Volume 49, Number 1, Spring 2008

ENGINEERING
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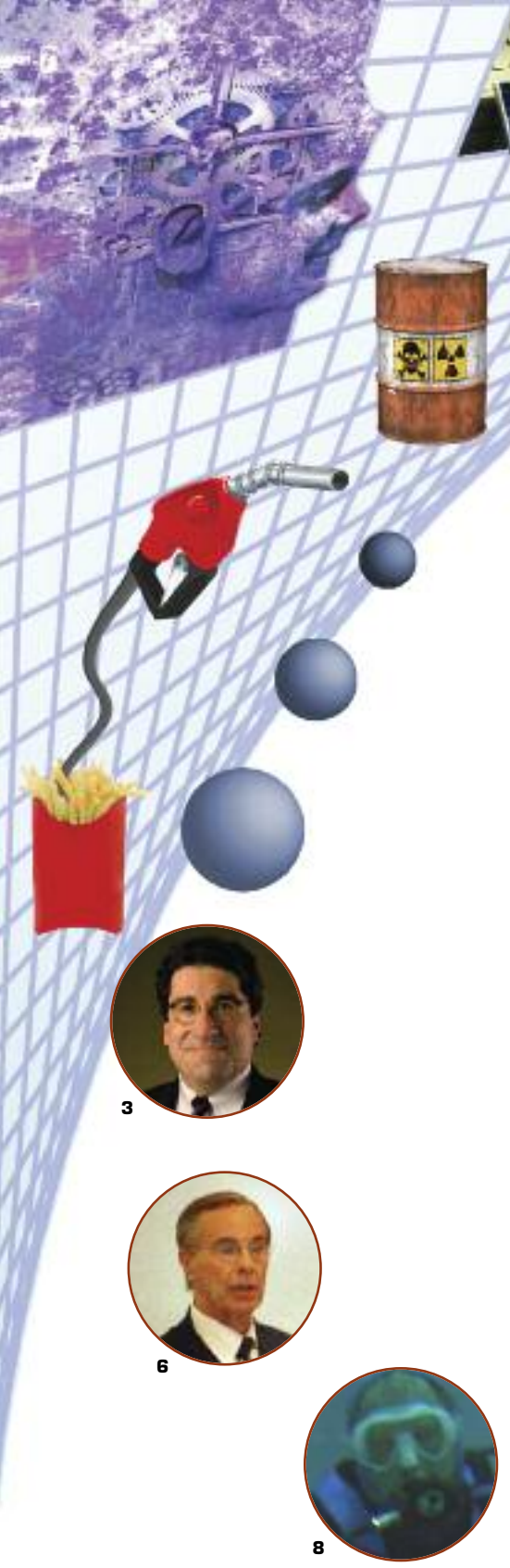
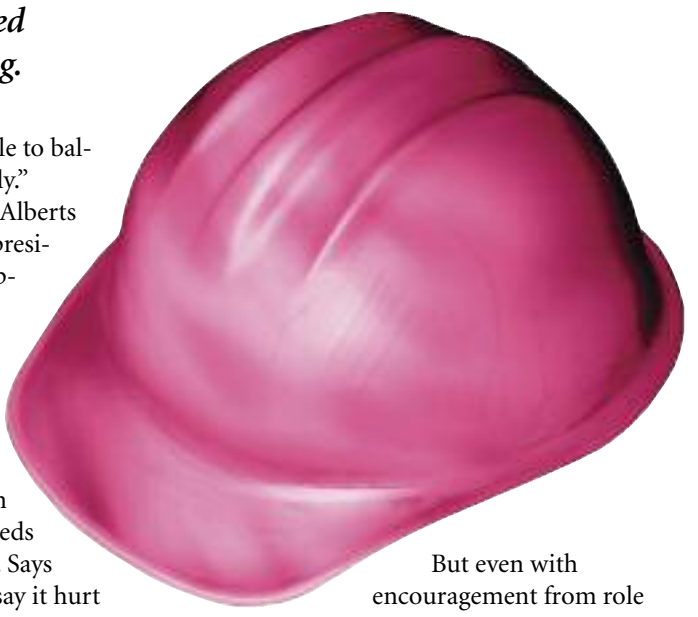


Mission to Buck the Trend

School, female students and alumnae are dedicated to increasing the number of women in engineering.



Although some national figures show that the number of women enrolling in engineering programs is dropping, efforts by the School of Engineering to attract female students and support women in engineering seem to be paying off.

The 2007–2008 freshman class, for example, is 33 percent female. Overall, "29 percent of undergraduates in the School of Engineering are women," says Art Overholser, senior associate dean of the school. "Nationwide there's been a decline in women enrolling in engineering. In 1999 it was 21.2 percent; in 2006, 19.3 percent."

The American Society for Engineering Education (ASEE) reports similar numbers, stating that women graduating with bachelor's degrees in engineering dropped to a 10-year low of 19 percent in 2006. Nationally, women represent about 17 percent of undergraduate engineering students, says ASEE.

The national decline could have various causes. Some experts point to the need to encourage girls to take math and science classes. Others note that many high school guidance counselors are not familiar with engineering, and thus, do not encourage girls to consider the profession. Still others wonder if women are concerned that the engineering field is not family-friendly.

Workplace Changes

Banging the drum for women engineers is a campaign 77-year-old Maryly Van-Leer Peck, BE'51, of Winter Haven, Fla., takes seriously. The first woman chemical engineering graduate of the School of Engineering, Peck later earned a doctorate and worked in aerospace before moving to college administration.

"When young women talk to me about engineering, I tell them they can do anything they want." She concedes, however, "Often their concern is whether they'll be able to balance career and family."

Elizabeth "Libby" Alberts Cheney, BE'82, vice president of corporate support for Shell-Exploration and Production, American Region, acknowledges that she has turned down assignments, in part, based on the needs of her three children. Says Cheney, "I wouldn't say it hurt my career, but there were trade-offs and it did slow things down."

Kelley Golden Zelickson, BS'79, sector vice president and deputy general manager for Northrup Grumman in Huntsville, Ala., says, "Achieving a work/life balance is key. There are varying degrees of flexibility within each field. Women want family-friendly jobs so they can be home at a reasonable hour to drive carpools, make dinner and help with homework."

While times do change, Zelickson says, that change can sometimes be glacial. She recalls how a customer, with whom she had a solid relationship, called her boss to complain about a problem. "He said he couldn't come to me about it because he really needed to vent and wasn't comfortable yelling at me."

Still, Zelickson says that she has seen the engineering workplace change since she graduated. "It's gotten much easier to be a working woman in general. These days, men see us in a job—not as women—so if you're responsible for something, you're held accountable."

