

VILLANOVA

Summer 2009

ENGINEERING

WORKING IN **HARMONY** TO **ENGINEER** A BETTER WORLD

VILLANOVA
UNIVERSITY

Villanova Engineering

Summer 2009

Drosdick Endowed Dean of Engineering

Dr. Gary A. Gabriele

Director of External Relations

Burton H. Lane

Writer and Editor

Suzanne M. Wentzel

Designer

Peter Volz Design

Photo Credits

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Questions or Comments

Send to suzanne.wentzel@villanova.edu

Address Updates

Send to marylou.glenn@villanova.edu

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Message from the Dean

In a sermon he delivered almost 500 years ago, St. Thomas of Villanova asked, "What is more pleasant than to live in harmony?"

For the students, faculty, and alumni of Villanova's College of Engineering, living in harmony isn't an ideal. It's a practice. These men and women are building collaborations that strengthen the College's reputation for excellence, enrich the life of the University, nurture the development of future engineers, and promote a more just society.

This issue of *Villanova Engineering* highlights selections from the College's repertoire of successful partnerships. Our structural engineering faculty have worked closely with industry partners to build up a world-class teaching and research lab. Other faculty have teamed up with colleagues in the Villanova School of Business to introduce students to the concepts of entrepreneurship.

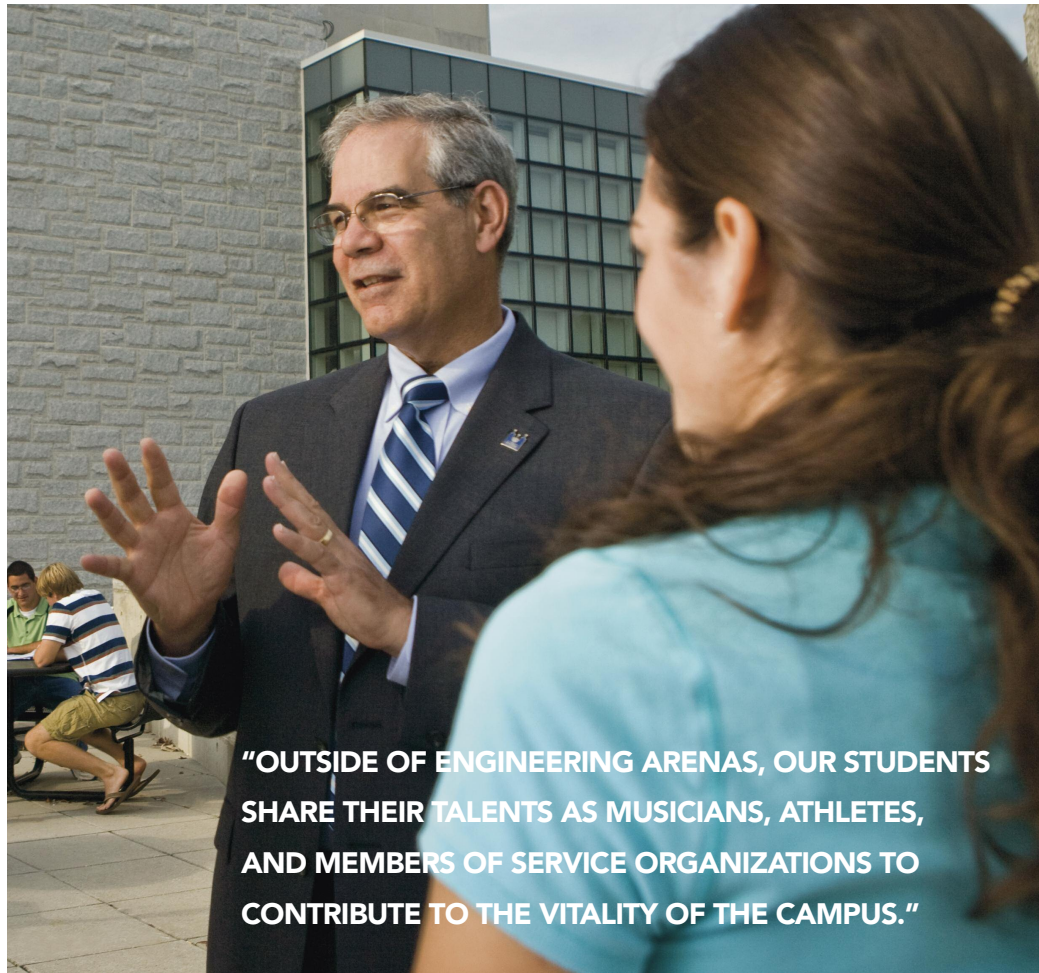
Meanwhile, our engineering students spread out across the globe to design and build systems that improve the quality of life of people in developing countries. These partnerships empower local residents to take ownership of the projects.

Students also mentor underrepresented youth in middle schools and high schools in the Philadelphia region. As these younger students build robots and perform experiments, our students help them discover their potential.

Outside of engineering arenas, our students share their talents as musicians, athletes, and members of service organizations to contribute to the vitality of the campus. Their involvement helps them develop personally, and often they rise to positions of leadership.

We celebrate, too, the extraordinary achievements of several female graduates. As collaborators and as leaders, they have advanced in their professions and defined what it means to be a Villanova engineer.

These stories testify to the Augustinian virtue of *unitas* that motivates and connects the Villanova family. We recognize our responsibility to work with others for the greater good, and our partners tell us how much these collaborations mean to them. Such feedback is music to our ears.




"OUTSIDE OF ENGINEERING ARENAS, OUR STUDENTS SHARE THEIR TALENTS AS MUSICIANS, ATHLETES, AND MEMBERS OF SERVICE ORGANIZATIONS TO CONTRIBUTE TO THE VITALITY OF THE CAMPUS."

Gary A. Gabriele, PhD
Drosdick Endowed Dean of Engineering

THE LOAD STARTS

Villanova's Structural Engineering Faculty Have Built Up a World-Class Lab

A large industrial laboratory setting, likely a structural engineering lab. The foreground is dominated by a long, thick, rectangular concrete beam resting on a metal support structure. The beam has a rough, weathered surface with some markings and a blue strap tied around it. In the background, there are stacks of similar concrete beams, an orange crane or hoist, and other structural components. The walls are made of concrete with several small, dark square openings. The overall atmosphere is one of a well-equipped, professional engineering facility.

Strength, durability, the capacity to withstand fatigue, and the long-term performance of individual components: these may be the characteristics of a well-designed bridge, but they also describe the team of Civil and Environmental Engineering (CEE) faculty referred to around campus as “the structures group.” Because of the vision, energy, and talent of these three faculty—Dr. David Dinehart, Dr. Shawn Gross, and Dr. Joseph Yost, PE—Villanova’s Structural Engineering Teaching and Research Laboratory (SETRL) opened its doors in June 2005.

continued



Dr. Joseph Yost (right) discusses the progress of an experiment with graduate students Angela Russo (left) and Zeyn Uzman.

Four years later, the 10,000-square-foot, state-of-the-art facility is abuzz with activity. In their hard hats and safety glasses, students assist faculty in testing the latest innovations in the construction industry and perform hands-on experiments that build upon classroom learning. “It’s very satisfying to go into the lab and see a group of researchers, an undergraduate class, and the Steel Bridge Team all doing work under one roof,” said Dr. Dinehart, Professor and SETRL Director.

Among Villanova’s peer schools, the SETRL is without rival. It can accommodate the simultaneous testing of structural members up to 100 feet long and structural frames that are two stories high, under both static and dynamic loads. It has a 25-ton overhead crane, and a 22-foot-high reaction wall corner allows for lateral loading of structural frames. Four structural steel testing frames can support five MTS servo-controlled hydraulic actuators. Specimens shorter than 16 feet are tested on a 400 kip self-reacting test frame fitted with dedicated hydraulic loading and data acquisition equipment. In addition to a complete array of instrumentation, the lab has a materials testing and characterization room, a machine shop, an environmentally controlled full-scale testing room, and a wet room.

FOUNDING OF THE LAB

It was providential that the original three members of the structures group were hired in the same academic year. Dr. Dinehart and Dr. Yost joined the CEE faculty in fall 1998, and Dr. Shawn Gross came on board the following spring. Dr. Dinehart had worked for Bechtel, designing power-generating facilities, and had studied the seismic behavior of wood structures for his PhD. Dr. Yost had extensive experience

in bridge design and rehabilitation and was interested in the use of innovative materials in transportation infrastructure. Dr. Gross, who earned his master’s and doctoral degrees right after college, had focused his studies on high performance, prestressed concrete bridges. The three inventoried each other’s experiences, research strengths, and goals—and the dream of what they could accomplish together began to take shape.

The immediate task was equipping a room in John Barry Hall with elements of a structural testing facility to increase research opportunities and to enable undergraduates to apply in a lab what they were learning in their lectures. Pooling their talents and financial resources, they purchased supplies to build a small test frame, a hydraulic loading system, and a data acquisition system.

As the three professors began to receive more funding, they turned their attention to increasing graduate enrollment, which at that time was thin. With the support of the College, the group also instituted an undergraduate research course, which over the years has helped swell the graduate ranks even more. “Students see that research is fun, and the experience opens their eyes to the possibility of staying to earn a graduate degree,” Dr. Dinehart said.

To purchase more equipment, the three faculty applied for and received a \$250,000 Major Research Instrumentation grant from the National Science Foundation (NSF) in 2003—and then another half million from the W. M. Keck Foundation. These awards begged the question: Where would the structures faculty put all the equipment that they would purchase with this funding?

The University considered the evidence, and the answer was clear. These guys

were worth backing. Villanova made the commitment to support the construction of a full-scale structures lab, and more contributions flowed in from other sources, including MTS Systems Corporation and SMI Joist Company, a division of Commercial Metals Company (CMC) whose president, John Robins CE ’70, also was a big believer in the structures group. In his remarks at the dedication of the SETRL, Dr. Ronald Chadderton, PE, Chair of the CEE Department since 2001,





“IT WAS THE RIGHT MATCH OF PEOPLE WITH THE RIGHT TYPE OF INSTITUTION.”

— *Dr. Shawn Gross*

summed up the evidence well. “When we began to hire new structural engineering faculty members, we charged each of them to maintain our tradition of high-quality education for the undergraduates. We also asked them to work together, as a team, to revitalize the structural engineering graduate program and to expand our presence in structural engineering research. I think it is safe to admit that they have exceeded all of our expectations.”

MAJOR AREAS OF RESEARCH

The capabilities of the new SETRL allowed the faculty to take on new projects and test bigger systems. One area in which they quickly expanded the scope of their work was beams. Before the SETRL was built, the group had had a research contract with CMC to study the behavior of cellular and castellated beams and to verify and develop beam design processes. When the new facility opened, they were able to

continue that research on a much larger scale. This summer, the researchers will start work on the latest project from CMC: looking at how castellated and cellular beams perform under seismic conditions. In addition, the American Institute of Steel Construction has tapped Dr. Dinehart to coauthor the U.S. design guide for cellular and castellated beams.



Graduate student Matt DeSimone BSCE '08

Since 2000, the researchers also have been investigating the behavior of open web steel joists. Initially, the group received a five-year contract from CMC to perform open-ended studies that met the needs of the company, whether that need was gaining a competitive edge or improving a design process. The relationship with CMC has continued, and the researchers have conducted numerous joist projects, from studying the behavior of crimped web members to developing a ductile design procedure.

“One of the outflows of working with CMC is that we have come to be considered experts in the field of open web steel joists,” Dr. Dinehart said. “Having a bigger lab has allowed us to network with the Steel Joist Institute, a nonprofit organization that promotes better understanding of the industry, and to do two funded research projects for them.”

Concrete is another area in which the structures group has recognized expertise,

and they are conducting several studies in which the manufacturing industry is extremely interested. In one experiment, the researchers are looking at the fatigue behavior of concrete beams strengthened with carbon fiber reinforced polymer (CFRP) bars. This lightweight composite is being studied as a retrofitting material that can be added to the steel reinforcements of in-service concrete bridges so that they have the stiffness and strength required for modern highway loads. Because the SETRL’s hydraulics allow for load cycles at high frequencies, beams are being fatigue-loaded for 2 million cycles. Hughes Brothers, Inc., has donated CFRP bars for the study.

A big problem associated with the use of steel reinforcement is corrosion. To improve durability in concrete bridge decks, the structures group is studying the low-cycle fatigue behavior of two-span continuous concrete beams doubly reinforced with high-strength, noncorrosive glass fiber reinforced polymer (GFRP) rebars. The scope of the SETRL has enabled the researchers to replicate the real-life load and support conditions of a bridge deck, a step that is critical for accurately assessing the pros and cons of GFRP bars as a substitute for steel. “The industry needed research that recognized the importance of re-creating in the lab the conditions that characterize a

deck in service,” Dr. Yost said. Once again, Hughes Brothers donated the materials. A fellowship from the Michael Baker Corporation covered the stipend for the graduate assistant working on the project.

