

NC STATE UNIVERSITY

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engineering **FRONTLINE**



Wide World of Engineering

• NC State Engineering Foundation, Inc. Annual Report 2002-03

letter from the Dean of Engineering

December 17, 2003, marks the centennial of the Wright Brothers’ flight, and nowhere is there a better place to celebrate than right here in North Carolina. The one hundredth anniversary of this historic achievement in Kill Devil Hills near Kitty Hawk allows us to reflect on our own connections with aviation history and to celebrate a century of flight.

Among the many activities that have taken place around the nation to commemorate the event was Energy Challenge ’03, a national competition held at Kitty Hawk in May 2003. It seems especially fitting that our own NC State students took first place in this contest. We are particularly proud of these students because this event represented much more than a contest to construct a hang glider from paper wings. The multidisciplinary team of students worked together to develop an outreach program, an educational website and a poster contest for children in grades four through eight, involving them in problem-solving about ways to conserve energy and natural resources. You will read more about these students and the competition in a feature story in this issue of *Engineering Frontline*.

In the spirit of commemorating the historic event, the Curtiss-Wright Corporation, which has a long history of involvement with aviation dating back to the Wright brothers’ flight, has chosen to establish an endowment of \$75,000 within the College for the Curtiss-Wright Centennial of Flight Scholarship, which supports students who have an interest in aviation.

NC State University’s own aeronautical involvements span the decades. One milestone concerns our alumna Katharine Stinson, who was not only the first woman to receive an engineering degree from NC State — a mechanical engineering degree with aeronautical option in 1941 — but also the first woman engineer hired by the Federal Aviation Administration, then known as the Civil Aeronautics Administration.

Through the years, NC State has enjoyed a long relationship with NASA. Most recently, NC State is one of six universities working together with NASA in the National Institute of Aerospace (NIA). The world-class center will allow researchers from government, academia and industry to collaborate on aerospace research, develop new technologies, and educate and inspire the next generation of scientists and engineers.

NASA called upon our Department of Nuclear Engineering in the reconstruction of the space shuttle Columbia after the 2003 disaster. The PULSTAR reactor was used to perform analysis on the shuttle’s wing as part of the investigation of the accident, and the media contacted one of our professors, Dr. Fred DeJarnette, for his expert opinion because of his close ties to the space shuttle. Fred heads up the North Carolina Space Grant Consortium, which works with NASA to encourage young people in the areas of math and science.

The progress made — from that historic morning on the sand dunes of North Carolina on December 17, 1903, to today’s innovations in supersonic and hypersonic aircraft design and technology — is nothing short of astounding, and this most certainly is just cause for celebrating the centennial of flight.

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



Nino A. Masnari

engineering frontline

Engineering Frontline was created for alumni and friends of the College of Engineering at North Carolina State University. This publication combines news from the College of Engineering with the NC State Engineering Foundation annual report. *Engineering Frontline* appears annually in print, with updates throughout the year in *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

College of Engineering Career Fair
February 19, 2004

College of Engineering Endowed
Scholarship Dinner
March 19, 2004

Entrepreneurs Lecture Series
Richard O. Holcomb (MScS ’89)
Co-Founder and CEO of StrikeIron
Wednesday, April 7, 2004

Engineering Open House
April 3, 2004

NC State Engineering Foundation
Board Meeting
April 30, 2004

change of address?

Alumni, you can update your contact information online at

www.engr.ncsu.edu/ncf/registration

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(Image courtesy of Michael Young)

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Groundbreaking for Engineering Building I took place one year earlier, on October 25, 2002. Attendees for that event included (left to right) Dr. Peter K. Kilpatrick, head of chemical engineering; Dr. Nino A. Masnari, dean of the College of Engineering; Dr. Stuart L. Cooper, former provost and vice chancellor for academic affairs of NC State University; Dr. J. Michael Rigsbee, head of materials science and engineering; and Dr. Sarah A. Rajala, associate dean for research and graduate programs in the College of Engineering. (Photo: Linda Rudd)

Groundbreaking for Engineering Building II held October 24

Formal groundbreaking for Engineering Building II took place October 24, 2003, on Centennial Campus at NC State University. Chancellor Marye Anne Fox, Dean Nino A. Masnari of the College of Engineering and other dignitaries attended the ceremony. Keynote speaker was Thomas R. McPherson, Jr. (EE '76, MSEE '77), former CEO of Hatteras Networks and founder of Rapid City Communications, which was acquired by Bay Networks.

Engineering II will house the Department of Computer Science and the Department of Electrical and Computer Engineering and will include classrooms, laboratories and offices. The College of Engineering plans to complete its relocation to new facilities on the Centennial Campus within the next 10 years. Building II, the second building funded by the bond referendum passed in November 2000, is expected to be completed in 2005.

NC State's Department of Civil Engineering renamed

In May 2003 the Department of Civil Engineering at North Carolina State University was renamed the Department of Civil, Construction, and Environmental Engineering. The name change reflects the department's graduate education and research programs in these three areas, as well as the B.S. degree in civil engineering, the B.S. degree in construction engineering and management and the B.S. degree in environmental engineering.

NC State has had a department of civil engineering since 1895. The current department is one of the largest in the nation, with more than 40 faculty members, more than 600 undergraduates and more than 200 graduate students, including 75 at the Ph.D. level.

Graduate students pursuing the master's or Ph.D. degrees may concentrate in water resources and coastal engineering, computer-aided engineering, construction engineering and management, environmental engineering, geotechnical/geoenvironmental engineering, structural engineering and mechanics, or transportation systems and materials. A distance education master of civil engineering is also available.

NASA officials visit NC State University

Two visits by officials from the National Aeronautics and Space Administration (NASA) National Institute of Aerospace and NASA Langley Research Center occurred at North Carolina State University recently. A group of competency directors from Langley Research Center arrived September 4 to meet with faculty, tour research facilities and hear technical presentations. On September 11 Dr. Bob Lindberg, vice president of research for the National Institute of Aerospace and former senior executive vice president of Orbital Sciences, also visited NC State for a day of meetings and tours.

The visits provided an opportunity for NC State, one of the six university members of the National Institute of Aerospace (NIA), to participate in development of a new strategic plan for technology innovation in aerospace as the NIA is starting the second year of its operation. The NIA founding institutions are NC State, North Carolina A&T University, Georgia Tech, University of Maryland, University of Virginia and Virginia Tech.

