Notre Dame’s Wireless Institute – Standing Apart from the Crowd in Mobile Communications

From a historical perspective, it’s natural that wireless communications is a research focus at Notre Dame. It was in April 1899 when Jerome Green, who had recently joined the University as its first professor of electrical engineering, became one of the first U.S. researchers to reproduce Guglielmo Marconi’s early experiments in the transmission and reception of radio signals. In the years since, Notre Dame professors have been prominent internationally in the development of communication technology – most notably Professor James L. Massey, a digital communications pioneer who taught at Notre Dame from 1962 to 1977 and was Notre Dame’s first endowed chair holder, and Professor Daniel J. Costello Jr., a leading expert on reliable communications who received a Notre Dame PhD in 1969 and was on the EE faculty from 1985 to 2009.

Continued on page 4
In my 2014 “Letter from the Chair,” I expressed some concern about the relatively low numbers of undergraduates majoring in electrical engineering at Notre Dame. That concern continues; while the College of Engineering has enjoyed robust growth over the last 10-15 years – going from less than 10% of the undergraduate degrees awarded in 2001 to about 20% in 2016 – the Department of Electrical Engineering has “stalled” at about 35-40 BSEE degrees per year. That’s less than 10% of the BS degrees awarded in the College of Engineering, and not a place where we want to be.

There are many theories as to why that’s happened, and I expounded on some of them in my 2014 column. But regardless of the problem, it seems clear to me that part of the solution must be to expose more first-year students to electrical engineering – to show them all the cool things that EE encompasses and all the great opportunities that a BSEE makes possible, and to do so during a time when we can still affect their major selection.

With that in mind, my colleague (and associate dean of engineering) Yih-Fang Huang and I taught a new course during the Spring 2016 semester. EE 10114 is entitled, “Introduction to Microprocessors and Multimedia,” and it is the first EE course in years to be targeted at first-year students. Traditionally, Notre Dame undergraduates do not declare majors until the end of the first year; so while EE has contributed to engineering courses geared to all engineering “intents” – currently, that’s EG 10111 and EG 10012, “Introduction to Engineering Systems” – there has been no first-year EE course. The opportunity for EE 10114 arose because in 2014 two departments – the Department of Electrical Engineering and the Department of Computer Science and Engineering – dropped the chemistry requirement for their degrees from two courses to one, opening up a curricular “hole” in the schedules of first-year students with a leaning towards information technology.

As its name suggests, EE 10114 is composed of two halves. The “microprocessor” part of the course is built around the Arduino – an Atmel Atmega 328 microcontroller, together with a variety of sensors and actuators and electric components bundled with a breadboard. The Arduino is a hardware/software platform that is wildly popular with hobbyists, and it gives students the chance to write “C” programs for embedded systems – sensing light or sound or temperature or position and responding accordingly by switching a motor or LED or buzzer. The “multimedia” part of the course uses the MATLAB environment to introduce students to audio signal processing, teaching them about the “frequency domain” representation of signals and using MATLAB’s filter design tools to create projects like graphic equalizers and noise cancelers.

The two subjects (and the two platforms) may seem like an odd combination, but there is an underlying theme – they both represent the interface between the physical world of sound and light and F=ma and the cyber-world of ones and zeros along with the programs that manipulate them. That interface is one of the places where electrical engineering is at its most engaging and is most easily distinguished from “competing” disciplines like computer science. (CS majors can write a lot of code, but it took an EE grad like Shazam co-founder Avery Wang to write the FFT-based software that recognizes the song playing on the radio in a matter of seconds.)

One of the most striking things about teaching
first-year students is the very broad diversity of backgrounds and experience they bring to the class. While EE 10114 is targeted at students who intend to major in one of the EE or CSE disciplines, a surprisingly large number of them had essentially zero programming experience – and, at the other extreme, a small subset of them had already carried out major Arduino projects and knew more about the platform than the instructors. As a result, when we would solicit input from the students on what they’d like to see changed, how the class could be improved, their responses were sometimes antipodal. It was a delicate (and sometimes impossible) balance.

