



VILLANOVA
UNIVERSITY

College of Engineering

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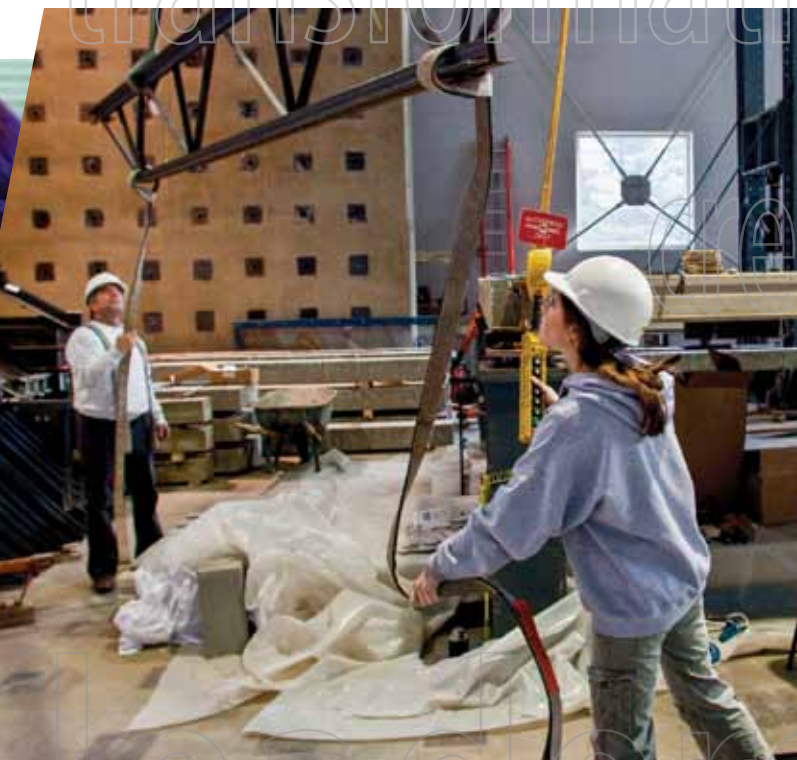
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VILLANOVA UNIVERSITY

Villanova

COLLEGE OF ENGINEERING

transformational
creative



leaders
humanitarian

Our Mission

Villanova University's College of Engineering is committed to an educational program that emphasizes technical excellence and a liberal arts education within the framework of the University's Augustinian and Catholic traditions. As a community of scholars, we seek to educate students to pursue both knowledge and wisdom, and to aspire to ethical and moral leadership within their chosen careers, their community and the world. We value a spirit of community among all members of the College that respects academic freedom and inquiry, the discovery and cultivation of new knowledge, and continued innovation in all that we do.

About Villanova University

Since 1842, Villanova University's Augustinian Catholic intellectual tradition has been the cornerstone of an academic community in which students learn to think critically, act compassionately and succeed while serving others. There are more than 10,000 undergraduate, graduate and law students in the University's five colleges—the College of Liberal Arts and Sciences, the Villanova School of Business, the College of Engineering, the College of Nursing and the Villanova University School of Law. As students grow intellectually, Villanova prepares them to become ethical leaders who create positive change everywhere life takes them.

Degrees

- BS in Chemical Engineering
- BS in Civil Engineering
- BS in Computer Engineering
- BS in Electrical Engineering
- BS in Mechanical Engineering

Five-year bachelor's-master's degree program

- MS in Chemical Engineering
- MS in Civil Engineering
- MS in Computer Engineering
- MS in Electrical Engineering
- MS in Mechanical Engineering
- MS in Sustainable Engineering
- MS in Water Resources and Environmental Engineering

PhD Program (part time or full time)

Certificate Programs

Visit VUengineering.com to learn more.

Accreditation

All five undergraduate programs are accredited by the Engineering Accreditation Commission (EAC) of ABET (Accreditation Board for Engineering and Technology), 111 Market Place, Suite 1050, Baltimore, MD 21202-4012.

Ranking

Once again, *U.S. News & World Report* ranked Villanova's College of Engineering in the top 10 in the nation in the Best Undergraduate Engineering Programs category among schools that award primarily bachelor's and master's degrees.



VILLANOVA
UNIVERSITY
College of Engineering

2011-2012 ANNUAL REVIEW

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Drosdick Endowed Dean of the College of Engineering
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NEWS AND EVENTS

Visit www.engineering.villanova.edu

ONGOING UPDATES

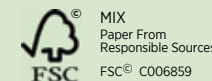
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Stay up-to-date on College, student and faculty news with protoTYPE, the College's e-newsletter. Visit www.engineering.villanova.edu or send your email address to kimberly.shimer@villanova.edu to be added to the distribution list.



Message from the Dean

As I've traveled the country meeting with alumni and friends of the College, more are expressing their concern for the increasing cost of higher education. The topic has been in the headlines for several years as the media echo parents and students when they ask, "Is it worth it?" While research has shown that a college degree has never been more valuable in terms of employment and earning potential, in the College of Engineering we recognize that we must continue to be good stewards of our resources, provide the value that parents and students deserve, and demonstrate our worth at every level. The increasing quality of our students, faculty and alumni achievements indicates that we are doing just that, but we know that there is still work to do.

In 2006, the College of Engineering introduced a strategic plan that has guided our decision making and investments throughout the past six years. The plan focused attention on three main goals:

Strengthen our human and physical resources to be a top-ranked national engineering college.

Develop an intellectual and humanitarian engineer who is both a technical innovator and a contributor to the greater community.

Create graduate and research strengths in selected areas that are consistent with our values and enhance our national reputation.

Considerable progress has been made on these goals and important momentum achieved. Among our accomplishments:

- Maintaining a Top 10 *U.S. News & World Report* ranking for our college classification for the past seven years
- Making significant strides in diversifying both the undergraduate population and the faculty
- Reaching an all-time high for College applications in the past two years
- Increasing our interaction with industry partners
- Designing a nationally-recognized innovative first-year engineering course
- Securing increased undergraduate and graduate research funding and opportunities
- Developing our graduate and distance education programs
- Establishing several of the College's Science, Technology, Engineering and Math (STEM) outreach programs
- Expanding service learning opportunities for students

There is much to feel good about and still more to strive for as we plan to ignite change throughout the next five years. In our feature article, "Reviewing the Blueprint for Excellence," we'll look more closely at what we have achieved and where we see the College of Engineering in 2017. We are grateful for having your unwavering support along the way.

Sincerely,

Gary A. Gabriele, PhD
Drosdick Endowed Dean of the College of Engineering

In 2006, the College of Engineering faced a big challenge: How to make a top program stronger without losing what makes this engineering school unique from any other.

In the process of developing a strategic plan at that time, the members of the planning group recognized that what makes this College unique is not so much the individual components, but our ability to blend teaching, research and service, with our underlying values.

The result of the work of our planning group was a strategic plan with a lofty vision, one that called for no less than becoming a top-ranked national engineering school while staying true to our Augustinian Catholic tradition. The vision used words like “leaders,” “innovative,” “intellectual” and “humanitarian.” It established targeted strategies for meeting ambitious goals. Six years later, we reflect on what the College has accomplished, and look ahead to the challenges and opportunities that remain.

The College of Engineering, in a Word

Leaders

The College of Engineering takes great pride in its *U.S. News & World Report* ranking as one of the nation’s “Best Undergraduate Engineering Programs.” Having been among the top 10 schools for the seventh consecutive year affirms the results of Villanova Engineering’s efforts and establishes it as a national leader. However, a magazine ranking is not the only indicator of leadership. The College of Engineering is gratified by a record of developing individual student and faculty leaders. You’ll meet them in the coming pages.

(continued on Page 4)

REVIEWING THE blueprint for excellence



(continued from Page 2)

Gary A. Gabriele, PhD, Drosdick Endowed Dean of Engineering, is particularly proud of the progress made in bringing talented women faculty and students to the College:

- Female students are 27.3 percent of our total undergraduate enrollment, versus 18.2 percent nationally
- 17.5 percent of College faculty are women, versus the national average of 13.8 percent*

These numbers help demonstrate Villanova's commitment to an engineering community that includes everyone.

Innovative

Innovation in education is always slow, but Villanova Engineering is proud of completing a number of significant innovations in the past six years:

- The Villanova Multidisciplinary Design Lab (MDL) brings together students and industry partners.
- A master's degree in Sustainable Engineering is one of just a handful of programs nationally in this rapidly growing field.
- The Engineering Entrepreneurship minor engages students in collaborative project experiences and offers a sense of how engineers can respond to market needs.

The innovative, challenging first-year curriculum is yet another area where Villanova Engineering has demonstrated its commitment to offering a premier undergraduate engineering education. According to Dr. Gerard 'Jerry' Jones, PhD, Senior Associate Dean for Graduate Studies and Research, and Professor, Department of Mechanical Engineering, "Our program delivers possibly the best learning experience for first-year students among all freshman programs in U.S. engineering schools." By combining classroom time with hands-on experience and professional development, freshmen are being increasingly challenged and are ultimately better prepared for their upper level courses.

The next frontier for innovation will lie in the very way faculty teach. As learning research develops, new opportunities exist that have the potential to make our faculty even more effective educators. These innovations are currently in the works, and we look forward to telling you about them in the coming year.

Intellectual

One of the intellectual objectives of the strategic plan called for significantly increasing undergraduate participation in research and internship opportunities. The Villanova Undergraduate Research Fellows program, alumni donations and industry partnerships have all contributed to success in this regard. Learn more about our students' current research projects on Page 14 and about the value of strategic partnerships on Page 34.

Along with undergraduate research, national and international recognition for research by faculty also has been a top priority, and has been supported by:

- Expanded research funding
- A new research center in sustainability
- A National Science Foundation (NSF) Industry/University Cooperative Research Center (I/UCRC) in Energy Efficient Electronic Systems
- Growing research in the areas of biochemical engineering, energy and environment

"I am impressed by the level of scholarship currently achieved by our faculty despite the large teaching loads they carry relative to our peer institutions. They are excellent examples of the College's commitment to the teacher-scholar model that Villanova values," notes Dean Gabriele.

At the graduate student level, the College of Engineering has made progress reinvigorating the full-time master's degree programs and more fully developing the PhD program, which has seen steady growth in enrollment. Looking ahead, one of the greatest opportunities for growth lies in the untapped potential of a part-time program for professionals, both on campus and through distance learning.

Humanitarian

Last, but most certainly not least, reflecting the University's Augustinian Catholic values, the College of Engineering remains committed to educating the whole student. Leadership, integrity and core values are developed by offering:

- Workshops with a global perspective
- Study abroad opportunities
- International service projects

What's Next?

The College of Engineering stands on solid ground, but the blueprint for excellence will require continual updating. The College cannot lose sight of what is most important to potential students—class size, access to teachers and the quality of faculty—though at the same time, we must stay cognizant of the rapid changes facing higher education, including:

- Demographic shifts resulting in declining numbers of college age adults
- The increasing cost of education
- Access to information via new models of delivery
- Recent discoveries in the science of learning

We encourage you to join the College on this transformational journey.

Some specific five-year goals have been developed to respond to these challenges:

- Pursue an increasingly innovative and contemporary approach to educating engineers
- Strategically use resources to support teaching and research infrastructure
- Increase master's program enrollment for working professionals
- Continue emphasis on teacher-scholar model

These goals grow out of the vision for 2017, which is to see Villanova's College of Engineering

recognized as one of the institutions leading the transformation of engineering education in the United States. Dean Gabriele says "Through innovative teaching, curriculum and research, we will create an engineering college that will be exciting, creative, rigorous, demanding and empowering to ignite the heart, inspire the mind and illuminate the spirit of our students."

*Source: ASEE, 2011

The Vision: Villanova College of Engineering will become the premier engineering program in the country while maintaining our Augustinian Catholic values. We will be known for our innovative curricula, pedagogy and research. We will be leaders in developing the intellectual and humanitarian engineer who is both a technical innovator and a contributor to the greater community. We will judge ourselves in this vision through the success of our alumni and the view of our peers.



(above) Caitlin McGinley ME '12 conducts research on cryopreservation in Associate Professor Jens O.M. Karlsson, PhD's, Biothermal Sciences Laboratory.



