THE COLLEGE OF ENGINEERING

NC STATE UNIVERSITY

January 2006

engineering FRONTLINE

Biomedical Breakthroughs

• NC State Engineering Foundation Inc. Annual Report 2004-05

From the Dean of Engineering

Nino A. Masnari

This past year has seen a number of landmark events for the College of Engineering at NC State University. With the September 2005 kickoff of the university's $1 billion fundraising campaign — *Achieve! The Campaign for NC State* — came the announcement from alumnus Edward P. Fitts (IE '61) of his pledge of $10 million to endow the Edward P. Fitts Department of Industrial Engineering. This is the largest gift ever received by the College of Engineering from an individual donor and the largest endowed gift to academics in NC State's history. We in the College are extremely grateful to Ed for this generous show of alumnus loyalty, and we appreciate the example he has set for the campaign.

Our students have made a pledge of their own to the Achieve fundraiser. Because they held their most successful Engineering Career Fair ever, the Engineers' Council was able to increase their endowment to the college to $100,000 over the next five years. The endowment will be used to provide scholarships for engineering undergraduate students. This exceptional level of giving by our students demonstrates their strong sense of leadership and their consideration for those who will follow them.

The College of Engineering is experiencing unprecedented growth. With two new buildings completed, the multiphase relocation of the College of Engineering to Centennial Campus is well underway. Engineering Building I, which opened in fall 2004, houses the departments of Chemical and Biomolecular Engineering and Materials Science and Engineering. In fall 2005 the departments of Computer Science and Electrical and Computer Engineering moved to Engineering Building II (EB II), a 110,000 square-foot building.

The construction and occupation of three more buildings will complete the relocation of the college to Centennial Campus. EB III, which will house the departments of Mechanical and Aerospace Engineering and Biomedical Engineering, has received planning funding. EB IV and EB V are in the conceptual stage. When completed, EB IV will house the Edward P. Fitts Department of Industrial Engineering and the college's administrative offices. The departments of Nuclear Engineering and Civil, Construction, and Environmental Engineering are scheduled to occupy EB V.

Another landmark event was the renaming of the Engineering Graduate Research Center as the Larry K. Monteith Engineering Research Center. At the standing-room-only dedication ceremony in October 2005, friends, family members, and colleagues gathered to see the building renamed to honor Larry, whose 41-year affiliation with NC State included serving as Dean of Engineering for 11 years and Chancellor of the university for 9 years.

We hope you will enjoy this issue of *Engineering Frontline*, which highlights a small sampling of the biomedical research conducted in the College of Engineering. This research crosses all of our engineering disciplines, and our faculty and students work closely with engineers from other institutions as well as surgeons from medical facilities across the U.S. At the center of this activity is our newest academic department, the joint Department of Biomedical Engineering colocated at NC State University and the University of North Carolina at Chapel Hill.

We invite you to keep in touch with our activities throughout the year by visiting our website: **www.engr.ncsu.edu**.

— *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

National Engineers' Week
January 30 — February 3, 2006

College of Engineering Career Fair
McKimmon Center
February 2, 2006

NC State Engineering Foundation
and College of Engineering
Endowment Dinner
March 16, 2006

Engineering Open House
April 8, 2006

NC State Engineering Foundation Board
Meeting and Dedication Ceremony for
Engineering Building II
April 28, 2006

Engineering Summer Programs
for high school students
June 11-16, 18-23, and 25-30

Middle School Engineering Camp
June 26-30, 2006, and August 7-11, 2006

Elementary School Engineering Camp
August 7-11, 2006

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

engineering FRONTLINE

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ABOVE: Engineering Building II, which opened in fall 2005, is the new home of the Department of Computer Science and the Department of Electrical and Computer Engineering. *(Image: Perkins and Will)*

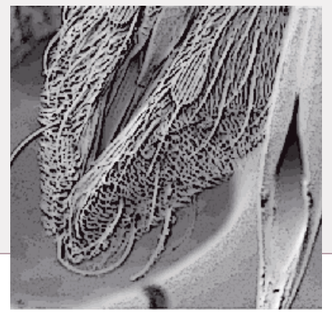
OPPOSITE TOP: The Engineering Career Fair has become so successful that the Engineers' Council has pledged to increase their scholarship endowment to $100,000 over the next five years. *(Photo: Jennifer Weston)*

BELOW RIGHT: A scanning electron microscope image shows the mosquito's proboscis (left) and the tip of the fascicle (right).

ON THE COVER: In the Cell Mechanics Laboratory at NC State, Dr. Elizabeth Loboa's research uses a unique approach to create bone tissue from adult stem cells. Unlike typical mechanical loading research, which uses macrofluidics, Loboa and her team in collaboration with Dr. Glenn Walker are testing the use of microfluidic devices as a means to apply fluid shear stress to human mesenchymal stem cells (hMSCs). In addition Loboa's team is the first in the world to prove that palladin, a protein associated with the actin cytoskeleton, is present in mesenchymal stem cells — a breakthrough in hMSC research. *(Photo: Roger Winstead)*

Latest News

Features — Biomedical Breakthroughs



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LATEST
news

Making the biomedical connection

Twenty years ago it was the combination of engineering and medicine in the Research Triangle that attracted Dr. Troy Nagle. UNC–Chapel Hill's graduate biomedical engineering curriculum and NC State's strong engineering college made North Carolina the perfect place for Nagle's research.

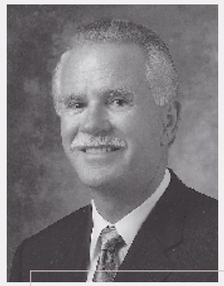
Twenty years later, after working with his colleagues to establish a department of biomedical engineering, Nagle, professor of electrical and computer engineering at NC State and biomedical engineering at NC State and UNC–CH, was named founding head of the joint Department of Biomedical Engineering at NC State and UNC–CH in 2004.

"The synergy of the College of Engineering at NC State and the School of Medicine at UNC–CH creates an environment in which researchers can draw from various fields of expertise to develop new approaches to finding solutions to medical and health issues," says Nagle. "The cooperation among the faculties has already produced new processes and new tools that will benefit everyone."

Nagle points out that while the department is still in its infancy, its reputation is growing as a leader in biomedical research in North Carolina and across the nation. The new department has attracted talented new faculty to the NC State campus. The department also draws on the expertise of existing engineering faculty at NC State. In addition, the NC State researchers collaborate with researchers and doctors from the UNC–CH School of Medicine.

"The unique partnership gives NC State's engineers and Chapel Hill's medical researchers an easy conduit for working together to find novel approaches to meet medical challenges and to advance biomedical knowledge in the 21st century," says Nagle. "This department will benefit us all."

Alumnus Fitts gives $10 million to Industrial Engineering



Edward Fitts (IE '61)

Edward P. Fitts has given $10 million to the Department of Industrial Engineering at NC State University. The commitment is the largest gift ever received by the College of Engineering from an individual donor and the largest endowed gift to academics in NC State's history.

Fitts is the chief executive officer of Dopaco, a Pennsylvania-based global packaging company. A native of Littleton, he earned his bachelor's degree in industrial engineering from NC State in 1961 and was named Distinguished Engineering Alumnus in 2001.

A dedicated supporter, Fitts currently serves on the NC State Engineering Foundation Board of Directors. He established the Edward P. Fitts Scholarship in 1999, the Edward P. Fitts Industrial Engineering Professorship in 2002 and gave an unrestricted gift of $250,000 to the college in 2005. Through this most recent gift, Fitts hopes to increase awareness among fellow alumni, friends and the academic community of the strengths of the internationally recognized program in industrial engineering at NC State.

In honor of his dedication to the college, the department has been named the Edward P. Fitts Department of Industrial Engineering.

Two elected to National Academy of Engineering

Two faculty members in the Department of Chemical and Biomolecular Engineering have been elected to the National Academy of Engineering (NAE): Dr. Carol K. Hall, Alcoa Professor of Chemical and Biomolecular Engineering at NC State, and Dr. Joseph M. DeSimone, the William R. Kenan, Jr. Distinguished Professor of Chemistry at UNC-Chapel Hill and Chemical Engineering at NC State.

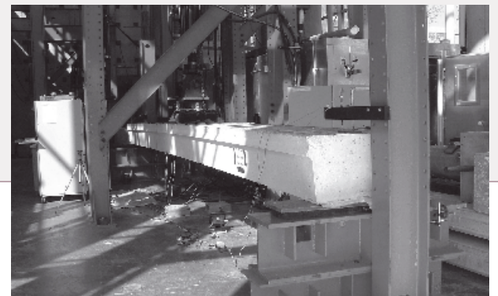
Hang up and drive

— Study Shows Cell Phones and Driving Don't Mix

Dr. David Kaber, associate professor of industrial engineering, and doctoral student Ruiqi Ma have studied the effects of cell phone use and in-vehicle automation on driver situation awareness performance.
www.engr.ncsu.edu/news/news_articles/cellphone.html

Constructed Facilities Lab researchers test advanced bridge materials

One-third of urban bridges in the US are structurally deficient or functionally obsolete, but engineers at NC State are working to make bridges stronger and safer, as well as reduce costs and duration of repairs.
www.engr.ncsu.edu/news/news_articles/bridges.html



Engineering Building II
(Image: Perkins & Will)

EBII opens in time for classes

NC State worked very hard to make sure that the first floor of Engineering II Building (EBII) was ready for classes in time for the fall 2005 semester. EBII is the new home of the Department of Computer Science and the Department of Electrical and Computer Engineering. A dedication ceremony is planned for April 28, 2006.

Golden LEAF awards $5.4M

The Golden LEAF Foundation has awarded $5.4 million to the College of Engineering as part of a $9.3 million Aerospace Alliance Initiative to help businesses in North Carolina make parts for the naval air depot at Cherry Point and the U.S. Coast Guard air repair and service center in Elizabeth City.

With this grant, the College of Engineering will provide engineering and manufacturing expertise, help businesses meet government standards quickly and develop facilities for businesses to test new parts. The effort is being led by Dr. Jerome J. Cuomo, Dr. Roger C. Sanwald and Dr. John S. Strenkowski, all of the College of Engineering.

NC State biomedical engineers conduct unique stem cell research

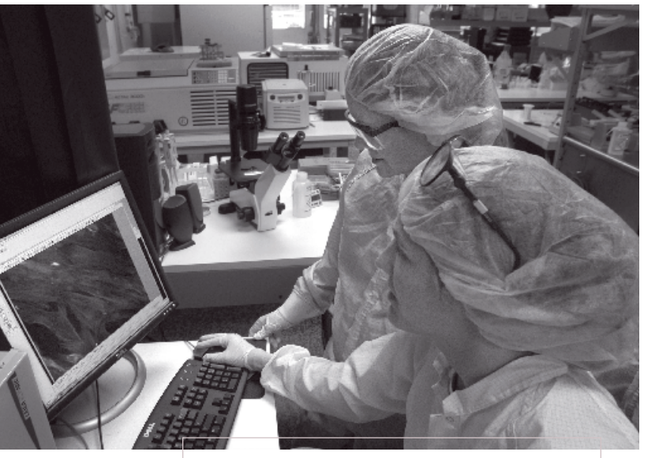
A new discovery and new process for stem cell research is aimed at helping people with skeletal defects

biomedical **breakthroughs**

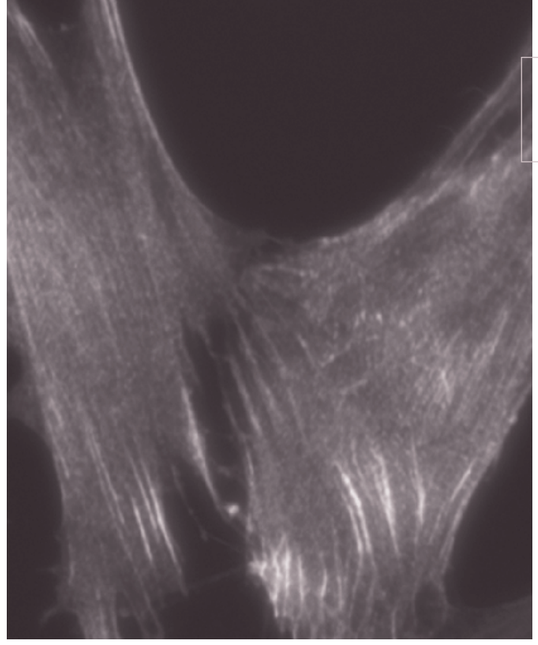
Coaxing stem cells to become bone tissue is one of many potential applications of stem cell research that is being explored around the world. At North Carolina State University, Dr. Elizabeth Loboa's research uses a unique approach to create bone tissue from adult stem cells.

In the Cell Mechanics Laboratory at NC State, Loboa, assistant professor of biomedical engineering, and her research assistants use fluid shear stress applied to human mesenchymal stem cells (hMSCs) that have been seeded into a polymeric scaffold to grow bone tissue. Mechanical loading, such as applying fluid shear stress, is a key factor in functional tissue engineering of bone. However, research on mechanical loading using this method has typically focused on macrofluidic devices. Loboa and her team, in collaboration with Dr. Glenn Walker, an expert in microfluidics, are testing the use of microfluidic devices as a means to apply fluid shear stress to mesenchymal stem cells seeded in three-dimensional (3D) scaffolds. Microfluidics could more easily enable researchers to analyze multiple shear stresses simultaneously by allowing them to compare data from parallel tests concurrently while lowering costs through reducing the amount of media, scaffold material and the number of cells needed for each shear stress experiment.

