

VILLANOVA COLLEGE OF ENGINEERING

Summer 2008



ACHIEVING OUR VISION

**Strategic Plan Builds
on College's Strengths
and New Initiatives**

On The Cover:

At the far left, volunteers from the College's student chapter of Engineers Without Borders completed a project in Thailand that delivered cleaner drinking water to an orphanage and two nearby villages. The wave forms, which are through-the-wall radar images of a person walking, were generated by technology in the Center for Advanced Communications.

The photo and the wave forms, along with the historic twin spires of St. Thomas of Villanova Church, represent the vision of the College of Engineering: to be a leader in developing the intellectual and humanitarian engineer who is both a technical innovator and a contributor to the greater community.

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Cover:	Engineers Without Borders service project: Ean Mulligan St. Thomas of Villanova Church: Donna Blaszkowski
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Message from the Dean

Villanova Engineering students benefit from close interactions with faculty, who are dedicated to rigorous teaching and to helping young people develop their potential through research in the lab and service in the field. Besides enjoying opportunities inherent in the College, students also have the advantage of studying at a university that is committed to a liberal arts education, which enables future engineers to see the broader context of their individual disciplines. Finally, all of us at Villanova participate in the transformative ethos of a Catholic, Augustinian institution, with its emphasis on service to others.

I doubt any other engineering institution could rival the Villanova experience. Yet the College cannot be complacent. Challenges and opportunities emerge every day. This issue of *Villanova College of Engineering* highlights how the College community has developed a strategic plan to ensure that future Villanova engineers will receive the best possible education and that our students will excel in their chosen careers. The three principles of the strategic plan are that students will:

- Develop a solid understanding of fundamental engineering principles and problem solving within their chosen discipline
- Develop a multidisciplinary perspective through engagement of their technical knowledge with the liberal arts
- Develop leadership abilities and effective team skills, which will allow graduates to successfully work within and lead in diverse, multidisciplinary settings

As you read this issue of *Villanova College of Engineering*, you will see how all of these elements already thrive in the College: Student leaders have formed and guided award-winning chapters of service organizations, such as Engineers Without Borders. The undergraduate curriculum will soon launch a course of studies on entrepreneurship, and opportunities for undergraduate research have expanded. Partnerships with external organizations bring students in contact with the real world of engineering early in their time at Villanova. And the faculty successfully compete and collaborate with the best-known engineering institutions in the country to win major research grants, while also conducting scholarship that is published in major journals.

In short, the strategic plan described in these pages draws on the strengths and traditions of Villanova engineering in a manner that makes sure that as we move forward, we keep and build on what has worked well in the past and strive to become even better in the future.

Gary Gabriele, Ph.D.

Dean, College of Engineering

A Vision of Excellence By Jeff Oddo

New Strategic Plan Maps a Clear Path for the Future

Over the next five years, Villanova University's College of Engineering will make enormous strides toward becoming the premier engineering program in the country, educating the "whole brain engineer" to thrive in the global knowledge economy of the 21st century.

The new strategic plan is a product of wide-ranging input and deep collaboration among administration, faculty, students, and partners. It leads the way to a shared future by building on the strengths of the College's technical and liberal education while maintaining the traditions of the University's Augustinian and Catholic roots.

"Today, we have a solid program and reputation," said Dr. Gary Gabriele, Dean of the College of Engineering, "but there is consensus that great opportunities exist to expand and enhance the College. This plan gives us a clear road map to achieve our vision, our mission, and our goals."

The vision of the College is to become the premier engineering program in the country while maintaining and promoting its Augustinian and Catholic values. Achieving that vision will require a continued commitment to make the College a recognized leader in innovative curricula, pedagogy, and research. Most importantly, Villanova will build on its reputation for developing the intellectual and humanitarian engineer, one who is both a technical innovator and a contributor to the greater community.

The Case for Change

The College of Engineering has an impressive record of success. In 2006 and 2007, *U.S. News & World Report*

ranked the College ninth in the country for engineering schools that award primarily bachelor's and master's degrees. Nevertheless, both administration and faculty recognize the need to be more competitive and innovative.

"We are already a strong College, but the field of engineering has changed, and the competition for faculty and students has increased," noted Dr. John Johannes, Vice President for Academic Affairs. "We knew that we wanted to reposition ourselves. Examining where we've been and where we want to go puts us on a clear path of growth and progress."

The strategic plan is a blueprint for excellence that will raise the profile of the College in the eyes of students, faculty, alumni, industry, and the global engineering community.

A Collaborative Effort

The development of the plan was a collaborative effort marked by input from administration, faculty, students, alumni, and other stakeholders at every step of the process. Each of these

Our Vision

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



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— Dr. Gary Gabriele, Dean of the College of Engineering





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— *Dr. John Johannes, Vice President for Academic Affairs*

discrete sets of voices has its own perspective on the College’s vision, aspirations, assets, and distinctive qualities.

Work began in November 2006 with a series of all-College meetings that continued into February 2007. These resulted in a comprehensive SWOT (strengths, weaknesses, opportunities, threats) analysis in the spring of 2007.

“We talked to students, department leadership, and University leadership,” noted Dr. David Dinehart, a professor in the Department of Civil and Environmental Engineering and the chair of the committee that determined the undergraduate

perspective. “We also spoke with alumni, employers, and even other universities.

“The perception was that we did not have a strong vision for the future,” Dr. Dinehart continued. “This also raised additional questions, such as the desire to make the curriculum more flexible, what role research would play within the College, and the need to improve our connection with the rest of the University. The new plan had to answer these fundamental questions.”

During leadership retreats in the summer of 2007, plan points began to be articulated. The first draft of the strategic plan, in October 2007, led to an expanded SWOT analysis focused on graduate programs.

Open comment on the draft plan took place in October and November of 2007, during which time an enormous amount of input was collected. A revised plan was presented in December 2007 and published in February 2008.