The six competency directors, with their areas of expertise, are Dr. Doug Arbuckle, airborne systems; Dr. Carl Gray, systems engineering; Dr. Ajay Kumar, aerodynamics, aerothermodynamics and acoustics; Ms. Cindy Lee, aerospace systems concept and analysis; Mr. Leonard McMaster, atmospheric sciences; and Dr. Mark Shuart, structures and materials. NC State participants included administrators and faculty from the College of Engineering and College of Physical and Mathematical Sciences.

This PULSTAR reactor helped NASA scientists determine why the space shuttle Columbia deteriorated during re-entry. (Photo: Dr. Jerry Kohl)

NC State's nuclear reactor used for some surprising tasks

In the 1950s the world's first university nuclear reactor was built on the NC State campus. Housed for the past 30 years in Burlington Nuclear Engineering Laboratories, the teaching reactor has helped train scores of nuclear engineering students. At times, however, the reactor is used for unusual tasks in service to humanity.

One use is forensic toxicology, as when Scott Lassell, manager of nuclear services in the nuclear reactor program at NC State, helped determine that UNC scientist Eric Miller was poisoned with arsenic in 2000. In 2003 Lassell used the reactor to conduct analyses on recovered left wing pieces from the space shuttle Columbia disaster. Pieces from the wing were irradiated and compared with similarly treated carbon samples from known manufacturing lots. Determining which lot a piece came from may enable NASA scientists to reconstruct its location on the wing and to figure out why the plane deteriorated during re-entry.



dream comes true for alumnus herb fishel



Herb Fishel (left) greets Johnny Rutherford, a former Indy 500 winner. (Photos: Jim Fets for General Motors)

On Memorial Day 1952, armed with a glass of lemonade, a notepad and an AM radio, 11-

year-old Herb Fishel (ME '63) set up a card table under the shade of an oak tree in his front yard in Winston-Salem, North Carolina, ready to listen to the Indianapolis 500, just as he would do every Memorial Day throughout the 1950s.

“The Indianapolis 500 was the greatest race in the world, and it still is,” Fishel says. “As a symbol of this country and a symbol of greatness, the Indy 500 is it.”

Some 50 years later, on May 25, 2003, he was driving the official pace vehicle for the 87th running of the Indianapolis 500, realizing a lifelong dream after a monumental 40-year career in motorsports with General Motors.

After receiving a mechanical engineering degree from North Carolina State in 1963, Fishel sent his resume to three of the hottest NASCAR teams at the time: Junior Johnson, Lee Petty and Bondy Long, the car owner for Ned Jarrett. Only Jarrett wrote back, sending his thanks but explaining the team did not need an engineer. General Motors, however, did have an interest in the young Fishel, and he packed up his 1950 Oldsmobile and headed for Detroit.

As a young engineer at GM, Fishel mentored under childhood heroes: American racing legends Smokey Yunick, Junior Johnson and the Father of the Corvette, Zora Arkus-Duntov.

Fishel drove the Chevy SSR Official Pace Vehicle at the Indy 500 auto race in May 2003.



The highlight of Fishel’s career was driving this 1953 Ferrari 250MM built specifically for the Mille Miglia, an annual road race in Italy for sports cars built between 1927 and 1957. The Ferrari, which has an aluminum body and right-hand drive, is housed in the Maranello Rosso Collection of Fabrizio Violati in the Republic of San Marino. Fishel’s passenger is his wife Sandy Heng. (Photo: courtesy of Herb Fishel)

In 1969 he landed a job in the Chevrolet Product Performance Group, where he learned to design high-performance engines for Chevrolet’s race cars. Subsequent positions at GM included staff engineer, director of Chevrolet Special Products and, in 1991, executive director of GM Racing, where he was responsible for the engineering resources and program management of GM’s North American racing programs.

Fishel’s priority and emphasis have always been engine design, and he dedicated his career to making sure General Motors engines powered the winners. The engines he helped design have won 12 of the last 15 Indy 500 races, 21 of the 24 Winston Cup titles from 1979 through 2002 and 9 consecutive NASCAR Winston Cup Manufacturer’s Championships from 1983 through 1991.

In 1996 Fishel’s leadership helped form a new open wheel series, an effort that was ridiculed by the media. Today, that

series, the Indy Racing League, just finished the season with what is called the closest, most entertaining racing in the world.

In 1997 *Hot Rod* magazine named Fishel one of the 100 most influential people in hot rodding, and *Racer* magazine has repeatedly recognized him as one of the dozen most influential people in racing.

Under Fishel’s guidance as executive director of racing, in 2001 GM won the Indianapolis 500, the Daytona 500 and the 24 Hours of Le Mans, becoming the first automaker in more than three decades to win the Triple Crown of racing in the same year.

In June 2003 he was awarded the prestigious Spirit of Le Mans award from the Automobile Club de l’Ouest, organizers of the Le Mans 24 Hours.

Fishel, who retired from GM in September 2003, says the highlight of his career in motorsports was racing in the 2001 Italian Mille Miglia, driving a 1953 Ferrari 250MM with the love of his life, Sandy. ■

NC State alumnus drives Indy 500 pace vehicle

learning for life

Dr. Linda D. Krute directs the Engineering Online program at North Carolina State University.
(Photo: Sheri Thomas)



wide world of
engineering

Engineering Online opens new doors to master's degree

"Learning for life" is a phrase that means different things to different people. For some, their structured education ends with high school or college, and any further learning is informal. For others, though, earning an advanced degree is an important part of their scholastic life.

While these people value advanced education, not all of them can go to college or graduate school full time. Family obligations, financial considerations or military service can be obstacles to earning a degree.

Engineering Online, the newly redesigned College of Engineering distance education program at North Carolina State University, aims to remove these obstacles. Dr. Linda

D. Krute, director of distance education for the College of Engineering at NC State University, hopes to develop a multifaceted program that will address the special needs of adult learners.

"We're serving the needs of the nontraditional adult learner," Krute said. "They're not full-time, on-campus students — they're working and have family obligations. The outstanding part of our program is that they can make the master's degree part of their family and work life with Engineering Online. Engineering adult learners are taking the courses because they would like to achieve a personal or professional goal. We try to structure the program to help them succeed in their goals."