(right) Garrett M. Clayton, PhD, Assistant Professor of Mechanical Engineering, works in the Mechatronic Systems Laboratory with Brian Maxwell ME '12.

Jordan Ermilio ME '98, MSWRE '06, the first full-time director for service learning, explains, "These experiences allow our students to understand the impact that engineering has on society." See Page 32 for a sampling of the work faculty and students are doing to ignite change worldwide.

The College's Science, Technology, Engineering and Math (STEM) outreach programs are another example of its humanitarian and community-focused efforts. Villanova Engineering is believed to support more active outreach programs, than any other engineering school in the country. These programs provide exposure to engineering concepts and problems, and offer a better understanding of how engineering impacts lives. Read more about them on Page 31.

chemical

ENGINEERING

Undergraduate and Graduate

- The Chemical Engineering department added popular graduate courses in Biomass Conversion, Sustainable Industry Chemistry and Systems Biology.
- 2011-2012 saw a major upgrade to the department's teaching laboratory with the purchase of a new state-of-the-art distillation system, which replaced units that were more than 30 years old. In addition, two new research labs were constructed in White Hall.
- Ryan Lojek ChE '12 won "Undergraduate Poster of the Year" at the International Society of Pharmaceutical Engineers' student research competition. He also received the "Best Laboratory Report" award from the Delaware Valley section of the American Institute of Chemical Engineers (AIChE).
- Colleen Clark ChE '12 won the "Best Undergraduate Student Poster" award at the Delaware Valley International Society of Pharmaceutical Engineers Student Poster Contest.



Seniors Jeremy Kuhn and Sam Bandel measure the surface area of new materials generated in Assistant Professor Michael Smith, PhD's, lab.

from the chair

Randy Weinstein, PhD

Professor and Chair
Department of Chemical Engineering

The class of 2012 was the first to graduate under the Chemical Engineering Department's newly revised curriculum, which offers more electivity and the ability to focus undergraduate studies in one of three emerging areas:

- Bioengineering and Pharmaceuticals
- Advanced Materials and Nanotechnology
- Sustainability and Alternative Energy

This flexibility, along with the option to pursue a

full-year of undergraduate research under the direction of a faculty member, is unique and distinctive. Faculty contributed to the success of our curriculum by winning grants for related research and designing new projects for use in the undergraduate courses. Our faculty continue to publish and present, and we also have had an increase in students presenting their work at conferences and winning awards in the process.



(left) Dorothy Skaf, PhD, Associate Professor, researches how to destroy carbon dioxide using nanomaterials and sunlight.



(right) Justinus Satrio, PhD, Assistant Professor, shows Laura-Ann Chin MSChE '12 the procedure to extract fast-pyrolytic lignin from bio-crude oil.



Faculty

- Dr. William J. Kelly, Associate Professor, delivered a keynote lecture at the 1st European Congress of Applied Biotechnology, held in Berlin, Germany.
- Dr. Justinus Satrio, Assistant Professor, gave five invited lectures in Malaysia, Indonesia and the United States.
- Dr. Zuyi Huang, Assistant Professor, set up a Computational Systems Biology lab where he conducts research with both graduate and undergraduate students. See "Engineering Microorganisms Using a Systems Biology Approach" under Research Initiatives below.
- Dr. Noelle Comolli, Assistant Professor, and Dr. Dorothy Skaf, Associate Professor, won and implemented two different Villanova Institute for Teaching and Learning (VITAL) mini-grants aimed at the department's undergraduate curriculum. One focused on impromptu design in class while the other worked on bringing advanced simulation software into lower-level courses.
- Dr. Randy Weinstein, Professor and Department Chair, was elected president of Alpha Chi Sigma, the professional co-ed chemistry fraternity, for a two-year term.

Research Initiatives

The nation's energy crisis has resulted in a critical need for affordable, environmentally friendly and sustainable options. Zuyi Huang, PhD, and Dr. Satrio are both conducting research to this end.

Converting Biomass Materials

Dr. Satrio, Assistant Professor, is researching the potential of converting lignocellulosic biomass materials into a source of energy. Now in his third year of research at Villanova, Dr. Satrio, director and founder of the Villanova Biomass Resources and Conversion Technologies Laboratory, and his interdisciplinary team of undergraduate and graduate student researchers are developing thermochemical processes to convert biomass into a liquid form, called bio-crude oil (BCO). BCO has many end applications including use as heating fuel and intermediate feedstock for the production of bio-chemicals and fuels for transportation.

Engineering Microorganisms Using a Systems Biology Approach

Microbial fuel cells (MFCs) are devices that can use bacterial metabolism from a wide range of organic substrates to produce an electrical current and advanced biofuels such as hydrogen. Systems biology expert **Dr. Huang** is investigating how retooling the metabolism of multipopulation microorganisms could allow them to form highly conductive biofilms on the anode and to produce hydrogen on the cathode. One promising approach is using genome-scale modeling to explore pathway optimization, such as importing nonnative pathways into host microorganisms.

civil + environmental

ENGINEERING

Undergraduate And Graduate

- The Department of Civil and Environmental Engineering was ranked 8th nationally by *U.S. News & World Report* for the second consecutive year.
- William Angiolillo CE '12 won an "Undergraduate Student Paper" award at an invitation-only student poster presentation that was part of the 2012 annual Engineers Week Luncheon, hosted by the Engineers Club of Philadelphia.
- Nicholas Mascitelli CE '12 was awarded the Metropolitan District Scholarship from Chi Epsilon National Civil Engineering Honor Society and also won third place in the American Concrete Institute (ACI) 2011 Concrete Projects Competition.

- ACI Foundation selected Blake Campbell CE '13 as the 2012-2013 recipient of the \$3,000 ACI Richard D. Stehly Memorial Scholarship for undergraduate engineering.
- Francis Nagel CE '12 was awarded the CEE Faculty Award for superior academic performance and notable service to the University.
- David Mensching MSCE '12 won the CEE Graduate Student Research Award.
- For the third consecutive year, a team of Villanova Engineers won first prize in the American Society of Civil Engineers (ASCE) Structural Engineering Institute (SEI) Student Structural Design Competition. Team members included 2012 master's degree graduates Scott Albarella, John Garland, Stephen Kane, Michael Mignella and Louis Ross.
- Erin Lane CE '13 received the Society of American Military Engineers' (SAME) Philadelphia Post Scholarship Level III award.



Kevin Flynn MSSE '11 calibrates a pressure transducer, which measures the depth of stored rainfall.



Nicholas Mascitelli CE '12 maps cracks in a reinforced concrete beam.

Faculty

- Dr. Andrea Welker, PE, Associate Professor, delivered a "State of the Practice" talk on geotechnical engineering education at the 2012 Geo-Congress, presented by the Geo-Institute of the American Society of Civil Engineers (ASCE). She also served as a panelist at the United States Universities Council on Geotechnical Education and Research (USUCGER) Workshop, which was held in conjunction with the Geo-Congress.
- Leslie McCarthy, PhD, PE, was an honored guest of the Traffic Club of Philadelphia, as a result of her work introducing railroad engineering into the Villanova engineering curriculum.
- A paper in the *Journal of Irrigation and Drainage Engineering* by Dr. Welker, et al., was the most downloaded ASCE paper of 2011.



Professor and Assistant Department Chair David Dinehart, PhD, at work in the Structural Engineering Teaching and Research Laboratory.

Research Initiatives

Improving Bridge Deck Design

With primary financial support from AECOM and supplemental funding from McCormick Taylor, graduate civil engineering students **Christopher Rapone CE '10** and **Michael Mignella CE '11** undertook research on bridge deck infrastructure. The goal of their project was to evaluate different design methodologies to establish a longer design life with lower capital costs. **David Reichmann CE '12** and **Philip Reilly CE '12** expanded this research by conducting a fatigue study on the bridge decks. Faculty advisors for this project are **Dr. Dinehart**, Professor and Assistant Department Chair, **Joseph Robert Yost, PhD, PE**, Associate Professor and Director of the Structural Engineering Teaching and Research Laboratory, and **Shawn Gross**, Associate Professor.

Membrane Separation Systems Offer Potential for Clean Water

In a world of increasing demand on a limited water supply, technology that can purify water more efficiently could benefit millions of people. In partnership with a researcher from Drexel University, **Brian Chaplin, PhD**, Assistant Professor, and **Metin Duran, PhD**, Professor, received a grant from the National Science Foundation (NSF) to develop membrane separation systems that could greatly improve water and wastewater treatment facilities' ability to remove contaminants from water. The Villanova research team has developed a self-cleaning membrane technology—reactive electrochemical membranes (REMs)—that has great promise for mitigating membrane fouling and in the process reducing operational costs.

from the chair

Ronald Chadderton, PhD, PE

*Professor and Chair
Department of Civil and Environmental Engineering
and the Edward A. Daylor Chair in Environmental
Engineering*

The Department of Civil and Environmental Engineering has seen a favorable response to the revised curriculum and new courses introduced throughout the past two years. This past spring, a Hydraulic Engineering and Hydrology Laboratory was added. The department hired two new faculty members,

and currently four women professors are on the tenure track. Women professors represent 33% of our faculty, which is more than twice the national average. We also have a significant

female student population, on the order of 25%. A highlight of the year is a new partnership with AECOM Technology, the No.1 ranked design firm by *Engineering News-Record*.



electrical + computer ENGINEERING

Undergraduate and Graduate

- The Electrical and Computer Engineering (ECE) department continued to support the Institute of Electrical and Electronics Engineers (IEEE) Humanitarian Technology Network Reliable Electricity program, the Sunblazer. Graduate Brendan McCoy EE '11 traveled to Haiti to work on a project aimed at providing electricity and jobs for hundreds of Haitians.
- New graduate courses in Cybersecurity and Semantic Web were offered for the first time this academic year. In addition, a new Cybersecurity certificate was brought online.
- A senior design CpE team developed an electronic medical record system for the Unity Clinic in Philadelphia, a community health clinic run by Augustinian priest, The Rev. Jack Deegan, OSA.

- Electrical Engineering PhD candidate Amal Kabalan and her team of three other students from Monroe College and Elizabethtown College, took top honors in a best green-business plan competition. Their concept of energy-storing book bags, called Solar Brite Backpacks, won a Presidential Grant for best socio-economic business idea at the World Bank Athgo Global Forum.
- The "Undergraduate Dr. Kozikowski Senior Design Project" award was won by EE seniors Marc Dupuis, George Gresko and Gerald Mayer III for their project titled "Bullet Impact Detection System." Faculty advisors were Moeness Amin, PhD, Director of the Center for Advanced Communications (CENDAC) and Professor of Electrical and Computer Engineering, and Ramazan Demirli, PhD, Director of the CENDAC Acoustics and Ultrasound Lab.



Christopher Darvell MSEE '13 performs solar cell testing.

Faculty

- Dr. Kevin Buckley, Professor, and Dr. Lunal Khuon, Assistant Professor, delivered a new freshman multidisciplinary mini-project, which included participation by professors in Biology and Nursing.
- As a part of the Kern Entrepreneurship Education Network (KEEN) program, Dr. Pritpal Singh and Edmond Dougherty, Assistant Professor, developed a workshop on engineering entrepreneurship for College faculty. They also offered an entrepreneurship workshop to engineering students in Nicaragua.
- Dr. Moeness Amin published his 500th paper in 2012.
- Dr. Xiaofang ("Maggie") Wang, Assistant Professor, was awarded a VITAL grant with which she developed and introduced a new laboratory component to the required Computer Architecture course for undergraduate computer engineering students.
- Dr. Rosalind Wynne, Associate Professor and Director of the Laboratory for Lightwave Devices, continued an outreach program to a diverse community of middle school students in Brooklyn, N.Y. The ECE department supported the program.