In 2008, Girder Slab Technologies awarded a \$120,000 grant to the group to conduct full-scale and component tests on the Girder-Slab® system, an advanced technology in which precast slabs and an integral steel girder form a monolithic structural slab assembly. This system allows for more rapid construction and assembly, as well as for variations in floor-to-floor heights. In the spring, the structures group began to conduct tests to more accurately quantify the strength and stiffness of the composite system. This research will lead to innovations that will expand the use of the system beyond its current market.

NEW FACULTY, NEW EXPERTISE

In recent months, the structures group has experienced an impressive growth spurt. Dr. Aleksandra Radlinska and Dr. Leslie McCarthy, PE, joined the CEE Department in fall 2008 and spring 2009, respectively. Each brings a new area of expertise to the lab.

Dr. Radlinska earned a doctoral degree from Purdue University in 2008. Her research interests include concrete and cement in sustainable design, and the durability, shrinkage, and cracking of concrete. With Dr. Yost and colleagues at Philadelphia University, she has applied for and received an NSF grant and a Delaware County Keystone Innovation Grant to investigate full-scale, precast structural members made from alkali-activated fly ash concrete. The most common ingredient found in traditional concrete is portland cement, the production of which contributes 5% of the world’s greenhouse gases. This sustainable alternative is made from fly



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— Dr. Aleksandra Radlinska

ash, a byproduct of coal-burning power plants. Dr. Radlinska is also a co-investigator on a joint proposal with Drexel University to further develop alkali-activated cement made from slag, a waste product of the steel industry.

These studies are critical because concrete has developed into a sophisticated material. As new products come to market, they require extensive testing, especially to determine their long-term performance. And if those materials can be produced more from waste materials and less from natural resources, then, as Dr. Radlinska pointed out, this research is preserving a piece of the world for future generations. “One cubic yard of concrete per person in the world is produced each year. Whatever optimization we can do, whatever percentage we can improve, is a huge benefit,

environmentally and economically.”

A transportation engineer, Dr. McCarthy worked for six years with the Federal Highway Administration (FHWA) before coming to Villanova. She specializes in pavement design, particularly asphalt materials. Her main goal is to “craft Villanova’s transportation research to the current needs of the state and the nation.” These research initiatives will heavily involve undergraduate and graduate students.

For example, the FHWA has issued new guidelines concerning the retroreflectivity of pavement markings and traffic signs. Dr. McCarthy is proposing to collect and analyze data, which would lead to an efficient strategy to help state and local agencies meet the federal standards. She also is seeking funding through the

National Cooperative Highway Research Program to evaluate the feasibility of using a software tool called the AASHTO Mechanistic-Empirical Pavement Design Guide to establish pavement performance metrics as part of innovative highway contracts between states and the private sector.

This summer, Dr. McCarthy is joining forces with Dr. Radlinska, Dr. Gross, and Civil Engineering professors at Rowan University to conduct a feasibility study on decorative concrete overlays applied to vertical transportation structures, such as bridge piles and parapet walls. This research, which will be conducted simultaneously in the SETRL and at Rowan, supports the FHWA initiative for a nationwide implementation of context-sensitive solutions to transporta-



tion-improvement projects. Such an approach takes into account the physical, historical, and scenic “context” of a given transportation facility, as well as safety and mobility. Because decorative concrete overlays have not been used in infrastructure, the researchers will test them under varying environmental conditions for durability and cost effectiveness.

THE ROLE OF UNDERGRADUATES

From steel joists to alternative concrete, almost every project in the SETRL involves undergraduates. They work alongside faculty and graduate students, contributing to test setup and execution, data reduction and analysis, and decision making and team discussions. This undergraduate involvement was important to the faculty from the start, and they quickly made it their practice to earmark funds for paid summer internships in the lab. “We don’t give the undergraduates token exposure to our research. They are in the trenches with us. They feel a sense of ownership, and that empowers them,” Dr. Yost said.

The students know that they play an important role and benefit from it. As a sophomore, Zachary Ells CE ’10 helped investigate open web steel joists with continually crimped critical web members. The experience he gained doing undergrad-

Dr. David Dinehart (blue hard hat) is the SETRL Director.

uate research in an advanced lab was a huge boost to his engineering career at Villanova. “Not only did it prepare me for my classes as an upperclassman, but I also was able to create a thesis paper that I will be proud of long after I graduate.”

As passionate as the structures professors are about undergraduate involvement in research, they are even more passionate about undergraduate education—both in the classroom and in the lab. Every step the three have taken since arriving at Villanova has supported that mission. In their early days together, Dr. Lewis Mathers, then Chair of the CEE Department, gave them the green light to strengthen the undergraduate structures curriculum by adding or revising required courses. “Not too many people get the opportunity to go into an established university and create their own program,” Dr. Dinehart said.

The fact that they had the same mindset and the same desire to set the bar high didn’t hurt. In addition, Villanova provided the perfect environment in which they could realize their vision for undergraduate education. “It was the right match of people with the right type of institution,” Dr. Gross said.

The program they created integrates classroom learning, hands-on lab work, and industry exposure. For example, in their sophomore year, students learn how to analyze a truss in class. Then in the lab they test to failure an example of a truss: an open web steel joist. As juniors, they hear a lecture on the design of open web steel joists from an industry representative. Afterward, they return to the lab and, applying what they have learned, retrofit the same joist to increase load capacity and change the failure mode. Finally, as seniors, they can conduct more projects with joists in an elective course.

While this scenario serves to illustrate the integrated approach that the professors have taken, it also demonstrates how students are exposed to knowledge usually gained only on the job. According to Dr. Gross, joists are not covered in the typical undergraduate structural design course, yet almost every professional structural engineer will work with them. Thus, students are learning about an important structural component from an expert within the industry.

For the coming year, the three professors have restructured the undergraduate curriculum to make greater use of the SETRL. Sophomores will perform more experiments in the facility, and freshmen will work on multidisciplinary projects. Thus, students could potentially be in the lab every year of their academic career. Nothing would make the structures group happier. “There was a reason why we

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— *Dr. David Dinehart*

insisted that 'teaching' come before 'research' when the lab was named," Dr. Gross said.

EXPANDING THE DREAM

Despite the group's many accomplishments, Dr. Dinehart still has big dreams for the lab. One is to work with corporate partners to develop named fellowships for graduate students. Recipients would receive funding to do research during the semester

and then do an internship at the company during the summer. It is hoped that this relationship would lead to permanent employment. He also would like to see endowed professorships for the faculty working in the lab. Whatever the future may bring, Dr. Dinehart knows that he, Dr. Yost, and Dr. Gross will continue to count on each other's support. "We're much stronger when we work together than when we work as individuals, and we made the decision long ago to sink or swim together."

SUPPORTERS OF CONSTRUCTION, EQUIPMENT, AND RESEARCH

American Institute of Steel Construction

Ben Franklin Technology Partners of
Southeastern Pennsylvania

Bechtel

Boise Cascade

Estate of Anthony F. Calapristi '40

The Conti Group

Girdler Slab Technologies

Hughes Brothers

Michael Baker Corporation

MTS Systems Corporation

National Science Foundation

O'Donnell & Naccarato

Pagnotta Engineering, Inc.

Pennsylvania Department of Education

Estate of Thomas M. Rockett '44

SMI Joist Company (later CMC)

Steel Joist Institute

Villanova University

W. M. Keck Foundation

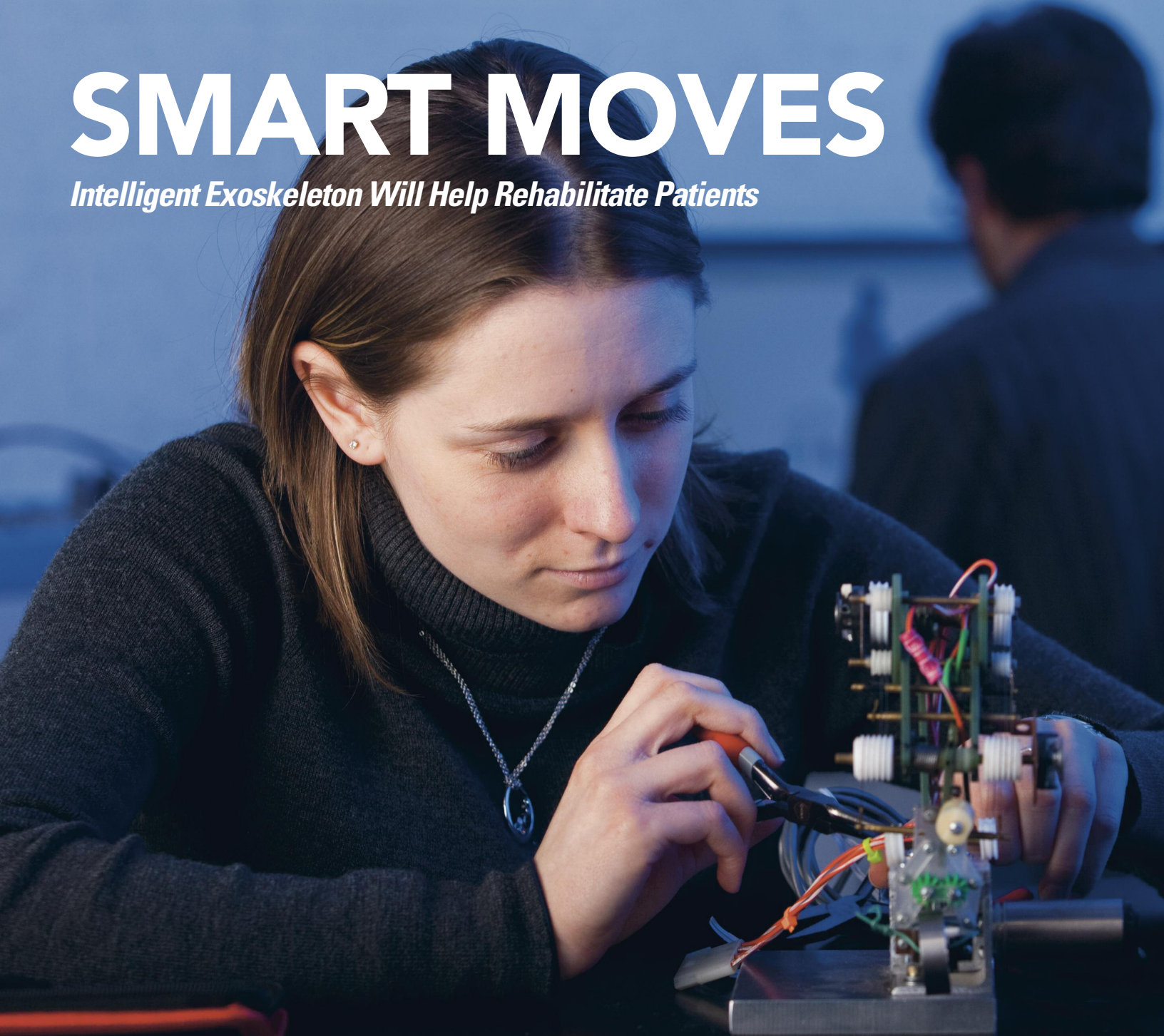


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— *Dr. Shawn Gross*

SMART MOVES

Intelligent Exoskeleton Will Help Rehabilitate Patients



Katleen Bommer ME '11 will interview physical therapists to learn about joint movement and rehabilitative exercises.

This summer, Dr. Hashem Ashrafiun and a team of undergraduate students are carrying out research that may help patients recovering from joint replacement surgery and spinal cord injuries get back on their feet—literally.

In 2008, Dr. Ashrafiun, a professor in the Department of Mechanical Engineering (ME), received a patent for the Intelligent Exoskeleton for Spinal and Lower Extremities Rehabilitation, a device that can be used by patients for standing exercises, as well as for more standard rehabilitative walking exercises. With the help of an

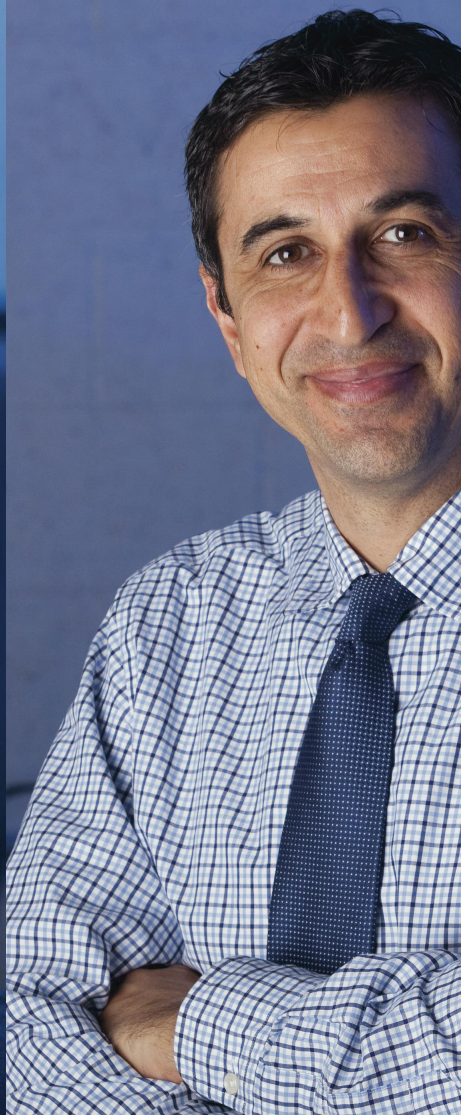
electrical engineering and two mechanical engineering students, he hopes to have a proof of concept developed within the next few months.

