More Progress Faster

Having access to world-class biologists and medical researchers at the same university can be an enormous advantage for an engineer who studies the mechanical behavior of bones and cartilage.

"Of all the institutions I've seen, Boston University is by far the most collegial and exciting," says Elise Morgan. "A lot of people here are doing work related to what I do, and we're able to leverage each other's scientific expertise in tackling problems—like bone fractures and arthritis—that have such a tremendous impact on people's lives. Through collaboration we're making more progress faster. There is a true sense of camaraderie because we know we're working to make the University even better."

ELISE MORGAN
PhD, University of California, Berkeley
Assistant Professor of Aerospace and Mechanical Engineering

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BU College of Engineering
BOSTON UNIVERSITY
44 Cummington Street
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SPRING 2006

BU College of Engineering MAGAZINE

THE MAGAZINE OF THE BOSTON UNIVERSITY COLLEGE OF ENGINEERING

Engineering a Better Military

BU College of Engineering BOSTON UNIVERSITY

MAGAZINE SPRING 2006

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COVER: Scott Brown ('98) straps into his Blackhawk helicopter as he prepares to launch on a medevac mission in Iraq. Inset: Karen Panetta ('85) in the cockpit of the solar-powered car her Nerd Girls team is working on.

Thinking Globally

By Solomon R. Eisenberg, Dean *ad interim*

With the emergence of the global economy and its impact on engineering, there has been a good deal of hand-wringing about the durability of America's leadership position in science and technology. Globalization and the "flattening world" have indeed presented American engineers with new challenges, and we need to pay careful attention to how we educate coming generations in order to maintain our edge as a global technology leader.

At first glance, engineering graduation statistics paint a worrisome picture of the future: 70,000 engineering graduates per year in the United States; 350,000 in India; and a staggering 600,000 in China. But scratch the surface and you find—as a recent Duke University study did—that the Indian and Chinese figures include huge proportions of graduates from 2- and 3-year programs. Students earning these "sub-baccalaureate" degrees are more like technicians than engineers; their training equips them to be highly adept at performing specified tasks but does not address the more creative problem-solving aspects we tend to associate with engineers.

The greatest advantages American engineering graduates have over their Indian and Chinese contemporaries are the benefit of growing up in a pluralistic and democratic society, and the breadth of their education. While technical competence is emerging as a worldwide commodity, engineering students at schools like Boston University are also exposed to the arts, humanities, social sciences and writing, and they graduate as educated and well-rounded professionals. When engineers are challenged by large, complex problems, the narrowly trained technician is at a severe disadvantage; the engineer with the broader perspective and the ability to innovate and think outside of the box will be far better suited to meet these challenges.

As the economy expands globally, engineers increasingly work in multinational and multicultural teams. Hence, it is becoming ever more important that engineering students in the United States be educated to compete in the global economy. One way we're doing this at Boston University is by developing study-abroad programs specifically for engineers; in fact, we were among the first to make such programs available. All students can incorporate this experience seamlessly into their respective degree programs without additional cost or time. Our first program at the Technical University of Dresden, Germany, started six years ago and has been tremendously successful. This year, we opened a similar program at the Tecnologico de Monterrey in Guadalajara, Mexico, an important operational base for many multinational firms. A third program, at Tel Aviv University in Israel, is slated to start next year.

Our goal in developing these programs is to expose students to technology centers around the world, get them out of their comfort zones, and introduce them to other cultures and people of different perspectives. Virtually all students who participate in these study-abroad programs return transformed. In the classroom and in social settings, students returning from semesters abroad share their experiences with others, thus allowing a wider worldview to creep into the consciousness of all students.

While we work to introduce our students to other cultures, we must also enhance the breadth and depth of the education we offer at home. Students often experience their engineering education as a series of discrete and unrelated courses. Professors and students focus on each course with defined expectations implicit for both parties. While this may be an efficient way for a professor to teach a course and for a student to get a good grade, it encourages narrow thinking and fails to create the connections between ideas so important to creative thinking in the real world.

We need to take each of the disciplines and courses we teach out of their silos and find new ways to integrate the material. Integrating the curriculum and getting students to think about the connections between courses and disciplines encourages the broader thinking that is at a premium in the modern world and in the economy of the future. Technical competence alone no longer distinguishes American engineers—that's something that all engineers everywhere have. What does distinguish American engineers is their ability to see both the forest and the trees. At Boston University, we want our engineers to be critical thinkers with highly developed quantitative abilities, and superior communication, social and intercultural skills.

Of course, these qualities are also useful in just about any field of human endeavor. Our graduates today are working not just in engineering, but in law, business, finance, government and a host of other professions; we expect that to be true of our future graduates as well. Whether they pursue careers in engineering or elsewhere, training our graduates for the global economy will reap dividends for many years to come. ■

College Opens Study-Abroad Program in Mexico

By Michael Seele

With demand exceeding supply in the College of Engineering's study-abroad program in Dresden, Germany, the College opened a similar program in Guadalajara, Mexico, this spring and is in discussions to open a third program in Israel.

Started in 2001, the program at the Technical University of Dresden was among the first in the nation to offer a foreign study program specifically for engineering students and designed to allow students to participate seamlessly. An almost instant success, it quickly reached maximum capacity as many students are attracted by the opportunity to spend the spring semester of their sophomore year in a foreign country.

The German program begins before the start of the semester. Students get an intensive course in the language and culture of the country, quickly enabling them to get around, go shopping and explore German society. After a short break—which many students use to travel around Germany and Europe—students begin coursework, all of it in English. The courses are functionally equivalent to those their peers take back at BU. As a result, students move directly into their junior-level courses when they return to Boston and their graduations are not delayed.

The unique program has attracted students from other engineering schools—including Brown, Tulane and Vanderbilt Universities—who have studied in Dresden through BU. Within the last few years, it became obvious that more programs were needed.

"Our students realize that they will need a broad background to succeed as engineers in an increasingly global society," said ENG Dean *ad interim* Solomon Eisenberg, who also heads Undergraduate Programs at the College. "They understand that engineers who have exposure to a foreign culture and a different perspective will have a competitive advantage, and that study-abroad experience is something employers and graduate schools increasingly value. It gives our students another asset for competing in the global economy."

Eisenberg noted that the College wanted to expand its offerings in view of the increasingly global nature of the economy. Accordingly, the College began a program at the Tecnologico de Monterrey in Guadalajara, Mexico, this year and is close to finalizing plans for a third program in Tel Aviv, Israel, next spring. The College is also exploring the possibility of adding future sites in Turkey, India and China.

Boston University's strong international presence and wide variety of international programs aid the College of Engineering, according to Eisenberg. "BU is one of the country's leading international universities and has an established international programs infrastructure, which has been tremendously helpful in facilitating these programs designed for our engineering students." ■

Photo courtesy Undergraduate Programs

From left to right: Sophomores Stephanie Sczylvian, Sarah Steinberg, Natalie Brill, Andrea Fiaschetti and Justin Sacco enjoying some free time in Dresden.

Graduate Programs Jump Into *U.S. News & World Report*'s Top 50

The College of Engineering has risen in the ranks. *U.S. News & World Report* has rated the College's graduate programs 42nd in the nation—a jump of 10 places over last year's ranking.

The annual report, "America's Best Graduate Schools 2007," also ranked the College for the strength of its specializations. The Department of Biomedical Engineering moved out of a tie with MIT into sole possession of seventh place, its third consecutive year in the top 10.

"The College of Engineering has been working to steadily improve the educational experience of its students and the quality of its research and faculty, and this jump in the ranking validates these efforts," said Solomon R. Eisenberg, dean *ad interim* of the College. "The quality of our graduate students has been rising and external funding that supports our faculty's research is at record levels. This most recent ranking is evidence that we are on the right track."

Other departments earned recognition, as well: In computer engineering, the College tied with Dartmouth at 52nd place and it ranked 51st for electrical/electronics engineering and mechanical engineering.

"While we don't place too much emphasis on the *U.S. News* rankings, they are nonetheless used by prospective students when deciding which university to attend," said Eisenberg. "Breaking into the top 50 is especially welcome because the printed edition of this ranking sold on newsstands includes only the top 50 schools."

Last year, the College's graduate programs ranked 52nd in the survey. Boston University now joins Harvard and MIT as the only Massachusetts engineering programs in the *U.S. News* top 50.

— Chhavi Sachdev

Engineering a Better Military

BUOYED BY ROTC SCHOLARSHIPS AND A COMMITMENT TO THE ARMY, ENG ALUMS ARE WORKING TO BE ALL THEY CAN BE.

By Ryan Olson

Engineers have long formed a critical component of the United States military. The history of one of the nation's most prominent engineering groups, The Army Corps of Engineers, dates back to 1775. That year, the fledgling Continental Congress appointed Colonel Richard Gridley of Boston as the first Chief Engineer. Gridley directed the construction of fortifications at Breed's Hill—the site of the famed Battle of Bunker Hill—as well as at Dorchester Heights, which proved crucial in repelling the British. In 1802 a corps of engineers was stationed at West Point, constituting the nation's very first military academy.

Photo courtesy Dan Caunt

Photo courtesy Scott Brown

Photo courtesy Rachel Sullivan

Clockwise from left: Dan Caunt ('00) in a Blackhawk helicopter on his way to Basra; Scott Brown ('98), left, with the staff sergeant in charge of working on the 12 Blackhawks in his unit; Rachel Sullivan ('99) briefs two other soldiers in preparation for a convoy in Mosul five days after the city's liberation.

Since then, engineers have played a crucial role in military activities, from civil projects (like the construction and operation of dams) to combat engineering. In the modern military, engineers fill many roles; they build bridges, demolish all manner of structures and hold jobs at the forefront of public consciousness today—reconstruction.

Army Reserve Officers' Training Corps (ROTC) programs across the country play an integral part in providing the U.S. military with officers. Each year, a number of dedicated students participate in Boston University's Army ROTC program, known as the Charles River Battalion. Almost every class includes students from the College of Engineering.

For ENG students intent on serving their country, the requirements of a BU education and a commitment to the military often result in a demanding four years. But if the experiences of four young ENG alums are any indication, BU did an outstanding job of preparing them for the challenges they faced after leaving Boston. Whether helping people abroad or on U.S. soil, the combination of these two worlds has proven to be just what they've needed to succeed.

The Civil Approach

RACHEL SULLIVAN ('99) grew up in Leavenworth, Kansas, about 30 miles northwest of Kansas City. She decided to attend BU largely on the strength of its engineering program and studied for four years thanks to an ROTC scholarship. She left Boston University with a degree in aerospace engineering.

In February 2003, Rachel was deployed to the northern Iraqi province of Erbil, where she spent the majority of her time helping the reconstruction efforts.

"I found that I was almost able to do more engineering in civil affairs," she says.

"It was very motivating to see the positive impact of what I was doing, not only from a reconstruction standpoint, but [also] from a lifesaving standpoint," she says of her experience, "It felt good."

Sullivan stayed in Iraq for just over a year, coming back to the States in March of 2004. Within a few months, the Army moved her back to her hometown and she now works at Fort Leavenworth as an operations officer involved in the training and evaluation of units deployed overseas.

When asked about the link between BU and her time overseas, one of the classes Sullivan remembers particularly well is AM 310, Instrumentation and Theory of Experiments.

Caunt believes his BU education prepared him for the challenges he faced in the military.

She spent time working with the Office of Reconstruction and Humanitarian Assistance—the forerunner to Iraq's Coalition Provisional Authority—helping to examine many different types of structures, from schools and bridges to power systems.

"So much of the country was in such disrepair," she says. "The electrical power systems had not been kept up for decades."

She still remembers learning a terrifying fact in the middle of 2003: Iraq is one of the most heavily mined countries in the world.

For nearly a year, Sullivan worked closely with many different organizations, including mine-risk education groups and the agencies directly responsible for clearing mines.

She recalls poignant "handover ceremonies" designed to officially give control of specific areas back to Iraqis. In many cases, by the time ceremonies took place, repairs and new construction were already under way. Seeing the faces of farmers once again able to farm their land, or people able to walk through their backyards and not be afraid, gave her a real sense of purpose.

"It was the process I took away," she says. "Having that background helped me look at a situation and prioritize. Being able to approach it with a sound decision-making process… helped me look at things from outside the military," a perspective that helped her perform her job more effectively.