Research Initiatives

Patent Received for Method for Embedding Information in Sonar

Undersea acoustic communication, ranging and target detection is made possible by employing active sonar. In an undersea acoustic network environment employing multiple nodes, it is not possible to identify the point of origin of a sonar transmission or echo based solely on signal shape. **Bijan Mobasseri, PhD**, Professor, has perfected a method to authenticate, identify and trace sonar transmissions and echoes by embedding transparent, secure and robust digital watermarks in signal space, where the additional information incurs no cost in bandwidth. Such a digital watermark is application-dependent and may contain numerous pieces of information such as platform, location, physical characteristics and mission. This valuable capability enables authenticating friendly returns, instituting countermeasures and performing covert communications. With research funding from the Naval Undersea Warfare Center and the Office of Naval Research, sonar watermarking received a U.S. Patent in February 2012.

Identifying Presence of Antibodies with Optical Fiber Sensors

Dr. Wynne has developed a method for identifying the presence of monoclonal antibodies (mAbs) using microstructured optical fiber and spectroscopy techniques. The identification of pathogenic antigens is important for public health. Immune systems typically attack potentially harmful antigens by producing proteins called antibodies (e.g. mAbs). Dr. Wynne has advised students **Emily Battinelli BSEE '12**, **Francis Anuszewski BSChE '12**, **Mark Reimlinger BSEE '12** and **Julie Dell Antonio MSSE '13** in the development of optical fiber sensors that employ mAbs to allow for quick and sensitive analysis of a variety of bacterial and viral antigens. A compact, real-time sensor based on this dye-free technology has the potential to benefit water quality monitoring, drug manufacturing and food quality control. The next step in her research is the development of a hybrid method for enhancing detection selectivity via antibody/antigen recognition and microwave radiation induced cellular transport. This work is performed under the auspices of the Center for Advanced Communications and is a multidisciplinary effort with collaborators **Robert Caverly, PhD**, Professor of Electrical Engineering, **Dr. Duran**, Professor of Civil Engineering, and **Drs. Comolli and Kelly**, Associate Professors of Chemical Engineering.



Arlene Wangia MSEE '13 works on the electrodeposition of cadmium telluride solar cells.

from the chair

Pritpal Singh, PhD

*Professor and Chair
Department of Electrical and Computer Engineering*



Enrollment in the Department of Electrical and Computer Engineering is holding steady as graduates continue to be in high demand both in the work force and graduate schools. Timely new courses, including a certificate in cybersecurity, help to generate interest, as do more interdisciplinary

opportunities. While a number of department faculty members were recognized with awards, ECE is particularly excited about a \$625,000 Kern Family Foundation grant for our entrepreneurship activities. See Page 28 for an article about this award.

mechanical

ENGINEERING

Undergraduate and Graduate

- The department received two grants directed at attracting and retaining under-represented students; one from Air Products Foundation for \$25,000, and the second for \$20,000 from Rolls Royce Marine Corporation.
- Andrew Smith ME '13 received the Society of American Military Engineers' (SAME) Philadelphia Post Scholarship Level III award.
- William Albert ME '12 received the 2012 Mechanical Engineering Outstanding Achievement Award, a 2011 Villanova Undergraduate Research Fellows award (VURF), a Science, Mathematics and Research for Transformation (SMART) Scholarship from the Department of Defense in 2011, and performed impressive research with Gang Feng, PhD, Assistant Professor. Albert presented his research at the Materials Research Society (MRS) 2011 fall meeting — one of the most distinguished meetings in materials science and nanotechnology in the world.
- Susan Muckian (nee Mischinski) ME '10, MSME '12 received the 2012 College of Engineering Outstanding Graduate Student Medallion and the department's Outstanding Graduate Student certificate. She co-authored three publications, which appeared in prestigious national journals, and also presented papers at leading international conferences.
- Kevin Woods ME '07, MSME '08, PhD '12 received the inaugural 2012 College of Engineering Outstanding PhD Student award. His research was funded by a Department of Defense SMART Scholarship.
- Students working in ME laboratories won all engineering awards at the annual Sigma Xi Student Research Competition. PhD student Parham Ghorbanian and John McCloskey MSME '12, tied for first place in the graduate student division, while Sean McManus '12, a biology major conducting bioengineering research in the ME department, took first place in the undergraduate division.



C. Nataraj, PhD

Professor and Chair
Department of Mechanical Engineering

The Mechanical Engineering Department has seen a steady increase in applications and has met its target enrollment of 60 students per year. Department faculty are conducting a greater degree of research as they work with our many PhD candidates. Our students have been actively involved in service learning and internship opportunities, research assistantships and new study abroad programs. The department has been intellectually stimulated by regular seminars with high profile researchers from universities, research laboratories and industry.

chair

Dimitrios Karagiannis ME '09, MSME '12 researches piezoelectric vibration control with advisors, Drs. Clayton, Assistant Professor, and Nataraj, Professor and Chair



Calvin Li, PhD, Assistant Professor, examines metal hierarchical structures on a porosimeter with Russell Rioux ME '13 and graduate students Fei Qin and Eric Nolan.



Kenneth Kroos, PhD, PE, Associate Professor, supervises Victoria Franzen CE '13 as she operates the gas turbine.

Faculty

- Dr. Amy Fleischer made College of Engineering history in June, when she was promoted to full Professor of Mechanical Engineering—the first time a female faculty member has ascended to this rank in any engineering discipline at Villanova.
- On the heels of winning the 2010 “Woman Engineer of the Year” award from the American Society of Mechanical Engineers' (ASME) Electronic and Photonic Packaging Division (EPPD), Dr. Fleischer received the society's K-16 Clock Award for 2011. The award recognizes her six-years of service to the K-16 Committee on Thermal Management of Electronics.
- Dr. Alfonso Ortega, Associate Vice President for Graduate Studies and Research, and the James R. Birle Professor of Energy Technology, along with two of his former research assistants, Bryan Hassell MSME '09 and Hari Potluri MSME '13, was awarded the Harvey Rosten Award for Excellence 2011. This is one of the most prestigious international awards for scholarly work within the field of thermal management in electronic systems.
- Dr. Hashem Ashrafioun, Professor, was appointed Director of the Center for Nonlinear Dynamics and Control (CENDAC). Read more on Page 22.

Research Initiatives

Prostate Cancer Treatment

With funding from the National Institutes of Health, **Dr. Li**, Assistant Professor, is exploring the combined effect of thermotherapy and radiotherapy for late-stage prostate cancer. Together with Ishmael Parsai, PhD, of the University of Toledo, Dr. Li is determining the feasibility of a new thermo-brachytherapy seed that combines a sealed radioactive source with a ferromagnetic core, which will self-regulate heat output when implanted in tissue.

Zebrafish Oocyte Preservation

The National Science Foundation has awarded **Dr. Karlsson**, Associate Professor, and Ali Eroglu, PhD, DVM, of Georgia Health Sciences University, a \$660,000, three-year grant to conduct interdisciplinary research into the cryopreservation of zebrafish oocytes. Zebrafish are emerging as an important experimental model for human biology. As an alternative to keeping individual genetic strains of zebrafish segregated in aquarium tanks and maintaining the populations by continuous breeding, Dr. Karlsson and **Angela DiBenedetto, PhD**, Associate Professor of Biology in the College of Arts and Sciences, are exploring the feasibility of freezing zebrafish embryos, which would allow convenient long-term storage in liquid nitrogen.

from the

undergraduate

RESEARCH

The College of Engineering stands out among engineering schools in the unique access that its undergraduates have to research experiences. Students pursue these opportunities in a number of ways, including:

- Projects with individual faculty members
- Independent research projects with the approval and oversight of a faculty member
- Competitive fellowships through the Villanova Undergraduate Research Fellows (VURF) program

The real-world problems that students encounter offer firsthand experience with research that can help solve some of society's toughest challenges.

The following engineering students have received VURF fellowships for the coming year:

Kyle Brundin ChE '13 - "Production of Hydrogen from Glycerol Using E. Coli," mentored by **Dr. Huang**, Assistant Professor, Chemical Engineering

Gregory Campbell ME '15 - "The Synthesis and the Size Dependence of Mechanical Properties of SiO₂ Nanoparticles," mentored by **Dr. Feng**, Assistant Professor of Mechanical Engineering



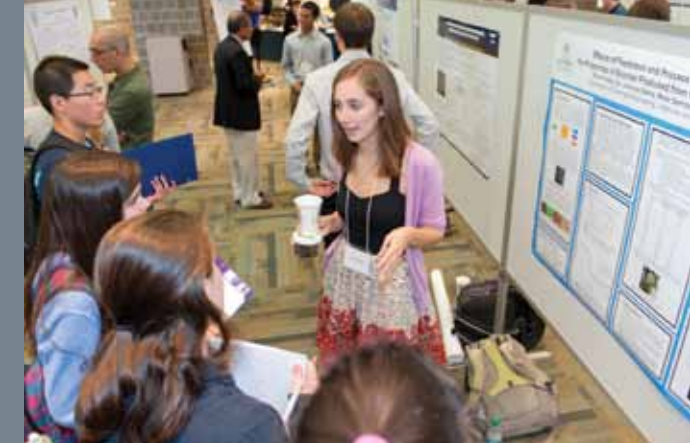
Both undergraduate and graduate engineering students benefit from the College's research opportunities.

Gregory Michel ME '15 - "An Investigation of the Dynamics of a Gas Propelled Droplet Impacting Onto an Isothermal Surface," mentored by **Dr. Ortega**, Associate Vice President for Graduate Studies and Research, and James R. Birle Professor of Energy Technology, Department of Mechanical Engineering

Andrew Pansulla ChE '13 - "Hydrothermal Liquefaction of Pretreated Sludge," mentored by **Dr. Satrio**, Assistant Professor, Chemical Engineering

Lindsay Peterson '15 - "Potential of Phragmites Australis as a Sustainable Feedstock for Biofuel Production," mentored by **Dr. Satrio**

Rebecca Weigand ME '13 - "Thermal response and stability of nano-enhanced phase change materials for practical applications," mentored by **Dr. Fleischer**, Professor, Mechanical Engineering



Ellen Knapp ChE '13 presents her work at Undergraduate Research Poster Day.

Engineering Students Named 2012 Falvey Scholars

Seniors **Mark Reimlinger EE**, **Emily Battinelli EE** and **Frank Anuszewski ChE** were named 2012 Falvey Scholars in recognition of their outstanding undergraduate research.

Engineering Students Sweep 2012 Villanova Student Entrepreneurship Competition

Out of 42 teams of students, seven from the College of Engineering contributed to the top three winning ideas at the 2012 Villanova Student Entrepreneurship Competition (VSEC). This is the second consecutive year that engineering students participated on the first-place-winning team. First place and the Halloran Prize for Best Social Entrepreneurship Venture went to Vita Suction, a low-cost surgical suction device for use in developing countries that may lack access to reliable electricity. Winning team members included **Kyra Holmquest EE '12**, **Emily Battinelli EE '12**, **David Falco EE '14** and **Julia Musso ME '11**, **MSSE '13**.

Cameron Piper ME '14 and **Simeon Dubois ME '14** took second place for Lift-Off Solutions, a training wheels innovation for children's bikes, and third place went to Keep it Warm, a socially responsible winter weather apparel company whose team included **Kyle Pucci ME '14**.

student

ACCOMPLISHMENTS

Mechanical Engineering Student Wins Prestigious Scholarship

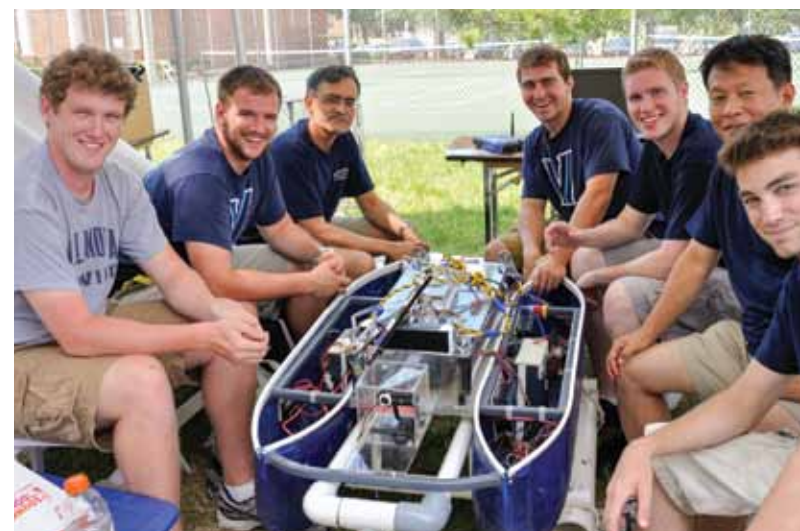
Ian Dardani ME '13, a Villanova Presidential Scholar, is the recipient of the Barry M. Goldwater Scholarship. The Goldwater Foundation awards scholarships to highly qualified college students who intend to pursue careers in science, math or engineering.

