

# VILLANOVA

COLLEGE OF ENGINEERING

2007 – 2008 ANNUAL REVIEW



VILLANOVA  
UNIVERSITY

Drosdick Endowed Dean of Engineering  
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Falcone, Frank, & Glynn, Ed: CEE students  
in creek, p. 25

Johnston, Barbara: Prof. Dougherty, p. 15;  
VESTED, p. 17; Drs. Garret Clayton, Gang Feng,  
Jens Karlsson, and Aaron Wemhoff, pp. 18-19;  
Dr. Mercede and students, p. 27

Nogueras, Paola: EAS awards, p. 21;  
Dr. Fleischer and students, p. 29

Singelyn, Jane: Students in Ireland, p. 4

Smoke, Ryan: Amigos de Jesús, p. 17

Welsh, John: PWD, pp. 8-9; Angela Lynn Russo,  
Jevon Avis, and BEST Robotics, p. 17

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**On the Cover:**

Clockwise from upper left: Mr. John G. Drosdick, who is endowing the Dean of Engineering; an example of a CENDAC robot that navigates autonomously; a student building the frame of a car for an SAE competition; Villanova researchers on a data-gathering visit to a Philadelphia Water Department facility.

# Contents

<b>Message from the Dean</b>	<b>1</b>
<b>Fueling the Future</b> John G. Drosdick endows the Dean of Engineering.	<b>2</b>
<b>Making Our Better Best</b> The College takes steps to improve its already excellent undergraduate program.	<b>4</b>
<b>Degrees of Success / New MS in Sustainable Engineering</b> With its plethora of options, the graduate program accommodates the needs of today's engineers.	<b>6</b>
<b>Little Bugs, Big Effect</b> Villanova researchers work with the Philadelphia Water Department to create sustainable energy from biosolids.	<b>8</b>
<b>Had Lab—Would Travel</b> In the Laboratory for Advanced Thermal and Fluid Systems, researchers seek to understand complex thermal phenomena in cooling systems.	<b>10</b>
<b>Building Growth Engines</b> Engineering faculty, students, and alumni use their expertise to help spur economic development.	<b>12</b>
<b>Connecting Academics with Business</b> The Ben Franklin Technology Partners matches the College's expertise with industry needs.	<b>13</b>
<b>Field of Their Dreams</b> Engineering students undertake sports-related senior design projects that provide creative solutions and show commercial promise.	<b>14</b>
<b>Knowing His Own Mind</b> Senior Kyle Doolan has taken advantage of all that the College offers to grow as a researcher and leader.	<b>16</b>
<b>Student Achievements</b> Engineering undergraduates and graduates excel in academics and community outreach.	<b>17</b>
<b>Faculty Achievements</b> Current and new engineering faculty point the way to the future.	<b>18</b>
<b>Like Father, like Daughter</b> Engineering Advisory Board member Lisa Catania lives out the values instilled in her by family and at Villanova.	<b>20</b>
<b>2008 Engineering Alumni Society Awards</b> The EAS pays tribute to outstanding alumni at its annual reception and awards ceremony.	<b>21</b>
<b>Departments</b>	
Chemical Engineering	<b>22</b>
Civil & Environmental Engineering	<b>24</b>
Electrical & Computer Engineering	<b>26</b>
Mechanical Engineering	<b>28</b>
<b>Centers</b>	
Center for Advanced Communications	<b>30</b>
Center for Nonlinear Dynamics & Control	<b>32</b>
<b>Funded Research</b>	<b>34</b>
<b>Donors</b>	<b>38</b>

We've heard a lot about change this past year from our politicians. Dealing with and implementing change is what we engineers were educated to do. We're always changing, evolving, and innovating. Today's communications systems, computers, power plants, and health systems are improvements of earlier systems. Our penchant for improving things is part of our nature as engineers.

The past year exemplified how Villanova engineers' drive to improve applies to how we look at higher education. This was a year of reflection and action, during which students, faculty, alumni, friends, and administration contributed to making a strong program better. It was also a year in which the College achieved an unprecedented endorsement from one of our outstanding alumni whose belief in the College of Engineering will affect the lives of Villanova faculty and students in perpetuity.

John G. "Jack" Drosdick ChE '65, through a leadership commitment to endow the position of the Dean of Engineering, has ensured that the College will always be able to envision a better future and take the steps to implement it. As the former Chairman, CEO, and President of Sunoco, Jack Drosdick appreciates the importance of making the right choices about how to improve based on sound strategic planning. In looking at how the College is preparing itself for the future, he concluded that his gift will go directly to helping engineers build a better world.

To get an idea of the kinds of initiatives this endowed gift will support, one just has to look at the College's activities in this busy year. We came together to develop and initiate the first steps of a strategic plan that opens new avenues for intellectual, personal, and professional growth for students and faculty. As part of that plan, the curriculum for first-year students was retooled and will be in place in fall 2009. Graduate studies expanded as envisioned in the strategic plan, with growth in the doctoral program and the launch of a master's degree in Sustainable Engineering.

The College hired eight new faculty this year, a large number made possible only through the hard work of our current faculty. All of the new teachers attributed their choice of Villanova to the College's sense of community, combined with the demanding academic program, opportunities for scholarship and research, and the close interaction with students. We have hired 15 new faculty in the past three years, 25 percent of our total tenure-track lines, and they bring excitement and new thinking to our college community.



Engineering students again excelled not only in the classroom and lab but also in the community. Student-led service programs have brought hundreds of middle and high school students to campus this year to help develop future engineers. The College's chapter of Engineers Without Borders, as well as the Amigos de Jesús and Water for Waslala projects, provided students with real-world, leadership experience that will have a lasting impact on the students and the communities they serve.

As you will see in the pages of this review, this has been a dynamic year for the College of Engineering. Like all good engineers, we know that standing still is not an option.

Gary A. Gabriele, PhD

*Drosdick Endowed Dean of Engineering*

It seemed inconsequential at the time—just a passing conversation with Dr. Robert White, then Chair of the Department of Chemical Engineering. But as a result of that exchange, a young, searching John G. “Jack” Drosdick ChE '65 found himself being offered an assistantship at the University of Massachusetts—and, later, embarking on a career path that would culminate in his becoming the Chairman, CEO, and President of Sunoco.

# FUELING THE FUTURE

by Suzanne Wentzel

## JOHN G. DROSDICK ENDOWS THE DEAN



"I don't think any of that would have happened without the follow-up by Dr. White," Mr. Drosdick said. "That moment was a turning point in my life."

Memorable experiences such as these have inspired the now retired alumnus to create a lasting legacy for the College and for Villanova University. Thanks to Mr. Drosdick's \$2.5 million gift, Dr. Gary A. Gabriele and his successors will be known as the Drosdick Endowed Dean of Engineering. With this named position come recognition, prestige, and the financial resources to help the College realize its bold vision for the future.

"I hope that whatever impact I have will be on the University as a whole. I just chose to do it through the College of Engineering," said Mr. Drosdick, who recently completed a term as Chair of the Villanova Board of Trustees.

That impact will be significant. By endowing the deanship, the internationally renowned business leader is publicly endorsing the College of Engineering, which has been consistently ranked as one of the top ten undergraduate engineering programs in the country by *U.S. News & World Report*.

"In his decision to endow the dean's position, Jack has reinforced the strong academic reputation of the College of Engineering," said Rev. Peter M. Donohue, OSA, A&S '75, President of Villanova University. "This endowment will add distinction to the leadership of the College while also honoring Jack's legacy of leadership in business, in the community, and at Villanova. As Chair of the Board of Trustees, Jack was instrumental in bringing the University to new levels of excellence, and his gift will do the same for our College of Engineering."

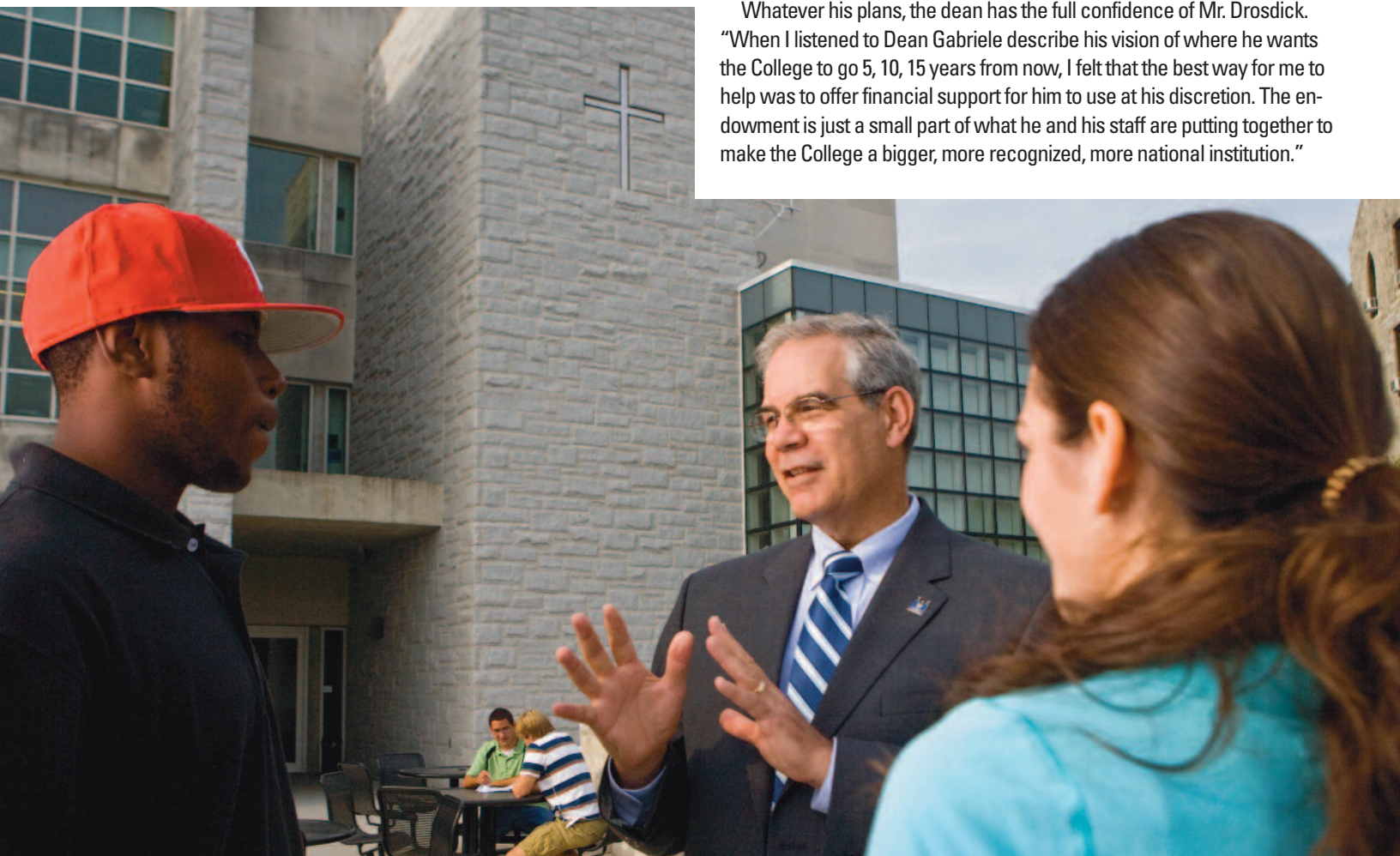
Besides increasing the visibility of the College, the endowment exemplifies for all alumni the importance of giving back to Villanova, a place where Mr. Drosdick believes that he and many others received far more than an academic education. "We had the opportunity not only to earn a degree but to be strengthened by the challenges of getting through school. Faith was right there in front of me, and I realized afterward how important it was to my success."

Making a financial gift at any level preserves the value of a Villanova education for generations to come. "Mr. Drosdick's generous gift is a meaningful investment in Villanova's future," said Michael O'Neill, Vice President for University Advancement. "Time and time again, he has demonstrated true leadership in his numerous roles at the University. Such dedication and commitment inspires others and is crucial for Villanova to remain a thriving, vibrant academic community."

The endowment also ensures that the dean will have a regular source of support with which to implement strategic initiatives that will carry the College forward, especially during times of economic uncertainty. "The endowment provides a solid foundation that can maintain the College at the level and quality it enjoys now," Dean Gabriele said. The dean's immediate goals are to

- improve the College's values-based education by more fully integrating ethics into the curriculum
- provide more explicit instruction to help students develop leadership skills
- involve every engineering student in service learning
- grow the research program and PhD enrollment to achieve national distinction among peer institutions

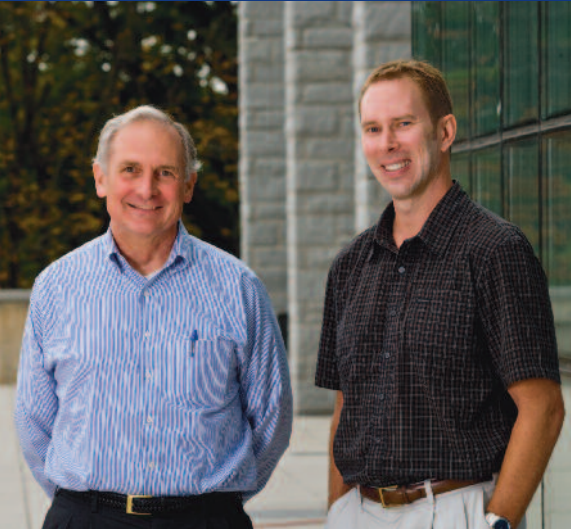
Whatever his plans, the dean has the full confidence of Mr. Drosdick. "When I listened to Dean Gabriele describe his vision of where he wants the College to go 5, 10, 15 years from now, I felt that the best way for me to help was to offer financial support for him to use at his discretion. The endowment is just a small part of what he and his staff are putting together to make the College a bigger, more recognized, more national institution."



