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 15,000 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.
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
REVIEWING THE blueprint for excellence

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)
Gary A. Gabrielle, 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—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 and research infrastructure

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:

- 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 Gabrielle 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.”

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

- Expand 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 Gabrielle.

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.

Innovative

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:

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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.

The Engineering Entrepreneurship minor engages students in collaborative project experiences and offers a sense of how engineers can respond to market needs. 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.

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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.

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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.

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 students 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.

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.
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 ’12 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.
- 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.

 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.

 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 softcleaning membrane technology-reactive electrochemical membranes (REMs)–that has great promise for mitigating membrane fouling and in the process reducing operational costs.
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 travelled 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.


- 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 Detection System 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 Detection System (CENDAC) and Professor of Electrical and Computer Engineering, and Ramazan Demirli, PhD, Director of the CENDAC Acoustics and Ultrasound Lab.

- Dr. Duran Christopher Darvell MSEE ‘13 performs solar cell testing.

- Dr. Wynne has advised students Mark Reimlinger BSEE ‘12 and Emily Battinelli BSEE ‘12 on projects involving the use of monoclonal antibodies (mAbs) for detecting specific antigens. This work is the development of a hybrid method for enhancing detection selectivity via antibody/antigen recognition and microwave radiation induced cellular transport.

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, realtime 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.
**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) 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 Achievement Award, a 2011 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) fall meeting — one of the most distinguished meetings in materials science and nanotechnology in the world.

**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 Islamel Parsai, PhD, of the University of Toledo, Dr. Li is determining the feasibility of a new thermodrivery-therapy 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 Engha, 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.

**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 Ortego, 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 Ashrafiuon, Professor, was appointed Director of the Center for Nonlinear Dynamics and Control (CENDAC). Read more on Page 22.
During his service trip to Panama, Ian Dardani ME ‘13 enjoys time with local children.

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

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

**Rebecca Welgand ME ‘13** - “Thermal response and stability of nano-enhanced phase change materials for practical applications,” mentored by Dr. Fleischer, Professor, Mechanical Engineering

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

**Antonio de la Mata**, Assistant Professor, Chemical Engineering

**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.

**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. Bielf 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

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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.

**Mechanical Engineering Student Wins Prestigious Scholarship**

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**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.

**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 Holquest EE ‘12, Emily Battinelli EE ‘12, David Falco EE ‘14 and Julia Musso ME ‘13, 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.

**Autonomous Surface Vehicle Team Takes Silver Medal at “Roboboat” Competition**

The Villanova Autonomous Surface Vehicle Team navigated its way to second place and a $5,000 prize at Roboboat 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 Hollihan ME ‘12, Alex Poultney ME ‘14, Mike Weber CpE ‘12, Lester "Jim" McMackin ME ‘13 and Shahriar Khan MSSE ‘13. The team was advised by Dr. Nataraj, Professor and Chair of the Department of Mechanical Engineering.
Hillary Guardo '13
Major: Mechanical Engineering
Hometown: Flemington, New Jersey
Activities
• Engineering Student Council and Activities
Hometown: Flemington, New Jersey
Major: Mechanical Engineering
Hillary Guardo '13
Campus Ministry service learning experiences
• President of the executive board of Villanova
Campus Ministry
• Put Engineering to the Business Test

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 students engineers tend to focus on.

Dylan White '13
Major: Civil Engineering
Hometown: Harrisburg, Pennsylvania
Activities
• WVU 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.

Emily Battinelli ‘12
Major: Electrical Engineering, Biomedical Minor
Hometown: Ellicott City, Maryland
Activities
• Research on Monoclonal Antibody Detection with Dr. Wynne
• Development of Solar-Powered Headlamp and Surgical Suction Device with Dr. Singh
• Service learning experiences with Water for Wasali 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

“Joe is the best, the brightest and the most well-rounded student with whom I’ve ever worked closely.”
—Dr. Satish, Assistant Professor, Chemical Engineering

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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 Engineering Student Council and Activities
Hometown: Flemington, New Jersey
Major: Mechanical Engineering
Hillary Guardo ‘13
Campus Ministry service learning experiences
• President of the executive board of Villanova
Campus Ministry
• Put Engineering to the Business Test

Putting Engineering to the Business Test
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PUBLICATIONS & PRESENTATIONs
Dr. Alfonso Ortega, Associate Vice President for Graduate Studies and Research, and the James R. Bire 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. 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, P.E., WRE, MSCE ’92, 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. Pittpal 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 region director 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.

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

Dr. Alfonso Ortega, along with two of his former research assistants, Bryan Hassell MSME ’09 and Hari Potturi 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.

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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.

**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 Comprehensive 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).