Entrepreneurship Students Shine at Ford Innovation Contest

For the second consecutive year, students in the Engineering Entrepreneurship minor program contributed winning ideas in the University of Detroit Mercy/Ford Innovation Contest, which drew more than 25 teams from seven universities. Mechanical Engineering juniors **Nicholas DeLuca**, **L. Ryan Hughes**, **Brandon Orr** and **Javier Sevilla**, took second place with a proposed solution for reducing or removing automobile blind spots. Third place winners **Laura Krotowski**, **Monica Maschue**, **Daniel Knapp** and **Antonio de la Mata**, all juniors in Chemical Engineering, developed a concept for smart door technology, which automatically checks for oncoming hazards before the driver opens the door.

Autonomous Surface Vehicle Team Takes Silver Medal at "Roboat" Competition

The Villanova Autonomous Surface Vehicle Team navigated its way to second place and a \$5,000 prize at Roboat 2012, an international robotics challenge hosted by the Association for Unmanned Vehicle Systems International and the U.S. Office of Naval Research. Team members included **Nick DiLeo ME '13**, **Joe Denny ME '13**, **Ryan Holihan ME '12**, **Alex Poultney ME '14**, **Mike Weber CpE '12**, **Lester "Jim" McMackin ME '13** and **Shahriar Khan MSEE '13**. The team was advised by **Dr. Nataraj**, Professor and Chair of the Department of Mechanical Engineering.



The Autonomous Surface Vehicle Team poses with its award-winning "Roboat."



During his service trip to Panama, Ian Dardani ME '13 enjoys some down time with local children.

engineering

STUDENT SNAPSHOTS



Joseph Reckamp '14

*Major: Chemical Engineering,
Engineering Entrepreneurship Minor
Hometown: Betavia, Illinois*

Activities

- Research on biomass conversions for which he received the Carlos B. Rosas Chemical Engineering scholarship
- Executive board member of the American Institute of Chemical Engineers (AIChE), Student Chapter
- President of the Villanova University Chem-E Car program

Next Step

In the summer of 2013 Joseph will intern at Procter & Gamble with a focus on manufacturing. He sees a career on the business side of engineering and eventually plans to pursue an MBA.

Putting Engineering to the Business Test

By the time we complete the program, students pursuing the Engineering Entrepreneurship

minor are challenged with developing an idea that we can bring to fruition; something we can actually market. Our group currently is working on an idea for a portable and inexpensive rice huller for the developing world. With this device, farmers would no longer have to manually shell the rice, or sell it to industrial rice hullers and then buy it back at a higher price. Another project we're considering involves building a system in a smartphone to allow it to expand to tablet size. This integration between phone and tablet would be much like Microsoft's integration between tablet and laptop.

By combining engineering with business, we've learned to consider how to deliver projects at cost and how to be most efficient. You have to ask yourself if what you're working on is going to be feasible. It's cool to be able to look at the big picture instead of just those research results student engineers tend to focus on.



Dylan White '13

*Major: Civil Engineering
Hometown: Harrisburg, Pennsylvania*

Activities

- WXVU Radio
- Chi Epsilon (National Civil Engineering Honor Society)

Next Step

Dylan would like to stay in the Philadelphia/Northeast area and is considering working for a private firm, perhaps in structural engineering.

Taking it to the Streets

Upper Darby, Pennsylvania, is a township with many diverse challenges and limited resources. Through my professor, Dr. Myers McCarthy, PE, I became involved in a pavement management project in which I am assessing structural capacity. This work will assist the township

officials in making founded decisions for reconstruction.

I'm collecting data using NDE-360, a spectral analysis surface wave pavement test device. With this device you tap a piece of roadway, and it measures the waves that come through it and their frequency. Then, using pavement analysis software, you can learn the thickness and material properties and ultimately correlate that data to design life and strength and serviceability.

I remember who I was freshman year and what I knew and what I thought about everything. I see how much I've learned and grown. In addition to this Upper Darby project, I've had two great summer internships with the Pennsylvania Department of Transportation. I know I'm learning in a different way and at a different level. My Villanova education has been very, very good.

"Joe is the best, the brightest and the most well-rounded student with whom I've ever worked closely."

— Dr. Satrio,
Assistant Professor,
Chemical Engineering

Hillary Guardo '13

*Major: Mechanical Engineering
Hometown: Flemington, New Jersey*

Activities

- Engineering Student Council and Ambassadors
- President of the executive board of Villanova University's Presidential Scholars
- Society of Women Engineers
- Campus Ministry service learning experiences

Next Step

Hillary has been hired by the U.S. Navy as a Naval Reactor Engineer.

Abstract Principles in Action

I will never forget engineering lab during our sophomore year. That's when we had to take

apart power tools and lawn mower engines and put them back together. When it's time to see if they're going to work, your heart stops and there's a huge sense of relief afterward when they do. I always enjoyed discovering how principles that we learned in the classroom that sometimes seemed boring or a little abstract were actually used to create something incredibly useful in our everyday lives.

From listening to presenters in different fields of engineering who helped me discover my passion, and sitting with patient professors for hours when there were principles I didn't understand, to traveling to Cambodia for service work, and being offered numerous leadership opportunities, my experiences at Villanova have combined to set me on a path I'm confident and excited about.



"Hillary is one of those unique students who has a sincere desire to impact the lives of others. Her commitment to helping those less fortunate than herself is contagious, and she inspires others to follow her lead."

— Jordan Ermilio ME '98, MSWRE '06,
Director of Engineering Service Learning

Name: Emily Battinelli '12

*Major: Electrical Engineering,
Bioengineering Minor
Hometown: Ellicott City, Maryland*

Activities

- Research of Monoclonal Antibody Detection with Dr. Wynne
- Development of Solar-Powered Headlamp and Surgical Suction Device with Dr. Singh
- Service learning experiences with Water for Waslala and Engineers Without Borders
- Volunteer for LIFT Philadelphia
- CEER PEERS
- Pastoral Musicians

Next Step

Emily will pursue an MD/PhD at Hofstra Northshore-LIJ School of Medicine.

Engineering, Medicine and Service

How many schools allow or actually encourage their undergraduates to participate in research with their professors? Working on projects with Drs. Singh and Wynne was one of the highlights of

my time at Villanova. I was able to combine my interests in engineering and medicine, and discovered a passion for clinically relevant translational research. My experiences helped me understand the importance of the relationship between basic science and clinical medicine, and how, when they influence each other, real progress can be made in patient care and population health.

A great example of the potential of science and medicine—and one of my proudest moments at Villanova—was the development of an award-winning solar-powered suction device. Created by the Villanova Student Entrepreneurship Competition design team that I was part of, our "Vita Suction" device is actually being used and making a real difference in a hospital I visited in Nicaragua. I look forward to staying involved in the project after graduation because it represents my future goals of obtaining an MD/PhD and combining my love of engineering, medicine and service. I hope to be involved in the communication and cooperation between what basic science can offer, and the needs of the patient and clinician in the real world.



"Emily Battinelli is not only an academically gifted student, but she is dedicated to serving humanity. Her excellent work on the suction device, along with her impressive research and her post-graduate mission work illustrate the breadth of her extra-curricular activities at Villanova and beyond."

— Dr. Singh, Professor and
Chair, Department of Electrical and
Computer Engineering

faculty

ACCOMPLISHMENTS

PUBLICATIONS & PRESENTATIONS

Dr. Alfonso Ortega, Associate Vice President for Graduate Studies and Research, and the James R. Birlle Professor of Energy Technology, Mechanical Engineering, headlined the international Institute of Electrical and Electronics Engineers' (IEEE) 28th annual Semiconductor Thermal Management and Measurement Symposium (SEMI-THERM) as its keynote speaker.

Dr. Amy Fleischer, Professor of Mechanical Engineering, represented Villanova and the College of Engineering at the U.S.-Egypt Joint Workshop on Solar Energy Systems and Materials. She presented "Energy Storage Using Phase Change Materials with Applications in Solar Energy Systems." The event is sponsored by the National Science Foundation.

FACULTY SCHOLARSHIP

Books/monographs published	2
Edited books	1
Refereed journals	83
Book chapters	6
Conference papers published	120
Other publications	4
Grants applications	193
Papers presented	140
Service on editorial boards/ professional leadership positions	86

APPOINTMENTS

Dr. Robert Traver, PE, WRE, MSCE '82, Professor and Director of both the Villanova Center for the Advancement of Sustainability in Engineering and the Villanova Urban Stormwater Partnership, was elected president of the American Academy of Water Resource Engineers (AAWRE). He previously served three years as a member of the organization's Board of Directors. Dr. Traver also was selected to chair the American Society of Civil Engineers (ASCE) Task Committee on Flood Safety Practices and Procedures.



Dr. C. Nataraj, Professor and Chair, Mechanical Engineering, was appointed as the Mr. and Mrs. Robert F. Moritz Sr. Endowed Chair in Engineered Systems. Established in 2006 through a generous gift from Robert F. Moritz Jr., DDS, VSB '51 and his wife Diane, the Moritz Chair was created in recognition of the increasingly interdisciplinary nature of real-world engineering problems. Dr. Nataraj is an internationally renowned scholar in dynamic systems.

Dr. Nataraj also joined the editorial boards of the *International Journal of Advanced Robotic Systems* and the *Journal of Applied Nonlinear Dynamics*.

Dr. Amy Fleischer, Professor of Mechanical Engineering, along with 11 other top female engineering educators, has been tapped to join the inaugural class of faculty fellows of the national Executive Leadership in Academic Technology and Engineering (ELATE) program at Drexel University.



Dr. Zuyi Huang, Assistant Professor of Chemical Engineering, served as an editorial board member of the *Journal of Computer Science and Systems Biology*.

Dr. Pritpal Singh, Professor and Chair, Electrical and Computer Engineering, was appointed as an at-large member of the national Electrical and Computer Engineering Department Heads Association board.



Dr. Michael Smith, Assistant Professor of Chemical Engineering, served as chairman and then director of the Catalyst Club of Philadelphia.

Dr. Aaron Wemhoff, Assistant Professor of Electrical and Computer Engineering, has been appointed as a regional editor for the *International Journal of Transport Phenomena*. He was also elected vice chair for the ASME Heat Transfer Division K-20 Committee on Computational Heat Transfer, and was elected treasurer for the Philadelphia section of American Society of Mechanical Engineers (ASME).



AWARDS & RECOGNITION

The Institute of Electrical and Electronics Engineers (IEEE) tapped **Dr. Moeness Amin**, Director of the Center for Advanced Communications and Professor of Electrical and Computer Engineering, to offer his expertise as a member of the editorial board for its flagship publication, *IEEE Signal Processing Magazine*.



Dr. Brian Chaplin, Assistant Professor of Civil and Environmental Engineering, was awarded the World Environmental and Water Resources Institute's (EWRI) 2011 Samuel A. Greeley Award for Best Paper (*ASCE Journal of Environmental Engineering*).

Dr. Sarvesh Kulkarni, Associate Professor of Electrical and Computer Engineering, received the Global Consortium of Entrepreneurship Centers' award for Excellence in Entrepreneurship Teaching and Pedagogical Innovation.



Instructor **Edward Char**, Electrical and Computer Engineering, was the recipient of the College of Engineering's Farrell Award, which recognizes a faculty member who has demonstrated personal concern for students and exceptional dedication to the College.



Dr. Alfonso Ortega, along with two of his former research assistants, **Bryan Hassell MSME '09** and **Hari Potluri MSME '13**, was awarded the 2011 Harvey Rosten Award for Excellence. This is one of the most prestigious international awards for scholarly work within the field of thermal management in electronic systems.



Dr. Shawn Gross was named a Fellow of the American Concrete Institute (ACI).