Having said that, the class was a blast to teach. It was a chance to introduce a bunch of smart kids to basic EE concepts – things like voltage and current dividers, real-time programming, Nyquist sampling and A/D conversion, pulse-width modulation, FFTs, and FIR filters – at a level that was superficial enough to avoid most of the mathematics while sufficiently enabling that they could immediately apply those concepts on their breadboards and in their “C” and MATLAB code. It was fun to see 60+ students hunched over their digital multimeters, comparing the V/I characteristics of different color LEDs. It was even great to see soon-to-be computer science majors, who will probably never again have to think about voltages or currents, measuring the physical properties that actually distinguish a logical “1” from a logical “0.”

Yes, there were some things that didn’t go perfectly, and our many “lessons learned” will make for a better course offering in 2017. Next time around, we will try to employ some of the “flipped classroom” techniques that have been deployed successfully in EG 10111/10112 – preparing short, 10-minute videos on a variety of topics and requiring the students to watch them in advance, freeing up class time for more “hands-on” problem solving. We will try some structural fixes to address the wide disparities in student backgrounds, offering optional “bonus classes” on programming basics to those students who feel they need it. And having this year generated from scratch the large volume of content necessary to fill forty 50-minute lectures and the associated recitations, next year we will be in a position to “tweak” that content, optimizing both the subjects covered and the examples used. (Courses are always better the second time they’re taught.)

On balance, was the first offering of EE 10114 a success? In terms of student (and instructor) engagement and effort – yes, absolutely. Was it a success in terms of encouraging more students to major in EE? Well, the course started with 63 enrolled, about half initially indicating that they intended to study computer science and the other half split roughly equally between electrical engineering and computer engineering. Throughout the course of the semester, numerous students changed their intended majors, and by the end of the semester, there were 60 students left standing – with, still, about half indicating that they intended to study CS and the other half split roughly equally between EE and CPEG. So it’s too early to declare success, but I think we have a great new venue to showcase the things that make EE distinctive, and I’m confident that EE 10114 will help us grow the undergraduate numbers.

I invite your input. Please feel free to send me an email at tfuja@nd.edu or to call me at 574-631-7244.
Continued from page 1

So when Notre Dame’s Wireless Institute (WI) was formed in 2010, it was already part of a tradition of excellence.

The WI serves as an organizing structure and a resource for Notre Dame faculty members who work in wireless communications. It includes 14 faculty members from four different colleges. Although its technical core resides in the Department of Electrical Engineering and the Department of Computer Science and Engineering, its multidisciplinary focus has attracted specialists in regulatory policy from Mendoza College of Business and the Law School.

“Our long-term goal is to be a ‘one-stop shop’ for expertise on wireless technology and policy among academic institutions,” said Professor J. Nicholas Laneman, founding director of the institute. “We want to be not only in the first tier of universities when it comes to communication engineering but also a place that people turn for thoughtful and informed opinions about where the wireless ecosystems will go and should go.”

Ubiquitous wireless communication used to be the goal, but that achieved pervasiveness has become its own problem. There are several mature wireless technologies and ecosystems, especially cellular and WiFi, that are experiencing explosive growth in the use of mobile Internet data. This growth is putting tremendous pressure on the deployed wireless networks as well as the underlying radio spectrum. Continued growth of these wireless technologies and ecosystems will depend upon addressing several grand challenges — problems that WI researchers formulate in terms of “crowds.”

“We want to be not only in the first tier of universities when it comes to communication engineering but also a place that people turn for thoughtful and informed opinions about where the wireless ecosystems will go and should go.”

“More and more, the radio spectrum allocations are crowded, making it harder to expand capabilities and deliver new services,” said Laneman. “And making reliable wireless capacity available in crowded venues like Notre Dame Stadium — an untapped experimental testbed we intend to leverage — is a huge challenge.”

Laneman also mentioned “crowded” wireless devices — with their multiple transmitters and receivers implementing not just current 4G (LTE) cellular technology but also backward-compatible 3G (UMTS) functionality in addition to WiFi and Bluetooth radios — as yet another challenge.

In 2014, WI received funding from the U.S. National Science Foundation (NSF) to become part of the Broadband Wireless Access and Applications Center (BWAC), a multi-university research and development consortium that includes, in addition to Notre Dame,
researchers at the University of Arizona, Auburn University, Catholic University of America, the University of Mississippi, Virginia Tech, and the University of Virginia. Notre Dame and its BWAC partners are supported under NSF’s Industry/University Cooperative Research Centers (I/UCRC) program, designed to foster regular interactions and long-term relationships among the partners, prioritize cooperative research directions, and adapt the research activities and student training to address market needs.