Role Models Matter

Leslie Shor, research assistant professor of civil and environmental engineering and faculty adviser to the Vanderbilt chapter of the Society of Women Engineers (SWE), speculates that a lack of female mentors may be a factor in fewer women entering the profession. "I don't think it's a barrier or a conspiracy. Rather, there's a dearth of women engineers at higher levels who provide opportunities and mentor women," she says.

Role models do appear to be a key element in young women's decisions to become engineers. For Peck, it was her father, then president of Georgia Tech. He encouraged her to take higher math early, which propelled her into engineering. Ironically, when she was ready for college, Georgia Tech had a no-women policy.

In Zelickson's case, her father was an electrical engineer with NASA and wanted his children to consider careers in science and math. For Cheney, a high school chemistry teacher saw the nascent engineer in her.

But even with encouragement from role models, the idea of taking a career path that starts in late middle school with algebra and spirals toward increasingly challenging levels of math and physics can be a tough sell to a 14-year-old. Combine that with the public's generally hazy understanding about engineering careers and old stereotypes that question whether or not girls are good at math, and the stage is set for student disinterest.

A Matter of Math

Rachel Riti, a sophomore engineering major, dismisses the stereotypes. "I don't buy it that there's a difference in men's and women's brains," Riti says.

Dean Overholser has the figures to back her up. "There's no statistical difference in the GPAs of women versus men in our program," he says. Likewise, women and men have similar graduation rates. So once a woman enrolls in the School of Engineering, she stays, does well and graduates.

Riti and seven other sophomore women engineering majors live in a large apartment in Mayfield Place, one of Vanderbilt's Living and Learning lodges. Together the women are applying their engineering problem-solving expertise to the enrollment conundrum. Their strategy includes making presentations to high school students that buck the stereotype of engineers as cubicle-bound men with pocket protectors. "Since we're kind of the same age as them, we're hoping they'll listen more to us than to a professor," says Riti, who plans to become a veterinarian.

Riti's objective of using her engineering degree and its problem-solving emphasis as a springboard to a different profession has precedent. Take Sandra Brophy Cochran, BE'80. After graduation she was an officer in the U.S. Army for five years before becoming a banker. An MBA later, she was named CEO of Books-A-Million, the nation's third largest book retailer, in 2004.

"An engineering degree teaches you how to work hard, pay attention to detail and problem solve," Cochran says. "The discipline of engineering also taught me to do my best to ensure

Continued on page 2

IN THIS ISSUE

DANIEL DUBOIS

These sophomore engineering students want to convince high school girls that it's cool to be engineers. Heading the effort are (front, from left) Amy Shaw, Rachel Riti, Katelyn Herbert and Catherine Killinger; (back, from left) Lauren Pulley, Courtney Thomas, Jennie Wolfgang and Veronica Hawkins.

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A Look Ahead to an Uncommon Commons Experience

Ron Schrimpf, professor of electrical engineering and computer engineering and director of the Institute for Space and Defense Electronics, and his wife, Kathy, will start a new adventure in fall 2008 as heads of Memorial House, a residence in The Commons. Here are their thoughts on what's ahead.

JOHN RUSSELL

Kathy and Ron Schrimpf in their newly finished apartment in Memorial House in The Commons

The first-year experience at Vanderbilt is about to undergo a dramatic transformation, beginning in fall 2008. Approximately 1,550 new students will arrive at The Commons, a new campus for first-year students and residential faculty.

Located on the Peabody College campus, The Commons comprises 10 houses, The Commons Center and a residence for the dean of The Commons. Each of the houses has a faculty head who will live in an apartment in the house and participate in the life of the house. We will head Memorial House, with faculty members from the College of Arts and Science, Peabody, Blair and Divinity among the other heads of house.

Each house will include a mix of students from all four undergraduate schools; for incoming engineering students, this builds on Vanderbilt's tradition of offering an outstanding engineering education that is fully integrated into the overall university experience.

We are looking forward to helping to define the character of Memorial House and arranging activities that take place in the house. In particular, we plan to host meals, receptions and study breaks so we can get to know the 85 students living with us and to help them feel at home. We expect that the experience will affect us as much as the students. Living on campus will make it much more convenient for us to participate in evening and weekend activities.

Frequently, the most vibrant part of a research university's intellectual activity exists outside the classroom. First-year students in The Commons will benefit from opportunities to interact with Vanderbilt's faculty and visiting researchers in an informal setting. Discussions, receptions and meals at which students mingle with faculty will serve as a catalyst for this type of interaction. The participation of faculty from all of Vanderbilt's undergraduate, graduate and professional schools will give students access to information that they would be unlikely to encounter in a conventional undergraduate experience.

Student-run entertainment and social activities within each house also will be an essential part of The Commons. The shared public space, The Commons Center, contains a dining facility, fitness center and various student services. It will host live musical performances in The Commons Café many nights and weekends, providing a social focal point.

Meeting a variety of needs, each house contains wireless Internet, a seminar room, music practice rooms and various public spaces. Commons seminars will be offered in the houses, and the students will help define the content of these seminars. In the inaugural semester, the seminars will be organized around three themes: Energy, Sustainability and the Environment; Election 2008; and Music.

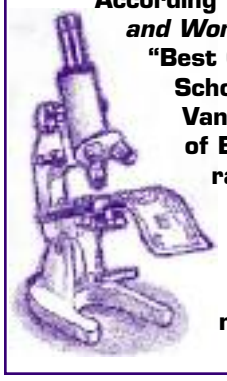
As the parents of two college-age students, including a daughter who is the same age as the entering class, we are optimistic that we already have some insight into college lifestyles. However, we're also certain there will be many surprises, and we look forward to representing the School of Engineering in this exciting endeavor.

—Ron and Kathy Schrimpf

Engineering Vanderbilt, the biannual alumni newsletter of the School of Engineering, once again has received an Award of Excellence from the Council for Advancement and Support of Education (CASE), Region III. Phillip B. Tucker, editor in Vanderbilt's Office of Development and Alumni Relations Communications, served as interim editor of the *Engineering Vanderbilt* issues that were honored. Nancy Wise is the current editor.

FACTOID

Strong in Research



According to *U.S. News and World Report's* "Best Graduate Schools 2008," Vanderbilt School of Engineering ranks 20th in the nation for research expenditures per faculty member.

Mission to Buck the Trend *page 1*

my decisions are correct and on time." She notes that those are skills common to business and all professions.

Cheney, who was with ExxonMobil for 24 years before joining Shell, concurs. "Success in business is about problem solving. It doesn't matter what stage your career is in—the ability to optimize and to problem solve are essential. In making decisions I frequently fall back on the chemical engineering principle of material balance—what comes out depends on what goes in.

"It's a powerful metaphor for business and for life."