BUILDING ON HIS EXPERTISE

In conceiving of this idea, Dr. Ashrafiun drew on his experiences in several key areas. First, he has done extensive research in human body dynamic modeling. At Wright-Patterson Air Force Base in Dayton, Ohio, for example, he conducted experiments to see how the huge loads associated

with seat ejection contribute to pilot injury. Second, Dr. Ashrafiun, an expert in autonomous control, had worked with a graduate student to develop control algorithms for a human-like robot that would be able to walk up and down the stairs and maneuver in different environments by itself.

Combining his human body modeling and his control research, Dr. Ashrafiun came up with the idea of using an intelligent, lightweight exoskeletal device to train patients to walk again. The device will be strapped to a part of the body—a leg, for example. In the earliest stage of rehabilita-



Dr. Ashrafiuon instructs his undergraduate assistants.



The patented Intelligent Exoskeleton for Spinal and Lower Extremities Rehabilitation

HOW THE PROTOTYPE WILL WORK

The prototype that Dr. Ashrafiuon and his team are building this summer will be a small, fairly simple device used for standing exercises and will demonstrate the potential capabilities of the complete intelligent exoskeleton. It will have links on the femur, tibia, and foot. Two DC motors will rotate the links on the femur and the tibia, while the foot link will be fixed to the ground.

In the experimental setup, voltage will be applied to the motors through a computer with a controller board. The computer will give the command to move the joint a specified number of degrees. Encoders then will measure the joint angle and feed the information back to the computer. Based on this feedback, the computer will adapt itself. For example, if a joint does not move the number of degrees required, then the computer adjusts the voltage so that the joint can achieve the required angle. On the other hand, if a patient is applying force to move the joint, then the angle will be closer to what is required, and less voltage will be applied.

ASSISTANCE FROM UNDERGRADUATE RESEARCHERS

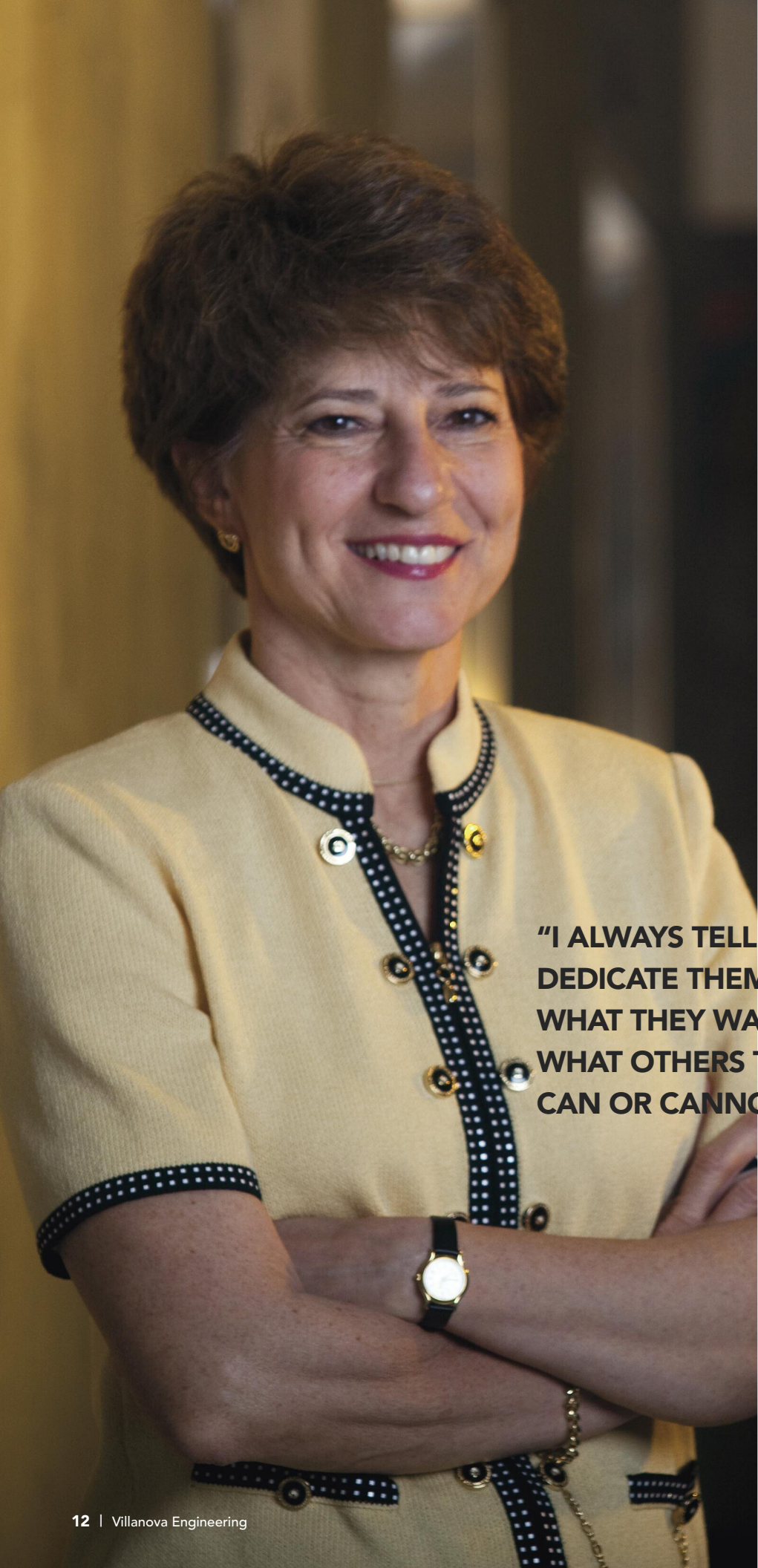
Each of the undergraduates has an important role to play in the research. Kent Grosh ME '10, the recipient of an undergraduate research grant from Villanova University, will be contributing to the modeling and the building of the proto-

type, when patients have no control over their bodies, the device will move the joints and do the exercises on its own. In later stages, as patients start to gain control, the device will adapt to the patients' ability by exerting less force.

"The design of the exoskeleton will be modular," Ashrafiuon said. "When the patient is doing exercises to move joints in the standing position, the device will require only a few motors. When the patient is ready to begin walking exercises, more motors can be added."

type. Kathleen Bommer ME '11, who has been accepted into the College of Engineering's new Bioengineering minor, will interview physical therapists to learn about joint movement and rehabilitative exercises. That information will be included in the modeling. Kevin Burke EE '11 will be responsible for the electronics. "These are excellent, very capable students, and I am confident that we can build a proof of concept by the end of the summer," Dr. Ashrafiuon said.

In addition to his work on the exoskeleton, Dr. Ashrafiuon does research funded by the Office of Naval Research on unmanned surface vehicles, which can be used in surveillance, mine sweeping, search-and-rescue missions, and other applications. He has developed many control algorithms that enable these autonomous vessels to operate in remote areas and avoid obstacles. He also investigates shared memory alloys (SMA) and recently published a paper on the control of SMA actuators in mechanical systems. In addition, he did the modeling for the design of the Wavacam, an aerial, mobile, robotic camera system built by Ablaze Development and now used in the Pavilion, and he continues to do studies on the dynamics and control of this technology.



CAN'T

New University Trustee Nance

It is fitting that the movie version of Charles Portis' novel *True Grit*, a tale about a spirited female protagonist living in the Old West, was released in 1969. For in that same year, a real-life go-getter living on the East Coast became the first full-time female student to earn a BS in Chemical Engineering from Villanova University—and the world got an early glimpse of the stuff that Nance K. Dicciani is made of.

Today, that determined young woman from the Roxborough section of Philadelphia has achieved international renown. Dr. Dicciani is the former president and chief executive officer of Honeywell Specialty Materials, a \$4.9 billion strategic business group of Honeywell. Twice she has been ranked on *Forbes'* list of the World's 100 Most Powerful Women, and from 2006 to 2008, she served on the President's Council of Advisors on Science and Technology.

"I ALWAYS TELL YOUNG PEOPLE TO DEDICATE THEMSELVES TO ACHIEVING WHAT THEY WANT, IRRESPECTIVE OF WHAT OTHERS TELL THEM THAT THEY CAN OR CANNOT DO."

FENCE HER IN

Dicciani Has Made It Her Business to Succeed

BELIEVING IN ACHIEVING

Part of the “stuff” that has enabled Dr. Dicciani to rise to the top of her profession is her unquestionably sharp mind. In addition to her degree from Villanova, she holds an MS from the University of Virginia and a PhD from the University of Pennsylvania, both in Chemical Engineering, and an MBA from the Wharton School at Penn.

But an equally important factor is her will to succeed. The bring-'em-on attitude with which she meets challenges, overcomes obstacles, and defies naysayers calls forth the best in herself and in others. Whether she is coaching a Special Olympics basketball team or mentoring high school students, she repeats the mantra that has impelled her on her course: Never, ever, ever give up. “I always tell young people to dedicate themselves to achieving what they want, irrespective of what others tell them that they can or cannot do.”

This mindset was critical for a college-bound woman looking to study in a male-dominated field. Her affinity for math and science qualified her to pursue a degree in Chemical Engineering, but Dr. Dicciani had an added incentive. “Some people told me that I couldn't be an engineer. I've always had a stubborn streak in me in terms of doing what was hard.” Fortunately, her parents supported her decision, and Dr. Dicciani enrolled in the school of her mother's dreams.

At Villanova, Dr. Dicciani thrived. She loved the University's ineffable character—its commitment to caring; its Catholic, Augustinian tradition; and its sense of community. She enjoyed the challenge of

being with smart, energetic students and was impressed by the faculty's personal attention and high standards.

ADVANCING TO THE TOP

Dr. Dicciani's Villanova education had prepared her well for graduate school and employment. She completed her MS in 1970 and then got a job as the Superintendent of Reservoirs at the Philadelphia Water Department. The people she managed had a range of educational backgrounds, and they took tremendous pride in their work. Their example taught her that leaders have a responsibility to recognize each employee's capabilities and desire to contribute. “People do their best work when you affirm them, understand the direction in which they're going, and give them a task worthy of their best efforts.”

After several years, the lure of college teaching pulled her back into academia, this time for a PhD. In 1977, with the ink on her doctoral degree still wet, Dr. Dicciani decided to return to industry to gain more experience—and she never looked back. “I got heavily into engineering, technology, and the business application of technology. Then I became involved with sales and marketing and running businesses, and that's where I made my career.”

The first stop on that career path was at Air Products and Chemicals, Inc., where Dr. Dicciani worked for 14 years and held positions in research, engineering, research management, and business development. In 1991, she went to work for Rohm and Haas and became the senior vice president and business group executive of chemical specialties and director of operations in

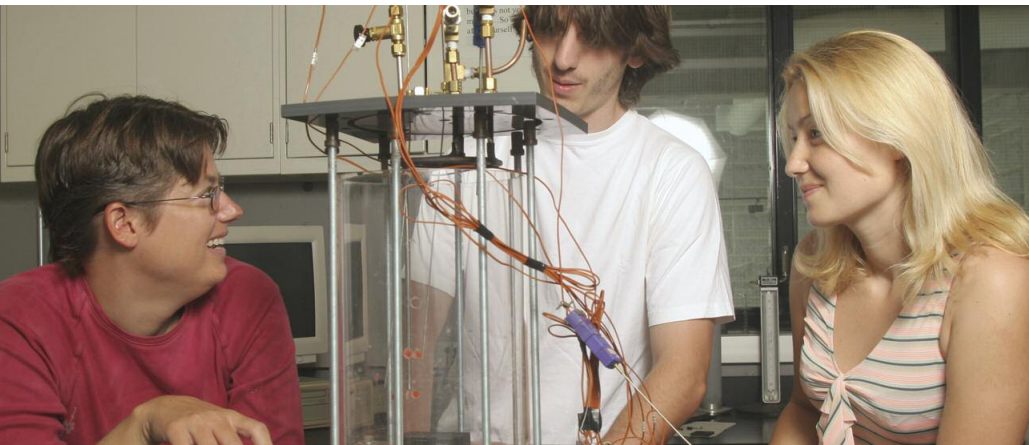
Europe, Middle East, and Africa. Dr. Dicciani joined Honeywell in 2001.

