2011 Electrical & Computer Engineering *Currents*





INSIDE:

Read about the faculty research showcase at JPMorgan Chase Expo—one of many partnerships developing in the Electrical & Computer Engineering department this year.























College of Engineering DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

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MESSAGE FROM THE CHAIR

KENNETH E. BARNER It is my pleasure to share with you the latest edition of Currents, which highlights news and achievements from UD's Department of Electrical and Computer Engineering (ECE). Our department continues to move confidently forward, despite the persistent economic challenges confronting many universities. By staying focused, UD ECE was able to hire new faculty members that expand our expertise in areas of opportunity and bolster core disciplines.

ECE programs experienced strong enrollment this past year, with the undergraduate and graduate student bodies now including approximately 250 and 175 students, respectively. Notably, the number of enrolled U.S. graduate students has increased more than 50% over the last three years. Research endeavors have also kept pace, with \$9M in expenditures supporting the department's intensive research efforts.

Our department continues to play a leading role in major UD initiatives, including the establishment of a biomedical engineering degree (BMEG) and the new Interdisciplinary Science and Engineering Laboratory (ISE-Lab), slated to open in 2013. The addition of Prof. Abhi Singh to the ECE faculty is symbolic of our expanding efforts and leadership at the interface of biology and core electrical and computer engineering disciplines. Prof. Singh's research focuses on Systems and Control —more specifically, modeling and analyzing the dynamic nature of gene-protein networks inside living cells. His efforts place him at the intersection of ECE, BMEG (where he holds a joint appointment), and UD's Bioinformatics and Computational Biology program—a position that exemplifies the increasingly multidisciplinary nature of engineering.

A state-of-the-art teaching and research facility, the ISE-Lab will feature a 10,000 square foot clean room, helping propel UD ECE's national leadership to new heights in nanofabrication, siliconphotonics and semiconductor device fabrication. The facility will advance these core areas and make possible new innovative initiatives, such as the biology nano-device boundary. Multiple new faculty hires are anticipated in the next five years to advance these strategic areas at UD. For the first time on campus, the ISE-Lab will bring together, under one roof, world class research programs, and outstanding faculty and students—greatly enhancing collaboration between students and faculty. To stay informed on the progress of the building, please visit the ISE-Lab website (www. udel.edu/iselab).

The following pages highlight recent achievements by our students, faculty and programs. I am extremely proud of these accomplishments and I am confident that as UD ECE continues on its strategic path as a field leader, even greater achievements will be realized.

I thank our many alumni, friends and industry partners who have provided the support that is integral to our efforts for excellence in student education. As always, please feel free to contact me at barner@udel.edu with your ideas for further UD ECE accomplishments.

/Latelan

Kenneth E. Barner, Ph.D. Professor and Chair Electrical and Computer Engineering

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Looking for an old friend? Want to share your latest news? Searching for information on upcoming alumni events such as Homecoming? Now you can do it all in one place, **www.UDconnection.com**. UD and the UD Alumni Association (UDAA) have collaborated to bring alumni a vibrant online community—so register and get active! The online community allows you to search the alumni directory, post class notes, update your contact information, and see if there are any upcoming alumni events in your area. You can also take advantage of networking opportunities and volunteer opportunities to get involved with your alma mater! Visit **www.UDconnection.com** today!

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Moth eyes inspire antireflective surfaces for military applications

If you look closely at the surface of a moth's cornea, you see that it is comprised of tiny protruding bumps. These bumps exist to keep moths safe from predators by preventing light from reflecting in their eyes and betraying their presence. In essence, the moth's eyes are naturally antireflective.



Antireflective (AR) surfaces are commonly used to prevent glare in optics—think of the thin film coating applied to the lens of your favorite glasses.

In a unique application, MARK MIROTZNIK, ECE associate professor, has adapted these AR ideas and applied them to materials at microwave frequencies.

Advances in passive imaging at millimeter wave frequencies have created a need for high

quality optical components, such as lenses, designed specifically for these wavelength bands, explained Mirotznik.

Broadband AR surfaces are commonly implemented by coating the surface with multiple layers of thin films, with the exact number and thickness of layers needed determined by various optimization algorithms.

The approach is tricky when using microwave and millimeter wavelengths, however, because suitable materials are scarce and signal strength is commonly many orders of magnitude smaller than that encountered in the visible or infrared wavelengths.

Inspired by the subwavelength surface pattern of the cornea in common insects, Mirotznik has developed an inverse motheye

surface that is easier to fabricate than traditional motheye surfaces, more mechanically robust and provides good AR behavior.

The main application for this research is to create radio frequency (RF) transparent windows, most likely using composite materials, for use in military applications.

"We've demonstrated that it is possible to use a moth eye approach to create special surfaces in which microwave energy is transmitted with very little reflections over large ranges of frequency or bandwidths," Mirotznik said.

"We've demonstrated that it is possible to use a moth eye approach to create special surfaces in which microwave energy is transmitted with very little reflections over large ranges of frequency or bandwidths," he said.

"Expensive antenna systems can then be placed behind the structural windows, safe from the outside environment, or in the case of military applications, from hazards such as gun fire or explosives."

Mirotznik's research is documented in a paper entitled "Broadband Antireflective Properties of Inverse Motheye Surfaces." The paper,

RESEARCH

which appeared in the IEEE journal Transactions on Antennas and Propagation, earned Mirotznik the 2011 H.A. Wheeler Prize Paper award. The H. A. Wheeler Prize is presented to authors of the best applications paper published in the IEEE Transactions on Antennas and Propagation during the previous year.

Co-authors for the paper include UD doctoral student Brandon L. Good, one of two researchers at Carderock Division of the Naval Surface Warfare Center; and two researchers from the U.S. Army Research Laboratory.



Early warning system for unrecognized drug side effects discovery



HUI FANG, ECE assistant professor and STEVEN STANHOPE, professor of health, nutrition and exercise sciences.

are one of nine UD faculty teams to be

awarded strategic initiative grants from the University of Delaware Research Foundation (UDRF) for their work on an an "early warning system for unrecognized drug side effects discovery."

The one-year funding includes \$35,000 provided by UDRF, which is matched by \$5,000 from the provost and \$5,000 by the researcher's dean.

Fang and Stanhope are working to develop a novel early warning system that monitors the Internet, such as social network sites, to identify possible unrecognized drug side effects. Cathy Wu, Edward G. Jefferson Chair of Bioinformatics and Computational Biology, is a co-mentor on this project, which involves collaborations within the Delaware Valley Institute for Clinical and Translational Science (DVICTS) and with AstraZeneca Pharmaceuticals.

UDRF created the strategic initiative grants program in 2008 to support research in the life and health sciences, energy and the environment—priority areas in the University's Path to Prominence[™]. In addition to advancing the University's strategic plan, major goals of the program are to pair early-career faculty with senior faculty mentors and to seed promising research that will lead to larger proposals to such agencies as the National Institutes of Health and the National Science Foundation, according to Mark Barteau, UD's senior vice provost for research and strategic initiatives. ELECTRICAL & COMPUTER ENGINEERING | 201

UD researchers unveil technology to reliably detect IEDs

According to U.S. military statistics, improvised explosive devices or IEDs are the number one killer in the Middle East, particularly in Afghanistan and Iraq. They are the largest cause of casualties to U.S. troops and NATO forces combined.

"It's a huge issue. We believe IEDs are going to impact all types of warfare scenarios because they are easy to make, hard to detect and tremendously destructive because you never know where they will turn up," explained **DENNIS PRATHER**, Alumni Professor of Electrical and Computer Engineering at UD.

To help with this problem, Prather and his research team have developed a highly sensitive, low cost application for accurately detecting and identifying IEDs using millimeter waves (mmWs). The approach involves using high-frequency photonic modulators, which convert mmWs, found in the electromagnetic spectrum between infrared waves and microwaves, into an optical signal that can be more easily imaged.

"Imaging in the millimeter wave spectrum offers many of the advantages common to infrared imaging, but allows for the ability to see through obscurants, such as blowing sand, fog, dust, smoke and light rain. It also offers the ability to see through certain types of materials, like outer garments, fiberglass, drywall and others," Prather said.

Prather has extensive experience in the development and application of photonic devices and their integration into systems for imaging, communications and photonic applications. He is also a Commander in the U.S. Naval Reserves and the United States representative on the NATO Technical Group for High-Performance Millimeter Wave Imaging.

