THE COLLEGE OF ENGINEERING



Reaching Out NC State Engineering Foundation, Inc. Annual Report 2003-04

From the Dean of Engineering



Fall 2004 marked the completion of Engineering Building I, the new home of the Department of Chemical and Biomolecular Engineering and the Department of Materials Science and Engineering. This long-awaited building represents a milestone in the history

of the College of Engineering in that it is the first academic building to be fully funded by the state since the construction of Mann Hall in 1964.

Over the years, burgeoning enrollments have packed our North Campus buildings to capacity. The development of Centennial Campus and the passing of the bond referendum have afforded NC State the opportunity to grow. With the construction of Engineering Building I, the College of Engineering is one step closer toward our goal of relocating to Centennial Campus.

The ribbon-cutting for Engineering Building I is planned for spring 2005, and later that year the construction of Engineering Building II will be completed, providing a new location for the Department of Computer Science and the Department of Electrical and Computer Engineering. The construction of these buildings is a result of the bond referendum of 2000, which shows support of education by the citizens of North Carolina.

More important than the construction of buildings, though, is what takes place within the walls — innovative research, teaching that will inspire generations of engineers and scientists, collaborative problem-solving - and the outreach that results from the teaching, learning and research.

In this issue of *Engineering Frontline*, we share with you some of the ways in which the College of Engineering is reaching out, whether through our K-12 programs, programs for underrepresented groups, workshops to help high school teachers with classroom instruction, extension activities that help communities and North Carolina industries find solutions to problems, research and technology that improves the quality of life, or individuals dedicating themselves to helping those in need.

A major boost this year to our outreach programs are grants of \$2 million from the National Science Foundation and \$500,000 from the GE Foundation to help fund a new program, Recognizing Accelerated Math Potential in Under-Represented People (RAMP-UP), a collaboration among the College of Engineering, the College of Education and the local public schools.

I hope you will enjoy reading about this initiative that has an impact on the future of our young people and about a few of the other outreach endeavors here in the College of Engineering at NC State.

— Nino A. Masnari Dean, College of Engineering Distinguished Professor of Electrical and Computer Engineering

Engineering Frontline

Engineering Frontline, created for alumni and friends of the College of Engineering at North Carolina State University, comprises news from the College of Engineering and the NC State Engineering Foundation annual report. Engineering Frontline updates appear throughout the year as Engineering Frontline–Online. Keep up with all the latest activities of the College of Engineering at www.engr.ncsu.edu.

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Upcoming Events

Engineering Career Fair McKimmon Center *February 3, 2005*

Endowed Scholarship and Fellowship Dinner March 18, 2005

Engineering Open House April 2, 2005

NC State Engineering Foundation Board Meeting and Dedication Ceremony for **Engineering Building I** April 22, 2005

Pullen Society Social **Engineering Building I** April 23, 2005

Change of Address?

Alumni, you can update your contact information online at

www.engr.ncsu.edu/ncef/registration

or send address corrections to

NC State Engineering Foundation, Inc. Campus Box 7901 Raleigh NC 27695

or call

(919) 515-7458 toll free: (866) 316-4057

engineeri



- ▶ ABOVE: Engineering Building I, which opened in fall 2004, is the new home of the Department of Chemical and Biomolecular Engineering and the Department of Materials Science and Engineering. (Photo: Becky Kirkland)
- >> OPPOSITE TOP: Nuclear Engineering's Lisa Marshall reaches out to high school students and their teachers. Story on page 12. (Photo: Jennifer Weston)
- >> OPPOSITE BOTTOM: Engineering alumnus Peter Powell is now a priest who helps the homeless. Story on page 8. (Photo: Gordon Joseloff)
- ▶ ON THE COVER:



Dr. Donald L. Bitzer, Distinguished University Research Professor of Computer Science, won an Emmy for his efforts in advancing television technology. In 1964 he co-invented the flat plasma display panel for his students working long hours at their computers. Plasma screens, which do not flicker, are a significant advance in television technology. A member of the National Academy of Engineering since 1974, Dr. Bitzer was designated a National Associate by the National Academies in 2002.

Dr. Don Bitzer - teacher, inventor, achiever.

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<u>news</u>



Engineering Building I

Engineering Building I opens

Engineering Building I, the new home of the Department of Chemical and Biomolecular Engineering and the Department of Materials Science and Engineering, opened in fall 2004. The new building brings the College of Engineering one step closer to its goal of relocating entirely to Centennial Campus. Classes will start in the new building in January 2005.

The new building contains 157,000 square feet of space that includes three theater-style lecture halls with wireless technology connecting students, professors and the Internet, a 4,800-square-foot lobby/atrium, administrative offices, conference rooms, laboratories, student lounges, computer labs, graduate student offices, faculty offices and faculty labs.

The College is already starting to plan for an exciting dedication ceremony on April 22, 2005.

Chemical Engineering gets new name

The Department of Chemical Engineering has been renamed the Department of Chemical and Biomolecular Engineering, effective September 16, 2004. The name change reflects the changing character of the profession, the increased interest in the biomolecular engineering concentration among chemical engineering undergraduates, the importance of biochemical engineering as a research focus and the department's association with the NC Biomanufacturing Training and Education Center.

Graduate students pursuing master's or doctoral degrees focus on scholarly research in cell and protein engineering; enzyme and conventional catalysis; electrochemical, reaction and bioreactor engineering; electronic materials; green chemistry and engineering; polymers and colloids; nanotechnology and interfacial science; thermodynamics and molecular simulation; and supercritical fluids. A distance education master of science degree in chemical and biomolecular engineering is also available.

Engineers develop breakthrough processes for creating self-assembled 3-D nanostructures

Nanotechnology promises to revolutionize modern life, but the impediment to progress has been an inability to create usable nanostructures that self-assemble. Engineers at NC State recently applied for a patent for two processes that help break that barrier. Dr. Jagdish "Jay" Narayan, the John C.C. Fan Family Distinguished Professor of Materials Science and Engineering and director of the NSF Center for Advanced





Materials and Smart Structures, and Dr. Ashutosh Tiwari, research associate in the Department of Materials Science and Engineering, have developed two methods for selfassembly of three-dimensional nanostructures. Their research is supported in part by the National Science Foundation.

The new methods open the door to creating new materials for a myriad of applications, including super-dense data storage, solid-state lighting, super-strong materials and advanced detection systems.

The two methods involve using pulsed laser deposition, which works with a variety of materials and reduces imperfections. Both methods produce consistent size and shape of the nanodots and demonstrate control of the materials that cannot be achieved by previously proposed methods. Since these new methods can create self-assembled matrices of nanodots both randomly and epitaxially, the applications are seemingly infinite.

The most interesting application may be the development of energy-efficient, low-cost, solid-state lighting that would use about one-fifth the energy of standard fluorescent lighting and last for approximately 50 years. Another application is the development of a chip that can hold 10 terabits of information, which is equivalent to 250 million pages.

According to Narayan, the key to moving nanotechnology from the laboratory to the consumer is keeping the cost of manufacturing low. These new processes make it possible to build a three-dimensional matrix of nanodots that is more efficient, costs less to produce and reduces the impact on the environment because all of the steps can be performed in the same processing chamber. Narayan anticipates that the first applications of the technology will be available to consumers within the next five years. Atomic-resolution electron micrograph showing (in cross-section) three-dimensional self-assembly of nickel nanodots of uniform size (6 nanometers) in alumina matrix. (*Photos: Dr. Jay Narayan*)

Biomanufacturing Training and Education Center to open in 2006

NC State has received a \$33.5 million grant from the Golden LEAF (Long-term Economic Advancement Foundation) to build the 95,000-square-foot North Carolina Biomanufacturing Training and Education Center (BTEC) on Centennial Campus. Golden LEAF receives one-half of the monies that flow to the State from the national tobacco settlement. Golden LEAF's objectives are "to promote the social welfare of North Carolina's citizens and to receive and distribute funds for economic impact assistance."

The design of the BTEC will simulate a biomanufacturing facility capable of producing sterile bulk biopharmaceutical compounds and will include support-training and education classrooms, laboratories, and building and process utilities. The facility will be outfitted so that students will gain bioprocessing experience using largescale equipment, including bioreactors, downstream separation and purification processes, bioreactor control systems and aseptic processing operations.

The BTEC will support the delivery of distance learning modules to sites throughout the state while hands-on laboratory sessions take place on-site. BTEC will also feature a training and education laboratory for biotechnology support staff. Dr. Peter Kilpatrick, head of the Department of Chemical and Biomolecular Engineering, was appointed BTEC's first director. Occupancy is anticipated for late 2006.

Journey from engineer to priest took a leap of faith

Alumnus Peter Powell devotes his life to helping the homeless

For the Reverend Dr. Peter R. Powell (BSChE '70) the journey from chemical engineering student to Episcopal priest required a leap of faith. He is president and CEO of the Interfaith Housing Association (IHA) in Westport, Connecticut - a career that allows him to combine his training as an engineer with his calling to serve others.

"During my years as an undergraduate in chemical engineering, my professors taught me to use a systematic approach to problem solving," says Powell. "In engineering you need to be able to break problems into solvable pieces so that they don't overwhelm you. The same is true for problems in the homeless community. The skills I learned as an engineering student have proved invaluable to me in my work with Interfaith Housing Association."

Powell's trek from the classrooms in Riddick Laboratories to a homeless shelter in Connecticut began while he was a student at NC State in the late 1960s. He explored the possibility of attending seminary during his junior year, but the seminary advisers told him to change his major to something in humanities. Powell balked at the idea.

"Once you've passed physical chemistry and are just one year from finishing a chemical engineering degree, you can't justify giving up and moving down a totally different degree path," says Powell. He remained at NC State. After graduation Powell took a job with Procter & Gamble.

"After I worked for several years, I wondered again about the direction of my life," says Powell. "I began to wonder if I was really being called to the ministry and decided to find out."

Powell left his job in 1973 to attend Virginia Theological Seminary, where he earned a master's degree in divinity in



Peter Powell works to improve the lives of the homeless. (Photo: Audrey Sparre)

1976. He continued his exploration of Old Testament theology and earned a master's degree in theology from Princeton Theological Seminary in 1979 and a doctor of ministry degree from the University of the South in 1997.

Powell was serving as rector of a church in Weston, Connecticut, when he began to wonder, again, about the direction of his life and decided to work with the homeless. In 1988 he accepted the presidency of Interfaith Housing Association, thinking that he would give it six months and then move on. He never left.

When Powell joined the association, it was a fledgling organization with a total budget of \$90,000 and a failing halfway house. He tackled those challenges using problem-solving skills learned in his engineering classes at NC State.

In the 16 years since Powell began working with the association, the budget has grown to \$1.6 million, most of which is privately donated money. The association now employs 21 staff members and serves 30,000 meals per year. The shelter capacity has increased from the original 15-bed, overnightonly facility to include two shelters, two halfway houses and a 3-house complex. Each emergency shelter operates continuously, making IHA one of the few Connecticut shelters to provide round-the-clock services to the homeless. Each of these facilities has been added under the leadership of Powell and represents a tremendous expansion of services for the Westport community.

The Interfaith Housing Association also sponsors programs that attack homelessness from a variety of angles: PRIDE, an intensive employment-readiness program designed to help people with barriers such as mental illness; Women's Interfaith Network (WIN), a one-on-one mentoring program to help homeless and at-risk women build self reliance; and the Gillespie Work Force, a structured work force re-entry program for shelter clients.