“The undergraduate environmental scan was carefully and thoroughly researched,” Dr. Dinehart noted. “We developed a strong consensus. Everyone had a voice because of the inclusive nature of the process. This was not a plan created in a vacuum or in isolation.”



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— *Dr. David Dinehart, Professor,
Department of Civil and Environmental Engineering*



Goals That Encompass the Entire College

The plan defines goals that incorporate all aspects of the College's facilities and life:

- To increase the diversity of the student body along gender, ethnic, racial, economic, and geographical lines so that it significantly exceeds national levels.
- To similarly increase the diversity of the faculty.
- To increase the number of opportunities for alumni and key industry partners to interact with the College.
- To ensure that faculty and staff are up to date on current industry practices, professional requirements, and the latest research developments in their respective areas.
- To develop the College's physical facilities and thereby increase the sense of community and provide an enhanced learning environment for all students.

Goals for Enhancing the Undergraduate Experience

The plan defines six goals for the College's undergraduate education programs:

- To leverage the College's strengths and traditions to develop innovative courses, pedagogy, and curricula, resulting in a strengthened understanding of engineering fundamentals.
- To develop a first-year experience that significantly improves retention from first year to second year while providing a solid foundation upon which to build the subsequent three years.
- To increase opportunities for students to engage in curricular and co-curricular activities that will make them more creative problem definers and solvers.
- To develop courses and curricular options that allow for interdepartmental and intercollegiate collaboration of students and faculty, which will enhance the students' ability to work in multidisciplinary settings.
- To significantly increase participation in undergraduate research and internships.
- To create curricular and/or co-curricular activities that provide every undergraduate with an opportunity to develop leadership skills.

Guiding Principles behind the Plan

A set of guiding principles provided the context within which the plan was developed. Every element of the plan was measured against intellectual and practical litmus tests.

- **“Whole Brain” Engineer:** To prepare students to excel in their chosen careers, the College embraces a core educational philosophy that nurtures students' intellectual and personal development. The College provides students with a comprehensive understanding of fundamental engineering principles and equips them with strong technical knowledge and problem-solving skills within their discipline. In addition, it offers students a multidisciplinary perspective on engineering by exposing them to the liberal arts and developing their leadership abilities and team skills so that they can succeed in diverse settings.
- **Catholic/Augustinian Traditions:** Many engineering students choose Villanova University because of its deep spiritual and ethical roots and traditions. Principles of integrity, leadership, and service to society are fundamental threads in the fabric of the College and the plan.
- **Core Strengths of the College:** While looking to the future, the College has embraced the present by acknowledging and building on its strengths. These efforts will take the College to the next level, representing world-class excellence in every respect.

The College also developed a comprehensive set of quantitative and qualitative metrics and milestones against which the plan will be measured.

Goals for Energizing the Graduate Experience

The plan also defines goals for graduate education at the College:

- To reinvigorate the full-time M.S. program across all departments by cultivating undergraduate student research, increasing domestic matriculation (particularly from Villanova undergraduates), and improving the quality of program delivery, student services, and faculty participation.
- To leverage untapped potential and develop the part-time professional M.S. program through innovative new curricula that fully exploit the Distance Education infrastructure.
- To develop a high-quality, well-balanced, full- and part-time Ph.D. program that will be the center of the intellectual and research activity of the College and will offer unique opportunities for working professionals to obtain a doctorate.
- To increase the graduate student FTE population to 25 percent of undergraduate enrollment, including a Ph.D. program that attracts top-quality students and graduates 8 to 10 fully supported Ph.D. students on external research in any two-year period.

Fostering and Recognizing Excellence in Research

The plan also embraces excellence in research by

- Developing international recognition for research in all the Centers, as measured by professional society recognitions, journal and conference leadership, and participation in national review panels.
- Choosing and developing two additional multidisciplinary research foci that engage all five programs.

All are agreed that enhancing the College's commitment to research will not come at the expense of students and their educational experience. "We embrace the teacher-scholar model," observed Dr. Gabriele, noting that Villanova's engineering faculty will be judged on classroom success, participation in scholarly research, and publication in peer-reviewed journals.

Dr. Gabriele sees an important connection between research and improving the quality of an engineering education at Villanova. "Our goal is to attract and retain faculty who are passionate about their fields, about teaching, and about being part of the ongoing research in their areas." Increasing

participation in scholarly activities ensures that students will be taught by faculty who are absolutely current in the leading-edge ideas in their fields.



The Engineering Advisory Board (shown above with faculty and administrators) consists of alumni and friends who return to campus to provide an industry perspective and valuable feedback on the College's programs.

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.

Forging Stronger Connections

Another important strategic initiative is to strengthen the College's external partnerships, particularly with alumni and industry. A member of the strategic planning team who brought a unique perspective to the discussions was Bill Lorenz, who graduated from Villanova in 1968 with a degree in Chemical Engineering. With four decades of industry experience, Lorenz has come full circle in his career and is now an adjunct professor in the College of Engineering.

"Alumni are a tremendous resource for the College," said Lorenz, "particularly for the opportunity to serve as mentors for students and give them a 'real-world' perspective." While Lorenz maintained his connection to the College through the Alumni Association after his graduation, he believes that these relationships can be stronger and more active. "Alumni can and should play a major role in helping educate and inspire the next generation of Villanova engineers. With this new plan, it is going to be an important priority moving forward."

"We are going to put more energy and effort into cultivating and leveraging our alumni network," Dr. Gabriele agreed. "It will complement and enhance the educational experience and provide students with internships and externships where they can apply their knowledge."

A Values-Based Education

In today's hypercompetitive global marketplace, companies want and need executives who can bring leadership, integrity, and core values to their organizations.

Villanova University and the College of Engineering are uniquely qualified to forge a deep sense of ethical leadership



among students. Catholic and Augustinian values and culture are a fundamental element of the Villanova experience.