COMPLETELY COVERT

Over the past few decades, imaging in the infrared spectrum has allowed us to see through the darkness or "in the absence of

light" because objects at non-zero Kelvin give off radiation (think hot, glowing coals in a fireplace).

By contrast, Prather's system uses passive radiation and requires just 400 watts to operate, about the same energy needed to run a high-end personal computer. It does not illuminate objects; rather it looks for radiation given off from systems that emit heat, using the sky temperature as a reference.

This means that while humans see blue sky during the day and black sky at night; mmWs always see the absence of mmW radiation, or black. As luck would have it, anything metal on earth also reflects mmWs. Since many IEDs are metallic in nature, Prather's device uses mmWs to "see" through the sand and other environmental conditions and detect IED's buried underground.

"This system requires much less power than typical active systems like infrared, and because it never has to illuminate anything,

RESEARCH

it is entirely covert—a huge advantage for the military," he said.

NO FALSE POSITIVES

Another benefit of mmWs is that they are a great discriminator of false alarms because they use the sky temperature, not radiation, to visualize targets. While IEDs typically look "hot" under infrared, so do rocks and mounds of sand and dirt. When viewed with mmWs, only IEDs are visualized.

"You don't see this in optics or infrared at all, which change based on the environmental conditions, making this wavelength a good tool for tracking and discerning IEDs," Prather remarked. The tradeoff, however, is that you don't get the same high-resolution as in the visible or infrared spectrum, so in that regard, it is not the most optimal solution for target acquisition.

NEVER BLIND

When imaging conditions hinder the ability to see in visible and infrared, so called VIS-IR blind, they lose sight of what they are tracking. The mmW system is never blind, making it advantageous when used in combination with other types of technology.

"It's called image fusion—where you take visible, infrared and millimeter waves and put them together to create a high quality, information-based image in all conditions," Prather said. "We're just beginning to think about applications on that level."

NEXT STEPS

Funded through grants from the U.S. Government Office of Naval Research (ONR), the Air Force Office of Scientific Research, the Defense Advanced Research Projects Agency (DARPA) and the Army Research Laboratory, Prather's mmW system is currently being tested in laboratory scenarios. The current system measures 60 cm x 60 cm x 20 cm and weighs 27.6 pounds. According to Prather, it needs to be smaller—by about 15 cm in depth.

"In the military, SWaP—size, weight and power—is the mantra," explained Prather. "That's what we're working on now, making it small enough to be mounted to a Humvee or secured to an unmanned aerial vehicle (UAV)."

Prather is also working with partners including Lockheed Martin, Heico, Systems Integration Organization and Phase Sensitive Innovations to investigate scalability and manufacturing scenarios that would help transition the technology to industry.



UD's Gao is taking supercomputing to the extreme

GUANG GAO and a team of researchers at the University of Delaware are posed to break new ground in the supercomputing landscape. Again.

Gao, Distinguished Professor of Electrical and Computer Engineering, is leading research to improve the speed, efficiency and computational capacity of the nation's extreme-scale supercomputer systems.

The effort is part of a research and development initiative by the Defense Advanced Research Projects Agency (DARPA) to create an innovative, revolutionary new generation of computing systems under DARPA's recently announced Ubiquitous High Performance Computing (UHPC) program. Gao and the University of Delaware are members of the Intel Corporation UHPC team.

According to DARPA, the research arm of the U.S. Department of Defense, advanced computing is critically important to national security. The UHPC program plans to advance radically new extreme-scale computer architectures and programming models that deliver 100 to 1,000 times more performance, and that are easier to program than current systems. Prototype UHPC systems are expected to be complete by 2018.

Gao and his team at the Computer Architecture and Parallel Systems Laboratory (CAPSL), located in the Department of Electrical and Computer Engineering (ECE) at UD, are part of the Intel-led UHPC team focused on prototyping revolutionary hardware and software technologies for extreme-scale computing systems.

The UD team is leading the fundamental computer system research on execution models and its impact on system (software) design. They will work in close collaboration with other principal members of the Intel team from University of Illinois at Urbana Champaign, University of California at San Diego, Reservoir Labs Inc. and E.T. International, Inc. (ETI).

"This is a very important event for the nation. This project will develop a supercomputer that puts the United States ahead of our competitors. But with that comes a lot of responsibility," said Gao, an expert in computer architecture and parallel systems.

Parallel computing is an important technology employed by supercomputer architectures to use multiple processors (CPUs) to speed up the execution of application programs. Computing performance increases have historically been driven by Moore's Law, which states that "the number of transistors that can be placed on an integrated circuit doubles every two years." Current models have limitations, however, and achieving projected performance gains requires new thinking.

The UHPC program recognizes that "a new model of computation or an execution model must be developed that enables the programmer to perceive the system as a unified and naturally parallel computer system, not as a collection of microprocessors and an interconnection network."

"Professor Gao's involvement in the DARPA ubiquitous high performance computing project demonstrates his leadership in the extreme computing realm. The outstanding collaborative team comprised of Intel and leading universities are certain to ensure that the project outcomes significantly impact the future of high-performance computing for many years," said Kenneth Barner, ECE department chair.

A consummate researcher and educator, Gao's pioneering work on novel computer architecture models and system software serves as the basis for high-performance parallel supercomputers. Gao and his associates founded ETI as a UD start-up in 2000, a computer technology software company that specializes in system software solutions and tools for advanced computing architectures and platforms based on new multi-core ship technology.

Powerful Partnerships

Since its founding in 2000, ETI has been building software for multiple platforms—from mobile devices to desktop computers to data centers—focusing on solving problems with parallelization, synchronization and data movement so programmers can concentrate on the issues they are trying to work out.

Congressman John Carney visited the Newark-based ETI in April to see first-

hand the technology being developed for supercomputing, in particular parallel computing systems.

"From the most advanced supercomputers to handheld devices like cell phones, the world is moving toward many-core computing systems," said Rich Collier, chief operating officer of ETI. "The more sophisticated our needs become, the more processing power required, and new computer architectures are emerging to deliver this power at the national scale." Collier and Rishi Khan, ETI vice president of research and development, explained to Carney that the technology and software systems developed at ETI are what enable innovations needed by application developers to advance the computers of tomorrow in areas as diverse as national security, geological research and economic modeling.

"Science and technology-based companies are critical to future job creation and economic growth in America," said Carney. "I am incredibly impressed with the work ETI



"This is a very important event for the nation. This project will develop a supercomputer that puts the United States ahead of our competitors. But with that comes a lot of responsibility," said Gao, an expert in computer architecture and parallel systems.

is doing and think they are headed for huge success."

More than a decade ago, UD's David Weir recognized ETI's potential and has supported Gao with everything from business development to patent procurement over the company's lifespan.

"The partnership between UD and ETI is the poster child of what can happen with collaboration between UD and its faculty, researchers and entrepreneurs," said Weir, director of the Office of Economic Innovation and Partnerships (OEIP), which now offers similar services university-wide. "ETI benefits UD by providing employment opportunities for graduates and hands-on experience through internships for students. Being born and bred in Delaware, the state also profits by having a company that is a leader in the field of supercomputing."

ETI remains at the forefront of extreme-scale supercomputing, winning government contracts for building such complex systems. Likewise, ETI continues to strengthen ties with UD, employing more than 35 people, with more than half a dozen UD alumni—including Khan. A dozen students from the University have also interned with ETI over the years.

The powerful ties linking the University and ETI were evident to Carney. "The partnership between ETI, the University of Delaware and the federal government is a great example of how government can help create an environment where small businesses and entrepreneurs succeed and grow," he said.

(Adapted from an article by Meredith Chapman)

Faculty showcase research at JPMorgan Chase Expo

STEVEN BOHACEK, ECE associate professor and **JOHN CAVAZOS**, assistant professor in computer and information sciences are working on research that will provide a "lens" for JPMorgan Chase & Co. to observe the interactions between users and the firm's various databases and track performance. The collaborative project between JPMorgan Chase and UD's College of Engineering is an example of how capitalizing on UD's faculty expertise can improve operational efficiency at the firm.