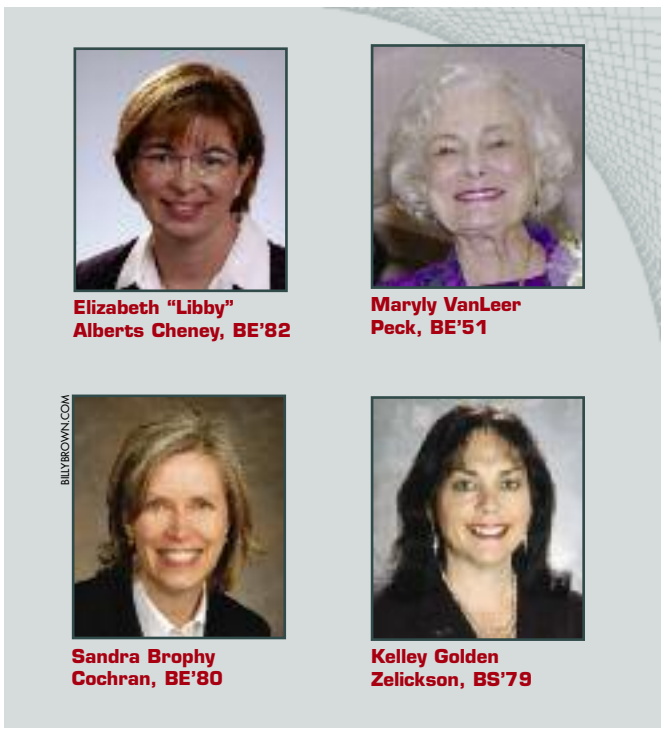
Communications Strategy

Though demand for engineers is growing worldwide and the professional playing field is increasingly a level one for women, the School of Engineering, like most of the 359 accredited universities with engineering programs nationwide, is still fine-tuning its strategy for attracting women, Overholser says. Part of that strategy included co-hosting the national convention of the Society of Women Engineers in Nashville in late 2007.

One area where there may be a need for change is in simple communication.

Many women seem to be drawn to careers where the thread of altruism is clear and strong, both Shor and Overholser point out. That theory appears to be borne out by a review of the areas in which women enroll in the School of Engineering: 42 percent of the students enrolled in the biomedical engineering program are women, as are 41 percent of those in civil and environmental engineering, and 39 percent of students in chemical engineering.

"The message we're not communicating to young women is that engineers develop safer roads and cars, environmental solutions, pharmaceuticals, and advanced medical equipment," Shor says.



Elizabeth "Libby" Alberts Cheney, BE'82

Maryly VanLeer Peck, BE'51

BILLYBOWMAN.COM

Sandra Brophy Cochran, BE'80

Kelley Golden Zelickson, BS'79

Overholser speculates that developing a recruitment message specifically targeting women that also taps into the liberal arts and entrepreneurial environment at Vanderbilt could be powerful. "Math and science in their purist forms are about discovery," Overholser says. "As engineers, we create things that never existed. We build devices and systems and structures that are good and helpful and meaningful to society."

—Mardy Fones

New Chancellor Named

Vanderbilt's new chancellor won't take long to get up to speed on goals and objectives for the School of Engineering: Nicholas S. Zeppos is already a good friend of the school, and a familiar face to alumni, faculty, staff, parents and students.

On March 1, the Vanderbilt Board of Trust unanimously elected Zeppos as the university's eighth chancellor. Zeppos, formerly the interim chancellor as well as provost, vice chancellor for academic affairs and professor of law, has been a member of the Vanderbilt community since 1987.

"We were seeking a person who could manage, lead and inspire; who is committed to Vanderbilt's central missions of education, research and service; and who has a passion for excellence and success in everything that we do," said Dennis C. Bottorff, BE'66, chair of the nine-member search committee that had been at work since the resignation of E. Gordon Gee on Aug. 1, 2007. "We sought someone who will value and promote the life of the mind in all corners of the university, who can effectively represent Vanderbilt locally and nationally, and who can promote a culture of philanthropy to sustain Vanderbilt's growth. Our search identified the person who uniquely possesses these qualities, and he is Nick Zeppos."

Dean Kenneth F. Galloway applauded the Board's choice. "Nick Zeppos will be a terrific chancellor. He has the leadership skills and the vision that Vanderbilt needs," Galloway said. "As provost, he has been involved with the academic and development goals of the engineering school—indeed, of all the schools of the university—and he understands the school's priorities and initiatives. He's innovative, methodical, and dedicated to excellence—if he hadn't become a lawyer, he'd have made a good engineer."

Committed to Excellence

Zeppos said he was "honored and grateful for the trust that the Board, faculty, students and alumni have placed in me at this critical time in Vanderbilt's history. I look forward to working with my colleagues on campus, in the community and around the world to continue this university's mission of excellence and service."

Zeppos joined Vanderbilt in 1987 as an assistant professor in the law school. He subsequently served as an associate dean and then as associate provost before being named provost and vice chancellor for academic affairs in 2002. Since then, Zeppos has overseen the university's undergraduate, graduate and professional education programs, as well as research in liberal arts and sciences, engineering, music, education, business, law and divinity. As provost and vice chancellor, he chaired Vanderbilt's budgeting and capital planning council and led all fundraising and alumni relations efforts across the institution, as well as directed the dean of students and dean of admissions. He also led the university's Shape the Future fundraising campaign, which exceeded its $1.25 billion goal two years ahead of schedule and set a new target of $1.75 billion by 2010.

A native of Milwaukee, Wis., Zeppos is a 1976 Phi Beta Kappa graduate of the University of Wisconsin, where he studied history, and a 1979 magna cum laude graduate of the University of Wisconsin Law School.

DANIEL DUBOIS

Chancellor Nicholas Zeppos

> "Nick Zeppos will be a terrific chancellor. He has the leadership skills and the vision that Vanderbilt needs."
>
> —*Dean Kenneth F. Galloway*

French-Fried Fuel

Come fall, the smell of fried food in the air in Featheringill Hall may not be from someone's lunch: It could be coming from the new Vanderbilt Multi-User Biodiesel Engine Test Facility.

A $100,000 gift from the DENSO North America Foundation will establish a state-of-the-art biodiesel testing facility at the School of Engineering. Students will be able to investigate diesel engine-performance parameters and test campus-produced biodiesel fuels made from recycled cooking oil. The facility will be managed by the mechanical engineering department under the direction of Amrutur V. Anilkumar, professor of the practice of mechanical engineering.

"The facility will include a four-cylinder diesel engine typically used in passenger cars," says Robert W. Pitz, professor of mechanical engineering and chair of the department. "The engine will be linked to a computer that will analyze the test data and monitor engine performance with various fuels." The biodiesel engine will be equipped with an eddy current dynamometer to vary the engine load and to characterize torque and power curves as a function of engine speed. Students will also use diagnostic equipment to monitor particulate and gaseous emissions.