Earning a graduate engineering degree through Engineering Online has many advantages. Program quality is one. "We are working hard to ensure that the academic integrity of our program is maintained — to carry the same high standards of quality from the on-campus program to the off-campus program," said Krute.

Convenience and portability are advantages for many students. Plus, the program is highly affordable — a resident of

North Carolina can get a master's degree for under \$6,000, a bargain because students don't have to live near campus or spend money commuting.

Another, perhaps more subtle, advantage of online education is its support of the learning process itself. Lectures are captured electronically, and students can review them repeatedly, if needed, to reinforce difficult concepts. All board drawings and diagrams are available as well as the professor's lecture. "This is really an outstanding way to learn, if the student can be motivated to complete the course," said Krute.

However, online learning is not for everyone. According to Krute, "It takes very special people who can be structured, be disciplined, set up a schedule and maintain that schedule on their own. Also, for some people this may not be the best means of getting a graduate degree because they enjoy the socialization and one-on-one interaction, not only with faculty but also with other students."

Krute is working to expand the Engineering Online programs in several arenas. First, she would like to spread the word about the availability of this program to the citizens of the state. "It's part of my vision that every resident of North Carolina who has a background in engineering or computer science is aware of the opportunity we have here," she said.

"NO MATTER WHERE YOU ARE
IN THE WORLD, YOU'RE STILL
CONNECTED TO THE COLLEGE
OF ENGINEERING AT NC STATE."

When Krute arrived at NC State in spring 2002, the master's of civil engineering online program was being developed; it has been the most successful program so far. Since her arrival the master's in computer science, the master's in mechanical engineering, the master's in aerospace engineering and the master's in chemical engineering have been launched. These NC State offerings are unique. "Other universities have distance master's programs, but we're really

one of the first to offer these programs totally online," said Krute. "I'm hoping to be able to expand into other areas of engineering, such as electrical, materials science and industrial."

[see Online, page 23]

military around the globe take NC State courses

Keeping up with education can be a challenge for members of the armed forces. Constant transfers make it hard to achieve much continuity. But through Engineering Online, the NC State program that provides distance education courses via streaming media on the Internet, students can take courses from anywhere in the world.

Several members of the U.S. armed forces are taking advantage of this program. For example, Dr. Thomas Johnson, professor of agricultural and resource economics and statistics at NC State, notes, "Last year I had a student in the Air Force who began the semester in South Dakota. He was soon transferred to Arizona and then to the Middle East. But thanks to Engineering Online, all this moving around only delayed his studies about two weeks."

Students currently enrolled in the program are members of the Army Corps of Engineers in Tennessee, North Carolina military bases such as Seymour-Johnson Air Force Base in Goldsboro and the Naval Air Station at Cherry Point, naval bases in California and overseas units stationed in places such as Abu Dhabi in the United Arab Emirates.

Dr. Linda D. Krute, director of distance education for the College of Engineering, said, "We are pleased to support our military personnel by providing graduate courses and degree programs available via the Internet from any military location in the world." ■



Scott Stabler

aircraft carriers a passion for alumnus stabler

Scott Stabler is an avid Wolfpack fan who returns to Raleigh a couple of times a year to cheer the team to victory. He lives in Williamsburg, Virginia, with his wife Beth; his children David and Meg; and Isabelle, a black Labrador retriever. He enjoys golf, woodworking, cooking and watching his children play sports.

An aircraft carrier is quite amazing.

It's more like a city than a ship. A Nimitz-class aircraft carrier, for example, rises 20 stories above the waterline, has a four-and-one-half-acre flight deck and is home to about 6,000 U.S. Navy personnel. It can carry enough food and supplies for three months and has distillation plants that convert 400,000 gallons of fresh water from sea water daily. Aircraft carriers have daily newspapers and radio and television stations.

Aircraft carriers have always fascinated Scott Stabler, (ME '82). "It's their sheer size, the complexity of the systems and construction techniques and the magnitude of just about any measurement you want to use to describe the scope of the effort," he said. "This engineering and construction project produces a self-sustaining city at sea, complete with its own power plant and airport. It amazes me."

Stabler is the project manager for the construction of the tenth and last Nimitz-class aircraft carrier, the George H. W. Bush, for the U.S. Navy. Since 1984 he has worked at the Northrop Grumman Corporation Newport News shipyard; his first position was in aircraft carrier engineering. After earning his master's in business administration from the College of William and Mary in 1986 by attending evening classes, Stabler moved into the business management end of the shipyard for a few years. He is now in program management, which uses both his engineering knowledge and his business management skills. Since 1999 he has been a vice president. His work has focused on the new aircraft carrier since January 2001, when the contract was awarded to Northrop Grumman.

His job as sector vice-president, CVN77, combines business management, customer relations and leadership. "My job includes setting the expectations for the team, identifying and dealing with areas of risk and keeping the right sense of urgency across the company," he said. The cross-functional team Stabler directs includes representatives from all areas of the company, for example engineering, planning, contracts, manufacturing, sourcing and ship assembly.

Directing such a complex process can be a challenge, but Stabler enjoys solving problems with his team. "My favorite part of my job is being able to head off a problem or finding

The George H.W. Bush is being built at the Newport News Shipyard in Virginia.
(Photo: courtesy of Northrop Grumman Newport News)



our way out of a jam by working together as a team," he said. "It's a marathon run. We have a tough budget and schedule to meet, but we have the planning and shipbuilding expertise required to pull it off."

Indeed, the process of building an aircraft carrier takes several years. The George H. W. Bush will be delivered to the Navy in 2008. According to Stabler, "Between now and then we will be erecting the ship in our drydock and completing underwater work in preparation for a 2006 launch and christening ceremony. Once the ship is waterborne, complete outfitting and testing of all ship systems takes place." The Navy will take ownership of the onboard spaces and systems gradually over the following two-year period leading up to delivery.

Stabler is also helping to redefine how the company operates. The George H. W. Bush is the lead program for implementation of a new operating system at Northrop Grumman Newport News. This includes both new enterprise software (SAP) and a new set of operating principles. This project is important not only for the Nimitz-class carrier currently in construction but also for the success of future programs, such as the next aircraft carrier class Northrop Grumman will design and build with the Navy.