For example, service projects related to Amigos de Jesús in Honduras, Water for Waslala in Nicaragua, and Engineers Without Borders in Thailand help engineering students develop their hearts as well as their minds as they make real contributions to communities abroad.

"One of the strongest assets we have is our emphasis on service," noted Dr. Johannes. "We take great pride in graduating engineers who are leaders and who bring integrity, ethics, and values to their work."

A Bright Future in a Challenging World

This five-year plan is designed to lead the College into a future that promises excellence both for the College and the world-class engineers it graduates. "My strong belief is that if we can implement this plan," Dr. Johannes said, "we can create real, positive change."



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— Bill Lorenz ChE '68

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— Dr. John Johannes,
Vice President for Academic Affairs

Q&A With Dr. Gary Gabriele

Dean, College of Engineering

Historically, the College of Engineering has been a very successful institution. Why envision something that's already working well?

The need to look at new ways to improve things is inherent in an engineer's intellectual DNA. While it is true that we continue to enjoy success, commerce in general, and the engineering profession in particular, have changed significantly. If we are going to remain successful, we cannot be content with the status quo. We need to change, evolve, and improve. It is the best way for us to deliver more value to students.

You closely follow the changes in the engineering profession, particularly in terms of demographics. How will the College respond to those changes?

Our student body and faculty will need to reflect the changing demographics. Engineering needs to attract more females and minorities, and that presents us with an exciting opportunity because we will have an even larger pool of talent to draw from in terms of students and faculty.



Another important change is the globalization of business. Collaboration is going far beyond national borders, and it is imperative that we train and prepare our students to work successfully in that type of environment. I believe that as the College evolves demographically, students will gain a global perspective. This perspective, combined with the College's leadership opportunities, provides graduates with the knowledge and skills they need to succeed in a changing profession.

You are a strong advocate of student leadership. Why is this aspect of the plan so important?

It starts with the foundation of our Catholic and Augustinian traditions. The service part of a student's Villanova education helps bring those ideals into focus.



When students apply their knowledge by dedicating their time to worthy service projects, they experience what it means to be a leader. To me, that's the type of leadership that matters.

When students understand the importance of doing good, giving back, and thinking of others, they can't help being successful. But we should not measure leadership solely on the basis of one's personal success. Leadership also is about lifting up others and conducting oneself with integrity. We have a responsibility to educate and inspire this type of leader.

Is it really possible for the College to educate a student to become a "whole brain" engineer?

Absolutely. I believe we can achieve an academic and spiritual balance. That is what makes Villanova such a unique institution. It is not just about giving students a strong technical expertise. We are committed to educating the whole person so that students come away with a well-rounded perspective and a strong religious foundation. I think a "whole brain" engineer not only is possible but is something we must be committed to achieving.

"We should not measure leadership solely on the basis of one's personal success. Leadership also is about lifting up others and conducting oneself with integrity. We have a responsibility to educate and inspire this type of leader."



Learning to Think like an Entrepreneur *By Suzanne Wentzel*

Multidisciplinary initiatives are teaching engineering students how to turn their ideas into products.

Today more than ever, engineers must bridge the gap between technology and marketplace. “Because commodity-type engineering is being outsourced,” said Dr. Pritpal Singh, Chair of the Department of Electrical and Computer Engineering, “students have to be more creative so that they can develop new technology and stay ahead of the competition.”

To that end, interdisciplinary teams of faculty and staff are working to foster a spirit of entrepreneurship in Villanova students and to encourage them to ask—and answer—not only technical but also business questions: What are the market’s needs? Where do I find funding? How do I protect my idea?



Students from all four colleges heard from successful entrepreneurs during *Beyond Ideas: The Art of Entrepreneurship*, a one-day event.

Entrepreneurship Minor

This fall, 26 engineering sophomores will pursue creative solutions to real problems in a one-credit course called Innovation and Creativity, the first offering in a proposed entrepreneurship minor that will combine theory with hands-on experience to equip engineering students with business and leadership skills.



A new entrepreneurship curriculum has been developed by a College of Engineering-Villanova School of Business team (from left): Dr. James Klingler, Dr. William Hurley, Professor Edmond Dougherty, and Dr. Pritpal Singh.

The curriculum was developed by Dr. Singh and Visiting Assistant Professor Edmond Dougherty EE '69, GS '86 from the College of Engineering; and, from the Villanova School of Business (VSB), Dr. James Klingler, Interim Director of the Center for Entrepreneurship, and Dr. William Hurley, Business Fellow in the Department of Management. In 2007, this team received a grant from the Kern Family Foundation to implement and develop the minor, and to support student activities such as Villanova’s

Electronic Inventors Club and the Entrepreneurial Society.



University President Rev. Peter M. Donohue, O.S.A., is pictured with (from left) Zareh Baghdasarian, Joseph A. Powers, Steve Christini, and Eric Griffin-Shelley, presenters at *Beyond Ideas*.

Beyond Ideas

In 2004, Patricia Burdo, the College’s Administrator of Professional Development, joined forces with the Villanova Entrepreneurial Society to sponsor an

entrepreneurship forum. From it evolved *Beyond Ideas: The Art of Entrepreneurship*. During this one-day event—which is planned by a University-wide team and open to all Villanova students—entrepreneurs discuss topics from business planning and venture funding to intellectual property and e-commerce. Students can present their ideas, and network with speakers, alumni, and faculty. “They come away empowered to become entrepreneurs,” said Burdo. The third *Beyond Ideas* will be held November 1. The Delaware County Keystone Innovation Zone helps fund the event.

Technology Commercialization

Thanks to a Keystone Innovation Grant awarded in 2007, Villanova is creating opportunities for innovative thinkers to move their ideas off campus and into the marketplace. Strategies include mining for new technologies, encouraging regional startups, and exploring the feasibility of a technology-transfer office. The long-term goal is the formation of an enterprise center where ideas can achieve commercial viability.