**Areas of research**
- Radial Imaging
- Sensor Technology
- Signal Processing for Communications
- Smart Antennas
- Synthetic Aperture Radar
- Radar Imaging
- Acoustics and Ultrasound
- Target Detection and Classification
- Antenna Design
- Radio Frequency Identification
- Low-profile Antenna Modeling and Measurements
- Microwave and RF
- Multimedia and Watermarking
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- Target Detection and Classification
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- Low-profile Antenna Modeling and Measurements
- Microwave and RF
- Multimedia and Watermarking
- Signal Processing
- Image Processing
- Machine Learning
- Data Analytics
- Biomedical Imaging
- Artificial Intelligence
- Cybersecurity
- Quantum Computing
- Internet of Things
- 5G and Beyond

**Research Awards**
- **Competitive Awards**
  - Dr. Fauzia Ahmad
  - Dr. Moeness Amin
    - PI, National Science Foundation, “Partnership for Innovation in Acoustic and Ultrasound Technologies for Medical and Industrial Applications,” $600,000 (2010-2013)

**Congressional Award**
- Dr. Ahmad Hoorfar, PI, DARPA/CTC,

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

**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. Ahmad Hoorfar, Professor of Electrical and Computer Engineering

**Center For Advanced Communications (CAC)**

**Fauzia Ahmad, 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.
CENDAC Highlights

- Dr. Ashrafiuon 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 15 students worked on CENDAC projects this past year.
- CENDAC faculty authored a total of 62 scholarly publications. Sergey Nersesov, PhD, Associate Professor of Electrical and Computer 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.”

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.

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

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

Research Initiatives

Acquisition and Analyses of Brain Waves

Dr. Ashrafiuon 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.

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

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.

CENDAC Faculty Researchers

- Dr. Garrett Clayton, Assistant Professor of Mechanical Engineering
- Dr. Verica Radisavljevic-Galic, 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. Darvesh 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
- Dr. C. ‘Nat’ Nataraj, Professor and Chair of Mechanical Engineering
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- 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

Innovations in Robotics Laboratory

- Nonlinear Stochastic Dynamical Systems
- Unmanned Surface and Underwater Vehicles Laboratory

Core Skills

- Biomedical System Dynamics
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- Nonlinear System Analysis and Design
- Nonlinear System Modeling and Identification
- Prognostics and Diagnostics
Villanova Center for the Advancement of Sustainability in Engineering (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 national Science Foundation proposals.
- 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.

VCASE Focus Areas and Faculty Researchers

Alternative and Renewable Energy
- Dr. Prtpal 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. Bible Professor of Energy Technology
- Dr. Aaron Wernhoff, Assistant Professor
- Dr. Qianhong Wu, Associate Professor

Biomas Resources and Conversion Technologies
- 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 Wainstein, Professor and Chair

Research Initiatives

Boron-doped Diamond Electrode Development
Dr. Chaplin is working with Advanced Diamond Technologies, a manufacturer of diamond electrodes, to develop boron-doped ultranano crystalline 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.

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.

Environmental
- Dr. Matin Daran, Professor
- Dr. Brian Chaplin, Assistant Professor
- Dr. John Komlos, Visiting Assistant Professor

Global Learning Community
- William Lorenz, Adjunct Professor, Chemical Engineering
- Dr. Prtpal Singh, Professor and Chair of the Department of Electrical and Computer Engineering

Sustainable Infrastructure and Materials
- Dr. Leslie McCarthy PE, Assistant Professor
- Dr. Sari Park, Clare Boothe Luce, Assistant Professor

Villanova Urban Stormwater Partnership
- 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

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

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

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.

Progress on Roadside Blast Protection

Dr. Santanam, 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 Ed整顿 Laboratory in Watervill, 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.

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.

Dr. Feng to conduct characterization experiments and analyses on NTF samples.

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

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:

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 Prof 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.

Taking the Heat off Electronic Equipment

Dr. Jones and Dr. Ortega, Associate Vice President for Graduate Studies and Research, and the James R. Birie 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.

Dr. Jones works with PhD student Jacob Kephart.

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

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.

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.

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.

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, ExxonMobil, Westcon 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.

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 students from the University of Dayton.

The Rev. Wally Kasuboski, OSA’s Chepo/Institute region outside Panama City and annual service-learning trips (KEEN) grant from 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.

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.
**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.

**Simulation-based engineering**

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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.

**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.”

**The 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.

**A Commitment to Outreach**

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.

**NovaCANES** (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 NovaCANES.

**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 10 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.
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.

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. 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.
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 College research and STEM outreach.
- 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.

**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 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 endowed gifts designated to the College of Engineering, visit our website at [http://eg.vu/gifts](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

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

DEGREES CONFERRED AT MAY 2012* COMMENCEMENT

The College of Engineering is home to 940 undergraduate students pursuing degrees in their respective fields. In May 2012, 346 degrees were conferred, ranging from Bachelor of Science degrees to Master of Science degrees. Of the 346 degrees conferred, 190 were Bachelor of Science degrees, 146 were Master of Science degrees, and 10 were Doctoral degrees.

Research Expenditures for Fiscal Year 2012

Annual Research Expenditures $4.56 M Total

STATE 12%

CORPORATE 14%

PRIVATE 3%

FEDERAL 71%

Career Choice, College of Engineering, Class of 2011*

Employed full-time: 67%

Full-time graduate school: 8%

Total: 75%

Total Bachelor of Science Degrees: 190

Total Master of Science Degrees: 141

BS Chemical Engineering 50

MS Chemical Engineering 13

BS Civil Engineering 36

MS Civil Engineering 27

BS Computer Engineering 16

MS Computer Engineering 13

BS Electrical Engineering 21

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

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

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