According to Stabler, combining his engineering background with leadership is highly rewarding. "When you

can see recurring movement in the right direction for key parts of the program," he said, "it's really very exciting to think that your efforts made a difference." ■



Three Northrop Grumman Newport News vice presidents greet former President George H. W. Bush and his daughter Doro Bush Koch, who is the sponsor of the George H. W. Bush Nimitz-class aircraft carrier. Left to right are Stabler, Koch, Bush, Bob Gunter, senior vice president of the aircraft carrier program, and John Shephard, senior vice president of operations. (Photo: courtesy of Northrop Grumman Newport News)



Using a virtual world set in the great hall of a 13th century castle, Michael Young can create computer programs that tell a story in this world tailored to a student's interest in and knowledge of history. (Image: courtesy of Michael Young)

computer gaming more than child's play

From heroic epics of old to this winter's blockbuster movies, everyone loves a story. How we experience and enjoy stories, or narratives, has a lot to do with our own cognitive processes and how we understand the physical and social rules at work in the world around us. According to Dr. R. Michael Young, assistant professor of computer science at NC State University, computers can contribute to the process of helping people understand narratives and social context.

Young directs the Liquid Narrative research group, a collection of collaborating professors, graduate students and undergraduates working to apply artificial intelligence (AI) computer pro-

grams to the construction of interactive narratives. "My research has to do with putting AI behind the scenes of a computer game or a virtual world so that the interaction inside that world is different, more engaging, more compelling than it would be without the behind-the-scenes tools," he said. This increased level of engagement, in turn, yields a higher level of comprehension of the narrative by people playing a computer game or experiencing a virtual world in an educational setting. By creating types of interactions that are more readily understandable, Young and his research team hope to use AI to study cognitive models of comprehension traditionally examined in disciplines such as linguistics, narrative theory and psychology.

For example, online subscription games services such as Everquest or Asheron's Call, known as Massively Multiplayer Online Games (MMOGs), provide tens of thousands of people with an opportunity to interact with other computer game players around the world. Because players can log in and out of the action, they may miss important events; Young is developing programs that can spin a story-like summary of the action that occurred while the player was absent based on the program's ability to understand story structure. Typically computers can provide a transcript but not a summary. "Our computer models of storytelling employ abstraction — selecting what elements to leave in or take out to summarize the story," said Young. Just as cinematographers choose appropriate scenes for a movie to convey the plot to the viewer, Young's computer models translate cognitive theory into programs that can automatically select elements of the action to summarize.

Although the overall goal of Young's research is to create computational theories describing how people and computers interact, the practical applications of the research are many. Teaching students about social dynamics is one of the educa-

tional applications. For example, Young has created a virtual world set in the great hall of a thirteenth century castle. Young's computer programs can create a story in this world tailored to a student's interest in and knowledge of history, and students can observe and understand the social rules that operated in that world as they work through the narrative. The story can be complete, or it can contain gaps that the student can fill in by controlling one of the story's characters. According to Young, "Rather than just being a passive observer, players use their cognitive processes to recognize opportunities for their own action. They see how the world around them works, formulate theories about it, then test those theories out by actually stepping into the story, trying actions and seeing if their theories are right or wrong."

Studying historical periods this way can make history come alive and be much more engaging, in the same way that seeing one of Shakespeare's plays performed makes it easier to understand the society of the time than simply reading the play. In the case of Young's gaming and virtual world programs, users will understand more about the story and its context when the computer program creates a story and tells it in a manner that matches the way people naturally think about narratives. These same techniques carry over from educational applications to ones focused on training. For example, a virtual simulation of a disaster relief operation can use storytelling techniques to effectively train rescue personnel in the best way to manage dynamic, time-critical emergency environments.

Another educational program under development in the Liquid Narrative group is a virtual tour of the Monterey Bay Aquarium, a large, public marine science education center located in California. In this system, the AI program controlling the simulation can tailor the actions of each character in the environment so that the visitor will experience or observe events based on his or her interests. In the virtual tour, the system will make



Michael Young

certain that a visitor interested in sea otters, for instance, will view a mother otter feeding her children in one of the large habitats, whereas a visitor to the actual aquarium might not see this event in many visits.

What's next in computer gaming?

Working with other NC State researchers interested in computer gaming, Young hopes to establish a Center for Digital Entertainment, which will explore new avenues of research in computer game studies across a range of disciplines. The goals of this center will be the creation of new knowledge in all aspects of digital entertainment, both in theory and in practice. The center will provide a focal point for the design of courses and programs focusing on the technologies, theories and methods relevant to computer games, their development and their integration into social life. To engage NC State researchers and students with experts in the field, the center will also seek to develop innovative models for academic/industrial cooperation to advance game-related research. Co-director of the center with Young will be Dr. Pat FitzGerald, assistant professor of art and design. Other cross-disciplinary researchers involved are Dr. Christopher G. Healey, associate professor of computer science; Dr. James C. Lester, associate professor of computer science; Dr. Brad Mehlenbacher, associate professor of adult and community college education; Dr. Robert St. Amant, associate professor of computer science and engineering; and Dr. T. L. Taylor, assistant professor of communication. A proposed industrial affiliates program will encourage ties between the university and industry; several industrial participants are already working with NC State researchers to make this center a reality.

In addition to educational applications, Young's work shows promise for the computer gaming industry, which generates more than \$6 billion in sales per year. Using computer models of narrative comprehension, Young hopes to merge storytelling techniques developed for the film industry with computer gaming. Traditionally, film industry designers have understood how to tell a story but have had little experience incorporating interactive elements. For computer gaming designers, the reverse is true. "We hope to merge these two approaches to create games more like films but that retain the very interactive flow typical of today's computer games," said Young. "Action-oriented experiences make a game entertaining, but we hope to improve both the action and the story line using AI."

Future computer game players may be able to have their computers create alternative endings to the stories that they play through, much like the create-your-own-story books for children that currently exist. Seeing how the different endings play out makes the game more entertaining, increases interactivity and improves cognitive development for the player. Increased understanding of social context is a traditional benefit of storytelling that has found application in the computer age through Young's work. ■



Joan Patterson, doctoral student in chemical engineering at North Carolina State University, demonstrates the twin screw extruder that will be used to recycle PET plastic bottles into plastic pellets, in bag at left.