Among those using the biodiesel facility will be mechanical engineering students as part of their core laboratory curriculum; mechanical, chemical and environmental engineering seniors involved in capstone projects in biodiesel characterization and reactor design; and students from the Vanderbilt Biodiesel Initiative, which is involved in campus-wide waste oil recycling and biodiesel production.

Environmentally Friendly

Processed fuel derived from biological sources, biodiesel and biodiesel blends can be directly used in current diesel-engine vehicles without any modifications. The environment-friendly fuel produces substantially less net carbon-dioxide emissions than petroleum-based diesel fuel. It is also a better lubricant than diesel in the sense that it cleanses the engine and removes deposits in fuel lines, producing less wear on the engine over time.

As part of the Vanderbilt Biodiesel Initiative, engineering students and other volunteers from Wilderness Skills (WilSkills), a student-run outdoor education program at Vanderbilt, collect used vegetable oil from Vanderbilt Dining Services and recycle it into biodiesel. The fuel is currently being used to power a van WilSkills owns, as well as plant operations vehicles; perhaps in the near future, it will be used in some medical center shuttle buses.

Doctoral graduate student Derek Riley, MS'06, is one of the leading forces behind the student-run Vanderbilt Biodiesel Initiative. While the project seeks to create a self-sufficient, sustainable, student-run biodiesel production system on the Vanderbilt campus, it also wants to educate people about environmentally friendly systems. He says the project is going to increase awareness about biodiesel and biofuels while reducing vehicle emissions. The process does have a potential drawback however.

"Biodiesel is really good fuel. When you use it, however, the exhaust smells like French fries. It's a funny byproduct," Riley says. "It's definitely something you have to get used to."

—Nancy Wise with David F. Salisbury and Kara Furlong

DEREK RILEY

Graduate student Derek Riley with biodiesel made on campus from used cooking oil

No Simple Solutions

An international symposium considers issues in nuclear waste management.

U.S. courts have given the federal government the responsibility of ensuring the safe disposal of high-level nuclear waste for one million years. This tall order confounds even those in the business of dealing with the potentially deadly material. At the same time, rising oil prices have caused some to call for more use of nuclear power (and thus more waste) as a cheaper source of energy.

To explore the implications of this shifting geo-political landscape, Vanderbilt School of Engineering hosted a symposium, "Uncertainty in Long-Term Planning: Nuclear Waste Management, a Case Study," Jan. 7–8. The two-day event honored Frank L. Parker, Distinguished Professor of Environmental and Water Resources Engineering, an internationally respected pioneer in nuclear waste management and environmental protection.

Speakers included Edward "Ward" F. Sproat III, director of the U.S. Department of Energy's Office of Civilian Radioactive Waste Management; Thomas B. Cochran, BE'62, MS'65, PhD'67, a senior scientist in the Natural Resources Defense Council's nuclear program; E. William Colglazier, executive officer of the National Academy of Sciences; Charles W. Powers, professor of environmental engineering; and David S. Kosson, chair of civil and environmental engineering and professor of civil and environmental engineering and of earth and environmental sciences. Other speakers included representatives from industry, public health, law and ethics, as well as international experts from Japan, Sweden and Canada.

KURT STRAZDINS/COURTESY MCT DIRECT

Inside the Yucca Mountain nuclear waste storage site

The symposium was underwritten by Steve Mason, BE'82, Kym Freeman Mason, BSN'82, the Mason Family Foundation, the Garrick Foundation, and the Consortium for Risk Evaluation with Stakeholder Participation.

JOHN RUSSELL

Thomas B. Cochran, BE'62, MS'65, PhD'67, and Edward "Ward" F. Sproat III discuss issues in nuclear waste management during the recent symposium.

On the Mountaintop

A reoccurring subject of the symposium was the proposed nuclear waste repository at Yucca Mountain in Nevada. The project was authorized in 1987 and is still preparing a license application to the Nuclear Regulatory Commission.

"The U.S. needs nuclear energy as part of its overall strategic energy policy," said Sproat, who oversees the project for the Department of Energy. "For that to occur, progress must be made on waste storage policy."

According to Cochran, the Department of Energy's attempts to build the facility remain trapped within a maze of politics and regulation. Challenges include concerns about water sources, operating standards that cannot be measured or implemented, and public opinion that has shifted dramatically. In addition, project funding has been problematic since its inception, though more than $9 billion has been spent to date.

Sproat urged the Environmental Protection Agency to set standards for nuclear waste storage and called for resolution of resistance to Yucca Mountain. "Interim storage is not possible or cost effective. Starting over is not an option," he said. "The shortest path forward is licensing and building Yucca Mountain."

(Ironically, the very same week as the symposium, the Department of Energy announced deep congressional budget cuts for Yucca Mountain, expected to result in hundreds of layoffs.)

Moving Forward

While politics and money are operational issues on the road to nuclear waste storage, the images and dangers the public associates with all things nuclear exacerbate the debate, Powers said.

Nuclear waste management that is credible to the public and protects health and the environment is essential, Kosson said, concurring. Pointing out that large quantities of spent nuclear fuel and radioactive waste already exist, he emphasized that the issue needs to be resolved, especially in light of today's escalating demand for energy.

He proposed ongoing honest communication and public education regarding the risk of nuclear waste, as well as public/private partnerships, stable government financing and consistent policy. "The likely future reliance on nuclear materials for defense, energy and other uses requires a forward-looking, sustainable approach," Kosson said.

—Mardy Fones

Up for a Challenge

Whether motivating students, international scientists or himself, Frank Parker won't slow down.

It's a racquetball day for Frank L. Parker. A lot of sweat, a lot of exercise, and an hour when nothing matters but whacking a small ball hard against the wall. And burning off some of his boundless energy.

Look for him on the racquetball court three days a week. Or hiking at Radnor Lake or a national park.

At 81, Parker, Distinguished Professor of Environmental and Water Resources Engineering and professor of engineering management at Vanderbilt, has a burning appetite for challenge. Whether coaxing his wife's printer to work, consulting with Russia on its nuclear program, or nurturing aspiring engineers, he finds solutions.

A pioneer in nuclear waste management and environmental protection, Parker has led a number of major international studies on nuclear waste during the past five decades. His collaborations include work for the U.S. National Academy of Sciences, the International Atomic Energy Agency, the International Institute for Applied Systems Analysis, Austria, and the Royal Swedish Academy of Sciences.

JOHN RUSSELL

Frank Parker (left) and symposium underwriter, Steve Mason, BE'82

In January, a two-day symposium exploring the management of nuclear waste was held in his honor at Vanderbilt. Steve Mason, BE'82, and Kym Freeman Mason, BSN'82, whose family foundation was the lead sponsor of the event, credit Parker with motivating the young engineer. "In my junior year, Frank had the audacity to tell me I wasn't working very hard," Steve Mason recalls. "It still comes back to me at crucial times. Frank showed me the harder I work, the luckier I get."