One of the most exciting projects implemented during Powell's tenure is Homes With Hope, a program that provides permanent housing for the formerly homeless who have a mental illness that prevents them from living independently.

Powell says that the current trend in government funding focuses on sheltering rather than offering permanent housing for the homeless, a practice with which Powell strongly disagrees.

"Long-term sheltering is destructive," says Powell. "People do better when they are not placed with 15 strangers in a large room. It is a matter of dignity. We try to treat the homeless with the same dignity we would expect for ourselves." Powell believes that people who are subjected to long-term sheltering begin to lose their ability to think or act on their own. By giving them a permanent housing opportunity a place to call their own - Powell says they are more likely to stay engaged in life and function better over time.

In addition to his program development responsibilities, Powell serves as the association's lead fund-raiser, finding resources in the community to support the association's efforts. The association avoided holding fund-raising events in the past, relying on support from individuals and community service clubs.

"People are often surprised to find that a community as affluent as Westport has a homeless problem," says Powell.

The path to homelessness varies for each person, explains Powell. Common to most in Fairfield County or affluent towns like Westport is addiction or mental illness. Also, in the present volatile economy, those who are fragile in their employment may become homeless as a result of unexpected job loss.

> Powell appears on stage at a Westport fund-raise to benefit the Interfaith Housing Association. (Photo: Gordon Joseloff/WestportNow.com)

"My interest in the issues of poverty has a theological basis," says Powell. "I take my direction from Matthew 25. I believe the issues of poverty are an integral part of the New Testament teachings."

In addition, Powell is convinced that the journey to recovery from addiction is a spiritual one. "It is a spiritual process that heals the addict," he explains. "Not necessarily a Christian process, but it is spiritual. My experience tells me that addiction is an illness of the spirit."

Powell's life has been a faith journey that he hopes will lead him and his wife, Barbara, back to his father's hometown of Pittsboro, North Carolina. He says the course of his life would surprise those who knew him in the 1960s and that the most valuable lesson he learned while at NC State came from the chemical engineering professors. "They taught us to be curious," he says. "Curiosity is so important in life."



Inspiring future engineers



Bottomley a boon to K-12 students

Bottomley holds up 10 fingers to lead the countdown. Ten ... nine ... eight ...

Nearly 60 kids from grades 2 through 5 chime in — a little off count but at the tops of their lungs.

Three ... two ... ONE! BLAST OFF!

So goes a typical afternoon for Dr. Laura J. Bottomley, director of the Women in Engineering and Outreach Programs in the College of Engineering at NC State. Tirelessly dedicated to breathing new life into math and science education, today Bottomley leads two classrooms at a Raleigh elementary

school in a physics lesson. From a box of scrap materials ranging from paper towel rolls and torn nylons, to plastic

Anything goes with these rockets. "Just leave one end open for the engine," Bottomley reminds Carolina Giraldo (left) and Clementine Obama.

Laura Bottomley directs the Women in Engineering and Outreach Programs for the College of Engineering at NC State. *(Photos: Bradley Wilson)*

spoons and straws, students in groups of four design their own rockets with only two rules: be creative and try to incorporate everyone's ideas.

After slightly nervous teachers affix Class-A rocket engines with a hot glue gun, Bottomley adds the electronic ignition wire. Then comes the exciting culmination of the hour-long lesson. The students pour out of the classroom and gather at the edge of the baseball field — a safe distance away — to watch their creations blast off from a launching pad on the pitcher's mound.

It doesn't take long to realize that "blast off" is a relative term. While some of these recyclable inventions shoot straight up 20 to 30 feet, others sling sideways, dropping parts, a couple barely clear the pad, and one goes 10 feet up and makes three sloppy circles parallel to the ground before dropping within inches of second base.

But hang time doesn't matter to these kids. Regardless of the results, they cheer, laugh and clap. And they learn a little something about propulsion and aerodynamics in a way that likely makes an impression. Perhaps even a permanent one.



Bottomley lives for this reaction. "Look at those kids," she beams. "To see the smiles and the excitement in their eyes that's why I do this. I want to show them how fun science can be, and you can't get that from a textbook."

Everybody likes rockets, Bottomley notes. She's even been known to turn herself into one. Speeding down a school hallway while sitting on a skateboard and clutching a CO_2 fire extinguisher, she inspires visions of Wile E. Coyote on the hunt. But there's a method to her madness. "Kids love it when they see adults do silly stuff. It's a great way to get their attention."

Recently, she managed to translate her "silly" experiments into serious funding and lofty educational goals. Along with Dr. Karen Hollebrands and Liz Parry from NC State and Dr. James Nelson from Shaw University, Bottomley is the principal investigator of a \$2.5 million grant program called Recognizing Accelerated Math Potential in Under-Represented People (RAMP-UP), which aims to provide under-represented students in the Wake County public school system with the foundation necessary to pursue careers in engineering or other math-based fields.

According to Bottomley, while Wake County students do fairly well in math testing, there is a significant achievement gap in the performance of African American, Hispanic, Native American, special-need and at-risk students. This shortcoming, together with other factors, leads to the inability of these students to enroll in higher math classes in middle and high school and eventually to their severe under-representation in freshman engineering and science classes.

Grades 3 through 8 are especially important targets for the program, she said. "This is when students must develop a strong basis in math. They must also not develop a feeling of incompetence or a dislike of the subject. This early impression can have a great impact on their future."

The group plans to form teams of students — drawn from NC State's colleges of Engineering and Education as well as mathematics majors from Shaw — to work alongside teachers to develop lesson plans, or perhaps to directly tutor a select group of students. "Customization will be key," Bottomley notes.



One of Bottomley's rockets makes three circles parallel to the ground before dropping within inches of second base.

Ideally, Bottomley hopes, the interaction will instill a new appreciation for inquiry-based instructional techniques and for the use of creative engineering as a vehicle for teaching mathematics in the K-12 classroom. "And who knows?" she added. "Maybe some of these kids will become great engineers or scientists. That would be really cool."

\$2 million NSF grant boosts RAMP-UP program

NC State University received a \$2 million grant from the National Science Foundation (NSF) in 2004 to support educational collaboration with Wake County public schools.

The grant helps fund a new program called Recognizing Accelerated Math Potential in Under-Represented People (RAMP-UP), which seeks to raise interest and performance in math for women and minorities. The colleges of Engineering and Education at NC State first launched the program with the help of a \$500,000 grant from the GE Foundation.

"The NSF grant also paves the way for a new partnership with Shaw University," noted Dr. Sarah A. Rajala, associate dean for research and graduate programs in the College of Engineering.

RAMP-UP is designed to promote and facilitate the teaching of problem-solving and inquiry-based mathematics to children in grades K–12.





Lisa Marshall holds a Geiger counter she uses to demonstrate how common items often contain naturally occurring radiation.

Nuclear Engineering thrives under the Marshall plan "When you hear 'nuclear engineering,' what comes to mind?"

That's the first question Lisa Marshall asks when she enters a classroom. As director of outreach for the Department of Nuclear Engineering, she gets some interesting responses.

"I usually hear 'the bomb,' 'radiation,' 'glow in the dark' and then some component of the latest Hollywood movie that has anything to do with nuclear engineering," she said.

Marshall relies on the idea that if you understand something then you don't have to fear it. That's why her main thrust since coming to NC State in 2001 has been to reach as many students and teachers as she can to increase their awareness of the field of nuclear engineering. Through science teacher workshops, classroom visits, open houses and summer programs, Marshall and others have demystified nuclear science for dozens of teachers and more than 4,000 pre-college students in the past three years.

Once initial fears and misconceptions are set aside, Marshall said one can start teaching about nuclear theory, fission and fusion, and the role of nuclear science in our daily lives. "We utilize it on a daily basis but are not necessarily aware of it."

Take nuclear medicine — one out of three people going into the hospital come into contact with nuclear medicine, whether through barium enemas that help diagnose gastrointestinal abnormalities, therapeutic radiation treatments for prostate and breast cancers or radiation used to sterilize medical supplies and instruments.

Beyond medicine, nuclear technology is found in items that people come in contact with on a regular basis: campsite lanterns, smoke detectors and polymerized plastics in car dashboards. Irradiation also is used to kill dangerous illnesscausing microorganisms, such as salmonella and E. coli, which frequently contaminate meat and poultry.

The main point for Marshall is that nuclear technology has been used safely and successfully for years. At controlled levels, it can be a great benefit in many aspects of our lives, including power generation. Nuclear power currently provides 21 percent of all US energy resources. Marshall organizes workshops for high school teachers each spring and programs for high school students in summer. (*Photo: Felicia Watson-Gray*)

The prevalence of nuclear science in North Carolina's high school curriculum has created a target audience for Marshall.

According to Marshall, science teacher workshops, held each spring at NC State's nuclear engineering department, are invaluable for those who want to increase their knowledge of and comfort level with nuclear engineering. These workshops include lectures on radiation sources and radioactivity, nuclear reactions, detection and biological effects, combined with hands-on radiation detection and exponential law experiments plus tours of the research reactor and neutron activation analysis lab. "When teachers are comfortable with the material, they pass their enthusiasm on to their students," Marshall noted. She makes several classroom visits per year.

NC State also hosts the Young Investigators' summer program in nuclear technology, a three-week residential program held every July that provides high school students with an in-depth education in nuclear engineering topics and an opportunity to perform hands-on experiments.

Working so closely with students has made for some interesting revelations, Marshall noted. As soon as she brings up forensics or nuclear medicine, she is bombarded with questions concerning the latest television episode of "ER" or "CSI." To Marshall, this reaction points out a group of students not necessarily interested in going to medical school but fascinated with the technology. "I can show them that there are other ways to link their interests to future study or work opportunities."

Originally from Trinidad, Lisa Marshall was educated in Ottawa, Canada, where she worked before moving to Raleigh. She started her PhD in the geography of science in fall 2004. Her husband is a technology education student at NC State. In her free time, Lisa enjoys yoga, cultural arts and travel.



Understanding the high school mind assists Marshall in another major aspect of her job — undergraduate recruitment — and she goes about it in an unusual way. Marshall uses Geographic Information System (GIS) mapping techniques to identify high schools and individual candidates with the best potential for advancing nuclear studies. "There is a culture around knowledge production in the scientific realm," she explained. "I'm looking at the environment in which nuclear science is produced." It's her belief that recognizing those students with high PSAT and SAT scores and an expressed interest in engineering, then mapping them by county, will make her a more effective and efficient recruiter.

Marshall said that the national trend shows a growing interest in nuclear science from students, as well as from government and industry. Such unique recruiting methods could quickly become a big advantage in maintaining and building on a strong nuclear engineering program that recently celebrated its 50th anniversary.

"Nationwide, there is an increase in the number of students going into nuclear engineering," she said. "We want to keep in line with that trend — but most importantly, we want to attract the highest quality students."





Alumna Karen Burg infuses new life into breast reconstruction research Karen Burg was included in MIT's list of the world's 100 Top Young Innovators in 2003. She has also received a 2002 Presidential Early Career Award for Scientists and Engineers and a 2001 NSF Faculty Early Career Award. *(Photo: courtesy of Clemson World)*

You can hear the excitement in Dr. Karen J.L. Burg's voice and for good reason. Her innovative research with injectable transplants may one day provide a more natural and minimally invasive surgical alternative for breast-cancer survivors.