FINDING NEW WAYS TO GROW

Although she retired from Honeywell in 2008, Dr. Dicciani continues to bring her energy and creative thinking to other engagements. She serves on the board of directors for two companies and has maintained close ties with the College of Engineering. In 2005, the College presented her with an honorary medallion and award for her significant achievements. Dr. Dicciani also finds time to fly her own airplane, maintain a respectable golf handicap, and travel the world.

This year, Dr. Dicciani was elected to the Villanova University Board of Trustees. She is eager to work with the other trustees in furthering the University's mission. “Nance is returning to the Board after having had to leave when she was transferred to Europe, and I am thrilled to have her return,” said Rev. Peter M. Donohue, OSA, A&S '75, President of Villanova University. “She brings to the Board an impressive record of leadership in industry, as well as a passion for Villanova's Augustinian traditions. I believe she will be a valuable addition to the Board as it continues to guide the University.”

And as if this schedule isn't enough, Dr. Dicciani is exploring other opportunities to build on her education and experience. “The same three things have always been important to me: to learn, to contribute, and to enjoy myself. I have too much energy and too many interests to stop now!”



In December 1968, *The Villanova Engineer* published the responses to a survey of 8 of the 13 female students enrolled in the College of Engineering. The answers showed that these women were ready to take their place in a world dominated by men. They

DEFINING WOMEN

A Retrospective on Villanova Women in Engineering



wanted to build highways, work at NASA, and teach in universities. Above all, they believed that Villanova was furnishing them, as one student commented, with “all things necessary to succeed as well-rounded individuals.”

Why have female engineering students thrived at Villanova since first being admitted in 1958? Why does the College outpace other institutions in enrolling women? In 2007, 21% of the College’s undergraduate engineering enrollment was female, compared to 17.5% nationwide. This fall, 31% of the freshman engineering class will be female.

Perhaps the answer lies in the type of engineering education that Villanova provides. For 51 years, the College has attracted female students who are intellectually gifted, possess extraordinary leadership abilities, seek a strong community, and abide by a core set of values. These students want a school that will foster their development in these areas, and they choose Villanova.

What follows are profiles of four women who did make that choice. Each alumna represents a different discipline, a different decade, and a different destiny. Together, they exemplify the quality, character, and talent that define Villanova women in engineering.





Marie Maguire EE '69

In her position as a rover on Villanova's first women's basketball team, captain Marie Maguire EE '69 was one of only two players allowed to cross the midline during the game, which was not yet played full court. Although forty years have passed since Maguire graduated from the College of Engineering, she has never stopped being a rover. She has followed her heart wherever it has led her and has worked in an eclectic array of fields. "You can't be afraid to pursue your dreams and make them happen," Maguire said.

PROVING HERSELF

One of the earliest dreams that Maguire pursued was that of attending the university from which her father had graduated in 1953. Because enrolling as a math major—Maguire's preference—at Villanova was not an option for female students in 1965, Maguire applied to the College of Engineering instead. She was accepted, and the dream did not disappoint. "I used to go to church every day to thank God that I was at Villanova."



Marie Maguire (second from the left) with the Villanova Engineer staff in a yearbook photo from 1969.

Maguire flourished in the engineering program, and she never felt that her male classmates discriminated against her. True, one or two of them may have thought that she had taken the seat of a guy who had been sent to Vietnam. And many had the advantage of having tinkered under the hoods of their cars in high school. But Maguire soon proved her mettle. She doubled up on labs to gain more hands-on experience, rose to the top tier of her class, and was inducted into two honor societies, Tau Beta Pi and Eta Kappa Nu.



**“ENGINEERING HAS
TAUGHT ME TO ENJOY
BEING A LIFELONG LEARNER.”**

The “can-do attitude” of the administrators at the University—and their willingness to expand the involvement of female students in campus life—enabled Maguire to realize another dream: bringing women’s basketball to Villanova. As captain, she scheduled games, purchased uniforms, and signed the team up for the NCAA. Daniel Caramanico CE ’69 used to help with coaching and with pulling together a squad of guys for the women to scrimmage. In 1974, Maguire and Caramanico married at St. Thomas of Villanova Church. Their daughter, Diana Caramanico, inherited their passion for basketball and holds the Ivy League, Big Five, and Penn’s men’s and women’s scoring records.

“FIRST” LADY

After graduating, Maguire earned a master’s degree in Electrical Engineering

and did all the course work for a PhD at the University of Notre Dame, where she was the only full-time female student in the engineering program. Next, she landed a job with IBM, working in the future systems division in Endicott, NY. “I realize now how lucky I was to be on the ground level of a new system, the only woman out of 2,000 engineers.” Several years later, IBM sent her to Bucks County, PA, to test helicopter systems at the Johnsville Naval Air Development Center.

In another pioneering move, Maguire became the first woman to join the engineering faculty at Temple University. While she was on maternity leave and teaching night classes, Maguire decided to strike out in an unexpected direction. She earned a Master of Social Service from Bryn Mawr College, opened a private practice, and pursued post-graduate clinical training at a family therapy institute. Maguire, who still

carries a caseload, is a licensed clinician and is certified by the American Board of Examiners in Clinical Social Work.

In 1987, Maguire accepted a job as a corporate management consultant, mentoring the top execs in a New York banking firm and analyzing the interfaces and data flow throughout the bank. “It was a phenomenal opportunity to bring my psychology and engineering skills into a new environment.” In addition, she and her husband were growing their business, Caramanico Maguire Associates, Inc., which for 23 years has helped companies in various industries build their sales forces. Their clientele includes Villanova alumni who are entrepreneurs and company presidents.

GIVING BACK

Maguire has been a tremendous resource for Villanova students and faculty. In 2000, for example, she created a mentoring program that gives junior and senior students in Electrical and Computer Engineering (ECE) the opportunity to network with professional engineers. The students do assignments with their mentors and seek their advice on topics such as internships and interviewing skills. Maguire presents seminars to students in their sophomore year to teach them how to network and to explain why this skill will be useful in advancing their careers.

Dr. Pritpal Singh, Chair of the ECE Department, appreciates Maguire’s involvement. “Marie serves on the department’s Industrial Advisory Board, is a sponsor of ECE Day, and has provided funding for a senior project award. In addition, she has offered invaluable insight into how to market our programs to prospective students and their families.” The Engineering Alumni Society presented Maguire with a Meritorious Service Award in 2003.

Despite her many accomplishments, this rover is not ready to take the bench. Maguire’s latest dream: earning a PhD in Social Work. “Engineering has taught me to enjoy being a lifelong learner.”

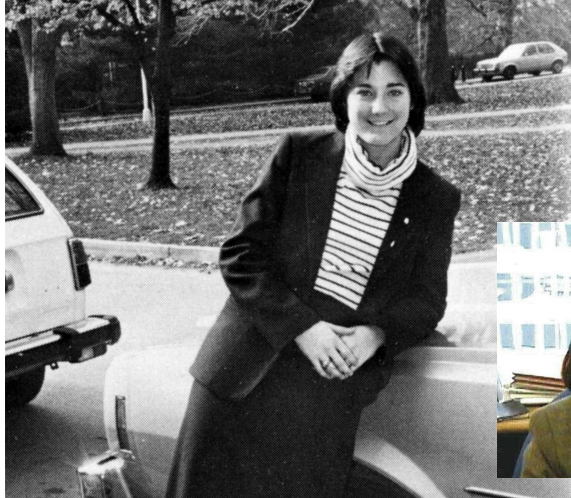
Few people could rise from refining engineer to senior executive at a global integrated energy company without having made a habit of tackling tough issues, seeing new possibilities, and closing multi-million-dollar deals. Susan Ward ChE '80 has done all that and more. But in her opinion, the single most challenging task she has ever performed over a sustained period of time was getting through four years of engineering at Villanova University.

RISING TO THE CHALLENGE

"It was a difficult curriculum, and the professors had high standards," said Ward, who is now the Vice President of Upstream Commercial Finance at Shell International Exploration and Production B.V., a subsidiary of Royal Dutch Shell. "But they also were personally invested in helping the students succeed."

Of course, just because faculty wanted the students to do well didn't mean that they made achieving that goal easy, as Ward discovered in her sophomore year. Dr. Robert White, who was Chair of the Department of Chemical Engineering (ChE) from 1949 to 1983, taught a two-semester-long course that was not for the faint of heart. He placed a premium on accuracy and taught Ward and her classmates an invaluable truth about real-world engineering: you don't get partial credit for getting a project half right. "That lesson has stayed with me. No matter what your job is, it is critical that you pay attention to detail and make sure that you do everything right the first time."

The blend of academic rigor, small classes, and personal attention from faculty helped Ward maximize her store of natural resources: intelligence, perseverance, and ambition. Faculty and students alike recognized and respected her exceptional technical understanding. One of Ward's professors, Dr. C. Michael Kelly, who went on to be Chair of the ChE Department from



*Left: Susan Ward was selected for Who's Who in American Colleges and Universities (photo from the 1980 yearbook).
Below: Ward in her Netherlands office*



Susan Ward ChE '80

heights in the world of energy and investment banking. Along the way, she has worked as

1988 to 2007, remembers that "Sue had the rare ability to assimilate a concept at first hearing, internalize its essence, and then apply its principles in situations that did not simply mirror the context in which it had first been presented. Because of this, she could 'figure things out.'"

One of the University's first recipients of a Presidential Scholarship, Ward had come to Villanova from Bishop Eustace Preparatory School in Pennsauken, New Jersey, with two firmly fixed ideas: she loved chemistry, and Villanova had a reputation for graduating well-rounded, accomplished engineers. "When I would talk to older businesspeople, they were always praising the competence of Villanova engineers and the College of Engineering's focus on undergraduate education."

For Ward, a key piece of that education was the opportunity to do summer internships at Exxon after her sophomore and junior years. Working with full-time engineers in the refinery business helped her to find her niche—and get a jump-start on a career. "By the time I finished my four years of engineering at Villanova, I was as competent as any of my peers in industry, and that gave me confidence."

BANKING ON ENERGY

It also led to professional success. After graduating first in her class, Ward went on to earn an MBA from the Wharton School at the University of Pennsylvania. Since then, she has used her chemical engineering and financial expertise to ascend to rarefied

a financial analyst for Mobil; as a senior banker for Kidder, Peabody & Co.; as a managing director of the North American investment banking operation of the Union Bank of Switzerland; and as the head of mergers and acquisitions in the Americas for Shell Central Finance.

In every job, Ward's engineering education, with its emphasis on logical thinking and problem solving, has served her well, especially when it comes to managing complex projects. For this reason, she encourages the next generation of Villanova engineers not to be daunted by the rigorous curriculum. "When you persevere and achieve something that is not easy to achieve, you gain respect for your abilities."

STAYING CONNECTED

Even though Ward now works in the Netherlands, she maintains a home in New Jersey and close ties with Villanova. That's not hard to do, considering that her clan is an alumni association unto itself. Her late father, Daniel Ward, two uncles, and an aunt were all Villanova graduates. Ward grew up rooting for the Wildcats and listening to Nova stories at family gatherings. Five of her six siblings, as well as some of their spouses and dozens of friends, are alumni. In 2008, Ward's stepson Ryan carried on the tradition when he graduated from the Villanova School of Business. "Villanova has been a central theme throughout my life," Ward said. "I will always feel connected to it by a sense of continuity and community."



Coleen Burke ME '90

When Dr. Gerard Jones ME '72 was Chair of the Department of Mechanical Engineering (ME), he used to invite Coleen Burke ME '90, MBA '99 to talk at the department's Freshman Career Night about her experiences as a Boeing employee and about the many opportunities that an ME degree affords. Burke, who speaks enthusiastically about both topics, always accepted.

One year, when Burke was interviewing seniors for full-time positions at Boeing, she asked a candidate why she had chosen mechanical engineering. "Because of what you said," the student answered. As a freshman, she had heard Burke speak and had been inspired by her passion. This response stunned Burke. "That was an inflection point. I realized that I could have a positive impact on students. People had helped me when I was making important decisions, and I wanted to give back by helping others."

BEING A MENTOR

Her "giving back" has taken many forms: participating in career fairs, conducting interviews, judging design competitions, meeting with scholarship winners, and taking phone calls from students who needed a go-to person for advice. "If I can tell at the end of the conversation that the student has reached a decision, then I know I've made a difference."

Perhaps Burke has become an oracle because her advice is sound and practical: Look at every job as an opportunity to grow and gain experience. Build and maintain a network. Find a mentor you respect and emulate. Be the one to step up to the plate.