Life Choices

As a young man, Parker bypassed a history scholarship to Tufts for an MIT engineering degree. In 1956, the Oak Ridge National Laboratory recruited him. Working at Oak Ridge was ironic for the World War II Army veteran. At 19, he had been among the first troops to land at Nagasaki, Japan, after the dropping of the atomic bomb. It left an indelible mark on him. "Everything was flattened. There were still bodies in the streets," he says.

At Oak Ridge, Parker became head of radioactive waste disposal research. "I planned to stay at Oak Ridge a year," he recalls. He stayed 11 years, then joined the faculty of the School of Engineering.

Teaching drew Parker on two fronts—the freedom to do research and the raw potential of students. "I want to be around bright young minds and have them challenge me," says Parker, who describes the ideal engineering student as one with passion and creativity. "I like it when a student asks 'Why can't you do it this way?' It takes new ways and new viewpoints to find solutions."

DANIEL DUBOIS

Frank Parker

Parker chuckles at the idea of retiring, saying he doesn't have time. He has made more than 25 trips to Russia and has been traveling to Vienna twice a year for research. In between, he attends the annual World Federation of Scientists meeting in Sicily. "I like to stay busy," he says. "Besides, a moving target is hard to hit."

—Mardy Fones

International Tour May Be Passport to Global Collaborations

The Vanderbilt University School of Engineering has long been a magnet for international graduate students wishing to study at a leading American institution. Now the school is investigating expansion of its international impact and outreach in order to better prepare students to work in a global community.

Thomas R. Harris, the Orrin Henry Ingram Distinguished Professor of Engineering and professor of biomedical and chemical engineering and of medicine, along with other Vanderbilt University faculty and staff members, recently visited selected universities in the Far East and European countries. They included Malaysia, Australia, China, India, Germany, France, Austria and Hungary.

The visits, which involved interviews and discussions with more than 150 deans, department chairs and faculty members in engineering and related subjects, were arranged through the Vanderbilt International Office.

According to Harris, goals were to:

- Identify a few international institutions with missions and goals compatible with Vanderbilt's.
- Establish research collaboration with select laboratories in these institutions.
- Facilitate the exchange of faculty, postdoctoral fellows and graduate students.
- Establish a program of experiences for undergraduates.

"We hope to find a way to integrate our program with a few universities in the areas of research and faculty and student exchange," Harris says. "Other possibilities include jointly funded research grants and collaboration with the international arms of American companies, which will strengthen Vanderbilt Engineering's ties with business.

"Most important, our students will learn about the global impact of engineering and how it is practiced throughout the world," he says.

Investigating Study Opportunities

Stacy Klein, associate dean for outreach and associate professor of the practice of biomedical engineering, joined Harris in visiting the University of Grenoble in France. Klein also visited the University of Lorraine in Metz, France, where four VUSE students currently participate in the Georgia Tech study-abroad program. Additionally, Klein went to Dresden, Germany, to explore setting up Vanderbilt engineering study-abroad programs.

"Vanderbilt engineering students are increasingly interested in participating in international study, so it is important for VUSE to provide more opportunities in a broad range of locations," Klein says. "Visiting these programs gave me the chance to see firsthand where our students will study. I can now more readily promote these programs to them."

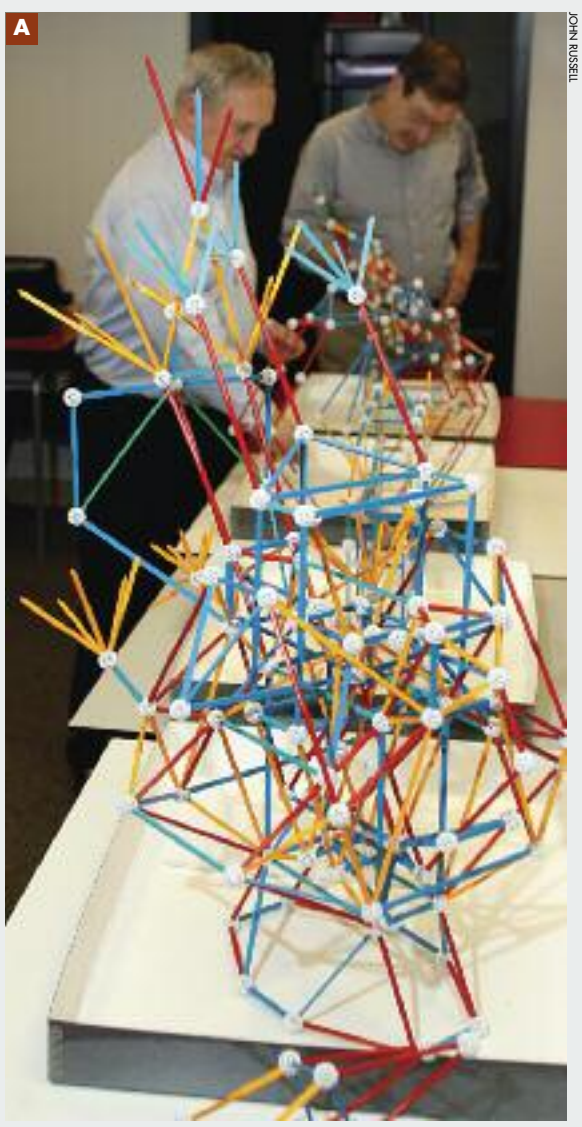
Tom Harris; his wife, Alene H. Harris, research assistant professor of education at Peabody College; and Joel Harrington, assistant provost for international affairs and associate professor of history, visit the Hong Kong University of Science and Technology.

Harris says that the international universities generally welcomed undergraduate exchange and were quite interested in establishing closer ties in research and graduate education.

— Joanne Lamphere Beckham

E-Week Unleashed

Creativity mixed with competition during the 2008 E-Week. Events included the FedEx Egg Drop Competition, iRobot Create programming challenge, Zome Stick construction contest, Dell computer assembly competition (Fastest Geek), and the ever-popular potato gun competition. New this year was a LAN/*Halo 2*/*Dance Dance Revolution*/Wii tournament and party. While E-Week was all fun, it wasn't all games. More than 30 Vanderbilt engineering students visited Nashville schools with activities designed to spark interest in engineering careers. Other engineering students met with VUSE alumni during informal networking sessions, and area high school students toured campus.



A) Robert Stammer, associate professor of civil engineering and director of the Engineering Science Programs, and Joel Barnett, associate professor of the practice of mechanical engineering, judge the Zome Stick building contest. B) Sophomore Lauren Nichols, biomedical engineering, took the lead in working with Head Middle Magnet School on E-Week activities. C) About to take the plunge: Will this container keep its contents from being scrambled? D) Competitors in the iRobot Create event received their robots on Monday and had two days to program them for an obstacle course competition on Wednesday.