For now, these initiatives are targeted primarily at engineering students. However, Dr. Singh hopes that “a climate of entrepreneurship will eventually pervade the campus.” Professor Dougherty shares this vision, believing the climate may even spur economic development in the Delaware Valley. “If students build their companies here, the region could see a renaissance of engineering entrepreneurship.”

Undergraduate Research Opportunities Grow

By Suzanne Wentzel

An increased offering of on-campus internships allows undergraduates to pursue their own research during the summer.

Studying the effects of microstructure on the initiation and propagation of microcracks in bones was not how rising junior Susan Mischinski imagined she would spend her summer. But after hearing Dr. Alfonso Ortega, Associate Dean for Graduate Studies and Research and the James R. Birle Professor of Energy Technology, pitch the idea of doing a research internship on campus, the mechanical engineering student decided to apply. "I didn't know this was an option," Mischinski said, "but Dr. Ortega encouraged me."

Providing more undergraduates with just such an opportunity has been a priority for Dr. Ortega. Since September 2007, he has been part of a committee of associate deans and faculty members from the College of Liberal Arts & Sciences and the College of Engineering that has worked to expand the existing program for summer research internships.

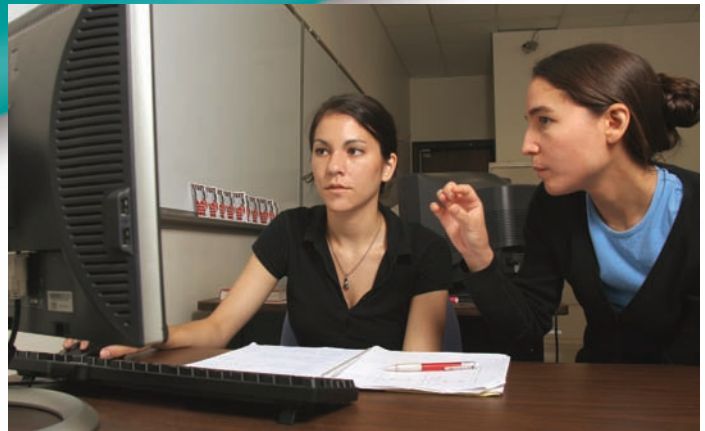
As a result, seven engineering students received internships for this summer. The internships include a stipend, funding for supplies and expenses, and room and board.

As part of the internship, students work with a faculty advisor—in Mischinski's case, Dr. Ani Ural, Assistant Professor in the Department of Mechanical Engineering. "Dr. Ural is teaching me things I wouldn't learn in the classroom." Faculty, too, benefit from this one-on-one relationship, experiencing what Dr. Ortega described as "mentorship and teaching in their most glorious form."

Under the revised program, more students can pursue their own research, with the chance of getting published or presenting at a conference. They also become more aware of the graduate-school opportunities at Villanova.

The program strengthens the University's reputation as an institution distinguished for its undergraduate education and research capabilities. It will attract high-achieving students who want the opportunity to do undergraduate research. "Along with growing opportunities for students in new minors and concentrations such as Bioengineering and Engineering Entrepreneurship, undergraduate research is yet another way to fully engage our best and brightest students in the total educational package that Villanova offers," said Dr. G. F. Jones, Associate Dean, Academic Affairs for the College.

Mischinski has already discovered how rewarding an opportunity that is. "I'm taking my learning to the next level, I'm doing research that hasn't been done before, and I'm getting paid!"



Villanova faculty strongly encourage undergraduate research. Dr. Ani Ural (above, right) mentors rising junior Susan Mischinski (left), who is doing paid summer research.



*Left: Dr. G. F. Jones, Associate Dean, Academic Affairs
Below: Dr. Alfonso Ortega, Associate Dean for Graduate Studies and Research*



Villanova Teams Up with Industry to Reduce Engine Emissions *By Mike Suavola*

In the state-of-the-art Automotive Emissions Lab, researchers study engine-catalyst systems to increase efficiency and reduce emissions.

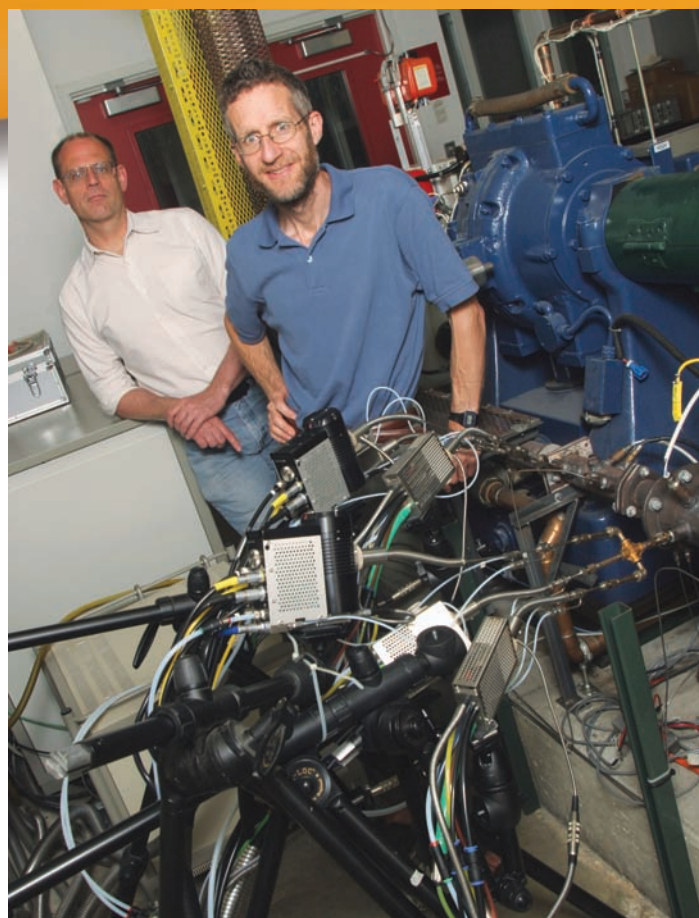
Greenhouse gases, ozone, smog, and acid rain are all problems exacerbated by the harmful emissions from one of the country's largest pollution sources: cars and trucks. Dr. James Peyton Jones, a professor in Electrical and Computer Engineering, and Dr. Kenneth Muske, the Mr. and Mrs. Robert F. Moritz, Sr., Chair in Systems Engineering and a professor in Chemical Engineering, have been working together within Villanova's Center for Nonlinear Dynamics and Control (CENDAC) to reduce gasoline engine emissions.