NC State University alumna Burg (ChE '90), associate professor of bioengineering at Clemson University, conducts most of her research as director of the university's Tissue Engineering Laboratory. Her breakthrough technique involves extracting a relatively small number of verified healthy cells from a breast-cancer patient and cultivating these cells on synthetic, biodegradable beads no larger than one millimeter across. The cellular beads are then mixed with a low-viscosity, biodegradable gel, placed into a syringe and injected into the damaged area of the breast, following a lumpectomy or mastectomy. Once inside the body, the beads dissolve slowly, allowing time for the new cells to mature and replace the removed or damaged tissue.

According to Burg, the technique would reduce scarring, help restore the breast's natural shape and promote quicker surgical recoveries than would traditional reconstructions. Additionally, since the patient is the donor of the injected cells, the need for immunosuppression is eliminated, and complications that accompany traditional transplant surgeries are minimized. Finally, after complete dissolution and absorption of the beads and gel, only natural breast tissue remains.

"I know so many women that have had breast cancer," Burg said. "Women at the university, in my own family — all over. They are extremely excited about the possibilities."

After earning her PhD in bioengineering at Clemson, Burg researched tissue engineering at Carolinas Medical Center in Charlotte, North Carolina. While there, she worked closely with an oncologist who wanted someone to look at possible breast reconstruction methods, integrating cellular biology and engineering concepts. For Burg, it was an irresistible and invaluable opportunity.

"I was able to shadow him and see the human side of things. It was a unique and exciting time for me," Burg said. "All these patients were terribly strong women and very open about their experiences. It was important for me to recognize how each case is slightly different and how treatments vary. They gave me a better perspective on what might or might not work."

For Burg, the patients not only provided good technical and practical information, they also provided her with an indelible source of motivation. "There's no better source than the patients — they have to live with it, but they still have such a positive outlook on life."

Burg said she has patented aspects of her research and is working hard to license the technology with a biomedical company. "I'm hopeful the technology will be in clinical trials (tested in human patients) within the next five years." But as with any scientific venture, it's important to be realistic about the timing, she noted. "There's so much more to learn."



Adult stem cells grow on biodegradable beads. The cellbead interaction is key to developing viable tissue and is both cell- and material-specific. *(Photo: Chuck Thomas, Clemson University)*

NC State Offers Atomic Force Microscopy Short Course for Industry

For users of atomic force microscopy (AFM), NC State University has become the new place to go for information and training in the US. Dr. Phillip Russell, professor of materials science and engineering and director of the Analytical Instrumentation Facility, held the first NC State University international short course on AFM and other microscopies during summer 2004. Prior to moving the course to NC State, Russell conducted the course at Lehigh University. Russell plans to offer the short course annually in mid- to late-June.

"Most research universities have these instruments," said Russell, "but, to my knowledge, NC State is the only one in the US that offers this type of short course for industry users."

What makes the NC State short course unique is the laboratory work that gives participants the ability to experiment with techniques discussed in the lectures. In an effort to provide individual instruction, Russell limits the number of participants to a maximum of 24 people, usually technicians, scientists, engineers and researchers from various industries and universities around the world.

"Strictly speaking, we teach people how to use the instruments, how to design experiments and how to interpret the data," said Russell. "The lectures introduce them to the many options available with these instruments, and the laboratories help participants learn how to avoid the classic mistakes made in interpreting the information."

Russell works closely with vendors to provide a variety of instruments for use in the laboratories. The availability of different types of instruments in one place is especially important because it gives participants exposure to instruments they might not otherwise encounter.

AFM and other microscopies are used in a variety of industries. From shampoos to semiconductors, microscopy provides much-needed information about atomic-level structures. AFM, in particular, is an important tool in the emerging field of nanotechnology.

updates Grinding pork skins into biomedical gold



Pork skins aren't just for breakfast anymore. Chemical engineering and food science students at North Carolina State University recently collaborated on a senior design project that would not only turn pork skins into valuable biomedical material but could also address some pressing economic and environmental concerns facing

Steve Peretti

North Carolina - how to add value to hog wastes and increase manufacturing jobs.

According to the team of students and their faculty research mentors, a key lies in the development of a high-grade gelatin manufacturing plant in North Carolina. High-grade gelatin is a primary component of pharmaceutical drug capsules, as well as breakthrough medical devices such as wound dressings and plasma substitutes. The best raw material for the derivation of gelatin is pork skin. Currently, North Carolina is the second leading pork processor in the nation with nearly 75 million kilograms of skins produced annually, yet almost all gelatin is produced in the Midwest.

Dr. Chris R. Daubert, associate professor of food science and engineering, said the question of building an in-state gelatin manufacturing plant is a no-brainer. "North Carolina has abundant raw materials right here. We have numerous biotech and pharmaceutical companies. It just seems like a really good fit." According to student estimates, such a plant could easily generate annual revenues exceeding \$10 million. It would also create new jobs and help alleviate the state's hog waste problem.

While researching ways to manufacture high-grade gelatin for a North Carolina biomedical company, Daubert was struck with the idea that a North Carolina company had to rely on out-of-state companies for their gelatin. Along with Dr. Steve W. Peretti, associate professor of chemical and biomolecular engineering, he proposed the idea of researching the feasibility of building an in-state plant for a senior design project.

The multidisciplinary approach made for a much more interesting and detailed project. "We pushed the food science kids to be more involved in the process design, and the engineers to get down and dirty with the chemistry part," Peretti said.

The team of 10 students toured a pork processing plant in Clinton and brought skins back to campus to work on gelatin extraction methods. They then used computer-modeling software to design the physical plant as well as the production process. Essentially, collagen can be extracted from pork skins by grinding and chemical treatment, followed by a filtering process. The dried end-result is a gelatin ready for

sale to prospective companies. While regular-grade gelatin is used in the food industry, the biomedical industry can demand a higher grade of purity. Clean processing is the key, Daubert said. A controlled environment minimizes contamination by viruses, bacteria, pyrogens and endotoxins, all of which can seriously degrade the gelatin.



Market analysis performed by the students showed that a high-grade gelatin could bring in as much as \$1,000 per kilogram. Additionally, byproducts could be sold for use in fertilizers, generating additional revenue. The analysis further estimated that a company could get a full return on their investment in less than three years. Start-up costs would be relatively modest as well, according to Daubert. Further research is required to make this idea a reality, and given the strong pharmaceutical and burgeoning biotech industries in North Carolina, Daubert and Peretti agree it's an opportunity worth looking into.

updates Industrial Engineering's Electron Beam Melting machine first and only in US

North Carolina State University became the owner of an Electron Beam Melting (EBM) machine last spring – the first and still the only one in the country. The Swedish-made machine is capable of fabricating fully functional 3D metal parts of virtually any geometric shape within hours of their design. While this capability satisfies a growing need within the manufacturing industry for rapid prototyping, industrial engineering researchers are more excited about its potential value to biomedicine and space exploration.

Dr. Denis R. Cormier, associate professor of industrial engineering, demonstrated the EBM machine's power by holding up a three-inch-tall piece of steel resembling a rook from an expensive chess set. While the piece looks impressive with its faux brick facing, it's what's inside that counts. The braided rope running vertically through the rook's center and a spiral staircase lining the inside wall are indicative of the complex geometry this machine is capable of reproducing. "Conventional manufacturing techniques simply can't create something this complex," Cormier said.

To create any part, the EBM machine translates a 3D model developed in a CAD (Computer-Aided Design) program into a series of 100-micron-thick slices, then uses a 4.8-kilowatt electron beam to draw each slice onto a bed of metal powder. The beam, focused to a pinpoint and guided by a pair of mag-





Ola Harrysson

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netic coils, generates approximately 3100°F to fuse the powder as it draws the prescribed pattern. Between each drawing, the substrate lowers and another thin layer of powder is spread out, allowing the part to be built layer by layer, all within a vacuum chamber. Once the part is completed, it can be removed from the pile of loose powder and bead-blasted, then finished with conventional machining. Any unused powder can be recycled for later projects.

> TO CREATE ANY PART, THE EBM MACHINE TRANSLATES A 3D MODEL DEVELOPED IN A CAD PROGRAM INTO A SERIES OF 100-MICRON-THICK SLICES, THEN USES AN ELECTRON BEAM TO DRAW EACH SLICE ONTO A BED OF METAL POWDER.

The machine's geometric versatility suggests several advantages over conventional manufacturing. "You could design and produce a single part to replace a group of two or three parts," Cormier said. This combination could limit excess material and lessen the overall weight. It might even reduce the potential for problems normally associated with groups of moving parts, such as leaks or abnormal wear from illfitted parts.

Cormier and colleague Dr. Ola L.A. Harrysson, assistant professor of industrial engineering, are most interested in fabricating parts out of titanium. According to Cormier, titanium's strength-to-weight ratio is extremely high compared with most other metals.

"Practically speaking, that means it takes far less titanium to get the same strength as you would have with other metals," Cormier said. "This is very important for certain aerospace, military and high-performance automotive applications."

This technology could also benefit future space exploration. A space station, for example, could use such a machine to create replacement parts on site. "There would be no need to have a collection of spare parts on board when storage and weight are such a concern. NASA could just send a digital file with the design info."

⁴ THE PATIENT'S BONES ACTUALLY ACT IN CONFLICT WITH THE IMPLANT. AS SURROUNDING BONES AGE AND GROW, THEY TEND TO EXAGGERATE ANY SIZE OR SHAPE DISCREPANCIES OF THE IMPLANT. ^{*11*}

The main problem in this scenario would be size. The machine is bulky, measuring six feet wide, three feet deep and almost eight feet tall. Cormier is quick to point out that the largest portion is the vacuum chamber. "In space, vacuum is readily available — and free. You could set a machine up outside the space station." With such potential, it's no surprise that the NC Space Grant Consortium is funding some of his research.

Harrysson's key interest lies in biomedical applications. The first parts he plans to make with the new machine will be custom-designed bone plates for osteotomies — bone realignment surgeries. This surgery typically involves cutting a wedge out of a bone that is abnormally curved, then putting the bone back together straight and attaching metal plates to immobilize it as it heals. These bone plates are thin strips of titanium with pre-drilled holes. "Surgeons often have to bend them to fit properly, and the holes don't always line up as desired," Harrysson said. The EBM machine would allow surgeons to customize the shape and hole placement to best fit a patient.

Cormier, whose father underwent double knee-replacement surgery not long ago, knows that surgery is a pretty heavy commitment in terms of time, money and discomfort. Unfortunately, implants suffer from generic modeling. A surgeon might have six or seven different size knees to choose from, but implanting the "closest fit" often creates problems in the long run. "The patient's bones actually act in conflict with the implant," Cormier explained. "As surrounding bones age and grow, they tend to exaggerate any size or shape discrepancies of the implant." This can lead to implant replacement surgeries 10 to 15 years later. Parts custom-designed and produced using EBM technology and advanced imaging techniques (such as Computed Axial Tomography or CAT scan), would improve the fit of the implant and the life of the patient.

Additionally, bone implant manufacturers have to go through a rigorous procedure to prove that any materials they use are biocompatible. "Regardless of what material is used, there will always be a certain amount of wear in a joint implant, making it extremely important that the resulting particles not be toxic," Cormier said. Titanium and a cobaltchromium alloy have proven to be the safest metals in the human body and therefore the best choices for making bone implants.