Photovoltaics at the Tipping Point

If the classic film *The Graduate* were made today, the famous one-word career advice given Benjamin Braddock wouldn't be "plastics." It would be "photovoltaics."

Lawrence Kazmerski, director of the National Center for Photovoltaics in the National Renewable Energy Laboratory in Boulder, Colo., made that point (and showed the famous film scene) while speaking as part of the School of Engineering's John R. and Donna S. Hall Engineering Lecture Series on Dec. 3, 2007.

In an entertaining and informative presentation that included news and movie clips, historic footage, and show-and-tell items, Kazmerski outlined how solar-electricity technology is at a tipping point.

"I have four messages: First, solar is real, in the future and now. It's not something that is just a future technology; it's a real business now. It's about an $18 billion business worldwide. Second, investment in policy and R&D are equal priorities. One without the other won't make this technology go," Kazmerski said. His third and fourth points were that the time from research to actual use needs to be shorter, and that science and technology graduates are needed in the industry.

World Needs Expected to Double

Although the science behind solar photovoltaics was first discovered in the 1830s, modern advances and applications are just over 50 years old. Evolution in five decades has pushed the clean-energy technology to the point that it is on the verge of spreading like wildfire, Kazmerski said.

Partially driving the growth is the projection that the world is expected to almost double its consumption of energy by mid-century. "It's going to take some while for this technology to prove itself and to build up capacity so that it's part of our energy future. Will it be? Yes, but so will fossil fuels, so will nuclear, so will all these other sources," he proposed.

During his standing-room-only lecture in the Jacobs Believed in Me Auditorium, Kazmerski sketched the history of photovoltaics, discussed recent research and development advances in solar cells and the materials used to make them, outlined the advantages and limitations of current crystalline and thin-film photovoltaics fabrication technologies, and revealed what next-generation approaches lie ahead. He also outlined how other countries are using photovoltaics successfully and are, in fact, surging ahead of the United States in manufacturing, sales, implementation, and research and development.

STEVE GREEN

Lawrence Kazmerski, director of the National Center for Photovoltaics, spoke as part of the John R. and Donna S. Hall Engineering Lecture Series on Dec. 3, 2007.

Research Now and for the Future

To catch up, the United States photovoltaics industry and the U.S. Department of Energy have set ambitious goals for development and implementation. "Right now, this is a hot field. There is more venture capital money coming into this technology than one could imagine," Kazmerski said, cautioning that developing technology is not going to have a quick return on investment.

"The investment in R&D must be balanced so that we look at all these areas and don't only focus on the near term and midterm," he said. "Look at all the work that's going on [in quantum dots and nanotechnology, for example] for the technologies we're going to need not in 2015–2020, but in 2030–2050. Unless we start to work on them now, they're not going to be ready to be able to use. There could be breakthroughs, but we have to make the investments now."

—Nancy Wise

Faculty Notes

Peter T. Cummings, the John R. Hall Professor of Chemical Engineering, received the 2007 American Institute of Chemical Engineers (AIChE) Nanoscale Science and Engineering Award at the institute's annual meeting last November in Salt Lake City, where he also delivered the guest lecture. The award honors Cummings for "outstanding research accomplishments and national leadership in computational nanoscience." In addition to his Vanderbilt appointments, he is principal scientist at the Oak Ridge National Laboratory's Center for Nanophase Materials Sciences and director of the laboratory's Nanomaterials Theory Institute.

Peter T. Cummings

Peter T. Cummings and **Thomas A. Cruse**, the H. Fort Flowers Professor of Mechanical Engineering, emeritus, have been elected fellows of the American Association for the Advancement of Science (AAAS), an honor bestowed upon them by their peers. They are among only 471 scientists nationwide who have been elevated to this rank. Cummings was honored for his research and national leadership in the emerging field of theoretical and computational nanoscience. Cruse is a noted pioneer in the development of a computer simulation method that has significantly improved predictions of fatigue cracking in gas turbine engines and other aerospace applications.

David Dilts, professor and director of the Engineering Management Program, and **Ken Pence**, assistant professor of the practice of engineering management, won the second-place award for best paper at the Academy of Management meeting in Philadelphia recently. Their article, published in the prestigious *Journal of Operations Management* in June 2006, examined the factors used by public service personnel and their contractors to reach the decision to terminate a project.

Robert L. Galloway Jr., professor of biomedical engineering, and **John P. Wikswo**, the Gordon A. Cain University Professor and professor of biomedical engineering, have been named IEEE fellows. Elevation to IEEE Fellow is considered one of the electrical engineering society's highest honors. Galloway was honored for "leadership in the field of image-guided therapy." Galloway also holds posts in the Departments of Surgery and Neurologic Surgery, and is the director of the Center for Technology-Guided Therapy *(www.tgt.vanderbilt.edu)* at Vanderbilt. Wikswo was recognized for "contributions to understanding electromagnetic effects on materials and biological tissues." He is also the A.B. Learned Professor of Living State Physics, professor of physics, and professor of molecular physiology and biophysics.

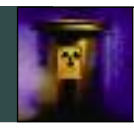
John P. Wikswo

Janos Sztipanovits, E. Bronson Ingram Distinguished Professor of Engineering, professor of electrical engineering and professor of computer engineering, and **Sandeep Neema**, research assistant professor of electrical engineering and computer science, along with former graduate student **Kai Chen**, MS'02, MS'03, PhD'06, will receive a Best Paper Award at the 11th Design, Automation and Test in Europe (DATE) conference in Munich for their paper, "Compositional Specification of Behavioral Semantics," published in the proceedings of the 2007 conference.

JOHN RUSSELL

Students Earn NSBE Accolades

Twenty-one Vanderbilt students attended the annual fall regional conference of the National Society of Black Engineers (NSBE), earning the Vanderbilt student group first prize for the most increased conference membership among medium-sized NSBE chapters. Tiffany Palmer (left), a junior in chemical engineering, serves as the NSBE regional membership chair. Ayotunde (Ayo) Oluwakorede Ositelu, a junior in biomedical engineering, won first place in the Undergraduate Students in Technical Research (USTR) Competition for Region Three. He then went on to compete in the USTR national competition during the NSBE national convention in March in Orlando, Florida.



Charting International Wastewaters

James Barnard's pioneering biological treatment has a worldwide impact.

Sewage changed James L. Barnard's life. A native of South Africa, Barnard, PhD'71, was a structural engineer whose life's work has had a global impact in wastewater cleanup.

"I was working for a municipality near Johannesburg where, very much against my will, they put me in charge of the sewage treatment plant," says Barnard, now the global practice and technology leader for advanced biological treatment at Kansas City, Mo.-based Black & Veatch, an engineering and construction firm. Frustrated by his limited knowledge of the interaction between the chemical reactions and microbiology at the heart of wastewater treatment, Barnard came to the United States for additional study in engineering.