Flying High

SCOTT BROWN ('98) grew up in Rhode Island and went to high school in Providence.

"I knew in high school that I was going into some branch of the armed services," he says. Thanks to the Army ROTC, he was able to come to Boston to study mechanical engineering. As he recalls, literally a week after graduating he was in San Antonio for officer basic training.

"I knew I wanted to fly," Brown says. He entered the medical service corps—the group responsible for flying medevac missions into dangerous areas to rescue the wounded. In early 2003 he became a Blackhawk helicopter pilot.

After a nine-month tour in the northern Iraqi city of Mosul, Brown came back to the States in February of 2004. That November he was back in Iraq, where he spent the next 12 months in the town of Taji, about 20 miles north of Baghdad.

Asked about his time overseas, Brown recalls one particularly harrowing adventure that happened last June:

"It was a bad weather day, with a low ceiling and limited visibility," he says. A medevac call came in for a U.S. soldier with an abdominal wound, and Brown's unit headed to downtown Baghdad.

"En route, I'm talking with the ground unit," he recalls. The severity of the call escalated quickly, changing from one soldier to two, and from an abdominal wound to a set of amputees. One solider had lost both of his legs, while the other lost both legs and an arm.

It took Brown's unit about four minutes to reach the injured men, at which point the soldiers were loaded aboard the helicopter and taken to the hospital. While the triple amputee didn't survive, the second injured soldier did.

Brown's unit was featured in the October 2005 issue of *Popular Mechanics* in an article titled "Birds of Mercy." Over the course of his second tour, he estimates his unit evacuated more than 4,000 people.

"It's humbling to know that we brought a lot of people home that would not have made it," Brown says.

When asked about how his experiences at BU helped him become the person he is today, he remembers the skills he learned in the classroom.

"Math, problem solving… certainly helped out. As far as ROTC, all the contacts I made, the officer[s] who taught us… it was very helpful."

Computerized Communication

DAN CAUNT ('00) grew up in Medway, Massachusetts, about 30 miles southwest of Boston. When he was younger, he did well in math and science.

"My first computer was a Tandy TRS80," Caunt says. He did BASIC programming and whatever else he could on it, having learned a great deal from his father, a computer engineer. He left BU

Photo courtesy Rachel Sullivan

Rachel Sullivan with students at the Ian Rimell School for Girls in the town of Hatra. Rimell, a friend of Sullivan's who sold scrap metal from disarmed ordnance to help fund Hatra's reconstruction, was killed in an ambush in 2003.

with a degree in computer engineering and entered the Army signal corps.

Caunt's first assignment was in Mannheim, Germany, near Frankfurt. He stayed there for three years, helping to provide phone, Internet and videoconferencing support for many different types of military units, from infantry to armor.

In January of 2004 he went to Kuwait for a year, performing similar support roles for local units and others in Iraq and Afghanistan.

Thinking back to his time as an undergraduate, Caunt believes his BU education prepared him for the challenges he faced in the military.

"It was good to have the engineering background," he says. "The learning curve wasn't as steep for me as opposed to others who didn't study it. I felt like I was ahead of the game when it came to doing my job there."

Now Caunt is back at BU working towards a master's degree in computer science; he started in the fall of 2005 and is scheduled to finish in May 2007. The military is paying for this degree, too.

"I've gotten used to selling myself for scholarship money," he says, laughing. "I'm not any richer than I was in undergrad." This time the money is coming from the U.S. Department of Defense. In all likelihood, Caunt will work in Washington, D.C., when he graduates from BU for the second time.

"Before I was in the military I had been to one other country—Canada," Caunt says. Thanks to the Army, he can add 25 nations to that count.

Setting Priorities

JAMES TUOHY ('03) grew up in Wyckoff, New Jersey, about 30 miles northwest of New York City. After Tuohy graduated from BU with a degree in electrical engineering, the Army sent him to a number of different places, including Ft. Leavenworth for combat engineer training, Ft. Irwin, California, for desert warfare training, and finally to Ft. Stewart in Savannah, Georgia.

In January 2005, Tuohy went to Kuwait as a combat engineer. Shortly thereafter, his unit traveled north to Samarra in Iraq, about 60 miles north of Baghdad.

During his time in Iraq, one of Tuohy's jobs involved keeping roads safe for military units traveling north to Tikrit. This often meant dealing with improvised explosive devices, weapons often hidden by enemy forces in all manner of places.

One particular project he remembers entailed building a protective earthen berm around the entire city of Samarra, a safety precaution designed to reduce the number of access points to the city.

Much like Sullivan, Tuohy also spent time working on civil engineering projects.

Tuohy returned to the U.S. in January. Scheduled to leave active duty in May 2007, he is thinking about going back to school, perhaps to get an MBA. When it comes time to submit applications, he believes his military experience will be a strong asset.

"It will help me out for the rest of my life," Tuohy says. "I think at such a young age it's almost impossible to get a job that gives you as much leadership experience as the military."

The demands of a schedule stuffed with ENG and ROTC obligations have helped Tuohy appreciate the importance of time management skills. He recalls that at one point in Iraq he was responsible for 26 soldiers and some $5 million worth of equipment.

"If you don't prioritize and stay on top of it, things can get out of hand," he says.

Worthwhile

Striving for success in a world-class engineering program while working to meet the demands of a commitment to the armed services often results in hectic schedules, doubts and frustration.

In addition to their academic responsibilities, ROTC students typically gather for a few hours each week for classroom instruction and drill exercises. Once each semester, everyone leaves campus for outdoor training.

The ROTC also offers optional opportunities. The Ranger Challenge, a competition involving other New England colleges, includes contests in weapons assembly, land navigation and marksmanship.

"They didn't always complement each other," Sullivan says of ENG and ROTC. Sometimes, she said, it felt like she was living two lives. But, if anything, that was only because both pushed her to do her best.

"To do well at the College of Engineering with ROTC, you really have to learn how to budget your time," Tuohy says. "The College of Engineering is tough; you have to work hard to do well there."

There were times where Sullivan wasn't sure she'd made the right decision.

"I struggled with it when I was a junior at BU," she says, remembering how friends would be interviewing for internships while she faced training exercises.

"One side of me was kind of jealous," she says. "On the other side, I knew I had a job when I graduated—an exciting job that allowed me to get out of the office."

Moments of doubt aside, the alums speak highly of both worlds.

"I think [BU] has a really strong program," Caunt says, referring to both ENG and the ROTC program. "It's hard to get actual military experience while in college. Nothing really prepares you for active duty before you graduate." Nonetheless, he feels both programs do a good job of preparing participants for whatever they might do next in life.

"I would do it again," Brown says of his decision. "There is no question in my mind." ■

ROTC Benefits Military, Engineering Students

By Chhavi Sachdev

At Boston University, the Reserve Officers' Training Corps is "a win-win situation," according to Richard Lally, the assistant dean of administration at the College of Engineering. Lally, who retired as a lieutenant colonel in the Army, was chairman of the Army ROTC program and a professor of military science at BU from 1995–2000.

The ROTC was started after World War I to create a cadre of trained officers. In return, the military provided financial assistance to students and promised graduating cadets a job. Through ROTC, the forces get smart, educated officers and raise their profile in the diverse population that is the University; in return, the University produces graduates who are trained to be leaders as well as team players.

"Their education will serve them well in any field," Lally said.

Boston University is one of only about 20 schools that offer ROTC programs in all three branches of the armed forces. The Army, Navy and Air Force each have an ROTC department at BU, governed by the Division of Military Education.

Since its inception in 1919, the program has operated at Boston University, excepting the period between 1970 and 1981 when it moved to Northeastern University following campus protests against the Vietnam War.

Currently, there are nine ENG students in the Army ROTC, 25 in the Navy ROTC (which includes the Marine Corps), and 16 in the Air Force program. "The number varies from year to year," said Air Force Captain Sara C. Zakrzewski. "We had a large number of freshmen engineering students this year due to the strong engineering program here at BU and also due to the Air Force's need for engineers; 70 percent of AFROTC scholarships are given to technical majors."

At one time, the Army even had a special scholarship for engineering majors.

"In the past, the Army particularly looked for people with technical degrees," said Lally. Even if that is no longer the case, "the Army needs people who can think analytically, manage their time and come up with quick solutions."

But balancing coursework and the ROTC is a challenge, Lally observed. "Engineering has a pretty rigorous curriculum, what with lab requirements and problem sets," he said.

Attrition rates reflect the rigors: The Navy ROTC class of '06 started out with 51 freshmen from the University; only 38 graduated.

Drew Konowicz ('06), from Monroe Township, New Jersey, attended Boston University on a three-year Navy ROTC scholarship. As a lieutenant commander in the reserves, the 22-year-old has been in charge of four divisions and the battalion's administration. For his senior project, the BME major worked on a robust algorithm for medical imaging under professors Hernan Jara and Osamu Sakai at the Boston Medical Center, even publishing a paper.

Like him, Midshipman Sara Thomas ('06) averaged 20 credits per semester. "The requirements for the programs don't overlap and it's very difficult. You have to keep it in the back of your mind that you chose this course," said the senior from rural Iowa, whose capstone AME project was a satellite designed to deploy a tether for NASA's Space Elevator Challenge.

It is hard work, said Captain Bob Holland, the Commanding Officer of the Boston University-MIT Naval ROTC Consortium. ROTC members are more active in public and community service than the average college student; they run blood drives, regularly clean up the river, visit nursing homes and help in shelters.

BU is very attractive to many students who get ROTC scholarships. "The overall diversity at BU makes them more adaptable and accepting of people from other backgrounds," said Holland.

According to Cadet Nicholas Robinson ('06) of the Air Force ROTC, BU has high-caliber students and faculty in both the ENG and ROTC programs. "I picked BU because of my major. We have one of the top ROTC programs in the country, organization- and event-wise," he said.

Konowicz, who was also accepted to the Naval Academy, chose BU largely for its biomedical engineering program and its culturally vibrant location.

Many students would probably not have been able to afford college without the ROTC's financial help.

In the fall, Thomas will join a Surface Nuclear community as an officer with a sub-specialty in nuclear power and could then be assigned to a surface ship.

Robinson, an AME major, will be stationed as a navigator, guiding planes and operating defensive and weapons systems on an air crew.

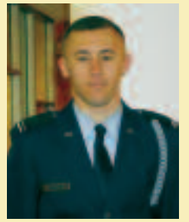
Konowicz will probably be attached to the air wing on a carrier after flight training. Eventually, he would like to return to the medical field. "The Navy has a lot of opportunities," he said. "I'm not going to let my degree go to waste."

If he had to do it over, he'd still do both ENG and ROTC: "You do lose sleep, but it's worth it."

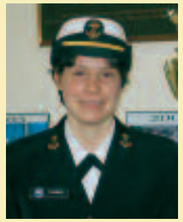
Photos: Chhavi Sachdev

Drew Konowicz

Nicholas Robinson



Sara Thomas



A Woman's Place

KAREN PANETTA ('85) AND HER NERD GIRLS SHINE IN SOLAR CAR AND LIGHTHOUSE PROJECTS

By Stu Hutson

They're here to take out Tinkerbelle.

The rickety metal steps crick and pang under the petite weight of fashionable sneakers and pink backpacks. A blown light has left most of the spiral climb inside the 165-foot-tall tower in shadows, so the girls fumble a bit on their way. But to get to the island, they've already crossed choppy waters in an eight-foot-wide aluminum boat and dodged the masses of Herring and Great Black-backed gulls in the throes of nesting season. It's at the top of the old north tower, though, that the girls meet their real adversary—Tinkerbelle, a car's tiny brake light jury-rigged to a dry cell battery.

Photo courtesy Karen Panetta

The Nerd Girls trek to the Cape Anne Light Station off Rockport, Mass., for an encounter with Tinkerbelle.

Karen Panetta with the Nerd Girls' solar-powered racing car.

The north tower, officially called the Cape Anne Light Station, is perched atop craggy Thacher Island off the coast of Rockport, Massachusetts, and is one of the oldest and most historic light houses on the American coastline. Built in 1771 to ward ships away from the razor-sharp reef that lies 500 feet out to sea, it progressed from candlelight, to whale oil, to lard oil, to kerosene, and—finally—to electricity in the early 1900s. But modernity did not bring reliability. The tower's juice is pumped in via an underwater power cable strung between Rockport and the island. Virtually every winter, at least one major nor'easter churns the ocean enough to snap the cable, leaving the north tower—and her sister lighthouse on the south end of the island—dark.