Other UD faculty members eager to match their skills to JPMorgan Chase's technology needs, showcased their research on April 11 at the company's Morgan Christiana Center in Newark. UD participants gained



insight into the technical challenges faced by the global financial services company at a luncheon, before showcasing their ideas to JPMorgan Chase technology team members.

"We are building a truly resilient, long-term partnership," said Peter Richards, managing director in JPMorgan Chase's Central Technology and Operations division in Manhattan. The expo is by far the largest research exchange between UD and JPMorgan Chase to date. Altogether, close to 200 people attended the event, including 30 UD faculty members representing eight academic departments from UD's Alfred Lerner College of Business and Economics and the College of Engineering.

ABOUT THE UD-JPMC PARTNERSHIP

UD became the second academic institution to join forces with the global financial services firm in March 2010. The partnership, modeled after the one JPMorgan Chase began with Syracuse University a few years ago, consists of a number of components, including internships, curriculum development, joint research and a speaker series. UD signed on, in part, because of the large number of alumni who take jobs at the company.

The internship component offers UD students problem-based learning through authentic, real-world experiences, including an intensive eight-month Global Enterprise Technology immersion experience designed to empower students with knowledge in such areas as strategy, IT-enabled innovation, organizational dynamics and effective communication.

Research between UD and JPMorgan Chase focuses on three key areas of business analytics: process productivity and efficiency, database analysis and optimization, and customer self-service.

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Steiner, Stanhope to lead Delaware INBRE biomedical research program

KARL STEINER, senior associate provost for research development and ECE professor, has been appointed principal investigator of Delaware IDeA Network of Biomedical Research Excellence (INBRE), a statewide, multiinstitutional program funded by the National Institutes of Health, National Center for Research Resources (NIH-NCRR), and administered by UD.

STEVEN STANHOPE, professor in the Department of Kinesiology and Applied Physiology, will serve as program coordinator and chair of the INBRE research committee.

The Delaware INBRE was launched in 2001 under the leadership of David Weir, director of UD's Office of Economic Innovation and Partnerships and former director of the Delaware Biotechnology Institute, as principal investigator and Karl Steiner as program coordinator.

Over the past 10 years, the program has won more than \$44 million in research grants from NIH-NCRR.

Partners in the Delaware INBRE include two medical centers—Christiana Care Health System and Nemours/Alfred I. duPont Hospital for Children—and four academic institutions—Delaware State University, Wesley College, Delaware Technical and Community College, and UD.

The program's primary goals are to support early-career faculty in mentored biomedical research; strengthen Delaware's



biomedical research infrastructure; integrate undergraduate institutions and their students in the research process; and enhance biomedical workforce development throughout the state.

In addition to supporting bioinformatics initiatives, core instrumentation centers, and undergraduate research opportunities, the Delaware INBRE provides pilot grant support for research projects in three focus areas: cancer, cardiovascular science, and the neurosciences.

"The Delaware INBRE has had a tremendous impact on the state by developing a thriving inter-institutional biomedical research capability at UD and at our partner institutions," Steiner said. "The amount of funding awarded by NIH to institutions in Delaware has quadrupled over the past decade, while the actual NIH budget only slightly more than doubled during that same time period. This means that Delaware has actually enhanced its national competitive position in biomedical research.

"INBRE has played a key role in this transition, as Delaware's institutions have undergone significant transformations on each of their campuses," Steiner continued. "We intend to build on this strong foundation and continue to develop and implement innovative programs to further strengthen Delaware's national competiveness in the biomedical arena to better serve the needs of Delaware."

Over the past decade, the INBRE program has helped to lay the foundation for the establishment of the Delaware Health Sciences Alliance (DHSA), which includes three INBRE partner institutions—UD, Christiana Care Health System, and Nemours—and combines their respective capabilities with the expertise at Delaware's medical school, Thomas Jefferson University.

Gao, Li present at multiscale computing of cloud physics workshop held at UD

GUANG GAO, Distinguished ECE Professor, and **XIAOMING**

LI, ECE assistant professor were among the UD speakers to exchange ideas on multiscale computing of cloud physics at a workshop held in Aug. 2010.



The workshop, hosted by UD with support from the National Science Foundation (NSF), brought together over 50 experts in cloud physics, turbulent multiphase flows, applied mathematics, computer engineering and computer science to discuss interdisciplinary research issues related to the cloud physics.

The effort comes as a result of a collaborative project between the University and the National Center for Atmospheric Research (NCAR) in Boulder, Colo. Funded through NSF's Accelerating Discovery in Science and Engineering through Petascale Simulations and Analysis (PetaApps) program, the project is developing tools and simulation models to couple large-eddy simulation of cloud dynamics and direct numerical simulation of cloud microphysics on upcoming petascale computers. This information can then be used to develop cloud physics parameterization for the next-generation weather and climate models.

"Clouds play an essential role in the weather, the hydrological cycle, and the earth's climate system," said Lian-Ping Wang, a professor in the Department of Mechanical Engineering, with a joint appointment in the College of Earth, Ocean, and Environment, and principal investigator for the project. "We wanted to encourage dialogue among investigators within the project team and researchers from various disciplines to stimulate new ideas and approaches for multiscale problems."

Supercomputing workshop highlights computing advances, challenges

National supercomputing experts gathered at the University of Delaware April 5-6 for an informative workshop examining how parallel program execution models impact system software and hardware design. The event highlighted current research efforts and future expectations in execution models for extreme scale computing.

The group included extreme scale and exascale experts from industry, academia and government, including members of the Ubiquitous High Performance Computing (UHPC) Intel-led Runnemede and Sandia-led X-Caliber projects.

Keynote speaker Jack Dennis explained that parallel program execution models play a crucial role in the design of high performance computers, as they dictate the way a program executes on the actual machine hardware. Learning from the past is necessary to creating future advances, he said.

Dennis, from the Massachusetts Institute of Technology (MIT) Computer Science and Artificial Intelligence Laboratory, has spent more than 50 years studying computer architecture. He holds a doctorate from MIT and has been an MIT faculty member since 1958, where his early work involved time-sharing through PDP-1, a machine famous in computer science for originating the hacker culture. He also is a founding member of the Multics project which inspired the development of Unix, a member of the National Academy of Engineering, and a fellow of IEEE and the Association for Computing Machinery.

High performance computing is important for science, national security and commercial applications, according to **KENNETH E. BARNER**, ECE department chair, which sponsored the workshop in collaboration with Intel Corporation and Sandia National Laboratories. Future extreme scale systems will enable improved largescale simulations for fields such as hydrodynamics and molecular dynamics.

GUANG GAO, UD Distinguished ECE Professor, cochaired the event with Thomas Sterling, Arnaud and Edwards Professor of Computer Science at Louisiana State University.

Colombian deans visit UD in hopes of expanding collaborative programs

A delegation of engineering deans representing seven leading Colombian universities visited UD June 26-29 to learn about the impact that graduate study through the College of Engineering is having on Colombian academics, and to discuss expanding the UD-Colombian partnership.

The delegates met with President **PATRICK HARKER**, Provost **TOM APPLE** and leadership from the colleges of arts and sciences, education and human development and engineering, the English Language Institute, global studies and the research office. Topics of discussion included UD's programs, talented faculty, state-of-the-art facilities and cutting-edge research.

"Colombia is investing heavily in graduate education, along with Brazil and Chile, by partnering with international universities. We believe this is a good opportunity for UD because we already have a track record of collaboration with Colombian universities," explained **GONZALO ARCE**, Charles Black Evans ECE Professor. Arce, together with **HERNAN NAVARRO**, research associate professor in the College of Education and Human Development, pioneered the UD-Colombian University partnership in 1997, a program which annually brings top Colombian scholars from partnering institutions to conduct research with UD faculty during the summer months. The program initially focused on recruiting student talent into UD's electrical and computer engineering graduate program.

Cultural and academic exchange agreements were formalized with 10 Colombian universities and the partnership began offering joint master's degree programs in 2008. A total of 14 Colombian universities have participated in the program, broadening UD's potential reach to more than 250,000 Colombian students and educators.

To date, nearly 20 Colombian students have graduated with ECE doctoral degrees. Recruitment to UD's doctoral programs is "on the order of 60 percent."

UD alumnus **SEBASTIAN HOYOS**, now an assistant professor at Texas A&M University, believes the program is creating "the largest group of highly educated Colombians in both

the United States and Colombian academia and industry."

