermal management, printed electronics, advanced materials, photonics, modeling/design and many others.

Hopkins has been a member of the IMAPS society for more than 20 years. He was student chapter advisor at the University at Buffalo for more than 10 years and co-founded the IMAPS Power Packaging Committee. He plans to start a new student chapter at NC State.

The IMAPS Outstanding Educator Award recognizes an individual who, in the opinion of the IMAPS Outstanding Educator Selection Committee, has provided significant contributions to education for the electronics packaging industry and/or to the advancement of IMAPS student chapters.

The award was presented at the Awards Ceremony at the 46th International Symposium on Microelectronics, held in Orlando, Fla., in September 2013. •

Ricketts receives NSF Career Award

Dr. David Ricketts

DR. DAVID RICKETTS, an associate professor in the department, has received a Faculty Early Career Development Award from the National Science Foundation (NSF). The award will provide $326,316 over three years to support Ricketts' project, "Spin-Torque Oscillator Arrays." The award, known as the NSF CAREER Award, is one of the highest honors given by NSF to young faculty in science and engineering.

This research investigates magnetostatic spin-wave generation, propagation, interaction and absorption in multi-layer giant magnetoresistance (GMR) and tunnel magnetoresistance (TMR) spin-torque oscillator (STO) arrays. With the recent demonstration of spin-torque transfer and self-sustained oscillators, a new class of oscillator has emerged with extreme tunability and potential for excellent RF performance. Recent results have shown, however, that the potential of these new devices is limited by the large phase noise of individual devices due to the small amount of energy stored in a single device. A potential solution is the phase-locking of many STOs in a large array. This research focuses on the fundamental science of STO-STO interaction in multi-device arrays with the goal of laying the foundation for controllable, scalable arrays of STO oscillators. These research programs will also include an integrated effort for the development of new interdisciplinary courses that focus on the fundamentals of device physics and their applications, the creation of virtual laboratories that enable students around the globe to explore these fundamental concepts, and the introduction of elementary and high school students in local communities to the exciting field of magnetics and electronics. •

Oralkan receives DARPA Young Faculty Award

Dr. Omer Oralkan

DR. OMER ORALKAN, associate professor in the department, has received the prestigious Young Faculty Award (YFA) of the Defense Advanced Research Projects Agency (DARPA) for his project titled "An Ultrasound-Based Noninvasive Neural Interface to the Retina." The award comes with $500,000 over two years.

Oralkan's research project proposes to develop a conformal miniaturized high-frequency ultrasound transducer array integrated with supporting electronics to be formed in the shape of a contact lens that can project ultrasound neural stimulation patterns onto the retina. Such a device has the potential to provide a noninvasive retinal prosthetic that can help restore vision for more than 30 million patients with degenerative retinal diseases worldwide.

The objective of the DARPA Young Faculty Award program is to identify and engage rising research stars in junior faculty positions at U.S. academic institutions and expose them to U.S. Department of Defense (DoD) needs as well as DARPA's program development process.

The YFA program provides funding, mentoring and industry and DoD contacts to awardees early in their careers so they may develop their research ideas in the context of DoD needs. The program focuses on untenured faculty, emphasizing those without prior DARPA funding. The long-term goal of the YFA program is to develop the next generation of academic scientists, engineers and mathematicians in key disciplines who will focus a significant portion of their career on DoD and national security issues.

"This is a tremendous honor," Oralkan said. "DARPA is one of the most important technology research and development organizations in the world, and I thank them for selecting me for this award. •

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