(Photo: Linda Rudd)

plastic recycling process improved

NC State
researchers developing
unique technology

Plastics are everywhere these days, but current recycling techniques allow only a very limited portion to be reclaimed after initial use. Researchers in the Department of Chemical Engineering at North Carolina State University are working to change that by developing a unique recycling process for certain kinds of polymers.

Polyethylene terephthalate (PET) is soda-bottle plastic. These bottles are common, yet recycling them poses challenges, primarily because of contaminants or impurities. Dr. George W. Roberts, professor of chemical engineering at NC State; Dr. Saad A. Khan, professor of chemical engineering and director of the chemical engineering graduate program at NC State; and Joan Patterson, doctoral student in chemical engineering, are working on a project designed to address this problem. “We’re trying to develop a process where we can take waste polymer and convert it back into the material from which it was made. In the process, all the

impurities are removed from the polymer,” said Roberts. “Ideally this should be done in a single step because the economics have to make sense for the process to have widespread applicability.”

According to Roberts the process has two unique elements. “First we run the process in a machine called a twin-screw extruder, which has high throughput. A lot of polymer can be processed in a very short time,” he said. “The extruder melts the PET and creates very thin films so we can interface the high molecular weight polymer with another material, either ethylene glycol or methanol, that will reduce the molecular weight of the polymer substantially.” Second, supercritical carbon dioxide (CO₂) is combined with the ethylene glycol or methanol, which reduces the viscosity, or stickiness, of the polymer, making it easier to process and allowing better contact between the materials. At the end of the process, the CO₂ is vented from the extruder; run through a condenser, where dissolved impurities can be removed; and the CO₂ is then recycled.

Since its release in early April 2003, this article has captured the interest of the media. The following media have run the story: United Press International, Toronto Globe and Mail, Seattle Times, Orange County Register, Albany Times-Union, Newark Star-Ledger, Boulder Daily Camera, Buffalo News, Flint Journal, El Paso Times, the Lakeland Florida Ledger, Process Engineering, Greenbiz.com, Waste Age Magazine, Science Daily, Environment News Services, Process and Control Today, and Science Letter.

There are several advantages to the process. The conversion is done under efficient processing conditions and is an environmentally benign, one-step process. In addition the process can be tailor-made for materials of different molecular weights.

A single-screw extruder has been used successfully in the research laboratory at NC State for this procedure. Now Roberts and his team are looking for ways to make this process economically feasible for an industrial-scale operation. “The basic reaction of ethylene glycol with the polymer is known, but our preliminary data say that this enhanced reaction is several orders of magnitude faster when done in the extruder with supercritical CO₂ than if it is run conventionally,” said Roberts. “That translates into lower cost.”

According to Khan, twin-screw extruders are common in the workplace, so these machines can be reconfigured to use supercritical CO₂. First the research team must determine how variables, including rate of flow of polymer; the amounts of CO₂, ethylene glycol or methanol; temperature; pressure of CO₂; and machine configuration, affect the processing.

“To our knowledge, the machines in the marketplace have never been used for this purpose, but they can be modified for this process,” said Roberts. “Part of our research involves configuring the existing machines so they can give optimal performance.” ■



The twin screw extruder depolymerizes PET plastic using a unique process being developed by NC State researchers.

(Photo: Linda Rudd)

updates private records found in recycling bins, trash



photo illustration: Martha Brinson

"THIS IS JUST UNFORGIVABLE."

— ANNIE ANTON

When a local television station poked through trash and recycling bins and found private medical records — name, address, type of test (pregnancy, venereal disease) and payment method — they called privacy expert, Dr. Annie Antón, who said, "This is just unforgivable."

The word "privacy" can mean many things — seclusion, secrecy or freedom from intrusion — but in our hectic, paper-heavy computer age, this term takes on new significance. Medical records, mailings, bank records and computer files all contain personal information that should be kept private. As individuals and companies seek to protect themselves and their personal information, a lack of resources about privacy issues has become apparent.

Dr. Annie I. Antón, associate professor of software engineering at NC State, is the founder and director of ThePrivacyPlace.org, a research group of students and faculty at NC State and Georgia Tech. The Privacy Place is designed to make information about privacy issues available to policymakers, software developers and private citizens.

Antón's research for the past several years has made her something of a privacy expert, so she was consulted by a local television station when a reporter discovered private medical records in a reproductive health center recycling bin and in a drugstore dumpster. She was not surprised, but she found the incident deeply unsettling. "They are not honoring the agreement they made with their patients," she said. "We have an ethical responsibility to our community to guard this information."

Helping the community's members deal with privacy issues in our complex world is the goal of Antón's work. ThePrivacyPlace website was created as part of a two-year, \$334,000 National Science Foundation Information



Annie Anton
(Photo: Roger Winstead)

Technology Research (ITR) grant to NC State and Georgia Tech researchers, who are studying Internet privacy policies and their relationship with user privacy values and software requirements. According to Antón, "Our research focuses on consumer privacy values and developing e-commerce systems whose functionality is aligned with those values and the privacy policies that govern them."

The mission of the research effort reflects society's concern with privacy issues. "Information technology policymakers and software developers must balance the requirements of security with the demands of liberty," said Antón. "This site reflects our efforts to reach this balance." ■

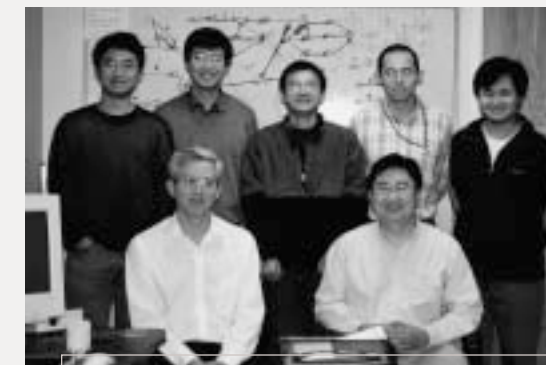
Cyber Defense Laboratory opens at NC State University

Since the terrorist attacks of September 11, 2001, the people and government of the United States have intensified their efforts to protect our critical infrastructure. Faculty and students in the Department of Computer Science at NC State have contributed to that effort with their research in cyber defense — keeping computer systems, data and networks safe from hackers. In April 2003 the department had a grand opening ceremony for the Cyber Defense Laboratory on NC State's Centennial Campus during which graduate students displayed posters about their computer security projects.