Their most recent research studied the effects of fluid shear stresses on hMSCs seeded in three-dimensional (3D) poly-l-lactic acid (PLLA) scaffolds in a flow perfusion microfluidic chamber. They found that the cells were able to survive and grow on the PLLA scaffold in the microfluidic device while exposed to fluid shear stress. Results were presented at the 2005 Summer Bioengineering Conference held June 22-26 in Vail, Colo.



Post-doctoral fellow Michelle Wall (right) and Dr. Elizabeth Loboa observe images that indicate palladin is located in human mesenchymal stem cells. Loboa's team was the first to prove that palladin is present in these cells. *(Photo: Roger Winstead)*



Human mesenchymal stem cells express a novel actin-associated protein. *(Photo: courtesy Dr. Elizabeth Loboa)*

The PLLA scaffolds were designed by Dr. Behnam Pourdeyhimi, the William A. Klopman Distinguished Endowed Chaired Professor and associate dean for industry research and extension for the College of Textiles at NC State. The scaffolds provide a biocompatible form for the cells to adhere to during growth and provide mechanical stability during the formation of new bone tissue.

"If mesenchymal stem cells can be harvested from the patient and used to create replacement bone tissue, the resulting replacement bone would be completely compatible with the native bone, avoiding rejection and other issues such as lack of autologous bone tissue for harvesting associated with present-day bone tissue replacements," said Loboa.

Loboa's team also announced a breakthrough in hMSC research at the conference. Her team is the first in the world to prove that palladin, a protein associated with the actin cytoskeleton, is present in mesenchymal stem cells. Since palladin is important in cytoskeletal organization, the team believes that this discovery could lead to clues about how mechanical stimuli modulate hMSC differentiation into bone.

"Eventually this research could lead to the development of a process to grow bone to replace damaged or lost bone in patients with osteoporosis or other skeletal defects," said Loboa. "One of the problems with these degenerative bone diseases is the loss of mobility. We hope that by giving patients new bone that matches their native bone, we can restore some of their mobility."

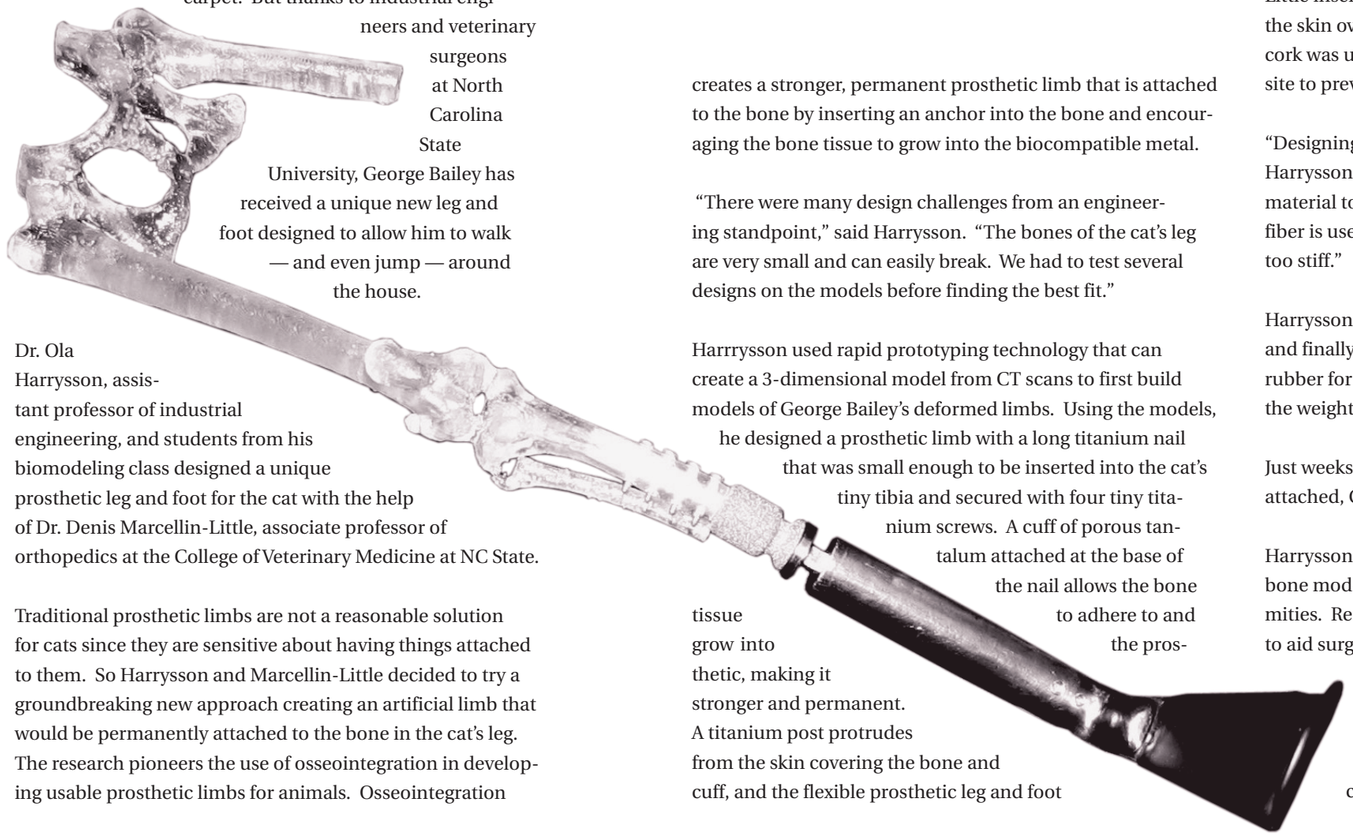
The hMSCs used in Loboa's lab are harvested from bone and bone marrow from patients at UNC hospitals and from fat tissue harvested during surgeries also performed by UNC surgeons. ■

Dr. Elizabeth Loboa (left) and graduate student Ariel Hanson set up the microfluidic device used to apply shear stress to human mesenchymal stem cells seeded in a poly-l-lactic acid (PLLA) scaffold. *(Photo: Roger Winstead)*

Industrial engineer designs unique prosthesis for lame family pet

Pioneering research uses osseointegration for attaching prosthetic limb

George Bailey, a pet cat, was born without the lower half of his hind legs. Instead of running and jumping with his housemates, George Bailey pulled himself along on the carpet. But thanks to industrial engineers and veterinary surgeons at North Carolina State University, George Bailey has received a unique new leg and foot designed to allow him to walk — and even jump — around the house.



The prosthesis attaches to the model of George Bailey's leg and pelvis. *(Photo: Jennifer Weston)*

Dr. Ola Harrysson, assistant professor of industrial engineering, and students from his biomodeling class designed a unique prosthetic leg and foot for the cat with the help of Dr. Denis Marcellin-Little, associate professor of orthopedics at the College of Veterinary Medicine at NC State.

Traditional prosthetic limbs are not a reasonable solution for cats since they are sensitive about having things attached to them. So Harrysson and Marcellin-Little decided to try a groundbreaking new approach creating an artificial limb that would be permanently attached to the bone in the cat's leg. The research pioneers the use of osseointegration in developing usable prosthetic limbs for animals. Osseointegration creates a stronger, permanent prosthetic limb that is attached to the bone by inserting an anchor into the bone and encouraging the bone tissue to grow into the biocompatible metal.

A veterinary technician preps George Bailey for surgery. *(Photo: courtesy Biomedical Imaging)*

Dr. Ola Harrysson holds the prototype of the prosthesis attached to a model of the cat's leg. *(Photo: Becky Kirkland)*

"There were many design challenges from an engineering standpoint," said Harrysson. "The bones of the cat's leg are very small and can easily break. We had to test several designs on the models before finding the best fit."

Harrrysson used rapid prototyping technology that can create a 3-dimensional model from CT scans to first build models of George Bailey's deformed limbs. Using the models, he designed a prosthetic limb with a long titanium nail that was small enough to be inserted into the cat's tiny tibia and secured with four tiny titanium screws. A cuff of porous tantalum attached at the base of the nail allows the bone tissue to adhere to and grow into the prosthetic, making it stronger and permanent. A titanium post protrudes from the skin covering the bone and cuff, and the flexible prosthetic leg and foot can be attached to the post. The final prosthetic was made by the Department of Industrial Engineering at NC State and BioMedtrix, a biomedical company with the capability of creating the porous tantalum cuff that is needed for the bone tissue to integrate with the prosthetic.

In a first-of-its-kind surgery on March 22, 2005, Marcellin-Little inserted the nail into George Bailey's femur and pulled the skin over the tantalum cuff. Following surgery, a wine cork was used to cover the titanium post below the surgery site to prevent the cat from snagging it on carpet.

"Designing the foot presented another challenge," said Harrysson. "We needed lightweight, strong and flexible material to fabricate the foot. In human prosthetics carbon fiber is used, but scaled down to the small cat foot, it proved too stiff."

Harrysson and his students tested several designs for the foot and finally settled on one made of spring steel covered with rubber for traction. The final foot design closely replicated the weight bearing and spring action of a cat's foot and leg.

Just weeks after his surgery, even before the artificial foot was attached, George Bailey was able to run and play.

Harrysson has worked with Dr. Marcellin-Little on many bone modeling projects that have benefitted pets with deformities. Recently, he has begun work on modeling soft tissue to aid surgeons and modeling sinuses to help Duke researchers develop nasal delivery pharmaceuticals. In addition he is working with Dr. Elizabeith Loboa, assistant professor of biomedical engineering at NC State, to find ways to repair structural defects, called voids, in the skulls of small children. ■

Biomedical engineer shrinks laboratory to a chip

Lab-on-a-chip technology will revolutionize lab testing

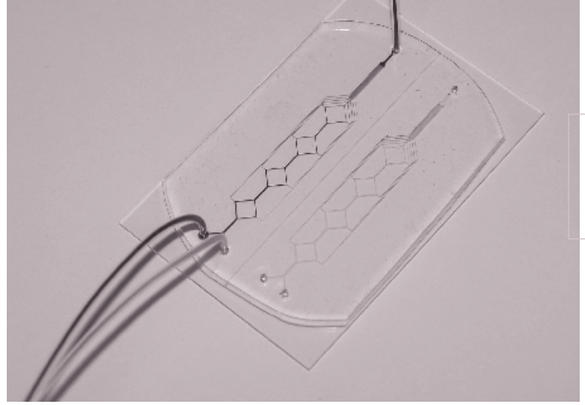
Even in a world that seems obsessed with the miniaturization of everything from computers to cellphones, the idea of shrinking a laboratory to the size of a chip seems a little too much like science fiction. But in the Tiny Biotools Laboratory at North Carolina State University, Dr. Glenn Walker, assistant professor of biomedical engineering, is making it a reality. An expert in microfluidics, he has developed lab-on-a-chip (LOC) technology that will revolutionize laboratory testing.

In his office Walker opens a glass dish that sits on his desk; it is about the size of the palm of his hand. Inside is a small glass slide with an even smaller chip attached to it. Tiny hoses protrude from the top of the chip like thin spaghetti. Walker holds up a 96-well tray typically used in laboratories for running multiple tests. "This," he says, gesturing to the chip, "replaces this," gesturing to the tray. "We can run the same tests on this small chip. And we've found that when we use the microfluid technology, the results are more accurate," he adds.

"THESE DEVICES WILL CHANGE THE WAY THAT TOXICITY ASSAYS ARE PERFORMED"

Walker's recent work has focused on creating microfluidic versions of high throughput screening systems for toxicity assays, but the technology can be applied to many other laboratory tests, allowing researchers and technicians to conduct many times more tests and experiments simultaneously while reducing the volume of chemicals needed by 99 percent.

According to Walker, there are several advantages to LOC technology. Fluids at the microscale have unique properties that allow them to perform unique functions. For example, surface tension can be used to guide fluid flow. This phenomenon can be used to create "virtual walls," as others in the field have demonstrated. Imagine a pipe with water in it, and then take away the walls of the pipe. The water will not spill out, but will keep flowing like it is in the pipe — this is the power of microfluidics. And the behavior of the fluids is more predictable, making results from biological and chemical experiments accurate.

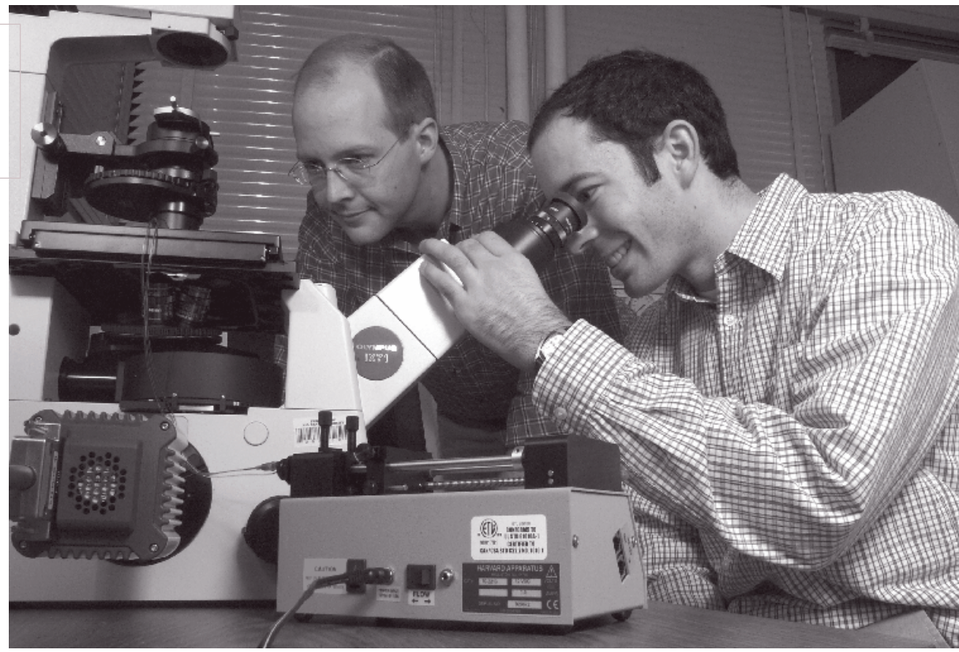


The lab-on-a-chip allows researchers to run multiple toxicity assays simultaneously. *(Photo: courtesy Dr. Glenn Walker)*

When testing a drug on cells in a traditional lab, scientists need enough medium and sample to fill several vials to run just a few tests. But using LOC technology, researchers can run multiple tests with just a fraction of the sample and medium. For example, one test of five concentrations of a chemical on cells would traditionally require tens of thousands of cells with a few milliliters of chemicals diluted by hand into different concentrations. The LOC technology will allow a researcher to run the test using a few hundred cells and a few microliters of chemicals. And the LOC can be designed to automatically make hundreds of different chemical concentrations. The reduced cost and greater accuracy make this technology the next revolution in drug testing and research.