After Barnard earned his doctorate at Vanderbilt and returned to South Africa, he saw immediate application for non-chemical wastewater treatment. "All over the world at that time, there was excessive algae growth in lakes and reservoirs resulting from the fertilizing effect of residual nitrogen and phosphorus in treated wastewater effluent," he says. Chemical removal of phosphorus resulted in increased salinity, which was unacceptable for irrigation and re-use of the water.

NATIONAL WATER RESEARCH INSTITUTE

James Barnard was honored with the 2007 Clarke Prize for developing a biological system to treat wastewater across the globe.

Natural Solutions

Intrigued by the challenges of wastewater cleanup and the need for chemical treatment alternatives, Barnard pioneered a method using naturally occurring bacteria to treat water. That method, biological nutrient removal (BNR), achieves more than 92 percent nitrogen removal. By using specific bacteria that naturally absorb large amounts of phosphorus, BNR eliminates the potential for eutrophication and algal blooms, making wastewater a safe resource for communities.

Barnard first successfully applied BNR at a water system near Pretoria, South Africa, where algal blooms were devastating the region's water supply. His success led to BNR's adoption across southern Africa and then internationally. Barnard also converted the system to a low-cost method for use by developing countries, which eventually led to a process allowing wastewater to be further treated to drinkable standards.

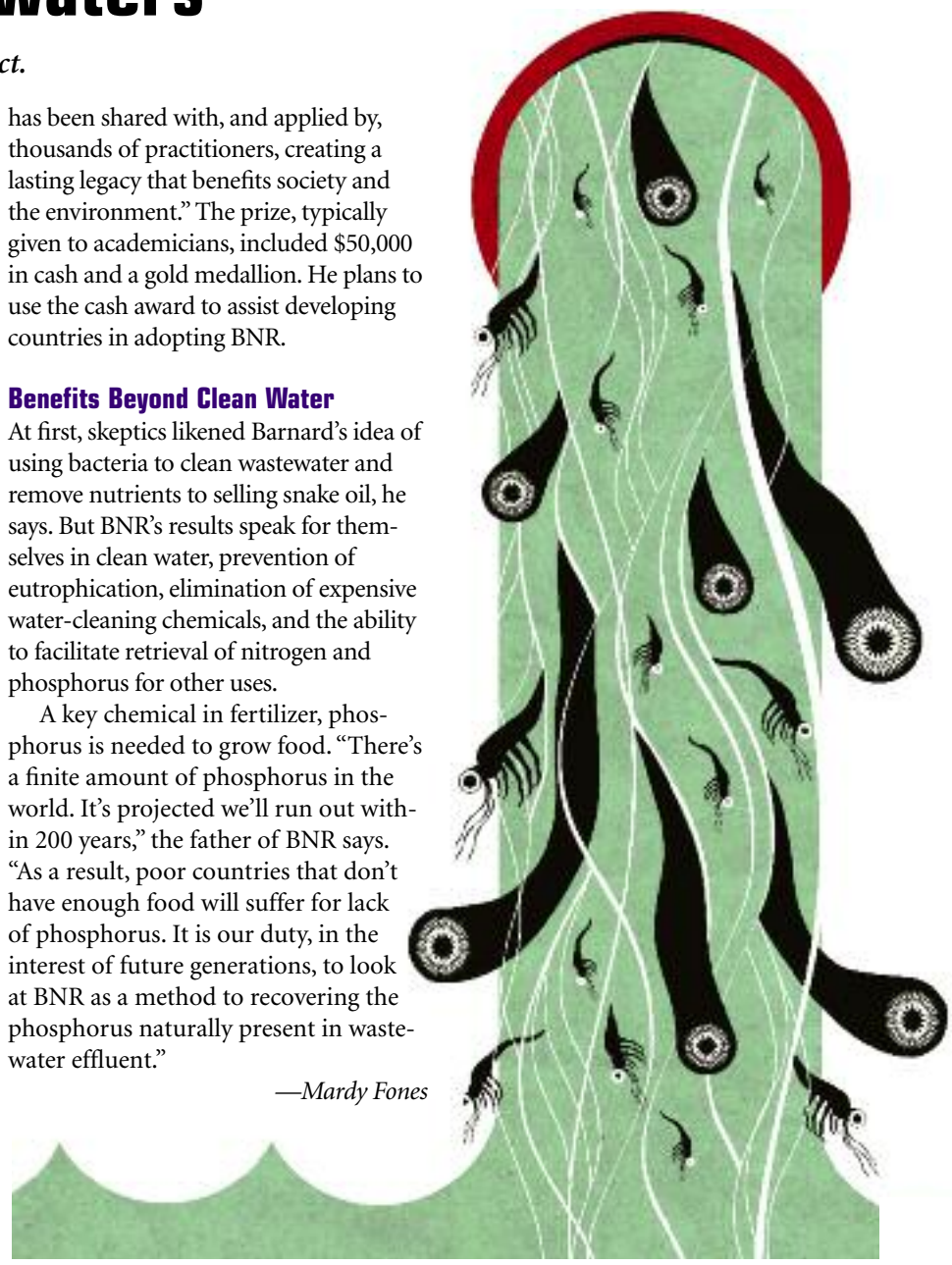
For his work, Barnard recently received the National Water Research Institute's Athalie Richardson Irvine Clarke Prize for excellence in water research. The person who nominated him for the Clarke Prize wrote, "His knowledge has been shared with, and applied by, thousands of practitioners, creating a lasting legacy that benefits society and the environment." The prize, typically given to academicians, included $50,000 in cash and a gold medallion. He plans to use the cash award to assist developing countries in adopting BNR.

Benefits Beyond Clean Water

At first, skeptics likened Barnard's idea of using bacteria to clean wastewater and remove nutrients to selling snake oil, he says. But BNR's results speak for themselves in clean water, prevention of eutrophication, elimination of expensive water-cleaning chemicals, and the ability to facilitate retrieval of nitrogen and phosphorus for other uses.

A key chemical in fertilizer, phosphorus is needed to grow food. "There's a finite amount of phosphorus in the world. It's projected we'll run out within 200 years," the father of BNR says. "As a result, poor countries that don't have enough food will suffer for lack of phosphorus. It is our duty, in the interest of future generations, to look at BNR as a method to recovering the phosphorus naturally present in wastewater effluent."

—Mardy Fones



VISAGE Engineering Component Heads Down Under

When the students in Gene LeBoeuf's VISAGE section hit the Australian water this summer, it won't be for surfing or snorkeling. Instead, they will focus on the quality of the water itself—and how to maintain it as a natural resource.

LeBoeuf, associate professor of civil and environmental engineering, leads one of three sections of the new Vanderbilt Initiative for Scholarship and Global Engagement (VISAGE), which is dedicated to providing students with a yearlong learning and international, field-based experience. The innovative program draws leadership and students from disciplines throughout Vanderbilt and combines coursework, a summer session abroad and independent study.