Harrysson said he is expecting delivery of a batch of titanium-aluminum-vanadium composite – Ti64 (Ti6Al4V) – which is even stronger than regular titanium.

"Pure titanium can be too soft for high-load implants like knees and hips," he said. "Ti64 should prove to be a better implant material, and it's still biocompatible." The EBM machine's processing parameters will need to be refined to produce such fine-walled parts, he added.

Considering the time and expense it takes to create a single part, the EBM machine is not practical for mass production, Cormier said. However, in situations where only a small number of customized parts need to be made, such as surgical implants or space station replacement parts, "this process is much less expensive than conventional manufacturing methods."

Cormier and Harrysson are running several experiments each week, with some time set aside to produce prototypes for companies and government agencies. The approximately \$500,000 machine not only has great research potential but is already a smart investment as well, Cormier noted. "We're the only show in town."

student



The unknown minority Native American students straddle two worlds

Stewart Lowry, a biomedical engineering student, dances in the men's fancy during the annual Native American powwow. (Photo: Rob Bradley) "We are the unknown minority," Lisa Smith (BAPSY '04), a Seneca Indian, stated as she described some of the challenges Native American students face at NC State University.

It is true that their numbers on campus are small. There are only about 200 self-identified Native American students here, although NC State has the second largest enrollment of Native Americans in the University of North Carolina system, surpassed only by UNC-Pembroke. Most of the students are Lumbees who come from Robeson and adjoining counties in North Carolina. Other represented tribes include Haliwa-Saponi, Waccamaw-Siouan, Coharie, Sappony and Cherokee. However, their small numbers on campus do not explain the lack of understanding that these students often meet when they reveal that they are Native Americans.

CULTURAL DIFFERENCES CAN SOMETIMES AFFECT CLASSROOM SUCCESS. "NATIVE AMERICAN STUDENTS SELDOM ASK FOR HELP. "

Nichol Brewer, a Lumbee Indian and a junior in biochemistry, and Nina Chavis, also a Lumbee Indian and a senior in chemical engineering, would like the campus community to have a better understanding of Native Americans. Chavis believes that a Native American studies course offered on campus would help inform the community about Native American cultures.

Alisa Hunt-Lowery (MSIE '04) identifies with Brewer and Chavis. She knows what it is like to be a Native American undergraduate on campus because she attended NC State during the '90s and received her BS in textile engineering in 1998. She also assisted Native American students and other minorities when she served as assistant director of minorities for the College of Engineering.

"The Native Americans in North Carolina come from rural communities," Hunt-Lowery said. "They don't have a lot of interaction with people outside of their race. Coming to a large university like NC State is a culture shock. Native American students who come here are not used to explaining who they are, why they look like they do and why they



Alisa Hunt-Lowery (MSIE '04) knows what it is like to be a Native American undergraduate on campus.

talk the way they do. Those are some of the biggest issues, and those issues can become hurdles. Cultural differences can lead to social differences."

Cultural differences can sometimes affect classroom success. "Our students have a sense of humility," said Brett Locklear, assistant director for Native American and Hispanic student affairs in the Department of Multicultural Student Affairs and a Lumbee Indian. "They simply don't challenge or participate in classes, and Native American students seldom ask for help. Professors can take that as a sign of laziness or lack of preparedness."

Locklear also noted that it is considered a sign of disrespect for a Native American to look directly into someone's eyes. According to Locklear, "We have a cultural dissonance. If you don't understand it, then you work as best as you can to figure it out. If you still don't understand it, then you go to another student, but you never go to a professor."

In fact, Locklear knows firsthand that these students care very much, especially about issues that matter to them, such as their heritage. One way these students get to share their heritage with others is through an annual powwow sponsored by the Native American Student Association (NASA), the American Indian Science and Engineering Society (AISES) and the Department of Multicultural Student Affairs at NC State.

Powwows are social gatherings of American Indians from many tribes featuring drum music and dances that hark back to traditional summer gatherings of Plains tribes during the first half of the 19th century. The annual NC State powwow is held the first weekend in April. In 2004, when the Lumbee

tribe decided to move its spring powwow to the same weekend as NC State's, which would have drawn participants away from the smaller NC State event, the students found out and immediately sent out emails to Lumbee powwow officials. Within two hours, the Lumbee tribe had agreed to change their date. According to Locklear, the student's victory made them realize that they could successfully articulate their issues to bring about change.

Many of the students have worked diligently to promote awareness of their culture and advance the cause of Native Americans. One shining example is Shelly Strickland, a 2004 graduate in biomedical and biological engineering and the first Native American Park Scholar at NC State. A Lumbee Indian, Strickland won the College of Engineering Outstanding Senior Award for Citizenship and Service in spring 2004. As vice president of NC State's NASA, she established a program for Native American youth in the Triangle to help them develop cultural awareness and leadership skills. Other community service included helping the homeless and volunteering at urgent care facilities and health clinics. In addition to her community work, her academic honors at NC State were numerous: she won the Udall and E.J. Tyson Memorial Scholarships, was a National Collegiate scholar and was inducted into the Gamma Beta Phi, the Golden Key and Phi Eta Sigma societies. Strickland, who is also the 2003-04 Miss Indian North Carolina, recently entered medical school at East Carolina University.

Another Park Scholar, Cory Blankenship, a sophomore in political science, decided to start a Native American Resource Center during his freshman year. A Cherokee Indian, Blankenship wanted students to have access to

books, film and other media about Native Americans, so he started a group to garner support from alumni and friends to promote the history and culture of Native Peoples at NC State.

Perseverance of Native American students helped lead to the creation of the position of assistant director for Native American and Hispanic student affairs in the Department of Multicultural Affairs. Locklear said that, for a number of years, Native American students had pushed for an additional staff person to handle some of the special issues facing Native Americans on campus.

Hunt-Lowery was one of the students pushing for such a staff position. As a senior, she worked in the Division of Student Affairs. Her job that year was to create a report that explored the feasibility of changing the then-Department of African-American Student Affairs to the Department of Multicultural Student Affairs. In 2001 through the persistence of the Native American students and the leadership of Dr. Tracey Ray, director of multicultural student affairs, a new staff position was created, which Locklear now holds.

Locklear and Hunt-Lowery both agreed that Native Americans derive such perseverance from family and culture. Hunt-Lowery said, "We're very determined to be successful, and we are willing to work hard."

With an attitude of resolve for success, this unknown minority will not remain unknown for long, at least if these students have anything to say about it.





In spring 2004 Brett Locklear, assistant director for Native American and Hispanic student affairs in the Department of Multicultural Student Affairs at NC State, and several Native American Students from AISES and NASA shared their experiences as Native Americans. Seated (left to right) are Danielle Chavis, Brett Locklea and Lisa Smith. Standing (left to right) are Amy Dial, Quintin Hunt, Lynn Harris, Nichol Brewer, Brad Lowery Matt Hunt, David Hunt, Nina Chavis, Marcus Hunt and Ashley Lowery.

Spotlight For full-time mom, yellow brick road leads to NC State



Pursuit of a bachelor's degree in mechanical engineering is no easy task. Try balancing intense studies and lab work with the demands of being the mother of two teenagers and an active member of numerous community service organizations.

Meet Mary-Kathryn "Kit" Adcock, *summa cum laude* graduate from North Carolina

State University, May 2003. Spurred on by an innate urge to get the most out of her "free time," she has achieved a remarkable goal.

Adcock's initial motivation grew from her extensive volunteer activities. As part of her role with the Bald Head Island Conservancy, Adcock often discussed details of the Wilmington Harbor project with scientists throughout the state on how the widening, deepening and relocation of local waterways would affect area ecology. She wanted to learn more about the mechanics and engineering involved in potential solutions — and suspected people would pay closer attention to her ideas if she had better credentials. So, 20 years after receiving a bachelor's degree in economics from Duke University, Adcock decided to enter NC State's mechanical engineering program.

Early on, she had to attend classes while her kids were in school. "I tried to do whatever I could do between 8 a.m. and 3 p.m.," she said. Adcock quickly recognized that traditional academic programs were geared toward a four-year plan. Still, the professors she took courses from were flexible and supportive of her non-traditional approach. And while she admits she could have tapered back her community involvement, "I wasn't willing to give that up."

Seven years later, at the resolute rate of two courses per semester, Adcock completed her degree. "I would not have been able to achieve this dream if I wasn't able to go part time," she said.

Perhaps more challenging than her prospective pace was the sudden realization that being a middle-aged student in a college environment made her feel like a minority. "I'd never felt that before, and it made me very uncomfortable in class. I mean, I was old enough to be these kids' mom." Then she realized it wasn't the students that were making her feel that way — it was her own perception. "Once I got past my age issue, I had a blast."

Kit Adcock likes listening to music from Broadway plays. Her current favorite is "Wicked," a story focusing on the witches from *The Wizard of Oz.* She enjoys sewing, which she calls "engineering for women of my era," and working closely with the loggerhead turtle conservancy on Bald Head Island. She lives in Cary with her son, Brooks, and daughter, Ali.

In fact, the students became an unexpected source of inspiration for her. "Meeting kids from all over the state and seeing what motivated them, as well as the struggles they go through and their ability to balance work and school, gave me courage and made me realize you're never too young or too old — to handle any of these things."

Adcock's diverse interests provided additional inspiration for unique engineering projects. As an avid croquet player and a member of the US Croquet Association, Adcock couldn't help noticing the importance of engineering to her sport. "Croquet is like billiards on grass," she explained. "The wickets in competitive croquet are only one-eighth inch wider than the ball — you're working with very tight tolerances. So physics and engineering strategies, collisions and mechanics are all very important."

For an honors project in a materials engineering class, Adcock studied the makeup of croquet mallets, many of which are custom-made. Adcock studied the various types of wood, head shapes and edgings that could affect a mallet's center of percussion and overall ergonomics. She posted her results on the Internet and immediately received e-mails from zealous croquet players around the world.

Adcock even turned her love of ACC basketball into a paper — "Numerical Analysis of the Basketball Shot" — coauthored with mechanical engineering faculty members Dr. Larry Silverberg and Dr. Chau Tran and published in the ASME *Journal of Dynamic Systems, Measurements and Controls.*

Ultimately Adcock wants to design water features, such as pools and fountains, as a way to help educate children. "I believe children have a much better understanding of science than we give them credit for," she said. Water is a primary example. "Kids understand how it works, and yet not 'til sixth or seventh grade do we start teaching about volume or displacement. They already know this stuff from taking a bath. There must be a way to help kids develop confidence in math and science by exploring the artistic and scientific elements of water."

Adcock's interest in engineering appears to be contagious, if not genetic. Her son, Brooks, is a senior at NC State studying electrical and computer engineering. She has taken a couple of classes with Brooks in the past — they even studied for exams together. But her greatest satisfaction is being able to talk to her son about his interests in an intelligent way — a common goal for mothers. "It's fun because, if nothing else, with my engineering degree I wanted to be able to understand what he's doing. It is very rewarding."

More rewards are no doubt just around the corner. A selfproclaimed super-fan of The *Wizard of Oz* (she wore ruby slippers to her graduation ceremony), Adcock likens her degree path to that of the bewildered but goal-driven Dorothy.

"Education opportunities are the yellow brick road," she said. "The ruby slippers are what you take away from the experience. They can perform magic, and they're always there to take you where you want to go."