Faculty Promotions

Dr. Amy Fleischer, Department of Mechanical Engineering, was promoted to full Professor.



New Faculty

(hired in the 2011-2012 academic year)



Dr. Seri Park, Clare Booth Luce Assistant Professor, Civil and Environmental Engineering, specialty in Transportation



Dr. Nisha Kondrath, Clare Booth Luce Assistant Professor, Electrical Engineering, specialty in Power Electronics



Dr. Eric Musselman, Assistant Professor, Civil and Environmental Engineering, specialty in Materials and Structures



Dr. Verica Radisavljevic-Gajic, Clare Booth Luce Assistant Professor, Mechanical Engineering, specialty in Dynamics, Systems, and Control



Dr. Danai Chasaki, Assistant Professor, Computer Engineering, specialty in Hardware Security



Sonali Joshi, Sustainable Engineer, Villanova Center for the Advancement of Sustainability in Engineering

Center For Advanced Communications (CAC)



CAC Highlights

- Yimin Zhang, PhD, Research Professor and Director of the Wireless Communications and Positioning Lab, was selected for the Air Force 2012 Summer Faculty Fellowship Program.
- The CAC signed a Memorandum of Understanding (MOU) with L'Institut Polytechnique de Grenoble in Grenoble, France, formalizing a framework for cooperation to facilitate and/or enhance current collaborative research, education and teaching opportunities. This arrangement marks the CAC's 10th international partnership.
- Dr. Mobasseri, Professor, Electrical and Computer Engineering, together with Robert S. Lynch and G. Clifford Carter of the Naval Undersea Warfare Center, Newport, R.I., received a U.S. Patent, no. 8127138 - Method for Embedding Information in Sonar.
- CAC postdoctoral Research Fellows, Batu Chalise, PhD, and Graeme Smith, PhD, were elected to the Senior Grade of the Institute of Electrical and Electronics Engineers (IEEE).

- Fauzia Ahmad, PhD, Research Associate Professor and Director of the Radar Imaging Lab, was elected senior member of SPIE, the international society for optics and photonics. She served as an organizer and chair of the Compressive Sensing Conference at the 2012 SPIE Defense, Sensing and Security Symposium.
- CAC received two "Best Paper" awards at the IEEE Sensor Array and Multichannel (SAM) workshop, and at the International Conference on Information Science, Signal Processing and their Applications (ISSPA).

Moeness Amin, PhD

Director of the Center for Advanced Communications, and Professor of Electrical and Computer Engineering

The Center for Advanced Communications (CAC) is a first-class facility staffed and used by world-class researchers in academia, industry and government. Nine

full-time faculty members are involved in 21 CAC-affiliated research projects, which have received more than \$3.3 million in active funding. Areas of research include radar imaging, acoustic and ultrasound, target

detection and classification, antenna design, and radio frequency identification.

In addition to faculty researchers, the Center also supports the work of 13 graduate and undergraduate students, as well as five postdoctoral fellows.



Topics of Study:

The research focus of the Center for Advanced Communications (CAC) is in the areas of Signal Processing, Antennas and Imaging.

CAC research activities include:

- Acoustics and Ultrasound
- Compressive Sensing
- Satellite Navigations
- Low-profile Antenna Modeling and Measurements
- Microwave and RF
- Multimedia and Watermarking
- Radar Imaging
- Sensor Technology
- Signal Processing for Communications
- Smart Antennas
- Synthetic Aperture Radar

Research Awards

Competitive Awards

Dr. Fauzia Ahmad

- PI, U.S. Army Research Office, "Multipath Exploitation & Knowledge Based Urban Radar Imaging Using Compressive Sensing," \$447,811 (2011-2014)
- PI, eWave Informatics, LLC, "Multilayered Wall Characteristic Extraction for Through Wall Radar Systems," \$98,086 (2011-2014)

Dr. Moeness Amin

- PI, Department of National Defence—Canada, "Development of Through-Wall Synthetic Aperture Radar Processing Algorithms," \$86,000 (2011-2013)
- PI, National Science Foundation, "Partnership for Innovation in Acoustic and Ultrasound Technologies for Medical and Industrial Applications," \$600,000 (2010-2013)
- PI, Office of Naval Research, "Improved Target Detection in Urban Structures Using Distributed Sensing and Fast Data Acquisition Techniques," \$257,500 (2010-2012)
- PI, Office of Naval Research, "Chief of Naval Research Challenge—Polarimetric and Indoor Imaging Fusion Based on Compressive Sensing," \$100,000 (2011-2012)
- PI, U.S. Army Research Laboratory, "Signature Exploitation Techniques for Detection of Weapons Behind Walls," \$141,200 (2009-2011)
- PI, Australian Research Council, "Advanced Processing for Through the Wall Radar Imaging," (Australian \$500,000) (2007-2012)

Congressional Award

Dr. Ahmad Hoorfar, PI, DARPA/CTC,

- "Intelligent Remote Sensing for Urban Warfare Operations, Phase II," \$600,000 (2011)

Dr. Ramazan Demirli

- PI, Vibration Specialty Corporation, LLC, "Evaluation and Improvement of Envelope Spectrum Technique for Bearing Fault Detection," \$16,500 (2011-2012)

Dr. Ahmad Hoorfar

- PI, National Science Foundation, "MRI-R2 Acquisition of Enhanced Antenna Measurement Facilities for Emerging RF Millimeter-Wave Applications," \$568,000 (2010-2013)
- PI, Applied Nanotech, Inc., "Printed Wideband Metamaterial Antennas for Ballistic Panels," \$33,655 (2011-2013)

Dr. Bijan Mobasseri

- PI, Naval Undersea Warfare Center, "Authentication of Active Sonar in a Multiuser Environment," \$95,000 (2011-2012)

Dr. Rosalind Wynne

- PI, U.S. Army Research Office, "Nano-Spectrometers with Microstructured Optical Fibers for Chemical Sensing," \$40,000 (2011-2012)

Dr. Yimin Zhang

- PI, U.S. Air Force Research Lab, Next-Generation Over-the-Horizon HF Radar (NGOTHR) Moving Target Indicator (MTI) and Clutter Mitigation Development," \$267,050 (2010-2012)

CAC Laboratories

Antenna Research Lab

Director: Dr. Ahmad Hoorfar, Professor of Electrical and Computer Engineering

Wireless Communications and Positioning Lab

Director: Dr. Yimin Zhang, Research Professor, Center for Advanced Communications

Radar Imaging Lab

Director: Dr. Fauzia Ahmad, Research Associate Professor, Center for Advanced Communications

Radio Frequency Identification Lab

Acting Director: Dr. Yimin Zhang, Research Professor, Center for Advanced Communications

Acoustics and Ultrasound Lab

Director: Dr. Ramazan Demirli, Research Assistant Professor, Center for Advanced Communications

Center for Nonlinear Dynamics and Control (CENDAC)

CENDAC Highlights

- Dr. Ashrafiun was appointed CENDAC Director in the fall of 2011. In this role, he leads a team of faculty researchers, each of whom directs his own laboratory. He also continues to direct CENDAC's Unmanned Surface and Underwater Vehicles Laboratory, and teaches undergraduate and graduate courses.
- Eleven PhD candidates and eight master's degree students are pursuing thesis work within the center, funded by research grants and awards. The center also encourages undergraduate research, and approximately 13 students worked on CENDAC projects this past year.
- CENDAC faculty authored a total of 62 scholarly publications. Sergey Nersesov, PhD, Associate Professor of Mechanical Engineering, and Dr. Nataraj, Professor and Chair of Mechanical Engineering, each published a book. Other published scholarly work included 20 journal articles, 35 conference publications and five book chapters.
- The center established a new seminar series to be presented biannually by distinguished speakers. The first presenter was Naomi E. Leonard, PhD, Edwin S. Wilsey Professor of Mechanical and Aerospace Engineering at Princeton University, who spoke to "Information Passing and Collective Animal Behavior."

- CENDAC faculty wrote 30 proposals and secured five competitive research grants worth approximately \$500,000, bringing the total active funding for research to nearly \$2 million. The total number of research grants is currently 15, 10 of which have been secured through competitive proposals. New grants were awarded by the Office of Naval Research, Briar Hill Foundation, ExxonMobil, Cummins Inc, and Potable On-Demand Diagnostics, Inc.
- CENDAC PhD student Parham Ghorbanian won the 2012 Sigma Xi "Best Poster in Engineering" award.



Allen Chang MSME '13 works on a novel spherical robot for his graduate research.

Hashem Ashrafiun, PhD

Director, Center for Nonlinear Dynamics and Control, and Professor of Mechanical Engineering



In 2011-2012, active research in the Center for Nonlinear Dynamics and Control (CENDAC) included autonomous systems, mobile robotics, unmanned surface vessels, biomedical modeling and diagnostics, systems biology, HVAC systems and automotive combustion. CENDAC fosters interdisciplinary collaboration across the College

and provides the research environment necessary to solve problems in nonlinear, highly integrated, multidomain systems. Graduate and outstanding undergraduate students benefit from this interdisciplinary systems approach, and from a coordinated sequence of graduate control systems courses.



Dr. Ashrafiun works with PhD student Parham Ghorbanian on an exoskeleton device for use in lower extremity rehabilitation.

CENDAC Faculty Researchers

- **Dr. Garrett Clayton**, Assistant Professor of Mechanical Engineering
- **Dr. Verica Radisavljevic-Gajic**, Assistant Professor of Mechanical Engineering
- **Dr. Zuyi 'Jacky' Huang**, Assistant Professor of Chemical Engineering
- **Dr. James Peyton Jones**, Professor of Electrical and Computer Engineering
- **Dr. Sarvesh Kulkarni**, Associate Professor of Electrical and Computer Engineering
- **Dr. C. 'Nat' Nataraj**, Professor and Chair of Mechanical Engineering
- **Dr. Sergey Nersesov**, Associate Professor of Mechanical Engineering
- **Dr. Subramanian 'Subbu' Ramakrishnan**, Research Assistant Professor of Mechanical Engineering

CENDAC Laboratories

- Advanced Control Theory and Applications
- Automotive Research Laboratory
- Autonomous Systems
- Biomedical Engineering Research
- Dynamic Systems Laboratory
- Innovations in Robotics Laboratory
- Mechatronics Lab Systems
- Networks for Control Systems
- Nonlinear Stochastic Dynamical Systems
- Unmanned Surface and Underwater Vehicles Laboratory

Core Skills

- Biomedical System Dynamics
- Nonlinear Control Methodologies
- Nonlinear System Analysis and Design
- Nonlinear System Modeling and Identification
- Prognostics and Diagnostics

Research Initiatives

Acquisition and Analyses of Brain Waves

Dr. Ashrafiun has been conducting research in the increasingly important area of brain injuries, specifically focusing on data acquisition, artifact detection and signal analysis of brain electroencephalogram (EEG). Wavelet transforms, FFT and nonlinear dynamic techniques are being used along with statistical analysis to analyze, compare and contrast EEG signals collected from healthy adults and those with Alzheimer's disease in order to predict and quantify abnormalities in brain function. The EEG data is acquired through a noninvasive and comfortable single electrode placement system with a Bluetooth enabled telemetric headset. The hope is to use this technology to monitor brain health in a variety of settings.

Dynamics of Robotic Swarms in Biological Systems

Complex systems often are characterized by emergent behavior as a collective that cannot be extrapolated from the analysis of individual behavior. The realization of engineered complex systems such as robotic swarms inspired by biological systems is currently an area of intense research. Supported by the National Science Foundation, **Dr. Ramakrishnan** is studying the dynamics of robotic swarm systems inspired by biological systems such as foraging ant colonies. In collaboration with researchers from UC Los Angeles, UC Riverside and the University of Toledo, Dr. Ramakrishnan's long term objective for this project is to be able to engineer robotic systems that can mimic the remarkable adaptive behavior observed in natural systems.