What does a college do when its undergraduate program is consistently ranked in the top 10 in the country? It makes the program better.



# MAKING OUR BETTER



*Dr. Russell Gardner, Chair of the Department of Biology, and Dr. William Kelly, Associate Professor of Chemical Engineering, were two members of the multi-college Bioengineering Planning Committee.*

by Suzanne Wentzel

**In fall 2009, Villanova's College of Engineering will implement a revised freshman curriculum to promote, by innovative means, students' acquisition of technical knowledge and their development of professional skills. In addition, the College is working to broaden the entire undergraduate curriculum to include new design opportunities and minors, a global perspective, and an integrated approach to ethics.**

## Revised Freshman Curriculum

The plan is to have students take a lecture course containing technical content during the first seven weeks in the fall. In the next seven weeks, they will apply technical and nontechnical skills to carry out two projects. During the first half of the spring semester, freshmen will do two more projects. After declaring their majors, they will finish the year in their respective programs.

"Our goal is to provide freshmen with core fundamentals, interdisciplinary electives, and an introductory experience in their majors," said ECE's Dr. Frank Mercede, PE, a member of the Freshman Program Committee.

With its challenging technical content and hands-on learning, the curriculum should attract even more high-achieving students. "We think this could be the best freshman engineering program in the country," said Dr. Gerard Jones ME '72, Associate Dean of Academic Affairs.

*Michael Race (VSB), Daniel Slavik (EE), Michael Sayers (VSB), and Gregory Karambelas (ME), all of the Class of 2010, spent spring semester of their sophomore year at the National University of Ireland, Galway. They visited points of interest in the country, including Killarney National Park, and several European cities.*



Right: Students in the Creativity and Innovation course engaged in a videoconference with Jamie Hyneman, host of the Discovery Channel series MythBusters.

Left: Dr. Gerard Jones, Associate Dean of Academic Affairs, is Chair of the Freshman Program Committee.

# BEST



## Multidisciplinary Design Lab

Dr. Jones also is overseeing the development of a proposed Multidisciplinary Design Lab. In one model of the lab, sophomores would receive a semi-technical introduction to design concepts. By senior year, they would be ready to apply quantitative design skills to their industry-funded capstone projects, which they would carry out in the studio. "The lab will stimulate students and help them understand the context of design," Dr. Jones explained.

## Engineering Entrepreneurship Minor

A multidisciplinary minor in Engineering Entrepreneurship was developed by faculty in the College of Engineering and the Villanova School of Business. The first course, Creativity and Innovation, was offered in fall 2008. "Students learned that entrepreneurs don't just launch companies. They keep established ones fresh," said Professor Edmond Dougherty BEE '69, GS '86, one of the architects of the minor.

## Bioengineering Minor

Another multidisciplinary minor—this one in Bioengineering—is expected to be approved in 2009. The minor is the first to be offered by three colleges: Engineering, Liberal Arts & Sciences, and Nursing.

"Students from these colleges will learn with each other and from each other," said Dr. William Kelly (ChE), a member of the planning committee. The minor also will increase students' employment opportunities.

## Professional Skills

Professor Frank Falcone, PE, BCE '70, MSWRE '73, and Dr. Andrea Welker, PE, developed Professional Practices in Civil Engineering, a cutting-edge course that teaches students concepts such as management, public policy, and leadership. "Learning how to solve an equation is easy. Learning how to lead a team—that's hard," Professor Falcone said. The College wants to expose all engineering students to this material.

## Global Perspectives

To help students develop a global perspective in a "flattened" world, the College last year offered three extracurricular workshops: understanding diversity, cultural approaches to problem solving, and business etiquette around the world.

"We need to complement students' academic knowledge with this information," said Patricia Burdo, the College's Professional Development Administrator. The College is looking to integrate these topics into the curriculum.

## International Studies

Studying abroad also opens up the minds and horizons of students. "It helps engineering students achieve the global competence they need to solve problems," said Lance Kenney, Director of International Studies. For years, engineers did not think studying abroad was an option. "We have shown that, with careful planning, this perception is untrue," said Dr. Welker, who advises CEE students.

## Ethics

Ethics has always been a core component of the engineering program. However, Dr. Jones believes it should be incorporated into lectures and labs. "Engineers deal with ethics in an engineering context." The College is working with the Ethics Department to develop a workshop for faculty on how to integrate the theory and application of ethics into their lessons.



Many engineers put off graduate school because they can't find a program to suit their career needs or lifestyle. In Villanova's College of Engineering, key players have worked to remove this hurdle. As a result, the graduate engineering program, under the leadership of Dr. Alfonso Ortega, the Associate Dean for Graduate Studies and Research and the James R. Birlle Professor of Energy Technology, has increased its offerings of high-caliber, mix-and-match options. These choices make it convenient for engineers to further their education in emerging areas with professors who are nationally recognized experts.

# DEGREES OF SUCCESS



## **Dr. Alfonso Ortega**

*Associate Dean for Graduate Studies and Research and the James R. Birlle Professor of Energy Technology*

*by Suzanne Wentzel*

### **PhD Program**

During the past two years, the College's PhD Committee established policies and procedures to make the nascent doctoral program run smoothly. It also redefined the nature of the degree, which initially had been envisioned as multidisciplinary. "By limiting the breadth of the degree, we made it stronger," Dr. Ortega said. The committee's next step is to shape the PhD into a "distinctive" degree that integrates Villanova's unique strengths.

Of those students enrolled in the growing program, almost half are pursuing their degree on a part-time basis. John Podhiny BME '00, MME '04, appreciates the program's flexibility and exceptional faculty support. "Villanova is one of the few schools where you can use 'full-time industry engineer,' 'parent of a 4-month-old,' and 'PhD student' in the same sentence."

### **MS Program**

The greatest testimony to the College's appeal to working professionals is its flourishing part-time MS program. "It is one of our core strengths," Dr. Ortega said, "but we have not come close to reaching our capacity for the program."

To that end, the College is looking to increase its distance-education capacity so that it can provide more Web-deliverable lectures. It also has revved up its marketing efforts, focusing primarily on an electronic campaign to advertise the program's distinctive degrees and online options.

Dr. Ortega's next challenge is to expand the full-time program. "We should grow in the areas of graduate education and research in a way consistent with the values for which we are known at the undergraduate level."

### **Distance Education Program**

The number of online courses offered continues to increase, as does enrollment. Although several factors account for this growth, the main reason why distance students choose Villanova is the quality of its award-winning Distance Education program. "We do whatever we can to support the graduate program and stay at the leading edge of delivery technology," said Distance Education Director Sean O'Donnell CPE '00.

### **Certificate Programs**

Engineers who want to broaden their knowledge without pursuing a master's degree can enroll in one of 17 graduate certificate programs. By taking an average of four courses, professionals can demonstrate that they have acquired expertise in a particular area. Certificates are especially beneficial for those who are changing career paths.



Many graduate students choose to take advantage of the College's five-year, bachelor's-master's degree program.



## NEW MS IN SUSTAINABLE ENGINEERING

by Suzanne Wentzel

Drawing on its expertise in areas such as water resources, alternative and renewable energy, and the environment, the College of Engineering is developing a multidisciplinary MS in Sustainable Engineering, which is expected to be fully rolled out in 2009 and available online.

"The new degree is another sign that the College is preparing its students for the future of engineering," said Dr. Randy Weinstein, Chair of the Department of Chemical Engineering. "The next generation must be able to tackle the difficult, complex, multi-disciplinary problems of sustainability and energy."

The curriculum will consist of three core courses that introduce students to the broader issues of sustainability. The first one, Sustainability and Climate Change, was offered in fall 2008. After completing the core courses, students can pursue one of several specialty tracks: watershed sustainability, alternative and renewable energy, environmental sustainability, and eventually, it is hoped, sustainable infrastructure.

Bill Lorenz ChE '68, the adjunct faculty member teaching the first two courses, has extensive experience as an environmental engineer and a consultant for sustainability in industry. He has played a pivotal role in developing this timely and necessary curriculum. "The world is overusing resources and contaminating the atmosphere," Professor Lorenz said. "We need to take a fundamental look at how humans live on earth."

Adjunct Professor Bill Lorenz ChE '68 helped develop the curriculum for the degree in Sustainable Engineering.

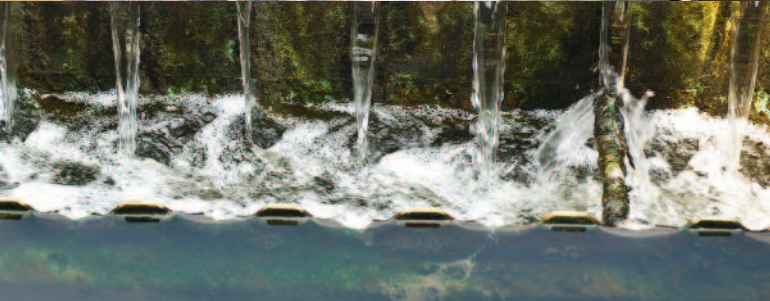


Villanova is helping the world get along better with methanogens, which is good because they are pretty much everywhere. Methanogens are single-celled, anaerobic microorganisms. There are about 50 species of them, and they live in a wide variety of places, including extreme environments such as thermovents and geysers, solid rocks, glacial ice, and desert sand. They might even live on Mars. They also live in less exotic places such as wetlands and the guts of animals, including humans. No matter where they live, they produce methane as part of their metabolic process.

# LITTLE BUGS, BIG EFFECT

by Burton Lane





*PWD Process Manager Douglas Cowley, PE (ChE '87), who has been instrumental in providing feedback to the Villanova researchers, meets with graduate student Cem Unlu (left).*

Depending on what you do with it, methane can either be a source of sustainable energy for heat or electricity through cogeneration, or it can be released in the atmosphere, where it is about 20 times more potent than CO<sub>2</sub> as a greenhouse gas.

The Philadelphia Water Department (PWD) is very interested in methane because it produces a lot of it. PWD treats roughly 500 million gallons of wastewater, mostly sewage, every day. Biosolids, a by-product of wastewater treatment, are further treated in 2-million-gallon capacity tanks called digesters. Methanogens in those digesters break down biosolids into more stable products, mainly methane and CO<sub>2</sub>. The methanogens act on the biosolids in a way that is similar to the way yeast acts on hops. However, instead of producing beer, they produce stabilized biosolids and biogas. About 70 percent of the biosolids are then processed for use as a filling material for mine reclamation or as a nutrient supplement for the agricultural industry. The remaining 30 percent of biosolids are sent to landfills (where they produce more methane). The biogas (about 70 percent of which is methane) is burned off at the treatment plant.

Currently, the digesters at PWD wastewater treatment plants produce approximately 400,000 kWh worth of methane daily, enough to supply energy to 13,000 households. As large as this amount seems, because of the costs and other issues associated with

*During a data-gathering visit to a PWD facility, the Villanova team, led by Dr. Metin Duran (right), review progress in their research on methane production for use in cogeneration. Shown with Dr. Duran are (from left) graduate students Alba Bega and Cem Unlu and research associate Dr. Cheol Park.*

building a cogeneration facility, it is not enough to make it cost effective. PWD's goal is to produce less sludge and even more methane. Less sludge reduces disposal costs and is better for the environment. More methane would make it economically feasible to create and sell power through cogeneration and would also be better for the environment. This is a challenge that a few other water departments in the country are also seeking to meet, each looking for solutions that are appropriate to the specific system.

To accomplish this goal, PWD turned to Dr. Metin Duran, in the College's Department of Civil and Environmental Engineering. Dr. Duran is a nationally recognized expert on methanogens. He and his research associate, Dr. Cheol Park, along with a team of graduate students, work in their laboratory and at one of PWD's treatment facilities to optimize how three species of methanogens – Methanobacterium, Methanosaeta, and Methanosarcina – can more fully metabolize the biosolids. Specifically, they are looking at engineering (as opposed to biochemical) variables such as what the optimum retention time is for the methanogens to work, how much stirring they should get, and what kind of nutrients they should have. The research is also designed to set up an environment in which only the right kind of methanogen predominates among all of the other microorganisms that may be in the digesters but not producing enough methane.