These days, the south tower is operated by the Coast Guard and powered by a self-sustaining electrical unit, but the Cape Anne light hasn't been officially used since the 1980s and the Coast Guard stopped repairing the cable two years ago. Still, the tower is a Rockport landmark, and so a group of conservationists known as the Thacher Island Association installed the 20-watt Tinkerbelle.

"It's a sad excuse for a light, we know," said Paul St. Germain, the head of the association. "But that's what these Nerd Girls are here to fix."

The Drive System

KAREN PANETTA ('85) decided to start Nerd Girls four years ago. After teaching computer and engineering courses at Tufts University for nearly six years, she had become frustrated at the low number of women enrolled in her courses and even more dismayed at how they interacted in class.

"The girls tended to be quiet; just happy to let the guys be the active members of the class," she said. "The number of girls I saw in my classes was the same number that I saw sitting around me 15 years ago at BU. I wanted to start a program that would draw young women in, let them find out what engineering really is and that it doesn't mean that you have to be a grease monkey or a social outcast."

So, Panetta purchased a used solar racing car from the University of Massachusetts, Lowell, and gathered a group of six female engineering students to start rebuilding it. This first car, however, was only to be a learner vehicle. With her encouragement, the next year's team decided to start building its own car from the pavement up.

"This is a major project, one that is passed off from one team to another," Panetta said. "Each year's team wants to make their own adjustments so the car itself is developing a little slowly. But that's the idea. Our main goal isn't to race this thing, it's to learn how to be better engineers."

The complexity of the project grew from year to year as more women—and some men—joined. Panetta crafted them into groups that would tend to specific problems associated with building the car. Some of the girls focus on the electrical schematics for the car's sensor systems, others work on adapting a frame for the car's 16-foot-long chassis—a long, flat, almost cockroach-like structure designed to mix aerodynamics with plenty of horizontal surface area for solar cells.

The scheme was meant to mimic the real-life skills of teamwork and cooperation Panetta had observed in her 11 years as a computer engineer. "My undergraduate work at Boston University focused on real application and teamwork. No one could get through the program on their own," she said. Upon entering the work force, however, she was surprised to find that many newbie engineers lacked these skills and failed because of it. She was determined to give her students, especially the often-overlooked women, better preparation.

Some of this year's nearly 20 Nerd Girls hope to enter a vehicle into the 2007 American Solar Challenge, a grueling 2,500 mile race from Austin, Texas, to Calgary, Alberta—and they don't mind working hard to advance that goal.

"All in all, I'd say the average Nerd Girl puts in about eight hours a week," said Torri Bydlon, a senior electrical engineering major. "But that's the point. This is working to figure out the details of a real car with real problems—it's the hands-on experience you don't get in the classroom. There's trial and error instead of a grade."

And most importantly, Bydlon said, it's a reinforcement of success that women in engineering don't often receive. According to Bydlon, for various reasons men always seem to be the most active and participatory in class; the professional world seems to be dominated by "the guys" who naturally relate better to other guys.

"I wanted to start a program that would draw young women in, let them find out what engineering really is and that it doesn't mean that you have to be a grease monkey or a social outcast."

Panetta with the Nerd Girls and the vehicle some call "The Cockroach."

The Society of Women Engineers states that while other fields have gone far to balance the scales between male and female, women comprise only 10 percent of the engineering workforce—a drop from 11.1 percent in 1998. On average, women entering the engineering workforce make $8,000 less per year than their male counterparts.

This might explain, in Panetta's philosophy, why the American Society for Engineering Education reports that 50 percent of medical and law students are females while women comprise only 20 percent of engineering students.

Hello Kitty

"The real name of Nerd Girls is the 'Breaking the Stigmas and Stereotypes of Women in Engineering' project," Panetta says. "You're not supposed to call yourself a 'nerd' because that discourages education. And you're not supposed to say 'girl' because that's demeaning to women."

Leaning back in her office chair, Panetta is wearing a foot-wide 'Hello Kitty' face on her t-shirt. With the pompoms on her boots, you'd expect to see the outfit on a student rather than a professor—but somehow her demeanor pulls it off.

"She dresses up for classes," says Allison Bedwinik, last year's project leader. "But the rest of the time Karen dresses like she is: outgoing and full of energy. I don't think she could pull off something like Nerd Girls otherwise."

Much of Panetta's personality seems shaped around the idea of unbending stereotypes. Just as she would like to change her students' views of what a professor can offer, she's challenging misimpressions that steer young girls away from engineering.

"When I was young, my father told me, 'You're going to have to become an engineer; that's the only way you're going to be able to afford all of your clothes,'" she says. "I knew that I could be a girl and an engineer, but most young girls don't get that impression."

Several times a semester, the Nerd Girls go on outreach programs where they take their solar car to local high schools, junior highs and middle schools. When talking to a co-ed group, the result is almost always the same, Panetta said—the boys rush forward to the car and immediately begin asking questions about how it runs; the girls hang back until "they see that the guys in their class are chatting and are interested in the girls, and that these girls aren't what they think of as mechanics."

Often, Panetta will ask a class of younger students to draw a picture of what they think an engineer looks like. Inevitably, she says, it's a picture of a garage mechanic with a wrench. The main point of the outreach programs is to break this image and show that engineering is a tool of a craftsman and thinker, and that women who do these jobs can be every type of woman there is.

"Over the years, I've had a Nerd Girl who danced the *Nutcracker,* a top-ranked tennis player; girls of every type," Panetta said. "And of course, we even have Nerd Girl guys." This year there are two men, who were drawn to the program by the engineering challenges they can't find elsewhere.

"Young women need to see that they don't have to make the choice between being feminine and being an engineer. Karen's a walking example of that."

Numerous studies show that girls usually lose interest in math and science at an early age unless otherwise encouraged. "The car is an important part, but it's amazing to see Karen as she relates to girls from tweens to late teens," said Karen Johnson, who is in the process of producing a television series based on Panetta's work [see accompanying story]. "Young women need to see that they don't have to make the choice between being feminine and being an engineer. Karen's a walking example of that."

New Light

The replacement for Tinkerbelle is a self-sufficient light system designed for ocean buoys. The girls adapted it and its solar panels. If all goes well, it should soak up enough sunlight during the day to power its rows of LEDs with enough lumens to be seen for eight nautical miles. To mimic firelight and to distinguish it from other official Coast Guard lights, the lamp will have to be fitted with an amber color wash.

As for the darkened stairs, the girls have designed another array of solar cells to power a series of eight compact fluorescent bulbs. For the two-story lighthouse-keeper's house, the team is working on a series of photovoltaic panels that will be mounted into concrete foundations on one side of the house. As with the other systems, it's a complex balance of circuits, amperages, inverter calibrations, fault detection and a thousand other minute details.

The team hopes to install the replacement for Tinkerbelle and the tower lights this spring. Solar panels for the house and other structures will follow. In fact, there seems to be no end to projects available from the 50-acre dot of land. Panetta plans to eventually bring more chemical and environmental students in to adapt the filtration system of a 100-year-old, 35,000-gallon cistern so that it will produce drinkable water. She also plans to have a team investigate whether wave power could be used to generate electricity on the island and possibly provide enough to build additional houses for the tourist season.

"Next year, we'll do even more and bring in more girls from other engineering fields," Panetta said. The growth seems to be contagious—she's been contacted by dozens of other universities interested in starting their own version of Nerd Girls. "I'm not going to stop until I change the stereotype of women in engineering across the nation." ■

Nerd Girls: The Reality Show

Over its relatively short life span, Nerd Girls has received a lot of outside attention. Articles in the *Boston Globe, Newsweek* and *Elle* have all told the story of this group of girls who are changing sexist stereotypes by simply doing what they do best—and now that story may be coming to television.

Karen Johnson is a Los Angeles-based film producer best known for the 2004 independent film *Double Dare,* a documentary that follows the trials and tribulations of two Hollywood stunt women. Jeanie Epper, who doubled for Lynda Carter during the *Wonder Woman* television series, takes Zoe Bell—a relative newcomer to Hollywood—under her wing. Bell had doubled for Lucy Lawless during the filming of *Xena: Warrior Princess.*

Johnson's work follows a theme of displaying strong women in feature-length films. For Nerd Girls, she is developing the groundwork for a television series along the lines of *The Real World.*

"Everything that you see on TV today seems to be superficiality competing against superficiality," Johnson said. "What attracted me to this group was that they are a bunch of real girls working together to break superficiality. They show you can be an A-student and a cheerleader. But, maybe more importantly, they show that you don't *have* to be either."

Using film shot as the girls worked on Thacher Island last summer, Johnson has created a short preview trailer she is using to market her idea to both the Discovery Channel and MTV.

"I show it to people, and they compliment me on my casting and wardrobe choices," she says. "But these are the real girls. They have such strong charisma just being themselves."

—*S.H.*

Looking Back, *Looking Ahead*

AFTER MOVING FROM THE ENG DEAN'S OFFICE TO THE PROVOST'S SUITE, DAVID CAMPBELL REFLECTS ON THE PAST AND LOOKS TO THE FUTURE

DAVID K. CAMPBELL joined the College of Engineering as dean in 2000. A theoretical physicist specializing in nonlinear phenomena and condensed-matter physics, he had previously served as a professor and department chairman at the University of Illinois and as director of the Center for Nonlinear Studies at the Los Alamos National Laboratory. In 2004, he added the title provost *ad interim* to his portfolio and managed the affairs of the College of Engineering as well as the academic programs, personnel, resources and support services of the University.

In September 2005, Boston University President Robert A. Brown named Campbell permanent provost. Campbell relinquished his deanship and a search for his successor was launched. As the University's chief academic officer, Campbell directly supervises 14 schools and colleges on the Charles River Campus, 12 centers and institutes, and several administrative offices. He found time to sit with *BU Engineering Magazine* Editor Michael Seele to reflect on his five years as dean and assess the current engineering landscape and the future of the College of Engineering.

BUE: When you arrived at BU in 2000, you introduced yourself partly by saying, "It's a great time to be a nerd." Do you think that is still true?

DKC: Yes, I do. America's future—economically and politically—in the world will hinge on our ability to innovate in technology, and the nerds are the innovators.

The one aspect of that I might change in emphasis, however, is the idea of a nerd not being engaged and so often in her corner just doing her little thing. That's not something we want our engineers to be; we want them to be socially engaged and to make a difference. That's essential if we are going to have engineering contribute to the American economy, to the world's economy. Being aware of sophisticated and quantitative reasoning is very important but the ability to reach out and communicate is also a very important skill that we try to teach our students. So maybe being not the conventional nerd, but the math and science and engineering whiz is still a good thing to be.

BUE: In 2000, what did you see as the strengths and weaknesses of the College of Engineering and how did you go about setting a direction for the College?

DKC: When I arrived here, I thought that the College had among its greatest strengths a real sense of collegiality and purpose. It was four departments, six degree programs and many centers—but one College. People really worked hard across any interdepartmental barriers; in fact, there were almost no barriers to doing things collaboratively in an interdisciplinary way. The Whitaker Foundation Leadership Award we received in 2001 allowed us to capitalize on that. In addition to people we hired in biomedical engineering under the grant, we also hired people in aerospace and mechanical and in manufacturing engineering. I think we had a large number of strong individual programs—which we have been trying to foster—and we have built some more.

In terms of weaknesses, our most glaring were our contact with alumni and our low philanthropic base. I made both a real focus of my work and I think that we have been quite successful in changing that.

BUE: What are you most proud of from your tenure as dean?

DKC: Overall, the great number of faculty hires we made and the quality of students has made a huge difference to the College. We have some outstanding young faculty who are going to be with us for a good, long time and who will help take the College to a still higher level. Of course, we are very proud of our major grant successes, in particular the Whitaker grant and the recent Coulter grant [see story on page 23], but also a large number of multi-university grants from the NSF and other agencies. Because of our expertise, we have been the leader among peer institutions in getting these multi-institutional grants.

Of course, we are obviously all very pleased with the Life Science and Engineering Building, and particularly proud of our new W. Bradford Ingalls Engineering Resource Center, a wonderful new facility for our students that was very generously donated by Brad Ingalls, who made a lasting contribution to the College.