Wolfpack Motorsports is on a roll



Wolfpack Motorsports, a unique program at NC State, had both of its vehicles to score top-five finishes (out of 140) in the design portion of their international competitions in summer 2004. The Formula SAE is a scaled-down Formula One car that houses a 600cc motorcycle engine and is honed for tight turns and ear-pinning acceleration. The Mini-Baja is a roll cage with big wheels and a fully removable drive train that is welded with mud-slinging and durability in mind. Each vehicle is built from the ground up by students under the guidance of Dr. Eric Klang, associate professor in the Department of Mechanical and Aerospace Engineering. The first semester is spent designing and modeling everything from the brake pedal to the chassis. Building and testing (and repairing) dominates the second semester - culminating in a complex, multistage competition attended by engineering programs from all over the world.

spotlight Zorowski celebrates 50 years teaching mechanical engineering

Dr. Carl Zorowski refuses to slow down.

After 50 years pushing innovative teaching methods in mechanical engineering, he's got a right to. Instead, he's designing distance education courses for the Web and CD-ROM and preaching revitalization of undergraduate education. Topping it all off, after a nearly 20-year hiatus he's returning to the racetrack, tweaking his 36-horsepower Formula V to coax just a little more speed on the straightaways. Whether he's in a sports car or a classroom, Zorowski appears driven by two desires: have fun and push the limits.

Zorowski has been a member of the mechanical and aerospace engineering faculty at NC State University since 1962. He has served as head of the department and associate dean, authored more than 80 publications, and become an international authority on mechanical component and system design and on the mechanical properties of textile fibers.

Through it all, he has been repeatedly recognized for his teaching and research excellence with awards from the university, the American Society of Mechanical Engineers, the American Society for Engineering Education and the R.J. Reynolds Tobacco Co.

Zorowski began his career as a graduate assistant at Carnegie Institute of Technology (now Carnegie-Mellon). In spring 1953 he stepped in to teach a senior aerospace course. "After a couple weeks in class I thought, hey, this is kind of fun," Zorowski said. By the time he joined the faculty at NC State in 1962, he already had received national attention for his teaching innovations.

While at Carnegie, Zorowski and another faculty member began to incorporate a mechanical design competition in which seniors would have to build a prototype of their final project. This developed a lot of interest from educators out-



Carl Zorowski shows one of his talking textbooks on CD-ROM, appropriately titled "Design for Strength and Endurance."

side the institute. "I'm not sure anybody else was doing that sort of thing at the time," he explained. Zorowski incorporate ed senior design competitions into the curriculum upon his arrival at NC State as well. Senior design competitions continue today in the mechanical and aerospace engineering department.

Zorowski's program innovations have also won him acclaim. He initiated development of an interdisciplinary research program in fiber and textile mechanics, which resulted in his being named R. J. Reynolds Professor of Mechanical Engineering in 1969. He also directed a new interdisciplinary master's degree program in integrated manufacturing systems engineering, which was awarded the prestigious LEAD (Leadership and Excellence in Application and Development) University Award by the Society of Manufacturing Engineers in 1989.

More recently, working with Engineering Online, the college's distance education program, he developed a "talking textbook" - a combination of CD-ROM and Web-delivered materials that caters to continuing education and distance learning students.

Zorowski said he has had a lot of interesting and bright

students in his 50 years of teaching a key factor in his longevity. "One of the greatest challenges was to be able to teach in such a way that I could recognize that a light was going on inside a student's head." Engineering is almost like learning a foreign language, Zorowski said, in that students don't really understand the language until they start to think in that language. Watching a student start to think like an engineer is the most satisfying aspect of teaching, he said. "Once you see that light go on, you know they're on their way."

Zorowski recently realized he had taught five generations of doctoral students who had gone into teaching. "That's a real kick in the pants for me."

His affect on other educators has also been significant. In 1993 Zorowski assumed direction of SUCCEED (Southeastern University and College Coalition for Engineering Education), a multimillion dollar National Science Foundation program geared toward revitalizing undergraduate education. Due in large part to his leadership, the program has had a significant impact on undergraduate engineering education in the Southeast. Although Zorowski retired in 1997, he continues part time as director of assessment and evaluation for the coalition.

CONGRATULATIONS TO CHEMICAL AND BIOMOLECULAR ENGINEERING FACULTY MEMBERS ON RECEIVING TOP HONORS FROM THE NATIONAL SCIENCE FOUNDATION



Christine Grant

Zorowski said he plans to keep teaching as long as NC State will let him and as long as it's fun. "I want to keep seeing that light go on." As for racing, he has one more event to requalify for a track license and a return to the sport he loves. Zorowski's appraisal of his latest outing was succinct and typical: "The old bones were a little sore, but the car ran great."



Jason Haugh



David Ollis

▲ Dr. Christine S. Grant, associate professor of chemical and biomolecular engineering, received a Presidential Award for Excellence in Science, Mathematics and Engineering Mentoring (PAESMEM) in a special White House ceremony. Grant is one of only nine awardees for 2003. The award recognizes outstanding mentoring of underrepresented groups in science, mathematics and engineering.

▲ Dr. Jason M. Haugh, assistant professor of chemical and biomolecular engineering, received a 2002 Presidential Early Career Award for Scientists and Engineers (PECASE), NSF's highest award to young scientists and engineers.

A Dr. David F. Ollis, Distinguished Professor of Chemical and Biomolecular Engineering, received the NSF Director's Award for Distinguished Teaching

Scholars, the highest honor bestowed by NSF for excellence in both teaching and research.



Ric Porter

ALUMENT IN THE THE TIME Alumni marriage a tribute to Ric Porter



Newlywed alumni Thomas Vitolo and Jennifer Taranto met at the memorial service for their mentor, Ric Porter. (Photo: Terrell Russell)

Jenn and Tom got married — and they want all North Carolina State University engineering alumni to know it. Not just because they are themselves NC State graduates, but because they want to spread the word about their matchmaker and the amazing catalyst of their present careers.

Dr. Richard L. (Ric) Porter was assistant dean for academic affairs in the College of Engineering when he met Jennifer Taranto (CEM '00) and Thomas Vitolo (CSC '99, AMA '00). To each of them, and to countless other engineering students, Porter was mentor and friend. His thorough knowledge of the opportunities available in the College, and the occasionally daunting tasks associated with them, made academic life easier to navigate. On top of that, Vitolo said, "he was incredibly generous with his time and genuinely cared for students. That's what made him so special."

Porter passed away unexpectedly in 1999. Taranto and Vitolo, who after nearly four years in the College of Engineering had yet to cross paths, met at Porter's memorial service. After the service they had coffee together and shared their memories of Porter. They've been sharing coffee, and making their own memories, ever since.

"In a sense, Dr. Porter has full responsibility for our falling in love, even though he never thought to introduce us while he was alive," Vitolo said.

NC State University College of Engineering

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Porter's son, Nicolas, established the Richard L. Porter Memorial Scholarship in 2000. Taranto and Vitolo decided to make a gift to the scholarship fund as a part of their wedding celebration this past June, but they would love to do more to honor the man who had such an impact on their lives.

Vitolo, who grew up in Connecticut, came to NC State to study economics and computer science. Porter guided Vitolo through his degree programs and even pushed him to add a major in mathematics when he realized Vitolo was only a course or two away from getting a math degree. Vitolo won a Mitchell fellowship after graduation, which took him to Ireland to get his master's in financial and industrial math at Dublin City University. Now he is a PhD student at Boston University studying optimization. Or, as he puts it, "all math, all the time." He added, "This is all Dr. Porter's fault. I thought I'd come out of college as an economist."

Taranto came to NC State from Fayetteville to study environmental engineering but quickly decided it wasn't for her. A friend told her to see Porter. "He stepped right in and directed me to the construction management program, which I loved," Taranto said. She now works as a supervisor for a general contractor and spends most of her day on the job site with tradesmen. "There's never a dull moment," she said. That statement could also apply to Porter, Vitolo added. "Dr. Porter had a creative approach to teaching. He once taught principles of textile strength using spaghetti strands."

To the newlyweds, Porter was a true Renaissance man. "He loved music and good food and got excited about so many different aspects of life," Taranto said. "He realized the value of not being just a geeky engineering student."

Jenn and Tom needed unique direction in their careers. Porter provided such guidance for them, as he did for dozens of other students. It's their goal to see that "Dr. Porter" continues to make a difference — even after his passing.

To learn more about the Richard L. Porter Memorial Scholarship, please call Gwen Bell at (919) 515-7237.



Terri Helmlinger Industrial **Extension Service**



Teresa A. (Terri) Helmlinger (BSEO '78), assistant vice chancellor of extension and engagement and executive director of the Industrial Extension Service, is the first woman to serve as president of the National Society of Professional Engineers.

She was named Fellow of the Professional Engineers of North Carolina (PENC): Business Leader magazine named her to their seventh annual "Impact 100" list; and NC State University gave her the 2003 Equity for Women Award.

Alumna Terri Helmlinger — leader, engineer, pioneer, achiever.







Wolfpack on the prowl in Afghanistan



Louis Javoroski (left), a chemical engineering senior, was called to serve in Afghanistan in early spring 2003. He was in his last semester and ready to graduate with a job lined up and a baby on the way. He returned safely to North Carolina in May 2004 and saw his daughter, Lillyan Grace, for the first time. Javoroski received his bachelor's degree this fall and will start work with International Paper in Georgetown, SC, January 2005. Christopher Steele (right) is a doctoral student in zoology. This picture was taken on their last day in Afghanistan. (Photo: Louis Javoroski)

Experience the world of Engineering Online at North Carolina State University with the touch of a button! http://EngineeringOnline.ncsu.edu/

NC Solar Center capturing coastal winds

Strong, steady winds made Kitty Hawk on the Outer Banks of North Carolina the perfect testing ground for the Wright brothers' glider. It is those same strong, steady winds that make coastal North Carolina a perfect testing ground for wind turbines. The North Carolina Solar Center at NC State University is conducting the tests as part of its Coastal Wind Initiative program.

The NC Solar Center's program manager for wind and solar energy, Shawn Fitzpatrick, and renewable energy specialist, Beth Mast, want to increase the development of wind energy in North Carolina, especially in eastern North Carolina. Wind energy is the world's fastest-growing renewable energy resource, with an annual growth rate of 25 percent. Currently, only a few landowners in North Carolina have wind turbines. Through workshops and research projects, Fitzpatrick and Mast hope to educate eastern North Carolina residents, especially those in rural communities, about the economic potential of wind turbines.



Wind turbines are modern-day windmills that generate electricity without polluting the air. Mounted on towers up to 100 feet or higher, they capture the energy of the wind with their spinning blades. There are single wind turbines for farmers, ranchers and homeowners and utility-scale wind "farms" made up of a large number of wind turbines connected to a utility power grid. Some use wind turbines to offset their energy costs; others make a profit by selling their energy to a local utility or leasing land to a wind energy developer.

Wind resource assessment is critical in determining whether a site is appropriate for wind energy development. In North Carolina only two areas have suitable wind resources: the mountains and the coast. Both Appalachian State University (ASU) and the NC Solar Center are using tower-mounted anemometers, wind-measuring devices, to collect wind data from several mountain and coastal sites to determine whether the sites are suitable for wind turbines. They are also using that data to assess the accuracy of the North Carolina wind map that is based on computer-modeled wind speed predictions.