Villanova Center for the Advancement of Sustainability in Engineering (VCASE)

VCASE HIGHLIGHTS

- The Pennsylvania Senate Environmental Resources and Energy Committee tapped Dr. Traver, along with a number of engineers, infrastructure experts and government officials, to discuss flood mitigation and stormwater management during a two-day joint public hearing in November 2011.
- VCASE added solar panel atomic layer laboratory equipment, which in turn, helped generate a National Science Foundation proposal.
- More than 700 people attended the 2011 Low Impact Development Symposium, hosted by VCASE/Villanova Urban Stormwater Partnership (VUSP). The symposium drew national and international attention.
- Baker Engineering is VCASE/VUSP's first strategic partner pledging \$45,000 throughout the next 3 years.
- The number of proposals generated through VCASE has grown from 35 in 2010-2011 to 45 for 2011-2012, with dollar amounts increasing from \$5.0 million to \$5.7 million.

Biomass resources and conversion technologies are a VCASE area of focus.



Research Initiatives

Boron-doped Diamond Electrode Development

Dr. Chaplin is working with Advanced Diamond Technologies, a manufacturer of diamond electrodes, to develop boron-doped ultrananocrystalline diamond (UNCD) electrodes for the destruction of recalcitrant organics in industrial wastewater via direct anodic oxidation. Boron-doped diamond (BDD) film electrodes have generated considerable interest due to their ability to readily mineralize complex waste streams. Other treatment methods simply concentrate toxins, thus producing residuals requiring disposal in hazardous landfills or incinerators. The objective of Dr. Chaplin's work is to optimize the existing boron-doped UNCD technology to develop low-cost, long-lifetime electrodes to enable wide-spread adoption of electrochemical wastewater treatment technologies.

VCASE Focus Areas and Faculty Researchers

Alternative and Renewable Energy

- Dr. Pritpal Singh, Professor and Chair of the Department of Electrical and Computer Engineering

From the Department of Mechanical Engineering:

- Dr. Amy Fleischer ME '91, MSME '96, Associate Professor
- Dr. Gerard Jones ME '72, Senior Associate Dean for Graduate Studies and Research and Professor
- Dr. Calvin Li, Assistant Professor
- Dr. Alfonso Ortega, Associate Vice President for Graduate Studies and Research, and the James R. Birlle Professor of Energy Technology
- Dr. Aaron Wemhoff, Assistant Professor
- Dr. Qianhong Wu, Associate Professor

Biomass Resources and Conversion Technologies

From the Department of Chemical Engineering:

- Dr. Justinus Satrio, Assistant Professor
- Dr. Michael Smith, Assistant Professor
- Dr. Zuyi Huang, Assistant Professor
- Dr. William Kelly, Associate Professor
- Dr. Dorothy Skaf, Associate Professor
- Dr. Randy Weinstein, Professor and Chair

Thermal Transport in Nano-Enhanced Phase Change Materials

Phase Change Materials (PCMs) absorb thermal energy during transient heating applications. They have been used successfully on small scales in solar energy systems, as energy efficient building materials, and in rugged portable electronics for the military and civilian first responders. In many larger systems, however, the low thermal conductivity of most PCMs results in a bottlenecking of heat at the source and poor utilization of the PCM mass. **Dr. Fleischer** is developing nano-enhanced PCM using unique graphitic nanofibers (GNF). Preliminary results show that these nano-enhanced materials offer improved transient response time and energy storage capability. Dr. Fleischer is exploring the fundamental energy transport mechanisms behind this improvement and, by using both experimental techniques and numerical simulations, is researching how these mechanisms drive the enhancement.



Dr. Ortega and research assistant Hari Podluri discuss microchannel heat transfer experiments conducted in the Laboratory for Advanced Thermal and Fluid Systems.

Environmental

From the Department of Civil and Environmental Engineering:

- Dr. Metin Duran, Professor
- Dr. Brian Chaplin, Assistant Professor
- Dr. John Komlos, Visiting Assistant Professor

Global Learning Community

- William Lorenz, Adjunct Professor, Chemical Engineering
- Dr. Pritpal Singh, Professor and Chair of the Department of Electrical and Computer Engineering

Sustainable Infrastructure and Materials

From the Department of Civil and Environmental Engineering:

- Dr. Leslie McCarthy PE, Assistant Professor
- Dr. Seri Park, Clare Boothe Luce, Assistant Professor

Villanova Urban Stormwater Partnership

From the Department of Civil and Environmental Engineering:

- Dr. Robert Traver, PE, WRE, MSCE '82, Professor and Director, Villanova Center for the Advancement of Sustainability in Engineering
- Dr. Andrea Welker, PE, Associate Professor
- Dr. Bridget Wadzuk CE '00, Associate Professor
- Dr. Ronald Chadderton, Professor and Chair, and the Edward A. Daylor Chair in Environmental Engineering
- Dr. John Komlos, Visiting Assistant Professor

Robert Traver, PhD, PE, WRE, MSCE '82

Director, Villanova Center for the Advancement of Sustainability in Engineering; Director, Villanova Urban Stormwater Partnership; and Professor of Civil and Environmental Engineering



Now in its third year, the Villanova Center for the Advancement of Sustainability in Engineering (VCASE) continues to exceed expectations. In an effort to sustain growth and establish a vision for the future, the Center has developed its own specific mission statement:

"VCASE seeks to protect and restore the environment through research on the integration of sustainability principles in engineering practice. To meet 'the needs of the present without compromising the ability of future generations to meet their own needs' mandates an inclusive, interdisciplinary, systems approach to research using the campus infrastructure as a test bed. VCASE follows Villanova's Sustainability Policy of supporting the concepts of sustainability in its curriculum, research and activities, to contribute to an environmentally sound and socially just society."

Research Areas

Research Collaborations

The College's emphasis on collaboration is evident throughout this publication. From intercollegiate teamwork (the KEEN grant on Page 28) to reaching across departments and colleges within the University, the value of working together toward a common goal cannot be overstated.

Here are just a few of the collaborative projects currently under way:

Continued Progress on Nova Mobile Health

Funding from Halloran Philanthropies enabled further progress on the interdisciplinary Nova Mobile Health project, which took first place in the 2011 Villanova Social Entrepreneurship Competition. Together with students from the colleges of Nursing and Business, Electrical and Computer Engineering majors developed Nova Mobile Health to bring health care services to remote, impoverished villages that have limited access to modern technology. The objective is to provide cell phones to health care workers without formal medical training, so they can text patient conditions to a central server from which trained physicians can review them and prescribe a course of treatment or care. The faculty advisor on this project is **Dr. Singh**, Professor and Chair of the Department of Electrical and Computer Engineering.

Brendan McCoy EE '11 shows health care workers in Nicaragua how to use new technology.



Dr. Kulkarni is joined by Eduard Bachmakov ECE '13 and Andrew Dammann MSCS '12 to demonstrate working prototypes to Comcast's senior management team.

Comcast Awards First Research Grant to Villanova University

In 2011, Comcast Corporation awarded its first ever university research grant to Villanova University, providing \$225,000 throughout the period of the next two years for PIs **Sarvesh Kulkarni, PhD**, Associate Professor of Computer Engineering, and **Vijay Gehlot, PhD**, Associate Professor of Computer Science in the College of Arts and Sciences. The professors' research focuses on aiding Comcast's efforts in effecting a smooth transition to a complete Internet Protocol version 6 (IPv6) network. While Comcast's Internet backbone already runs on this next generation technology, the last mile leading to the customers' homes and businesses does not. Drs. Kulkarni and Gehlot and their students, in partnership with Comcast's network architects, have begun developing new software tools and techniques to analyze and report on network performance. More specifically, the different aspects of the project include:

1. Analyzing the IPv6 network's health and state of readiness

Comcast currently collects huge amounts of technical data that is largely uncorrelated and does not lend itself to meaningful analysis in real time. The goal of the project is to aggregate, correlate, prune, and make parallel the processing of these huge data sets in order to compute and report in real time the health of Comcast's national network, which is in varying stages of IPv6 readiness.

2. Gauging "customer experience"

For active and preemptive diagnosis of the network's health, diagnostic software tools were designed to be embedded in customer-premise equipment such as home routers and cable modems. This allows Comcast to gauge customer perception of Internet service quality. The comprehensive test data generated by the automated tools also provides advance warning of possible performance problems developing in any part of the network.

3. Long-term planning by use of simulations

A challenging facet of this project is long-term traffic and capacity projection to predict the performance implications of outages on different network sections. In order to make such predictions, the plan is to model the various network subcomponents, define the interactions between these subcomponents, and simulate their behavior in software.

The first phase of the Comcast project has been completed, and a grant proposal for the second phase of the project is under review.

Progress on Roadside Blast Protection

Dr. Santhanam, Professor of Mechanical Engineering; **Dr. Jones**, Senior Associate Dean for Graduate Studies and Research, and Professor of Mechanical Engineering; and **Edmond J. Dougherty EE '69, MSCS '86**, visiting Assistant Professor of Electrical and Computer Engineering, have been collaborating with researchers at the U.S. Army's Benet Laboratory in Watervliet, N.Y., to develop an improved blast shield for military personnel protection. Their work focuses on enhanced energy dissipation and materials and structures historically used in lightweight blast-protection systems. The professors are working on a full government agency proposal and anticipate funding of about \$1 million for the College of Engineering to carry out this work.

Dr. Jones works with graduate student Ledjan Qato ME '10 on computer simulations for the Viscous Assist Armor System (VAAS) blast panel.



Advancing Use of Nanotechnology-Based Products

Dr. Feng, Assistant Professor of Mechanical Engineering, was awarded a \$60,000 one-year research grant from the Nanotechnology Institute (NTI) to study "low-temperature mechanical reinforcement of nanoparticle thin films," a project he developed in partnership with Daeyon Lee, PhD, Assistant Professor of Chemical and Biomolecular Engineering at the University of Pennsylvania. Dr. Feng's research to strengthen nanoparticle thin films (NTFs) will enable the commercialization of nanotechnology-based products for energy conversion and storage, display, water purification and biomedicine.

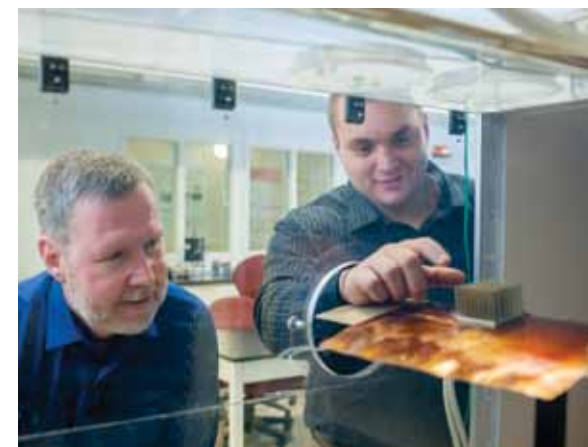
William Albert ME '12 and Dalmas Wambura ME '10, a graduate student in Chemical Engineering, work with Dr. Feng to conduct characterization experiments and analyses on NTF samples.



Taking the Heat off Electronic Equipment

Dr. Jones and **Dr. Ortega**, Associate Vice President for Graduate Studies and Research, and the James R. Birlle Professor of Energy Technology, Mechanical Engineering, are collaborating on a project to develop the best-possible cooler for heat-generating electronic equipment. A porous metal-matrix (PMM) cooler is considered because it presents a very large surface area for any given volume and is designed with a porosity that varies from point-to-point to maximize thermal performance.

PhD candidates **Jacob Kephart** and **John Podhiny BSME '00, MSME '04** are working on this problem from different perspectives. Kephart is using analytical methods and experiments within the mathematical frameworks of Constructal Theory and Separation of Variables. Podhiny is performing numerical studies by using a customized finite element approach, which is enabled by a user-defined element in the commercial code Abaqus.



Dr. Jones works with PhD student Jacob Kephart.

News Around the College of Engineering

Kern Family Foundation Awards \$625,000 to Entrepreneurship Program

With a three-year, \$625,000 **Kern Entrepreneurship Education Network (KEEN)** grant from the **Kern Family Foundation**, students in the Engineering Entrepreneurship minor have access to new intrapreneurship development and intercollegiate entrepreneurship opportunities. The Foundation's newly formed Helping Hands Dense Network (HHDN) is composed of engineering entrepreneurship programs at Baylor University, the University of Dayton and the University of Detroit Mercy, in addition to the College of Engineering. The College will work with the University of Dayton to facilitate intercollegiate projects, which will allow students to share resources and experiences in new collaborative ways. **Edmond J. Dougherty EE '69, MSCS '86, Assistant Professor of Electrical and Computer Engineering**, is director of the program, and additional faculty from each school will offer input.