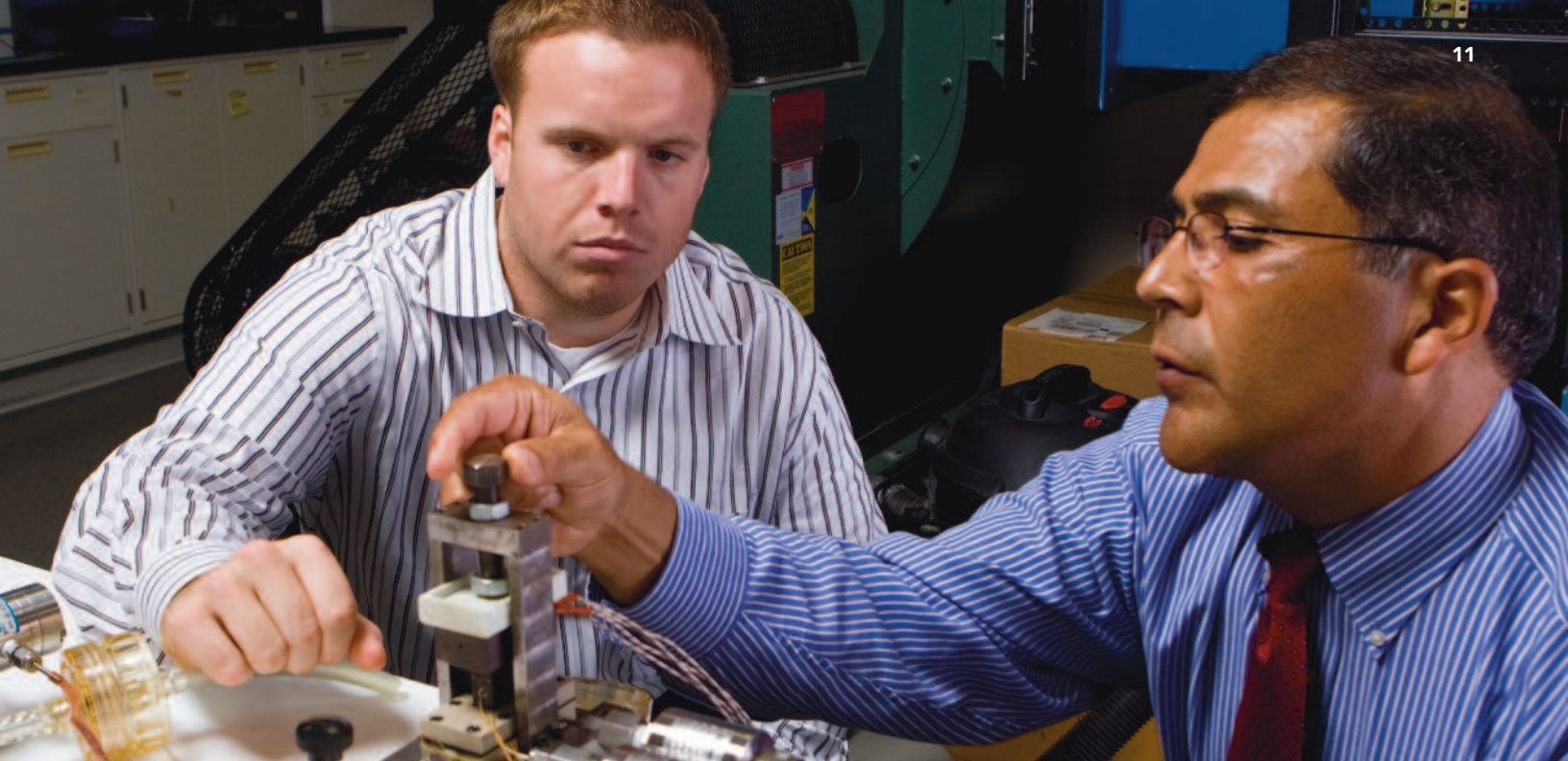
The research is being carried out as a result of a nationally competitive, multi-year contract from PWD that was awarded in early 2008 to Villanova and Brown and Caldwell, a national engineering firm. "The new knowledge generated through this multi-year contract could create a healthier environment not just in Philadelphia, but everywhere," said Dr. Duran. "Imagine the impact if just 10 percent of the world's treatment plants could harness the potential residing in these bugs."

It was a logistical tour de force. In summer 2006, Dr. Alfonso Ortega, working out of his NSF office in Virginia, orchestrated the transfer of the lab he had built up at the University of Arizona to Villanova University, where he would be launching a new phase of his career as the James R. Birle Professor of Energy Technology. A difficult task under any circumstances, the move was made harder by the fact that the lab consisted of wind tunnels, specialized rigs, and other large apparatus. "As an experimentalist, I had accumulated a lot of equipment in 18 years," said Dr. Ortega, who recently was named the College of Engineering's Associate Dean for Graduate Studies and Research.

# HAD LAB—WOULD TRAVEL

by Suzanne Wentzel





Now after two years, the Department of Mechanical Engineering's Laboratory for Advanced Thermal and Fluid Systems (LATFS), housed in CEER, is running at full speed. Part of reestablishing the lab was finding and initiating personnel to continue Dr. Ortega's research. "Fortunately, I did not have any trouble recruiting talented students." His research group comprises six graduate students (four of whom are PhD candidates) and seven undergraduate research assistants. Dr. Ortega has two goals for his lab: to be the premier thermo-fluids lab in the country and to be the finest training ground for the next generation of researchers.

Dr. Ortega is an expert in the cooling of electronic systems. He has conducted internationally recognized research and has been an invited speaker at symposia in countries such as Chile, China, and Korea. The current focus of Dr. Ortega's lab is on finding innovative ways to use liquids such as advanced refrigerants to cool today's electronic systems, which, because they are smaller and faster, can no longer be cooled by air.

For example, Dr. Ortega's research group has been experimenting with the use of liquid-cooled, miniaturized heat sinks to absorb and dissipate the heat from processors. The researchers use state-of-the-art experimental and computational techniques to unravel detailed, complex phenomena, thereby enabling improvements in the design of thermal management systems.

Another branch of Dr. Ortega's work focuses on the challenging issues that arise in the cooling of gas turbines. "Turbines present really hot, nasty flow environments, and yet we have to design them so that the metal survives." In Arizona, Dr. Ortega had collaborated with industry partners to develop sophisticated cooling processes and for five years served as an executive consultant. "That was one of best experiences I've ever had, and in every way it made me better. I came to understand not only the problems but the processes necessary to create a real engineering system." Now that his lab is rebuilt, Dr. Ortega can continue working with these partners on this research.

*The LATFS team, which includes PhD, MS, and undergraduate researchers, uses experiments and computer simulation to better understand complex thermal phenomena in cooling systems.*

*For further information, visit the laboratory's Web site: [www.villanova.edu/latsf](http://www.villanova.edu/latsf)*

Colleges and universities drive economic development in today's globalized economy. Regions and countries that have more educated workers attract and retain knowledge-based employers. Graduates, especially those from engineering schools, may start new companies near their alma maters. And finally, faculty researchers often develop partnerships with businesses to commercialize new knowledge – the process known as technology transfer.

# BUILDING GROWTH ENGINES

by Burton Lane



Villanova engineering students, faculty, and alumni play active roles in all of these areas. The College just started a new Engineering Entrepreneurship undergraduate minor, and the annual “Beyond Ideas: The Art of Entrepreneurship” conference brings together students and internationally recognized entrepreneurial alumni. Engineering faculty have filed more patents and assisted more companies recently than at any time in the College’s history. Growing interest in commercializing knowledge results from macro trends and from faculty, student, and alumni involvement. A key element has been direct encouragement from the Commonwealth of Pennsylvania’s Department of Community and Economic Development (DCED).

DCED invests in targeted growth areas to spur the state’s economy and promote collaboration among business, higher education, and communities surrounding the colleges. Since 2004, DCED has established 29 Keystone Innovation Zones (KIZs), designed to encourage technology-based new businesses through tax incentives, grants, and partnerships with higher education and community organizations, as well as other support. In 2006 Villanova partnered with other organizations, many in and around the City of Chester, to form the Delaware County KIZ.

DCED established two complementary programs: the Keystone Innovation Starter Kit program, which helps Pennsylvania’s Institutions of Higher Education recruit top researchers, and the Keystone Innovation Grant, which fosters technology transfer. Villanova has received more than \$500,000 in grants through these programs. Since January 2008, involvement with the KIZ has helped Villanova and its partners create three new businesses, save more than 300 jobs, and develop many technology transfer and entrepreneurship initiatives.

These and other programs, including BFTP (please see the article on the facing page), have helped Pennsylvania develop a more sustainable economic base while making Villanova a more interesting engineering school.

*Dr. Pritpal Singh, Chair of the Department of Electrical and Computer Engineering, is the principal investigator on the KIGs, which encourage entrepreneurship and technology transfer.*



# CONNECTING ACADEMICS WITH BUSINESS

by Burton Lane

## Ben Franklin Technology Partners brings together university experts and technology companies

Since 1992 the Ben Franklin Technology Partners of Southeastern Pennsylvania (BFTP/SEP) and Villanova's College of Engineering have created new jobs, strengthened Southeastern Pennsylvania's technology-based businesses, and provided real-world experiences for students and faculty.

BFTP/SEP, celebrating its 25th anniversary, invests in entrepreneurs and innovative technology companies and creates commercialization pathways by partnering throughout the region. The entrepreneurs and companies depend on being the first to solve a critical problem in their industry. The people who work for BFTP are in unique positions to help. By developing relationships with their region's companies and with area colleges, they are able to match industry needs to academic experts. Frequently BFTP/SEP is able to bring in grants or in-kind support to help the process of transferring theoretical knowledge to the workplace.

The 16-year relationship between Villanova and BFTP/SEP began with faculty in the Center for Advanced Communications (CAC). In the last four years, there have been more than 20 projects, valued at more than \$850,000. BFTP/SEP is also a partner with Villanova and other organizations in the Delaware County Keystone Innovation Zone, where it plays an important role in fostering an entrepreneurial spirit and keeping talented graduates in the region.

Some of the ways BFTP/SEP has worked with Villanova include

- helping businesses and Villanova jointly apply for SBIR (Small Business Innovation Research) and STTR (Small Business Technology Transfer) program grants
- helping Villanova apply for Partnership for Innovation (PFI) grants from the National Science Foundation (NSF)
- finding state and federal funding opportunities for equipment and postdoctoral researchers in areas that have a bearing on technology transfer
- arranging direct research partnerships between faculty and companies

*Dr. Yimin Zhang, of Villanova's Center for Advanced Communications, worked with BFTP/SEP's Dr. James R. Woods (left) and Richard P. Thompson, PE (EE '64, right), on an NSF-sponsored project that involved 14 businesses in the region.*

The far-reaching impact of BFTP/SEP's partnership with Villanova can be seen in a recent \$600,000 PFI grant from the NSF. This grant to Villanova and BFTP/SEP was built on Villanova's strength in wireless communications, antenna design, and thermal management within the CAC. With the help of BFTP/SEP's network, the partnership—which was led by CAC Director Dr. Moeness Amin—has included two other universities, three federal laboratories, 14 small and large companies, two community colleges, and a local high school.

In recent years, Villanova has been fortunate to have two field representatives, Dr. James R. Woods and Richard P. Thompson, PE (EE '64), who have developed excellent working relationships with the faculty and administration in the College of Engineering. In speaking of the partnership, Dr. Woods said, "We always enjoy working with Villanova because the faculty are usually excited about the opportunities represented by the engagements that we can bring them. This degree of interest in being a part of the region's economy makes Villanova an ideal partner with BFTP/SEP."

How does a pool player decide which pocket to sink a ball into? Can an umpire be sure that a pitch caught the outside corner of the plate? Engineering students at Villanova University are seeking creative solutions to these and other challenges that arise in the world of amateur and professional athletics. Some of those solutions are making—or have the potential to make—their way into the marketplace as viable, cost-saving products.

# FIELD OF THEIR DREAMS

by Suzanne Wentzel





Professor Edmond Dougherty's company, Ablaze Development, built the first version of Wavecam™, an aerial, mobile, robotic camera used in sports and entertainment venues.



For the past several years, Visiting Assistant Professor Edmond Dougherty BEE '69, GS '86, has worked with the Athletic Department to develop a variety of sports-related capstone design projects, from instrumented football helmets that measure impact, to robots that draw lines and logos on football fields, to a high-speed aerial camera for use in the broadcast of auto and horse racing. Several teams of students have received corporate funding, manpower, and equipment.

According to Vincent Nicastro, Director of Athletics, this collaboration benefits everyone. "The students are engaged in hands-on, innovative learning that underscores the integration of academics and athletics, which has been a crucial part of Villanova's fabric for many years."

Already the commercial possibilities of projects are being realized. For example, a company is working with Professor Dougherty to debut BestShot. These computerized boxing gloves measure the force of each punch and then transmit that information to a ringside computer, which automatically creates a graphical overlay for broadcast during the live fight. The Nevada Boxing Commission has already approved this technology.

In addition, students continue to do projects related to two different types of aerial cameras. Wildcam is a low-cost version of Skycam, the Emmy Award-winning camera that Professor Dougherty helped design and that has revolutionized sports broadcasting. Eventually, it will be installed in the Jake Nevin Field House and the Pavilion.

Wavecam™ is an aerial, mobile, robotic camera technology for the sports and entertainment markets. Professor Dougherty's company, Ablaze Development, which performs applied R&D in technological fields, built the first version and then spun off a separate entity, Wavecam Media, to manufacture, sell, and install the product.

To give students an industry experience, Professor Dougherty invites them to work on their projects at Ablaze Development, which is only a block from campus. "They get lab space, a chance to talk to engineers, and access to our resources." Students appreciate these opportunities—and the positive attitude with which Professor Dougherty approaches their work. "He's an excellent advisor and encourages us to develop any ideas we have," said Kelly Mehaffey ME '09.

In addition to partners on campus, Professor Dougherty and his colleagues are now developing capstone projects with Purdue University, Sportsvision (which provides sports-television enhancements such as the virtual first-down line in football), and Jamie Hyneman of the Discovery Channel's *MythBusters*. "We want to teach students how to communicate with outside entities, as that is a critical skill in business."

Multidisciplinary teams of students and faculty develop sports-related capstone design projects. Front row: Robert Sorbello EE '09, Louis Criso CPE '09, Francis Kitrick CPE '09, Kelly Mehaffey ME '09. Back row: Dr. Young Chun (ME); Vincent Nicastro, Director of Athletics; Professor Edmond Dougherty (ECE); Ryan Lewis ME '09.