The chip component of the LOC is made from micromolded polydimethylsiloxane (PDMS), which is bonded to a glass slide. The micromolding process can be adapted to a wide variety of plastics and is an attractive way for devices to be mass-produced.

"These devices will change the way that toxicity assays are performed," says Walker. "It will make the process much less expensive, more efficient and more accurate." ■



Walker and graduate student Adrian O'Neill examine fluid flow through a lab-on-a-chip under the microscope. *(Photo: Becky Kirkland)*

Engineers' device to reduce pain in heart surgery patients

Researchers have designed an instrumented retractor that can help doctors reduce post-surgical pain

Each year, more than 700,000 Americans undergo open-heart surgery. In addition to the many risks associated with this procedure, it can result in post-operative pain lasting for months or even years. A primary cause of this pain is opening the ribcage for access to the heart.

Researchers at North Carolina State University are working to reduce post-operative pain associated with open-heart surgery. Dr. Gregory Buckner, associate professor of mechanical and aerospace engineering at NC State, and Nicholas Jardine, undergraduate research assistant in biomedical engineering, are collaborating with surgeons from the University of Chicago to develop a force-controlled retraction device that can help doctors reduce post-surgical pain.

When doctors open the chest of a heart surgery patient, they use a standard retractor with two steel blades to pry the ribcage open either at the sternum or between the ribs. The forces exerted by these blades can result in rib fractures, nerve tissue damage or other trauma. The instrumented retraction device designed by Buckner's group features six adjustable blades to help distribute the forces.

"Our design uses pivoting blades with embedded sensors to measure retraction forces and give immediate feedback to the surgeon," said Buckner. "Our first prototype was tested on cadavers at the University of Chicago. Results from these trials led to design modifications in our second prototype."

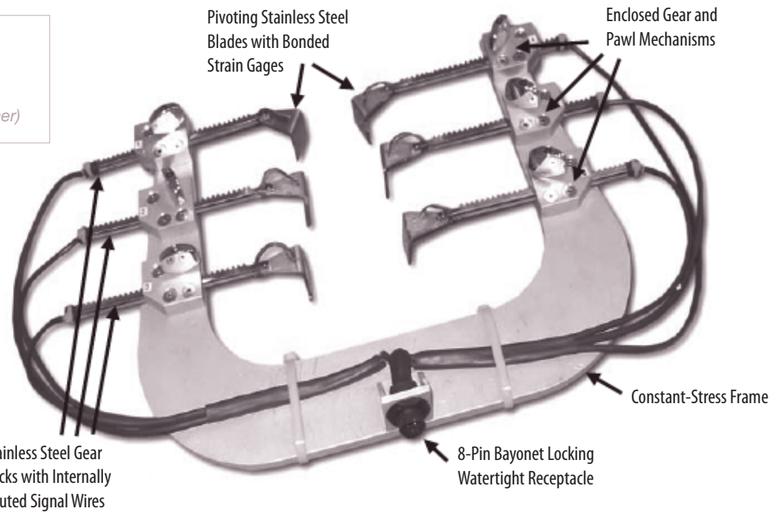
Dr. Gil Bolotin, a surgical specialist at the University of Chicago, performed surgeries at NC State's College of Veterinary Medicine to compare the second-generation

"OUR DESIGN USES PIVOTING BLADES WITH EMBEDDED SENSORS TO MEASURE RETRACTION FORCES AND GIVE IMMEDIATE FEEDBACK TO THE SURGEON."

prototype to a conventional retractor. The researchers found that monitoring retraction forces during surgery resulted in significantly lower forces on the ribcage. They also documented a reduction in rib fractures from five incidences with conventional retraction to one incident with instrumented retraction. Buckner reported these findings at the New Era Cardiac Surgery Technology Conference held in Laguna Niguel, Calif., in January 2005.

The research team has applied for a patent on the device and recently received approval to conduct a 70-patient clinical trial on human patients at the University of Chicago Hospitals. They are awaiting funding from the National Institutes of Health before starting the clinical trials.

"The results from our animal trials are encouraging, but we still need to correlate reduced retraction forces to reduced post-operative pain," says Buckner. "We hope to document this correlation through clinical trials." ■



The prototype device uses six instrumented blades to retract the ribcage to give surgeons access to the heart during surgery. *(Image: courtesy Dr. Gregory Buckner)*

This image shows the components of the second prototype retractor. *(Photo: courtesy Dr. Gregory Buckner)*

Engineers create new generation of antimicrobial textiles

NC State engineers (left to right) Drs. Mohamed Bourham and Marian McCord work with Professor Samiha Gawish and Ameera Ramadan from the National Research Center in Cairo, Egypt, to graft antimicrobial agents to fibers at the molecular level. *(Photo: Jennifer Weston)*

Antimicrobial agents are not new to the marketplace. Our stores are filled with antibacterial soaps and gels, and in a post-9/11 world, wearable protection from biological agents is in increasing demand. So far antimicrobial textile production has used coatings that can wash away over time, reducing the useful life of protective clothing.

At NC State University, nuclear and textile engineers have joined forces with textile scientists from Egypt to create textiles that have permanent antimicrobial properties. Dr. Mohamed A. Bourham, professor of nuclear engineering, and Dr. Marian G. McCord, associate professor of textile engineering, chemistry and science and biomedical engineering, are working with Professor Samiha Gawish and Ameera Ramadan from the National Research Center in Cairo, Egypt, to produce this new generation of antimicrobial textiles.

Using atmospheric plasma and glycidyl methacrylate (GMA), a chemical catalyst, to open the molecular bonds of fibers, the research team has been able to successfully attach antimicrobial agents to the molecular structure of fibers, creating a permanent bond between the fibers and the agent so that washing and wearing do not reduce the efficacy.

Sponsored by the National Science Foundation (NSF) and the US Department of State through the US Embassy in Egypt, the project has potential for defense, homeland security and healthcare applications. For example, a soldier or emergency responder wearing clothing made of this special fabric could be protected from biological agents. Other applications include surgical scrubs and hospital bedding, which could lead to reduced infection rates among patients.

The current coating process uses a chemical bath that creates chemical soups, making it both costly and environmentally unfriendly. But the new plasma-based process eliminates chemical wastes, making it more environmentally sound. And fabrics made of molecularly altered fibers would be more economical for the end user since the properties are permanent, meaning uniforms, sheets and other items would not have to be replaced to maintain a high level of efficacy. Keeping in mind that production cost and retooling would be an issue for textile manufacturers, the researchers designed their system so that it can be plugged into an existing production line easily without interrupting the process.

Tests performed at US Department of Agriculture laboratories at NC State by Dr. Fred Breidt, associate professor of microbiology/fermentation, and Dr. Doria Wafa, visiting scientist in food science for the USDA, confirmed that the fabric samples altered with chitosan, a naturally occurring antimicrobial agent made from the shells of crabs and other shellfish, were up to 90 percent effective against three commonly occurring microorganisms: *Lactobacillus planterum*, *E. coli* and *Staphyloccus aureus*.

"This kind of cooperation between two countries is very important," says Bourham. "This can benefit the textile industries in both countries." ■

Engineers use computer game approach to automate in vitro fertilization

From stem cells to in vitro fertilization to transgenic mice, cell microinjection is the first step that makes biomedical research possible. Cell microinjection is the process of selecting a single cell and injecting it with DNA material. At present the process is a manual, time-consuming and tedious process that can take technicians as much as a year to learn. It is one reason that biomedical research is so expensive.

At NC State University, engineers are creating a new system for cell microinjection that uses computer games and robotics to semiautomate the process, reducing the time and labor factors and increasing the accuracy and efficiency, which will eventually lower the cost of the genetically altered cells and transgenic mice.

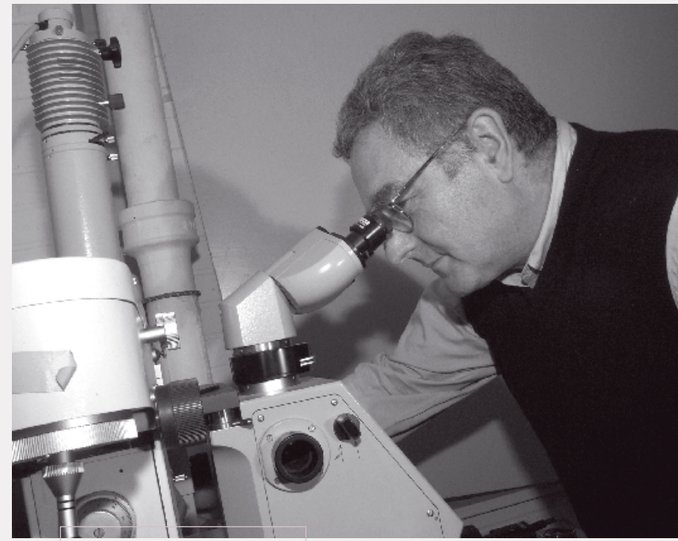
Currently the microinjection process requires technicians to sit at a microscope attached to a micromanipulation system and manually maneuver a tiny pipette to collect a single cell while maneuvering a tiny needle to inject material into the cell. The risk of error is high even for highly skilled technicians.

Dr. Edward Grant, professor of electrical and computer engineering, biomedical engineering and director of the Center for Robotics and Intelligent Machines, and Leonardo Mattos, a doctoral student in electrical and computer engineering, have created an interactive computer interface linked to the micromanipulation system that treats the process like a computer game, complete with joystick and onscreen images. The researchers are using machine learning techniques and experimental results to develop a controller for the microinjection process that can be used to train technicians more quickly by creating a virtual environment for practicing techniques.

The semi-automation increases efficiency and accuracy since the computer can be programmed to correct for human error. Using the joystick, a technician can manipulate a cell with the pipette and inject it with material without ever having to look through the microscope and without having to spend months learning the skill.

"Eventually we plan to fully automate the process by having users 'teach' the robot and computer," said Grant. "Basically we would be capturing the soul of the individual and putting it in the robot."

Dr. John Muth, assistant professor of electrical and computer engineering at NC State, has helped with the project. It is a joint research project with Dr. Randy Thresher and Dr. Al Banes, both from the UNC–Chapel Hill, through the joint Department of Biomedical Engineering.



Eddie Grant
(Photo: Becky Kirkland)

Mosquitoes inspire painless blood collection method

M.K. Ramasubramanian

Diabetics may soon have the mosquito to thank for alleviating some of their pain.

Researchers at North Carolina State University are collaborating to study, then mechanically mimic, the blood-sucking prowess of mosquitoes. Their ultimate goal is to design a "synthetic mosquito" capable of drawing blood painlessly — an especially attractive idea for the millions of diabetics worldwide who must draw blood several times a day for glucose monitoring.

Dr. M.K. Ramasubramanian, associate professor of mechanical and aerospace engineering and the project's principal investigator, said he has long sympathized with diabetics and has close friends who suffer from the disease. "It's terrible," he said. "It ravages the body." Development of a painless blood collection method could also lessen the trauma for newborns that require monitoring of a variety of different constituents, such as bilirubin levels that signal jaundice.

Ramasubramanian has joined forces with Dr. Jay Tu, professor of mechanical and aerospace engineering, who specializes in manufacturing processes, and Dr. Charles Apperson, professor of entomology, who provides biological expertise (and mosquitoes), to form what Ramasubramanian called a perfect combination of researchers. The project recently was approved for funding by the National Science Foundation.

The primary objective of the project is to study the specific mechanics of drawing blood by a mosquito. This requires the study of the material and structural characterization of the parts of mosquito anatomy used to accomplish the task — specifically, the proboscis and fascicle. The proboscis acts as a sheath for the fascicle, the actual tube that punctures the skin like a hypodermic needle. After a mosquito lands and locates a place to feed, she (only females bite) lowers her head to the skin's surface, allowing the fascicle to enter the tissue while the proboscis folds to the side.

Studying a slow motion video of mosquitoes feeding on a student's thumb, Ramasubramanian noted another detail. "See the shaking it does? The mosquito is not just striking like a shot at the doctor's office; it's gently wiggling the fascicle to insert it into the skin. Pretty sophisticated behavior, actually." Wiggling dynamics — does the fascicle move in a circular motion or just back and forth — might also be important to the process. Also, how does the mosquito get the force to drive the fascicle through the skin's surface? Modeling of the behavior of the fascicle, his graduate student, Vinay Swaminathan, has discovered that the mosquito is using what is called a non-conservative follower force application strategy by tilting the head to prevent buckling and apply large forces in the process. In addition, the lateral and longitudinal vibration helps stabilize the fascicle like that of the "Indian rope trick." With these sophisticated features, the mosquito is able to generate as much as 10 times the force required to statically buckle the fascicle.