One of the things that was probably below most people's radar screen was the College pulling together in our preparations for the ABET accreditation review we had a couple of years ago. It really required us to scrub and polish the entire ship of state, so to speak, and all faculty participated enthusiastically and positively. We had an absolutely great review and got wonderful grades.

BUE: What do you think the next dean can build on?

DKC: The College is really poised for the next level. I don't foresee a large expansion in size, so I think the College can now work on really trying to invest in its faculty and students more on a per capita basis and build in excellence.

The College is trying to develop programs across disciplines even more to pursue projects like the Coulter grant, which is a translational grant to take things from biomedical benchtops to the bedside in Boston Medical Center. We are going to work on that kind of thing. I think the change in leadership in the Photonics Center [see story on page 25] gives us a huge opportunity to really integrate not just our photonics, but also a lot of our electrical and computer engineering programs more fully with that center—and that's a great opportunity for the new dean.

The new strategic planning process President Brown has initiated means that the College has done a lot of thinking about where it is and where it wants to go, and from what I've seen, that's been very carefully carried out with a lot of faculty input. Obviously, you don't want to present a new dean with a determined road map, but what they've done is present an understanding of what the opportunities are and I think it's a very exciting time.

BUE: Now that you're the provost, you have to balance the needs of many schools, colleges, institutes and centers. What sort of an advantage does a science and engineering background give you for managing that job?

DKC: I see this from two levels. I see it from my own experience, but I also see it from observing President Brown—he is a real master, having been provost for seven years at MIT before he came here.

I think being able to think quantitatively and make quantitative metrics that enable you to assess the value of programs—the excellence of programs—is extremely important. The ability to look at the data, not be swept away by rhetoric, and synthesize hard facts simply with a sort of back-of-the-envelope calculation is extremely helpful. I wouldn't say by any means that it's essential, but if you can't analyze things quantitatively, you're going to have a pretty hard time following, for example, budgetary matters, or really deciding what the tuition discount rate means and what it should be, and how you compare with your peers. So there's no question that being able to think quantitatively is helpful.

At the same time, you have to recognize that not everything can be reduced to numbers and metrics; there are lots of intangibles. I think one of the most important intangibles overall for the whole campus is morale and the sense of what is going on. In that respect, I'm delighted with the way President Brown is open, stresses the need for transparency in trying to clarify how the University works, gives a view of where we're going, and tries to build a consensus. That's a people skill that he has and that's something that I certainly want to emulate.

BUE: Looking at the landscape of engineering education today, what do you see as opportunities that hold the most promise for the Boston University College of Engineering?

DKC: I think the Boston University College of Engineering is always going to stay focused on a limited number of activities and never try to be a completely full-service College, because it's better to do a few things well than a whole lot of things not so well. And we are quite poised to do a few things well.

The most obvious is our biomedical area, where we already have one of the top-ranked programs in the country. And as I've mentioned, we've won these grants and we're well-tied into our medical center, so we're really poised to make a huge difference and certainly be in the top five, maybe even the number-one department in the country. But we're not the college of biomedical engineering.

We have a large number of other excellent efforts that really are also ready to come into their own; I think probably one of the most important is in the area of photonics. We have the opportunity to fully realize the promise of the Photonics Center and to move up to be on par with some of the leading academic centers in photonics and optics in the country. I think that's a realistic goal for us.

Also, in nanotech and nanoscience, we have great emerging strengths in several departments. I see new opportunities in our Manufacturing Engineering Department with fuel cell work, aspects of green manufacturing and environmentally friendly extraction of ores. There are a lot of opportunities going forward for some sort of push in environmental engineering that makes us leaders there.

That's not an exhaustive list, but I think we're starting to see national interest in many of our more focused programs, particularly in graduate students who are recognizing our excellence and choosing us over other schools. As for potential undergraduates, our beacons of excellence will help us recruit very high-quality students. I think we're in very good shape to remain a midsized but increasingly excellent College of Engineering.

BUE: Readers of this magazine will recall your "Ecology of Technology" essays from 2003–04, in which you argued that America's dominance in technology was threatened by the deterioration of the infrastructure that supports it. You cited things like poor K–12 science and math education, post-9/11 immigration restrictions on foreign scholars and researchers, and insufficient support for fundamental and applied research in science and engineering. What's changed?

"I think the Boston University College of Engineering is always going to stay focused on a limited number of activities and never try to be a completely full-service College, because it's better to do a few things well than a whole lot of things not so well."

DKC: Well, I think the biggest thing that's changed is that there is a serious awareness that what was written in that article is right. I was not the only person writing about these things at that time, but gradually the awareness has crept through the entire population. President Bush has said he will propose doubling the hard science budget, particularly for funding science and math education. We can't lead in innovation if we don't have the brains and the training. I think what's extremely important is to make sure that the people who are now saying all the right words follow through with the right deeds. So, in that area I would say there has been some progress.

The restrictions on foreign scholars and visitors originally were extremely cumbersome. Over the past two years, through the lobbying of various organizations and with the recognition by Congress that we really were inhibiting ourselves, those restrictions have been eased. That threat has been substantially alleviated.

So there have been some real improvements. We'll see whether the words of the politicians are matched by their deeds, but they're saying the right words now.

BUE: American engineers everywhere—including a number of our alumni—have been affected by the outsourcing trends of recent years which have sent their jobs to Asia and elsewhere. What do you see as the brightest hope for the future of American engineers?

DKC: I think we have to stay ahead of the curve. We cannot hold back the tides of globalization; it's a fact. I grew up in California, so I'll push the surf metaphor and say we're out there riding the big waves. As surfers know, if you don't stay ahead of the wave you're going to get wiped out. So, we have to stay ahead in terms of innovation. This means we need to train our students to be lifelong learners so that when a particular skill set or technology becomes dated or is outsourced, they're ready to leap to the next technology.

We've seen many examples—among our faculty, among our alumni and among our friends—of people reinventing themselves. I think the idea that one goes to one company and stays there for 40 years—the way my father who was a chemical engineer at Proctor & Gamble did—is just not the way of the future. But that doesn't necessarily mean that the jobs of the future will be less secure. You just have to be lighter on your feet, willing to be a lifelong learner and develop skill sets that allow you to stay ahead of the curve in innovation.

BUE: Earlier, you touched on the College's renewed effort to engage its alumni; there has been an encouraging response. Donations are up, alumni event attendance is up, people are reconnecting with their *alma mater.* At this point in the College's evolution, how important is alumni involvement?

DKC: Alumni involvement is *the* key to our future. If you look at a crass business model of a college, the total income from our undergraduate tuition is not going to be going up very much. We may expand the College in terms of number of undergraduates somewhat, and we certainly will be expanding in terms of graduate students, but the total number of dollars coming in from tuition is going to be limited. The research funding that we get from the federal government has continued to go up but that money is restricted. It supports our faculty in the summers, pays for our graduate students and creates new knowledge, but it won't allow us to undertake programs such as the creation of a new building or center.

So, the example I gave of the Ingalls Engineering Resource Center is a perfect one. We really needed to create a study area for our students that was high quality, interactive, completely wireless, and offered access to the Internet and outstanding video and audio. It was not something that the University, out of its unrestricted funds, could afford to build for us. And so, thanks to the gift of Brad and his wife, Joan, and some matching money from Alan Leventhal, the chairman of the Board of Trustees, we were able to make this resource available to our students. It would not have happened without philanthropy. So that's extremely important to us.

Just as important as their fiscal support is the involvement of our alumni in telling the story of Boston University, getting back to the College, seeing our students, coming and speaking to the students about their experiences, helping us recruit outstanding new students and just generally becoming more involved in the College. We want to give something of value to our alums so that they want to come back. Their time, commitment, energy—as well as with their financial support—are extremely valuable to us.

I think that as we build a tighter network of engineering alums, we'll see the value to everyone increase. I mean in terms of references, in terms of internships through companies, in terms of hiring, in terms of all sorts of things. So just networking our alums more tightly—getting them more involved—is something we really want to do. It is the one part of the equation where we have historically not devoted as much attention as we should have and so it's the one area where we have the most to gain by enhancing our interactions. ■

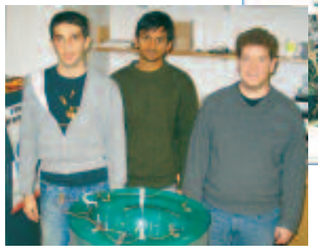
The Best of the Brightest

THIS YEAR'S SENIOR DESIGN PROJECTS YIELD INNOVATIVE IDEAS

By Chhavi Sachdev

ENG undergraduates get to have some fun with their senior design project. Every year features a few innovative, useful and just plain clever projects. Here are four from the Class of 2006 that showcase the creativity and dedication the College fosters.

Photo: Michael Seele



Students: Joseph D'Errico, Vyas Venkataraman, Yaniv Ophir. Andrew Hagedorn is not pictured.

ECE

SmarTrash

By sending surveys to park authorities nationwide, the SmarTrash team learned that it takes upward of $100,000 every year to empty trash barrels in a typical public park.

It's not surprising, then, that the team had an overwhelmingly positive response to its project, a monitoring system that would indicate when a can is full.

The students devised a system that rigs every trash can lid with a planar sensor, an infrared depth sensor, two solar-powered batteries, and a small wireless device—or mote—that communicates with a base station every two minutes through a mesh network.

The trash cans talk to each other, explained Yaniv Ophir, and relay signals from can to can until they can be picked up by the base station, which could be housed on a pole or in a parking garage nearby—anywhere with either WiFi or an Internet connection. A park the size of the Boston Common has trash cans positioned about 100 feet apart, well within the mote's 300-foot range.

At headquarters, park employees would look at a Web page displaying a satellite photograph of the park superimposed with colored trash can icons indicating the position of each receptacle in the park. The green cans don't need emptying, but the yellow ones are nearly full, their contents within 10 to 15 centimeters of the top. Red means the can is overflowing and needs immediate attention.

By pinpointing the location of the cans that need attention, employees can take the most efficient route in emptying them. This would leave more time for other tasks such as landscaping, which the students' survey indicated is often performed by the same workers who empty the trash.

Some park officials are already interested in what the technology promises. At Roeding Park, a 150-acre area in Fresno, California, the Parks Department spends $183,519 a year on trash removal. Southland Park in Lexington, Kentucky, said 100 locations cost $250,000 a year.

The SmarTrash units would cost a little over $100 each, a fraction of the cost of the typical park trash can. "The authorities should be able to save money immediately," said Ophir.

Toward the end of their final semester, TeamX received a formal invitation from New York City's park authorities to present SmarTrash at the annual fleet show on May 17.

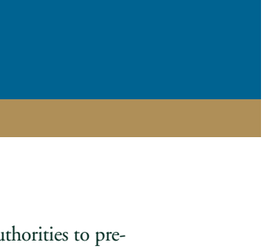
BME

Breaking Boundaries: Analogue Brain-Computer Interface Using fMRI

Paul Bower's work may someday help people with physical disabilities operate computer interfaces using only their thoughts. His project, "a brain-computer interface that allows users to move a cursor in a two-dimensional plane using thoughts as directional commands," is more robust than anything else out there today, he said.

Working in collaboration with Seung-Schik Yoo, a radiologist at Brigham and Women's Hospital, Bower used fMRI, or functional Magnetic Resonance Imaging, to do three things. First, the subject's brain was calibrated to identify the areas used in mechanical and verbal tasks. Lying in an MRI machine, the subject trained the program to recognize his brain patterns, either by imagining a physical activity (such as moving an arm) or thinking words in a sequence (Bower's example was mentally reciting "Engine, engine, number nine …")

Photo: Chhavi Sachdev



Student: Paul Bower

Next, Bower's algorithm calculates the best "regions of interest" in the brain that are activated during these tasks. Finally, based on that activity, it translates the subject's next thoughts, whether verbal or motor, into mouse actions.

Besides its application in helping disabled people maneuver a computer interface, the algorithm itself is important. It only takes about 6 minutes to calibrate the brain, including the active training as well as data processing; in one scan, it computes what normally takes up to 12 fMRI scans.

As a time-saving and smart device, it's sure to have applications in the near future, said Bower, who will start a combined MD-PhD program at Boston University in the fall.