As a senior at Bishop Guertin High School in Nashua, New Hampshire, Kyle Doolan had a mission: to find an outstanding engineering program that focused on undergraduates. His quest led him to Villanova University. Four years later, Kyle has found everything he wanted—and more. “Here, undergraduates receive a high-level education and play an important role in research. Also, they have access to their professors—not just to talk about what they got right or wrong but to ask, ‘What if?’”

# KNOWING HIS OWN MIND

by Suzanne Wentzel

Villanova offers its students many opportunities to thrive, and Kyle has capitalized on them. As a freshman in Chemical Engineering, he was fascinated by chemistry’s relationship with biology and the everyday world, so he decided also to pursue the College of Liberal Arts & Sciences’ new degree in Biochemistry. “I am an engineer first, but understanding biochemistry has been beneficial, especially in the research I’ve done.”

That research began in his sophomore year, when Kyle worked on a senior capstone project. This experience introduced him to important techniques and ignited his interest in research. During that summer and the next, he participated in cancer-therapy studies at MIT. An unexpected bonus: the doctoral candidate with whom he worked was a Villanova graduate.

These experiences prepared Kyle to undertake his own capstone project this year: the cryopreservation of mammalian cells. Because the project is new, Kyle is especially grateful to be collaborating with two expert advisors: Dr. Jens Karlsson, Associate Professor of Mechanical Engineering, and Dr. William Kelly, Associate Professor of Chemical Engineering. “Kyle is extremely capable, assuming responsibility not just for the execution of experiments, but for the choice of techniques and design of experiments—as a graduate student would,” Dr. Kelly said.

In addition to excelling at his studies—he belongs to Gamma Sigma Epsilon Chemistry Honor Society, is on the Dean’s List, and has received many awards—Kyle serves as President of the International Society of Pharmaceutical Engineers, Vice President of the American Institute of Chemical Engineers, and member of the University’s Board of Academic Integrity.

After graduation, Kyle plans to pursue a PhD and possibly teach at a university. “In academia, you have a great environment in which to keep learning and an opportunity to give back and to mentor other people.”

It seems that Villanova can also say, “Mission accomplished.”





During the College of Engineering's Recognition Ceremony in May, Dean Gary Gabriele presented Angela Lynn Russo (CE) with the Engineering Alumni Society's **Robert D. Lynch Award**, which is given to a graduating senior for outstanding academic achievements and community service.



In addition to earning his MME, Jevon M. Avis (pictured here with Dr. C. Nataraj, Chair of the Department of Mechanical Engineering), received the **Graduate Student Research Excellence Award** for his exemplary work in the area of research.

## STUDENT ACHIEVEMENTS



Each fall about 300 students from middle and high school robotics clubs throughout the region come to Villanova for a major kickoff event (shown here) of the **BEST (Boosting Engineering, Science and Technology) Robotics competition**. Villanova students partner with the School District of Philadelphia to host the event, mentor students, and run the regional competition.



During the ninth **mission trip to Amigos de Jesús**, an orphanage in Honduras, Drs. David Dinehart and Shawn Gross (CEE) and 16 students built 20 foundations for an elementary school (shown here). In March, Dean Gary Gabriele, Dr. Bridget Wadzuk (CEE), Jim O'Brien (ME), and ten students went to Nicaragua to collect information from three sites so that new water supply systems could be designed.



**VESTED (Villanova Engineering, Science and Technology Enrichment and Development)** opens the world of engineering to high school students who come to Villanova on Saturdays in the spring and on weekdays in the summer to conduct experiments in various engineering disciplines. Villanova students, primarily from the Service Learning Community, serve as mentors.



In August, a multidisciplinary team of engineering students traveled to the Space and Naval Warfare Systems Center in San Diego to participate in the first annual **International Autonomous Surface Vehicle Competition**, sponsored by the Association for Unmanned Vehicle Systems International (AUVSI) and the Office of Naval Research (ONR).



The teacher-scholar model continued to be the hallmark of the engineering faculty. The opportunity to work closely with students while engaging in scholarship and research attracted new faculty with expertise in leading technology areas.

# MARKS OF EXCELLENCE



## ENGINEERING

### NEW FACULTY



### Innovative Teaching Award

**Randy Weinstein, PhD**, Professor and Chair of the Department of Chemical Engineering, was one of two Villanova faculty members to receive the newly instituted Faculty Award for Innovative Teaching. Dr. Weinstein's distinction was announced at commencement in May.

A member of the Villanova faculty since 1998, Dr. Weinstein is proud to be part of a university that regards teaching as the faculty's primary responsibility. "You can put time and effort into teaching and know that it will be appreciated."

This award is given to faculty members who incorporate creative strategies, such as interdisciplinary teaching, effective use of technology, and exemplary distance learning.

**Garrett M. Clayton, PhD**  
**Assistant Professor,**  
**Mechanical Engineering**

- Instrumentation and control for high-speed nanotechnologies; image-based control of scanning probe microscopes
- BS, Mechanical Engineering, Seattle University
- MS, Mechanical Engineering, University of Washington
- PhD, Mechanical Engineering, University of Washington

**Noelle Comolli, PhD**  
**Assistant Professor,**  
**Chemical Engineering**

- Biomaterials and drug delivery; polymers; tissue engineering
- BS, Chemical Engineering, University of Delaware
- PhD, Chemical Engineering, Drexel University

## Faculty Scholarship

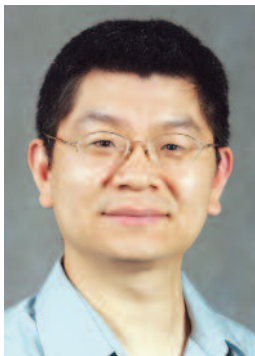
In addition to teaching and conducting research, engineering faculty contributed to numerous conferences and publications, and shared their expertise with various organizations.

Journal Articles Published	54
Conference Proceedings Published	119
Conference Papers Presented	100
Books or Monographs	1
Edited Books	3
Chapters in Scholarly Books	7
Published Book Reviews	6
Other Publications	31
Grant Applications	127
Service on Editorial Boards & Professional Leadership	117

## Faculty Promotions

- Dr. David Dinehart, Department of Civil and Environmental Engineering, was promoted to Professor.
- Dr. Sarvesh Kulkarni, Department of Electrical and Computer Engineering, was promoted to Associate Professor with tenure.
- Dr. Robert Traver, Department of Civil and Environmental Engineering, was promoted to Professor.

# FACULTY ACHIEVEMENTS



### Gang Feng, PhD

#### Assistant Professor, Mechanical Engineering

- Nanomechanical characterization and modeling; rational design of advanced nanomaterials and nanostructures
- BE, Materials Science and Engineering, Tsinghua University
- MPhil, Mechanical Engineering, the University of Hong Kong
- PhD, Materials Science and Engineering, Stanford University



### Jens O.M. Karlsson, PhD

#### Associate Professor, Mechanical Engineering

- Cryopreservation of cells and tissue engineered devices; thermodynamics and kinetics in biological systems
- SB, Physics, MIT
- SM, Mechanical Engineering, MIT
- PhD, Mechanical Engineering, MIT



### Aleksandra Radlinska, PhD

#### Assistant Professor, Civil and Environmental Engineering

- Cement and concrete in sustainable design; durability, shrinkage, and cracking of concrete
- MS, Civil Engineering, Szczecin University of Technology
- PhD, Civil Engineering, Purdue University



### Michael Smith, PhD

#### Assistant Professor, Chemical Engineering

- Advanced materials; nanotechnology; alternative energy
- BS, Chemical Engineering, Lafayette College
- MS, Chemical Engineering, Villanova University
- PhD, Chemical Engineering, University of Delaware



### Aaron P. Wemhoff, PhD

#### Assistant Professor, Mechanical Engineering

- Heat and mass transfer in nanoscale and microscale systems; thermal cookoff of energetic materials
- BS, Mechanical Engineering, University of Virginia
- MS, Mechanical Engineering, UC Berkeley
- PhD, Mechanical Engineering, UC Berkeley



Elizabeth (Lisa) Catania, PE, comes from a blue-blooded family—Villanova blue, that is. When she was growing up in Delaware County, her father, 1956 alumnus Charles Catania, Sr., PE, repeatedly assured her, “It never rains at Villanova.” Lisa attended her father’s alma mater, as did her four siblings, and in 1981, earned a degree in Civil Engineering.

# LIKE FATHER, LIKE DAUGHTER

by Suzanne Wentzel



Now, 27 years after graduating, the talented, outgoing Vice President of Catania Engineering Associates maintains close ties with Villanova and the friends she made as an undergraduate. She is on campus frequently: to cheer on her niece in soccer, to root for the men’s basketball team, and to participate in University events.

Lisa is serving her second year on the College’s Engineering Advisory Board, and the caliber of her fellow members awes her. “I look around at the prominent people on the board and wonder, why am I here?”

No one else is wondering. Lisa has distinguished herself in her work and among her peers. Her first job was not at the business founded by her father in 1964 but at Sun Company’s Marcus Hook refinery. “I wanted to make my own way in my career.” The only civil engineer on staff at Sun, Lisa learned a valuable lesson. “Before you design, you listen.”

By the time she started at Catania Engineering Associates in 1987, she didn’t care if people said she was “Chuck’s daughter.” For two decades, she has continued to prove herself: as a project manager and municipal engineer, as the former Vice President and Membership Chair of the National Society of Professional Engineers, and as the former President of the Pennsylvania Society of Professional Engineers (PSPE). Her many community affiliations include the Ridley Township Planning Commission, the Delaware County Chapter of the Red Cross, and the Pennsylvania Institute of Technology Advisory Committee.

Lisa’s greatest achievement, however, is following in her father’s footsteps. “He has made outstanding contributions and is one of the engineers who helped shape Delaware County.” In fact, Charles Catania is being honored in April by the Delaware County Chapter of the PSPE—which, in 2000, named Lisa Engineer of the Year.

Lisa’s professional ethos testifies to the values that her father and Villanova instilled in her. “Civil engineers can’t have a cookie-cutter mentality,” she said. “We have an obligation to stay abreast of technological changes and to make breakthroughs for a sustainable society.”

## About the EAS

The dedicated members of the EAS meet throughout the year to work with the engineering departments and the Villanova University Alumni Association to support the College of Engineering's students. Through the generosity of its members, the EAS helps fund student projects and activities, as well as scholarships for incoming freshmen.

## 2008 Engineering Alumni Society (EAS) Awards



Thomas J. Durling ME '80 chats with students about their project.



Nelson J. Shaffer, Sudhakar Goverdhanam, Peter Fong, Joseph G. Lamack III, Dean Gary Gabriele, Zareh Baghdasarian, John J. McFadden, Peter Michel, Jordan Ermilio

## EAS Award Sponsors

O'Donnell & Naccarato, Inc.  
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 Wick Fisher White  
 W.S. Cumby  
 AEC, Inc.  
 Hill International, Inc.

Alumni, faculty, administrators, and staff gathered for the Engineering Alumni Society's 32nd annual reception and awards ceremony, held in CEER on Friday, September 26, 2008.

The program opened with a reception, building tours, and student displays. The presentation of awards followed. The ceremony included remarks by Rev. Peter M. Donohue, OSA, A&S '75, President of Villanova University; Dr. Gary Gabriele, the Drosdick Endowed Dean of Engineering; and Sean O'Donnell CPE '00, President of the EAS.

### The J. Stanley Morehouse Memorial Award

Zareh Baghdasarian EE '83

### The Carl T. Humphrey Memorial Award

Sudhakar Goverdhanam MME '95

### The John J. Gallen Memorial Award

Craig Fennie, PhD, BEE '93, MSEE '96

### Meritorious Service

Jordan Ermilio BME '98, MSWRE '06  
 Joseph G. Lamack III ChE '87  
 John J. McFadden, PhD, BCE '91, MCE '94  
 Peter Michel BCPE '02, MCS '05

### Professional Achievement

Peter Fong ME '86, MBA '95  
 Raymond Hozalski, PhD, BChE '90  
 Bruno Pattan EE '52  
 Nelson J. Shaffer MTE '81

Growth and change in the Department of Chemical Engineering (ChE) distinguished the past year. Record numbers of students enrolled, and curricular additions and research initiatives reflected emerging fields. Two faculty with expertise in cutting-edge areas were hired.

Faculty continued to teach and mentor students, preparing them to tackle and solve real-world problems. Equally dedicated to their research with undergraduate and graduate students, faculty participated in over \$950,000 of funded projects. (See pp. 34-37.)



**Dr. Randy Weinstein**  
Chair, Department of Chemical Engineering



## UNDERGRADUATE

- Projected class sizes for the next four years reflect an increase in the undergraduate population of more than 200%. Female students made up 50% of the freshman class.
- Electives and research focused on core areas: (a) bioengineering, pharmaceuticals, and medical; (b) materials, nanotechnology, and polymers; and (c) environment, sustainability, and energy.
- To enhance its instructional labs, the ChE Department developed new experiments in biotechnology and heterogeneous catalysis.
- Many students carried out interdisciplinary research projects, and seven students received grants to do summer research.
- The Class of 2008 had 37 students, the highest number in recent history.

## GRADUATE

- The ChE Department offered its first two distance education courses and added two graduate certificates, both of which are available online: biochemical engineering and biotechnology.
- Partnering with the College, the department helped create the proposed MS in Sustainable Engineering. (See p. 7.)