"The material that makes up the fascicle is amazing," Ramasubramanian notes. "It's like an intricately woven and coated fabric that has both strength and flexibility — a classic composite structure." *(Photo: US Department of Agriculture)*

It is well known that the fascicle bends once it is inside the tissue, almost at a right angle, yet it maintains a hollow tube approximately 30 micrometers in diameter (a micrometer is one thousandth of a millimeter) that allows the blood to travel through to the mosquito's abdomen. Reproducing this flexibility and small size, while maintaining structural integrity during the insertion process and flow, is a critical part of the project. Bending is necessary for easier access to capillaries, but if the tube pinches to less than five micrometers, red blood cells could get stuck inside.

Atomic force microscopy will help determine force deflection characteristics of the fascicle, or how much bending it can take without breaking. Micro-tensile tests will allow the determination of the properties of the fascicle structure as a composite. Graduate student Rob Gannnon is working on developing the micro-tensile stage for biological tissue testing. This information will in turn determine the type of material they can use, whether steel, titanium or something else entirely. "We will have to study novel materials, then translate all our research findings into engineering specifications in order to assemble a viable device," Ramasubramanian said. "But there are a host of manufacturing issues to understand first."

That's where his colleague's expertise comes in, he said. "Tu will be looking at questions like how do we actually take a 40-micrometer-diameter wire and drill a 30-micrometer hole through it — can we use lasers to do it? And how do you assemble a device suitable for mass production?"

And what about the itching? Dr. Ramasubramanian cites Dr. Apperson, who is providing the mosquitos and is instrumental in helping set up the system of videotaping the mosquito feeding. Mosquitoes inject an anti-coagulant through their saliva into the host's skin when they feed. This keeps the blood from solidifying during draw, but it also causes the allergic reaction in skin that results in swelling and itching. The anti-coagulant would not be necessary for a synthetic mosquito. Still, production of such a novel blood-drawing device and subsequent development of a glucose monitor interface present a sticky challenge. Ramasubramanian knows that the process will be complicated but says the possibilities are endless.

They could, he suggested, design something that fits on the back of a watch. A real mosquito gets 2.5 microliters of blood in one draw, which is sufficient to test for glucose levels — currently available home-use tests already rely on blood from a single finger prick. One synthetic mosquito could keep an almost constant check on the wearer's glucose levels — automatically and painlessly. Taking the concept one step further, the system could be reversed to inject insulin or other therapeutic agents back into the body when necessary. Such a device could potentially be available in the next 5 to 10 years, Ramasubramanian said.

Drawing inspiration from the natural world is nothing new for Ramasubramanian. He professes a long-time interest in biomimetics — the practice of taking ideas from nature and implementing them in another technology, such as engineering, design or computing. "We can learn a lot from looking at biological systems," he explained. "I was never a big fan of mosquitoes, but the more I learn about them the more fascinating they become." ■

STUDENT

spotlight

Engineers' Council pledges support for future students

This past year, the Engineers' Council sponsored the largest Engineering Career Fair in the College's history. The event attracted more than 100 companies to the campus, and 1,685 students attended. This annual event, which brings potential employers and current students together, is so successful that the Engineers' Council has recently pledged to increase their endowment to $100,000 over the next five years.

In this way, the Engineers' Council will not only help current students find jobs after graduation, it also will help future engineering students pay for part of their education. At the annual Engineers' Council banquet, council president Tyler Schweitzer presented a check to the NC State Engineering Foundation for $25,000 to supplement the Engineers' Council endowed scholarship fund. As part of the university's current fund-raising campaign — *Achieve! The Campaign for NC State* — the Engineers' Council presented the College of Engineering with an additional $12,500 and pledged to create a $100,000 endowment over the next five years. The announcement was made at the Campaign Kickoff in September 2005.

"We are extremely impressed with our students in the Engineers' Council and this demonstration of how much they care about the generations of students who will follow them. They are setting a superb example for their fellow students and creating a legacy of leadership and generosity," said Dr. Nino A. Masnari, dean of the College of Engineering.

The endowment will be used to provide scholarships for undergraduate students in the College of Engineering. One scholarship will be used to encourage a freshman engineering student to participate in the Engineers' Council.

"The 25,000 endowment plus the $12,500 gift were made possible by the generosity of the students and the success of the Engineering Career Fair. We are all very proud of their commitment to the College," said Brian Koehler, coordinator for the First-Year Engineering Program.

"We could not have been more pleased when Tyler came to us with the campaign donation from the Engineers' Council as well as the long-term pledge of $100,000. To my knowledge, this level of giving by a student organization is unprecedented in the College and the university, and we are grateful for their show of loyalty and support," said Ben Hughes, executive director of the NC State Engineering Foundation.

"We feel strongly that pledging this gift to the College fits with our leadership role among engineering students," said Schweitzer. "In addition to supporting scholarships for future students, the gift will foster giving and encourage young engineering graduates to support scholarships in the College." ■

Engineers' Council leaders Tyler Schweitzer, Joe Morrow, Alex Carter, Laura Shearin, Casey Fields and Sara Brumbaugh meet on the steps of Page Hall.
(Photo: Jennifer Weston)

Tribal school students attend Engineering camp

Summer for middle school students usually means a vacation from math and science studies. It is a time of swimming pools and long lazy days. But at North Carolina State University, students are diving head first into math and engineering.

The Middle School Summer Engineering Camp is designed to give rising fifth through ninth graders experience in math, science and engineering in a fun and comfortable environment. The camp encourages the students to pursue math and science at an age when many lose interest or become intimidated by those subjects. This is especially true for students who come from underrepresented groups.

This year, for the first time, funding was available for 12 students from the Haliwa-Saponi Tribal School in Hollister, NC, to attend the camp as part of a program to promote math and science education in underrepresented groups.

"This was a great opportunity for our students to be exposed to a college campus and gain experience through the science projects at the camp," said Dr. Ogletree Richardson of the Haliwa-Saponi Tribal School. "The camp was a very positive experience that would not have been possible without the funding provided by the College of Engineering. After attending the camp, our students are now thinking in terms of attending NC State. We hope to be able to have students attend the camp each year."

Funding for the Native American students' registration was provided by the Women in Engineering and Outreach Programs in the College of Engineering and the Recognizing Accelerated Math Potential in Under-represented People (RAMP-UP) program. Designed to promote and facilitate the teaching of problem-solving and inquiry-based mathematics to children in grades K-12, RAMP-UP focuses on raising interest and performance in math and science for women and minorities.

Campers from the Haliwa-Saponi Tribal School show Dr. Laura Bottomley their completed projects from the 2005 Middle School Summer Engineering Camp held at NC State University.
(Photo: Jennifer Weston)

Activities at the camp were based on inspirations from the Survivor and CSI series on television. Students at the camp created and tested signaling devices, airplanes, solar ovens and lip balm. The camp culminates with competitions between various teams for awards based on performance, creativity and design of their projects. The middle school students spent the week with NC State professors, graduate students, undergraduate students and high school interns.

For more information about engineering summer camps, visit **www.engr.ncsu.edu/summerprograms/index2.html**. ■

STUDENT

spotlight

Spend a Day in Engineering draws students and parents to NC State

Alice Fogerty (center), academic advisor in the College of Engineering, and student hosts Erin Moore (left) and Shameeka Scott (right) helped make the Spend a Day in Engineering event successful.

Visiting families settle in to hear students and faculty share their experiences at NC State University.

It's like the parting of the red sea — parents are directed to the Walnut Room of the Talley Student Center at NC State University for an information session and their high school students to the room across the hall to be paired up with hosts. They are here by invitation to check out the College of Engineering during the Spend a Day in Engineering event, which helps students and parents become more familiar with what the college and university have to offer. Students attend classes with their hosts, eat lunch with them and visit campus facilities, such as the residence halls, the library and the gymnasium.

Parents begin their day with a two-hour information session that includes a freshman year overview and information on the Women in Engineering (WIE) Scholars and Women in Science and Engineering (WISE) programs, student-owned computers, scholarships, financial aid, career services and cooperative education. After a question-and-answer session, the parents take a campus tour. Students and parents come together for a wrap-up session.

The Spend a Day in Engineering event is extremely popular with participants, and it never fails to persuade a few more wolves to join the Pack. ■

Kay Leager (center), director of enrollment management in the College of Engineering and organizer of the Spend a Day in Engineering gets some great assistance from student hosts Heather McFelea (right) and Erin Gatling.
(Photos: Kathi McBlief)

Half Wuf, half engineer makes one terrific college job

Half Wuf, half engineer makes one busy life for senior Julian Willoughby.

You see them at football games and basketball games, on TV and at major college events. Mr. and Ms. Wuf, the furry mascots for the Wolfpack, are arguably the busiest couple at NC State. One would never guess that they could possibly have time to pursue engineering degrees, but for chemical and biomolecular engineering seniors Julian Willoughby and Mary Andrews balancing mascot engagements and engineering studies is a way of life.

Andrews, who is minoring in biotechnology, hopes to work in forensics with the FBI after graduation. A seasoned traveler, she has spent summers in Spain and spent last summer in Charleston with her sister. Prior to becoming Ms. Wuf, Andrews had no cheerleading or mascot experience. She got involved after attending a ballgame and watching Ms. Wuf entertain the crowd. After the game, she met with the coach and tried out to become one of three to play Ms. Wuf.

Engineering seniors Julian Willoughby and Mary Andrews balance Wuf duties with their studies. *(Photos: courtesy Media Relations, NC State University)*

"Balancing the weekly appearances and my classes is not very high stress for me," says Andrews. "Planning and organizing is the key. And there are three of us, so if someone can't make a game or an event, we have another person who can go in our place."

Willoughby, who is also minoring in biotechnology, is interested in biomolecular science and the new field of nanoscience. In addition to attending classes and being Mr. Wuf this fall, he worked on a research project with Dr. Orlin Velev, assistant professor of chemical and biomolecular engineering at NC State. Willoughby enjoys his life as mascot and often works in other mascot costumes from Arthur the Aardvark to the Cat from Busy Town.

"I really enjoy the community work," says Willoughby. "We go to hospitals and minor league baseball games. Last year I threw the opening pitch at the Durham Bulls game. I was Arthur the Aardvark. I'm a big sports fan, so it has been great to be standing beside T.A. McLendon in the end zone during last year's homecoming game and riding to Hickory in a van with Chuck Amato last summer."

In addition to their official appearances at college and community events, Mr. and Ms. Wuf go to private parties and deliver happy birthday messages for a fee.

Wherever they go, both Andrews and Willoughby agree that the reactions of the fans are the best part of the job. They know their presence helps kids and adults get more enjoyment from the event. Both say that being Mr. and Ms. Wuf is a terrific college experience. ■

FACULTY

spotlight

Masnari to step down as Dean

Nino Masnari

Dr. Nino A. Masnari has announced that he will step down as dean of the College of Engineering July 31, 2006. Dean of the college since August 1996, Masnari has overseen major growth in enrollments, research funding, private financial support for scholarships and professorships, and college facilities, including the opening of three new buildings on Centennial Campus.

During his term as dean, the College of Engineering undergraduate and graduate enrollment increased significantly. The number of undergraduate and graduate degrees reached record highs. The college currently is third in total degrees awarded in the nation. Research funding almost doubled, exceeding $90 million. Scholarship funding more than quadrupled, and the total endowment benefitting the college doubled to more than $51 million. The college established a joint department of biomedical engineering with UNC-Chapel Hill and added a bachelor's degree in paper science and engineering. The number of distance education, two-plus-two, and dual-degree programs greatly increased.

"I have made no specific plans beyond next July, but I certainly look forward to continuing my relationship with NC State University and the College of Engineering. During my 26 years with NC State, I have had the rare opportunity of seeing the College of Engineering from many sides — as a faculty member, department head, center director, and dean — and I have enjoyed each of these roles and the people and experiences that accompanied them," Masnari said. "Being a part of this college has been very rewarding for me. We have many accomplishments of which we can be proud, and the credit for these achievements goes to the faculty and staff for their hard work and dedication."

Under his direction, the quality of entering freshmen increased, 112 new faculty members were hired, national recognitions by the National Science Foundation tripled, a novel orientation program for new faculty was initiated, four new centers and institutes were created and a number of other major research initiatives began.

Programs for minorities and women increased significantly, including the appointment of the first woman as a center director and associate dean. Masnari also instituted an aggressive recruiting program, including hiring a director of recruiting and conducting statewide recruiting visits. In 2000 the college received the Presidential Award for Excellence in Science, Mathematics and Engineering Mentoring.

"Dean Nino Masnari's leadership through the years has brought considerable strength to the College of Engineering," said Chancellor James L. Oblinger. "Building on an already strong standing among engineering colleges in the United States, he moved the college into the top tier in enrollments, degree production, external funding and institutional cooperation. But one of the things he is most noted for is keeping the best interest of the students as his top priority."

"I've had the opportunity to work alongside Dean Masnari both as dean of the College of Natural Resources and as provost," said Dr. Larry Nielsen, provost and vice chancellor for academic affairs. "I have appreciated his leadership, insight and the wealth of experience he brings to our campus."

During his final year as dean, Masnari will oversee planning for Engineering Building III and conceptual planning for buildings IV and V.

Masnari, who is a Distinguished Professor of Electrical and Computer Engineering, has served as vice chair of the American Society for Engineering Education (ASEE) Engineering Deans Council. He joined the faculty at NC State in 1979 as head of the Department of Electrical and Computer Engineering, and from 1988 to 1996 he was director of the Center for Advanced Electronic Materials Processing. Prior to coming to NC State, he was a professor of electrical engineering and the director of the Electron Physics Laboratory at the University of Michigan.