"It's a highly interdisciplinary field," said Dr. Peyton Jones, the Director of CENDAC. "Ultimately, you're trying to optimize the chemical reaction of combustion within a mechanical system that is controlled by an electronic engine management system." The interdisciplinary team approach has worked well, and, together, Dr. Peyton Jones and Dr. Muske have established a world-class automotive emissions research and teaching laboratory. Working with both graduate and undergraduate students, they apply nonlinear theoretical techniques to real engine and exhaust aftertreatment systems.

Making better use of the proven catalytic converter

For many years, automakers have used catalytic converters in the exhaust system to transform harmful carbon monoxide, hydrocarbon, and nitrogen oxide into carbon dioxide, nitrogen, and water. "It's well known that, to remove all three exhaust gas pollutants at the same time, you have to hold the air-fuel ratio within a narrow window around stoichiometry," Dr. Peyton Jones explained, "but the conversion efficiency also depends on the nonlinear dynamics of the engine-catalyst system. Our research focuses on modeling the nonlinear system dynamics and incorporating these models into the air-fuel ratio control strategy to achieve higher conversion efficiencies and lower emissions."

The facilities for performing this research at Villanova are exceptional. A \$320,000 Major Research Instrumentation award from the National Science Foundation enabled the laboratory to be equipped with a suite of fast-response exhaust-gas analyzers that can measure exhaust emissions on the millisecond timescales required to characterize the catalyst system. A rapid prototyping system also allows new control strategies to be developed in a high-level Matlab/Simulink environment, and then cross-compiled and downloaded to run on the engine management system's microprocessor. "This rapid prototyping approach gives



Dr. James Peyton Jones (right) and Dr. Kenneth Muske (left) carry out advanced research in the Mechanical Engineering Department's Automotive Emissions Laboratory, which is supported by the National Science Foundation, industry partners, and individual alumni, all of whom are interested in developing cleaner-running engine-catalyst systems.

us complete control over the entire engine management system and has enabled us to implement advanced model predictive control strategies for air-fuel ratio control much more quickly than would otherwise be possible," Dr. Muske said.

On Board Diagnostics

Although the industry has been very successful at reducing auto emissions for new vehicles, a high proportion of the total automotive emissions comes from a small number of highly



The interdisciplinary team approach has worked well, and, together, Dr. Peyton Jones and Dr. Muske have established a world-class automotive emissions research and teaching laboratory. Working with both graduate and undergraduate students, they apply nonlinear theoretical techniques to real engine and exhaust aftertreatment systems.

Mike Breckenridge EE '08 worked on developing a prototyping system as an undergraduate and is continuing to assist in the lab as a graduate student.

polluting vehicles whose emissions control systems have failed in some way. To address this problem, the law requires that all cars and light trucks sold in the United States be equipped with On Board Diagnostic (OBD) systems, which monitor the health of the catalyst system and light a malfunction indicator light if a problem is detected. "Traditional catalyst OBD strategies are often heuristic, or they require the emissions control strategy to be suspended while the catalyst oxygen storage capacity is being measured," explained Dr. Peyton Jones. "But since our catalyst models capture the behavior of the system more fully, we can use model-based diagnostic strategies to discriminate more effectively between healthy and unhealthy catalysts, and we can do so without having to impose special test conditions." Dr. Peyton Jones and Dr. Muske have also submitted a patent application based on a novel approach to catalyst diagnostics that infers catalyst health from the amount of hydrogen being produced by the catalyst.

Exhaust Gas Oxygen Sensors

Any control or diagnostic strategy is dependent on the sensors it uses to measure the gas composition upstream and downstream of the catalyst. Despite the name, the Exhaust Gas Oxygen (EGO) sensors on which most systems rely actually have a strong cross-sensitivity to hydrogen. "If you ignore this cross-sensitivity," explained Dr. Muske, "you compromise the performance of the entire system." The Villanova team, therefore, spends as much of its time measuring and modeling the behavior

of the EGO sensors as it does modeling the catalyst itself. Rather than treating the cross-sensitivity as unavoidable sensor distortion, they aim to use it to extract additional information about what is happening on the catalyst surface and thereby to develop improved catalyst control and diagnostic systems.

Contributions and Funding

The initial funding to set up the laboratory came from the National Science Foundation, and it has since been supported by a cross-section of the automotive industry. The Ford Foundation funded several projects, and Ford Motor Company donated the 2.0L I4 engine on which the experiments are performed. Johnson Matthey, an international corporation whose U.S. headquarters are in Wayne, Pennsylvania, provided the catalysts for study, while ExxonMobil provides the reference fuels that are required for repeatable experiments. Alumnus Edward Barry ChE '54 also has provided invaluable support for the operational costs of the laboratory, student support, and equipment items needed for the research. When asked about their future research needs, Dr. Peyton Jones and Dr. Muske said they would like to build a second test bed so that they could apply similar techniques to reducing diesel engine emissions. They also hope to acquire an AC dynamometer system so that they can test the engine under much more realistic transient conditions.

Partnerships Strengthen Villanova's Engineering Education

By *Burton Lane*

Villanova's collaborative efforts enhance engineering knowledge and practice.