"As this group of UD-Colombian graduates gets larger, it will represent a critical mass of highly educated contributors to both the Colombian and U.S. society," said Hoyos, who earned both a master's degree and a doctoral <u>degree in electrical engineering at UD.</u>

Arce and Navarro are now working to expand the program beyond engineering. Professors from the Department of Music, for example, traveled to Colombia in August to perform and initiate a similar collaboration.

"Our mutual goal is to train 100 future Colombian faculty at the Ph.D.-level over the next ten years," added Navarro. "Ten years ago, the number of Ph.D. degreed individuals in Colombia was very small. Now, many doors are opening at UD. We look forward to producing new initiatives that will raise the level of academic expertise and educational infrastructure available to Colombian students."

The collaboration may also lead to new funding sources as Colciencias, the Colombian National Science Foundation, makes funds available to UD-bound students.



ECE courses meet Army's growing professional needs

Since signing a Cooperative Research and Development Agreement (CRADA) in January 2010, the University of Delaware and the U.S. Army at Aberdeen Proving Ground (APG) have joined forces for research and development opportunities as well as graduate education, professional development and employment or internship opportunities for the UD community.

"UD's comprehensive program offers classes I have not seen at other universities, and the knowledge I've gained helps me ensure that systems that are reaching soldiers will survive the complex environments that they face."

— Janeen Winne, APG engineer

Last spring, the ECE department began supplementing on-campus and distance learning offerings with courses taught on-base to make it easier for APG employees to continue their education.

The first course, advanced engineering electromagnetics, attracted six students, including Janeen Winne, an APG engineer supporting the Army Evaluation Center in non-ballistic survivability.

"UD's comprehensive program offers classes I have not seen at other universities, and the knowledge I've gained helps me ensure that systems that are reaching soldiers will survive the complex environments that they face," said Winne.

UD-APG on-base offerings in antenna theory & design and digital signal processing saw a three-fold increase in enrollment, with nearly 20 APG employees attending the 2011 spring semester.

"Local course offerings greatly ease my travel burden and reduce my time away from work," explained Joseph Deroba, an APG electrical engineer and UD alumnus currently pursuing a doctorate in electrical engineering at UD. "Taking courses with my peers, many of whom have similar experience levels and responsibilities, is also a benefit."

In addition, new degrees such as the University's recently added Master of Science in Software Engineering, designed at APG's request by faculty from ECE and the Department of Computer & Information Science, position students and professionals to meet future job challenges with advanced innovation and problem solving skills.

Past Distinguished Lecturers

October 27, 2010

JOSEPH BORDOGNA

University of Pennsylvania

"Life at the Edge—Embracing Cacophony, Enabling Symphony"

December 1, 2010

STEPHEN CHOU

Princeton University

"Nanostructure Engineering—A Path to Discovery, Innovation and Commercialization"

February 16, 2011

FEDERICO CAPASSO

Harvard University

"Sub-wavelength Photonics: From Light Manipulation to Quantum Levitation at the Nanoscale"

March 23, 2011

DAVID CARLSON

BP Solar

"Photovoltaics and Its Potential Impact on Climate Change"

May 4, 2011

RICHARD BARANIUK

Rice University

"Compressive Sensing"

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OCTOBER 5, 2011 JAMES WAGNER EMORY UNIVERSITY "Inquiry-Driven Engineering: One of the Liberal Arts"



NOVEMBER 16, 2011 **VINCE POOR PRINCETON UNIVERSITY** "Information and Inference in the Wireless Physical Layer"



FEBRUARY 15, 2012 **NADER ENGHETA** UNIVERSITY OF PENNSYLVANIA "Of Light, Electrons and Metamaterials"



APRIL 4, 2012 **THOMAS STERLING INDIANA UNIVERSITY** *"Towards an Execution Model Driven X-Stack Strategy"*



MAY 9, 2012 **TINGYE LI AT&T BELL LABORATORIES** *"Lightwave Communications: A Mainstay of the Information Society"*

Visit www.ece.udel.edu for webcasting and details.

Co-Sponsored by the Delaware Bay IEEE

Engineering students are IEEEXtreme regional champs

A team from the University of Delaware's IEEE student chapter competed in the IEEEXtreme 24-hour programming competition, finishing in the top 10 percentile in the world and claiming the eastern U.S. region championship last October.

The global competition pits various IEEE student chapter teams against one another in solving complex programming problems. The win placed UD ahead of more than 70 regional universities in computer programming prowess. Members of the UD team included **ERIC MCGRAW**, **WILL GIRTEN** and **STEPHEN ORLANDO**, all ECE undergraduates.

This was the first appearance for the College of Engineering's IEEE student chapter. They joined an impressive 1,000 teams from more than 350 universities around the world in the fourth annual competition.

"I enjoyed the thrill of having to solve a series of complex problems in only a short amount of time, all the while knowing that we were racing against thousands of teams worldwide to the answer," said Girten, a UD senior.





Many-core computer research wins 'best paper' at HiPEAC

ELKIN GARCIA and **DANIEL OROZCO** won "best paper" for their novel approach to reducing the energy consumed by computers at the 6th International Conference on High-Performance and Embedded Architectures and Compilers (HiPEAC) 2011 workshop on Programmability Issues for Multicore Computers (MULTIPROG).

The paper, entitled "Energy efficient tiling on a many-core architecture," details a simple but powerful model for describing the energy consumption of an emerging class of many-core architectures, and then uses this model to minimize the energy consumption of a parallel program based on the way the computations are tiled.

Energy consumption is a major cost in supercomputing, explained Orozco, with power and energy efficiency representing two main design constraints in creating new parallel computer architectures. "We've developed a new parallel algorithm that reduces the total energy consumption by 75 percent over naive tiling structures. This approach could be applied to extend the battery life of portable devices and to decrease the requirements of cooling systems on modern computers," explained Orozco, a fifth year doctoral student working under faculty adviser Guang R. Gao, Distinguished Professor of Electrical and Computer Engineering.

"This work will impact scientific programs in future generations, where the dominant design factor is likely to be energy consumption and not speed or cost per computer," said Garcia.

He and Orozco hope to extend their research, conducted under funding from the National Science Foundation (NSF), to other algorithms and study its impact on energy consumption, while also investigating the relationship between optimum tiling on increasing performance versus energy efficiency.

New senior design course ties student learning to the real world

The Department of Electrical and Computer Engineering has implemented a new two-semester design course for undergraduate seniors. Offered for the first time in the 2011-2012 academic year, the course enables small groups of two to five students to work on engineering problems suggested by commercial and military engineers.

"Students want to build things," said **CHARLIE BONCELET**, ECE professor. "In our new capstone design course sequence we're giving them that opportunity."

Unlike a traditional course with lectures, assignments and tests, the capstone design course emulates real-world engineering experiences. Students will select a project, form a team, and write a proposal detailing the problem and the project's goals, with support from faculty mentors and **CHASE COTTON**, ECE professor and instructor for the class.

Formerly a single semester experience, teams will now research the design space of their problem during the fall semester, as well as test and understand the behavior of components, and complete and validate initial designs by prototyping needed hardware circuits and software. In the spring semester, the groups will finalize their designs, order components and assemble and test the system against their project goals.

"The best part about this class is that you get to work on something you really enjoy...

and you are in control of your own goals," said **MEENA ABDOU**, a 2011 ECE graduate who participated in a pilot version of the program during the 2010-2011 academic year. Abdou's team designed and implemented a mapping system that enables a robot to map out Evans Hall, including detecting doors. Students document their efforts, including design documents, test results, images and videos, using a web-based wiki. This methodology simplifies the production of mid-semester and final reports and presentations, while also making the project highly visible to mentors and other student groups.

Current program sponsors include the U.S. Army Communications-Electronics Research, Development and Engineering Center; Science Applications International Corporation (SAIC); and UD's Office of Campus and Public Safety. Their financial and in-kind support of our program has enabled the ECE department to purchase robotic equipment; a software-defined radio laboratory; Android phones; various sensors; and dedicated computers devoted to the undergraduate design experience. Additionally, campus visits by government and industry experts provide students valuable perspective on how projects work in the "real world" and contacts for employment following graduation.

Future goals for the program include expanding the sensor, robotic and radio capabilities; providing new and better tools for circuit design, fabrication and testing; and supporting student projects in alternative energy and the smart grid.