Coleen Burke (second from left, front row) with the 1990 Team Solarcat

RISING THROUGH THE RANKS

These are words to live by, and Burke does. She went to work for Boeing in 1991 and spent 15 years at the Philadelphia site. After starting out with project management roles related to composite manufacturing R&D, she progressed to management positions in international new business for the CH-47 Chinook; financial planning for the Rotorcraft business segment; and test and evaluation operations, engineering repair and design, and business operations for the V-22 program.

In 2005, Burke relocated to Huntington Beach, CA. Since 2006, she has been the Director of Business Development Strategy & Operations for Integrated Defense Systems' Advanced Systems/Phantom Works group. A relatively young executive, she is responsible for the process of strategy integration and business development operations across Phantom Works within the defense segment of the business.

Villanova is one of several hundred schools worldwide with which Boeing has a formal relationship. Burke has played a role in strengthening this relationship, which involves recruiting graduates, encouraging continuing education, and exploring research opportunities. For example, the company selected Dr. Sridhar Santhanam, an associate professor in Mechanical Engineering, to participate in its Welliver

Faculty Fellowship Program, which exposes faculty to the latest engineering applications in the aerospace industry. Burke had encouraged him to apply and written a letter of recommendation.

Burke also has built her own network with fellow employees who are Villanova alumni. Whenever called upon, these men and women volunteer to speak in classrooms, participate in professional society events, and share their experiences at career nights. She believes they represent the kind of alumni that Villanova produces—accomplished professionals who give back to their school and the community. “The alumni have branded and will continue to brand the University as a solid institution that provides technical excellence within the context of a liberal education.”

NOVA'S FIRST TEAM SOLARCAT

Burke wears her school pride like a Wildcat jersey. She knew when she first set foot on campus that Villanova was the right fit. She developed a core group with whom she studied and relaxed. It didn't matter that she was in the minority as a female. “I got as much ribbing as any of the others!”

Never did Burke feel more a part of a group than when she served on the executive committee of Team Solarcat in her senior year. The multidisciplinary team designed, constructed, and raced a solar-powered vehicle from Florida to Michigan

“IF I CAN TELL AT THE END OF THE CONVERSATION THAT THE STUDENT HAS REACHED A DECISION, THEN I KNOW I’VE MADE A DIFFERENCE.”

for the GM Sunrayce USA, a college competition held in July 1990. Because no one in the College had attempted such a project, the team had to start from scratch in terms of designing, obtaining funds, and relying on industry partners for input on new materials and technologies. The year-long commitment forged lasting friendships and taught Burke a great deal about “going from design to manufacturing to testing to having a roadworthy product.”

Burke didn't stop achieving Villanova milestones when she graduated. In 1997, she received a Meritorious Service Award from the Engineering Alumni Society and, in 2001, the John J. Gallen Memorial Award for industry accomplishments and continued support of the University. Appointed to the ME Advisory Board in 2004 and the College of Engineering Advisory Board in 2008, Burke has been contributing to the College's strategic efforts to realize its vision of excellence.

Her professional successes and her zeal for Villanova surprise no one who knows Burke well. “Even as an undergraduate, Coleen was consistently willing to take on leadership roles in situations in which she undoubtedly did not feel comfortable,” said Dr. Jones, who is now Associate Dean of Academic Affairs. “She was eager to take a chance that she could do the right job, given the opportunity and the hope of support.”



Angela Russo CE '08

Some things can't be rushed—like building multiple 17-foot-long concrete beams with glass fiber reinforced polymer (GFRP) rebars and testing them through 100,000 cycles of fatigue load. Being in charge of such a massive project meant that Angela Russo BSCE '08, MSCE '09 became somewhat of a fixture around the Structural Engineering Teaching and Research Laboratory during the past year. And she wouldn't have had it any other way.

Russo, who in May completed the Department of Civil and Environmental Engineering's five-year, bachelor's-master's degree program, was focusing the research for her thesis on GFRP reinforcement in concrete bridge deck slabs. This work was the culmination of Russo's distinguished academic career, and as the Long Island native stood poised on the brink of a promising future in structural engineering, she had one reaction: "I love Villanova! I would be a freshman again if I could."



Dean Gary Gabriele presented Angela Russo with the Robert D. Lynch Award in May 2008.

SCHOOL OF HER DREAMS

That love took root when her older brother, Chris, came to Villanova to major in Biology. As soon as Russo—who excelled at math and science at her high school, Sacred Heart Academy—discovered that Villanova’s College of Engineering enjoyed such an outstanding reputation, she knew it was the only school for her. Her parents, who had always stressed the importance of a high-quality education and recognized their daughter’s capabilities, encouraged Russo to attend Villanova. Being awarded a Presidential Scholarship made her decision that much sweeter.

Russo immediately felt at home in the CEE Department. The faculty reached out to the students and engendered a spirit of camaraderie. “They wanted us to see that we were part of a bigger picture,” Russo said. For Russo, that bigger picture included a spring break trip to Amigos de Jesús, a Catholic orphanage for boys in Honduras, where she helped dig and pour the concrete for the foundation of a school building designed by students in the senior structural capstone course. “That experience opened

“THE COLLEGE OF ENGINEERING WANTS ITS GRADUATES TO SUCCEED. IT HAS ENCOURAGED ME IN ALL MY ENDEAVORS, AND I FEEL WELL PREPARED TO START MY CAREER.”

my eyes to seeing how my skills could be applied not just to make money but to help people,” Russo said.

Naturally inclined to be a leader, Russo took advantage of the many opportunities that Villanova offers students to use their talents to serve the campus and the community. She held positions of leadership on committees within Special Olympics and the Student Government Association. For three years, Russo was part of the committee that selects Presidential Scholars for the

College of Engineering and knew from her own experience as a candidate that her presence was a comfort to the interviewees. “When they see a student at the table with all the other committee members, it puts them at ease.”

Russo’s many successes and contributions as an undergraduate did not go unnoticed. At the College of Engineering’s Recognition Ceremony in May 2008, the cum laude graduate received the Civil and Environmental Engineering Faculty Award and the Engineering Alumni Society’s prestigious Robert D. Lynch Award for academic achievement and dedication to community service.

GRADUATE SCHOOL AND BEYOND

Immediately after receiving her BSCE, Russo turned her attention to the research she was undertaking with her advisor, Dr. Joseph Yost, PE, Associate Professor of Civil and Environmental Engineering. In every regard Russo proved to be a competent, organized, and thorough researcher. “Angela did a phenomenal job putting together the test setup, running the hydraulics, and configuring the data acquisition,” Dr. Yost said. “She was critical in tracking everything, and her work will make it easier for someone who wants to continue the project to come in and see what was done when.”

Russo’s immediate plans are to find a job designing buildings for a firm in New York City. Eventually, she would like to move up through the ranks or start her own company. “I don’t have my life planned out, but I’m not the type to stay in one position.” What she does know is that Villanova has educated her to meet the challenges and embrace the opportunities that lie ahead. “The College of Engineering wants its graduates to succeed. It has encouraged me in all my endeavors, and I feel well prepared to start my career.”

WORLDWIDE CLAS

Villanova Engineers Serve the Global Community—and Get the Education of a Lifetime



SSROOM



Andrew Packer ME '10 (second from right) and local residents work together on a water supply project in Nicaragua.

Among the passengers bumping along in a school bus for the eight-hour ride from Managua to Waslala, Nicaragua, in March 2007 was Dr. Gary A. Gabriele. As the new dean of the College of Engineering, he wanted to find out if what he had heard about Villanova service experiences was true. Before the week was up, he had his answer. These experiences were indeed authentic, powerful opportunities for learning.

In the President's annual address to the University Senate on December 5, 2008, Rev. Peter M. Donohue, OSA, A&S '75 reminded his listeners that "Villanova places a strong emphasis on service, ethical leadership, and working for the common good." Departments, colleges, and student organizations across the campus find meaningful ways to live out this core value of *caritas*.

The service performed by the College of Engineering is particularly relevant because students and faculty apply their technical knowledge in a real-world context to directly improve—and even save—lives. When the College drafted its new strategic plan in 2007, it specified that part of its vision was to continue to develop engineers who were technical innovators and contributors to the greater community. Service is a critical step in that process.

Service, particularly if it is undertaken in a developing country, also gives engineering students the opportunity to grow as leaders. As Dean Gabriele observed on his first and subsequent trips to Nicaragua, students have to formulate and solve challenging technical problems and make judgments quickly and accurately, often in a culture that is unfamiliar and desperately poor. According to Anthony and Christine Granese, who helped found Amigos de Jesús, an orphanage in Honduras that is a popular Villanova service site, "The mission experience is a type of conversion, influencing the students' worldviews and leadership decisions. They return home with a new faith and a new outlook on their engineering vocation."

As the accounts that follow demonstrate, the dozens of engineering students who forgo Cancun and Punta Cana each year to spend spring break in places that lack the most basic necessities come home “converted.” By expanding and developing service opportunities across the curriculum, Dean Gabriele hopes to open up yet another avenue for exposing students to real-world problem solving and to these life-changing experiences.

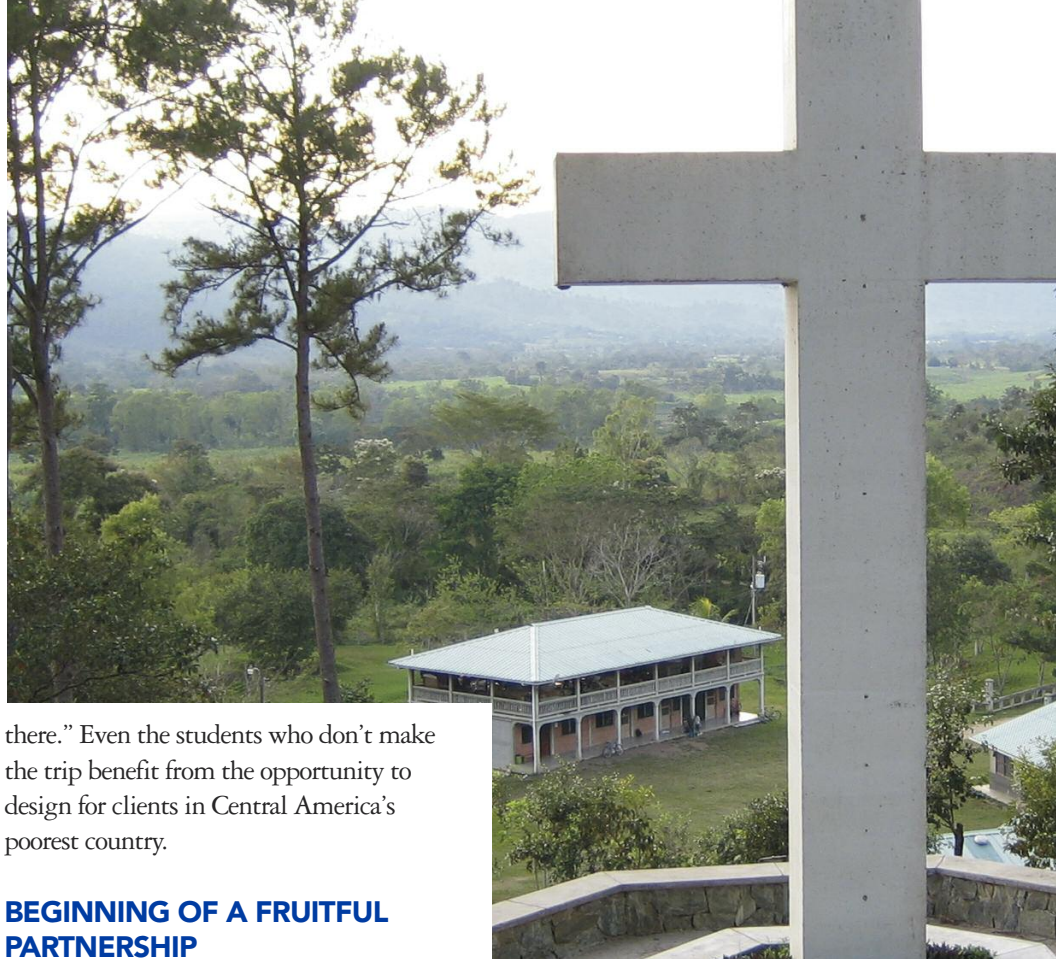
AMIGOS DE JESÚS

Since 2000, Dr. David Dinehart, Dr. Shawn Gross, and more than 90 students from the Department of Civil and Environmental Engineering (CEE) have made service-learning trips over spring break to Amigos de Jesús, a Catholic orphanage for impoverished boys in Poses Verdes, Honduras. There, they have worked on the construction of designs developed by students in the senior structural capstone course. On this year’s trip, the team laid out the foundation for a girls’ dormitory, as the orphanage plans to become a home for children of either gender.

The structural outcomes of this decade-long commitment to Amigos de Jesús are impressive: a 25-foot high, reinforced concrete cross that overlooks the orphanage and the surrounding valley; a 30 x 60-foot split-level chapel and volunteer center; and a school complex that includes multiple classroom buildings, a computer lab, and an administration building.