AME

SPATEN: Very Light Jet

Photo: Chhavi Sachdev

Clockwise: Aurel Mihai, Kyle Parker, John Ottander, Carl Russell, Seth Cohen and Thomas Ahern

When Team Six-Pack was looking for a suitable project, it came across the American Institute of Aeronautics and Astronautics student design competition. Uninterested in the undergraduate contest, they decided to tackle the graduate challenge even though they couldn't enter it. Their object: to design a Fast and Efficient Air Taxi (FEAT) that could carry four passengers 1,000 nautical miles, roughly the distance between New York and Chicago.

"Our mission was to create a plane that could utilize smaller airports that are not used as much and travel quickly between them," said Kyle Parker.

To target the on-demand air-taxi market, their plane would have to be compact. At smaller airports landing strips average about 3,000 feet, which is part of the reason only Cessnas and private jets service them; a Boeing 747 needs about 8,000 feet to take off and land safely.

There are already jets that fulfill these stipulations of size and distance—such as the Eclipse 500—but they follow a conventional design. The SPATEN plane would have no horizontal tail. "We've changed the design to put a canard in the front to make the plane more fuel-efficient," said Seth Cohen.

Another innovation the plane would feature is a set of vertical 'rudderlets'—a combination of winglet and rudder. Each wing has a split rudder—which opens up somewhat like a book—to control drag.

The plane would be made of aluminum alloy and have two Williams FJ44-1 jet engines. It would measure 25 feet in wingspan, about 23 feet from nose to tip, and about 5 feet in diameter. Its fuel tank capacity is 1,900 pounds (roughly 278 gallons) of jet fuel. In contrast, a Boeing 747 carries 450 passengers, measures over 240 feet from nose to tail with a wingspan of 224 feet 9 inches, and can fly a maximum of 8,000 nautical miles—say from New York to Hong Kong—using 411,255 pounds or 60,125 gallons of fuel.

While big passenger jets have their place, smaller planes mean shorter lines and faster security checks at closer suburban airports, said the team. Air taxi, anyone?

MFG

Raytheon: Process Proofing Project

When companies design products for customers, they follow a set procedure—but after the prototype is approved, most companies proceed by trial and error. To help smooth the steps between making five prototypes and manufacturing 50,000 products, Raytheon's Integrated Defense Systems approached the Department of Manufacturing—and three seniors stepped in to make it all more efficient.

"There are a lot of changes between making one prototype and the production line where there is no hands-on engineering knowledge," said Sam Davenport. "It can cost the company a lot of time and effort to refine a project." Often, products are not tested until they come off the assembly line.

While the design stage was working well, the students found that the development cycle was rife with delays and mistakes that mostly stemmed from bad planning.

The students evaluated Raytheon's existing methods and came up with a similar flowchart of structured steps for the development teams. Their process lets development teams choose from eight different kinds of projects depending on the production cycle and type of technology used.

Each of the eight choices details the succession of steps along with problems that could arise, plus checklists, information and tools to help solve them, said Monica Arias. Their biggest challenge was making the process general enough to apply to a broad range of products but narrow enough to be useful. In most cases, the forms and tests the students recommended already existed within Raytheon—but nobody followed them or knew when to implement them, said Arias.

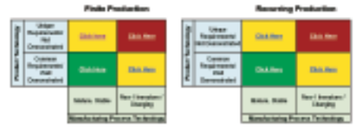


Photo: Chhavi Sachdev

Students: Christina Rodriguez, Monica Arias, Samuel Davenport

An innovation that the team introduced was a database of "Subject Matter Experts." For instance, explained Davenport, if a product uses a new type of adhesive, the team could find somebody in the directory with expertise in the area of adhesives who could proof the process ahead of time.

Response at Raytheon has been overwhelmingly positive. The teams liked their process tool and the manager of manufacturing process engineering at Raytheon, Andover, will present the final report at a company-wide conference this summer. ■

Vibrating Insoles Improve Balance in Diabetics, Stroke Patients

Professor James Collins

Sending imperceptible vibrations through the feet of diabetics and stroke patients significantly improves their balance, according to a study coauthored by BME Professor James Collins and published in the American Neurological Association's *Annals of Neurology.* The study's results have implications for reducing the risk of falls for these patients.

Collins said the results are similar to those obtained during a prior study of healthy elderly people and are the first to observe balance improvement in diabetics and stroke patients using this method.

The subjects in the study were evenly divided between stroke patients and people with diabetic neuropathy. In the case of stroke, the patient's ability to process information transmitted by foot neurons was impaired, while the diabetics had an abnormally high threshold for neuron stimulation. Regardless of the cause, Collins' team found that introducing the vibrations' "white noise" increased the subjects' use of sensory information transmitted through their feet and improved their balance.

The researchers used viscoelastic silicone gel insoles fitted with three quarter-sized vibration pads located under the heel and forefoot. Researchers conducted 10 tests on each subject; half the tests using a low-frequency vibration that could not be felt by the subject and half without vibrations. Subjects were not told when the vibrations were applied. Visual markers were placed on the subjects and video cameras recorded the markers' movement, or sway.

When the vibrating insoles were activated, the subjects' sway was, in general, reduced. The study found that the larger the patient's baseline sway, the greater the reduction achieved by the vibrations.

"These findings have implications for people with impaired balance control who are at increased risk for falls that can result in debilitating injuries," said Collins. "We have designed and constructed insoles for in-shoe use and are planning to use them in the next round of studies investigating locomotion and other activities."

Collins coauthored the paper, "Noise-Enhanced Balance Control in Patients with Diabetes and Patients with Stroke," with nine researchers from Harvard Medical School, Spaulding Rehabilitation Hospital, Joslin Diabetes Center, Beth Israel Deaconess Medical Center and other health care and research organizations.

Separately, Collins recently was named to *Scientific American* magazine's list of the top 50 leaders in science and technology for 2005. In 2003, he received a MacArthur Fellowship in recognition of his groundbreaking research into biodynamics.■

— Michael Seele

McDaniel Elected ASA Fellow

Associate Professor J. Gregory McDaniel's work on structural acoustics has yielded him fellowship in the prestigious Acoustical Society of America. The society recently elevated McDaniel from member to fellow, a distinction accorded to only 12 percent of the ASA's 7,000 members.

The letter notifying him of his election as a fellow "for contributions to structural acoustics" came as a surprise to McDaniel, who was not aware he had been nominated. Some of McDaniel's projects have involved the interaction between sound and underwater structures, structural vibration and automotive brake squeal.

"Personally, I'm happy my research in structural acoustics has been recognized as a body of work," said McDaniel, who has been a member of the AME faculty since 1996.

AME Chairman Professor John Baillieul said McDaniel's ASA honor is the latest addition to the department faculty's growing list of accolades.

Associate Professor J. Gregory McDaniel

"The department has long recognized the quality of Greg's work," he said. "His election as an ASA fellow shows that his research is recognized internationally." ■

— Michael Seele

Appreciation: Professor Leopold B. Felsen

A professor of aerospace and mechanical engineering at ENG for 11 years, Leo Felsen passed away on September 24 at age 81.

Dr. Felsen made significant contributions to the field of electromagnetics. His discoveries underlie the technology in every cell phone and *Radiation and Scattering of Waves,* the 1972 book he coauthored, is a standard text in the field. His pioneering work found application in other fields—such as optics and geophysics—which previously were thought to be unrelated.

Dr. Felsen fled his native Germany for New York City in 1940. After serving in the U.S. Army during World War II, he earned bachelor's, master's and doctoral degrees in electrical engineering at the Polytechnic University of New York. He stayed on as a lecturer and became dean of engineering in 1974. In 1994, he joined the ENG faculty at BU.

The author of more than 300 research papers, Dr. Felsen was a member of the National Academy of Engineering and a life fellow of the Institute of Electrical and Electronics Engineers, which awarded him its Heinrich Hertz Medal for his theories advancing the study of electromagnetic waves. In 2003, he won the IEEE Electromagnetics Award.

Dr. Felsen also was known for his poetry, some of which was related to his work. In tribute to his lifework, the IEEE put out a call for poems to be published in the June issue of its magazine, and also scheduled a special session at the annual IEEE Symposium on Antennas and Propagation Society in July. A special issue in his memory will appear in the next *IEEE Transactions on Antennas and Propagation.*

Dr. Felsen is survived by a son and a daughter. ■

Green Manufacturing Lab Wins Technology Investigation Award

In a few years, Americans could start driving cars that don't belch nitrogen oxide, hydrocarbons, carbon monoxide and other pollutants. Instead of fossil-fuel burning, internal-combustion engines, fuel cells would sit under the hoods and produce electricity with only heat and water as by-products. The fuel cells themselves are ready, says Srikanth Gopalan (MFG), an assistant professor who, as the head of the Green Manufacturing Lab, researches environmentally benign power generation technologies.

What's lacking is the high-purity hydrogen the cells need to make electricity.

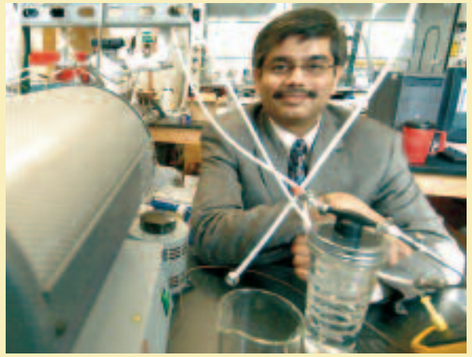
That's why devising a cheaper and more efficient way to produce pure hydrogen is one of the main focuses of Gopalan's lab. For two years, he has been working under a Department of Energy program, seeking to make large amounts of hydrogen free of impurities such as carbon monoxide, particulates and sulfur. This February—in a boost that may help speed Gopalan's research to market—his lab received a $25,000 Technology Investigation Award, one of five given out by the Massachusetts Technology Transfer Center (MTTC).

The money will help Gopalan and his corporate partners, CTP Hydrogen of Westborough and Air Products and Chemicals, Inc., of Allentown, Pennsylvania, perfect their patent-pending hydrogen production process, in which a dense ceramic membrane conducts the oxygen out of high-temperature steam, leaving a stream of pure hydrogen.

"What we have now are lab prototypes," says Gopalan. "We're looking to demonstrate a beta-scale system—which is something between the lab and actual scale—within a year."

A fuel cell consists of two electrodes of opposite charges sandwiched around an electrolyte catalyst. Hydrogen is fed to one electrode while oxygen is fed to another. The catalyst separates the hydrogen into electrons that flow through an external circuit (electricity) and protons that migrate to the oxygen and produce water and heat.

Gopalan's hydrogen production system is geared toward what are known as proton-exchange membrane (PEM) fuel cells, which operate at a relatively low temperature (80 to 100 degrees Celsius) and for that reason are the most likely candidates for powering cars and other vehicles in the future. His lab is also researching solid oxide fuel cells, which, while powerful, are probably not the best option for a car's engine block because they reach temperatures as high as 1,000 degrees Celsius. Solid oxide cells, says Gopalan, are better suited for powering houses and buildings.



Assistant Professor Srikanth Gopalan

Almost everywhere power is needed, fuel cells appear to be on the cusp of becoming a commercial reality; Gopalan estimates that one of the major car manufacturers may introduce a commercial fuel-cell car in about five years. Last year, MTTC held a clean-energy conference where Gopalan presented his work to other researchers and corporate executives. Abi Barrow, director of the MTTC, clearly liked what he saw.

"There's a huge interest in clean energy," says Barrow. "People are beginning to see that fuel cells are going to be commercially available and they need to find ways to supply the hydrogen those fuel cells will need."

For Gopalan, the market pressures for fuel-cell development coincide with environmental imperatives.

"The energy crisis in a global sense is becoming worse with every passing day," he says. "We need a way to utilize our fossil energy resources more efficiently and reduce emissions." ■

— Chris Berdik

Interdisciplinary Team Studies DNA's Attachment to Microarrays

Under the auspices of Boston University's interdisciplinary engineering programs, a team of researchers has developed a new application to more precisely measure the location of a fluorescent label in a DNA layer. According to the study, published in a recent issue of *Proceedings of the National Academy of Sciences,* the new technique provides insight into the shape of DNA molecules attached to surfaces such as microarrays used in genomics research.