Editor's note: The ECE senior design laboratory received a facelift over the summer, thanks to the generous support of our alumni (including one \$5,000 anonymous gift), increasing the laboratory's size and introducing new AV and technical construction capabilities for our students.



STUDENTS

ECE grad student named 2011 Laird Fellow

COREY LANGE, a graduate student in the Department of Electrical and Computer Engineering, has been chosen to receive the 2011 Laird Fellowship. The award is aimed at encouraging the recipient to become engaged in a broadening intellectual pursuit that may or may not have direct applications to his or her chosen field of study.

First awarded in 1977 to honor the memory of George W. Laird, a mechanical engineering graduate of UD who died in an accident at the age of 35, the prestigious fellowship is bestowed upon candidates who exhibit character, creativity, imagination and perseverance, all of which are focal points of the selection process.

"I think curiosity is at the heart of engineering. You can have all the math and physics you want, but if you aren't curious about how the world works, you won't make a good engineer," said Lange.

Lange is advised by ECE Professor **FOUAD KIAMILEV**, whom he calls "a tremendous influence" that profoundly affected his career path.

"I began working with Dr. Kiamilev as an undergraduate...and he guided me to continue with my education at the graduate level," he said.

As an undergraduate, Lange conducted research on infrared LED systems, helping to build hardware systems to test 2-D arrays of the *semiconductor light source*. He earned an honors bachelor of computer engineering degree, summa cum laude, with a minor in computer science in May 2009. He continued this research as a graduate student with a focus on larger arrays. The work led Lange to present at an IEEE conference and to write a paper that will soon be published in an upcoming SPIE technical journal.

Lange credits **KATHY FORWOOD**, ECE academic support coordinator, with prodding him to submit for the fellowship. "If it weren't for her encouragement I probably wouldn't even have applied," he said.

This is the second year in a row the prestigious Laird Fellowship has been awarded to an electrical and computer engineering student. **NICOLE KOTULAK**, a doctoral student in UD's Solar Power Program, received the 2010 award.

"It is fantastic to see such well-rounded students in the electrical and computer engineering program," noted **KENNETH E. BARNER**, chair of the department.

"My experience with the Laird Fellowship has given me a chance to really see how far l've come since my early days playing with the family computer. This tight-knit group of engineers strives to give back to the UD community in many ways, and I am deeply honored to be a part of it," added Lange.

Like all previous winners of the Laird, Lange has many interests. He enjoys camping, hiking, fishing, reading and logic games. Musically inclined, he plays the trumpet, French horn and harmonica. He is a licensed amateur radio technician and he has even produced and engineered an online radio show.

A staunch UD volunteer, Lange has logged countless hours at nearly every Discovery Day, Blue and Gold Day, and Decision Day since his sophomore year, as well as serving as a Russell Fellow with the University's Honors Program.

In June, Lange began a new chapter when he joined Apple, Inc. in Cupertino, Calif., where he will design hardware systems for use in product development and production.

James Mutitu receives UD dissertation fellow award



The Office of Graduate and Professional Education awarded JAMES MUTITU, a Ph.D. graduate student under the direction of Professor Dennis Prather, the University Dissertation Fellow Award for the 2011–2012 academic year. This award was established by the Office of the Provost to enable and support Ph.D. students

to devote full attention to the completion of their doctoral dissertations. The fellowship is given in recognition of prior academic achievements and potential for success in the candidates field of study.

Mutitu's research is concerned with increasing the light trapping capacity of thin film photovoltaic devices by applying photonic engineering concepts and methodology. The ultimate goal is to increase the overall efficiency of solar cells which are much thinner than the currently manufactured wafer based devices, to a point where the performance of the thicker and thinner cells is comparable. James has also been recognized as a Senior Teaching Assistant Fellow as a result of his efforts in educating incoming teaching assistants on effective pedagogical techniques for the engineering sciences.

National engineering honor society president visits UD

Larry A. Simonson, national president of Tau Beta Pi (TBP), learned about the University of Delaware's ongoing efforts to advance engineering excellence during a campus visit this year.

Open discussions with UD President **PATRICK HARKER** and **MICHAEL J. CHAJES**, former dean of engineering, both TBP members, centered on UD's targeted efforts to engage students and stimulate excitement about science and engineering, including projects such as the Interdisciplinary Science and Engineering Laboratory (ISE-Lab) and UD's Science and Technology Campus.

In a rare private audience with their national president, members of the University's student chapter discussed mutually beneficial outreach programs to inspire K-8 students toward careers in science, technology, engineering and mathematics (STEM) fields.

"Tau Beta Pi promotes engineering excellence nationwide. This site visit exemplifies their recognition of the greater role UD is playing as a talent magnet and educational training ground for future engineers," said Michael Vaughan, senior assistant dean for academic affairs in engineering.

Only students in the top fifth of their senior class or the top eighth of the junior class are invited as members to TBP, said Vaughan, also a TBP member. The University's Alpha Chapter has inducted over 2,100 engineers since its inception in 1933.

Wii Assist project on G4 Network

UD seniors ROB HAISLIP, JOSHUA

MARKS and ROB REHRIG showcased their research to a national audience of video gamers when the G4 network's *Attack of the Show* featured a segment on their "Wii Assist" project in Aug. 2010. The project aims at making computers more accessible for individuals with disabilities. Together Haislip, Marks and Rehrig adapted hardware from Nintendo's Wii, transforming it into devices that control a computer mouse. The segment, videotaped by Haislip, aired during a segment called "Viewer Army."



2010–2011 TA award winners

The ECE department has established two new awards to recognize our outstanding teaching assistants (TA); a \$400 "Best TA award" and a \$250 "Outstanding TA award." Winners are chosen each semester by the ECE graduate committee based on student evaluations. Please join us in congratulating our 2010–2011 award winners.

BEST TA AWARD:

Furkan Cayci (fall 2010; spring 2011)



OUTSTANDING TA AWARD:

Gonzalo Garateguy (fall 2010)

Carlos Aponte (spring 2011)







Undergraduate research experience puts education to practice

Students from eight universities across the nation put their education to practice this summer through The Nature InSpired Engineering Research Experiences for Undergraduates (NISE-REU) program, now in its third year at University of Delaware.

Student participants came from UD, Northwestern University, University of Maryland, Northeastern University, Brandeis University, North Carolina State University, Villanova University and the University of Pennsylvania.

Led by ECE Professors **BARNER** and

BUMA and funded by the National Science Foundation (NSF), the nine week program featured intensive laboratory research experiences coupled with workshops on technology tools for research and communications, employment and graduate school preparation, technical writing and poster presentation, and engineering ethics.

Students worked on a wide array of projects across the College of Engineering, including robotic exploratory mobility units for the biologically challenged; identification of transcription factors for cellular reprogramming; biomedical imaging for virtual surgery simulation; materials for natural energy capture; production of biodiesel from wastewater treatment plant microorganisms; self assembly of colloidal articles; and biochar's impact on greenhouse gas emissions from agricultural soils.

Field trips to companies and research facilities related to the NISE theme, including UD's new 2-megawatt Wind Turbine and Remote Sensing Laboratory located on the Lewis, Delaware, campus, offered students real-life examples of research in action.

On August 9, 2011, participants concluded their experience by presenting research posters (developed with their faculty mentors) at the Undergraduate Research Symposium, a university-wide event featuring undergraduate research results from across campus.