Villanova Engineering students discuss collaborative projects with advisors and students from the University of Dayton.



Guest speaker Alberto Alemán Zubieta addresses the Villanova community as part of the Patrick J. Cunningham Jr. and Susan Ward '80 Endowed Lecture Series.

College Hosts CEO of Panama Canal Authority

Alberto Alemán Zubieta, CEO of the Panama Canal Authority, made a special presentation to students, faculty and members of the Villanova community as part of the **Patrick J. Cunningham Jr. and Susan Ward '80 Endowed Lecture Series**. Alemán was joined by a delegation from Panama, including Mario Jaramillo, Ambassador of the Republic of Panama, and a number of members of the Villanova University Alumni Panama Chapter, including **Aurelio Barria VSB '73, William Herron ME '73, Rolando Perez VSB '76** and **Roberto Mendez VSB '76**.

Alemán has been at the helm of the Canal for 16 years, serving in several leadership positions. During this time, the Panama Canal has become a world leader in services to the maritime industry and a cornerstone of the global transportation system. As the CEO, Alemán is overseeing the \$5.25 billion Panama Canal Expansion Project, which will have a significant impact on world maritime commerce.

In addition to reviewing the processes involved with launching, managing and completing a global project of such magnitude, Alemán fielded questions from **William Angiolillo CE '12** and **Ian Dardani ME '13**, who each have extensive experience with service engineering in Panama and kicked off the question-and-answer portion of the event.

The College of Engineering has a long-standing relationship with the people of Panama, including a new initiative to develop a water resources master plan for the growing region outside Panama City and annual service-learning trips in support of **The Rev. Wally Kasuboski, OSA's Chepo/Bayano mission**.

Students See a Greener Future at Engineers Week Sustainability Fair

As the centerpiece of this past year's National Engineers Week celebration, the College of Engineering hosted a "Careers in Sustainability Fair and Career Panel," featuring more than a dozen organizations that incorporate unique sustainable practices into their businesses. Students appreciated the opportunity to network with working professionals, share background on their studies and areas of focus, and receive advice about how best to market their skills for internship and work experiences. Exhibitors and panelists took advantage of the face time with students to share information about their sustainable practices and to meet potential new hires.

Exhibitors included ERM, Air Products and Chemicals, Exelon Nuclear, Weston Solutions, Johnson & Johnson, Waste Management, Eneractive Solutions, Steel ORCA, Michael Baker Corporation, Preferred Sands and the Villanova Center for the Advancement of Sustainability in Engineering.



American Concrete Institute Names Villanova a "2011 Excellent University"

For the second consecutive year, the **American Concrete Institute (ACI)** recognized the Villanova chapter of the organization for its commitment to ACI-related activities. This year, the ACI named Villanova a "2011 Excellent University," its highest university chapter honor. Only 22 schools nationwide received this award.

Collaboration Leads to Gold

Along with colleagues in the Kern Entrepreneurship Education Network (KEEN), which comprises engineering schools at 19 colleges and universities, the College earned the Gold Award in the category of Collaborative Networks and Support at the 2012 Edison Awards Gala. The event honors achievements in innovation and excellence in the development of new products and services.

College of Engineering Signs Educational Partnership Agreement with NAVAIR

The College of Engineering signed an Educational Partnership Agreement with **Naval Air Systems Command (NAVAIR)**, whose mission "is to provide full life-cycle support of naval aviation aircraft." Through this agreement, faculty and students will have access to the expertise of NAVAIR personnel and their advanced systems, facilities and technologies, while NAVAIR will be introduced to the next generation of future Navy engineers.

Graduate Studies Update

A Master's of Professional Practice

Throughout the past five years, the College of Engineering's PhD program has grown at a steady pace to its current enrollment of 43 students. While the College is certainly pleased with the success of the program, Dr. Gerard F. "Jerry" Jones, Senior Associate Dean for Graduate Studies and Research, has noted a side-effect of sorts. "As the PhD program has expanded, courses that were designed for our master's degree students became increasingly challenging. They started to look like doctoral level courses," he says.

To attract those seeking an advanced, but more practical master's degree, Dr. Jones and Dr. Gary Gabriele, Drosdick Endowed Dean, College of Engineering, have decided to refocus the graduate programs to be more appealing and valuable to working professionals. Dr. Jones envisions what the College will call a "Master's of Professional Practice." Students will graduate with a Master of Science in Engineering, but the program will offer learning that a practicing engineer can apply immediately. The College also wants to increase awareness of, and enrollment in, its award-winning distance-education program, which is ideal for the part-time student.

In addition to adjusting the content and methods of teaching, the College of Engineering also is developing new master's courses and certificates in topic areas where there is strong interest among professional engineers. Among the programs under consideration are:

- **Simulation-based engineering**
- **Biochemical engineering**
- **Cybersecurity**

Dean Gabriele has high hopes for this revamped graduate program. "As the job market becomes increasingly competitive, the importance of a graduate degree cannot be overstated. I want to double our master's enrollments during the next five years," he says.



The Learning Center at the Philadelphia Navy Yard offers a high-tech classroom experience both for those in-house and those taking distance-learning courses.

Graduate Students Dedicate Time to Service

Graduate student **Daniel Cain CEE '09** first discovered a passion for international service when he traveled to Peru as a freshman. He later participated in service work in Honduras, and spent more than two years in the Peace Corps after graduation. That experience connected him to former Peace Corps volunteer **Jordan Ermilio ME '98, MSWRE '06**, Director of Service Learning, and that relationship brought Cain full circle back to Villanova.

Cain is pursuing a Master's in Sustainable Engineering and will spend one full year of service abroad, taking classes through the distance learning program at the same time. In spring 2013, he will travel to **Panama** to work with the Panama Canal Authority on issues of water resource management and sanitation development. Cain hopes to learn from the Canal Authority's best practices in this area, and apply them in rural, international development scenarios in Panama and Nicaragua.

Cain's work demonstrates that service learning is not only for undergraduates. "We are integrating service learning activities into the graduate program because they complement the program's educational and research goals, and can be a distinguishing feature of a Villanova Engineering graduate degree," explains Dean Gabriele. He adds, "Service to the community is a core value of Villanova and one that we believe should be a part of every student's experience in the College—undergraduate and graduate."

Dan Cain's commitment to service has taken him to several Central and South American countries.

A Commitment to Outreach

The College of Engineering's nine local, regional and national STEM programs touch more than 650 students from sixth through twelfth grades each year. These programs illustrate Villanova University's Augustinian Catholic tradition of service and introduce the field of engineering to youth in underserved communities. As baby boomers retire, STEM programs help the College reach the best and brightest; those needed to compete in a global economy regardless of gender or ethnicity.

Briefly, the programs are:

VESTED (Villanova Engineering, Science, and Technology Enrichment and Development) brings 65 high school students each year, mainly from Philadelphia, to campus for engineering experiences and mentoring on Saturdays. Reports have shown that VESTED provides an understanding of engineering, improves performance in all subjects, and increases college attendance.

The national **Leadership Education and Development (LEAD)** program prepares academically gifted minority students for engineering and other fields at top universities. Each summer 30 high school students live on campus for three weeks, engage in hands-on experiences, learn about college and visit industry sites.

NovaCANE (Villanova Community Action by New Engineers) takes 50 Villanova students to middle and high schools where they conduct experiments and provide teacher

education. The students then work on follow-up projects. The classes that participate later experience hands-on activities during a day at the College.

First Tech Challenge (FTC). Villanova hosts a regional kick-off of this robotics event in the fall and then runs the competition five months later. The event draws more than 300 students. Villanova Engineering students also mentor teachers and students.



Dr. Dinehart explains the egg drop lesson to the sixth grade structural engineering club at St. Martin of Tours. The club was started by NovaCANE.

MATE (Marine Advanced Technology Education), a national, NSF-supported organization encouraging maritime STEM, partners with Villanova's Mechanical Engineering faculty and students to hold its regional Underwater Remotely Operated Vehicles contest. Villanova wrote the curriculum, runs the competition, and mentors teachers and students from about 30 middle and high schools from Virginia to New York.

In addition to its work around the world, Villanova **Engineers Without Borders** sends teams of undergraduate and graduate students to area schools and clubs.

Members of the Electrical and Computer Engineering department provide demonstrations to students and offer teacher training at an underserved school in **Brooklyn, N.Y.** They also host a visit to Villanova for a day of hands-on engineering.

Dr. Amy Fleischer, Professor of Mechanical Engineering, hosts **Girl Scouts** for a Day of Engineering. She presented a paper with related outcomes data at the national meeting of the American Society of Engineering Education.

Villanova Engineering brings **high school teachers** to campus to work with faculty on research projects and develop teaching modules for the classroom.

For more information about the College's STEM commitment, contact Dr. Stephen Jones, Associate Dean for Student and Strategic Programs at 610-519-5439 or s.jones@villanova.edu.



Jordan Ermilio, Director of Service Learning, works with students in the LEAD program.

A Global Commitment to Service

Service opportunities are one of the most memorable experiences many students have during their college career. Students may serve in Philadelphia and surrounding communities, in areas of need throughout the country, or, on the other side of the world. In 2011-2012, a highwater mark of 28 engineering students participated in service learning.

Mechanical Engineering junior **Philip Arets '13** is among those students who traveled internationally this year. Seeking an opportunity to engage his interest in alternate energy, clean technology and sustainable solutions to nature's challenges, Philip traveled to **Waslala, Nicaragua** with his team to address water supply issues. Often, students found they needed to actually create water supply systems that didn't exist. "I was surprised by the number of obstacles that stood between a community and the construction of what would seem to be a simple and small scale water system," says Philip. His teammates in Waslala were **Katherine Duggan ChE '13, James J. Costabile ME '13, Ellen Knapp ChE '13, Christine McQuade ChE '13, and Margaret Smith CE '14. James O'Brien**, Assistant Professor of Mechanical Engineering, led the group.



A local resident joins Electrical Engineering students Robert Callaghan '14, Thomas Certo '14, and MSSE graduate student John Beyer EE '11 in preparing to carry a solar powered refrigeration unit for medical supplies up the mountain in Nicaragua.

Another engineering student who discovered both the rewards and challenges of international service was **Fernando Rabell CE '13**. Seeking to "change the scope" through which he viewed things, Fernando traveled to **Bang Lung, Cambodia** with **Sam Olson ME '14, Hillary Guardo ME '13, Dr. Clayton**, Assistant Professor of Mechanical Engineering, and **Jordan Ermilio ME '98, MSWRE '06**, Director of Service Learning. In this remote village, the team spent time at the Caramanico School, built by **Anne and Thomas Caramanico PE, CE '71, MSCE '83**. They immersed themselves in the culture, identified needs (among them, a preschool), and worked with the community to determine how they might make a difference. Fernando was inspired to follow up on this experience by making the village's desired preschool the focus of his senior capstone project.

Engineering students and local residents are surrounded by the natural beauty of Bang Lung, Cambodia. From left: Director of Service Learning, Jordan Ermilio; Hillary Guardo ME '13; Sam Olson ME '14; Dr. Clayton, Assistant Professor of Mechanical Engineering; and Fernando Rabell CE '13



A fortuitous encounter on the flight to Cambodia resulted in an exciting opportunity for Fernando's teammate **Hillary Guardo**. On that flight she met Len Austin, head of the Golden West Humanitarian Foundation, which was established to address the critical issue of the country's landmines and unexploded ordinances (UXOs). He invited the group to the Foundation's test facility, and a

relationship was quickly established. Excited by what she learned during that visit, and with funding from Golden West, Hillary chose to create for her senior design project a cost-effective, simply designed humanitarian robotics device for the clearing of UXOs.