The new laboratory houses all faculty and students performing cyber defense research, as well as all necessary equipment. Three computer science faculty members, Professor S. Purushothama Iyer, Assistant Professor Peng Ning, Professor Douglas S. Reeves and Assistant Professor Ting Yu, have moved their operations to the new facility. According to Ning, housing students and faculty together in one space promotes collaboration and provides centralized support for faculty who have technical questions about security issues. ■



Dr. Iyer analyzes software for computer bugs.
(Photo: Kathi McBlief)



Protecting computer systems from hackers is a current focus of faculty and students at North Carolina State University. (Left to right, seated) Dr. Reeves and Dr. Ning and (left to right, standing) graduate students Kun Sun, Pai Peng, Dingbang Xu, Yan Zhai and Donggang Liu are developing techniques in the critical area of cyber defense. (Photo: Kathi McBlief)

spotlight

The team's hang glider consistently exceeded a distance of 140 feet.
(All photos: Dr. Richard Spontak)



NC State students win Energy Challenge '03 at Kitty Hawk

THE COMPETITION MARKED
THE 100TH ANNIVERSARY OF THE
WRIGHT BROTHERS' FLIGHT.

Piloting a hang glider with paper wings, North Carolina State University students won Energy Challenge '03 at Jockey's Ridge State Park, Kitty Hawk, on Saturday, April 5. The competition was held as part of the anniversary of the Wright brothers' 1903 flight. The winning team was awarded a prize of \$15,000.

NC State students took first place in the Energy Challenge '03 competition. Four of the seven team members are chemical engineering students; the other students are majoring in aerospace engineering, mechanical engineering, and pulp and paper science.



The competing glider wings were constructed primarily of materials derived from paper, such as cardboard. Scoring for the event was based on a number of factors, including distance flown, weight of the glider, material properties, recycled content and novelty of design. The NC State team "AeroPack" developed a novel paper that incorporated fine sawdust from the furniture industry to improve properties. They used computer-aided design to produce, in efficient fashion, a sail meeting the performance requirements without wasting energy or resources. After testing more than 300 paper sheets with different compositions, they manufactured their own paper for the glider.

In addition to designing and constructing the glider wing, the team developed an outreach program, which included a website to provide children in grades four through eight with information regarding the Energy Challenge project, the centennial of the First Flight and the paper industry. They also sponsored a poster contest for fifth grade students at North Ridge Elementary School in Raleigh. The winning entry showing the Wright brothers was prominently featured on the wing, and the student, Jacob Odishoo of Raleigh, was recognized at the competition.

NC State team members — all seniors — represented multidisciplinary departments and included Trey Hathaway, chemical engineering; Josh D. McCall, chemical engineering; Sarah M. Mertens, aerospace engineering; Jody R. Moss, chemical engineering; Bryan K. Ransom, pulp and paper science; K. Brandon Teague, mechanical engineering; and Daphne S. Wang, chemical engineering. The faculty advisor for the team was Dr. Richard J. Spontak, professor of chemical engineering and materials science and engineering at NC State.

The annual Energy Challenge competition is sponsored by the United States Department of Energy and the Institute of Paper Science and Technology. The Energy Challenge provides undergraduates with the opportunity to solve open-ended problems designed to demonstrate how paper can be used in non-traditional applications, as well as to enlighten the public about the rational use of natural resources, energy/waste minimization and alternative resources. ■



Not all teams were fortunate. One team's sail tore badly in the first of three trials.

Spotlight

you're looking at the leaders of the Pack



Student leaders (left to right) Josh Hitzemann, president of the Engineers' Council; Anup Shah, president of the senior class; Thushan Amarasiriwardena, co-editor of the *Technician*; and Erich Fabricius, president of the Student Senate, are all students in the College of Engineering. (Photo by Roger Winstead).

You see before you four computer science and engineering students. But what you're also looking at is the leadership of student life at North Carolina State University. This year, four top leadership positions are all held by students from the College of Engineering — presidents of the Student Senate, Engineers' Council, and senior class, and the *Technician* editor. Although their backgrounds and goals vary, they share a dedication to excellence typical of NC State's student achievers. Dedication to excellence and the leaders of the Pack — a winning combination for NC State.

Thushan S. Amarasiriwardena

Technician Co-Editor

computer science student, political science minor, published writer, web designer, graphic designer, startup company president and cofounder

Erich M. Fabricius

Student Senate President

chemical engineering and economics student, web programmer/designer, computer consultant, former Engineers' Council president, honor societies member

Joshua D. Hitzemann

Engineers' Council president

mechanical engineering student, teaching assistant, head student engineering leader, director engineering summer programs, major events organizer, career fair director

Anup M. Shah

Senior Class President

electrical engineering student, history minor, Cisco Systems testing engineer, web and database programmer, teaching assistant, software engineer, future patent lawyer



Curtiss-Wright endows \$75,000 to College of Engineering

In the 2003 centennial celebration year of the first sustained, powered flight, which took place on the sand dunes of North Carolina, Curtiss-Wright Corporation of Gastonia established an endowment of \$75,000 in the College of Engineering at NC State. The Curtiss-Wright Centennial of Flight Scholarship will provide merit-based scholarships to engineering students with an interest in a career in aviation or technology applicable to aviation. Awards are for one academic year and are renewable.

Curtiss-Wright Corporation has a long history of involvement with aviation, dating back to the Wright brothers' flight in 1903. Their engineering activities extend to three markets — motion control, flow control and metal treatment. According to Kenneth R. Lewis, corporate director of human resources and management development for Curtiss-Wright corporation in Gastonia, "We feel a strong commitment to contributing to the training of future engineers." NC State was chosen for one of three Curtiss-Wright hundredth-anniversary scholarships in states where the company has headquarters.