Researchers at ASU have already collected one year's worth of data from sites in the mountains through an anemometer loan program. In summer 2004 the NC Solar Center began their own anemometer loan program to determine wind resources in eastern North Carolina. The program, called the North Carolina State Observation of Wind (NC SOW), is made possible by the US Department of Energy's Wind Powering America initiative. Equipment and data are free to participants. Typically, the cost of such systems would range from \$1,500 to \$7,500.

Shawn Fitzpatrick mounts a wind direction vane to the tower.

At the top of a 104-foot tower is the NC Solar Center's 1000-watt wind turbine. Below the wind turbine are anemometers and a wind direction vane.

Fitzpatrick and Mast selected 5 sites spread across 20 coastal counties. Participants had to demonstrate that their sites met a list of criteria, including having a good wind resource according to the wind map. They also had to have a viable wind energy project in mind.

Tower heights for the NC SOW project range from 20 meters to 50 meters with three to five anemometers positioned at various elevations along each tower. An electric data logger at the base of the tower stores the data collected from the anemometers. At the end of every month, participants in the loan program pull data plugs from the loggers and mail them to the NC Solar Center.

By the end of the yearlong collection process, data from the NC SOW project will determine which sites are economically suitable for wind turbines. "If a site looks very promising, we will encourage the owner to invest in an energy system," Fitzpatrick said.

A companion project to NC SOW is the formation of a Coastal Wind Working Group (CWWG). Mast plans to take data collected from NC SOW and present it to key stakeholders. She also plans to demonstrate the economic potential of wind energy development in eastern North Carolina, especially in low-income rural communities.

According to Mast, low-income farmers would especially benefit from erecting wind turbines because they could cut electric bills while using their land for other purposes. "Wind is a homegrown energy that we can harvest right alongside our corn, soybeans, hogs, poultry or other crops. We can use the energy in our local communities, or we can export it to other markets."

In addition to offsetting energy costs, wind turbines have the potential to be moneymakers. Fitzpatrick noted, "Most people are interested in NC SOW because they are interested in generating their own power. Fewer are aware that they can start a project and sell the power to the utility grid. In fact, NC GreenPower is actively seeking wind projects."

Established in January 2003 by the NC Utilities Commission, the NC GreenPower program (www.ncgreenpower.org) is a nonprofit program that uses voluntary contributions to purchase electricity generated from renewable energy sources, such as wind, to add to the state's power supply. "NC GreenPower pays a premium price for wind-generated electricity," Fitzpatrick said.

According to Fitzpatrick, a utility-scale wind project could be as small as one 10-kilowatt wind turbine or as large as 15 turbines totaling 20 megawatts interconnected to a local utility grid. "One to two acres of land would need to be set aside for a project like this," he said, "but the land would serve a dual purpose. It would generate electricity up to 200 feet in the air, but underneath the wind turbine there would still be grazing or farming land."

Leasing land to a third party wind developer is another possibility. "In the Midwest, farmers are able to lease their land to developers and get \$2,000 to \$4,000 annually per turbine installation," Mast said. "Although currently there are no wind developers in North Carolina, two companies have been following renewable energy in North Carolina," Fitzpatrick added.

In addition to NC SOW and CWWG projects, Fitzpatrick and others installed a 1000-watt wind turbine on a 104foot tower at the NC

For more information about the Coastal Wind Initiative program, access the NC Solar Center's website, www.ncsc.ncsu.edu.

Solar Center as an outreach project so that people could see what a wind turbine looks like. "The site doesn't have a good wind resource, but there is nothing better than having a wind turbine in the backyard that people can touch," Fitzpatrick said. That particular wind turbine also serves another outreach purpose — Fitzpatrick and Mast have dismantled it and erected it many times for wind turbine installation workshops.

In North Carolina there is burgeoning interest in wind energy. Through education and research, Fitzpatrick and Mast hope to foster that interest. Harnessing the energy of coastal winds helped to create the era of flight. Perhaps harnessing that same power will create an era of wind energy development in North Carolina.

footnotes



Dr. Thomas Dow, director of the Precision Engineering Center, has been appointed the Dean F. Duncan Professor of Mechanical Engineering. The Duncan Professorship was established in 1998 by Hugh M. Duncan (IE '55) of Charlotte, retired president of Southern Precision Spring Co., in honor of his father, who graduated from NC State in 1923. The gift was the first named professorship at NC State's College of Engineering to be endowed by an individual.



Dr. Hassan Hassan, professor of mechanical and aerospace engineering, received the Alexander Quarles Holladay Medal for Excellence from the NC State Board of Trustees.



Dr. Robert Kelly, Alcoa Professor of Chemical and Biomolecular Engineering, received the R.J. Reynolds Tobacco Company Award for Excellence in Teaching, Research and Extension for 2003.



Dr. Nino Masnari, Distinguished Professor of Electrical and Computer Engineering and dean of the College of Engineering, was appointed vice chair of the American Society for Engineering Education Engineering Deans Council through June 2005.



Dr. John Muth, assistant professor of electrical and computer engineering, was selected to participate in the 10th annual Frontiers of Engineering symposium by the National Academy of Engineering.

Paper Science and Engineering degree offered

The College of Engineering at North Carolina State University has joined forces with the College of Natural Resources to administer a Bachelor of Science degree in paper science and engineering.

Dr. Richard Keltie, associate dean of academic affairs in the College of Engineering, said that, historically, many students pursuing a degree in pulp and paper science completed a dual degree in chemical engineering as well. "It was a nice blend and placed students in better standing for jobs." The new program will now require an introductory course to engineering, reflecting a national trend toward formalized engineering training for all pulp and paper students.

According to the head of the Department of Wood and Paper Science, Dr. Michael J. Kocurek, the new program will qualify for accreditation by the Accreditation Board for Engineering and Technology (ABET). NC State's pulp and paper program is one of only eight such programs nationwide.

Dr. Adrianna Kirkman, associate dean of academic affairs in the College of Natural Resources, said completion of the new program will allow students, once they are in the work force, to achieve the designation of Professional Engineer (PE) — a key for professional development and advancement in the industry.

Kocurek also noted that, along with accreditation, just adding the word "engineering" to the degree should help in recruiting new students. "High school students hear the word 'technology' and aren't sure what they're in for," he said. "Paper science and engineering makes a lot more sense."

All four Outstanding Senior Awards go to women

For 2004, all four College of Engineering Outstanding Senior Awards went to women, and two of the four are underrepresented minorities.

Melanie Chin, ranked first in her class in chemical engineering, won the award for scholarly achievement.

Shelly R. Strickland, a double major in biological and biomedical engineering, won the award for citizenship and service. A Lumbee Indian, she is the first Native American to win a Park scholarship at NC State. She also won Udall and E.J. Tyson Memorial scholarships, was a National Collegiate Scholar and served as Miss Indian North Carolina.

Natalie M. Scurry, a chemical engineering major and vice president of the senior class, won the award for leadership. Scurry was also a Caldwell scholar and a National Action Council for Minorities in Engineering (NACME) Scholar.

Georgiana B. Williams, a chemical engineering major with a bachelor of arts in French language and literature, won the award for humanities.

NC State and Meredith create dual degree program

The College of Engineering at NC State has formed an agreement with Meredith College to establish a dual degree program that allows students to attend Meredith College for three years and the College of Engineering at NC State for two years. Participants will receive a bachelor of arts degree in chemistry or mathematics from Meredith and a bachelor of science degree in chemical, environmental, civil, computer, electrical or industrial engineering from NC State.

The new dual degree with Meredith is one of several such programs offered jointly by the College of Engineering and other institutions in North Carolina, including Saint Augustine's College, Elon University and St. Andrews Presbyterian College.

Hammoudi, Jimison named 2004 Faculty Senior Scholars





The College of Engineering Faculty Senior Scholarship Awards for 2004-05 went to biomedical engineering major Taymour Hammoudi and materials science and engineering major Leslie Jimison. Hammoudi has been engaged in HIV research for Duke University and GlaxoSmithKline while maintaining a 4.0. Jimison currently holds a 4.0 and is a member of the university's cross-country and track teams and has volunteered with Habitat for Humanity.

Engineering delivers 2+2 program to Craven County

The College of Engineering has added Craven Community College's new Havelock campus to its list of 2+2 program partners. The new program will offer a bachelor of science degree in engineering (BSE) with a concentration in mechanical engineering. The program was designed specifically to address the need for more advanced technical education in an area dominated by working professionals and active military associated with Cherry Point Marine Corps Air Station.

Students spend their first two years taking courses on the Havelock campus. The sophomore year they enroll in distance education courses delivered from NC State. Students transfer to NC State for their final two years or remain in Havelock and complete the BSE dearee.



From the executive director



This year marks the 60th anniversary of the NC State Engineering Foundation, and there are many reasons to celebrate. The fiscal year that ended June 30, 2004, brought a solid rebound to the equity markets. As a result, many of our endowed funds have risen above water, and spending should pick up going

forward. In addition, the College of Engineering set a record, having received more than \$61 million in total private support, including the largest grant in the University's history — \$27 million from Golden LEAF in support of the Biomanufacturing Training and Education Center to be built on Centennial Campus. The NC State Engineering Foundation received \$7.4 million in direct support and leveraged an additional \$13.4 million in pledges, deferred gifts and gifts-in-kind, for a total of \$20.8 million. Privately sponsored research funds accounted for the balance. As a result, the College of Engineering and the more than 30 percent of the total private support the Foundation crossed the \$40 million mark. Perhaps the most noteworthy achievement is the growth of the Dean's Circle, a recognition society for donors who have made annual, unrestricted gifts directly to the Engineering Foundation in support of the people and programs in the College of Engineering. We are extremely grateful to the four individuals who stepped up to the Lampe Society level, hope their example will spur others to do likewise.

These are but a few of the many causes for celebration. We have come a long way in our first 60 years, and we have no intention of stopping here. The Foundation board and the staff have set aggressive goals for attracting greater resources to the College and gaining increased recognition for the outstanding engineering programs we offer. We look forward to your participation and to celebrating many more anniversaries and successes to come.

Thank you for your dedication and support. It truly does make a difference.

– Ben Hughes Executive Director Development and College Relations

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Donors Henry and Lou Mitta meet their scholar, Donald Grantham, at the 2004 Scholarship and Fellowship Dinner.

Scholarship/Fellowship Dinner Held

The Eighth Annual Engineering Endowed Scholarship/Fellowship Dinner was held March 19, 2004, at the Brownstone Hotel in Raleigh. Sponsored by the NC State Engineering Foundation, the event brings together donors and student recipients of endowed scholarships and fellowships to celebrate academic achievement and private support. Approximately 200 donors and recipients gathered for the dinner in 2004.

"This is a very popular event for both the students and the donors," said Benjamin H. Hughes, executive director of the NC State Engineering Foundation. "It gives the donors a chance to meet the beneficiaries of their gifts, and the students enjoy having an opportunity to thank the people who are helping them achieve their goals."

Besides providing financial benefits, scholarships and fellowships also offer alumni, friends and supporters a means to demonstrate their interest in NC State engineering students. These donors understand the impact scholarships and fellowships have on continuing to build top-quality programs in engineering education. 🔳

The annual dinner gives scholar Brooke Porras an opportunity to thank donors Tricia and Stuart Phoenix.