More impressive are the outcomes that cannot be quantified on a spreadsheet. The students have used their engineering skills to build a better life for boys who had once lived on the streets, foraged in garbage cans, and endured unspeakable acts of violence. No Villanovan returns from these mission trips unchanged.

Kelly Donmoyer CE '09, who has gone to Honduras three times, quickly realized that the personal contact with the children overshadowed the engineering projects. “Their enthusiasm and affection have transformed me, and I will never forget my experiences



there.” Even the students who don’t make the trip benefit from the opportunity to design for clients in Central America’s poorest country.

BEGINNING OF A FRUITFUL PARTNERSHIP

For the 50-plus boys living at the orphanage, the visits by the Villanova contingent are eagerly anticipated occasions. Fr. Dennis O’Donnell, a priest of the Archdiocese of Philadelphia and one of the founders of Amigos de Jesús, said that the faculty and students have had a big impact on the property of the orphanage—but an even bigger impact on the residents. “The boys know that for one week there will be healthy people that they can play with, learn from, walk with, and talk to.”

The growth of Amigos de Jesús and the involvement of Villanovans are threads that have been entwined since 1997, when civil engineer Anthony Granese '90 and his wife, Christine, founded the orphanage with Fr. O’Donnell and Sister Teresita, SSND, a Honduran nun. In December 1999, Mr. Granese approached Dr. Dinehart and Dr. Gross with an unusual proposition: would they and the seniors enrolled in the structural capstone project design and build a cross that would be a symbol of hope for abandoned boys in Honduras?

The students and professors accepted this challenge, and in March 2000, the first CEE cohort headed for Honduras and laid the foundation for a rewarding alliance between

The first structure designed by CEE students, the cross stands as a symbol of hope.

Amigos de Jesús and Villanova. The department, the College of Engineering, and Campus Ministry have been cosponsoring trips ever since.

SERVICE-LEARNING COMPONENT

In 2003, a service-learning course evolved from the capstone course. Taken by the subset of students who commit to going to Honduras, the one-credit course strengthens the link between education and service. These “site representatives” meet weekly and participate in the four stages of a service-learning experience: preparation, service, reflection, and celebration.

As part of the reflection stage, students spend time each night in Honduras writing answers to questions about their experiences: Which child has made the greatest impression? How will your daily life be altered when you return home? What has made your heart break? Student leaders then facilitate a discussion.

This reflection is integral to all campus mission trips and service opportunities. According to the Executive Director of Cam-

"SEEING THE CHILDREN PLAYING, LAUGHING, AND PROSPERING AT THE ORPHANAGE HAD A PROFOUND IMPACT ON ME. I STARTED TO THINK ABOUT MY FUTURE AND WHAT I COULD DO TO MAKE A DIFFERENCE."

—Jeffrey Cook (pictured below)



Reflections on Amigos de Jesús

My first trip to Honduras was in 2003. I was amazed at our determination to advance the success of Amigos de Jesús. The work was hard, but leaving the work behind was harder.

When I was a senior, my project team worked around the clock on our design—not to ace the class but to help the children. That week in Honduras, I remember thinking how lucky I was to witness God's grace living, breathing, and growing right before me.

The bonus trip came in 2005, when I was a graduate student. I gave my attention to the undergraduates traveling to Honduras because I wanted them to make the orphanage their mission, as I had made it mine.

As engineers, we too often focus on profits, recognition, and the next deadline. We forget that the real purpose of engineering is to advance society. I learned from the construction supervisor at Amigos de Jesús that engineers do not work toward a deadline; they just keep working. And having gone on service-learning trips, I understand why.

— Andrew Blasetti BSCE '04, MSCE '05



pus Ministry, Beth Hassel, PBVM, people all over the world who are served by Villanova write to her and say that the reflection is what makes the Villanova experience unique. “This is Augustinian education at its best—that we take the time to dialogue together as friends.”

SPREADING THE WORD

Inherent in the celebration stage is the challenge to students to share the impact of their Honduran experience with others—and not just with the classmates in their capstone course or the audience at CEE Day. Perhaps this is the reason Jeffrey Cook BSCE '06, MSCE '07 made his Amigos de Jesús story the centerpiece of the speech he delivered at the National Honor Society induction ceremony at his high school alma mater in February.

As a junior, Cook had signed up for the Honduras trip because he wanted to travel and get hands-on construction experience. While there, he learned about the horrific histories of some of the boys. “Seeing the children playing, laughing, and prospering at the orphanage had a profound impact on me,” Cook said during his speech. “I started thinking about my future and what I could do to make a difference.”

In his senior year and twice during a fifth year at Villanova, when he was earning his master's degree, Cook returned to Honduras. He then volunteered for a two-year commitment. As Director of Construction, he oversaw the completion of four school buildings and the expansion of the dining facility. He continues to “celebrate” his experience by telling others the lessons he learned: “Do not be afraid to step out of your comfort zone. Use your skills to improve society.”

NEW DIRECTIONS

Now that the orphanage's structural components have been designed, this tenth anniversary marks a period of transition.

“EVERY STUDENT UNDERWENT A TRANSFORMATIONAL EXPERIENCE, AND WE HAD FRONT ROW SEATS.”

“The focus is shifting to the orphanage's water and energy needs, and so it is our hope that the relationship between Amigos de Jesús and the CEE Department will continue in those areas,” Dr. Gross said. Faculty and students have made three fall break trips to Honduras and, on the most recent one, collected data to determine the feasibility of developing hydroelectric power, irrigating crops, and creating a solar energy field.

Dr. Dinehart and Dr. Gross are proud of what their students have accomplished technically, but seeing them grow personally has been more rewarding. “Every student underwent a transformational experience,” Dr. Dinehart said, “and we had front row seats.”

WATER FOR WASLALA

Late one afternoon during the 2009 spring break, weary from hiking through the mountainous terrain of Nicaragua to assess prospective sources of fresh water, engineering students returned to the village below—only to be met by local teenagers who had been waiting for hours for the chance to play baseball with the visitors from Villanova.

The teens led the Americans to their diamond in the rough—a baseball field constructed in the middle of the mountains. “It was amazing,” one student wrote. “The backstop was made out of bamboo, the bases were made out of ragged bean sacks, and livestock grazed in the outfield.” But seeing the joy on the faces of the Nicaraguans made the pickup game the highlight of the trip.

CLEAN WATER, RENEWED HOPE

Since 2004, when members of the Department of Mechanical Engineering (ME) first became involved with Water for Waslala, an NGO founded by Villanovans, the students who make this annual service trip to Nicaragua have experienced similar transcendent moments. At the same time, they have provided critical engineering services to improve the quality of life for the region's 40,000 residents, many of whom live in remote villages with limited or no access to potable water, sanitation, or electricity.

To date, 51 Villanova students have designed gravity-flow water-distribution systems for 17 communities in the region. These systems distribute water from springs and other clean water sources up in the mountains to a central point in the village below. According to ME faculty member Jim O'Brien, who has made six trips to Waslala, “The best feedback we get is when we return to inspect a system and the people in that community tell us, ‘Nobody gets sick from the water anymore!’”

Whether they are collecting data to design new systems (usually for a senior capstone project) or inspecting previously installed systems, the students are availing themselves of an extraordinary opportunity to apply their classroom learning in challenging, real-world circumstances. More than that, the trip exposes them to the harsh realities of living in the Western Hemisphere's second poorest country.

“At first, the students were shocked to see how much of the world's population lives, yet as the week went on, they quickly learned to appreciate that and really connected with the young people of Waslala,” said Karl Schmidt BSCE '78, MSCE '82. A member of the College of Engineering Advisory Board and the Vice President of Business Improvement Services at Johnson & Johnson, Schmidt made his first trip to Waslala this past spring.

Alumnus Karl Schmidt, who served as an advisor on this year's trip to Waslala, takes time out to have a catch.

BUILDING A SUSTAINABLE FUTURE

The engineering students and faculty (who are joined each year by equally dedicated College of Nursing students and faculty), work closely with community partners in Nicaragua. Chief among these partners are the parish priests, who have so many responsibilities that it seems as if they wear a Roman collar, a white collar, and a blue collar all at the same time.

The relationship with the Nicaraguans is predicated upon the understanding that the local people own the water systems. They not only build them and maintain them; they also weigh in at the earliest stages of the projects. "The community's participation in the planning and design phases empowers members to take ownership of the projects, and ownership means sustainability," said Jordan Ermilio BSME '98, MSWREE '06, Special Projects Coordinator for the College of Engineering. Ermilio speaks from experience. Having volunteered with the Peace Corps in the Philippines and with Oxfam in East Timor, he is an expert in designing rural water systems for developing countries.

It was because of this expertise that Ermilio was in on the Water for Waslala project almost from the start. Matt Nespole VSB '04 and Nora Pillard A&S '02 had founded the nonprofit organization after visiting Nicaragua in 2002 and observing that lack of funding and technical know-how thwarted the Waslalans' efforts to address the water crisis. In fall 2003, they brought two priests from Waslala to Villanova to meet with Engineering, Nursing, and Campus Ministry representatives.

As a result of that conversation, Dr. Gerard Jones ME '72, who was then Chair of the ME Department; Professor O'Brien, who had worked on projects in Panama; and Ermilio joined the cohort that made the exploratory trip to Waslala the following spring. The ME Department continues to play a strategic role in the mission of Water for Waslala, which raises funds to pay for the water systems.



"THE COMMUNITY'S PARTICIPATION IN THE PLANNING AND DESIGN PHASES EMPOWERS MEMBERS TO TAKE OWNERSHIP OF THE PROJECTS, AND OWNERSHIP MEANS SUSTAINABILITY."

—Jordan Ermilio

“WHEN WE WERE IN THAILAND, ONE OF THE LOCALS I TOLD HIM THAT WE SHOULD BE THANKING HIM AND FOR THE DURATION OF THE PROJECT. WE WERE GET

NEW PERSPECTIVES ON ENGINEERING

Both Ermilio and Pillard are members of Water for Waslala’s board of directors. According to Pillard, who also is the Assistant Director of the Center for Undergraduate Research and Fellowships at Villanova and serves as translator on the break trip each spring, engineering students return from Nicaragua keenly aware that their work is meaningful and relevant. “They no longer view their studies in terms of assignments and grades. Their engineering designs will impact people with whom they’ve built relationships, and they want everything to be correct.”

This new, broader perspective continues to influence students long after they have graduated and taken their places in the professional world. Brian Bozzo ME ’07, who is now an engineer with Lockheed Martin, said that the trip “forced me to embrace the reality that I have been blessed with a great education, and that I am responsible for using that education for the benefit of our society and world.”

Many students and alumni also remain committed to improving the situation in Nicaragua. For example, this year, 350 men and women participated in the annual fundraiser Walk for Water, which was held in April on Villanova’s campus. The event raised \$17,500. Every penny of that money is needed, as nearly 70 Waslalan communities still lack water systems. “It’s easy to get overwhelmed and to wonder, how much difference can I make?” Professor O’Brien said. “Our attitude is that we can change the world—one community at a time.”

ENGINEERS WITHOUT BORDERS

When students join the Villanova chapter of Engineers Without Borders (EWB), they know they will face challenges that are not covered in their college textbooks. But designing a water system that is elephant proof? Now that’s real-life engineering.



The Villanova contingent embraces the Masai culture (above); JP Gunn and others prepare to take flow measurements (top right); Rory Kotter ME ’11 and a local resident relax together (bottom right).

This past March, a multidisciplinary team of students from EWB traveled to a remote area of south-central Kenya to assess the feasibility of installing a water-distribution system for several villages populated by the Masai people. Because these communities lack developed water resources, the women and children spend 10-12 hours every other day fetching water from distant sources.

During its visit, the team surveyed the project area, collected data, and spoke with the people about their needs and concerns. Having identified two potential sites, the students—including those who did not make the trip—are coming up with several alternative designs. The project managers will then present these designs to Water Is Life – Kenya, the chapter’s NGO partner in that country.