"Curtiss-Wright Controls is headquartered in Gastonia, so we feel a strong connection to North Carolina based on this and the state's historical association with the founders of our company — Wilbur and Orville Wright and Glenn Curtiss," said Lewis. "Also, NC State is the preeminent engineering school in North Carolina." ■

"WE FEEL A STRONG COMMITMENT TO CONTRIBUTING TO THE TRAINING OF FUTURE ENGINEERS."

Online, continued from page 11.

Right now Engineering Online is primarily a community-based program that serves the Research Triangle area, but Krute wants to expand the program internationally. One avenue for this expansion is the military. "We've had a very good response from the military and civilians working at military bases," she said. "In the fall 2002 semester we had military students in Japan and Abu Dabi, as well as at military bases throughout the United States. No matter where you are in the world, you're still connected to the College of Engineering at NC State through the Engineering Online program."

Krute sees an exciting future for Engineering Online. "We're experimenting with synchronous format, where the student can dial in and see the class live, even though most of our current students are employed and choose to watch the lectures

evenings or weekends," she said. Another particularly exciting possibility involves a partnership between NC State and a university in Venezuela, which would be the host institution for the courses and provide infrastructure such as advising, library resources, computer networks and exam proctoring, while NC State would deliver the courses.

Ultimately, Krute sees Engineering Online as a positive vehicle for higher education. "When all is said and done," she said, "I would like to help create a more educated workforce."

For an update on Engineering Online's expansion to coastal North Carolina, visit www.engr.ncsu.edu/news/news_articles/CherryPoint.html. ■

STUDENT spotlight

ASME spells success

The North Carolina State University student section of the American Society of Mechanical Engineers (ASME) in the Department of Mechanical and Aerospace Engineering has become one of the largest and most active groups in the nation. Dr. Richard R. Johnson, professor of mechanical engineering, has been the section's faculty advisor for 21 years. Under his guidance, the section has consistently maintained a large membership, placing in the top 10 in this regard among other ASME student sections across the U.S.

Like many student organizations on campus, the ASME student section participates in service projects, volunteer programs, competitions and other activities. Over the years ASME students have excelled in many areas. Recently they have especially excelled in competitions.

Last fall the ASME students took first place in the 2001-02 ASME Interregional Student Section Contest, co-sponsored by ASME International and Ingersoll-Rand. This annual event, involving student sections from across the country, is a two-part, point-driven contest. In the intraregional part of the contest, which has a cap of 1,000 points, sections earn points based on year-long activities, including technical events and service projects. The NC State chapter was one of only six sections to receive a perfect score of 1,000.

For the interregional part, with no point cap, sections compete against all other sections for first place. With a grand total of 4,535 points, NC State took first place.

Elizabeth Baldwin, chapter chair for 2001-02 and vice chair during 2002-03, said, "One reason our section has done so well is because of our unique technical sessions." The NC State chapter was the first section to provide multiple-day workshops on industry software to students. Their advisor, Johnson, believes the section's success is also due to their long tradition of sending large numbers of delegates to the ASME Regional Leadership Conference and the ASME International Mechanical Engineering Conference and Exposition.



Mechanical and aerospace engineering students won first place in the 2003 ASME Regional Student Design Contest; (front row, left to right) Luke Davis, Joe Grappe, Ang Uy. (Back row, left to right) Dr. Hamid Davoodi, John Dyess, Dr. Mohammad Noori, Dr. Richard Johnson. (All photos: Kathi McBlief)

In March a team of students called the "Sonic Death Monkeys" brought more acclaim to the section by winning first place in the ASME Regional Student Design competition. The four students on the ASME student section team were Joe Grappe, John Dyess, Luke Davis and Ang Uy. Their project advisor was Dr. Hamid Davoodi, director of undergraduate administration in the Department of Mechanical and Aerospace Engineering.

The theme of the design contest was the mining industry. All teams were required to simulate a system to harness energy stored in mountain streams in order to lift ore from the bottom of an open pit mine. Two liters of water served as the energy source, and approximately 3.2 kilograms of long-grain rice served as ore. There were three aspects to the project: transfer of water, rice and energy. The ultimate goal was to move the simulated ore to the top of a 50-centimeter-high ramp.

Approximately 12 schools entered the contest, and 10 physically competed. Only four managed to propel the rice up the ramp. The Sonic Death Monkeys was the only team with two successful runs.

Although Johnson gives ASME student officers credit for the chapter's success, excellent mentoring also deserves credit. According to Dr. Mohammad N. Noori, professor and head of the Department of Mechanical and Aerospace Engineering, "the secret of the chapter's success is the devotion of Dr. Johnson."

Once, when Johnson was on leave to his native South Africa as a Fulbright scholar, he traveled back to the U.S. at his own expense just so that he could take a group of students to the annual ASME meeting as he does every year. Nicole Kaufman, 2002-03 treasurer and 2003-04 chair, noted that section membership dropped significantly during one of Johnson's sabbaticals.

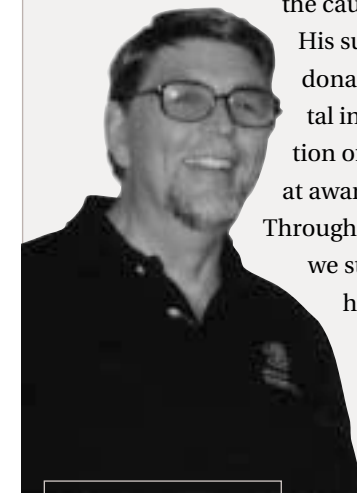
ASME International, the parent organization, has recognized the success of both Johnson and the ASME student section. In

1996 the organization gave Dr. Johnson the national Outstanding Faculty Advisor Award. Prior to that he had received the ASME Region IV Outstanding Faculty Advisor Award



Dr. Richard Johnson – a champion for ASME students

Mechanical engineering students at NC State and recent alumni have started the Dr. Richard R. Johnson Endowment Fund to create a scholarship for NC State mechanical engineering students and to provide support for the ASME student chapter. According to Saunders Campbell Smith (ME '01), who is responsible for the initiative, "For years Dr. J. has championed the cause of ASME at NC State.



Richard Johnson

His support, through time and donations, has been instrumental in keeping NC State's section of this professional society at award-winning levels.