Donors 2003-04

R. STANHOPE PULLEN SOCIETY

The R. Stanhope Pullen Society, named after the Raleigh philanthropist who donated the original 62 acres of land for the site now known as North Carolina State University, recognizes donors who have included NC State University in their estate plans. Here, the College of Engineering at NC State recognizes individuals who have planned gifts for the College, either in their wills or through a life income gift such as a charitable remainder trust that provides income for the donor(s) or a beneficiary for life or a term of years and passes the remainder to the College. These gifts are typically funded with cash, bonds, stock, real estate or other real property. They often result in a named endowment fund that benefits the College in perpetuity.

The names listed for the Pullen Society include donors who announced planned gifts prior to June 30, 2004. For information about including the College of Engineering in your estate plans – or if you have already done so and would like to become a member of the Pullen Society - contact David Nolan, Director of Development, NC State Engineering Foundation, (919) 515-7458, (866) 316-4057 toll free, or david_nolan@ncsu.edu or Joan DeBruin, Director of Gift Planning, Campus Box 7501, NC State University, Raleigh, NC 27695-7501, (919) 515-9076, or joan_debruin@ncsu.edu.

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The Lampe Society, named for John Harold Lampe, Dean of Engineering 1945-1962, recognizes donors of annual, unrestricted gifts of \$10,000 or more directly to the Engineering Leadership Fund.

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Susie and Russ O'Dell attend the 2003 Dean's Circle dinner.

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Wright's leadership inspired by mentor



When Robert G. Wright (BSCE '68) is asked what drives him to be involved in supporting the College of Engineering and North Carolina State University, his response quickly turns to another College supporter and alumnus, C.E. "Ed" Vick Jr. (BSCE '56, MSCE '60).

Bob Wright (Photo: C.J. Walker)

"Ed is my mentor," says Wright, who served as president of the NC State **Engineering Foundation Inc.** (NCSEF) Board of Directors for

2002-04. "He has always been a dedicated supporter of the College and NC State, so it follows that I would be, too."

Wright is chairman of Kimley-Horn and Associates Inc., a Raleigh-based engineering consulting firm with a long historical connection to NC State that continues through today. The three original founders, Bill Horn, Bob Kimley (BSCE '50, MSCE '51) and Vick, had very close ties to the College: Kimley and Vick were engineering graduates, and Horn was a former faculty member.

That NC State connection continues not only through the alumnus who sits at the helm of the business but also through the many engineering graduates who enter the work force as Kimley-Horn employees.

"We hire a number of NC State engineering graduates," says Wright. "I continue to be amazed at the quality of students that come to Kimley-Horn each year. They are well-prepared and have a tremendous work ethic."

While president of the College's NCSEF board, Wright worked diligently to help the foundation provide the support necessary to maintain the high quality education expected and delivered by the College. A thoughtful leader and dedicated volunteer, he increased board involvement, enhanced membership in the foundation and orchestrated an executive committee session to plan strategies for supporting the future of the College. In addition to his work with the foundation board, he serves on the College of Engineering

Advisory Council, supports Wolfpack athletics and has hosted student recruiting events. He sees the move to Centennial Campus as the most important project for the future of the College.

"One very important initiative for the foundation is to make sure we have the funding to continue the planned move of the College to Centennial Campus," says Wright. "From the foundation standpoint, we want to continue to be a support mechanism. We also want to get more alumni engaged in the financial support of the College. I would like to see more alumni step up and make a financial commitment to academics."

Wright points out that it is easy to get excited about athletics at the University, but that enthusiasm needs to be balanced with support for academics. That balance is one of the reasons that Kimley-Horn, under his leadership, created the Ed Vick Civil Engineering Fellowship by Kimley-Horn and Associates. The fellowship supports a graduate student majoring in transportation engineering.

"When Ed retired from Kimley-Horn, we wanted to honor him and his many years of service," says Wright. "Following Ed's lead as a long-time supporter of the College, we thought there was no better way to honor him than to establish the fellowship."



Kristopher Justo meets donor Dr. Raymond L. Murray at the 2003 Scholarship and Fellowship Dinner held at the Brownstone Hotel.

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Be true to your school — like Russ O'Dell



Dr. Francis P. (Russ) O'Dell (CHE '75) has signed a charitable remainder unitrust valued at approximately \$500,000 that will be used to create several undergraduate scholarships and graduate fellowships in the Department of Chemical and Biomolecular Engineering.

Russ O'Dell

The unitrust, created in his name through the NC State Engineering Foundation, is designated as the beneficiary of his 401(k) and 457 retirement accounts. The trust will pay Russ and his wife a guaranteed income for life, with the remainder going to his endowment in the NC State Engineering Foundation.

As a recipient of several scholarships and fellowships during his undergraduate and graduate studies, O'Dell fully understands the impact his gift can have on future students.

O'Dell, who is director of development in chemical engineering for the NC State Engineering Foundation, had previously established an endowment supporting two scholarships for chemical engineering students. Beyond the usual attention to academic achievements, both scholarships emphasize participation in sports or physical education classes, a reflection of O'Dell's participation on the NC State swimming team and on several intramural teams.

Now O'Dell has furthered his support through a method he describes as a very easy way to give.

"It is basically painless to give to the university using a remainder trust. The personal benefit is that, after age 55, the donor will receive a guaranteed income stream for life, with the remainder going to NC State. It is a way for NC State to manage my retirement accounts and still provide funds to NC State that will benefit future students that come to the university." O'Dell was valedictorian of his class when he graduated from NC State in 1975. He received his doctorate from NC State three years later.

If you would like to learn more about this method of giving, you can contact the NC State Engineering Foundation toll free: (866) 316-4057, or in the Raleigh area: (919) 515-7458, or by e-mail: engr-foundation@ncsu.edu. ■

Scronce delivers freshman welcome address

First-year engineering students attended the College of Engineering Welcome on September 7 from 6:00 to 8:30 p.m. in Stewart Theater at the Talley Student Center. The event was designed to welcome the new class of 1,200 engineering freshmen to campus, to expose the students to an engineering leader through the keynote address and to present information about campus resources such as internships, study abroad and student organizations.

This year the keynote address was presented by Timothy E. Scronce (BSIE '87), president and COO



of Blue Rhino, a propane tank exchange company. Blue Rhino has expanded to more than 30,000 retail outlets in the United States during Scronce's tenure with the company.

Guest speaker Timothy Scronce addresses students at the Freshman Welcome. Scronce is president and COO of Blue Rhino.

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John Hauser's dedication to NC State spans four decades

From the time he was a young boy, "understanding the laws of science and how the universe works" has appealed to Dr. John R. Hauser, Distinguished University Professor of Electrical and Computer Engineering at North Carolina State University. That curiosity spurred him on to a long, successful career as a researcher, professor, center director and department head, as well as one of the world's leading experts in semiconductor technology.

Hauser grew up on a farm near Mocksville, North Carolina. In 1960 he received his bachelor's degree in electrical engineering from NC State. After receiving his PhD in electrical engineering from Duke University in 1964, he worked as a research engineer at the Research Triangle Institute (RTI). Hauser joined the NC State faculty in 1966.

In 1978 Hauser and the students on his research team partnered with RTI on a project for the US Air Force. Their research led to the world's first monolithic cascade solar cell, a more efficient means of converting sunlight into electricity. Dr. Salah Bedair, a professor of electrical and computer engineering at NC State who was working for RTI at the time, also played a key role in the project. This type of high efficiency solar cell is used mainly in space applications today.

Hauser believes his most significant research has been in the area of semiconductor technology, for which he received the Semiconductor Industry Association (SIA) University Researcher Award in 2002. He has made significant contributions to the development of new technologies for nanoscale CMOS (complementary metal oxide semiconduc-

John Hauser in his classroom in 1990.



tor) devices. According to Hauser, within the next 5 to 10 years, much of the new technologies that use new materials for increased speed, packing density



John Hauser (Photo: Ross Mehan, Electronic News)

and new applications will make their way into the manufacturing of computer chips and communication circuits. From 1998 to 2001 he was the director of the SRC/SEMATECH Center for Front End Processing, a multi-university research program on advanced CMOS technologies. SEMATECH is a global consortium of semiconductor manufacturers.

From 1996 to 2000 Hauser was director of the Engineering Research Center for Advanced Electronic Materials Processing. He has twice served as interim head of the Department of Electrical and Computer Engineering. The author of more than 150 refereed technical publications and two books, he has developed most of the graduate-level courses in the area of microelectronics, and his course notes are still used in classes.

Hauser's service to the university does not end with contributions in the laboratory and the classroom. In 1997 he established the John R. and Ann C. Hauser Scholarship Endowment to support students in the Department of Electrical and Computer Engineering.

Hauser's career has been rich with achievements. In addition to receiving the SIA award, in 2002 the NC State University Board of Trustees awarded him the prestigious Alexander Quarles Holladay Medal for Excellence.

Recently, Hauser entered into a new phase of his career partial retirement. He is currently working on a book about nonlinear analysis and plans to write textbooks based on his graduate-level course notes. Reflecting on his long career, Hauser notes, "I have really enjoyed working here and have especially enjoyed my interactions with students and other faculty."

And not everyone would be able to say, after four decades of service to the same institution, as Hauser does, "I have always looked forward to coming to work, every day."

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Alumni and new technology benefit EB II

Engineering Building II (EB II) on Centennial Campus will be the new home for the Department of Computer Science and the Department of Electrical and Computer Engineering, but it is already the site of new computer and communications technology. Clancy & Theys, the construction company for the new building, is using ConstructConnect to keep the project on schedule.

Developed by Field2Base, a Morrisville-based technology development firm, ConstructConnect uses a Tablet PC with wireless and cellular communication and digital photography capabilities to replace the usual clipboard and yellow legal pad carried by the site superintendent. It allows instant wireless communication directly from the construction site to the home office and off-site engineers and architects. EB II is one of the first projects on which this new tool has been used; Clancy & Theys, cofounded by E.I. Clancy (BSCE '38), is one of the first companies to put it to use.

With the new technology, site superintendent Don Street can take photos of potential problems, then annotate and e-mail them off-site for instant problem solving.

Another alumnus who is benefitting from the new technology is senior project manager Dave Bennett (BSCE '76). "Being able to communicate directly from the construction site represents a big time- and money-saver for us," said Bennett. "Don can take a photo with the camera mounted on the Tablet PC, draw on it and send it directly to the architect in Charlotte to get an immediate answer. In the past, it would often take days."

Field2Base also has close ties to the College of Engineering. Alumnus Ed White (EO '78) is chairman of the board of the company. He became involved after Field2Base cofounder David Lea told him about the startup technology company. White, who had experience starting software companies, was a perfect match, lending his knowledge and his capital as well as his connections to the construction industry.



Don Street (left) and Dave Bennett use ConstructConnect to stay on schedule. (Photo: Dustin Patterson)

Street could not be happier with the new tools. He learned how to use the Tablet PC and navigate through the software in less than a day. "This has made my job much easier. Before, when a problem popped up, I would have to walk back to the construction trailer, call architects and engineers, walk back out and take photos or sketch the problem, and then get the pictures or drawings to the right people and wait for them to respond. Taking photos and sending an e-mail with attachments is much quicker."

According to Ed Holloway, president and chief technology officer for Field2Base, the ConstructConnect technology is designed for ease of use, and the communications functions are virtually transparent to the user. In addition, the software can be used to scan and create paperless forms that are completely interactive.