The WI has four corporate and government partners that each support its I/UCRC participation with yearly contributions of $40,000 or more. Those partners – Interdigital, Nokia, the Laboratory for Telecommunication Sciences, and the Office of Naval Research – not only provide financial support but also expose the Wireless Institute’s researchers to some of the most important and timely problems confronting the wireless industry.

As an example, “Radiohound” is the name of a WI I/UCRC project led by Bertrand Hochwald, the Freimann Professor of Electrical Engineering. The purpose of Radiohound is to create a low-cost device for measuring spectrum usage that can be produced and deployed on a large scale to create a spectrum mapping capability in support of cognitive radio and other technologies for enhancing spectrum utilization. The name comes from the device’s ability to “sniff out” unutilized (or under-utilized) spectral resources.

“The RadioHound project is striking a chord with many of our industry and federal government partners. We see it snowballing into a multi-year project with a broad range of applications in finding underutilized spectrum and characterizing new spectrum in the millimeter bands yet to be deployed,” said Hochwald. Two other projects funded by I/UCRC industry sponsors include: Fast Mobile Network Characterization, which uses TCP/IP “tricks” to enable a mobile device to rapidly characterize and select from among multiple available wireless networks, and WiFi with Uplink Multiuser MIMO, which is prototyping and experimentally validating algorithms that enable multiple WiFi stations to transmit simultaneously to an access point.

As another example of its outreach, in 2015 the Wireless Institute offered a massive open online course – a so-called “MOOC” – entitled “Understanding Wireless: Technology, Economics, and Policy.” The course was co-taught by four Notre Dame faculty members – Laneman in EE, Aaron Striegel in computer science and engineering, Patricia Bellia in the Law School, and Barry Keating in the Department of Finance in the Mendoza College of Business. Over 11,000 students from more than 140 countries registered for the course and watched at least part of the online content, and 238 students received a certificate of completion – ten times more students than completed a similar on-campus course offered to only Notre Dame students. Plans for a second offering of the initial MOOC, as well as additional courses, are being developed.

You can learn more about the WI at wireless.nd.edu.
Three new faculty members have recently joined the ranks of Notre Dame’s Department of Electrical Engineering.

Jonathan Chisum joined Notre Dame in January 2015 as an assistant professor of electrical engineering. A Seattle native, Jon was an undergraduate at Seattle Pacific University, completing his BSEE in 2003 and then working for three years as a hardware design engineer at Ballard Technology. He pursued graduate study at the University of Colorado at Boulder under the supervision of Professor Zoya Popovic, working on problems related to near-field probes for microwave measurements. Chisum received his PhD in 2011 and then became a member of Technical Staff at MIT Lincoln Laboratory in Cambridge, MA. As lead of the RF Laboratory in Lincoln Lab’s Wideband Networking Group, Jon worked on a wide array of projects related to millimeter wave wideband and linear wireless communications and multifunction apertures. Hired as part of Notre Dame’s “Advanced Circuits Initiative,” a hiring initiative designed to leverage existing EE strengths in materials and devices and to create bridges between research programs, he has already brought a new dimension to the research being carried out under the aegis of the Wireless Institute. His wife, Kathryn, and his one-year-old son, Simon, round out the Chisum family.

Suman Datta was named the inaugural Chang Family Chair Professor of Electrical Engineering when he came to Notre Dame from Penn State University in January 2016. Datta is a highly regarded researcher with a sterling reputation for creativity and leadership in the international semiconductor community. He spent eight years, from 1999 to 2007, at Intel Corporation, where his 160 patents helped to define the state of the art transistor technology used in advanced microprocessors, most notably with his work on silicon with high-k dielectrics and metal gates, Tri-state (3D) transistors and beyond-silicon transistors. In 2007, Suman transitioned to academia, where he spent the next eight years at Penn State University building a highly productive and well-funded research enterprise. Datta’s research lies in solid state device physics and engineering broadly drawn, with projects in areas such as tunneling-based devices with steep-subthreshold slopes, energy harvesting circuits, neuromorphic and cognitive processing architectures, and millimeter-wave electronics. Prior to joining Notre Dame, he worked with Notre Dame faculty as part of the Center for Low Energy Systems Technology (LEAST) consortium of universities, serving as theme leader for the thrust in “Quantum Engineered Steep Slope Transistors.” Suman was joined in his move to South Bend by his wife, Anjuli, who has also joined the ND faculty in the role of an assistant teaching professor in Notre Dame’s Department of Biological Sciences. They have two children – son Rajeev is fourteen years old, and daughter Tanya is ten years old.