## FACULTY

- Two new tenure-track faculty were hired. (See pp. 18-19.)
- Dr. Kenneth Muske (the Mr. and Mrs. Robert F. Moritz, Sr., Chair in Systems Engineering), Dr. Randy Weinstein, and two students authored a paper that won best paper in its session at the 2007 American Control Conference.
- Dr. Randy Weinstein was one of two Villanova faculty members to receive the newly instituted Innovative Teaching Award. (See p. 18.)
- Through the efforts Dr. William Kelly, Villanova was selected as one of 10 North American universities to partner with ISPE to work on pharmaceutical education initiatives. Dr. Kelly also presented the results of his study on active learning at the June conference of the National American Society of Engineering Education.
- Dr. Dorothy Skaf was selected to review applications for the Fulbright Awards. As study-abroad advisor, she helped four students pursue international studies.
- Dr. Vito Punzi served on the Havertown Superfund Site Environmental Committee.

*Hands-on experience with fully integrated, larger scale process equipment is provided in the Unit Operations Laboratory.*

# CHEMICAL ENGINEERING



## RESEARCH INITIATIVES

*Undergraduate research facilities are available for students to carry out experimental investigation.*

### Nanostructured Materials

Dr. Michael Smith MChE '99 specializes in the use of nanostructured materials for alternative energy applications. With the Fritz Haber Institute of the Max Planck Society in Berlin, he is building nanostructured materials to study the catalytic activity of titanium dioxide and vanadium oxide. He also is researching how surfactants and block-copolymers self-assemble into nanostructures that can provide the molecular architecture for solar thin films and unique catalysts for sustainable energy production.

### Biomaterials and Drug Delivery

Dr. Noelle Comolli has been working with neurobiologists to develop materials and drug-delivery design to support nerve regeneration following a spinal-cord injury. The research focuses on the thin-film delivery of anti-inflammatory agents immediately after injury and the long-term, sustainable delivery of growth-promoting factors using nanoparticles. In addition, Dr. Comolli has developed a drug-delivery design in which particles targeting tumors, cells, or injury sites are injected through a lumbar puncture.

The Department of Civil and Environmental Engineering (CEE) made impressive strides in 2007-2008. Faculty received approximately \$1 million in new research awards. (See pp. 34-37.) The department underwrote faculty initiatives in microbiology, mechanics, and campus sustainability, and it sponsored five continuing education programs.

Enrollment in research and service-learning courses increased, and capstone projects became more multidisciplinary. External partners provided scholarships and internships, while industry engineers shared their expertise on the CEE Advisory Committee.



# CIVIL



**Dr. Ronald A. Chadderton, PE**  
 Chair, Department of Civil and Environmental Engineering, and the Edward A. Daylor Chair in Environmental Engineering

## UNDERGRADUATE

- Nine CEE students from the Class of 2008 studied abroad. The department has the highest percentage of engineering students in the program.
- During the ninth service-learning trip to the orphanage Amigos de Jesús, in Honduras, Drs. David Dinehart and Shawn Gross and 16 students built 20 foundations for a school.
- CEE Day in April incorporated research and senior design project presentations.
- The ASCE Steel Bridge Team won awards for technical presentation and aesthetics and for bridge stiffness in competition.
- At the Dean's Award Dinner in April, 14 CEE students were honored.
- Four CEE students received summer undergraduate research fellowships.
- In May, 51 students earned bachelor's degrees.

## GRADUATE

- The CEE Department had 24 full-time and 67 part-time graduate students.
- Five more CEE distance education courses were offered this year.
- Fifty students received master's degrees in May.
- The department awarded its first PhD.

## FACULTY

- With the hiring of two female faculty (one of whom will start in January 2009), one third of the CEE faculty is now female. (See pp. 18-19.)
- Dr. David Dinehart, Director of the Structural Engineering Teaching and Research Laboratory, was promoted to full professor. He also received the 2008 Farrell Award and was named to the Board of Directors of the Delaware Valley Association of Structural Engineers.
- Dr. John Komlos, whose PhD is in environmental biochemistry, joined the faculty as a Visiting Assistant Professor.
- Dr. Robert Traver, PE, Director of the Villanova Urban Stormwater Partnership, was promoted to full professor. He continued to serve on the National Academies Committee on Reducing Stormwater Discharge Contributions to Water Pollution.
- Dr. Andrea Welker, PE, was named Geotechnical Engineer of the Year by the Philadelphia Section of ASCE. She serves as the Education Chair for the United States Universities Council for Geotechnical Education and Research.

*Undergraduate and graduate students have the opportunity to work in the state-of-the-art Structural Engineering Teaching and Research Laboratory.*

# + ENVIRONMENTAL

## ENGINEERING



*CEE sophomores get hands-on learning during a field trip to Valley Forge National Historical Park.*

## RESEARCH INITIATIVES

### Testing of Structural Slab Assembly

Dr. David Dinehart, Dr. Shawn Gross, and Dr. Joseph Yost received a grant from Girder-Slab Technologies, LLC, to conduct tests on the Girder-Slab® system, an advanced technology used in multi-story residential structures. This research will lead to innovations that will expand the use of the system beyond its current market.

### Converting Biosolids into Renewable Energy

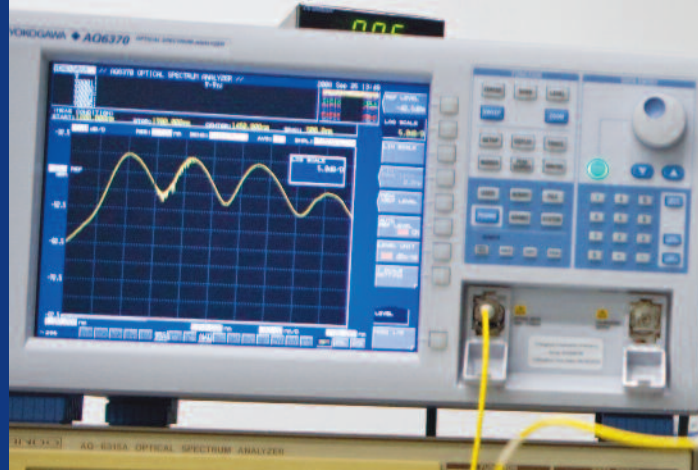
Dr. Metin Duran is leading a Villanova research team partnering with the Philadelphia Water Department and Brown and Caldwell, a national engineering firm, to investigate novel approaches to optimizing the biosolids digestion process. The long-term goal is to increase methane generation, producing sustainable energy and limiting landfill use.

### Stormwater BMPs

The Villanova Urban Stormwater Partnership continued its research on the stormwater best management practices (BMPs) on campus. Dr. Bridget Wadzuk CE '00 received a grant from the Pennsylvania DEP to reconstruct the stormwater wetlands, and Dr. Andrea Welker monitored the performance of the pervious concrete-porous asphalt comparison site.

In 2007-2008, faculty and students in the Department of Electrical and Computer Engineering (ECE) celebrated many achievements, especially in terms of research and scholarship. Undergraduate and graduate students were involved in research with faculty and coauthored published papers.

The ECE Department continued to promote multidisciplinary learning. It spearheaded the development of a new College-wide minor in collaboration with the Villanova School of Business and offered joint senior design projects with the Mechanical Engineering Department.



# ELECTRICAL + COMPUTER

## ENGINEERING



**Dr. Pritpal Singh**  
Chair, Department of  
Electrical and Computer Engineering

### UNDERGRADUATE

- Thanks to the efforts of Dr. Kevin Buckley BEE '76, MSEE '80, and Dr. Edward Kresch, the department created a track in Biomedical Engineering.
- Dr. Pritpal Singh and Visiting Assistant Professor Edmond Dougherty BEE '69, GS '86, along with faculty in the Villanova School of Business, were awarded a Kern Family Foundation grant to develop a minor in Engineering Entrepreneurship. (See p. 5.)
- At the 21st annual ECE Day, Jamie Hyneman of the Discovery Channel's *MythBusters* introduced the evening talk in a pre-taped segment.
- The department started a new senior design project in collaboration with the Overbrook School for the Blind.
- Students received first- and second-place awards at the IEEE Region 2 competitions.
- Thirty-six students earned degrees in either Electrical or Computer Engineering.

### GRADUATE

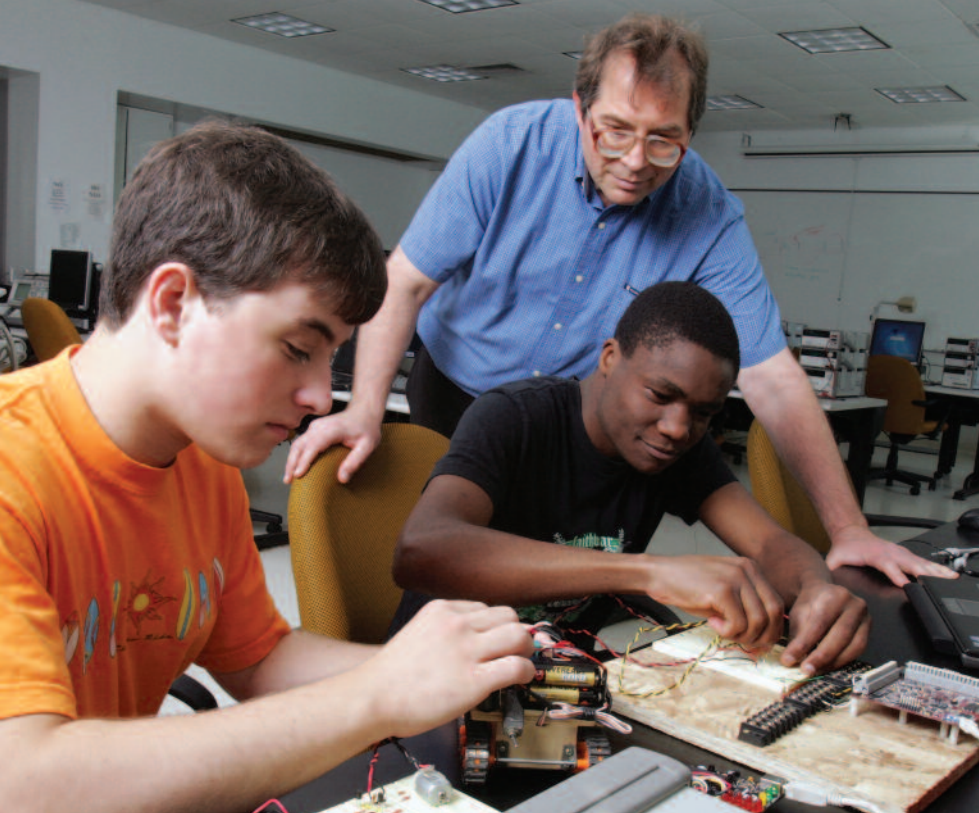
- Three students received awards for outstanding papers at conferences.
- Approximately 170 students were enrolled in graduate courses, and 30 master's degrees were awarded.
- A new course in renewable energy policy was established and offered in summer 2008.



## FACULTY

- Dr. Sarvesh Kulkarni achieved tenure and was promoted to the rank of associate professor. Dr. Kulkarni introduced courses in computer networks and developed a course in C++ and data structures.
- Dr. Rosalind Wynne received approval for a sabbatical leave to collaborate with colleagues at Johns Hopkins University in the area of photonic sensors. In May, Dr. Wynne was awarded a Minority Junior Faculty Award from the Christian R. & Mary F. Lindback Foundation.
- Dr. Pritpal Singh attended the second Globalization Workshop, held in San Jose in February, to discuss with academic and industry leaders the impact of globalization on the profession and curricular development.
- Dr. Pallav Gupta's 2004 Design, Automation & Test in Europe (DATE) paper was selected as one of the most influential DATE papers in the last 10 years.

*Dr. Rosalind Wynne is the Director of the Laboratory for Lightwave Devices, which is used for education and for research related to the development of fiber optic sensors.*



*Dr. Frank Mercede, PE, supervises students using a circuit-lab-on-a-board, an innovative learning tool that is designed to enrich the sophomore curriculum.*

## RESEARCH INITIATIVES

### Energy Conversion, Storage, and Transformation

Dr. Pritpal Singh is conducting research in the following areas: new, advanced solar cell structure and materials, with the goal of improving efficiency and lowering costs; alternative energy system designs, primarily solar but also battery and fuel cells, for integration into hybrid power systems; and energy-harvesting applications, for example, using energy from the environment to power circuits and recharge batteries.

### Microwave and High-Frequency Solid-State Devices

In his ongoing work with electronic devices that control radio frequency and microwaves—specifically, high-speed switches—Dr. Robert Caverly is focusing his research on the modeling of devices used in the MRI process. He also is continuing his work in CMOS technology, looking specifically at how to put integrated circuits for communications and digital processing onto one chip.

### Computer Architecture and Reconfigurable Computing

Dr. Xiaofang “Maggie” Wang continues her research in computer architecture and reconfigurable computing. Recently she has focused on hardware aspects of two frontline topics: high-performance and power-efficient on-chip communication architectures for multi-core processors; and reconfigurable multiprocessors, which can dynamically change and adapt their capabilities and architectures to better match diverse computing needs of various applications.

In 2007-2008, the Department of Mechanical Engineering (ME) embarked on a curriculum restructuring to give students maximum flexibility and to position them well in an interdisciplinary marketplace.

Faculty received approximately \$1 million in research grants. (See pp. 34-37.) Four new faculty, who are doing pioneering work, were hired. In addition, the department received a \$250,000 Keystone Innovation Starter Kit (KISK) grant to provide funds for a new faculty member.



# MECHANICAL

## ENGINEERING



**Dr. C. Nataraj**  
*Chair, Department of  
Mechanical Engineering*

### UNDERGRADUATE

- As part of the Water for Waslala program managed by ME faculty, 10 students made a service trip to Nicaragua to collect information for designing new water systems.
- Twelve students participated in the study-abroad program.
- A multidisciplinary team of undergraduates and graduates won an award for best design at the Autonomous Surface Vehicle Demonstration in Orlando in August 2007.
- Two senior design teams funded by Boeing and the Engineering Alumni Society prepared aircraft assemblies for the SAE Aero Design competition.
- Some 20 students were employed as undergraduate research assistants, many of them supported by external grants.
- Three students were awarded research fellowships in a university competition.
- In May, the ME Department had 80 graduates, 29 of whom also earned minors.