"Within VISAGE are the overarching themes of global citizenship, sustainability and social justice," LeBoeuf says. His VISAGE section combines all three in the study of sustainable water resource development.

"Clean water and sanitation have saved more lives than the medical profession," LeBoeuf says, detailing the impact a ready source of clean water can have. By eliminating waterborne diseases, especially in developing countries, residents lead healthier, more productive lives, he explains.

In its inaugural year, VISAGE has 36 students participating, including six from engineering. "VISAGE is a terrific resource for engineering students," LeBoeuf says, noting that the structured nature of engineering's curriculum makes it difficult for students to participate in traditional semester-abroad programs. With its four-week, hands-on international component, VISAGE allows engineering students opportunities they might not otherwise experience.

In LeBoeuf's section, the spring semester focuses on the science of sustainable development and water resource management. Using Australia for reference, students also explore how land-use practices, social policy, economic strategies, and indigenous, national and international cultures have influenced water-related infrastructure development. The in-class portion is followed by a summer session at the University of Melbourne in Australia.

In a concurrent VISAGE section, students study education, social cohesion and economic development in Cape Town, South Africa, with Peabody professor Brian Heuser. In a third section, led by history professor Marshall Eakin, the topic is family, community and social justice in Managua, Nicaragua.

LeBoeuf's VISAGE class includes the six engineering students, an economics major, and two students with undeclared majors. As part of the in-class sessions this spring, professors from the other VISAGE sections present historical and sociological perspectives. LeBoeuf reciprocates by teaching sessions specific to sustainable development in a global environment.

"Australia is an ideal setting to examine the challenges of meeting a nation's water needs," LeBoeuf says. "The University of Melbourne is a world-class institution with an outstanding faculty on the engineering, sociopolitical and economic side of water resource management."

DANIEL DUBOIS

Gene LeBoeuf

During their session in Australia, students will intern for 12 to 20 hours per week with government and non-governmental agencies. At the close of the four-week session, students have the option to extend their stays through paid internships with agencies and companies. Students receive between seven and nine credit hours for participating in VISAGE.

Back on campus in the fall, VISAGE students will select subtopics relating to their experiences to examine in more detail through independent study, rounding out the program's focus on international study, civic participation, service abroad and innovative scholarship.

"As we increasingly live in a global economy, an opportunity like this can be life-changing for students," LeBoeuf says. "Participating in VISAGE and having international experience on their résumés can only pay dividends in the long run."

—Mardy Fones

"Clean water and sanitation have saved more lives than the medical profession."

Robert Galloway hovers about 30 feet underwater near Little Cayman Island in the Caribbean.

Mysteries of the Deep

On a cold, rainy afternoon, Robert L. Galloway Jr.'s mind turns to the Caribbean. "I once saw a squid trying to mate with a woman's hair," he reminisces, sharing his passion for hovering motionless in scuba gear and watching the undersea world go by. "But the best thing ever was a grouper, a really big one. It had the tail of a moray eel sticking out of its mouth and the eel's head coming out of one of [the grouper's] gills," he laughs, recalling the unexpected moment underwater.

Oceanography was going to be Galloway's undergraduate major at Duke University, but he says he couldn't cut the double foreign language requirement. He flipped a page in the course catalog and saw biomedical engineering. "I thought, 'I'm good at math and science. Why not?'" he shrugs.

Fast-forward 35 years and that decision led Galloway to a career as professor of biomedical engineering at the School of Engineering. He is also professor of neurologic surgery and surgery at the School of Medicine and is the director of Vanderbilt's Center for Technology Guided Therapy. In that role he applies his zeal for solving problems to finding ways to expand therapy delivery.

His company, Pathfinder Therapeutics, recently received U.S. Food and Drug Administration approval for its SurgiSight Linasys™ device. Using technology analogous to a GPS, it enables surgeons to navigate safely around fragile vessels and tissues during open liver procedures. "We design systems to guide sharp pointy things into people," he has been known to deadpan.

"I have a great job. It's indoor work without heavy lifting. I wrestle with important problems in health care," he says, recalling one of the first patients to benefit from his work in image-guided surgery, a 14-year-old girl with a brain tumor. That young woman recovered, went onto college, and graduated a few years ago.

In January the IEEE named him a fellow, one of electrical engineering's highest honors.

Galloway sees the designation as just a tool. "When you win awards, people listen. The ideas I have now aren't better than the ones I had 20 years ago; I just have more virtual gravitas," he says.

Perhaps more significant, Galloway has nearly half a dozen teaching awards and a reputation as a professor who always has time for students. The admiration cuts both ways. "I deal with some of the brightest students in the country," he says.

His teaching, research and other responsibilities keep him busy. "I go to work seven days a week. I'm just not smart enough to get it all done in five," Galloway says. He neglects to mention that he holds nine U.S. and international patents for devices arising from his research.

The one-time budding oceanographer downshifts his professional life by staying connected with the water. In addition to an annual diving trip, every year he and his wife "spend a week or so on a lake in Virginia, where I float in an inner tube with one of my retrievers across my lap and a glass of wine in my hand."

Galloway also reads science fiction. "I'm an unabashed geek. I like wrestling with problems. I keep asking, 'Why is it some things are the way they are?' or 'What happens if we do it this way?' That's where the good ideas really explode," he says.

—Mardy Fones

A LOOK BACK

VUSE REMEMBERS DEAN ROWE

Robert S. Rowe, who guided the Vanderbilt School of Engineering in the 1960s from a mostly technical training unit to one that offered graduate degrees and whose faculty engaged in advanced research, died Nov. 3 in Sebring, Fla. He was 87.

A civil engineer with a doctoral degree from Yale University, Rowe was appointed dean after being recruited to Vanderbilt from Duke University in 1960. With funding from the Ford Foundation, he upgraded faculty salaries and attracted faculty with advanced degrees and research interests. During his tenure, the engineering curriculum was revised so that students took more required and elective courses in the College of Arts and Science, and degree offerings expanded to include master of science and Ph.D. programs in electrical, civil, chemical and mechanical engineering.

Rowe resigned as dean in 1970 and was named professor of civil engineering and environmental and water resources engineering, emeritus, and dean of the School of Engineering, emeritus.

A native of Wilmington, Del., Rowe earned a bachelor's degree in civil engineering from the University of Delaware, a master of science degree from Columbia University, and a master of engineering degree and doctor of engineering degree from Yale. He served in the U.S. Army during World War II and was a member of the National Society of Professional Engineers, American Society of Civil Engineers, American Concrete Institute, and the American Society for Engineering Education.

He and his wife, Emma Jean Rowe, had lived in Sebring since 1991. He is survived by Mrs. Rowe, two sons, two sisters, and several grandchildren and great-grandchildren.

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Dean Robert Rowe is honored at his retirement party in 1970.

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