Masnari received his bachelor's, master's and doctoral degrees in electrical engineering from the University of Michigan. A native of Three Rivers, Mich., he is a Life Fellow of the Institute of Electrical and Electronics Engineers. ■

NC State Ranks Number One Best Buy in Engineering Online Degrees

NC State University's online Master of Engineering and Master of Civil Engineering degrees rank as the number one best buy in the nation for online engineering education.

www.engr.ncsu.edu/news/news_articles/bestbuy.html

CONGRATULATIONS TO TWO CHEMICAL AND BIOMOLECULAR ENGINEERING FACULTY MEMBERS ELECTED TO THE NATIONAL ACADEMY OF ENGINEERING IN 2005

Carol Hall

Joseph DeSimone

- Dr. Carol K. Hall, Alcoa Professor of Chemical and Biomolecular Engineering at NC State University. *(Photo: DeLaRosa Photography)*
- Dr. Joseph M. DeSimone, William R. Kenan, Jr. Distinguished Professor of Chemistry at UNC-Chapel Hill and Chemical Engineering at NC State. *(Photo: Dan Sears)*

Membership in the NAE recognizes those who have made outstanding contributions to engineering research, practice, or education.

NC STATE achieve! Innovation in Action

ALUMNI IN THE

frontline

Pop culture embraces engineering alumnus' "hip" new device

— The hiptop™ communication device called T-Mobile Sidekick® was developed by company founded by alumnus Joe Britt (CPE '91)

What's it like to create pop culture's hottest new accessory?

Just ask NC State computer engineering alumnus Joe Britt. He is chief technology officer and founder of Danger Inc., the Silicon Valley company that designed and developed the hiptop™ communication device, popularly known as the T-Mobile Sidekick®. This latest must-have accessory in Hollywood and across the nation adorns the hips of pop culture icons like Paris Hilton, Nicole Richie and Jennifer Aniston. Danger's hiptop offers users the ability to instant message (IM), email, surf the Internet and talk on the phone wirelessly on a device that isn't much larger than a standard cell phone.

And the answer to the question?

"It's great," says Britt with a laugh. "We could never have purchased that level of advertising, but what it really speaks to is the design of the device. If it weren't filling a need with a high coolness factor, then these people would not have one."

The "coolness factor" and the combination of applications are what put the hiptop on top of the communications device industry and on the hips of the rich and famous. It has won numerous industry awards and is on several "best of" lists.

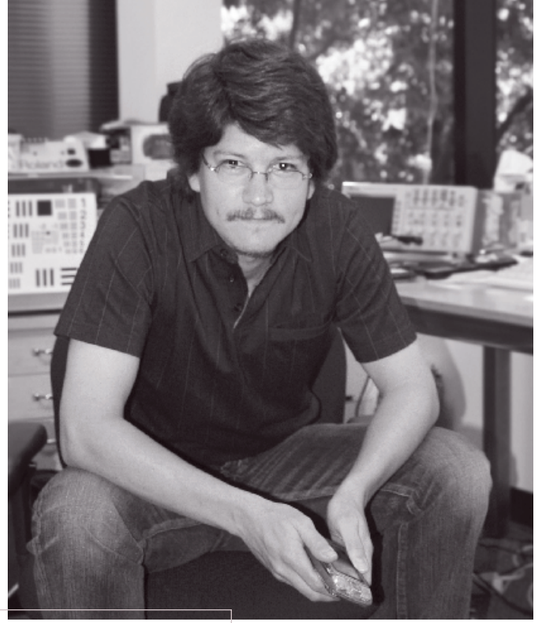
"When we were designing the hiptop, we incorporated what I call 'surprises in surprises' in the design," says Britt. "You want to continually delight the user so the device isn't just useful — it is fun to use."

Britt and his colleagues did not start Danger with the hiptop in mind. They learned from trial and error and listened to their contacts in the investment community. With that input and their backgrounds building consumer-focused digital products, the original idea for an inexpensive Internet marketing device evolved into the hottest new communication tool on the market. Along the evolutionary path, the Danger team encountered many challenges related to creating a multifunctional wireless communications device. The company holds several patents for the technologies developed to address those challenges.

"Developing intellectual property (IP) is necessary for the success of a technology-based company," says Britt. "The IP aspect and how to protect what you build is very important."

Danger's nonlinear path to the hiptop reflects Britt's own path to Danger. At age 19 he began his Silicon Valley career, working summer internships at Apple Computer Inc. After graduation from NC State in 1991, he joined the Apple team, working in the Reduced Instruction Set Computer (RISC) Products Group. He also was a core member of the Read Only Memory (ROM) development team for the first-generation PowerPC-based Macintosh.

He left Apple in 1993 to join the 3DO Company, where he contributed to the design of a new video game console. After 3DO, he joined a very small startup called Catapult Entertainment and was part of the team that created the Xband Video Game Network, which enabled multi-player gaming over the Internet. His experience and contacts there led him to another startup, Artemis Research — that being the "stealth name" for the company that would become WebTV. He was responsible for the architecture and creation of the system software used in the WebTV set-top boxes. He holds five patents based on his work with the hardware design at WebTV.

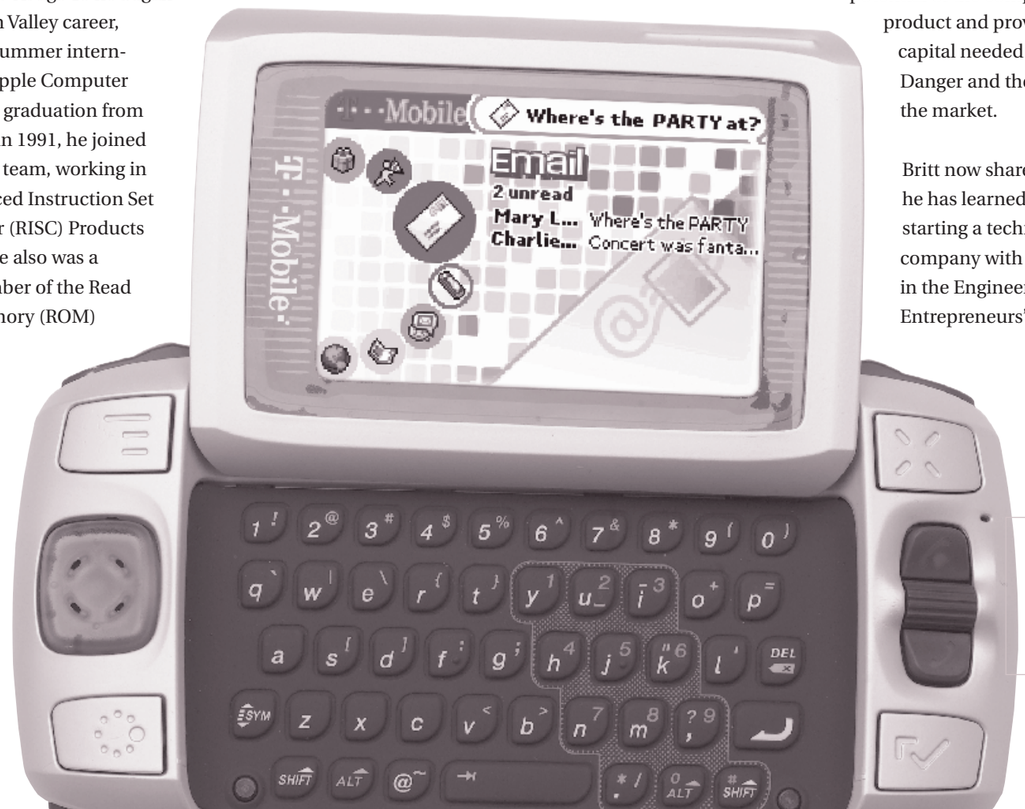


Joe Britt (CPE '91) is chief technology officer and founder of Danger Inc. *(Photo: Kristi Ribble)*

In late 1999, he and two friends, Andy Rubin and Matt Hershenson, came up with the idea to start Danger. They raised enough money to cover the initial start-up costs from friends and family. The idea and the investment paid off. Venture capitalists recognized the potential of the company's product and provided the capital needed to bring Danger and the hiptop to the market.

Britt now shares what he has learned about starting a technology company with students in the Engineering Entrepreneurs' Program at NC State. Each year, Dr. Tom Miller, vice provost for distance education and learning technology applications and founder of the Engineering Entrepreneurs' Program, brings his student entrepreneurs to meet alumnus Britt and tour Danger. Britt says he enjoys the connection with NC State and the interaction with the students. He tells the students about his work and how his engineering education helped him.

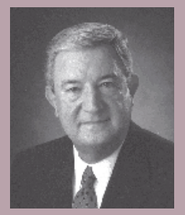
"The most important lesson I learned in engineering at NC State was how to think about a problem," says Britt. "Learning the philosophies for approaching problems was important to the process of creating the hiptop." ■



The hiptop™ communication device, popularly known as the T-Mobile Sidekick®, is the latest must-have accessory in Hollywood and across the nation. It was developed by Danger Inc., a company founded by engineering alumnus Joe Britt. *(Photo: Danger Inc.)*

The College of Engineering salutes our cochairmen for *Achieve! The Campaign for NC State*

Culberson



Day

McPherson

- S. Frank Culberson (CHE ’60), president and CEO, Rimkus Consulting Group; Distinguished Engineering Alumnus 2002; member of the NC State Engineering Foundation Board of Directors.
- Fred N. Day IV, president and CEO, Progress Energy Carolinas; member of the NC State Engineering Foundation Board of Directors; proud parent of two NC State engineering graduates.
- Thomas R. McPherson Jr. (EE ’76, ’77), CEO, Cognio Corporation; Distinguished Engineering Alumnus 2004; advisory board member, Engineering Entrepreneurs’ Program.

Thanks to the dedication of these College of Engineering supporters, *Achieve! The Campaign for NC State* is off to a great start. This historic, university-wide, $1 billion fundraising effort will ensure our ability to transform lives for generations to come through truly innovative teaching, research, extension and public service.

achieve!
The Campaign for NC State

Alumna Whitman brings home the platinum

“Costs will be prohibitive.” “No contractors will bid.” “Paints will peel.” “Storm water won’t perk.” “The gophers will eat the drip irrigation.” These were just a few of the concerns that alumna Eliza Jane Whitman (BSCE ’89, MSCE ’91) heard while she was project manager for the “green building” design and construction of the Inland Empire Utilities Agency’s (IEAU) administrative headquarters.

The IEUA in Chino, California, is a municipal water district that distributes imported water and provides municipal and industrial wastewater collection and treatment services to 750,000 residents just east of Los Angeles in San Bernardino County. Its headquarters are a handsome complex made up of two 33,000-square-foot buildings designed to meet standards established by the U.S. Green Building Council’s Leadership in Energy and Environmental Design (LEED®).

With the square footage of 40 houses, the complex consumes the same energy as four and will soon produce 100 percent of its energy needs through a combination of energy conservation, solar panels on the roof and the power and waste heat from internal combustion engines using methane gas generated at the adjacent wastewater treatment plant. Recycled water and efficient plumbing fixtures reduce water consumption by 73 percent. Recycled materials are used throughout the complex, including a foundation made of crushed toilets, bathroom tiles made of windshields and parking stops made of milk cartons. Even parking and landscaping reflect “green thinking.”

Whitman and supervisor Neil Clifton spurred IEUA’s decision to go with a LEED integrated approach to design, construction and operation of buildings. The end result was an environmental showcase. In 2004 the IEUA became the first public agency — and largest building — to receive a LEED platinum 2.0 rating, the U.S. Green Building Council’s highest. ■

EXTENSION update

NC State engineers help workers with disabilities

Last Christmas came early to one local business seeking to employ teenagers with developmental disabilities. Thanks to a team of NC State engineering students who designed and built a user-friendly workstation, the workers can accomplish their job tasks more easily.

The project began in fall 2004 when Rick and Jackie Holcombe contacted the College of Engineering for help in creating a workstation that is easy for their prospective employees to use and safe to operate. The Holcombes’ business, It’s Lagniappe, is a small startup company in Morrisville aimed at employing teenagers who have developmental disabilities, including the Holcombe’s daughter, Lindsay.

Dr. Hamid Davoodi, a lecturer in the Department of Mechanical and Aerospace Engineering, took the Holcombes’ request to some of his students, then seniors in mechanical engineering: David Anderson, Nathan Houston, Bernard “BJ” Meier and George Ware; they were immediately interested in the proposition.

The students set up a schedule, created the design and met each of their targeted goals on time with a high level of professionalism and enthusiasm. They worked as a team to resolve hurdles, including finding a source of funding.

The home business produces bags of buckwheat hulls for sale on the Internet. Buckwheat hulls are used for a variety of health, craft and beauty products. The workers transfer the hulls from a 700-pound bag into individual 2-pound bags.

The assignment for the engineering students was to design a repackaging workstation that could safely deliver the hulls from the bulk bag to an accessible location for repackaging. The workstation also needed to incorporate features that would allow the workers to easily measure two pounds of hulls without having to weigh each individual bag.

The team kept the project on track and delivered the completed prototype workstation in early December.

“This workstation is exactly what we needed and is so user-friendly,” said Jackie Holcombe. “We are very appreciative of all the work these students and Dr. Davoodi have done to help us. The new workstation prototype will make it possible for us to expand our business and hire more workers. There are several people with disabilities who have been waiting for this opportunity, and now we are closer to being able to offer them a chance to work and learn.”

“We had a great time working on this project,” said Ware. “We learned how to use the strengths of each team member to accomplish our goals. It was a very rewarding experience.”