### GRADUATE

- Dr. H. Ashrafiuon, Dr. Kenneth Muske (ChE), and two graduate students won a poster competition at the 2008 ASNE Launch & Recovery Symposium in Annapolis. They also won first place at the Sigma Xi Poster Day.
- Four students pursued PhDs, and 25 earned MME degrees.
- Dr. Alfonso Ortega and a graduate assistant received an award for best paper at the 2007 ASME International Electronic and Photonic Packaging Conference.

## FACULTY

- Former chair Dr. Alan Whitman retired after four decades of teaching and research.
- The Office of Naval Research (ONR) awarded Dr. C. Nataraj and Dr. William Messner (Carnegie Mellon University) a \$400,000 grant to fund the nonlinear analysis and design of smart-valve systems for ships.
- The Discovery Channel filmed an episode of *Weapons Masters* in the department's wind tunnel. Dr. Amy Fleischer BME '91, MME '96, provided commentary.
- Dr. H. Ashrafioun served as associate editor for the *Journal of Mechanical Design*.
- Faculty published 27 journal articles and book chapters and were invited to give seminars at other institutions.

*A graduate student uses a scanning electron microscope (SEM), located in the High Resolution Microscopy Laboratory, to characterize nanoceramics.*



## RESEARCH INITIATIVES

### Nanomechanics

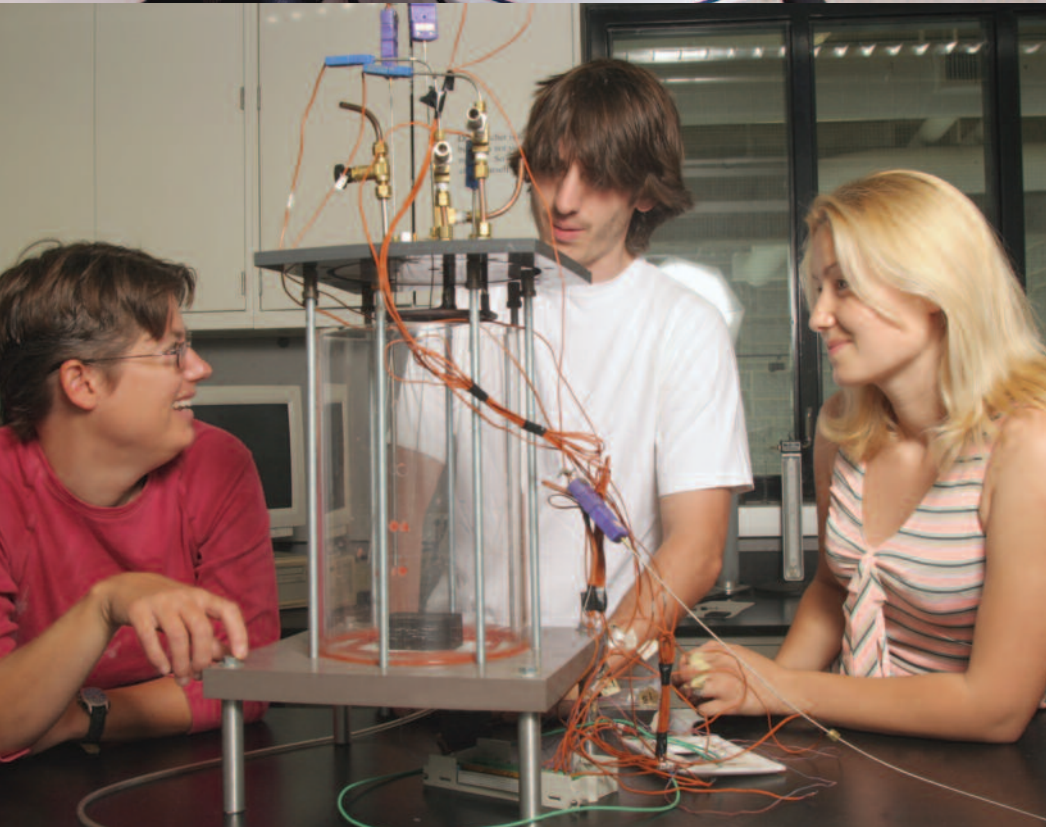
Dr. Gang Feng's focus is on nanomechanical characterization and nanomechanics, with particular emphasis on understanding the mechanical behavior of nanomaterials and biomaterials through experimental techniques and theoretical modeling. His research also is aimed at the rational design and optimization of advanced nanomaterials and nanostructures.

### Prognostics

Dr. B. Samanta and Dr. C. Nataraj are engaged in applications of computational intelligence (CI) techniques to diagnostics and prognostics of engineering and biomedical systems. The research has attracted support from Naval Sea Systems Command (NAVSEA), and Children's Hospital of Philadelphia (CHOP) is collaborating on the biomedical component.

### Materials Science

Dr. Sridhar Santhanam and Dr. Kei-Peng Jen collaborated on a DOE Phase I STTR project with EverNu Technologies. This research helped develop and characterize mesoporous catalyst supports for the catalysis of select high-temperature chemical reactions.



*Villanova's Thermal Management Laboratory, supervised by Dr. Amy Fleischer, focuses on solving challenging thermal problems using nanotechnology and phase change materials.*

In 2007-2008, the Center for Advanced Communications (CAC) continued to be in the forefront of several research areas, such as urban sensing and through-wall imaging, radar signal processing, and low-profile antennas. It collaborated with numerous partners in government, industry, and academia. The Center's four state-of-the-art labs attracted \$1.3 million in new research awards alone. (See pp. 34-37.) CAC researchers disseminated their technical findings in many publications and gave several technical presentations and lectures in this country and abroad.

# CENTER FOR ADVANCED COMMUNICATIONS



**Dr. Moeness Amin**

*Director, Center for Advanced Communications*

## CAC Highlights

- Eleven full-time faculty members participated in 32 CAC-affiliated research projects. Thirteen graduate and undergraduate students and six postdoctoral fellows received external funding.
- In addition to securing multiple industry contracts, the CAC received a Defense University Research Instrumentation Project (DURIP) grant from the Department of Defense (DOD). The Center and SCS, LLC, received a Navy Small Business Innovation Research (SBIR) award.
- Three researchers from Germany, France, and Romania visited the CAC and worked on problems related to radar imaging.
- The CAC continued to work closely with the University of Pennsylvania and Concurrent Technology Corporation (CTC). It pursued research sponsored by the Defense Advanced Research Projects Agency (DARPA), the Air Force Office of Scientific Research (AFOSR), and the Office of Naval Research (ONR).
- For the fifth year, the CAC served as the U.S. representative in the NATO scientific task force on through-wall imaging. Dr. Amin presented the Center's latest research at the NATO meeting in Italy in November.
- In January, the CAC signed a Memorandum of Agreement with Ain Shams University (ASU) in Cairo, Egypt, to promote academic, scientific, technical, and cultural relations between ASU and Villanova.
- The CAC continued to support the College of Engineering's involvement in the Delaware County Keystone Innovation Zone.

## Topics of Study

Acoustics and ultrasound  
 GPS technologies  
 Low-profile antenna modeling and measurements  
 Microwave and RF  
 Multimedia and video compression  
 Radar imaging  
 Sensor technology  
 Signal processing for communications  
 Smart antennas



*Dr. Fauzia Ahmad, Director of the Radar Imaging Laboratory, prepares an experiment in through-wall imaging.*

# MUNICATIONS

## Research Initiatives

### Acoustics

The Radar Imaging Laboratory, directed by Dr. Fauzia Ahmad, is supporting research on the use of acoustic resonances to detect and classify manmade objects behind walls and in enclosed structures. Acoustic sources excite the vibration modes of the object from a standoff distance, and then instrumentation measures the vibrations. The CAC recently acquired a laser vibrometer, which measures displacements on the order of a few nanometers. Classifying objects provides information that can help determine “the intent of the building.” Funding is provided by the ONR.

### Wireless Ad Hoc and Sensor Networks

In the Wireless Communication and Positioning Laboratory, Dr. Yimin Zhang is leading research in how to more effectively deliver information using smart antennas and developing new protocols for wireless ad hoc and sensor networks, which relate to seamless, non-line-of-sight communications for urban warfare; high-rate, multi-user cooperative diversity systems; applications of smart antennas to rotorcrafts and unmanned aerial vehicles; array processing for interference suppression in GPS receivers; space-time coding for wireless communications; and wireless channel modeling and equalization. Funds are provided by the DOD, the National Science Foundation, and the Ben Franklin Technology Partners of Southeastern Pennsylvania.

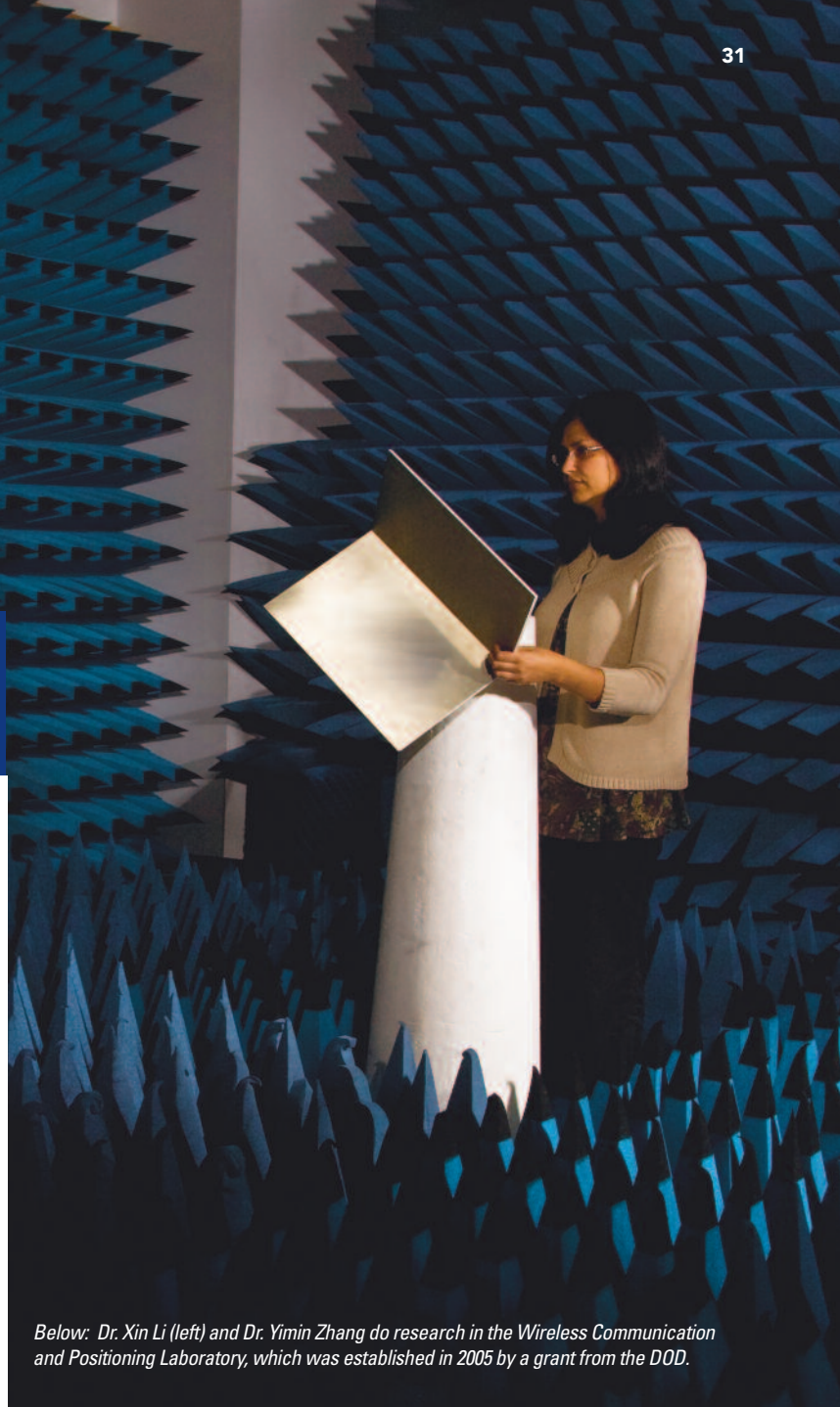
## CAC Laboratories

Wireless Communication and Positioning Laboratory  
*Director: Dr. Moeness Amin*

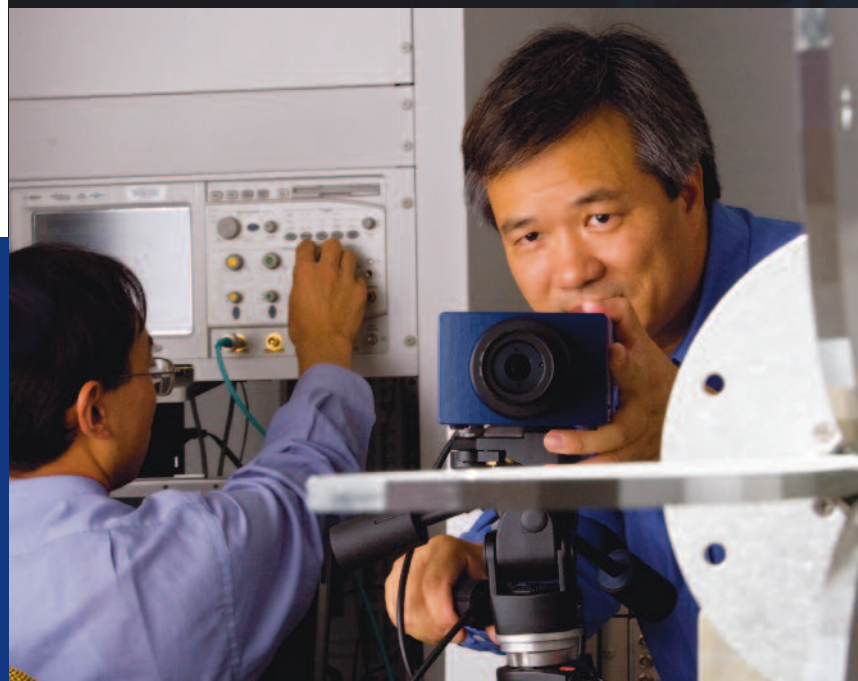
Radar Imaging Laboratory  
*Director: Dr. Fauzia Ahmad*

Radio Frequency Identification Laboratory  
*Director: Dr. Yimin Zhang*

Antenna Research Laboratory  
*Director: Dr. Ahmad Hoorfar*



*Below: Dr. Xin Li (left) and Dr. Yimin Zhang do research in the Wireless Communication and Positioning Laboratory, which was established in 2005 by a grant from the DOD.*



Since its founding in 2003, the Center for Nonlinear Dynamics & Control (CENDAC) has enabled teams of faculty and students from different disciplines to work together and apply advanced nonlinear identification, control, and analysis techniques to solve challenging, real-world problems in a broad range of fields.