Businesses, graduate schools, and government agencies enthusiastically recruit Villanova engineering students. Many factors contribute to the value of the College's students, including a curriculum strong on fundamentals and an institutional spirit of leadership and service to others.

Complementing these internal strengths is a network of relationships with organizations that participate in the life of the College in various ways.

Student Development and Recruiting

Beyond participating in career days, many organizations provide summer internships. These give students and organizations a chance to get to know each other and often lead to job offers. They also help students see how their lessons apply to the real world and enrich the learning that takes place the next academic year.

Many organizations send speakers to talk with students—often sophomores—about what engineers do in their companies. Villanova is also fortunate to have working professionals come to campus to judge student competitions, such as the senior capstone projects.

One of the most effective ways for an organization to build relationships with students and to develop future engineers is to sponsor research that addresses a problem the company is trying to solve. The company works with engineering students on campus and at its own site throughout the year.

Faculty Development and Research

Fellowships enable faculty to work on research projects for a company. This provides expertise to the organization while helping faculty and students make the classroom and lab relevant to the workplace. In addition, an organization can support long-term research, strengthening Villanova's undergraduate research program.

Continuing Education

Villanova provides graduate education to employees of organizations on campus, at the work site, and through an award-winning distance education program. The flexibility of the graduate program is ideal for busy working adults.

Providing Feedback

Each department in the College of Engineering seeks advice from working engineers through discipline-specific

Organizational Highlight – NAVSEA

The College of Engineering has enjoyed a long and mutually beneficial partnership with NAVSEA. With locations throughout the country, NAVSEA provides engineering support for the Navy. Philadelphia NAVSEA is the country's premier facility for hull, mechanical, and electrical systems.



Students learn about complex, real-world engineering during summer internships.

For the past three years, the College's faculty and students have conducted Autonomous Systems Research with NAVSEA. This is a high priority for the Navy and critical in helping the country meet challenges that have arisen since the end of the Cold War. In addition NAVSEA supports undergraduate research in Autonomous Surface Vehicles (ASV). Villanova students will be in a major national ASV competition this year in San Diego.

Most of these students (about 12 in all) are serving as interns this summer at NAVSEA Philadelphia. Patricia C. Woody (front row, center), Department Head of Machinery Research and Engineering, said, "The NAVSEA internship program gives students a chance to explore what it is like to work in a complex, systems-oriented operation and decide what interests them most. If they come to work here, they can continue to explore everything from pursuing advanced research to traveling on ships and troubleshooting systems."

The internship program's advisor, Dr. C. Nataraj, Chair of the Mechanical Engineering Department, also teaches graduate classes at NAVSEA's facilities at the Philadelphia Navy Yard and has had research fellowships there. "NAVSEA not only is a valuable research partner for our students and faculty," Dr. Nataraj said, "but also sends engineers to serve on focus groups about our curriculum, judge senior competitions, and talk to our sophomores to explain what engineers do at the Navy. Many Navy engineers also have pursued their graduate studies in our College. This partnership has been valuable to our students and faculty."

advisory boards. These groups ensure that the educational program matches the most current thinking in the industry. A College-wide advisory board helps identify external opportunities and provides feedback on the planning of the engineering program. These organizational representatives ensure that Villanova will continue to have one of the top engineering programs in the country.



The DE operator monitors the Web broadcast of a live graduate engineering class.

DE Program Celebrates 10th Anniversary *By Suzanne Wentzel*

In its 10-year history, the College's Distance Education Program has evolved into a nationally recognized leader in its field.

Ten years ago, students and faculty from the Department of Electrical and Computer Engineering got the nod from Dr. Robert Lynch, then the College's dean, to build a prototype of an online distance-learning system. The key players—one of whom was sophomore Sean O'Donnell—were not afraid to dream big. "We were banking on future technology to bring our ideas to fruition," said O'Donnell. "When that technology came out, we were ready to deliver."

Their confidence paid off. Today, the College of Engineering's Distance Education Program is not only delivering; it is leading the way. The award-winning program gives professionals the flexibility to earn a graduate degree from home or work. And given the rising gas prices, it also saves them the significant expense of having to commute to campus.

The backbone of the DE system is a technology that allows for the simultaneous broadcast of live audio, video, and digital content. Using state-of-the-art classrooms, professors instruct students seated in front of them and students off site. DE students see and hear classes, join in discussions, and ask questions. In addition, classes are archived for future reference.

"We've created a system that suits the world we live in," said O'Donnell, the DE director since 2001. The numbers prove it. When students have

The backbone of the DE system is a technology that allows for the simultaneous broadcast of live audio, video, and digital content. Using state-of-the-art classrooms, professors instruct students seated in front of them and students off site.



Sean O'Donnell and James Dion (shown above) display several of the awards that the DE Program has won over the past few years.

the option of taking a course in person or online, 50 percent choose the latter.

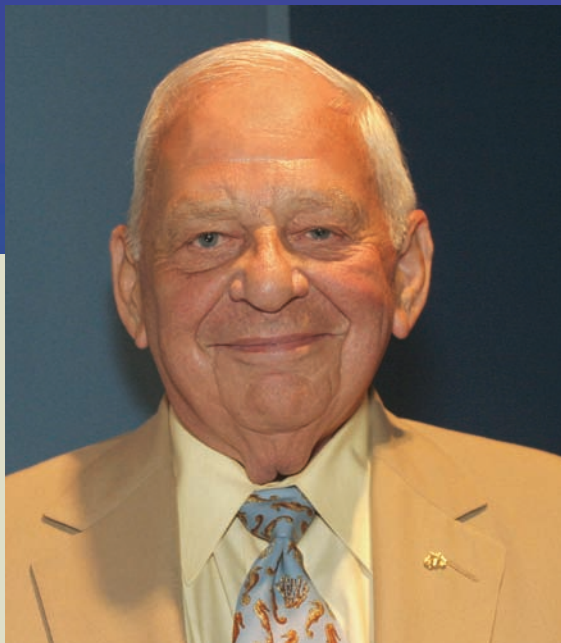
One satisfied customer is Christopher Felker. A project manager and lead stress engineer on the 787 program at Boeing, Felker earned his M.S. in 2005. "The technology and convenience of Villanova's program were superior," said Felker, who had taken a CD-based distance course elsewhere. "Whenever I had a question, the professor would display it on the screen and look at the camera to answer me."