STUDENTS

Dissertation/Thesis Titles

Fall 2010—Summer 2011

PH.D. DISSERTATION TITLES

Systematic Process Development Towards High Performance Transferred Thin Silicon Solar Cells Based on Epitaxially Grown Absorbers

Clara Paola Murcia Salazar (2011)

Large Area CMOS Compatible Near IR Metamaterials

Design, Fabrication, and Measurement of High Efficiency Concentrating Photovoltaic Modules Leading to Photovoltaic Systems with Low Energy Cost Xiaoting Wang (2011)

Design, Fabrication,

Characterization and Analysis of an Efficient Germanium: Silicon Solar Cell for a Multi-Junction Solar Cell System

Yi Wang (2011)

FFT Libraries on Heterogeneous Computers Liang Gu (2011)

Design, Fabrication, and Analysis of Thin Silicon Solar Cells Using Epitaxial Lateral Overgrowth to Increase the Voltage Ruiying Hao (2011)

Free Space Optical Coupling of Fiber Optic Sensors Integrated with Composite Structures Liang Qiu (2011)

Design, Fabrication and Analysis of Transparent Silicon Solar Cells Christopher Kerestes (2011) Design, Fabrication, Characterization and Analysis of Wide Band Gap Gallium Phosphide Solar Cells

luesong Lu (2011

A Comparison Between Virtual Code Management Techniques Joseph B. Manzano (2011)

Robust Phase Unwrapping and Its Applications in Radar Signal Processing and Imaging Xiaowei Li (2011)

Space-Time Coding For Asynchronous Cooperative Relay Networks

neng LI (2011)

Binary Dithered Oversampling Analog to Digital Converter Jirar Nicolas Helou (2011)

Fabrication and Characterization of Low-Dimensional Structures for Optoelectronic Device Applications Latha Nataraj (2010)

Exploring Novel Many-Core Architectures For Scientific Computing Long Chen (2010)

Design and Characterization of Modules for Millimeter-Wave Imaging Applications Rownak Shireen (2010)

New Methodologies for Performance Modeling of Routing Protocols in Wireless Networks

Silicon Nanocrystal Devices for Silicon Photonics Timothy Creazzo (2010) Design, Fabrication, and Characterization of Novel Microcavities for Silicon-Based Light Emitters

Statistical Approaches for Congestion Control in Computer Networks Ivan Dario Barrera Latorre (2010)

MASTER THESIS TITLES

Dynamic Suicide Gene Therapy Control

Cache-Collision Timing Attacks Against AES-GCM Bonan Huang (2010)

Interference Considerations in Mimo-Based Cellular Systems Chenzi Jiang (2010)

High Rate Space-Frequency Codes for MIMO-OFDM Systems Cheng Wang (2010)

Memory State Flow Analysis and Its Application

Design and Development of a 512x512 Infrared Emitter Array System Corey Lange (2011)

The Building and Characterization of a Stretched-Pulse Additive Pulse Mode-Locking Fiber Ring Laser with 2 Modes of Operation and an Amplification Stage

Luis Felipe Gerlein Reyes (2011

High Frequency Ultrasound Transducer for Real Time Ultrasound Biomicroscopy with Optoacoustic Arrays

(2011) Kinqing Guo

A Study of Spectral Domain Optical Coherence Tomography and Photoacoustic Microscopy for Biometric and Biomedical Applications Mengyang Liu (2011) On The Use of Scintillating Fibers to Concentrate Solar Light Kristen Pickelsimer (2011)

Real-Time Ultrasound Biomicroscopy with Optoacoustic Arrays Ya Shu (2011)

Exfiltration Techniques: An Examination and Emulation Ryan C. Van Antwerp (2011)

Terahertz Imaging with Synthetic Aperture Arrays and Adaptive Image Reconstruction

Three Terminal Si-Si:GE Monolitic Tandem Solar Cells Lu Wang (2011)

Interdigitated Back Contact Silicon Heterojunction Solar Cells: Analysis With Two-Dimensional Simulations John Allen (2011)

Design, Fabrication,

Characterization and Analysis of Wide Band Gap Gallium Phosphide Solar Cells and Gallium Phosphide on Silicon

Martin Diaz (2011)

Growth and Analysis of Gallium Phosphide on Silicon for Very High Efficiency Solar Cells Nicole Kotulak (2011)

The Synthesis of PBS Nanocrystal and Their Self-Assembly into Complex Nanowire and Nanocub Structure

Fan Xu (2011

Growth, Characterization and Modeling of New Semiconductors and Nanomaterials for Electronic and Optoelectronic Applications John Petropoulos (2011)

Interested in hearing more? Contact Ken Barner at barner@udel.edu.

ALUMNI SPOTLIGHT

Advisory Council Member Raymond L. Sokola, BEE '76



Alumnus and donor to the Interdisciplinary Science & Engineering Laboratory, RAYMOND L. SOKOLA is vice president of Future Technology for TE Connectivity, formerly known as Tyco Electronics. He is responsible for leading the development of future technology solutions for the company's broad range of product and process areas. After earning his bachelor's degree in electrical engineering, Sokola had a thirty year career with Motorola before joining TE Connectivity. He was one of the first engineers to work on cellular technology in 1976. His achievements include three Motorola Patent of the Year awards, nineteen U.S. patents and he was named a Dan Nobel Fellow, the highest technology honor at Motorola. When asked about his undergraduate experience, he said "I remember how fast my undergraduate years went by, it was an exciting time. I always had a lot to do and learn. When I return to campus, I have good feelings of those times." Sokola stays involved with UD by serving as a member of the Electrical and Computer Engineering Advisory Council.

How has your UD experience and education prepared you for your current position with TE Connectivity?

Both experience and education were key factors in preparing me for my career and current position. The education was solid and had the breadth that I needed since I didn't know my exact career path. Subsequently, my career has included software, hardware, radio frequency design, test equipment and components. Even with that range, I always felt that I had a foundation to build upon.

From the experience side, there were many factors including my senior project and my job on campus with the Department of Marine Studies where I learned the practical application of theory to a product. My interest in communications was enhanced by participation in the Amateur Radio Club. And, four years of playing varsity soccer at UD gave me an understanding of how to be a part of a team.

What are the most rewarding and challenging aspects of your job?

One of the most rewarding parts of my job is in developing talent in engineers early in their careers. I lecture on campus, give talks, work in small groups and try to lead by example in the area of innovation. The challenging aspect is learning the tough lesson that innovation usually starts out as something very disruptive, and is met with a great deal of opposition. Once you learn to expect this, it is less unnerving.

Another rewarding aspect is looking for opportunities to do big things that have potential and the ability to change people's lives. I've been fortunate to be part of several – among them was being a key part of developing cellular phone technology. In 1976 when I started developing cell phone technology, most people were very negative on the idea because they already had a phone that rang during dinner or they had pay phones if needed. The world sure has changed to the point that there are now well over five billion cellular devices, and the number is still growing.

I also had the opportunity to play a key role in Telematics. The most visible example of that is OnStar, which among other things, I transitioned from analog to digital. It is very rewarding to develop products that make our daily lives better or products that can save people's lives.

What motivated you to make a leadership gift supporting the new Interdisciplinary Science and Engineering building?

I wanted to support the University in a bigger way. I am also a believer in the importance of an interdisciplinary approach to developing solutions and opportunities. I think the magic occurs by combining experiences and various types of knowledge in new ways. I am excited about how big a role that can play in the future of the University and beyond.



James H. Miller inducted to Alumni Wall of Fame

JAMES H. MILLER was one of ten University

of Delaware gradues inducted into the University Alumni Association's Wall of Fame as part of Alumni Weekend festivities June 3–5, 2011.

During the ceremony held at the Roselle Center for the Arts June 4th, Alan Brayman, president of the UD Alumni Association and host of the ceremony, said, "Our recipients' level and diversity of accomplishments serve as a testament that a degree from the University of Delaware provides the foundation for the many wonderful opportunities that await our graduates....

"The worldwide recognition these individuals have gained brings pride to the University of Delaware and inspires fellow alumni and students alike."

UD President PATRICK HARKER

congratulated the newest members of the Alumni Wall of Fame. "Many Blue Hens—those enrolled and those already graduated—have the opportunities and advantages they do precisely because of the people we honor today. And so, when I consider our 10 Wall of Fame inductees, I see the University of our aspirations."

Miller earned his bachelor's degree in electrical engineering in 1977. With more than 35 years of diverse experience in the electricity industry, he currently serves as chairman, president and chief executive officer of PPL Corp. He also serves on PPL's Corporate Leadership Council, which sets the strategic direction for the company and its subsidiaries. In April 2010, Miller was a speaker the Department of Electrical Engineering's Distinguished Lecture Series, where he spoke on the trials and challenges of being in the electricity-generating business.

"The University of Delaware has played an important part in my personal success story. I've got great memories of my days as an undergraduate student there... and I will always be grateful for how understanding and supportive my electrical and computer engineering professors were at UD," said Miller in his acceptance speech.

Established in 1983, the Alumni Wall of Fame recognizes outstanding professional and public service achievements by UD graduates.

'The University of Delaware has played an important part in my personal success story. I've got great memories of my days as an undergraduate student there... and I will always be grateful for how understanding and supportive my electrical and computer engineering professors were at UD."