The Holcombes look forward to the possibility of partnering with other businesses that employ workers with disabilities. ■

Mechanical engineering students B.J. Meier, George Ware and Nathan Houston designed and built this workstation to make work easier for disabled workers. *(Photo: Jennifer Weston)*

Annie Antón, associate professor of computer science, was awarded one of four Women of Influence awards at the 2005 Executive Women's Forum. The awards, sponsored by *CSO Magazine*, highlight the accomplishments of women in the security field.

Rada Y. Chirkova, assistant professor of computer science, and **Gracious Ngaile**, assistant professor of mechanical and aerospace engineering, have received Faculty Early Career Development (Career) Awards from the National Science Foundation.

Chirkova will receive $489,810 to support her research project on adaptive automated design of stored derived data. Ngaile will receive $400,000 to support his research project on meso and macro hydroforming of complex shapes — mechanics and control.

Mo-Yuen Chow, professor of electrical and computer engineering, has been selected to receive the Region 3 Joseph M. Biedenbach Outstanding Engineering Educator Award by IEEE.

Paul D. Cribbins, professor emeritus of civil engineering, was inducted into the N.C. Transportation Hall of Fame in November 2005.

The Alcoa Foundation Engineering Research Awards for 2005 were presented to **Paul D. Franzon**, professor of electrical and computer engineering, and **Andrey V. Kuznetsov**, associate professor of mechanical engineering.

Christine S. Grant, professor of chemical and biomolecular engineering, was selected in 2005 as one of the first Boeing Company Engineering Education Senior Fellows by the National Academy of Engineering.

Ola L. A. Harrysson, assistant professor of industrial engineering, received the Robert A. Dougherty Outstanding Young Manufacturing Engineer Award from the Society of Manufacturing Engineers.

Hassan A. Hassan, professor of mechanical and aerospace engineering, has been named Fellow of the American Institute of Aeronautics and Astronautics. Hassan joined the NC State faculty in 1962.

Jason M. Haugh, assistant professor of chemical and biomolecular engineering, received a Camille Dreyfus Teacher-Scholar Award for 2005.

Thom J. Hodgson, Distinguished University Professor of Industrial Engineering and the James T. Ryan Professor of Industrial Engineering and Furniture Manufacturing, is the 21st recipient of the R.J. Reynolds Tobacco Company Award for Excellence in Teaching, Research and Extension.

George F. List became head of the Department of Civil, Construction, and Environmental Engineering in July 2005, replacing E. Downey Brill Jr., who had served as head since 1988. List received his Ph.D. in civil engineering from the University of Pennsylvania in 1984.

Xiaosong Ma, assistant professor of computer science, has been awarded the Early Career Primary Investigator Award by the US Department of Energy in support of her research proposal, "Runtime Data Management for Data-Intensive Scientific Applications." The award, valued at $300,000, will run for three years.

Jessica H. McCoy received the Faculty Senior Scholarship Award for 2005-06. McCoy is a dual-degree student majoring in industrial engineering and applied mathematics.

Two Industrial Engineering faculty members have been named Fellows of the Institute of Industrial Engineers (IIE): **Henry L. W. Nuttle** and **Clarence L. Smith**.

Gregory N. Parsons, professor of chemical and biomolecular engineering, has been named Fellow of the American Vacuum Society.

The International Institute for FRP in Construction (IIFC) has recognized as Fellow **Sami H. Rizkalla**, Distinguished Professor of Civil Engineering and Construction and Director of the Constructed Facilities Laboratory.

Hans Stadelmaier, professor emeritus of materials science and engineering, has been selected to receive the 2006 Albert Easton White Distinguished Teacher Award from ASM International for "outstanding contributions to the understanding of interstitial compounds and permanent magnet materials and a lifetime of dedicated teaching in the classroom and laboratory."

Robert H. Tolson joined NC State in 2005 as the Langley Professor in Planetary Atmospheric and Flight Sciences. He is the principal NC State faculty member resident at the National Institute of Aerospace. Tolson earned his PhD in engineering mechanics from Old Dominion University in 1990.

James R. Wilson, professor and head of industrial engineering, was named Fellow of the Institute for Operations Research and the Management Sciences (INFORMS).

For more information, **visit www.engr.ncsu.edu/news**

Computer Science students take first place in IEEE world finals

A multidisciplinary student team from the Senior Design Center in the Department of Computer Science at North Carolina State University won the $20,000 first-place prize in the sixth annual IEEE Computer Society International Design Competition (CSIDC) World Finals held in Washington, D.C., in June 2005. Team members are David Coblentz (CSC '05), Dakota Hawkins (CSC '05), Jonathan Lewis (CSC '05) and Ben Noffsinger (junior, Fisheries and Wildlife Sciences). This is the first team from the United States to win this competition since it began six years ago.

Their project, "NEAT: Networks for Endangered Animal Tracking," combines GPS technology and wireless sensor networks to track animal movements in the wild. Mentored by Dr. Robert J. Fornaro, professor of computer science and director of the Senior Design Center (SDC), and Margaret Heil, associate director of the SDC, the NC State team was one of 10 teams out of nearly 400 selected to participate in the World Finals. Judged on technical merits, a written final report, a formal demonstration, an oral technical presentation and teamwork, the NC State team met the 2005 challenge of "Going Beyond the Boundaries" to devise "computer-based solutions for real-world problems."

This is the second time that an SDC team has placed in the top 10 at the competition. In the CSIDC 2003, the NC State Team won third place for an invention called Diet Download.

NC State ranks 2nd in nation in engineering BS degrees, 3rd overall

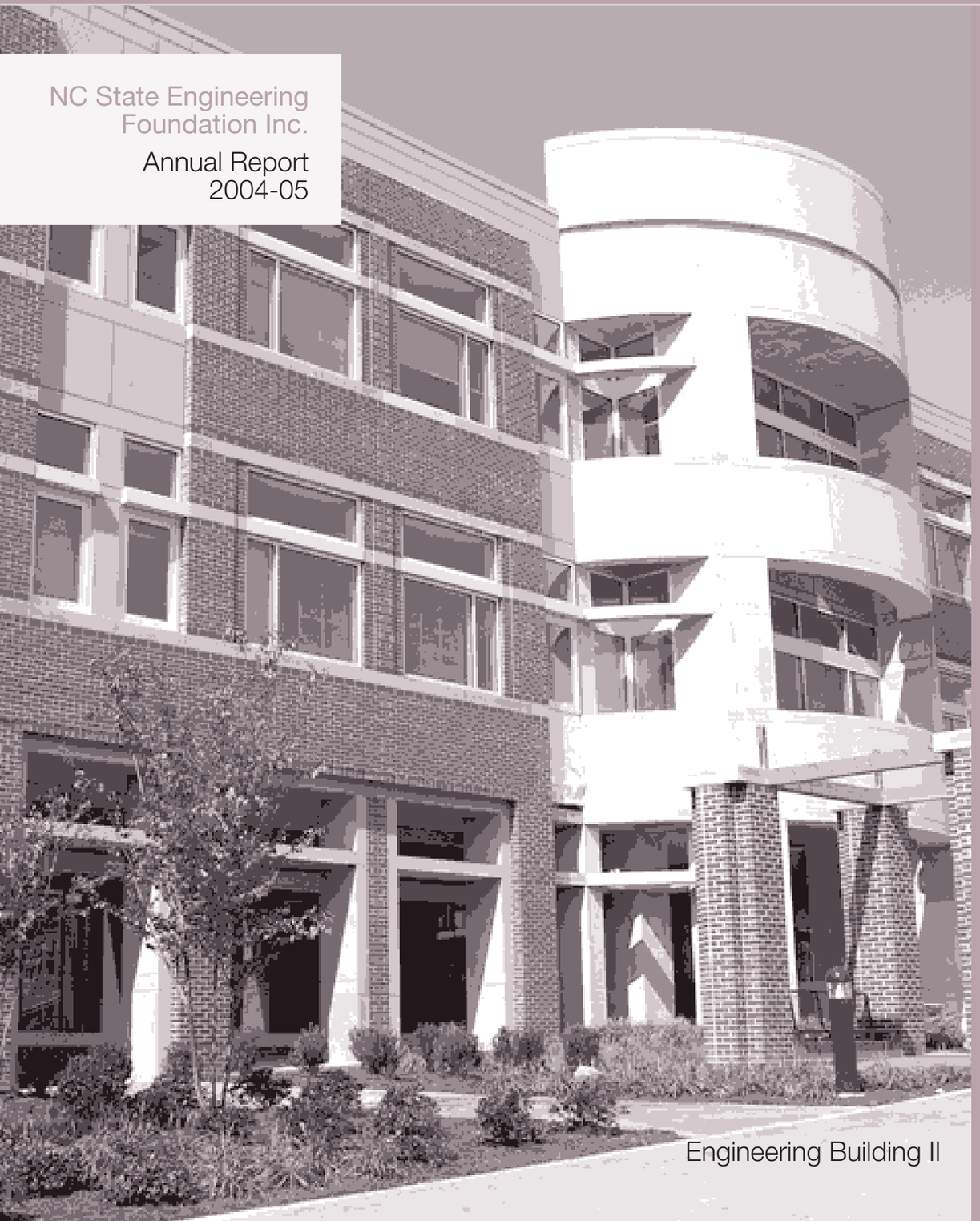
According to data released by the American Society for Engineering Education (ASEE), the College of Engineering at North Carolina State University has moved from third to second place in the number of bachelor of science (BS) degrees awarded among all engineering colleges in the nation. These figures from ASEE cover the 2003-04 academic year.

The College of Engineering at NC State routinely ranks in the top ten, usually in fifth or sixth place, but this is the first time it has climbed to second place. This quantitative ranking is partnered with a great increase in the quality of NC State's students, whose average grade point averages (GPAs) and SAT scores have continued to climb over the years.

NC State's engineering college ranks third in the total number of degrees awarded, which includes BS, master of science (MS) and doctoral (PhD) degrees. NC State ranks seventh in MS degrees and eleventh in PhDs awarded.

NC State Engineering Foundation Inc.

Annual Report 2004-05



Engineering Building II

From the executive director

Ben Hughes

This fall marks an historic time for North Carolina State University and the College of Engineering. On September 23, Chancellor James L. Oblinger and Board of Trustees Chair Wendell Murphy led a gathering of faculty, staff, students and alumni to formally kick off the public phase of NC State University's largest ever comprehensive fundraising campaign — *Achieve! The Campaign for NC State.*

This historic, university-wide, $1 billion fundraising effort will ensure our ability to transform lives for generations to come through truly innovative teaching, research, extension and public service. The money raised will support student scholarships and fellowships; investments in top faculty; new engineering courses and curricula; new and improved facilities; and research and extension efforts to solve statewide, national and global problems.

The College of Engineering has set a goal to raise at least $225 million toward the $1 billion university-wide goal. Thanks to the leadership and dedication of our College of Engineering Campaign Cochairs, S. Frank Culberson (CHE '60), president and CEO, Rimkus Consulting Group; Fred N. Day IV, president and CEO, Progress Energy Carolinas; Thomas R. McPherson Jr. (EE '76, '77), CEO, Cognio Corporation, *Achieve! The Campaign for NC State* is off to a great start. At the time of this writing, the College had raised over $177 million, or 79 percent of our $225 million goal.

Edward P. Fitts, of Exton, Pa., is another reason for our early success in this campaign. Ed has pledged $10 million to the Department of Industrial Engineering. His commitment is the largest gift ever received by the College of Engineering from an individual donor and the largest endowed gift to academics in NC State's history. The College of Engineering has announced that it will rename the Department of Industrial Engineering in honor of Ed's generosity and the transformative impact of this pledge, along with his many other important gifts to the College and the industrial engineering department. The Edward P. Fitts Department of Industrial Engineering will be the first named academic department in the history of the university.

All of our donors give us reason to celebrate, for your gifts truly do make a difference. Thank you for your dedication and support.

— Ben Hughes
Executive Director
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Beverly and Fred Gant greet scholars Natalie Johnsen and Jess Bardin at the 2005 Scholarship and Fellowship Dinner.

Engineering Foundation holds Scholarship and Fellowship Dinner

The Ninth Annual Engineering Endowed Scholarship and Fellowship Dinner was held March 18, 2005, at the Jane S. McKimmon Center. The event brings together recipients of endowed scholarships and fellowships and the donors who fund them. Organized by the NC State Engineering Foundation, the event celebrates the importance of private support of academic achievement.

"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 the gifts, and the students enjoy having an opportunity to thank the people who are helping them achieve their goals."

In addition to 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 have on continuing to build top-quality programs in engineering education. Sponsors for this year's event were Caterpillar, North Carolina Electric Membership Corporation, Progress Energy and R.J. Reynolds Tobacco Co.

Long-time donors Tempie Furr (left) and Ben Furr (right) greet scholars Charlene Maurer and Deanna Silsby.

Donors 2004-05

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, 2005. 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 Ben Hughes, NC State Engineering Foundation, (919) 515-7458, (866) 316-4057 toll free, or ben_hughes@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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Dean's Circle

Gifts listed below were received July 1, 2004, through June 30, 2005. For years of consecutive giving, a single asterisk indicates five years or more; a double asterisk, 10 years or more.

Gifts made directly to the NC State Engineering Foundation Inc. are utilized exclusively for the benefit of the College of Engineering. The Dean's Circle was created to recognize the vital support that annual, unrestricted gifts provide.