Knowing how DNA molecules conform to microarry surfaces may significantly improve the efficiency of DNA hybridization—the process of combining complementary, single strands of DNA into the familiar double helix. Better control of microarray technology could help it cross over into clinical research, said study coauthor M. Selim Ünlü, an electrical and computer engineering professor with a joint appointment in the Physics Department.

The technique, called spectral self-interference fluorescence microscopy (SSFM), pinpoints the location of a fluorescent marker attached to a DNA strand.

"Although a number of other methods have been used to determine the structure of the DNA layer, they are not very sensitive to variations in the shape of DNA molecules," said Bennett Goldberg, professor of physics and study coauthor. "Our group has developed SSFM to determine the precise measurement of the location of a fluorescent label relative to the microarray surface."

Their measurement capability is within 0.2 nanometers, which is smaller than 1 silicon atom, said Ünlü. A base pair of DNA is approximately 3 angstrom—or 0.3 nm—wide.

Using SSFM, the team estimated the shape of coiled single-stranded DNA—whether it was standing straight, bending from the top, or looping around the base. They could also estimate the average tilt of hybridized DNA of different lengths; double-stranded DNA is generally stiffer and straighter than single-stranded DNA. Based on their measures, they could also gauge the amount of hybridization and what happened to DNA when one strand was longer or shorter than the other.

"Our research shows that locating a fluorescent label attached to a certain position within a DNA chain offers highly accurate information about the shape of DNA molecules bound to the surface of a microarray," said Ünlü.

The project might not have come about without Boston University's encouragement. "Biologists would not know about technical problems and engineers often do not know the biological problems," said Ünlü, whose lab has researchers from ECE, BME, and the Physics Department.

Additional study investigators include Charles R. Cantor, professor of biomedical engineering and co-director of the Center for Advanced Biotechnology at BU, Anna K. Swan, associate professor of electrical and computer engineering, and Lev Moiseev, electrical and computer engineering research associate. ■

— Kira Edler and Chhavi Sachdev

Professor M. Selim Ünlü

College of Engineering Cohosts FIRST Robotics Competition for High School Students

Boston's largest two-day robotics event engages students in science and engineering

By Chhavi Sachdev

At first, the blaring rock music and the high schoolers in team colors waving banners and chanting made it seem like an ordinary sporting event. But the songs being played included "Mr. Robotso" and the athletes scoring baskets and goals on the floor were robots that the kids built for the FIRST Robotics Competition held at Boston University's Agganis Arena on March 24 and 25.

FIRST (For Inspiration and Recognition of Science and Technology) was started in 1989 by inventor Dean Kamen to foster interest in science and technology among kids. The College of Engineering cosponsored the Northeast regional FIRST event this year—the first time it was held in Boston—and ENG students volunteered and mentored some of the teams.

"An event like FIRST is good for the community," said Solomon R. Eisenberg, dean *ad interim* of the College. "One of the biggest problems in the U.S. education system is that students opt out of science and technology careers before they know what they're about. The career path does not have prominent individuals and is not perceived as cool or sexy, but is thought of as nerdy, geeky and to be avoided—FIRST has helped to change that."

Over 1,000 high school students on 44 teams—most local, but some from as far away as Brazil—had six weeks to design and build robots to play a basketball-like game involving the machines shooting and rolling Nerf basketballs at targets. The robots played offense and defense in the game. The top six teams advanced to the national championship in Atlanta and the chance to compete for $7 million in scholarships.

The College of Engineering sponsored several teams, including Boston University Academy, giving the team access

The BU Academy team works on its robot at the competition.

to the College's robotics resources and the expertise of its undergraduates, some of whom had participated in FIRST during high school. The BU Academy squad didn't make it to Atlanta, but did win the sportsmanship award for offering some coaching to several rookie teams.

The competition was also notable for the entry of three all-girl teams, a FIRST first. "We are committed to not just closing the gap between the number of engineers that are needed, but closing the gap between the number of men and women engineers," said FIRST Regional Director Brad Lauer. "We are showing the girls that this is not dorky."

Eisenberg agreed: "For the country to dominate in science and technology, students at all levels should be pushed to acknowledge that science is fun and can be creative."

The team that took home the gold at the Boston regional championship wasn't exactly a collection of rocket scientists, but it was close—the students from Cocoa Beach, Florida, worked with mentors from NASA and had access to the agency's prototype lab. ■

BME Expands Collaborative "Bench-to-Bedside" Research Efforts

By Michael Seele

The Biomedical Engineering Department has won a major translational research grant and formed a partnership with the Boston University School of Medicine to accelerate innovation and deliver new technologies to patients.

In November, the Wallace H. Coulter Foundation awarded BME a $2.9 million Translational Research Partnership Award to facilitate joint efforts between BU's biomedical engineers, medical researchers and the Coulter Foundation in order to develop promising new technologies and move them to clinical application.

"The Coulter Foundation conducted a rigorous review and we are gratified to have the quality of our basic and applied research programs recognized with this award," said BME chairman Professor Kenneth Lutchen. "It will advance our efforts to bring promising innovations from the laboratory to the patient."

Of the 63 institutions that applied nationally, the BU Biomedical Engineering Department was one of only nine chosen to receive the award.

Through this award, the Coulter Foundation will form a working partnership with BU's Biomedical Engineering Department to promote, develop and support translational research through such activities as funding promising research projects, increasing and supporting effective collaborations between biomedical engineers and clinicians, increasing awareness of the importance of moving promising technologies to clinical application, and developing and supporting sustainable programs and processes that will increase, enhance and accelerate this movement. The goal of this partnership is to focus on outcomes that will improve patient care.

Separately, BME has joined a consortium of clinicians, scientists and engineers that aims to solve complex medical problems using new technologies. BME and the Boston Medical Center are now members of the Center

Professor Ken Lutchen

for Integration of Medicine & Innovative Technology (CIMIT), based at Harvard Medical School. Other CIMIT institutions include Massachusetts General Hospital, Brigham and Women's Hospital, MIT, Draper Laboratory, Partners HealthCare, Beth Israel Deaconess Medical Center and Boston Children's Hospital.

"BU is very pleased to join CIMIT as a full member and we look forward to working with clinicians and engineers at the outstanding institutions that comprise CIMIT to accelerate the development and implementation of advances that will improve patient care," said Lutchen. "CIMIT's objectives parallel our increased focus on translational research."

To further capitalize on opportunities for collaboration with BU, BME and the School of Medicine have each assigned a faculty "site miner" to identify and foster opportunities for collaboration between engineers and clinicians. The BME site miner is Associate Professor Mark Grinstaff; Professor George O'Connor represents the Medical School. ■

First Science Bowl at the College of Engineering

By Kira Edler & Chhavi Sachdev

Competition was stiff at the Science Bowl.

Scientists and engineers of the future competed for a spot in a prestigious national science competition when, for the first time, Boston University hosted the Massachusetts regional qualifications for the National Science Bowl at the Photonics Center on February 18.

Sponsored by the U.S. Department of Energy, the Science Bowl is a prominent educational event during which teams of high school students are quizzed on their knowledge of all branches of science. Thirty-six teams of 260 students from 27 Massachusetts schools vied for an invitation to the national finals in Washington, D.C.

"It is an honor for the University to be chosen as a regional site by the Department of Energy," said Ashmita Randhawa, a sophomore biomedical engineering major and one of the BU student coordinators.

Aimed at encouraging involvement in science and math, the Science Bowl offers students who excel in these areas a challenging yet fun forum for their talent. Teams participate in a round-robin format and are asked questions about chemistry, biology, physics, astronomy, earth science, general science and mathematics. Each year, the winning team from each of the 70 regional tournaments—like the one at BU—qualifies for a trip to the finals where they join approximately 12,000 other students from across the country to compete for prizes, such as a monetary award for their school and scientific research trips.

At BU, the competition was very stiff. Only 8 teams advance to the finals, explained student coordinator Ishan Patel, a sophomore chemistry major. The first five teams were clear winners, but the rest of the 10 teams were tied with identical 3-1-0 records. To determine the last three places, they held an 8-team double-elimination playoff; the winner was decided with tie-breaker questions.

The overall winner was the Lincoln Sudbury High School Team 1. The Phillips Academy Team 1 placed second and Lexington High School Team 1 came in third.

The Boston University Science Bowl was largely sponsored by Merck Research Laboratories-Boston; many Merck employees served as volunteer moderators and judges at the competition.

"My Merck colleagues and I are excited to join Boston University and participate in this event which promotes the study of science," said Mark T. Goulet, executive director of Medicinal Chemistry, Merck Research Laboratories-Boston. "As a student I had the chance to compete in a similar event that gave my friends and me a unique opportunity to participate in a fun team competition that challenged our academic interests."

"All of the questions asked in the Science Bowl—supplied by the Department of Energy—made you think out of the box and were very math- and science-driven," said coordinator Patel.

According to the student organizers, this event united more than 100 staff from various programs and groups in the University.

The organizers are confident that BU will be hosting the Science Bowl again in 2007.

"We hope to get even more participation from the state's high schools and the University's departments, faculty, administration and students," said Randhawa. "This event also wouldn't be where it was without the great volunteer help from engineering—it would be great to get alumni to volunteer," she added. ■

MFG's Bifano Takes Photonics Center Helm

By Michael Seele

When the call came from University President Robert Brown asking if he would accept the interim directorship of the Photonics Center, Professor Thomas Bifano already had a pretty good idea what he could do. Bifano had helped write the proposal that created the center more than a decade earlier and was intimately familiar with the center's role as a technology incubator, academic resource and home to a variety of researchers. He knew where the center had been and—as a member of the Photonics Advisory Committee—had some ideas about where it should be going.

In February, President Brown was looking for a temporary director following the retirement of Donald Fraser and Bifano accepted the offer. While a search is conducted for a permanent director, Bifano has already set about the job of adding a new cohesiveness to the Photonics Center's work and bringing academics closer to the center's core.

"My plans will focus on integrating the four missions of the Photonics Center: commercial incubation; defense and government-sponsored photonics technology development; academic scholarship; and educational enrichment for Boston University students," he said. "I will work toward creating a shared vision and mutual support among these missions, with the goal of enhancing our reputation as a national center of excellence in this exciting field."

While the Photonics Center is not formally a part of the College of Engineering, 16 of 28 BU faculty members who have labs there are engineers—including Bifano, who is also chairman of the Manufacturing Engineering Department. The center was established in 1994 to conduct basic research in photonics and produce military and commercial applications. The center's impressive nine-story building—which houses equipment and facilities shared by a number of researchers—opened three years later. An optical fiber draw tower, an optical processing facility, a sophisticated optical metrology laboratory and an integrated optoelectronics packaging lab are just some of the center's special features. The Photonics Center's leading academic experts and dedicated staff also make it a valuable resource for students, faculty and affiliated companies.

Professor Thomas Bifano

The center has served as an incubator for small start-up companies with promising technology but without the expertise to convert it into a product. Some technologies developed at BU have also used the center as a launching point to bring products out to the marketplace or to government application. Bifano's own research is one such example. His deformable mirror technology—used to improve resolution in advanced telescopes, microscopes and ophthalmoscopes—is now being produced by Boston Micromachines Corporation, of which he serves as chief technology officer.

Historically, each of the center's faculty researchers has worked in a figurative vacuum and Bifano would like to change that. "We all have something to gain from close collaboration," he said. "I'd like to create an environment that facilitates communication and collaboration."

One way to do that would be to identify areas of strength among a number of researchers and bring their combined expertise to bear on an issue. Bioimaging and biosensors are two potential areas, Bifano said.

He's also planning to form an external advisory board representing all of the center's constituencies—companies, the military, leading researchers and academics—to help the center stay on the cutting edge while better serving undergraduate and graduate students.

"Students benefit from the mentorship of faculty members who are leaders in their fields, hands-on experience with state-of-the-art laboratories and equipment and the opportunity to work collaboratively on the research and development of new photonics technologies," he said. ■

— Kira Edler contributed to this story.

The Robots Are Here

Once the stuff of science fiction, robots are making a real impact

By Chhavi Sachdev

Photonics Center Deputy Director Glenn Thoren explains the features of the REDOWL sniper detection robot at the "From Hollywood to Homes: Robots for Today" conference.

Outside of Hollywood and science fiction, robots used to be confined to shop floors. Within the last year, however, robots have become visible in battlefields, hospitals and even doing chores around the house. This shift was one reason the Department of Manufacturing Engineering chose to focus its biannual seminar on robotics trends.