CENDAC has maintained government and industry partnerships that enhance the scientific goals of the Center and provide access to unique resources. Primary partners in 2007-2008 included the Office of Naval Research (ONR); NAVSEA, Philadelphia; Ablaze Development Corporation; Ford Motor Company; and the Ben Franklin Technology Partnership of Southeastern Pennsylvania.

# CENTER FOR NONLINEAR



**Dr. James Peyton Jones**  
Director, Center for Nonlinear  
Dynamics & Control

## CENDAC Highlights

- CENDAC's scholarly output increased in 2007-2008, and research awards remained high: approximately \$1.25 million in continuing grants and another \$700,000 in newly funded projects.
- CENDAC signed a cooperative research agreement with the University of Santiago, Chile (USACH), in the area of autonomous aerial vehicles, and the Center hosted a visiting USACH professor who had expertise in information sciences.
- This past year, 4 doctoral students, 20 MS students, and 29 undergraduates studied within the Center.
- Ford Motor Company donated new pressure sensors, charge amplifiers, and a set of ionization sensors to the Automotive Emissions Laboratory.
- A new tank was constructed for the Unmanned Surface and Underwater Vehicles Laboratory, and vision feedback is being used for feedback in trajectory-tracking algorithms for small, radio-controlled boats.
- Ablaze Development Corporation awarded \$290,000 for the second phase of research in support of an oceangoing decontamination system.
- Dr. C. Nataraj and Dr. Pritpal Singh (Chair of the Department of Electrical and Computer Engineering) received \$80,000 from a Small Business Technology Transfer Program Phase II contract issued by the Navy to Unmanned Ocean Vehicles, in Virginia, to develop an energy-scavenging unmanned surface vehicle.

## Focus Areas

Autonomous systems, including robots and unmanned surface vehicles  
Automotive systems, with a focus on emissions control and nonlinear dynamics  
Nanomaterials and mechanics

## Core Skills

Control-oriented nonlinear modeling and identification  
Nonlinear analysis and design  
Nonlinear control methodologies  
Prognostics and diagnostics

## Research Initiatives

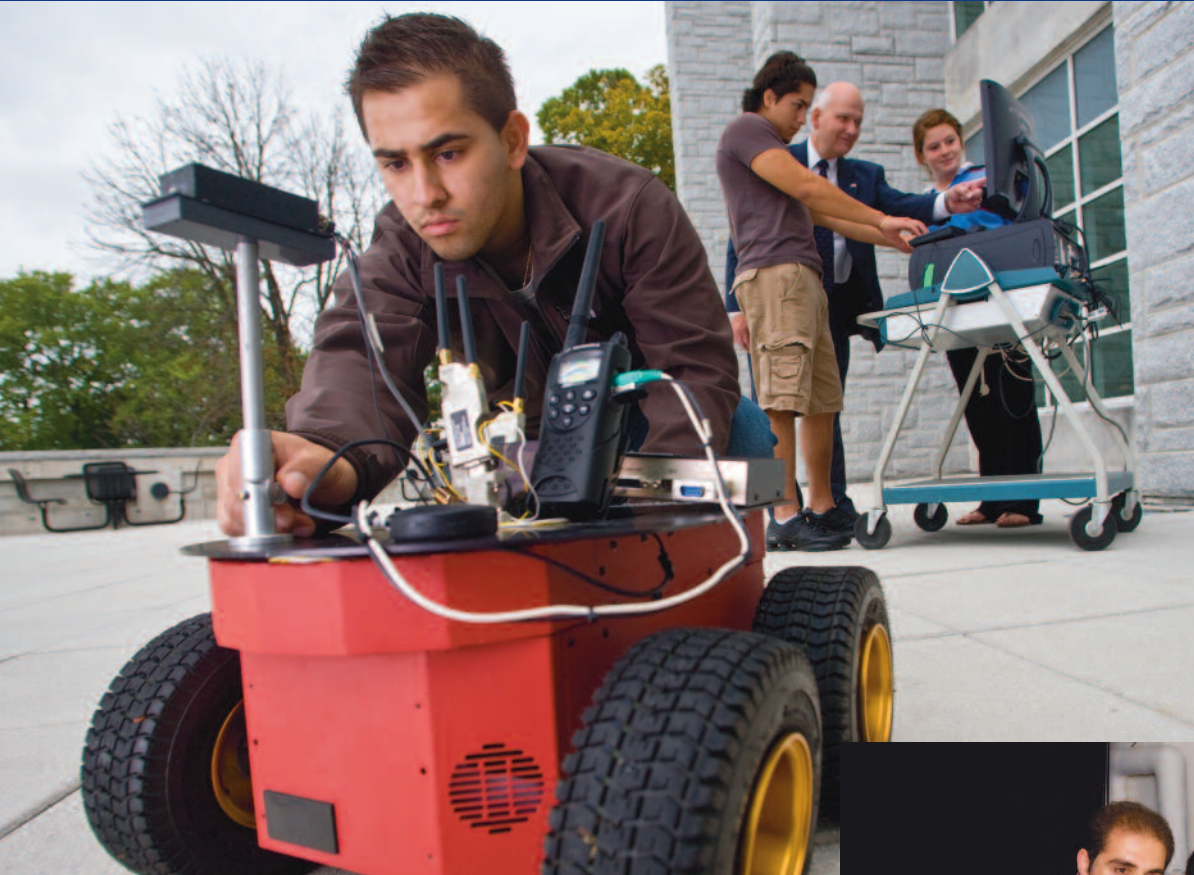
### Autonomous Systems Research

The Office of Naval Research (ONR) awarded a \$1.2 million grant to a team of investigators from CENDAC, headed by Dr. C. Nataraj, Chair of the Department of Mechanical Engineering. This research will help the Navy control individual and groups of autonomous vehicles, reduce personnel requirements, and protect personnel from having to operate in dangerous situations.

### Automotive Emissions Research

Dr. James Peyton Jones and Dr. Kenneth Muske (the Mr. and Mrs. Robert F. Moritz, Sr., Chair in Systems Engineering) have been modeling the nonlinear dynamics of the engine-catalyst system and then incorporating these models into the air-fuel ratio control strategy to achieve higher conversion efficiencies and lower emissions. Support for the lab and the research has come from the National Science Foundation, Ford Motor Company, Johnson Matthey, ExxonMobil, and Edward Barry ChE '54.

# DYNAMICS & CONTROL



*Left: Dr. Stephen Konyk, Jr. (ECE, shown in the background), helps students learn about robots that navigate autonomously and avoid obstacles in the outdoor environment.*

*Below: Researchers, including graduate students and Dr. H. Ashrafiuon (ME, right), use the recently renovated Unmanned Surface and Underwater Vehicles Laboratory to fabricate and test small boats that are controlled remotely or autonomously.*

## CENDAC Laboratories

Autonomous Systems Laboratory

Automotive Emissions Laboratory

Unmanned Surface and Underwater Vehicles Laboratory

*The Center also purchased and supports the Atomic Force Microscope in the High Resolution Microscopy Laboratory*



Listed below is new and ongoing funded research in the College of Engineering between July 1, 2007, and June 30, 2008. Information for each listing is presented in the following order: title of the project, amount, granting agency, principal investigators, and closing year.

**Pennsylvania Growing Greener Partnership**

\$2,000,000 (total for consortium of institutions)  
Commonwealth of PA  
R. Suri (co-PI in consortium)  
2008

**Through-the-Wall Target Detection and Classification for Achieving Transparent Urban Structures**

\$1,999,749 | ONR  
M. Amin, A. Hoorfar, Y. Zhang  
2011

**Autonomous Systems Research**

\$1,200,000 | ONR  
C. Nataraj  
2010

**Structural Performance of Prefabricated Steel Joists and Castellated/Cellular Beams**

\$750,000 | Commercial Metals  
D. Dinehart, S. Gross, J. Yost  
2010

**Reconfigurable Arrays and Signal Properties for Urban Sensing**

\$740,000 | DARPA  
R. Caverly, F. Ahmad, M. Amin, A. Hoorfar, B. Mobasser  
2008

**VisiBuilding - Interior Intelligence by Networked Sensing, Imaging, and Global Hierarchical Tomography (I2NSIGHT)**

\$654,000 | DARPA  
A. Hoorfar, F. Ahmad, M. Amin  
2007

**Atmosphere/Snow/Ice Interactions: Photochemistry of Organic Pollutants in Arctic Snow and Ice**

\$630,481 | NSF  
A. Grannas  
2011

**Reconfigurable Arrays and Signal Properties for Urban Sensing, Phase II**

\$625,000 | DARPA  
R. Caverly, F. Ahmad, M. Amin, A. Hoorfar, B. Mobasser  
2008

**Partnership for Broadband Wireless Innovations, Development, and Commercialization**

\$600,000 | NSF  
M. Amin, S. Chaudhry, A. Fleischer, A. Hoorfar, R. Weinstein  
2008

**Radar Imaging for Urban Sensing**

\$585,000 | ONR  
M. Amin, Y. Yoon  
2010

**High Resolution Scanning Electron Microscope for Nanotechnology Research**

\$535,500 | NSF  
P. Singh, M. Jupina, C. Liu, K. P. Jen, S. Santhanam, R. Weinstein  
2008

**Advanced Processing for Through-the-Wall Radar Imaging**

\$500,000 (Australian dollars)  
Australian Research Council  
M. Amin (with the Univ. of Wollongong, Sydney)  
2012

**Curriculum Development in Systems for Smart Communications**

\$452,742 | NSF  
R. Caverly, M. Amin, A. Hoorfar  
2007

**Watershed Impact—Rain Garden**

\$442,787 | CiCEET  
R. Traver (with Univ. of MD and NC State)  
2009

**Nonlinear Modeling and Control of Smart Valve Systems**

\$398,064 | ONR  
C. Nataraj, W. Messner (Carnegie Mellon)  
2009

**Ultrasound Treatment System Development for Destruction of APIs at Wyeth Brazil Facility (Phases I & II)**

\$393,000 | Wyeth  
R. Suri  
2008

**Research in Support of Oceangoing Decontamination System, Phase II**

\$290,000 | Ablaze Development  
C. Nataraj  
2008

**Investigation into the Application of Nano-Enhanced Phase Change Materials for Transient Thermal Management of Naval Electronics**

\$262,394 | ONR  
A. Fleischer, R. Weinstein  
2008

**Keystone Innovation Starter Kit**

\$250,000 | Commonwealth of PA  
C. Nataraj, S. Santhanam  
2009

**Test and Measurement Instrumentation for Transparent Urban Structure**

\$240,060 | DOD  
M. Amin, A. Hoorfar, Y. Zhang  
2009

**Fate and Analysis of Natural and Synthetic Estrogenic Hormones in Wastewater**

\$235,000 | Wyeth/Parsons  
R. Suri  
2008

**Core Genomics Laboratory for Teaching and Research in Biotechnology**

\$211,811 | NSF  
M. Duran, R. Wynne, Q. Wu, W. Kelly  
2009

**RUI: Polybrominated Diphenyl Ethers in Automobile Interior Dust: A Potential Human Exposure Pathway**

\$191,000 | NSF  
A. Lagalante  
2010

**Optimizing the Performance of Anaerobic Sludge Digestion Process at NEWPCP of Philadelphia Water Department**

\$186,615 | PWD  
M. Duran  
2009

**Wetland Reconstruction**

\$185,000 | PA DEP  
B. Wadzuk, R. Traver  
2009

**Side-by-Side Comparison Study of Porous Asphalt and Pervious Concrete**

\$185,000 | EPA  
A. Welker, R. Traver  
2008

**Molecular Level Characterization of Organic Matter in Ice Cores by High Resolution FTICR Mass Spectrometry**

\$180,000 | NSF  
A. Grannas, P. Hatcher (Old Dominion)  
2011

**Villanova Urban Stormwater Partnership**

\$175,000 | PA DEP  
R. Traver, A. Welker, B. Wadzuk, R. Chadderton  
2008

**Temple-Villanova Sustainable Stormwater Initiative, Phase I**

\$163,577 | William Penn Foundation  
R. Traver, A. Welker, B. Wadzuk (with Temple)  
2007