Thomas O’Sullivan joined the Notre Dame EE faculty in July 2016. O’Sullivan received his BSEE from Northwestern University in 2005 and subsequently received an MS and PhD, both in electrical engineering, from Stanford in 2007 and 2011, respectively. O’Sullivan’s research addresses diffuse optical imaging instrumentation for clinical applications and personal health monitoring. As a graduate student, he studied under Professor James Harris on the design and fabrication of implantable miniature sensors for continuous in vivo cancer monitoring in small animals. As a post-doc at the Beckman Laser Institute at the University of California at Irvine (UC-Irvine), he was designated a DoD Breast Cancer Research Program Postdoctoral Fellow and an NIH/NCI Cancer Biology Postdoctoral Training Fellow, and his research developed a clinical component, working with physicians and biologists on cancer detection technology. O’Sullivan’s most recent role at UC-Irvine was director of the Diffuse Optical Spectroscopy & Imaging Laboratory, where he supervised a staff of approximately 20 researchers and students on the development and application of noninvasive biomedical optical imaging technologies. He is married to Jennifer Ehren (ND BSChemE, ’99), who will be working as a lecturer in Notre Dame’s Department of Chemical and Biomolecular Engineering, and they have a son, Elijah, who is two years old.
Most Significant Bits

Four members of the EE faculty were recently promoted, and those promotions were recognized at the campus-wide end-of-year President’s Dinner on May 17.

Alan Seabaugh and Martin Haenggi were both elevated to endowed chair status, each earning the honorific “Frank M. Freimann Professor of Electrical Engineering.” The bestowal of an endowed chair is the highest honor in the academic ranks, and it carries with it a portion of the University’s endowment income dedicated to the holder’s salary and research.

Seabaugh has been a member of the Notre Dame faculty since 1999, and his research addresses many topics in electron devices and circuits, including tunneling-based switching, energy harvesting, and microwave and mm-wave technology.

Haenggi joined the EE faculty in 2000; he conducts research in wireless communication and networks, with an emphasis on cellular, ad hoc, mesh, cognitive, and sensor networks. In January 2017, Haenggi will become the editor-in-chief of IEEE Transactions on Wireless Communications.

Vijay Gupta was promoted to the rank of professor of electrical engineering. Gupta has been on the EE faculty since 2008, having received his PhD from California Institute of Technology and completing a postdoctoral appointment at the University of Maryland prior to joining ND. Gupta works at the interface between control, communication, distributed computation, and incentive design with applications to transportation, power, and water networks.

Tom Pratt was promoted to the rank of professor of electrical engineering. Pratt came to Notre Dame in 2008 from the Georgia Tech Research Institute, where he was a principal research engineer. He earned his PhD from the Georgia Institute of Technology in 1999, and his work focuses on multi-port radio frequency systems, with principle applications that include radar, wireless communications, and remote sensing.

Former EE grad student Ding Nie recently received the 2016 IEEE Circuits and Systems Society Outstanding Young Author Award for his paper, “Broadband Matching Bounds for Coupled Loads,” which appeared in the April 2015 issue of IEEE Transactions of Circuits and Systems I: Regular Papers. Nie, who wrote the paper with his faculty advisor Bertrand Hochwald, the Freimann Professor of Electrical Engineering, received his PhD in May 2016 and is currently working for Apple.

Gary Bernstein, the Freimann Professor of Electrical Engineering, was named the recipient of the 2016 1st Source Commercialization Award at a ceremony held April 12 at the Gillespie Center on the campus of Saint Mary’s College. Established in 2008 with a $1 million gift from 1st Source Bank, the award is presented each year to faculty from Notre Dame or the Indiana University School of Medicine-South Bend who have most successfully transitioned their technology from the lab to the marketplace. Bernstein’s award-winning technology is “quilt packaging” – a novel way to connect integrated circuit (IC) “chips” by building them with interlocking tabs and slots on their edges, allowing them to be pieced together like the pieces of cloth comprising a quilt. In 2009, Bernstein co-founded Indiana Integrated Circuits with Notre Dame EE graduate Jason Kulick to commercialize the quilt packaging technology.