Bennett believes that the construction industry will quickly employ this latest tool.

"In construction, time is money," said Bennett. "This technology has already saved us lots of time and money on this project and has helped us avoid some potential problems." UNRESTRICTED GIVING TO THE COLLEGE OF ENGINEERING



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Memorial gifts

Gifts to the NC State Engineering Foundation have been made in memory of the following individuals: William D. Alexander III '53 • Patricia S. Conner • Joseph W. David • J. D. Goins '65 • Neely F. J. "Sy" Matthews • Joseph D. Moore '36 • David L. Riley '65 • Mark C. Roberts '92, '97 • Harry C. Rudd Jr. '60 • Dr. Vivian T. Stannett • K. C. Tai • Marshall B. Vernon '51 • Hannibal G. Warren '50

Tributes

Gifts to the NC State Engineering Foundation have been made in honor of the following individuals: D. A. Allsbrook '75 • Norvin A. Clontz '65, '67 • Nick and Jen Davis • Salah Elmaghraby • Richard Johnson • J. O. Love '61 • H. Rooney Malcom '63, '70

Estate gifts

Gifts or bequests have been made to the NC State Engineering Foundation from the estates of the following individuals: Harry ('36) and Helen Bowling • Jack L. and Bonnie F. Covington • Mozelle Rose Thompson

Endowments

An endowment is created through the establishment of a permanent fund that is invested and managed. A portion of annual income generated is used to carry out the donor's designated purpose. Income earned in excess of the annual amount spent is added back into the endowment so that it continues to grow and maintain its purchasing power for future generations. The following permanent endowments benefit the College of Engineering at NC State.

ENDOWED SCHOLARSHIPS AND FELLOWSHIPS

W. F. Aldridge/High Point Sprinkler, Inc. • Ernest James and Ethel Hudgins Angelo Memorial • ARAI/Charles R. Manning • Dr. William W. Austin • James Bagwell • Robert M. Barefoot • Richard and Sarah Bean • John K. Beasley • Donald L. Bitzer Creative Award • George H. Blessis Memorial • John A. Boren Merit • Harry and Helen Bowling • Larry A. and Beth L. Bowman • Otto Branscomb Memorial • John C. Brantley IV Memorial • Berry G. Jr. and Glenda D. Jenkins • Harry M. Bremer •

[continued on page 48]



Sepi Asefnia has lived in Raleigh since she left Tehran. She enjoys reading, playing golf, listening to music, being outdoors and traveling. She and her husband, Farzin, have a daughter, Nakisa, 13, and a son, Bardia, 9.

In business, Sepi Asefnia (Agri. Engr. '85; CE '93) relies on the lessons she has learned in life almost as much as those she has learned in the College of Engineering at North Carolina State University.

As a young girl growing up in Tehran, Iran, her family taught her not to fear challenges but to meet them head on. Her mother, Mahin, was a schoolteacher who told her that anything was possible — the sky's the limit. "My upbringing was incredibly encouraging," Asefnia noted.

As president and founder of Sepi Engineering Group of Raleigh — a transportation engineering and planning business she began out of her home in 2001 and which now gainfully employs 35 — Asefnia seems to have taken those lessons to heart.

heart."Both experiences helped broaden my perspective of the
whole engineering community and the different disciplinesBut it's not just attaining lofty goals that she strives for. Asefnia
is determined to balance those goals with the importance of
family, not only for her own benefit, but for her employees' and
clients' benefit as well.We as engineering reflects this experience, adding the design of
pedestrian and bicycle bridges for city greenways alongside
grander projects, such as roadway planning for I-40 widening
in the Triangle. In May 2004 Sepi Engineering went a stepWhile businesses like to use the term "open-door policy" in ref-further, adding a stream restoration division.

While businesses like to use the term "open-door policy" in reference to their attempts at keeping the workplace personable, Asefnia's office doesn't even have a door. She believes that the openness with which she runs her business breeds honesty and familiarity within the company — a sense of family — that ultimately translates into quality service to her clients.

"We don't just talk about integrity, we really live it," she said. "We work to improve our quality of work every day."

Family lessons fuel alumna's engineering business

As a mother of two children, she understands the need to temper such hard work with family needs.

"Family is very important to me — and really, that's what we're all working for." That recognition helps her direct her business, as she remains keenly aware of the need to maintain the quality of life for area families as she meets the challenges of long-range transportation planning. "To be able to provide good schools and entertainment and parks — that balance is very important."

 Her prior experience studying agricultural engineering at NC State and working 11 years for the NC Department of Transportation also guides her.

Having lived in Raleigh for the past 25 years, Asefnia also has
 developed a strong commitment to the community and a
 genuine care for its future. And, as a graduate of NC State,
 she has discovered a huge network of existing alumni that
 have been invaluable to her success in the field. "I've met a
 lot of other professionals that I can quickly establish working
 relationships with. They've been a great resource for me."

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Asefnia also strives to be a good resource and role model for future engineers. "Role models are huge," she said. She has helped organize National Engineers' Week activities for Mecklenburg, Orange and Wake counties for four years. "Promoting engineering at an early age makes kids realize the opportunities that are out there."

The opportunities for women are of special interest to Asefnia, who also serves as president of the North Carolina chapter of the Women's Transportation Seminar, a nonprofit organization that seeks to advance the role of women in transportation. "Women bring a new perspective to business," she said. "They are very good communicators, very intuitive, and they care a lot about relationships. They make fabulous business leaders."

In the near future, Asefnia said she would like to see her own company continue to grow. Farther down the road, she'd love to look back and see that she has contributed to creating leaders in the community.

"To know that they joined me and gained experience that helped them become leaders and give back to the community — that's what I really want." ■

ENDOWED SCHOLARSHIPS AND FELLOWSHIPS (continued)

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Gard first to hold Pratt assistant professorship

Dr. Kevin G. Gard, assistant professor of electrical and computer engineering, has been awarded the William J. Pratt Assistant Professorship in the Department of Electrical and Computer Engineering at North Carolina State University. Gard is the first to fill the professorship funded by a gift from William J. Pratt, chairman and chief technical officer of RF Micro Devices.

The largest individually donated professorship in the Department of Electrical and Computer Engineering, the Pratt professorship provides funding for salary enhancement, new equipment and student fellowships. Pratt established the professorship to help the College of Engineering attract a new faculty member who specializes in the analog and radio frequency design field. Pratt's company makes integrated circuit chips for wireless applications.

Gard earned his bachelor's degree in 1994 and his master's degree in 1995, both in electrical engineering from NC State. He received his PhD in electrical engineering from the University of California at San Diego in 2003. His research interests include analog, radio frequency and mixed mode circuit design, microwave devices and circuits, computeraided design and modeling, communications and signal processing, nanoelectronics and photonics.

Corporate and foundation gift highlights

- The College of Engineering wishes to thank the following corporations for their generous gifts during 2003-04:
- GE Foundation \$500,000 to the colleges of Engineering and Education to help fund the program Recognizing Accelerated Math Potential in Under-Represented People (RAMP-UP).
- Progress Energy \$261,500 to support a wide variety of programs, scholarships, unrestricted funds and engineering student organizations.
- Duke Energy \$140,820 to support nuclear engineering, electrical and computer engineering and Ben Franklin scholarships.
- Hewlett-Packard (HP) a \$75,000 Technology for Teaching grant to help support a special project in the E101 course, Introduction to Engineering and Problem-Solving.
- Goodrich Corporation \$50,000 to the Department of Mechanical and Aerospace Engineering to establish a doctoral fellowship program, create an endowed faculty research award and support an undergraduate research intern.
- Shell Oil Company Foundation \$50,000 to support chemical engineering and aerospace engineering.
- Square D Company \$45,000 to support academic programs, scholarships and student organizations.
- The Boeing Company \$43,100 for scholarships, curriculum enrichment in aerospace and student organizations.
- Troan Foundation \$40,000 to help address the shortage of minority engineers in the work force.
- Alcoa 32,500 to support mentoring programs at NC State and to sponsor a senior design project in materials science and engineering.
- S&ME, Inc. \$30,000 to provide fellowships to students in the geotechnical engineering master's degree program.

Gift exceeds \$1.6 million

The James Wayne and Mozelle Rose Thompson Memorial Scholarship has been established through a gift in excess of \$1.6 million to benefit students in Civil, Construction, and Environmental Engineering. This bequest represents the single largest endowed scholarship in the College of Engineering.

FOUNDATION NOTES

Duke Energy supports engineering programs



Erika Young, global sourcing and logistics manager at Duke Energy, presents a gift check to Dr. Tony Mitchell (right), assistant dean and director of minority programs, and Ben Hughes, director of development and college relations.

Duke Energy recently donated \$140,820 to the College of Engineering at North Carolina State University. The gift will support a number of scholarships, including nuclear engineering, electrical and computer engineering and Ben Franklin scholarships. Last year Duke Energy contributed \$174,500 to the College. Duke Energy has been a strong supporter of NC State for a number of years. Currently, two Duke Energy employees serve on NC State foundation boards: E.O. Ferrell ('66 EE), senior vice president for Duke Energy, is a member of the NC State Engineering Foundation Board of Directors, and Cecil Smith ('69 AMA), senior vice president and chief information officer for Duke Energy, is a member of the NC State Physical and Mathematical Sciences Foundation Board.

Distinguished Engineering Alumni named for 2004



Albert Carnesale



The College salutes its Distinguished Engineering Alumni for 2004: Dr. Albert Carnesale (PhD NE '66), chancellor of UCLA; Dr. Calvin H. Carter Jr. (BS MSE '77, MS MSE '80, PhD MSE '83), director of materials technology at Cree Inc.; and Thomas R. McPherson Jr. (BSEE '76, MSEE '77), a developer and manufacturer of high-performance



broadband and optical communications equipment and former president and CEO of Hatteras Networks.

The award recognizes those outstanding alumni whose accomplishments have furthered their field and who have brought honor to their *alma mater*.

About the Engineering Foundation

The NC State Engineering Foundation, Inc. (NCSEF) was organized in 1944 as the North Carolina Engineering Foundation, Inc. by area industrial and business leaders. The purpose of the Foundation was to form a tax-exempt, non-profit organization to promote and receive monies to support the College of Engineering at North Carolina State University. The NCSEF is governed by a 32-member Board of Directors, which oversees \$40 million in assets. The Board, along with the Foundation staff, also works to enhance the image and presence of NC State's College of Engineering.

Still the primary recipient of private support for the College of Engineering, the NC State Engineering Foundation, Inc. continues the original mission developed by its founders and received nearly \$21 million in support of the College of Engineering in fiscal 2003-04.

Monies raised by the Foundation go to support scholarships, fellowships, professorships, academic programs, faculty research and areas that cannot be supported from state appropriations.

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Your gift to the College of Engineering at North Carolina State University can support a variety of funds, programs and academic endeavors. These many opportunities to give can be tailored to your needs and interests.

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Giving to the college is the best way to support scholarships, fellowships, professorships, academic programs, faculty research and areas that are not supported with state funds. These gifts make a huge impact on all facets of university life.

The College of Engineering appreciates your interest in its giving programs. If you would like more information, you can either visit our website at **www.engr.ncsu.edu/ncef/** or you can contact us:

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engineering

Jenn and Tom got married —



and they want you to know about it.

(Story on page 26.,

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