—James H. Miller

Do you know of any particularly noteworthy accomplishments by UD ECE-alum that should be recognized? Please send alumni award nominations, including selfnominations, to <u>ECE-alum@udel.edu</u>.

Share your recent career updates and honors with fellow alums. Send updates to <u>ECE-alum@udel.edu</u> for inclusion in future UD ECE Currents.

ECE Advisory Council Meeting held September 22–23, 2011

The Department of Electrical and Computer Engineering Advisory Council, comprised of academic and industrial field leaders, many of who are alumni, hosted its annual meeting on September 22 and 23. Working collaboratively with the department chair, faculty members and students, the council's mission is to strengthen the Department of Electrical and Computer Engineering by shaping and supporting its strategic objectives and goals.

The council meets annually, with members serving three-year terms. "The depth of expertise and broad experience provided by the Advisory Council members is critical to advising the department on its strategic objectives and ensuring that those initiatives continue the recent advancements in departmental education and research programs," notes ECE Chair, **KENNETH BARNER**. The 2010 Advisory Council meeting yielded specific recommended actions to increase department prominence, enhance student experiences, and further mentor the recently hired outstanding junior faculty members.

The current chair of the Advisory Council is **DR. KRISTOFER ROE**, director of Imaging Technology for Smiths Detection and proud Ph.D. graduate of the University. When asked about serving in this role, Dr. Roe answered, "Providing feedback to the department is an excellent way to play a personal role in the shaping of the experience and opportunities for future graduates. I am proud to serve as the chair of the Advisory Council for the current three year term."

The 2011 meeting included a particular focus on alumni engagement with students, internship opportunities, and building greater collaborative relationships to advance student opportunities and research efforts.



COUNCIL'S MEMBERS

- Prof. Fil Bartoli
 Chair, Electrical and Computer Engineering Department,
 Lehigh University
- Dr. Karen M. Bloch (BSAS '85, MEE '97, PhD '04) Engineering Manager, E.I. du Pont de Nemours & Company
- Prof. Edward J. Coyle, Jr. (BEE 78) Arbutus Chair, Georgia Institute of Technology
- Dr. William R. Gardner (BEE '89) Technical/Patent Consultant
- Dr. Daniel J. Grim (BEE '70, MEE '72, PhD '76) Chief Technology Officer, IT, University of Delaware
- Dr. Charles T. Johnson-Bey (MEE '93, PHD '94) Open Innovation Program Manager, Lockheed Martin Corporation, CERDEC, US Army
- Prof. John C. Kelly (BEE '81, PHD '88) Chairman, Electric & Computer Engineering, NC A&T State University
- Frederick L. Kitson (BEE '74) EVP & Chief Technology Officer, DTS, Inc.
- Michael R. Lombardi
 Deputy Director, Intelligence and
 Information Warfare Directorate
- Dr. Kristofer J. Roe (BEE '95, MEE '97, PhD '01) Chair, ECE Advisory Council Director, R&D Imaging, Smiths Detection
- Raymond L. Sokola (BEE '76) Vice President, Future Technology
- Dr. Edward S. Szurkowski (BEE '76, MEE '78, PhD '82) Founder & Managing Partner, Blue Mill Group
- Dr. Douglas F. Tipton Chair, IEEE Delaware Bay Section, IEEE MidAtlantic
- Dr. Wayne Westerman (PHD '99) Senior Engineer, Apple
- Dr. Sean Xiaolu Wang (PHD '92) Founder & Managing Director, B&W Tek, Inc.

In Memoriam

Sadly, this year our department mourns the loss of two ECE professor's, Walter **DAVID SINCOSKIE** and **DAVID M. ROBINSON**.



Walter David Sincoskie, Oct. 2010.

(Hockessin, Del.)

Dave joined UD in 2008. During his tenure, he established the Center for Information and Communications Sciences to help address national security issues and served as its director. Prior to joining UD, Dave worked for Bell Laboratories in Murray Hill, NJ in communication research. From 1986 to 1995, he led the world's leading switching research organization at Bellcore which spearheaded the telecommunications transition from circuit-switching to packetswitching, a key factor in the successful commercialization of the Internet. From 1996 to 2008, he was senior vice president of Telcordia's Networking Systems Laboratory where, among other achievements, he pioneered the creation of Internet telephony. Dave made many seminal contributions to the science and technologies of communications networks, including the first voice-over-packet phone, first virtual LAN, first description of a digital video server and first wide-area gigabit computer network. During these years he was also an adjunct professor of computer and information science at the University of Pennsylvania. As a special government employee since 2002, he advised senior executives within the Department of Defense. Also a UD alumnus, Dave received his bachelor's, master's and Ph.D. degrees in electrical engineering from UD. He was elected to the UD Alumni Wall of Fame in 2006. Dave is author of numerous papers and co-inventor on many patents. He was a member of the National Academy of Engineering and a fellow of the IEEE. He received the IEEE's Fred W. Ellersick Prize (2003) for his paper, "Broadband Packet Switching: A Personal Perspective," which detailed his research contributions over two decades to the development of today's broadband Internet. He was also a member of Tau Beta Pi and Eta Kappa Nu.



David M. Robinson, Sept. 2010

(Bethany Beach, Del.)

Emeritus ECE Professor David M. Robinson is remembered for his long and close association with the University of Delaware and UD electrical engineering. He was born in Wilmington, Delaware, and grew up in the Diamond State. After graduating from high school he served in the U.S. Navy before returning to UD to earn his Bachelor of Science degree in electrical engineering in1954. Dave then married Doris Carter (Dorie) and in that same year returned as a graduate student in electrical engineering to earn his master's degree in1960 and Ph.D. in1964. He had the unique distinction of being the first student to earn a Ph.D. in electrical engineering at the University of Delaware. Dave worked for 10 years at Bell Laboratories before returning to UD as a professor. During his years on the UD faculty, Dave served not only as a respected classroom teacher and researcher, but also as an advisor to many students. He truly loved teaching and interacting with young people, and was especially well regarded by his students for his fairness and willingness to spend time helping them with their problems. A devoted husband and father, Dave's other hobbies included UD Blue Hen football, fishing and scuba diving. He was very proud of becoming a certified scuba diver at age 65. In his later years he divided his time between Bethany Beach and Cudjoe Key, Florida.

Donated equipment supports student research, learning in engineering

Equipment donated to UD's College of Engineering by technology giant IBM is advancing student research efforts toward fabricating and characterizing electronic materials and devices.

The instruments, an energy dispersive x-ray fluorescence (EDXRF) system and a chemical vapor deposition (CVD) system, collectively worth about \$150,000, were given to **JAMES KOLODZEY**, Charles Black Evans Professor in the Department of Electrical and Computer Engineering.

Kolodzey explained that because the two devices measure and fabricate a wide range of materials, the acquisition benefits not only electrical engineering faculty and students, but the whole college.

"These new systems will solidify and expand the opportunities for research at UD and will enhance the sharing of results with industry," said Kolodzey, whose research interests lie in the characteristics and limitations of nanoelectronic devices operating at high speeds and in combination with different material systems.

First used in the laboratory of Mary Zaitz at IBM's East Fishkill facility, the EDXRF system will be used to determine the chemical composition of novel semiconductor alloys and structures, and to calibrate the operating conditions for epitaxial growth systems. The CVD device, with its ability to grow layers of thin films of semiconductor materials for devices and circuits, will enable researchers in Kolodzey's laboratory to produce and study novel experimental materials such as the carbon compound graphene, which is not yet used in standard practice.

"Homemade" by researchers including Jack Chu of IBM's TJ Watson Research Center, the CVD device includes unique features such as a 5-inch diameter quartz reaction chamber, a high temperature furnace, components for controlling the flow of process gases and vacuum pumps for their evaluation.

Students learned to operate the advanced instruments from Thomas Adam, senior scientist at IBM's Nanotechnology Center, who organized the donation. They will work with Kolodzey to install the equipment at UD and collaborate with UD faculty and IBM senior scientists in future measurements.

Hui Fang selected for annual HP Labs Innovation Research Program

HUI FANG, assistant ECE professor, has been selected to participate in the prestigious HP Labs Innovation Research Program, which enables colleges, universities and research institutes around the world to conduct breakthrough collaborative research with HP.