Patrick Fay has been named a Fellow of the IEEE. Fay has been on the Notre Dame faculty since 1997, and his research focuses on high-speed electronic and optoelectronic devices and circuits; he is also the director of the Notre Dame Nanofabrication Facility, the “clean room” in Stinson-Remick Hall of Engineering. The IEEE is the Institute of Electrical and Electronics Engineers, the international professional association for electrical engineers, and no more than one-tenth of 1% of the IEEE membership may be elevated to Fellow status in any given year. The citation for Fay’s elevation read, “For contributions to compound semiconductor tunneling and high-speed device technologies.”
Update on Massey and Kempf Funds

As announced in the September 2014 issue of this newsletter, Notre Dame is establishing named funds to honor two former EE faculty members – James L. Massey and Kenneth (“Kenny”) Kempf. The Notre Dame EE alumni who launched the fundraising effort report that substantial progress has been made towards their initial goal of $100,000 for each fund – a goal that enables the funds to become “active” and start generating support for Notre Dame EE students. Details are below.

James L. Massey (1934-2013) received the BSEE from Notre Dame in 1956 and subsequently (1962-1977) served on the Notre Dame faculty, where he was ND’s first holder of an endowed chair – the highest academic rank to which one can aspire. Jim was a pioneer in digital communications, having received virtually every honor and award available to communication engineers.

The James Massey Endowment in Electrical Engineering has been established through the efforts of Larry Ryan (BSEE, ’65) and Dan Costello (PhD, ’69). So far the fund has received a little over $70,000 in contributions, and some generous (but anonymous) benefactors have agreed to “match” any new contributions on a dollar-for-dollar basis until the $100,000 goal is reached. Funds generated by the Massey Endowment will be used to support ND students studying communications.

Kenneth (“Kenny”) Kempf (1921-1979) received his BSEE and MSEE degrees from Notre Dame in 1952 and 1955, respectively. He subsequently worked as an electrical engineer at Notre Dame, also teaching circuits courses in the undergraduate curriculum from 1962 until 1966. He is perhaps best remembered for his drill sergeant, blue-collar, roll-up-your-sleeves approach to instruction that challenged his students to step outside their comfort zones.

The effort to establish The Kenneth Kempf Memorial Scholarship Fund is being led by three members of the Class of 1964 – Mike Ciletti, Tom Duff, and Carl Massarini. They report that the fund currently stands at just over $80,000, and they hope to reach their $100,000 goal by January 2017. Proceeds from the fund will be used to support undergraduate students pursuing an EE degree at Notre Dame.

To donate to either fund, please go to donate.nd.edu and specify either “The James Massey Endowment in Electrical Engineering” or “The Kenneth Kempf Memorial Scholarship” as the designation for your gift. Alternatively, gifts and pledges can be mailed to: Annual Fund, University of Notre Dame, PO Box 519, Notre Dame, IN 46556. Contributions will count toward the donor’s football ticket application status for the following calendar year.
Thirty-three Graduating Seniors Receive BSEE Degrees

On Sunday, May 15, 2016, more than 2,100 undergraduates braved unseasonably cool temperatures in Notre Dame Stadium to take part in the University of Notre Dame’s 171st commencement exercises. Included among the graduating seniors were 33 receiving BS degrees in electrical engineering.

The principal speaker for the campus-wide event was Gen. Martin E. Dempsey, former chairman of the Joint Chiefs of Staff. Gen. Dempsey began his address by inviting the graduates through a rousing session of “Graduation Karaoke,” singing the opening line of a song and inviting the grads to sing the follow-up line. Taking a more serious tone, Gen. Dempsey then provided a thoughtful analysis of the familiar phrase, “God, Country, Notre Dame,” challenging the Class of 2016 to become “leaders of consequence.”

Another highlight of the University-wide ceremony was the awarding of the Laetare Medal to Vice President Joe Biden and former Speaker of the House John Boehner. Biden and Boehner were cited for their collegiality and willingness to seek common ground in an increasingly fractious political environment. Both recipients spoke of their deep appreciation for the honor while also entertaining the crowd with anecdotes and observations from two long political careers.

The Electrical Engineering Undergraduate Commencement Ceremony began at 1:30 PM in DeBartolo Hall, where the gathered students, family members, and faculty heard remarks from classmates Burton Judson, Enrich Hinlo, and Genevieve Heidkamp.