The event, "From Hollywood to Homes: Robots for Today," drew 150 industry leaders, academic researchers, students and venture capitalists. The daylong seminar—the spring installment of the department's "Emerging Technologies and Best Industry Practices Seminar" series—was held at the Photonics Center on March 31.

Keynote speaker Colin Angle—cofounder and chief executive officer of Burlington-based iRobot—kicked off the talks, closely followed by two of his company's long-necked PackBot military robots.

"Robots today are concretely making a difference and directly providing value in people's lives," said Angle, whose company started as a spin-off from MIT's Artifical Intelligence lab and is now worth $142 million. iRobot has sold 1.5 million Roomba autonomous vacuum cleaners as well as 300 PackBots that are deployed in Iraq, providing the military with real-time video, sounds and sensor readings.

While robots have been hyped before—the '70s saw an autonomous vacuum cleaner fail—success has generally been limited to the toy market in the United States. Investors today, however, are heartened by iRobot's success.

"Money is coming around," said Dan Kara, president of Robotics Trends, Inc. The toy market alone is worth $50 million, he said, and the worldwide robotics market could reach $7.9 billion by 2010, according to Japan Robotics Association.

Angle predicted that the biggest areas of growth would be in warfare and health care.

Stephen P. Welby, director of the Tactical Technology Office at the Defense Advanced Research Projects Agency (DARPA), pointed out that PackBots are already in use and REDOWL (Robot Enhanced Detection Outpost with Lasers) units developed by Boston University Engineering professors David Mountain and Allyn Hubbard are scheduled to be scouting and identifying snipers in Iraq by September.

"Robots are giving their lives in service for country," Welby said. "They are not just about doing dull, dirty, dangerous work or taking people out of the cockpit; they are about what we can do differently with an aircraft."

The same paradigm shift can be applied to health care. Angle pointed out that as baby boomers age and health care costs rise, both the quality of care and number of trained nurses are dropping. Robots could help the elderly stay in their own homes with some measure of independence—doctors could pay remote home visits and household robots could help with chores and monitor residents.

Applications in computer-assisted surgery and hospital administration will continue to grow, several seminar participants said. Panelist Deb Theobald, chairman and CEO of Vecna Technologies, Inc., a start-up that makes—among other things—interactive kiosks for hospitals, warned, "In 10 years, we might not be importing Odysseys from Honda, but nurses. It's important that we start getting funded so we can be the competition."

While robotics technology and opportunities for practical use are growing, seminar speakers said reliability and affordability are challenges researchers and industry must address if the market for robots is to grow significantly. ■

Passings

JOHN B. ROACH (ENG '48), 79, on April 29, 2005.

A B-25 pilot with the famed Tuskegee Airmen during World War II, Mr. Roach attended the New England Aircraft School and became an ENG alumnus when the school was purchased by BU in 1951. During his flying career, he qualified in over 45 different types of aircraft and retired from the Air Force Reserves as a colonel in 1985.

He also worked for the Federal Aviation Administration, retiring in 1983 as deputy director of the New England Region.

W. BRADFORD INGALLS (ENG '51, SMG '54), 75, on January 18.

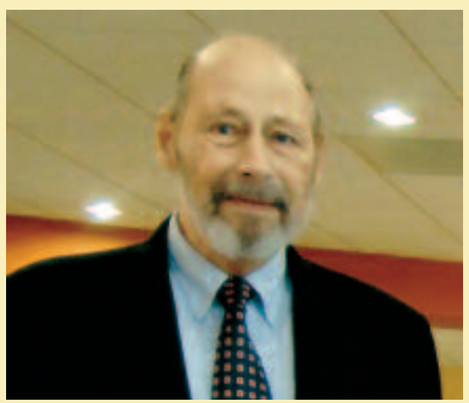
An active alumnus, Mr. Ingalls and his wife made a large donation that facilitated construction of the College's student resource center that bears his name. "It was a project that appealed to me because I think that helping the students is where it's at," Mr. Ingalls said as the College prepared to open the W. Bradford Ingalls Engineering Resource Center in September of 2005. "I wanted to help current students, help attract new students and help the College produce a better product."

Mr. Ingalls was among the first to receive a Boston University engineering degree when the University acquired the school Mr. Ingalls had been attending just as he completed degree requirements. While attending school part time, he worked a classified day job developing heat-resistant tiles to protect space vehicles during reentry. A similar design is still used on the space shuttle. After graduation, he briefly taught project engineering in what was then called the College of Industrial Technology.

Mr. Ingalls had a highly successful career in engineering and was a licensed pilot.

He is survived by his wife, Joan.

CHARLES H. RAYCHARD (ENG '51), on June 7, 2005.



W. Bradford Ingalls

JOHN GRIECO (DGE '56, ENG '59), on February 1.

Mr. Grieco, a fomer vice president of sales and marketing at PMX Industries, received the College's Distinguished Award for Service to Alma Mater in 2003. The award honors alumni who have worked to enhance the stature of the College of Engineering through their voluntary association with the University.

RUSSELL E. TEMPERLEY (ENG '57), on October 15, 2005.

ROBERT T. REARDON (ENG '58), on December 21, 2005.

ANTHONY J. TRIMARCHI (ENG '58), 72, on November 3, 2005.

LEONARD S. PHILLIPS (ENG '59), on February 17, 2005.

DOMENICO A. TORRISI (ENG '61), on September 26, 2005.

JOHN A. OLSEN (ENG '63), on December 7, 2004.

R. BARRY RICKARD (ENG '63), on September 30, 2005.

ROBERT L. HARRIS (ENG '64), on November 29, 2005.

CHARLES W. HARDING (ENG '65), on April 9, 2005.

GING S. LEE (ENG '70), 47, on September 28, 2005.

Recipient of a BS in systems engineering, Mr. Lee was an active member of the College of Engineering Alumni Board.

He started his career as a member of the technical staff at the Bell Labs Systems Response Group, working on the US SAFEGUARD antiballistic missile program. Concurrently, he earned a master's degree in operations research at Columbia University in 1972.

He moved back to Boston early in his 28-year term at Bell Systems, taking early retirement in 1997. For a year, Lee worked for MathWorks as an Information Systems Manager and subsequently became a good clinical practice and computer systems validation auditor at PAREXEL.

Mr. Lee received the College's Distinguished Award for Service to Alma Mater in 2003. The award honors alumni who have worked to enhance the stature of the College of Engineering through their voluntary association with the University.

CHRIS NOEL (ENG '82), 45, on January 29.

JOHN V. BIANCO (ENG '84), 43, on November 17, 2005.

A former member of the College of Engineering Alumni Board, Mr. Bianco was an active alumnus.

A specialist in intellectual property law, Mr. Bianco was a partner in the Fish & Neave IP Group at the law firm Ropes & Gray.

He is survived by his wife, Grace Curley, and two daughters.

CHRISTINE MICHELLE MAYNE (ENG '94), on October 10, 2005. ■

CLASS NOTES

1969

DAVID HOLLOWELL (MFG)
Newark, Delaware

At the 2005 AIA national convention David was recognized by the American Institute of Architects with honorary membership—the highest honor afforded by the AIA to a non-architect—in recognition of his contributions to campus architecture both at Boston University and the University of Delaware. He was also appointed to the newly restructured Boston University Alumni Council (BUAC) in 2005, a 40-member council with representatives from each of the University's Schools and Colleges. You can e-mail David at *Dave.hollowell@udel.edu.*

1977

RON HOPKINS (BME)
Pembroke Pines, Florida

I am working in the medical device industry—specifically cardiology—and have lived in the Ft. Lauderdale area for almost 14 years. I've been working in this industry for 25-plus years. My oldest graduated from college last year with a degree in business/MIS and a minor in music; my youngest is a sophomore studying for a dual criminal justice/pre-law degree and is also a member of a mock-trial team. I just celebrated my 24th wedding anniversary; the wedding was at BU's Chapel. I have two Boston Terriers, Sally and Gabby. I try to follow BU's hockey team, but it is difficult getting any news "down here." Hope everyone is well.

THOMAS ROKOWSKI (AME)
North Brunswick, New Jersey

I am a technical solutions architect for SAP America, a long way from my aerospace engineering degree. I have worked for SAP for nine years now and have been in the computer software business for over 20 years in many roles, including systems administration, computer software retail district manager, and system technical consultant. Contact me at *Thomas.Rokowski@sap.com* or *Tom3@aol.com.*

1979

STEPHANIE TERCYAK (BME)
New Britain, Connecticut

Stephanie is deputy manager of requirements and verification for the Joint Strike Force engine program at Pratt & Whitney. You can e-mail Stepanie at *tercyak@aol.com.*

1985

AL JAMES (AME)
Wilmington, Massachusetts

Hello to the engineering class of 1985. I would like to give a shout-out to my "homeboys": Brian Johnson, Paul Faustin, Lance Batson and Matthew Murphy. Get back in touch with me at *albert.james@ametek.com,* where I'm working as a senior project engineer.

1986

STEVE RYAN (MFG)
Latrobe, Pennsylvania

I have taken a position with ABB as the total quality manager for high-voltage products in Mt. Pleasant, Pennsylvania. To all the guys I played baseball with and all the guys at Lambda Chi Alpha, I wish you the best and hope to hear from you soon! Contact Steve at *ryan.stephen@comcast.net.*

WILLIAM SHAMPINE (ECE)
Syracuse, New York

Bill Shampine received certification as a PMI project management professional. He is employed as a senior project manager in the professional services organization of Hand Held Products in Skaneateles Falls, New York.

1987

QUEENIE (TAN) KOMORI (ECE)
Honolulu, Hawaii

Aloha from Hawaii! I am married and have one little girl, age 4. I am working for Hawaiian Electric Company in Honolulu. I've also been busy working on several school programs at various grade levels to promote engineering and foster interest in this field. I completed my master's degree in information systems and passed my EE license exam. I'd love to hear from former classmates. I can be reached by e-mail at *q.komori@heco.com.*

1988

COMMANDER MIKE COLMAN (ECE)
Arlington, Virginia

I am currently stationed with Multi-National Forces, Iraq, as the deputy secretariat for strategy, plans and assessments. I am working at the U.S. embassy in Baghdad until the end of August 2006. Feel free to e-mail me at *michael.colman@iraq.centcom.mil.*

JEFF LINCOLN (AME)
St. Augustine, Florida

I'm working at Naval Station Mayport, in charge of aviation readiness, force protection and counter-narco terrorism for the 13 ships of Destroyer Squadron 14. My wife Lisa works in treasury services for Wachovia Bank. We recently built a new home in St. John's County, Florida. E-mail me at *jeffrey.lincoln@navy.mil.*

1990

CHRIS SYVERTSEN (MFG)
Madison, Connecticut

Chris Syvertsen is the general manager of Unicast Development Company in New Haven, Connecticut, which manufactures ceramics for a proprietary precision casting process that it markets worldwide. Chris lives in Madison with his wife, Melinda, and three children, Erick, Emily and Elise. E-mail Chris at *csyvertsen@alum.bu.edu.*

1991

SHEILA (NOWAK) DOOLEY (ECE)
Indiana

Sheila married Randy Dooley in Las Vegas on May 27, 2005. She moved to the Indianapolis area in September 2005 and started a new job as a business analyst with ASAP Automation in November 2005.