**Keystone Innovation Grant**

\$150,000 | Commonwealth of PA  
P. Singh, E. Dougherty  
2008

**Pollution Prevention of Pharmaceutically Active Chemicals from University Dormitories and Municipal Wastewater Treatment Plants**

\$133,750 | EPA  
R. Suri, A. Grannas, A. Lagalante  
2008

**Electromagnetic Modeling and Complex Natural Frequency Characterization of Objects behind Walls**

\$130,000 | Eureka Aerospace  
A. Hoorfar  
2008

**Advanced Combustion Feedback for PZEV Emissions, HCCI, and Fuel Economy**

\$120,000 | Ford Motor Company  
J. Peyton Jones, K. Muske  
2008

**Model-Based Three-Way Catalyst Control & Diagnostics for Super Ultra Low Emissions**

\$120,000 | Ford Motor Company  
K. Muske, J. Peyton Jones  
2007

**Effective Width and Section Properties of the Girder-Slab® System**

\$119,941 | Girder-Slab Technologies, LLC  
D. Dinehart, S. Gross, J. Yost  
2010

**Temple-Villanova Sustainable Stormwater Initiative, Phase II**

\$111,467 | William Penn Foundation  
R. Traver, A. Welker, B. Wadzuk (with Temple)  
2008

**Measurement of Imidacloprid and Metabolites in Hemlock Treated with Imidacloprid by LC/MS/MS**

\$110,000 | U.S. Dept. of Agriculture; U.S. Forest Service  
A. Lagalante  
2009

**Nutrient Reduction in a Mature Constructed Wetland**

\$100,400 | EPA  
B. Wadzuk, R. Traver  
2008

**Development of a Chemical Detector for Residual Gases Surrounding a Photocathode**

\$100,000 | ONR  
R. Wynne  
2008

**Tracking Nonpoint and Point Sources of Fecal Pollution in Surface Waters by FAME Technology**

\$96,340 | PA DEP  
M. Duran  
2008

**Evaluation of the Effectiveness of Ozonation for the Removal of APIs in Wastewater and Correlation with Reduction in Endocrine Effects and Toxicity**

\$93,000 | Wyeth  
R. Suri  
2008

**Development of Orphan Meter Detection Techniques**

\$90,000 | Cellnet+Hunt  
Y. Zhang, M. Amin  
2008

**Impact Analysis of Water Lubricated Bearings, Phase I**

\$82,500 | Curtis Wright EMD  
C. Nataraj  
2008

**High Fidelity Modeling of Electromagnetic Bearings with PM Bias**

\$82,271 | ONR  
C. Nataraj  
2008

**Unmanned Surface Vehicles—Energy Scavenging**

\$78,052 | Unmanned Ocean Vehicles, Inc.  
C. Nataraj, P. Singh  
2009

**Rain Garden Cluster**

\$69,483 | PA DEP  
R. Traver  
2008

**Development and Modeling of Geothermal Heat Pump Technology**

\$65,000 | Geowell, Ltd.  
A. Ortega  
2008

**National Monitoring Program**

\$61,000 | PA DEP  
R. Traver  
2008

**RFID Lab**

\$50,000 | BFTP/SEP  
Y. Zhang, M. Amin  
2010

**Antenna Array Beamforming & Space-Time Processing Algorithms for Wideband Telemetry Digital Communications**

\$50,000 | Teletronics Technology; BFTP/SEP  
Y. Zhang, M. Amin  
2008

**Michael Baker Student Support for Structural Engineers**

\$50,000 | Michael Baker Corporation  
D. Dinehart, S. Gross, J. Yost  
2008

**RF Data Link Multi-Path Interference Mitigation Processing Solutions**

\$50,000 | Navmar Applied Science; BFTP/SEP  
Y. Zhang, M. Amin  
2008

**RF Data Link Multi-Path Interference Mitigation**

\$50,000 | Navmar Applied Science  
Y. Zhang, M. Amin  
2007

**Activated Carbon Adsorption for API Removal from Wyeth India Plant Wastewater**

\$34,000 | Wyeth  
R. Suri  
2008

**Crimped Angle Web and Joist Testing Project: Investigation of the Effect of Angle Thickness**

\$32,685 | Steel Joist Institute  
D. Dinehart, S. Gross, J. Yost  
2009

**Amendments to a Wearable Thermoelectric Cooling Device for Symptomatic Relief of Hot Flashes**

\$30,000 | BFTP/SEP  
A. Ortega, R. Weinstein

**Treatability Study on Surfactants Wastewater by Using Advanced Oxidation Technologies**

\$30,000 | Wyeth  
R. Suri  
2007

**Villanova Urban Stormwater Partnership**

\$30,000 | PA DEP  
R. Traver, A. Welker, B. Wadzuk, R. Chadderton  
2007

**RF Modeling of Layered Composite Dielectric Building Materials**

\$23,000 | Smart & Complete Solutions, LLC  
A. Hoorfar, M. Amin  
2008

**Effects of Ambient Anaerobic Storage on Decay on SPMU Wastewater**

\$23,000 | Wyeth  
R. Suri

**Development of a Prototype Superlattice Solar Cell**

\$20,000 | PA Green Building Alliance  
P. Singh  
2008

**VESTED High School Outreach**

\$20,000 | The Hamilton Family Foundation  
S. Jones  
2008

**Effectiveness of Fatty Acid Methyl Ester (FAME) Profiling to Determine Sources of Microbial Pollution in Chester Creek Watershed**

\$20,000 | PA Water Resources Research Center  
M. Duran  
2007

**Feasibility Study of RFID System**

\$18,000 | Feta Med, Inc.; BFTP/SEP  
Y. Zhang, M. Amin  
2008

**CVD Reaction Chamber Analysis by CFD**

\$16,500 | BFTP/SEP; Valence Process Equipment  
A. Fleischer  
2008

**Experimental and Computational Evaluation of a Wet Milling Process for Customized Medication**

\$16,500 | BFTP/SEP; Patients' & Consumers' Pharma  
A. Ortega  
2008

**Modeling, Simulation, and Control of Human Walking**

\$16,500 | BFTP/SEP; Live Event Media  
H. Ashrafiuon  
2008

**Wearable Thermoelectric Cooling Device for Symptomatic Relief of Hot Flashes**

\$16,500 | Life Quality Technologies; BFTP/SEP  
A. Fleischer  
2008

**Design of a Grid-Tied Inverter for a Solar Panel**

\$15,000 | BFTP/SEP; Clinlogix  
P. Singh  
2008

**Mesoporous Silicon Carbide for Catalyst Applications**

\$15,000 | DOE (with EverNu Technology, LLC)  
S. Santhanam, K. P. Jen  
2008

**Instron Chapry V-Notch Testing Machine**

\$5,836 | Commonwealth of PA  
D. Dinehart

**Mass Balance Analysis on Endocrine Disrupting Compounds in Wastewater**

\$12,800 | Wyeth  
R. Suri

**Detection and Quantification of Viable but Non-Culturable Pathogens in Disinfected Wastewater Effluents and Biosolids through Gene Expression Monitoring**

\$12,500 | Office of Research and Sponsored Projects, Villanova University  
M. Duran  
2007

**Numerical Analysis of the Thermal Impact of Solder Voids and Correlation with Thermal Images**

\$12,213 | Lockheed Martin (LMCO) Maritime Systems & Sensors  
A. Fleischer  
2008

**Squire Antenna Measurements**

\$11,460 | DRS Communications  
A. Hoorfar  
2008

**Effective Thermal Conductivity Modeling of Thermal Vias**

\$11,012 | Lockheed Martin (LMCO) Maritime Systems & Sensors  
A. Fleischer  
2008

**Modeling, Simulation, and Control of Human Walking and Gait**

\$11,000 | BFTP/SEP; Easy Walking, Inc.  
H. Ashrafiuon  
2008

**Microstructure Optical Fiber Detector with Multiple Solid Cores for Simultaneous Chemical and Strain Sensing**

\$10,000 | The Christian R. & Mary F. Lindback Foundation  
R. Wynne  
2009

**IUCRC Emerging Contaminant Center (ECC)**

\$10,000 | NSF  
R. Suri  
2008

**Finite-Time Stabilization of Nonlinear Dynamical Systems**

\$10,000 | Summer Research Fellowship, Villanova University  
S. G. Nersesov

**Thermal Modeling of 69kV Solid State Current Limiter**

\$7,807 | Silicon Power  
A. Fleischer  
2007

**Smart Communication System, Phase II**

\$7,000 | Turbo Research Foundation  
C. Nataraj  
2007

**DF Antenna Measurement**

\$5,730 | AMT, Inc.  
A. Hoorfar  
2007

**Formation of Minimum Contact Width Convuloid Gears**

\$5,500 | BFTP/SEP; Genesis Partners  
H. Ashrafiuon

**Solar Array Testing**

\$5,460 | Advanced Energy Conversion, LLC  
P. Singh  
2007

**Modeling Shear in Rotary Lobe Pumps**

\$5,200 | Merck  
W. Kelly  
2008

**Sting Free Grip Analysis on Golf Clubs**

\$5,000 | Sting Free  
C. Nataraj  
2007

**Determination of the Drying Properties of Waste Coffee Grounds for Recycled Consumer Products**

\$4,900 | ECOR Solutions, Inc.  
R. Weinstein, K. Muske  
2007

**NIST Summer Undergraduate Research Fellowship Program**

\$4,000 | NIST  
C. Nataraj  
2007

**PIVOTS High School Outreach**

\$3,000 | Wachovia  
R. Weinstein  
2008

The College of Engineering gratefully acknowledges the following alumni, parents, friends, and organizations that have contributed to the College during the 2007-2008 fiscal year. Contributions have been in the form of either individual endowed funds or annual giving funds designated to the College and its various programs or departments. The list does not include gifts that donors made to other programs at Villanova University.

## Endowment Gifts

<b>Robert S. Ayerle, MD</b>	<b>Rosanna S. and Robert S. Ayerle, MD, Endowed Scholarship</b>
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<b>Mr. and Mrs. William G. Christman</b>	<b>Christman Family Scholarship in Science or Engineering</b>
<b>Dr. Richard T. Dewling and Dolores M. Dewling</b>	<b>Richard T. Dewling Endowed Scholarship for Graduate Environmental Engineering Study for Women</b>
<b>Nance K. Dicciani, PhD</b>	<b>Nance K. Dicciani '69 Endowed Scholarship for Engineering</b>
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<b>Jack and Gloria Drosdick</b>	<b>Drosdick Endowed Dean of Engineering Fund</b>
<b>Mr. and Mrs. Robert J. Fitzmyer</b>	<b>Fitzmyer Endowment for Engineering Faculty Development</b>
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<b>Margaret and Robert J. Merkert, Sr.</b>	<b>Professor Joseph J. Hicks Endowed University Scholarship</b>
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Endowment gifts create a lasting legacy in support of a college, department, program, professorship, or scholarship. Endowed funds 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. They reduce Villanova's dependence on tuition revenues, provide a predictable source of income, enable the development of innovative programs, and attract exceptional students and faculty. To learn more about creating an endowed fund, contact the Development Office for the College of Engineering at 610.519.4564.

## Annual Fund Gifts: Making a Difference

A contribution to the Villanova Annual Fund is a meaningful way to honor your Villanova heritage and help the University deliver a quality education to those following in your footsteps. An annual fund gift supports programs and initiatives that benefit the campus community. You may also restrict your gift to the College of Engineering or a specific department. Make a gift now through the secure online gift form at [www.villanova.edu/advance/develop/makeagift.htm](http://www.villanova.edu/advance/develop/makeagift.htm). Or call 1.800.486.5244 to make a gift using your credit card (M-F, 9 AM to 5 PM).

## Planned Gifts: Customizing Gifts to Match Donor Needs

Alumni and friends often make their most significant gifts to the University through planned gifts. Various arrangements are possible, including bequests, gifts of property (real estate, art, jewelry, etc.), and donations from life insurance or retirement plans. One may also create "life income" arrangements, in which the donor(s) or other designee(s) receives an income stream and the University receives the remainder, such as through a charitable gift annuity or charitable remainder trust. Other types of planned gifts are possible as well. For more information, contact Charles Thomas, Director of Planned Giving, at 610.519.7976 or at [charles.thomas@villanova.edu](mailto:charles.thomas@villanova.edu).



## OUR MISSION

Villanova University's College of Engineering is committed to an educational program that emphasizes technical excellence and a liberal 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

Villanova University is the oldest and largest Roman Catholic university in the Commonwealth of Pennsylvania. Founded by the Augustinian Order in 1842 and located on a picturesque 254-acre campus, it comprises the College of Liberal Arts & Sciences, the Villanova School of Business, the College of Engineering, the College of Nursing, and the School of Law. With its rigorous, well-rounded curricula and its commitment to the Augustinian ideals of pursuit of knowledge and service to others, Villanova is recognized as a premier institution of higher education. **For more than a decade, Villanova University has been ranked No. 1 in the North region** (North – Masters) by *U.S. News & World Report*.

## 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 (new in 2009)  
MS in Transportation Engineering  
MS in Water Resources and Environmental Engineering

PhD Program (part time or full time)

## ACCREDITATION

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

## RANKING

For the third year in a row, Villanova's College of Engineering was ranked in the top 10 in the country by *U.S. News & World Report* for engineering schools that award primarily bachelor's and master's degrees.



**VILLANOVA**  
UNIVERSITY

**COLLEGE OF ENGINEERING**

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