There were several awards made to graduating seniors who excelled academically, including Zachary Imholte (recipient of the Steiner Award), Grant Weber (James L. Massey Award), John Wiese (Basil R. Myers Award), David Surine (Arthur J. Quigley Award), and Richard Fasani (Lawrence F. Stauder Award). Also honored were the recipients of the 2016 Faculty Teaching Award, Professor Gregory Snider, and the 2016 Graduate Teaching Award, Zachary Santonil.

Here are the May 2016 graduates of Notre Dame’s Department of Electrical Engineering, along with their immediate plans, where known:

- **Andre Bermudez** of San Juan, Puerto Rico, had not yet made a decision about his next step as of graduation day.
- **Richard (“Beau”) Bloomfield** of Novi, Michigan, will be working for Booz Allen Hamilton in Washington, DC.
- **Richard Fasani** of Oak Park, CA, is moving to Ene, PA, where he will work for GE Transportation.
- **Charles Filippak** of Sylavia, OH, will be pursuing graduate study at the University of MI, in Ann Arbor, MI.
- **Caitlin Gruis** of Kaysville, UT, will continue her studies at the University of California at Berkeley.
- **Oliver Hanes** of Wilmington, DE, has accepted a position with Textron Aviation in Wichita, KS.
- **Christopher Catalino** of Lansdale, PA, is working for IBM in Austin, TX.
- **Racine Hansen** of Eden Prairie, MN, will be working for United Health Group–Optum in Minnetonka, MN.
- **Bridget Harrington** of Tampa, FL, was still weighing her options on graduation day.
- **Genevieve Heidkamp** of Hinsdale, IL, has accepted a position with Intel Corporation of San Jose, CA.
- **Austin Hickman** of Huntington, WV, will move to Ithaca, NY, to pursue graduate studies at Cornell University.
- **Enrich Hinlo** of Franklin, TN, will be reporting to Barkdale Air Force Base in Louisiana, where he will work in Developmental Engineering in the USAF.
- **Gavin Hsu** of Taipei, Taiwan, will be returning to Notre Dame for a fifth year to complete a second BS degree in preprofessional studies.
- **Zachary Imholte** of Cincinnati, OH, is moving to London, UK, to begin work with Palantir Technologies.
- **Christine Joseph** of Allen, TX, will be pursuing graduate studies at the Massachusetts Institute of Technology in Cambridge, MA.
- **Burton Judson** of Chesterland, OH, is moving to Kalamazoo, MI, to work for Stryker Instruments.
- **Seung Goo Kang** of Jeonbuk Jeonju, Korea, will enter graduate school at UCLA in Los Angeles, CA.
- **Joseph Kosteck** of Orland Park, IL, will work for AT&T in Elgin, IL.
- **Michael Lindt** of Downers Grove, IL, is moving to Kansas City, MO, to work for Burns and McDonnell.
- **Patrick McCullough** of Kentfield, CA, has accepted a position with AT&T in Schaumburg, IL.
- **Anthony Nguyen** of Edison, NJ, will be working for ASA Electronics in Elkhart, IN.
- **Alison O’Connor** of Wyckoff, NJ, will be teaching in Austin, TX, as part of the Alliance for Catholic Education (ACE) program.
- **Jose Perrone** of Doral, FL, has accepted a position with Intel Corporation in San Jose, CA.
- **Adam Rainey** of Monroe, CT, will be working for Ford Motor Company in Dearborn, MI.
- **Christopher Ravasio** of Pittsburgh, PA, has not yet accepted a position as of graduation day.
- **John Reilly** of Western Springs, IL, will be working in Chicago, IL, for SunTrust Robinson Humphrey.
- **David Surine** of Restertown, MD, will be working for Textron Systems in Hunt Valley, MD.
- **Joshua Sy** of Anchorage, AK, was still pondering his options on graduation day.
- **Marisa Thompson** of Dallas, TX, will be returning to her home state to work for AT&T in Plano, TX.
- **Kara Vitale** of Wellfleet, MA, had not made a final decision about her future plans as of commencement.
- **Grant Weber** of Carmel, IN, has accepted a position with IBM in Rochester, MN.
- **David Wieczorek** of Orland Hills, IL, had not finalized his plans as of graduation day.
- **Jon Wiese** of Longwood, FL, is returning to Notre Dame for the next academic year to take classes to prepare for medical school.
Notre Dame Graduates 13 PhD Degrees in EE

The 2016 Graduate School Commencement was held on Saturday, May 14 in the Compton Family Ice Arena. The ceremony honored the recipients of 490 master's degrees and 214 doctoral degrees – including 13 graduating with a Ph.D. in electrical engineering.