WORKING THROUGH THE CHALLENGES

This project is the fourth that Villanova’s EWB chapter has worked on in as many years. “All our projects provide a wonderful opportunity from a service-learning perspective,” said Dr. Bridget Wadzuk CE ’00, an

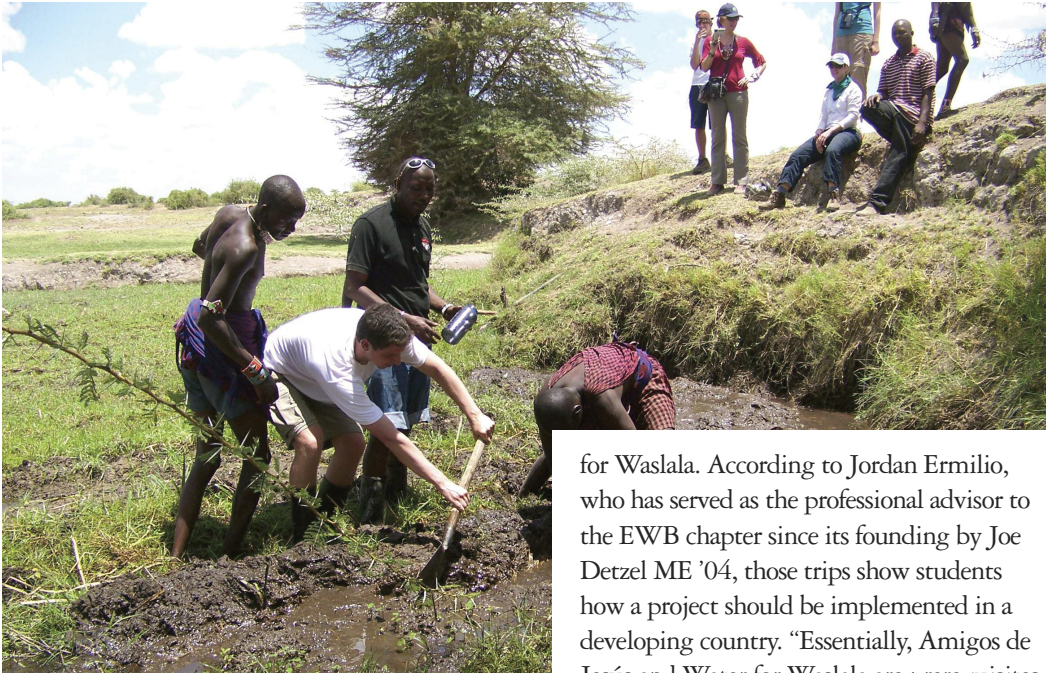
assistant professor in the Department of Civil and Environmental Engineering and the faculty advisor to EWB, “but the Kenyan one is requiring students to think creatively about a number of technical and economic factors.”

For example, the region does not have enough elevation potential to deliver water to the community from a mountain source. Therefore, unlike the water system that the EWB chapter installed in Thailand, this design cannot rely solely on gravity. Instead, the team must decide what type of pumping system to use and how it will be powered.

In addition, because the pipeline may have to pass under a seasonal lake, the students must consider whether it will shift when the lake is full. They also must protect the system against the destructive presence of wild animals. Controlling all these considerations is the need to optimize costs and to design a system that the local people can afford to install and maintain.

Such challenges do not daunt the students who volunteer for EWB, such as JP Gunn ME ’10. Gunn, who, along with Eric Baker, is Co-President of EWB, was part of the group that traveled to Kenya. “This proj-

THANKED ME FOR THE WORK WE HAD DONE ON THE WATER SYSTEM. HIS NEIGHBORS. THEY WERE GETTING OUR ENGINEERING DESIGN SERVICES, THE EXPERIENCES AND LESSONS THAT WILL LAST ALL OUR LIVES."



ect gives us a hands-on opportunity to better understand the problem, identify and engineer a solution, and then see that design implemented."

CAMPUS-WIDE COLLABORATION

In fact, all of Villanova’s EWB projects—from building ramps for Special Olympics, to reconstructing a playground in hurricane-ravaged New Orleans, to wrapping up the two-phase project in Thailand—have been student led. Often students have already participated in either Amigos de Jesús or Water

for Waslala. According to Jordan Ermilio, who has served as the professional advisor to the EWB chapter since its founding by Joe Detzel ME '04, those trips show students how a project should be implemented in a developing country. “Essentially, Amigos de Jesús and Water for Waslala are prerequisites to EWB projects. They give students the skills needed to identify, coordinate, and implement EWB projects while keeping issues of sustainability in the forefront.”

Despite its name, Villanova’s chapter of EWB comprises more than 100 undergraduate and graduate members from all four Colleges. This diversity allows the chapter to formulate an integrated, holistic approach to meeting the needs of a community.

For the Kenya project, EWB is collaborating with Business Without Borders. This newly established campus group is affiliated with the national organization Net Impact and is dedicated to promoting socially responsible business practices and sustainability. This summer, representatives will visit Kenya to work with the villagers on economic development initiatives. In addition, it is hoped that nursing students will eventually provide health and hygiene education. All these groups will work jointly under the umbrella title Villanovans Without Borders.

Another partner in any EWB project is the client—in this case, the Masai people. Serving more as consultants, the EWB volunteers provide engineering services and help with the construction. However, the

philosophy is the same as that of the Water for Waslala volunteers: the system belongs to the community, and the community must take ownership of that system if it is to last.

OTHER EWB INITIATIVES

The Villanova chapter is an affiliate of EWB - USA, a nonprofit, humanitarian organization that partners with developing communities worldwide to improve their quality of life by implementing sustainable, innovative, locally relevant programs. Since not all of its members can travel to international sites, the chapter is increasing the number of local projects that it undertakes.

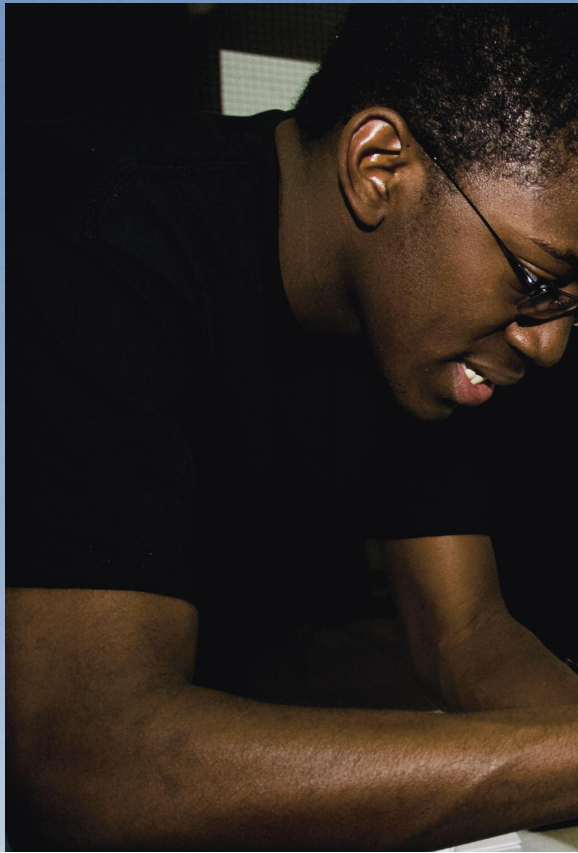
In Paw Prints, for example, EWB volunteers do hands-on activities with high school students to show them the relationship between science and engineering. One of the originators of Paw Prints was Sarah Arscott ME '09, the former president of EWB. The executive board is spending the summer mapping out the chapter’s activities so that they will be well prepared for another exciting and fruitful year for EWB.

EDUCATION OF A LIFETIME

Whether they are laying a foundation for an orphanage or designing a sustainable water system, Villanova students who take advantage of service opportunities turn the world into their classroom. “Nothing else has shown me so plainly the relevance of technical knowledge while also giving me the understanding of the effort it takes to go from a paper plan to a finished project,” said Ean Mulligan ME '09, who made four service trips in four years. “When we were in Thailand, one of the locals thanked me for the work we had done on the water system. I told him that we should be thanking him and his neighbors. They were getting our engineering design services for the duration of the project. We were getting experiences and lessons that will last all our lives.”

TURNED ON TO TECH

College Outreach Programs Nurture the Next Generation of Engineers



From energy to infrastructure to health care, global problems require solutions from experts in the fields of science, technology, engineering, and mathematics (STEM). The United States, however, faces a crisis in STEM education. High school students are outperformed in math and science by their peers in other countries. The nation also trails in the percentage of students who graduate from college. STEM education continues to be a priority for federal and state officials, who stress the need to find innovative ways to improve K-12 curricula and engage young people, especially female and minority students, in math and science so that the U.S. can stay competitive.

VESTED

For five years, Villanova's College of Engineering has been getting middle and high school students excited about STEM subjects. In 2005, it launched the Villanova Engineering, Science, and Technology Enrichment and Development (VESTED) program to enhance the technical literacy of underrepresented youth in the Philadelphia region and to "awaken in them the potential to become our nation's future engineers," said Dr. Stephen Jones, the College's Associate Dean of Student and Strategic Programs.

On eight Saturdays from January to April, 45-50 competitively selected high school students (and, starting next year, eighth graders) attend lectures, do experiments, receive college-prep training, and work closely with Villanova student mentors. This year, organizers introduced an entrepreneurship track for third-year VESTED students.

VESTED students build and launch rockets on Mendel Field during the program's final session.



Mentors for VESTED and BEST, such as Jude Coompton EE '11 (above, left) come from the Sophomore Service Learning Community.

The results of a survey of VESTED students and parents indicate that the program is achieving its goals. Educators, too, are pleased with the outcomes. “Principals and counselors comment that the program helps students gain an awareness of engineering and focus on doing well in math and science courses,” said Linda Coleman, Villanova’s Associate Director of Multicultural Affairs and the coordinator of logistics and student participation.

This awareness is dictating college and career decisions. For example, eight of the 13 seniors who attended VESTED this year plan to earn a degree in a STEM subject,

and two will receive technical training in the military. “This is what I enjoy most—seeing students choose to go into engineering fields,” said graduate student Rebecca Stein ME '07, who oversees the curriculum and student volunteers.

BEST

The College also partners with the School District of Philadelphia to help student teams prepare for participation in the Boosting Engineering, Science and Technology (BEST) Robotics Competition. BEST Robotics, Inc., is a volunteer organization that inspires students to



Monique Phillips CE '09 (left) and Rebecca Stein ME '07 welcome families to the kickoff of BEST.

pursue careers in engineering, science, and technology. Some 10,000 students nationwide compete.

The program kicks off in September, when local teams gather at Villanova to receive identical kits. Then, for the six weeks before the local competition, Villanova students visit middle schools and high schools to mentor teams as they design and build their robots. If teams advance from the local competition to the regional one, the mentors continue to advise them.

The mentors for VESTED and BEST come from Villanova’s Sophomore Service Learning Community (SLC). Part of the mission of SLC members is to improve the academic skills of the people they serve and to become a positive force in their lives. According to Noreen Cameron, Director of Service Learning, the mentors help the younger students discover their potential. “Is it important that students learn to build a robot? No. Is it important that they learn that engineering and science are fun and that perhaps they have talent in those areas? Yes.”

LEAD

Having established its track record of success, the College is expanding its offerings and exploring new directions. Beginning in summer 2010, a national program designed to introduce academically strong minority students to top-tier engineering schools and to engineering careers will come to Villanova.

Turned On to Tech

continued



Linda Coleman, Love Wallace ChE '10, and Rebecca Stein present certificates and hats at VESTED's closing ceremony.

Leadership Education and Development (LEAD) for Engineering is a three-week, on-campus residency experience for rising juniors and seniors. Participants, who are recruited by LEAD, will learn from the College's outstanding engineering faculty and from LEAD's corporate sponsors. LEAD raises funds to cover expenses such as faculty salaries and curriculum development.

In being invited to participate, Villanova joins an elite group. The first two schools to host LEAD for Engineering were the University of California, Berkeley, and the Georgia Institute of Technology. Being a LEAD school also will strengthen the University's connections with the nation's top minority high school students.

NCTL

A new partnership is enabling the College to help increase interest in engineering not just among local students but among teachers across the Commonwealth. This year, Villanova and Boston's Museum of Science, National Center for Technological Literacy (NCTL), signed a memorandum of understanding (MOU) to establish a formal relationship to strengthen the introduction of



Dalmas Wambura ME '10 (center) reads specs for a project with a VESTED student.

engineering education in K-12 classrooms in Pennsylvania and thus prepare more students in the Northeast for employment in the fields of engineering and technology.

According to the MOU, the College and NCTL will collaborate on curriculum design, research, and innovative instruction methods. In addition, they will promote STEM education for K-12 teachers, faculty, and graduate students, who will then help with curriculum implementation.

The NCTL works with state departments of education, teachers, administrators, and industry representatives to integrate engineering in the K-12 curriculum nationwide through advocacy and standards reform, curricular and educator resources, and professional development. "The NCTL is excited to partner with Villanova's College of Engineering to strengthen the introduc-

tion of engineering education in classrooms across Pennsylvania," said Dr. Yvonne Spicer, NCTL Vice President for Advocacy and Educational Partnerships. "Villanova's strong commitment to STEM education through a variety of successful outreach programs, particularly those involving underrepresented students, makes the partnership a natural for us."



Dr. Stephen Jones (center) directs the College of Engineering's outreach programs to middle and high school students.



HERE, THERE, AND EVERYWHERE

Engineering Students Make a Difference in Campus Life

“WE WERE HELPING TO BRING ABOUT A STRONGER FAITH EXPERIENCE FOR EVERYBODY IN THE CONGREGATION.”