LAMPE SOCIETY

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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Fitts Donates $250,000

Edward P. Fitts (IE '61), chief executive officer of Dopaco, has given the College of Engineering an unrestricted gift of $250,000. The funds will be used for various needs in the college at the final determination of the Dean. In 1999, Fitts, who serves on the NC State Engineering Foundation Board of Directors, endowed the Edward P. Fitts Scholarship, one of the largest scholarships in the industrial engineering department, and in 2002 he endowed the Edward P. Fitts Industrial Engineering Professorship at NC State. The funds will be administered by the NC State Engineering Foundation Inc.

It only takes a moment

One of the best ways to show your support for your *alma mater* is joining the Dean's Circle. Your tax-deductible gift to the NC State Engineering Foundation Inc. of $1,000 or more in unrestricted funds qualifies you for membership. Whether it is for student recruitment, faculty development, scholarship support or other programs not supported by the State, these critical dollars are of utmost importance. Please call Gwen Bell at (919) 515-7458 for more information. It only takes a moment.

— Join the Dean's Circle today

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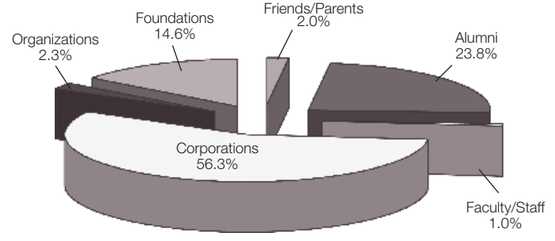

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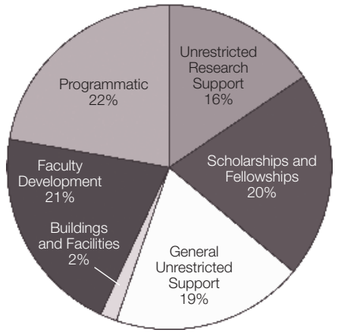

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Driverless vehicle carries NC State students and alumni to Top 20

INSIGHT RACING TEAM COMPETES IN DARPA'S GRAND CHALLENGE AUTONOMOUS VEHICLE RACE ACROSS THE DESERT

Early one October morning, in what seemed like a scene from a science fiction movie, a driverless 1987 Chevy Suburban, nicknamed "The Desert Rat," and 22 other driverless vehicles began making their way across the Mohave Desert on a grueling 150-mile race. The technology that guided The Desert Rat across the desert is the product of a partnership between North Carolina State University and Insight Technologies Inc. and may one day revolutionize not only the way the military performs missions but also the way that commuters drive to work each day.

Sponsored by the Defense Advanced Research Projects Agency (DARPA), the Grand Challenge competition requires teams to design a completely autonomous vehicle that can traverse rugged terrain while avoiding obstacles with no human assistance.

The Insight Racing team includes NC State students and alumni. Students in the computer science Senior Design Program initially designed and prototyped some of the software technology used on the vehicle.

Of the 23 competing vehicles, only five made it to the finish line. The Desert Rat placed 12th in distance traveled.

"What is so special about the Insight Racing team is that they are competing with teams that have spent literally millions of dollars on developing technology for the competition while Insight Racing operates on a shoestring budget," says Dr. Robert Fornaro, professor of computer science and director of the Senior Design Center. "It is a 'David versus Goliath' competition for our team." ■

Insight Racing team's Desert Rat is a driverless vehicle that competed in DARPA's Grand Challenge race for a $2 million prize.

Lanier delivers keynote address

First-year engineering students attended the 5th Annual College of Engineering Welcome September 6 at the Talley Student Center. The event welcomed the new class of 1,200 engineering freshmen to campus and exposed them to an engineering leader through the keynote address.

This year's address was presented by alumna Gayle Lanier (IE '82), vice president of Nortel Global Corporate Operations. Lanier has global responsibility for Nortel strategic direction and performance for Global Real Estate, Environment and Safety, the European Union Environmental Directives, Global Customer Satisfaction, Core Corporate Quality and Knowledge Services (training and documentation). She serves on the NC State University Board of Visitors, the NC State Engineering Foundation Board of Directors and the Computer Science Department Strategic Advisory Board. Lanier and her husband, Dwain (Accounting '79), have donated $25,000 to the College of Engineering for scholarships. The Laniers are also lifetime giving members in NC State's Polk Society. Their daughter Brittany is a student in chemical engineering at NC State.

Guest speaker Gayle Lanier (IE '82) addressed students at the 5th Annual College of Engineering Welcome.

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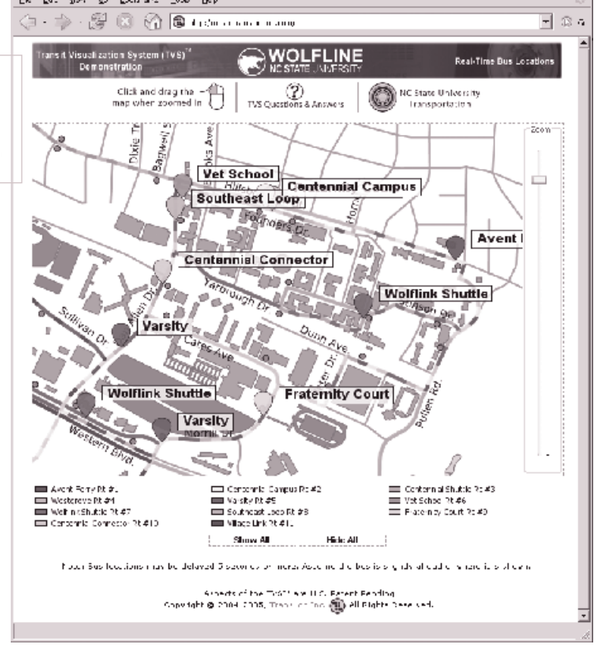

Wolfline riders can go to the NCSU Transportation website to see a map of the bus route with dots that indicate the location of the buses. *(Image: courtesy TransLoc)*

Engineering alumni create system to keep track of Wolfline online

New technology is the first in North Carolina to track public transportation on the Web

When students returned to the North Carolina State University campus this fall, they had a new resource for navigating the Wolfline system. The University Transportation Office contracted with TransLoc, a company founded by four NC State computer science alumni, to offer real-time information on the location of each of the Wolfline buses through a website.

Joshua Whiton (CSC '04), cofounder and chief executive officer of TransLoc, came up with the idea for an online, Web-based locator for buses while waiting for the bus with his friend and cofounder Dominique Bischof (CSC '03, MSCSC '04).

"People had kicked around the idea for a while, but no one ever really pursued it," said Whiton. "We were standing at the bus stop and just said that it was possible and then set out to make it happen."

The team, which also includes Jesse Lovelace (CSC '05) and Justin Harris (CSC '04), formed an intelligent transportation system (ITS) company to develop and market the innovative Transit Visualization System (TVS) that provides real-time tracking of multiple vehicles. They researched global positioning systems (GPS), radio systems and tracking programs. After building and testing several prototypes, they were ready to field-test the package.

The WolfLine system on campus was a perfect fit for testing since it was close to their offices in the NC State Technology Incubator on Centennial Campus. And the TransLoc system was a perfect fit for NC State's WolfLine since the traffic on campus and surrounding streets is a challenge for bus drivers to keep WolfLine buses running on time, especially with all of the construction on campus. The system allows students, faculty and visitors to go online and pinpoint where their bus is on its route. The TransLoc system is the first to offer this level of information in the mass transit market.

"With the new AVL technology in place, we are able to provide even safer, more convenient transportation services to students, staff and faculty," says Pat Mitchell, NCSU Transportation transit manager. "Rather than waiting at a stop in inclement weather or after dark, riders can check the TVS website and find out exactly when their bus is approaching their stop."

The TransLoc team is marketing its real-time online tracking system to mass transit providers in larger markets. The system offers public transportation officials another tool for managing a fleet of buses and other vehicles.

"It would take the worry about missing the bus out of the equation," said Bischof.

To view the Transit Visualization System for the Wolfline buses, visit the NCSU Transportation website at **www2.acs.ncsu.edu/trans/transit/index.html** and click on the Transit Visualization System link. ■

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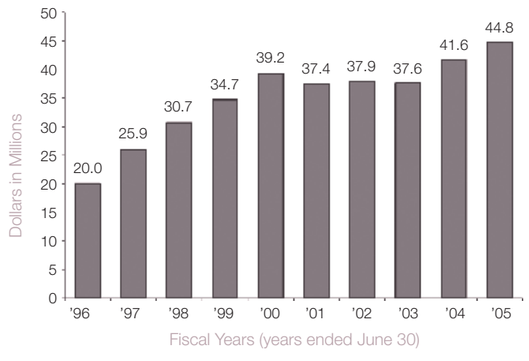

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W. F. Aldridge/High Point Sprinkler, Inc. • Ernest James and Ethel Hudgins Angelo Memorial • ARAI/Charles R. Manning • Dr. William W. Austin • James Bagwell • Robert M. Barefoot • Richard and Sarah Bean • John K. Beasley • Donald L. Bitzer Creative Award • George H. Blessis Memorial • The Boeing Company • John A. Boren Merit • Larry A. and Beth L. Bowman • C.R. Bramer • Otto Branscomb Memorial • John C. Brantley IV Memorial • Harry M. Bremer • Sarah L. Browning • R. A. Bryan Foundation • William N. Bullock • Carolina Tractor and Equipment Company • Robert and Elizabeth White Carson • L. W. Cartwright Memorial • William M. Cates • Michael B. Christie • E. I. Clancy • Worley "H" and Callie Anne Clark • William E. Clark Memorial • Maurice and Sophie Clayton • Norvin A. Clontz/Milliken Fellowship • Elizabeth B. Cockrell • Dr. Joseph S. Colson • John Estes Conway Memorial • I. Tunis and Bernardina B. Corbell • Arthur Glenn Corpening • Jack L. and Bonnie F. Covington Memorial • Richard Lee Craig Memorial • W. C. "Billy" Creel Memorial • Dan Culp • Everette B. Curlee • Curtiss Wright Centennial of Flight • Josephus Daniels • Harry G. Davis

Engineering Career Fair draws record crowd

It all started in spring 1998 with 58 companies and 1,500 students gathered at the McKimmon Center on NC State's campus. Amid the Frisbee rings, stress balls and logo-splashed mousepads, recruiters and students got down to the business of exchanging information for possible jobs after graduation. Codirected by Neal Guthrie (ME '99) and Sasha Lanning (TE '99), that first Engineering Career Fair was considered a complete success. At the end of the day, companies were already inquiring about the next one, and the annual event was born.

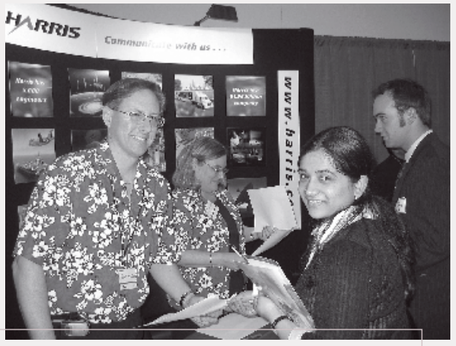
Now, eight years later, the Engineering Career Fair has more than doubled industry participation with more than 120 companies attending, placing it among the largest in the nation. The event has become so large that the Engineers' Council has enlisted the help of Brian Koehler, coordinator of the First-Year Engineering Program in the College of Engineering.

Expanded services for the fair include a new interactive website that provides a list of participating companies and online registration. The companies can list relevant information, including available positions, company culture and key statistics. Students can point and click on any company to receive a full profile, which can help them decide whether to prepare a resume and cover letter specifically for that employer.

Janvi Badlaney, a graduate student in computer science, talks with Jennifer Hare, human resources representative for Mulkey Engineers & Consultants.

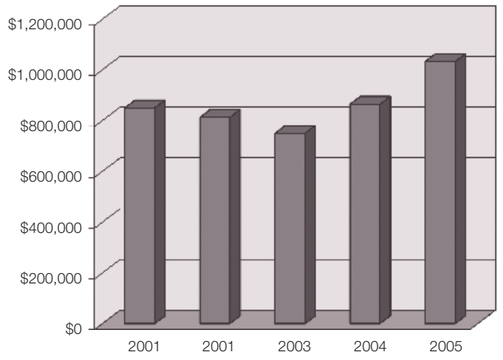
While the primary benefit of the Engineering Career Fair is providing a forum for industry and students to exchange employment information, the fair also benefits the Engineers' Council and the College of Engineering. It is the primary fundraiser for the council and helps support student events and programs. This year, the council also used the funds to present a gift of $25,000 to the college to increase the Engineers' Council endowed scholarship fund. The endowment now supports four $500 scholarships in the College of Engineering. *(See story on page 20.)* The fair also gives the College of Engineering valuable contact with industry representatives from across the nation.

Many companies have returned each year. Many staff their booths with NC State alumni and create themes that draw students. Harris, for example, is known for its bright Hawaiian shirts and beach balls. Many of the more recent participants, like Mulkey Engineers & Consultants and Cree, have already signed up for the 2006 event. Companies wishing to learn more about the Engineering Career Fair may visit their website at **students.engr.ncsu.edu/careerfair** .



Senior Swati Patel talks with Harris Corp.'s Scott McCoy. Harris Corporation's beach theme drew much attention. *(Photos: Jennifer Weston)*

UNRESTRICTED GIVING TO THE COLLEGE OF ENGINEERING



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NC State University

Civil Engineering Distinguished • Worley H. Clark • Dean F. Duncan • John. C. C. Fan • Edward P. Fitts • Kobe Steel Ltd. • McPherson Family • SAS Institute Distinguished • Edward I. Weisiger

GENERAL ENDOWMENTS

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Endowed professorships — an investment in education excellence

Often when we think back on our days in college and consider our professors, we see a dedicated teacher lecturing in a classroom. But in the College of Engineering, the classroom is only one factor in the whole process of teaching. Research conducted in the many laboratories across the campus is an integral part of the process of expanding knowledge and extending it to students. Much of the research conducted at NC State leads to the innovations that make our lives easier, safer and more productive. In the College of Engineering, many of our professors are internationally recognized experts in their fields, and the research they conduct impacts the frontiers of science and technology.