The distance-learning industry has recognized Villanova's innovativeness. In May, the DE program received a Learning Impact Leadership Award from IMS Global Learning Consortium for its effective uses of technology, and it has garnered accolades for excellence in education and classroom design. O'Donnell also has spoken at numerous gatherings, such as the United States Distance Learning Association's conference in April.

O'Donnell and his colleagues continue to grow the DE program. They hope to have all graduate engineering courses online within three years and to extend the archiving capability to undergraduate courses within five. O'Donnell is pleased with the program's progress. "When we started, we had one or two students. Now, the line between online and in the classroom has been erased." Not bad for a decade's work.

Alumni Support Is Key to College's Success *By Jim Mann*

Engineering alumni explain why staying involved with and contributing to the College matters to them.



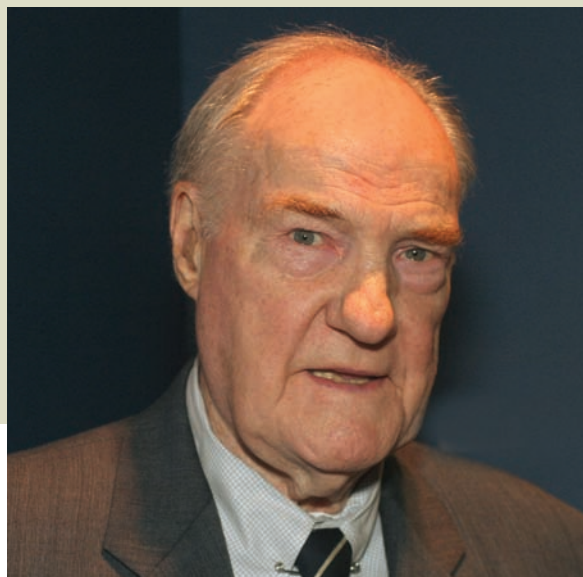
Gift support from alumni and friends is critical to ensuring that Villanova and the College of Engineering can continue to provide a high-quality education for today's students. Outlined below are several ways that one can support the College or University.

← **“Villanova was one of the most important influences in my life, along with the Marine Corps. My wife, Carolyn, and I created a scholarship in engineering to enable future generations to experience the same good things that I did.”**

— Philip Piro EE '50 and his wife, Carolyn, created the Carolyn and Philip A. Piro '50 Endowed Scholarship for Engineering

“Villanova has had an illustrious → and distinguished first century of engineering education. The endowments are important for maintaining and building upon that record.”

— James Drobile ChE '49 gifted the James Drobile Dean's Scholarship in Chemical Engineering



Dr. Edward V. McAssey, Jr., Professor Emeritus of Mechanical Engineering, was honored by his son Edward V. McAssey III '81 and daughter-in-law Linda through an endowed gift to support the Heat Transfer Lab. The gift honored Dr. McAssey's 40 years of service to Villanova. Pictured from left on the occasion of the dedication are Anne E. McAssey, Dr. Edward McAssey, Jr., Edward McAssey III, and Linda McAssey.

Endowments: Creating a Perpetual Legacy

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 Jim Mann, Director of Development for the College of Engineering, at 610.519.4564 or at james.mann@villanova.edu.



“Going through the chemical engineering curriculum prepared me well for industry. I learned independ-

ence, leadership, and the practical application of engineering, because Villanova faculty focus on the students, not just on publications or theoretical discoveries. I donate so that the program can maintain this position while developing new areas of expertise, such as biopharmaceutical engineering.

My husband and I value our membership in the Villanova community and stay connected to friends through the Villanova network. We love and respect Fr. Pete dearly, and trust him to maintain the reputation of the University and develop programs that will meet the needs of the future.”

— Kimberly Rafalski Palladino ChE '97 and Peter J. Palladino VSB '98

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/makeagift.edu. 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.



“In the churchyard of St. Columba, Drumcliffe, Ireland, next to the grave site of William Butler Yeats, is the Meehan tombstone, which reads: ‘An act of human kindness, once set in motion, endures forever.’ What better reason could one ask for, especially a Villanova alum?”

The University offers many opportunities for alumni and friends to give, ranging from donating to the general funds to becoming involved with the work of professors and students in the various Colleges. We have chosen the latter so that we can provide focused financial support to the University while establishing a relationship with the faculty, administration, and students in programs of key importance.”

— Edward G. Barry ChE '54 and his wife, Beth, who gift each year to the Automotive Emissions Laboratory

News in Brief

Recent achievements of the College of Engineering are highlighted.

Awards

Dr. David Dinehart, a professor in the Department of Civil and Environmental Engineering, received the **William F. Farrell Award** at the Annual Dean's Award Dinner in April. Established in memory of Rev. William F. Farrell, O.S.A., the award is given to recognize an engineering faculty member who has demonstrated exemplary personal concern for students.

Dr. Robert Traver, Director of the Villanova Urban Stormwater Partnership (VUSP), received the **Watershed Stewardship Award** from the Chester County Water Resources Authority in January. The award recognized Dr. Traver's outstanding efforts toward the stewardship and management of Chester County's watersheds.



Dr. Randy Weinstein, 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 during graduation ceremonies on May 18.

The Philadelphia Section of the American Society of Civil Engineers (ASCE) cited **Dr. Andrea Welker**, an associate professor in the Department of Civil and Environmental Engineering, as the **2008 Geotechnical Engineer of the Year** at its annual Spring Social in May. Dr. Welker also is the Associate Director of the VUSP.