The principal speaker was Rita Colwell, the first woman to serve as director of the National Science Foundation (NSF). Colwell, whose term as NSF director ran from 1998 to 2004, is an environmental microbiologist whose scientific career was dedicated to studying the microscopic Vibrio cholerae bacterium that causes cholera. In her address, she asserted that the graduates were starting their careers during a “golden era” of scientific discovery – and that it is not clear now, nor will it be for many years, which of the lessons they learned at Notre Dame will be their most important and enduring.

The Doctor of Philosophy degree is awarded after a prolonged and deep course of graduate study and research. Notre Dame's PhD in EE requires completion of a dozen courses beyond the BS degree and the completion of a PhD dissertation – a document that makes a substantive contribution to the theory and/or practice of electrical engineering.

Here is a list of the EE doctoral recipients honored during the ceremony, along with their advisors’ names, the titles of their dissertations, and their post-graduation plans:

- **Enrique Blair** was advised by Professor Craig Lent. The title of Blair's dissertation was “The Theory and Modeling of Power Dissipation and Quantum Decoherence in Molecular Quantum-dot Cellular Automata (QCA),” and he is currently an assistant professor of electrical engineering at Baylor University in Waco, TX.

- **Wann Jiarun Ma** worked with Professor Vijay Gupta. Ma’s dissertation was titled, “Control, Learning, and Optimization for Smart Power Grids,” and he is a postdoctoral researcher at Duke University in Durham, NC.

- **Zhen Tong** carried out research with Professor Martin Haeenggi. The title of Tong’s dissertation was “Power Control and Full-duplex Communication in Wireless Networks,” and he is a senior software engineer with Qualcomm in San Diego, CA.

- **Jun Chen** was advised by Professor Thomas Pratt, and the title of his dissertation was “Energy Efficiency Analysis of Packet-based MIMO Communications Systems over Space and Polarization Radio Channels.” Chen has accepted employment with National Instruments in Santa Clara, CA.

- **Golnaz Karbasian** completed her PhD advised by Professor Greg Snider. The title of her dissertation was “Fabrication of Metallic Single Electron Transistors Featuring Plasma Enhanced Atomic Layer Deposition of Tunnel Carriers,” and she is now working as a postdoctoral researcher at the University of California at Berkeley.

- **Tia Tamba** was advised by Professor Michael Lemmon, and his dissertation was titled, “Forecasting Regime Shifts in Nonlinear Dynamical Processes.” He is currently residing in Cimahi, Indonesia.

- **Yuning Zhao** was advised on his PhD by Professor Patrick Fay. The title of Zhao’s dissertation was “Fabrication and Performance of Advanced Photovoltaic and Plasmonic Devices,” and he is currently working as a software developer with Google in Mountain View, CA.

- **Bin Hu** worked with Professor Michael Lemmon, and the resulting dissertation was entitled “Stochastic Safety and Efficiency for Vehicular Networked Systems: Theories and Applications.” Currently, Hu is living in Las Cruces, NM.

- **SM Moududul Islam** was advised by Professor Debdeep Jena. The title of Islam's dissertation was “Ultra-Thin Quantum Structures for Deep Ultraviolet Photonic Devices,” and he is currently a visiting scientist at Cornell University.

- **Ding Nie** worked with Professor Bertrand Hochwald, and the title of his dissertation was “Matching Networks for Broadband Multiport Radio-frequency Systems: Theory, Analysis and Design.” He has accepted employment as an RF system integration engineer at Apple, Inc. in Cupertino, CA.

- **William O’Brien** was advised by Professor Mark Wistey. His dissertation was “Toward Direct Bandgap Germanium Optoelectronics,” and he is now a process engineer with Rigetti Quantum Computing in Berkeley, CA.

- **Meng Qi** was advised by Professor Debdeep Jena, and the title of his dissertation was “Novel MBE III-Nitride Heterostructure Devices Enabled by Bulk Substrates.” He is now a software engineer for Uber Technologies in San Francisco, CA.

- **Jonathan Simpkins** worked on his PhD with Professor Robert Stevenson. The title of his dissertation was “Modeling, Approximation, and Estimation of Spatially-varying Blur in Photographic Systems,” and he is currently a software engineer working for RetailMeNot in Austin, TX.