These high-caliber researchers are difficult to recruit and retain since they are so highly sought after by universities and industry. The best way to attract faculty who have distinguished themselves is through the use of endowed professorships that reward excellence in teaching and research, like the Dean F. Duncan Professorship in Mechanical Engineering and the John C.C. Fan Family Distinguished Professorship in Materials Science and Engineering. Making a commitment to recruiting and retaining top faculty benefits the students and the college.

The Duncan professorship, held by Dr. Thomas A. Dow, was established in 1998 by Hugh M. Duncan (IE '55) of Charlotte, retired president of Southern Precision Spring Company, to honor his father, a 1923 graduate of NC State. The Duncan professorship was the first named professorship in the college to be endowed by an individual. Selected to hold the professorship, Dow is a leader in the field of precision engineering and a fellow of the American Society of Mechanical Engineers (ASME). He is a charter member and executive director of the American Society for Precision Engineering (ASPE) and founding director of the Precision Engineering Center. A recipient of the Burt L. Newkirk Award from ASME, Dow has been the impetus behind the academic and research programs in precision engineering at NC State.

The Fan Family professorship, established in 2003, honors Dr. John Fan, a pioneer in solid state electronics who was educated at Harvard University and Massachusetts Institute of Technology. Fan is the founder and chief executive officer of Kopin Corporation, a Massachussetts-based multinational company. Dr. Jagdish "Jay" Narayan holds the John C.C. Fan Family Distinguished Professorship in Materials Science and Engineering. His most recent research in the area of nanotechnology resulted in a breakthrough in the formation of self-assembling nanostructures. He has patent applications submitted for two processes that he and his colleagues developed to create three-dimensional nanodots that have the potential for improving the light generation and data storage performance of optical devices.

"WITHOUT THE SUPPORT OF OUR ALUMNI AND FRIENDS, WE WOULD NOT HAVE THESE IMPORTANT ENDOWED PROFESSORSHIPS IN OUR COLLEGE."

At NC State, the College of Engineering is committed to providing the very best education for its students, and to help achieve that goal, the College of Engineering has made increasing the number of endowed professorships a top priority. These endowed professorships, like the Fan and the Duncan, reflect an understanding by the donors that the quality of the faculty directly impacts the education of the students and influences the perception of businesses and industry who hire them.

"Without the support of our alumni and friends, we would not have these important endowed professorships in our college," said Ben Hughes, executive director of the NC State Engineering Foundation Inc. "We are grateful to the Fan family and Hugh Duncan and our other generous donors, who recognize the importance of these gifts; we are dedicated to raising the private resources to support endowed professorships so that our students can continue to learn from, and be inspired by, our top engineering faculty."

The EGRC is now the Larry K. Monteith Engineering Research Center.
(Photo: Claude McKinney)

EGRC named in honor of Larry Monteith

The NC State University Board of Trustees has named the Engineering Graduate Research Center (EGRC) on Centennial Campus for former Chancellor and former Dean of Engineering Dr. Larry K. Monteith. The building is now the Larry K. Monteith Engineering Research Center (MRC).

A native of Bryson City, N.C., Monteith (EE '60) had a 41-year career associated with NC State. He was the university's 11th chancellor, serving from 1989-1998. He also was dean of engineering from 1978-89.

During Monteith's tenure, NC State earned a chapter of the elite Phi Beta Kappa honor society, and the six-year graduation rates for students improved from 59 percent to 67 percent, while the rates for student-athletes improved from 59 percent to 73 percent. The university strengthened its financial base by increasing its endowment from $42.7 million to $200 million, completing a $230 million fund-raising campaign, and launching a $120 million campaign to raise funds for student scholarships and fellowships. Monteith also helped create the Park Scholars program and the William R. Kenan Jr. Institute for Engineering, Technology and Science.

Growth exploded on the university's Centennial Campus during Monteith's tenure, with eight new buildings valued then at $120 million, including the $45.5 million Engineering Graduate Research Center. First as dean and later as chancellor, Monteith led efforts to move NC State toward broad use of distance education and to wire the campus for computer-based administrative services and use of computers in academic programs.

"Throughout his career, Larry Monteith's leadership style was characterized by a commitment to excellence," said Chancellor James L. Oblinger. "He developed clear priorities, set the direction and led the university with enthusiasm and integrity. There should be no doubt that he played a pivotal role in the success NC State enjoys today."

"From the initial concept for the Engineering Graduate Research Center in 1979, to the passing of the bond referendum in 1993, to the grand-opening celebration in 1997, Larry Monteith championed the cause of making this unique center become a reality," said Nino A. Masnari, dean of the College of Engineering. "Having the building bear his name is a fitting tribute to his impact on engineering education and on the history of NC State University."

"Larry Monteith not only was a leader at NC State, but he was a leader for all of North Carolina," said William C. Friday, president emeritus of the University of North Carolina system and an alumnus of NC State. "He was a visionary who helped bring Centennial Campus to life, and he was part of a group that helped give shape to the concept of the Research Triangle. But maybe the best thing you can say about Larry is that he was devoted to the students of NC State and took a genuine interest in their success."

Also during Monteith's years as chancellor, the NCSU Libraries jumped nearly halfway to the top among the 108 national research libraries, and funding for research increased significantly, rising from $170 million to nearly $300 million.

Completed in 1996, the 138,000-square-foot EGRC houses some of the most sophisticated research facilities on Centennial Campus. ■

Nancy and Larry Monteith view the plaque unveiled by Chancellor James Oblinger (right) at the dedication ceremony held October 5, 2005. *(Photo: Becky Kirkland)*

Lampe family endows professorship

The Ross W. Lampe Family of Smithfield has pledged $1 million to the College of Engineering at North Carolina State University. The gift will be used to create a professorship known as the "Lampe Professor of Electrical and Computer Engineering" and to support other initiatives in the College.

The Lampe professorship will be established using $666,000 from the $1 million pledged by the family and matching funds of $334,000 from the Distinguished Professorship Endowment Trust Fund, bringing the total value of the endowed professorship to $1 million.

The Lampe family has many ties to the College of Engineering and the university. Dr. Ross W. Lampe Jr., president of SMD Software, Inc., is a 1977 graduate who received his bachelor's degree in industrial engineering. He also earned a master's degree and a Ph.D. in electrical engineering from the University of Illinois at Urbana-Champaign. Ross Lampe Jr. currently serves on the NC State Engineering Foundation, Inc. Board of Directors. His father, Ross W. Lampe Sr., president of Guy C. Lee Manufacturing Company, is also a graduate of NC State, having received his bachelor's degree in chemical engineering in 1951. Ross Sr. is the son of Dr. J. Harold Lampe, who served as dean of the College of Engineering from 1945 to 1962 and was pivotal in the early planning of Research Triangle Park. In 2002 Ross Sr. received the Distinguished Engineering Alumnus Award, the highest award given by the College to an alumnus. Other Lampe family members who received degrees from NC State include Tempe Lampe (MS '82), Guy Lampe (BA '81) and John Lampe II (BA '83).

The pledge to endow the professorship is the second substantial gift from the family. In1993 in memory of Dean Lampe, they created the J. Harold Lampe Engineering Excellence Fund, which is an endowment providing unrestricted support for the College.

Dr. Nino A. Masnari, dean of the College of Engineering, said of the Lampe family gift, "We are very grateful for the generosity and commitment the Lampe family has shown the College of Engineering and NC State. This gift will greatly enhance our efforts to provide the highest quality faculty." ■

The Ross Lampe family members are (seated) John Lampe, Ross Lampe Sr., Ross Lampe Jr. and Guy Lampe. Standing are NCSU administrators Dr. Robert Trew, Dean Nino Masnari, Vice Chancellor for Advancement Terry Wood and Ben Hughes. *(Photo: Jennifer Weston)*

Corporate and foundation gifts

The College of Engineering wishes to thank the following corporations for their generous gifts. These are just a few of the gifts for 2004-05.

IBM — several gifts totaling more than $325,000 to researchers and students in the Department of Computer Science.

Progress Energy — $261,500 to support several academic programs as well as Benjamin Franklin Program scholarships, diversity scholarships and the renovation of a classroom and in Burlington Nuclear Engineeering Laboratories.

Caterpillar Inc. — $125,000 for programs in industrial engineering, materials science and engineering, and mechanical and aerospace engineering.

The Boeing Company — $36,000 for scholarships, summer programs and student organizations.

Square D Company — $43,000 to support scholarships and student programs.

Northrop Grumman Corporation — $35,000 for four scholarships, a summer engineering camp for middle school students and teachers, and senior design projects, within several departments in the College.

Alcoa — $27,500 to support mentoring programs at NC State and to support the Women in Science and Engineering (WISE) Living and Learning Together program.

Duke Energy — $145,000 to support several academic programs, scholarships, the Ben Franklin Program, student groups, lecture series and the College of Engineering.

Shell Oil Company — $75,000 for support to the College of Engineering, departmental programmatic support and student organizations.

Progress Energy Awards $252,500 to the College of Engineering

Progress Energy, a long-standing supporter of NC State and the College of Engineering, has awarded $252,500 to the College for a variety of academic programs, scholarships and renovations.

Alumnus Troxler Establishes Engineering Endowments

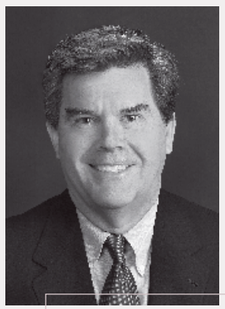
As part of *Achieve! The Campaign for NC State*, Dr. Robert E. Troxler (EE '83) of Raleigh has endowed a gift of $250,000 to the College of Engineering to establish the William F. Troxler Design Center Support Endowment and the William F. Troxler Enhancement Fund. Troxler, director of Advanced Technologies at Troxler Electronic Laboratories Inc., is a member of the NC State Engineering Foundation Board of Directors and an active supporter of the College.

Caterpillar Gives $125,000

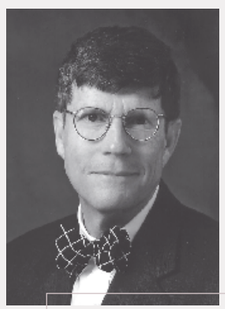
Caterpillar Inc. has donated $125,000 to support College of Engineering programs in industrial engineering, materials science and engineering and mechanical and aerospace engineering.

Distinguished Engineering Alumni named for 2005

Herbert A. Fishel



John Turner Whitted



Robert G. Wright

The College of Engineering salutes the Distinguished Engineering Alumnus recipients for 2005: Herbert A. Fishel (ME '63), CEO of the Business of Motorsports and retired Executive Director of GM Racing; Dr. John Turner Whitted (PhD EE '78), senior researcher and area manager at Microsoft Corporation, member of the National Academy of Engineering, a pioneer in 3D computer graphics, and the originator of the use of ray tracing for global illumination; and Robert G. Wright (CEC '68), chairman of Kimley-Horn and Associates Inc. and a member of the NC State Engineering Foundation Board of Directors.

The award, presented by Dean Nino A. Masnari November 17 at the Capital City Club in Raleigh, honors alumni whose accomplishments further their field and reflect favorably on 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 more than $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 $25 million in support of the College of Engineering in fiscal 2004-05.

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

Ben H. Hughes
Executive Director
Development and College Relations

David T. Nolan
Director of Development

Christine Cerny
Director of Corporate Relations and Special Projects

Russ O'Dell
Director of Development
Chemical & Biomolecular Engineering Department

Director of Development
Civil, Construction, & Environmental Engineering Department

Kenneth M. Tate
Director of Development
Computer Science Department

Gwen H. Bell
Administrative Officer

Wendy Cibils
Administrative Secretary

Bryony Williams
Program Assistant

Jennifer Goodwin
Office Assistant

Show your support — make a gift to the College of Engineering

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.

You are in control of how your contributions are allocated. Unrestricted gifts provide resources for a variety of funding priorities in the college. Gifts to the College of Engineering can also be designated to specific departments, academic programs and other funding opportunities.

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:

NC State Engineering Foundation Inc.
230 Page Hall
Campus Box 7901
North Carolina State University
Raleigh, NC 27695-7901

Phone: (919) 515-7458 • Toll Free: (866) 316-4057 • E-mail: engr-foundation@ncsu.edu

Thank you!

While space limitations allow listing only those donors who contribute $100 or more, we appreciate the support of all our alumni and friends. Every attempt has been made to ensure the accuracy of the information presented in this report. However, we admit mistakes sometimes occur inadvertently. Please notify our office of any corrections you have. We welcome inquiries regarding your support of the College of Engineering at NC State. This document was produced by the NC State Engineering Foundation Inc. No state funds were used; 52,000 copies of this document were printed at a cost of $31,818, or 61 cents per copy.

engineering

Half Wuf, Half Engineer —

One Terrific Job

(Story on page 23.)

Keep in Touch! Win Free Tickets!

Engineering alumni, here's a chance to **win free Wolfpack basketball tickets!** (Note: Tickets are non-transferrable; winner must show i.d. in person at the ticket call window.)

Fill out or update this registration form: **www.engr.ncsu.edu/ncef/registration** (include your e-mail address).

You'll receive the College of Engineering's e-newsletter — *Engineering Frontline-Online* — plus be eligible for the drawing. Hurry!

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