Fang will work with HP Labs on a research initiative focused on improving the quality of enterprise searches through integrated information and collaborative activities. She said the project "aims to develop effective tools for managing heterogeneous enterprise data and allow users to effectively and efficiently access useful information."

Fang said such tools are essential to improve the way users search for information, facilitate information exchange and make decisions, and can thus help improve the productivity of an enterprise.

"I am excited about this research collaboration opportunity with HP Labs because it allows faculty and students to work closely with world-class researchers and engineers from a company that has a long history of contributing leading edge computer technology to the world," Fang said. "The enterprise search problem we are tackling together is particularly important as it presents an interesting research challenge and opportunity to develop solutions that could have enormous benefits for the industry and society."

HP reviewed more than 375 proposals from 202 universities across 36 countries. UD is one of only 52 universities in the world to receive a 2010 Innovation Research award.

Fang, who joined UD in 2008, received a bachelor's degree in computer science from Tsinghua University in China and her master's degree and doctorate in computer science from the University of Illinois at Urbana-Champaign. Her research focuses on real world applications that effectively and efficiently manage large amounts of text information, and her primary research interest in information retrieval.

New Faculty

David Farber



Professor,

Electrical and Computer Engineering

DAVID FARBER rejoins UD electrical and computer engineering department, focusing his efforts on the translation of technology and economics into policy formulations, particularly in the areas of net neutrality and spectrum management. Other areas of his work include the impact of multi-terabit communications and new computer architecture innovations on future Internet protocols and architectures. Farber was a member of the UD ECE faculty from 1977–1988, before becoming the Alfred Fitler Moore Professor of Telecommunication Systems at the Moore School, and Professor of Public Policy at the Wharton School, University of Pennsylvania. He served as the Chief Technologist at the Federal Communications Commission (FCC) from 1999–2000 and, most recently, as Distinguished Career Professor of Computer Science and Public Policy at Carnegie Mellon University. A fellow of both ACM and IEEE, Farber was named in the 1997 edition of the UPSIDE's Elite 100 as one of the visionaries of the field and in the 1999 Network World as one of the 25 most powerful people in networking. In 2002, Business Week named him one of the top 25 leaders in E-Commerce.

Abhyudai Singh



Assistant Professor, Electrical and Computer Engineering

Assistant Professor, Biomedical Engineering Program

ABHYUDAI SINGH joins the UD ECE department as an assistant professor, with a joint appointment in Biomedical Engineering, after completing postdoctoral studies in the Dynamical Systems Biology Laboratory at UCSD. He earned his Ph.D. degree in electrical and computer engineering from University of California, Santa Barbara (UCSD). He also holds a Master of Arts in Ecology, Evolution and Marine Biology from UCSD; and master's degrees in ECE and mechanical engineering from Michigan State University, and a bachelor's degree in mechanical engineering from Indian Institute of Techology Kanpur, in India.

Singh's research interests are in the area of systems and control, with applications to systems biology and medicine. Employing mathematical techniques used for studying engineering control systems, his research group models and analyzes the dynamical nature of geneprotein networks inside living cells. These mathematical models help researchers uncover and understand the complex feedback circuitry encoded by these networks, and how deregulation in feedback control can lead to diseased states.

Retirements—over 70 years of service

The UD ECE community proudly celebrates the tremendous careers of three faculty members, Profs. **ALLEN BARNETT**, **ROBERT HUNSPERGER**, and **FEMI OLOWOLAFE**. Together, they have over 70 combined years of research and teaching service at UD.

Allen Barnett



Barnett received his MS and BS degrees in electrical engineering from the University of Illinois and his PhD from Carnegie Mellon University. He joined UD in 1976 as Director of the Institute of Energy Conversion and professor of electrical engineering. Barnett supervised 19 PhD students during his tenure as a faculty member. He also founded AstroPower, Inc., and served as the company's CEO. Barnett is a Fellow of the IEEE and received the IEEE William R.

Cherry Award for outstanding contributions to the advancement of photovoltaic science and technology and the Karl W. Böer Solar Energy Medal of Merit. He has more than 280 publications, 28 U.S. patents and 7 R&D 100 Awards for new industrial products.

Robert Hunsperger



Hunsperger earned his BSEE, MSE, and PhD degrees from Drexel, Princeton, and Cornell University, respectively. As a UD faculty member for 35 years, Hunsperger supervised 28 ECE master's and 22 PhD students, many of whom are now leaders in their fields. He was elected as an IEEE Fellow for his research contributions and photonics and education in the area. One of his numerous books, Integrated Optics: Theory and Technology, is in its sixth edition, serving as a fundamental

text for students and researchers in the area. Always an innovator, Hunsperger was an early adopter of distance education, an activity he continues to date.

Femi Olowolafe



Olowolafe earned a B.Sc. of Physics from Obafemi Awolowo University, located in his native home of Nigeria, and MS and PhD degrees in Apply Physics from the California Institute of Technology. Olowolafe retired after 16 years as a UD ECE faculty member. He also held regular and visiting faculty positions at MIT, Cornell, Federal University of Technology (Chair) and Obafemi Awolowo University. He served as a program director at the National Science Foundation and the

Motorola Advanced Products Research and Development Laboratory. Olowolafe is a Senior Member of the IEEE with a distinguished career of scholarly results and a rich teaching portfolio.

New Departmental scholarships recognize ECE faculty

Scholarships are being established to recognize the careers of faculty members that recently retired or passed away. Colleagues, former students, and friends of the ECE department have raised \$7,250 in honor of **DR. ROBERT G. HUNSPERGER** and \$17,300 to honor the memory of **DR. DAVE SINCOSKIE**. A generous alumnus of the Class of '92 has made an initial gift of \$14,000 hoping to create an endowed scholarship in the name of **DR. CHARLES S. IH**.

Permanent endowed scholarships for students in the Department of Electrical and Computer Engineering will be established celebrating each faculty member when a total of \$50,000 in gifts is received in their honor. Supporters are encouraged to help make these endowments a reality. Gifts should be clearly designated to: ECE Department—[Faculty Honoree Name].

If you interested in helping to establish these new funds, please forward your gift to:

Development & Alumni Relations Office 83 East Main Street 3rd floor Newark, DE 19716 Attn: Gifts Processing

You may also give online at *www.udel.edu/makeagift*.

Leonard Cimini receives four prestigious awards

LEONARD CIMINI, ECE professor, received four prestigious awards in 2010-2011, honors that demonstrate the importance of his contributions to the science and technologies of communications networks.

Cimini was recognized at the IEEE Globecom 2010 conference in February with the IEEE Donald W. McLellan Meritorious Service Award for long-term leadership and service to the organization's communications society.

Cimini has been an active member of IEEE, the world's largest non-profit association for the advancement of technology for humanity, for 34 years. He is the founding editor-in-chief of the IEEE JSAC: Wireless Communications series, which later evolved into the very successful journal, the *IEEE Transaction on Wireless Communications*. He served two terms on the board of governors for IEEE's Communications Society, and is currently vice president of publications. In acknowledgment of his pioneering work in wireless communications, Cimini also received the Recognition Award from the IEEE Communication Society's Technical Committee on Wireless Communications.

In 2010, Cimini received the IEEE Stephen O. Rice prize for his paper on resource allocation in wireless networks, which was published in *IEEE Transactions on Communications*. He was similarly honored with a 2010 Innovators Award from the New Jersey Inventors Hall of Fame for early research related to high speed wireless communications.

Cimini joined UD in 2002, after 20 years as a researcher for Bell Labs and AT&T Labs in Monmouth County, N.J. His early work, from 1982–1985, pioneered the first real application of orthogonal frequency-division multiplexing (OFDM) to wireless systems. Today, OFDM is a mature technology commonly used for wide band digital communication in applications relating to wireless networks, mobile internet access and next generation cellular systems.

Author of more than 140 journal and conference papers, Cimini holds 21 U.S. patents. His current research focuses on communication technologies including wireless communications, signal processing, cellular systems and wireless LANs. His work is supported by many industry and government organizations including Cisco, Intel, the National Science Foundation and the Air Force Office of Scientific Research.



FACULTY

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"These awards are just the latest recognition of Professor Cimini's fundamental and ongoing contributions to the electrical engineering profession and the communications field in particular."

—Kenneth E. Barner

Digital Communications



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