ODED LOEBL (AME)
Israel

After flight testing in the air force, I went from aeromechanics to biomechanics. I have worked as a project manager for various start-up companies. I am married with two boys, ages 1 and 3. E-mail me at *loebl_o@yahoo.com.*

ALAN MOK (ECE)
Hong Kong

Alan works in software outsourcing services, IT & Telecom consulting and project management services, recruitment and talent management services, and China market strategy services. Contact him at *alan.mok@brooklines.com.*

HENRY D. NGUYEN (AME)
Pacific Grove, California

Hello from sunny California. I'm enrolled at Naval Postgraduate School for an 18-month graduate program in systems engineering on behalf of my company, Northrop Grumman. I'm in the unique position of being one of five civilians attending a military institute. Lisa (formerly Jensen, CLA/SED '91), our two daughters, Haley and Jenna, and I are enjoying our new locale; it's a definite change from our hurricane-ravaged hometown of Ocean Springs, Mississippi. E-mail me at *hnguyen@prodigy.net.*

1992

CRAIG HUFFNAGLE (ECE)
Stafford, Virginia

I married Eshale (Byrum) on Oct. 31, 2005. I am still in the Navy and was promoted to lieutenant commander in 2002. I just transferred from Helicopter Sea Combat Squadron 25 in Guam to the Pentagon. E-mail me at *cbhuff@alum.bu.edu.*

JACQUI (HAZARD) O'KEEFE (BME)
San Francisco, California

I'm living in San Francisco with my husband Mark and 3-year-old daughter, Chloe. After a 10-year stint in biotech as a process engineer, I am happily ensconced at Macy's, working in the corporate training and development department. I'd love to hear from any BME classmates. E-mail me at *jacquihazard@yahoo.com.*

1993

VINAY CHANDRA (ECE)
Atlanta, Georgia

Vinay and Nandini Chandra are happy to announce the birth of their second daughter, Gauri, on March 8, 2005. Like their first daughter, Venya, Gauri was born in Bangalore, India, where she could be closer to grandparents and family. Vinay is currently spending his time between Bangalore and Atlanta, growing Resourcis, an executive recruiting business in the United States and Asia. He would love to hear from old classmates and friends. Write to him at *vinay@resourcis.com.*

KENNETH RICCI (AME)
Orlando, Florida

I recently completed my master's degree in mechanical engineering at UCF. I transferred from Disney's Animal Kingdom Engineering Services into a senior mechanical engineer role at Walt Disney World Ride and Show Engineering in January. I would love to hear from any former classmates; they may e-mail me at *Imagineer71@msn.com.*

1995

CHRISTOPHER J. MILLER (AME)
Sydney, Australia

Adding to my current 14 film projects and screen credits and 2 video game credits in Los Angeles, I am in Australia for my next movie project. Having completed work as a lighting technical director for *The Chronicles of Narnia: The Lion, The Witch, and The Wardrobe,* my next production takes me Down Under to work on productions at Animal Logic Studios, where I will be responsible for the effects for all three *Matrix* films, *Moulin Rouge, The House of Seven Daggers,* and award-winning Cartoon Network spots.

DAN TOLLIN (BME)
Aurora, Colorado

After grad school at Oxford and a stint as a post-doc and research faculty at Wisconsin, I have moved to the University of Colorado Medical School as an assistant professor of physiology and biophysics. I recently received a five-year grant from the National Institutes of Health to study the development of the auditory nervous system. You can e-mail me at *Daniel.Tollin@uchsc.edu.*

MARC UBALDINO (BME)
Maynard, Massachusetts

Marc married Jennifer L. Cooper (SSW '03) in 2003. They live in Maynard and are expecting a baby in June 2006. Marc still works at MITRE after 11 years, and Jennifer works locally in philanthropy education. E-mail them at *ubaldino@verizon.net.*

JENNIFER WARE (BME)
Essex, Massachusetts

I work for New England Biolabs in Ipswich, Massachusetts. I worked in research for a parasitology/DNA sequencing lab for several years and have switched gears to be a product manager for molecular biology products. I have been there for 10 years now! I got married this summer to David Hough, in Newport, Rhode Island. BU alums in attendance were Ann Capela Zovein (ENG '95), Jamshaud Zovein (ENG '95), Betty Mattica (ENG '95), Adam Malhoit (ENG '95), Yee Chen Tjie (ENG '96) and Mehul Ganatra (ENG '96). I would love to hear from my fellow ENG '95 or ENG '96 alumni at *ware@neb.com.*

DEREK WIEBENSON (BME)
Chicago, Illinois

I have just passed my 10th anniversary working at Aksys Ltd. in the Chicago suburbs. We make hemodialysis machines so patients with kidney failure can treat the condition at home instead of traveling to clinics three times a week (remember the Kidney Center near West Campus?). Remarkably, this little start-up company has actually changed the dialysis marketplace. In 2004, I married Sarah Klipfel of Cambridge, Massachusetts. She is getting her master's in Urban Planning at the University of Illinois. We live in downtown Chicago and miss the hills and the ocean. E-mail me at *dwiebenson@yahoo.com.*

1996

JOHANNA FIFI (BME)
Washington, D.C.

I'm doing a stroke fellowship at the National Institutes of Health after finishing my residency in Philadelphia. E-mail me at *jotf74@yahoo.com.*

1997

KRISTA BOTSFORD (AME)
Burlington, Massachusetts

Krista left IBM in May 2005 to join Cooper Perkins, an engineering design firm in Burlington, Massachusetts. Shortly after starting, she and the partners spun off a subsidiary based on environmental compliance for electronics products, which she is now responsible for running.The business is focused on the European Union's RoHS directive but will expand into China and the U.S. markets when their legislation is final. She now lives in Merrimack, New Hampshire; and yes—she is still racing cars. E-mail her at *kbots@5-Trees.com.*

MATTHEW J. CAVANAGH (AME)
Cleveland, Ohio

I recently earned my JD, *magna cum laude,* from Case Western Reserve University School of Law. I am working as an associate at the law firm of Baker & Hostetler, LLP in Cleveland. I also am engaged to be married in April of next year. E-mail me at *mattjcav@yahoo.com.*

PRATIK SHARMA (BME)
Atlanta, Georgia

Pratik Sharma recently launched Atyant Capital, an India-focused hedge fund, with his partners Vedant Mimani and Rahul Saroagi.

1998

KAREN FREEMAN (ECE)
Somerville, Massachusetts

Most of my career has been spent in the consulting world working as a software engineer for various companies in the greater Boston area, where I keep running into fellow BU alumni. I took a break and spent a year working for an exciting start-up and I got to revisit some of my EE days a bit. In between extensive work-related travel, I reside in Somerville, Massachusetts, enjoying Anna's burritos rather than the Burrito Max kind.

SERGIO TORTORA (MFG)
Norwalk, Connecticut

Hi! Well, I've been pretty busy since graduating in 1998. I entered the GE Operations Management Leadership Program (OMLP) at GE Aircraft Engines in Lynn, Massachusetts. Since then I entered the Six Sigma program and have been a black belt at GE Capital and a master black belt here at NBC Universal. Currently, I manage both the Six Sigma and project management programs for NBC-TV Operations and Production Services. I am also a GE OMLP campus recruiter. I met my wife Michelle (COM '98) at BU, and we got married at Marsh Chapel in 2002. We've been happily married, living in Norwalk, Connecticut, and just had our first child—Alexa Nicolina was born on Sept. 21, 2005.

1999

IRAD BEN-GAL (MFG)
Tel Aviv, Israel

Irad is a professor of industrial engineering at Tel Aviv University.

(JOSE) RICARDO PINEDA (MFG)
Tampa, Florida

Since 1999, I have been an exclusive agent for Allstate. I started from scratch with only one office and within five years had grown so much that I opened a satellite office in southern Tampa. The business is booming, especially the workplace area (health and voluntary benefits); my office has a leading team of benefit specialists (bilingual) who travel nationwide. On a personal note, I just became a grandfather for the first time and want to send off a quick hello to my fellow alumni.

YOAV SHAPIRA (ECE)
Brookline, Massachusetts

Yoav married Allison Shapira (formerly Greenspan, CAS '99) in April 2005 in Sarasota, Florida. Among the wedding guests were Paul Norgaard (ENG '99), Caleb Randall (ENG '99), Peter Zwinakis (ENG '99), David Galpern (SAR '00) and Robyn Galpern (formerly Feldstein, SAR '00). Yoav and Allison live in the Boston area and welcome contact from fellow Terriers at *yoavs@computer.org.*

2001

DARO CASTRO (MFG)
Durham, North Carolina

Daro is currently working for GE Aviation's jet engine assembly plant in Durham, North Carolina. Recently, he became the quality leader for the GE portion of the GP7200 engine assembly; the engine that will be used on the Airbus A380, the largest airplane in history. The engine is being built as part of a joint venture between GE and Pratt & Whitney. This past semester he started working on his MBA at Elon University in Elon, North Carolina.

SHANE MIGLIORE (BME)
Atlanta, Georgia

Shane Migliore married Bobbi-Jo Munson in June 2005 in North Palm Beach, Florida. The bridal party included Thomas DiCicco (ENG '01). Other alumni attending included Elizabeth Abbate Hyman (COM '00), Eric Hyman (ENG '00), Nadeen Chahine (ENG '01) and Mahima Santhanam (ENG '01). Shane received an MS in electrical engineering from Georgia Tech in 2004 and is currently pursuing a PhD.

2002

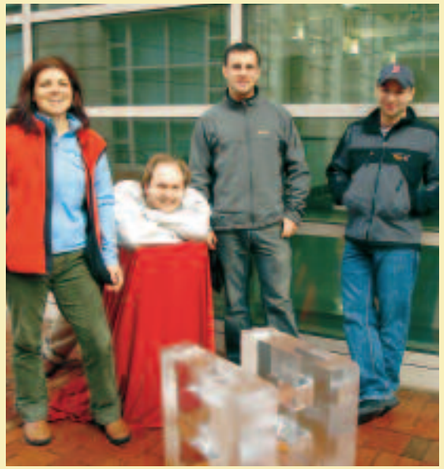
VINCENT LAURIA (ECE)
Palo Alto, California

Vincent recently moved to the San Francisco area from New York City. He joined a small start-up creating one of the first location-aware IM client applications, Meetro.com. Prior to joining Meetro, Vincent was a consultant in IBM's Business Consulting Services, where he had the fortune to help shape how IBM was approaching social networking as an emerging—and in some cases—disruptive technology. He spends much of his time following the trend of social software and its cultural impact on society. Outside of work, he has taken on a number of adventures, including live webcamming a tour of the southern United States, backpacking across Europe and taking the helm of an open cockpit biplane. Visit his website at *http://vinnie.net* or e-mail him at *vincent.lauria@gmail.com.*

What Are You Doing?

Send your Classnotes submissions to *engalum@bu.edu.*

Photos: ENG alumni relations office



Sirarpi Heghinian-Walzer ('79, '82), Jay Hancock ('99), David Lancia ('02, '04) and Viktor Vajda ('02, '04) with their ice sculpture at Winterfest, January 21.

ECE Professor Selim Ünlü, Nicholas Lippis III and Kenneth Lutchen, BME chairman, at the Annual Fund Leadership Giving Societies' member appreciation cocktail reception, January 20.

Eric Biagiotti (CAS '06), Gavin Gray ('05) and Rebekah Gensure ('05) at the hockey reception, January 13.

Mike Bufano ('95), Paul Bierden ('92), Carl Smith ('95) and Dave Susich (LAW '93) enjoy the reception prior to the BU vs. Maine hockey game, January 13.

David Hotchkiss ('04), Julie Perreault ('96, '99, '04), Sean Hardeo ('00) and Songeeta Palchaudhuri ('03) at the Backpacks to Briefcase alumni panel, February 22.

The Rollo Tomasi Quartet at the Annual Fund Leadership Giving Societies' member appreciation cocktail reception on January 20.

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We hope you will consider joining us. As a member of a Society, you will be part of a vital support system in BU's pursuit of excellence. Through your vision and generosity, you will also be an inspiration to others. Visit this website to join today: *http://www.bu.edu/alumni/giving/annualfund/societies/.* For more information, please contact Davi Axinn at 617-358-0500 or *daxinn@bu.edu.*

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Graham Robert Houtchens, ENG '07

TEGAN FAMILY SCHOLARSHIP FUND AWARD

"The Biomedical Engineering program has both challenged and inspired me. It demands deep mathematical and physical understanding and provides insight into cutting-edge developments. The Tegan Family Scholarship Fund helped to ease financial stress and allowed me to concentrate my time on academics, rather than on how to fund my education."

Michelle Young Chan, ENG '06

EXCELLENCE IN ENGINEERING BOOK AWARD

"A great education can be a financial burden, but thanks to the Excellence in Engineering Book Award, I was able to purchase all of the books and supplies I needed for my courses. The Book Award helped me out tremendously and encouraged me to never stop learning; the possibilities are endless."

Christina Rodriguez, ENG '06

SUMMER TERM ALUMNI RESEARCH SCHOLARS (STARS)

"STARS allowed me to spend the summer working in a high-tech lab learning sophisticated processes. My housing was paid for, allowing me to remain in Boston for the summer, which would not have been possible without STARS. I am really grateful to have been a part of it."