College of Engineering students also are making a difference in **Ifugao province, Philippines**. **Kyle Johnson CEE '13** spent his summer there, working on a solid waste management plan for the small rural town of Kiangan. Like Philip, he learned that some of the challenges related to these projects have nothing to do with engineering. "I was surprised to see how much politics were involved in actually getting things done. The budgeting and financing is incredibly challenging," he says. Since returning from his trip, Kyle has developed an independent study project working with **Dr. Komlos**, Assistant Professor of Civil and Environmental Engineering, to design an engineered landfill for the province. In addition

to providing him with a direction for his studies and career, Kyle admits that, "Because of the trip, I'm paying better attention in several of my courses, knowing that what I'm learning in the classroom has applications that I've seen in action."

To read how **Daniel Cain CEE '09** is getting involved in service through the College's graduate program, see Page 30. For more about the service program overall visit www.engineering.villanova.edu.



Students make trek to work site in Ifugao province, Philippines.

Industry Partnerships Benefit Companies and Villanova Students

Each year the College of Engineering partners with about 80 companies ranging from start-ups to Fortune 50 multinationals, and engages in activities from simple recruitment to advanced research. These arrangements ensure that companies have a pipeline of well-prepared future employees and that students have a practical understanding of the fields they are studying. Partnerships also provide companies with advanced research in areas of competitive importance.

Specific areas of partner involvement include:

- Support for the College's STEM outreach and other service programs
- Student scholarships and faculty fellowships
- Student Internships
- Funded senior design projects (in-house co-ops) in the Multidisciplinary Design Lab (MDL)
- Sponsored faculty-led research projects
- Guest lectures or serving as judges at student competitions

Here are a few examples of how current arrangements have been shaped (*most of these companies also hire Villanova students as summer interns and full-time employees*):

AECOM and McCormick Taylor

- Both companies have a three-year agreement to support College research and STEM outreach.

Michael Baker

- A three-year agreement supports research and teaching in the Villanova Center for the Advancement of Sustainable Engineering and the Villanova Urban Stormwater Partnership. Their experts also present guest lectures.

Air Products

- Air Products has a decades-long commitment to funding department programs, supporting STEM outreach, presenting guest lectures, and participating on boards and committees. They hire more College interns and full-time employees than any other company.



Villanova engineering students network with Lockheed Martin executives.



NAVAIR leadership tours the College's Radar Imaging Laboratory.

- Gifts that support laboratory facilities and capability expansions, or gifts in kind of equipment
- Service on departmental or College advisory committees

Boeing and Lockheed Martin

- These companies have shown long-term support for scholarships, senior design projects, STEM outreach programs, guest lectures, individual mentoring, and participation on College boards and committees. Boeing also provides summer faculty fellowships.

Precision Castparts Corporation/SPS

- The company provides substantial support for MDL projects and for the Formula SAE race car team. It also supports university-wide programs in multiculturalism.

Verizon Wireless

- Verizon is committed to major research support of the NSF-sponsored Industry/University Cooperative Research Center (IUCRC), and participation on boards and committees.

Comcast

- Comcast is a partner in the NSF-sponsored IUCRC, and funds a significant joint research project between the Department of Electrical and Computer Engineering, and the Department of Computer Sciences. Read more about this research project on Page 27.

For more information about these or other opportunities available to organizational and corporate partners, please contact Joe Borillo, Director of Corporate Relations, at 610-519-6947.

A Foundation of Support Thank You!

The College of Engineering gratefully acknowledges our donors for their contributions to the College during the 2012 fiscal year.

ENDOWMENT GIFTS

Endowment gifts create a lasting legacy in support of the College of Engineering and may be named for the donors or in honor or memory of someone, such as parents or a cherished professor. These gifts are fundamental to the health of the University and the College of Engineering as they reduce dependence on tuition revenues, provide a predictable source of income, enable the development of innovative programs, and attract exceptional students and faculty.

We would like to thank the following individuals for their exceptional generosity in creating the endowed funds highlighted below during the 2012 fiscal year. For a complete list of endowment gifts designated to the College of Engineering, visit our website at <http://eg.vu/gifts>. The minimum threshold to endow a fund at Villanova University is \$100,000.

Arthur A. Metzler

Arthur Metzler, PE '86 Endowed Engineering Entrepreneurship Fund

Thomas V. and Brenda F. Sanzone

Brenda F. and Thomas V. Sanzone '68 Endowed Scholarship Fund

Karl F. and Nancy Schmidt

Nancy and Karl F. Schmidt '78 Engineering Endowed Service Learning Fund

Bernard M. and Sigrun Giletta

The Daniel M. Giletta '11 Endowed Memorial Scholarship Fund

George P. and Mary Cain

Mary and George P. Cain '43 Endowed Scholarship Fund

Donald E. Schmitt

The Donald E. Schmitt '45 Endowed Scholarship Fund

George and Shirley Hoberg Trust

The Shirley and George G. Hoberg '45 Endowed Electrical Engineering Scholarship

James P. Dunigan

The Bernard F. and Helen E. Dunigan Memorial Endowed Scholarship Fund

Jennifer Fusilli

Donald P. Fusilli '73 Memorial Endowed Scholarship Fund

John A. and Frank P. Ermilio

The Ermilio Family Endowed Service Learning Fund

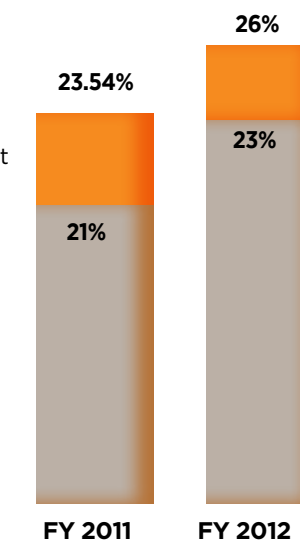


Dr. Chadderton, Professor and Chair, Department of Civil and Environmental Engineering and the Edward A. Daylor Chair in Environmental Engineering, congratulates Karl Schmidt CE '78, MCE '82 on his Meritorious Service Award from the Engineering Alumni Society.



Brenda F. and Thomas V. Sanzone Tom is a member of the board of the Villanova University Alumni Association and represents the College of Engineering.

Alumni Giving Has Increased!



College of Engineering Undergraduate Alumni
All Villanova University Undergraduate Alumni

To learn more about creating an endowed fund, contact Cynthia Rutenbar, Director of Development for the College of Engineering, at 610-519-6973.

For other ways to give, see Page 36.

Mike Gigliotti '70, Ed Dougherty '69, Assistant Professor and Director of Engineering Entrepreneurship, and Paul Varello '65



Other Ways to Give

ANNUAL GIFTS

Annual gifts to Villanova University and the College of Engineering provide critical resources that directly impact our students and faculty by supporting innovative teaching, research and service learning opportunities. This demonstrated commitment from alumni, parents and friends encourages additional support from foundations and corporations.

Make a gift now through the secure online gift form at www.villanova.edu/advance/development/makeagift. Or, call 1-800-486-5244.

An ongoing list of donors can be found on the College website at www.supportvillanova.com.

BEQUESTS AND PLANNED GIFTS

Alumni, parents and friends often make their most significant donations to the University through testamentary gifts, life-income gifts or the transfer of assets. These planned gifts enable individuals to

make larger gifts than they could make from their current income. While some planned gifts provide a lifelong income to the donor, others use estate and tax planning techniques to provide for Villanova and heirs in ways that maximize the gift and/or minimize its impact on the donor's estate.

The **1842 Heritage Society** recognizes and honors individuals who have made a bequest or planned gift. We invite you to visit www.villanova.edu/plannedgiving

to learn more about the benefits of joining the 1842 Heritage Society.

We welcome the following alumni to the 1842 Heritage Society:

- Armand A. Cote '61
- Michael S. '95 and Debra Curry '96
- Robert J. '59 and Margaret Merkert
- Henry P. Seager '66



Donor Spotlight: The Dearborn Family

For the Dearborns—John, Michele, Gregory and Christopher—Villanova's College of Engineering is like family. Gregory was part of 2012's graduating class in Chemical Engineering, and his brother Christopher is in the department's class of 2015. As members of the Parents Executive Committee, John and Michele are also part of the Villanova community. This year, as a family, the Dearborns made a

From left: John and Gregory Dearborn ChE '12, University President The Rev. Peter M. Donohue, OSA, PhD; Michele and Christopher Dearborn ChE '15.

generous contribution to the College which supported the renovation of two labs in White Hall. Dr. Weinstein, Associate Dean for Academic Affairs and a Professor in the Department of Chemical Engineering, expressed his appreciation for the Dearborns' commitment to the College, "Their support allows us to provide state-of-the-art research facilities for faculty, and both undergraduates and graduate students in Chemical Engineering."

When asked why the family decided to present this gift to the College, John and Michele Dearborn explained how the academic, social and spiritual growth of both of their children provided the stimulus for their gift. They also knew that their contribution would be put to good use: "By investing in these laboratories, the College has ensured that engineering students will have the resources they need to work on some of our most pressing societal challenges. Excellent facilities attract excellent talent, which results in an excellent education. We are delighted to be a part of the Villanova family and give back to the Villanova community in this small way."



Dr. Chadderton, Professor and Chair, Department of Civil and Environmental Engineering and the Edward A. Daylor Chair in Environmental Engineering; Kurt Conti '84, Gina Conti '84, and Dr. Gabriele, Drosdick Endowed Dean of Engineering

To learn how you can make a financial contribution to the College of Engineering, contact:

- Cynthia Rutenbar, Director of Development for the College of Engineering, Cynthia.Rutenbar@Villanova.edu

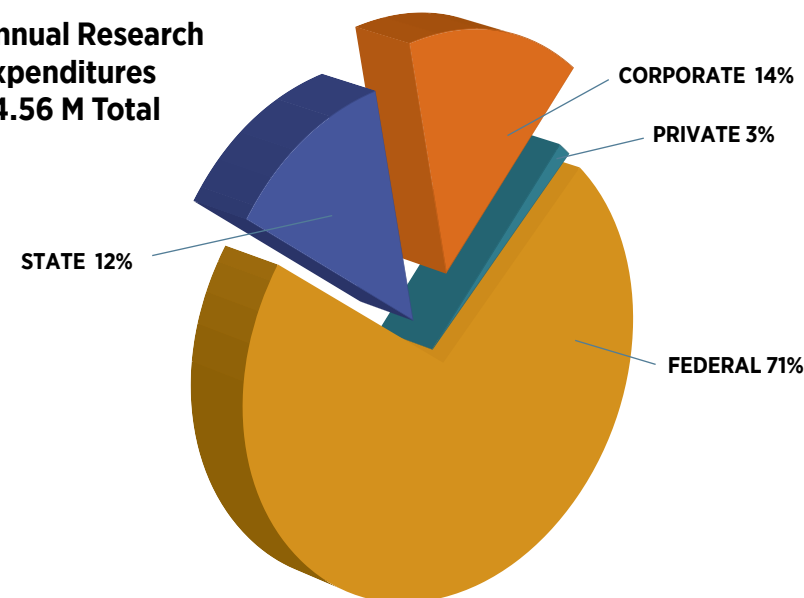
- Evan Zaletel, Major Gifts Officer, Evan.Zaletel@Villanova.edu

- Sean Grieve, Major Gifts Officer, Sean.Grieve@Villanova.edu

College of Engineering by the Numbers

Research Expenditures for Fiscal Year 2012

Annual Research Expenditures \$4.56 M Total



Career Choice, College of Engineering, Class of 2011*



Degrees Conferred at May 2012* Commencement

Total Bachelor of Science Degrees:	191	Total Master of Science Degrees:	141
BS Chemical Engineering	50	MS Chemical Engineering	13
BS Civil Engineering	55	MS Civil Engineering	39
BS Computer Engineering	16	MS Computer Engineering	13
BS Electrical Engineering	23	MS Electrical Engineering	25
BS Mechanical Engineering	47	MS Mechanical Engineering	29
		MS Sustainable Engineering	10
		MS Transportation Engineering	5
		MS Water Resources	10
		Total Doctoral Degrees	9

*denotes the most recent graduating class for which complete data is available

Retention

- Incoming class of 2011 returning to the College as sophomores in 2012: 91%



Did You Know?

For the 2011-2012 academic year, undergraduate applications to the College of Engineering hit an all-time high of 2,219. A record 97% of those students who enrolled were in the top 25% of their high school graduating class.