— *Kenneth Koncilja EE '09*
was a liturgical timpanist with the Pastoral Musicians.

During the spring semester, Kenneth Koncilja EE '09 had plenty to think about: completing his senior capstone design project, getting ready for graduation, and gearing up for his fall classes at the University of Toledo's College of Medicine. But another issue was occupying his mind. Who could he recruit and train to succeed him as timpanist in the Pastoral Musicians, the vocal and instrumental ensemble that supports the Sunday evening liturgies at Villanova?

The first timpanist ever to play with the ensemble, Koncilja had dedicated himself to the position for four years. In fact, playing with the Pastoral Musicians had become the defining experience of his Villanova career.

“It was a way of serving students from across the University,” Koncilja said. “We were helping to bring about a stronger faith experience for everybody in the congregation. People talk about the Augustinian charism of community. It's real, and when you are a part of it, it's overwhelming.”

Perhaps Koncilja's passion would have shocked folks laboring under the false notion that engineering students have no time for—or interest in—life outside the lab and field. But it came as no surprise to Associate Director of Campus Ministry Donald Giannella. Having coordinated the Pastoral Music program for 14 years, Giannella long ago induced that engineering students not only support the arts but are singularly faithful to their commitment.

“Generally speaking, those who have contributed most to the identity of the pastoral music ministry tend to come from an engineering background. Because they

are goal oriented, they look at their commitment in the long term and stick with it because they have an idea of the result that they are trying to achieve.”

In Koncilja's case, that result was the continuation of the element of music he had brought to the ensemble. He was determined to find a replacement, even if he had to teach the student how to play the timpani. “That's the kind of ‘I want to see this project succeed’ mentality that is heightened in engineering students,” Giannella said.

Andrew Clare CE '09 was not only a member of the Pastoral Musicians but also served as Vice President of the all-male Villanova Singers and as a musical director in the Villanova Student Musical Theatre. He found that his engineering training had prepared him to take a leading role in these activities. Relying on skills such as project planning, time management, and teamwork, Clare was able to balance his many commitments and execute his duties according to schedule.

But Clare and others also tapped into another resource, one that engineers sometimes are not given enough credit for possessing: the gift of creativity. “Engineering is the process of taking a piece of art, which could be anything from an idea to a drawing, and transforming it into something real and something practical,” said Nick Tumolo CE '10, a member of the



Villanova Band and of the Student Government Association's executive board. "The arts allow engineers to express their natural technical passion and ability in ways other than bridge and engine designs."

Saxophonist and fellow band member Kevin Leach ME '10 found that being part of a campus community strengthened his school pride and offered him a respite from the rigors of academic life. "By participating in the band, I was able to step out of my 'work shoes,' relax a little more, and experience what Villanova is all about."

Nobody knows better than Thomas Mogan, Director of Student Development, how important involvement in campus life is—and how qualified engineering students are to assume positions of management and leadership. One of the services that his office provides is a leadership program for student groups. Mogan has worked closely with engineering students who have held top positions in organizations such as the Belle Air Yearbook, Special Olympics, and the Student Government Association. He and his colleagues have had nothing but positive experiences.

"We know that engineering students are very busy with academic work, and yet we are confident in their ability to get everything done. It is not at all true that if you are engineer, you cannot do

"AS AN ENGINEERING STUDENT, I GAINED TECHNICAL KNOWLEDGE. AS AN ACTOR AND SINGER, I LEARNED HOW TO COMMUNICATE INFORMATION CLEARLY."

— Andrew Clare CE '09
was Vice President of the Villanova Singers
and a musical director in the Villanova
Student Musical Theatre.

"I HAD THE OPPORTUNITY TO PLAY AT A COMPETITIVE LEVEL AND GET RELIEF FROM THE DEMANDS OF MY COURSE WORK."

— Ameer Jones ME '10
and his club basketball teammates
advanced to the national championship
in 2009.

"THE LEADERSHIP AND TEAMWORK SKILLS THAT I HAVE LEARNED IN ENGINEERING WILL HELP ME REACH OUT TO THE STUDENTS MORE EFFECTIVELY."

— Dan Gelwicks ME '10
was elected Student Body
President for 2009-2010.

"THE MOST REWARDING PART OF MY POSITION WAS REACHING OUT TO THE STUDENTS, HEARING WHAT THEY HAD TO SAY AND ACTING ON IT."

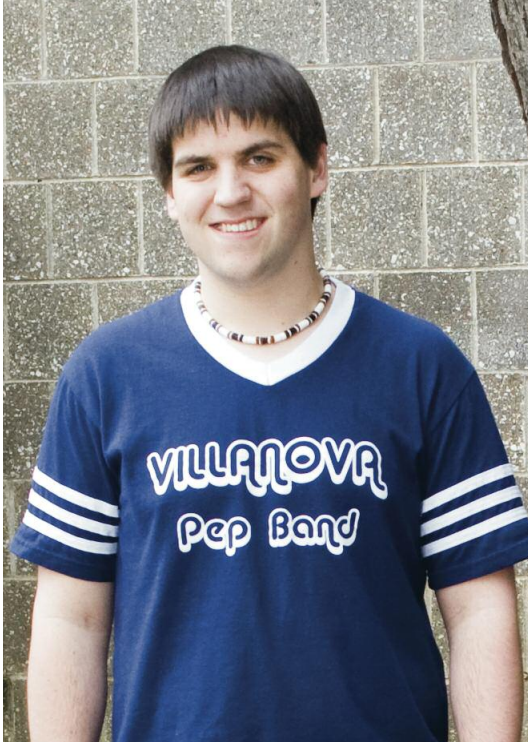
— Bryan Wagner CE '09
served as Student Body President
in 2008-2009.

Here, There, and Everywhere

continued

anything else,” Mogan said.

The images and testimonies included on these pages represent only a sampling of the many engineering students who, in the past year, found plenty to do away from their studies. They used their talents to make meaningful contributions to the University and to enrich campus life. “The students we’re attracting to Villanova want to develop as leaders and as whole persons,” said Dr. Gary Gabriele, the Drosdick Endowed Dean of Engineering, “and they have many opportunities to do that here.”



"MY ENGINEERING BACKGROUND HAS HELPED ME TO THINK ON MY FEET AT GAMES AND FIND SUITABLE SOLUTIONS WHEN THINGS GO WRONG."

— Tom Cherry CPE '10 directs the Pep Band, which provides entertainment at basketball games.



"I HAVE ALWAYS BEEN PASSIONATE ABOUT TRACK. YOU GET A TIME, YOU DO WHAT YOU CAN DO, AND IT'S EASY TO SEE WHERE YOUR BEST IS."

— Jordan Sarruda ME '09, a member of the women's track and field team, was a 2007 Big East champion (4 x 800m).



"I HAVE MADE FRIENDS OUTSIDE OF MY ENGINEERING CLASSES AND HAVE BEEN PROUD TO REPRESENT THE UNIVERSITY."

— Astrid Armgarth ChE '11 has won many freestyle and individual medley events for Villanova's women's swim team.



"AS DIRECTOR OF NEW MEMBER EDUCATION, I MAKE SURE THAT NEW SISTERS FEEL COMFORTABLE AND LEARN HOW TO GET INVOLVED."

— Mara Tsudis ChE '10 is an executive member of the Eta Epsilon Chapter of Alpha Phi.



"WHAT I ENJOYED THE MOST WAS SHARING IN THE CAMARADERIE, GETTING EXERCISE, BEING OUTDOORS, AND HAVING FUN."

—Joe Pawelczyk ME '09 belonged to the Villanova Cycling Club and competed throughout the Northeast.



"GOING TO NEW ORLEANS ALLOWED ME TO HELP REBUILD HOMES AND MEET THE FAMILIES WHO WOULD BE LIVING IN THEM."

—Alex Baumer ME '09 made a Habitat for Humanity service trip in his junior year.



"I GOT SATISFACTION FROM SEEING THE FACES OF THE KIDS WHO CAME TO THE FESTIVITIES AND OF THE VILLANOVA STUDENTS WHO INTERACTED WITH THEM."

—Rebecca Ferenchiak ChE '10 was an event coordinator for the 2009 Balloon Day, which brought persons with disabilities and children from nearby schools to campus.

THE FOUR FACES OF

Faculty Help Students Connect Technology with the Marketplace



Professors Edmond Dougherty (standing) and Bill Hurley discuss business concepts with students enrolled in the Engineering Entrepreneurship minor.

The best way to teach people how to think innovatively is to show them. That has been the MO of professors Pritpal Singh and Edmond Dougherty, from the College of Engineering, and James Klingler and Bill Hurley, from the Villanova School of Business (VSB). These faculty have put their enterprising minds together to develop classroom and extracurricular initiatives that introduce students to the concepts of entrepreneurship.

ENTREPRENEURSHIP



The importance of these initiatives cannot be overestimated. To be competitive in today's global economy, engineers must have an entrepreneurial mindset. "Because routine types of engineering are being outsourced and the life cycle of products is so short, engineering graduates need to be more creative and innovative," said

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

Getting the creative juices flowing is only the first step. To create products that will sell or businesses that will thrive, engineers must be market savvy. In fact, the National Academy of Engineering has identified mastery of business and

management principles as one of the attributes critical to engineering practice. "I tell students that they can't be engineers in a vacuum," said Dr. Hurley, a Business Fellow in VSB's Management Department. "To succeed in industry, they need business skills."



Dr. James Klingler (left) and Dr. Pritpal Singh

STRENGTH IN NUMBERS

In developing an approach that integrates technical and business education, the faculty drew on their academic and entrepreneurial experience:

- **Dr. Singh**, an innovator in the areas of solar and renewable energy, holds six patents and has been a founding principal in five startups. In April, the Philadelphia Section of the Institute of Electrical and Electronics Engineers recognized him for his outstanding innovations in engineering education.
- **Visiting Assistant Professor Dougherty BSEE '69, GS '86** has founded several companies and specializes in the design, development, and management of complex electronic and software systems. He helped develop the Emmy Award-winning Skycam and the next generation of aerial robotic cameras, the Wavecam.
- **Dr. Klingler** is the Academic Director of VSB's Innovation, Creativity and Entrepreneurship Initiative. A faculty member for 29 years, Dr. Klingler has been teaching about entrepreneurship for two decades and has consulted on numerous startup ventures.
- **Dr. Hurley A&S '62** earned his PhD in Chemistry at Princeton and then worked for 33 years at DuPont. After starting as a research scientist, he progressed through the

managerial ranks and was responsible for developing and commercializing new products and businesses.

ACHIEVEMENTS IN AND OUTSIDE THE CLASSROOM

The team's biggest curricular undertaking has been creating an Engineering Entrepreneurship minor in the College of Engineering. It was developed with a \$50,000 grant from the Kern Family Foundation. The minor covers topics such as opportunity analysis, product ideation and development, risk management, and project funding. In 2008-2009, the professors teamed up to teach the first two courses. Lauren Pugh EE '11 found the courses enriching. "I learned about various business disciplines without having to take classes in each one, and having faculty from two colleges brought in different perspectives."

The foursome hopes that the minor eventually will be open to all University students. A precedent for campus-wide entrepreneurship education already has been set. Since 2007, a committee that includes several of these faculty has been organizing Beyond Ideas: The Art of Entrepreneurship, a program that helps students turn ideas into products.

Beyond Ideas is not the only extracurricular opportunity students have to learn

about entrepreneurship. In the spring, Dr. Singh, Dr. Klingler, and Jordan Ermilio BSME '98, MSWREE '06, the College of Engineering's Special Projects Coordinator, received a \$49,000 grant from the National Collegiate Inventors and Innovators Alliance (NCIIA). As a result, business and engineering students are working with innovators in the Philippines' Ifugao Province to develop low-cost, sustainable technologies for the region. Because this partnership will stimulate the local economy, the students are seeing the benefits of social entrepreneurship.

To extend entrepreneurship education to future engineering students, Dr. Singh and Dr. Klingler added an entrepreneurship track to VESTED (Villanova Engineering, Science, and Technology Enrichment and Development), a high school outreach program. At the kickoff in January, the faculty challenged those students in their third year of the program to design a hair dryer that would be technically innovative and commercially viable. Students presented their results at the closing ceremony in April.

MODEL OF SUCCESS

The collaboration has succeeded for several reasons. The College of Engineering, VSB, and the University have enthusiastically supported this effort. Second, the faculty are passionate about their subject and respect each other's ideas. Finally, Villanova's collegial spirit allows such programs to flourish. "People here have big hearts and want to help each other. This kind of teaming is what you need for building strong ideas and companies," Professor Dougherty said.

In fact, the CEER-Bartley connection may be the most memorable lesson for students. "Life is an interactive, collaborative, multidisciplinary experience," Dr. Klingler said. "By cooperating across disciplines, we give students a model to follow."

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