External Funding

Dr. Robert Traver received a grant of \$442,787 from the **Cooperative Institute for Coastal Estuarine Environmental Technology (CICEET)**. Partnering with the University of Maryland and North Carolina State University, Villanova is investigating the effectiveness of low impact development (LID) bioretention Best Management Practices (BMPs).

Dr. C. Nataraj, Chair of the Department of Mechanical Engineering, received \$400,000 for this year and for each of the next two years from the **Office of Naval Research** to fund the nonlinear analysis and design of smart-valve systems on Navy ships and submarines. Dr. William Messner, a Professor of Mechanical Engineering at Carnegie Mellon University, is collaborating with Dr. Nataraj on the project.

The **Pennsylvania Department of Community and Economic Development** awarded Villanova a **Keystone Innovation Starter Kit (KISK)** grant of \$250,000. The grant came from a proposal written by **Dr. C. Nataraj** to recruit a faculty member in the area of nanotechnology.

The Center for Advanced Communications (CAC) received a **Defense University Research Instrumentation Program** grant of \$240,000 from the **Office of Naval Research** to purchase equipment for research in through-the-wall imaging. The Principal Investigator is **Dr. Moeness Amin**, CAC Director, and the Co-Principal Investigators are **Dr. Ahmad Hoorfar** and **Dr. Yimin Zhang**.

A Villanova Civil and Environmental Engineering team led by **Dr. Metin Duran** was awarded \$186,700 by the **Philadelphia Water Department (PWD)** to investigate novel approaches to optimizing PWD's biosolids digestion process. The team is working with PWD and Brown and Caldwell, a leading national engineering firm.

The **Pennsylvania Department of Environmental Protection** awarded Villanova a **Growing Greener Watershed Grant** of \$185,000 to implement a redesign of the constructed stormwater wetlands (CSW) located in the northeast corner of campus. The Principal Investigators are **Dr. Bridget Wadzuk** and **Dr. Robert Traver**, both of the Department of Civil and Environmental Engineering.



The Center for Nonlinear Dynamics and Control (CENDAC) received \$80,000 from a **Small Business Technology Transfer (STTR)** Program Phase II contract issued by the **Navy** to Unmanned Ocean Vehicles, Inc., to develop a prototype of an automated surface vehicle. **Dr. C. Nataraj** and **Dr. Pritpal Singh**, who is the Chair of the Department of Electrical and Computer Engineering, are the Co-Principal Investigators.

The CAC received \$23,000 from a Small Business Innovation Research (SBIR) Program Phase I contract issued by the Navy to Smart & Complete Solutions, LLC. **Dr. Ahmad Hoorfar** and **Dr. Moeness Amin** are Co-Principal Investigators on the project, which is titled “Radio Frequency (RF) Modeling of Layered Composite Dielectric Building Materials.”

The Green Building Alliance awarded a \$20,000 grant to a team of graduate and undergraduate researchers headed by **Dr. Pritpal Singh** to research the development of high-efficiency, low-cost solar cells for use on roofs. The grant is enabling the team to produce a proof of concept for their design.



The VESTED (Villanova Engineering, Science, and Technology Enrichment and Development) program received \$20,000 from the **Hamilton Family Foundation** to support operational expenses. Each year, VESTED helps about 60 low-income high school students learn about engineering.

Dr. Rosalind Wynne, an assistant professor in the Department of Electrical and Computer Engineering, received a Minority Junior Faculty Award in the amount of \$10,000 from the **Christian R. & Mary F. Lindback Foundation**. The grant is funding the purchase of detection equipment that Dr. Wynne will use to design and develop microstructured optical fiber devices with multiple solid cores for simultaneous chemical sensing and strain sensing.



International Outreach

In October, **Dr. Alfonso Ortega**, Associate Dean for Graduate Studies and Research and the James R. Birle Professor of Energy Technology, was one of three experts invited to China to lecture on thermal management in electronic systems at Xi'an Jiaotong University. He plans to return to China this year to establish a formal collaboration with Shanghai University and to visit the Beijing offices of the Chinese equivalent of the National Science Foundation.

Dr. Moeness Amin attended the fourth NATO Task Group SET-100/RTG056 meeting on Sensing Through the Wall Technologies at the Ingegneria dei Sistemi (IDS), Pisa, Italy, in November 2007. Dr. Amin presented the CAC team's most recent research work.

In January, **the CAC** signed a Memorandum of Agreement with Ain Shams University (ASU) in Cairo, Egypt. This agreement will promote the development of academic, scientific, technical, and cultural relations between ASU and Villanova through student and faculty exchanges, scientific research, professional internships, and technical cooperation.

The International Society for Pharmaceutical Engineering (ISPE) announced in January that it had selected Villanova's College of Engineering as one of 10 North American universities to join in a partnership with its members. The selection was based on the strength of the College's pharmaceutical and biotechnology research, course offerings, and interest and experience in working with industry; as well as the initiative of **Dr. William Kelly**, an associate professor of Chemical Engineering.

During a workshop in Santiago in April, **Dr. Alfonso Ortega** was part of an international panel of experts that advised the Chilean government on how to successfully research, develop, and apply nanotechnology.

Commencement Weekend 2008

As part of Commencement Weekend 2008, the College of Engineering paid tribute to its 241 undergraduate and graduate students at a Recognition Ceremony on Mendel Field on Saturday, May 17.

During graduation ceremonies on Sunday, May 18, **Clay Emerson**, whose dissertation was titled *Evaluation of Infiltration Practices as a*



Means to Control Stormwater Runoff, became the first Ph.D. graduate from the Department of Civil and Environmental Engineering.

To keep up with the latest news and events in the College of Engineering, visit www.villanova.edu/engineering/newsevents/



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