In addition to the 13 doctoral degrees listed above, the Department of Electrical Engineering also awarded 19 master of science degrees in the 12 months ending May 2016.
ALUMNUS PROFILE

Brian Richards

When Brian Richards moved into Dillon Hall as a freshman in August 2002, he knew he had some adjustments ahead. Growing up in Brandon, MS, he figured that the northern Indiana winters would take some getting used to, as would the size of Notre Dame; while hardly a “mega-school,” Notre Dame operated on a different scale from his high school with its 50 graduating seniors.

Transitioning to Notre Dame also meant increased intellectual challenges, but Brian was looking forward to that. He chose to study electrical engineering because of its intellectual challenge. It’s the hardest engineering discipline and, therefore, “the most elite major at ND,” he figured, and it didn’t take him long to find evidence of that. In the final exam for EE 20224 (“Intro to EE”), he was confronted with ten problems. Having studied non-stop, Richards felt good about his performance on the exam and assumed that he had “aced” it. So he was a little taken aback when he saw that his score was “only” 80, having received zero points for two of the ten problems. Looking more closely, he saw that the mistakes he had made were (he thought) trivial ones – a sign mistake in one problem and an addition mistake in the other. Certainly he should have received some credit for getting them almost correct, right?

“When I asked Professor Lemmon about it, he told me there were only two types of engineers – those who get it right the first time and those who get it right eventually. It was logic I couldn’t argue with and something that sticks to me to this day.”

Fortunately, Brian found kindred spirits at Notre Dame who helped him make the transition – many of them also electrical engineering students living in Dillon.

“There was a large contingent of amazing EE students in Dillon while I was there,” said Brian. A group of five EE “Big Red” residents – Andrew Pangilinan, Scott Horan, Joey Ernst, Brian Richards, and Glen Bradford – together with fellow EE student Kristen Woyach formed a bond over their shared travails that kept them working together throughout their four years at Notre Dame. Their collaboration reached a crescendo when they formed a team for EE 41440 (“Senior Design”) that undertook an ambitious-if-not-quite-successful effort to build a guided model rocket with an automatic control system capable of lifting a transmitter-carrying balloon.

“As a joke we called ourselves ‘PHWERB’ after the first initials of our last names,” recalled Brian. “The support from those five people was critical to my EE education – they were brilliant students and amazing engineers.”

Brian joined Accenture, a global consulting firm, upon graduating from Notre Dame in 2006. While Accenture wasn’t initially on his radar screen – “I had never heard of the place” – a serendipitous Career Fair encounter during his senior year with an ND engineering alum launched a career that has endured. Brian’s first assignment was as an analyst in the Technology Labs in Chicago, where Accenture seeks to identify and develop new technologies into first-of-their-kind projects for its clients.

“Back then we were working on how to apply new technologies such as mobile, RFID, cloud computing, big data, Radio over IP, and more to the enterprise market,” said Brian. “It was a fantastic environment filled with amazing engineers from Northwestern, Notre Dame, University of Illinois, MIT, and Stanford.”

Brian worked his way up the ladder at Technology Labs until 2012, when he was promoted to senior manager and transferred into Accenture’s Energy Industry (Oil & Gas) organization. Today, he is in Houston, TX, where he is the innovation lead for Accenture’s Energy Practice. In that role, Brian is responsible for bringing senior leaders at Accenture’s largest energy clients the latest technology and innovation and helping them craft differentiating strategies.

“It’s my job to thoroughly understand our clients’ challenges – things like improving asset integrity or reducing down-time – and develop ways that leverage new and emerging technologies to address those challenges,” said Brian. “Whether it’s wearable computing or drones or video analytics or something that you haven’t even heard about yet, our goal is to show how these new technologies can help our clients stand out from their competition.”

As part of this effort, Brian is leading the effort to build an Innovation Center in Accenture’s Houston office.

When Brian was asked about any advice he would offer to current undergraduates, he was succinct: “Don’t settle. Push yourself to try new things, meet new people, work on hard projects, live in new places, visit new countries,” he said. “Notre Dame graduates are multi-dimensional – continue that growth throughout your career.”

Brian is married to 2006 Saint Mary’s alumna Kathleen Richards, a 2006 MCMorrow, and they have three children – Kate (age 7), Ben (age 2), and Sophie Claire (born June 16, 2016). He would enjoy hearing from old friends and can be reached at brian.h.richards@accenture.com.