Through this scholarship initiative, we strive to honor Dr. J. for all his support and to provide for his cherished ASME section for many years to come." To make a donation to this fund, please make your check payable

to the "NC State Engineering Foundation, Inc." (with "Richard Johnson Fund" in the memo line) and mail it to the NC State Engineering Foundation, Inc., Campus Box 7901, NC State University, Raleigh, NC 27695-7901, or visit www.engr.ncsu.edu/ncef. ■

three times. More recently ASME International recognized the NC State ASME student section in a special way. For the section's positive impact on the Department of Mechanical and Aerospace Engineering, the organization gave the department a Clarke Scholarship in the amount of \$6,000 for incoming freshmen in fall 2003.

As one professor said of the ASME student section, "They are a wonderful group!" ■

catching up with Brandon White

Some readers will recall a feature we ran in the *Engineering Frontline* premier issue about former head drum major Brandon White (MSE '02). We thought we'd check in with him to see how he is doing. At the time we interviewed him, he had just graduated and was starting his job with Northrop Grumman in Baltimore, Maryland. White has just completed his first year.

"I've been very busy with work and getting settled in a new area," he said. "The job is great! But I miss the quiet and calm of North Carolina and going to every NC State football and basketball game."

White's career is off to a super start. He is enjoying his rotations through Northrop Grumman's departments. "First I worked as a manufacturing engineer, where I was responsible

for construction of the first MESA (Multi-role Electronically Scanned Array) antenna as a part of the wedgetail program," he said. White's next three rotations were as a test engineer on MESA, in manufacturing operations, and in the Wedgetail Program Office, where he was in charge of installation and checkout of the MESA system. He is also responsible for the senior design project that Northrop Grumman is sponsoring in the Department of Materials Science at NC State this year. In his "spare time" he will begin working on his master's degree in technical management at the Johns Hopkins University in spring 2004.

Best wishes to Brandon for continued success in his engineering career. ■



Brandon White
(Photo: Katherine White)

"Diet Download" wins international acclaim

In July 2003 an NC State computer science student team won third place in the world finals of the fourth annual Institute of Electrical and Electronics Engineers (IEEE) Computer



(left to right) NC State Computer Science Students Nathan Green, Jeremy Maness, J.R. Wilson and Buck Webb took third place in international competition with their senior design project, "Diet Download." They were the only U.S. team to make it to the finals. With them are team mentors Margaret Heil and Dr. Robert Fornaro. (Photo: Stacy Saul, IEEE Computer Society.)

Society International Design Competition. They were the only U.S. team to place in the top 10 finalists. Team members were Nathan D. Green (CSC/MA '03), Jeremy Maness (CSC '03), and Buck Webb and J.R. Wilson, both seniors in computer science. Under the guidance of Dr. Robert J. Fornaro, director of the Senior Design Center in the Department of Computer Science, and Margaret Heil, assistant director of the Center, the team developed an invention called "Diet Download," which can help consumers with their weight loss programs.

The device is a personal digital assistant with a bar-code scanner that can create a "virtual pantry" to help users easily record what they eat. Shoppers can look up specific dietary information about a product by scanning its bar code, store recent personal weight history and track weight loss.

The cash award for third prize is \$12,000, with \$6,000 for the team members and \$6,000 for NC State to establish an IEEE Computer Society financial aid fund for computer science and engineering students. ■

NC STATE UNIVERSITY

On the web at engineeringonline.ncsu.edu



Engineering Online at NC State

If you thought the doors to a master's degree in engineering were closed to you, try these. Visit our website at EngineeringOnline.ncsu.edu to open the door to a new learning experience and make plans now for your graduation from one of the following degree programs:



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- Master of Computer Science
- Master of Engineering
- Master of Science in Aerospace Engineering
- Master of Science in Chemical Engineering
- Master of Science in Mechanical Engineering

JOIN US IN CONGRATULATING THREE FACULTY MEMBERS WHO RECEIVED TOP HONORS FROM THE INSTITUTE OF INDUSTRIAL ENGINEERS IN 2003.

Three North Carolina State University professors have won prestigious awards from the Institute of Industrial Engineers (IIE). The awards were presented at the annual IIE conference in Portland, Oregon, in May 2003.

It is an especially high honor for any department of industrial engineering to receive these three IIE awards all at the same time.



Salah Elmaghraby



Thom Hodgson

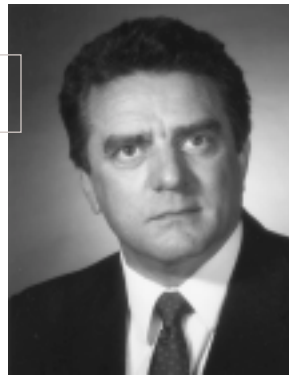


Russell King

- ▲ Dr. Salah E. Elmaghraby, University Professor of Operations Research and Industrial Engineering, received the Frank and Lillian Gilbreth Industrial Engineering Award, the highest honor IIE bestows.
- ▲ Dr. Thom J. Hodgson, the James T. Ryan Professor of Industrial Engineering and Furniture Manufacturing and Distinguished University Professor of Industrial Engineering, received the Albert G. Holzman Distinguished Educator Award.
- ▲ Dr. Russell E. King, professor of industrial engineering, received the Award for Technical Innovation in Industrial Engineering.

NC STATE
achieve!

Robert Fornaro



update

Fornaro brothers join forces at NC State



Gene Fornaro takes the wheel in a 1/8 scale race car at the 1998 Industrial Extension Service meeting held at the 600 Racing company in Harrisburg, North Carolina. (Photo: Ruthann Cage)

It all began with a family vacation at the North Carolina coast in the mid-1980s. The Fornaro family members were scattered up and down the East coast. Gene F. Fornaro was living with his family in Alabama, his parents lived in Pennsylvania and Gene's brother Bob lived in Raleigh, North Carolina. They all converged on coastal beaches for family reunions.

During one such vacation, the Fornaro brothers began talking about Raleigh. Robert J. (Bob) Fornaro, professor of computer science, director of the Senior Design Center and director of undergraduate programs at NC State University,

had been teaching at NC State since 1969. Gene F. Fornaro, now director of business development for the Industrial Extension Service (IES) at NC State's College of Engineering, was ready for a move from his position in Alabama in industry, where he worked on advanced composite materials evaluation, product design and stress analysis. Bob Fornaro introduced his brother to some administrators in the Industrial Extension Service at NC State, and the rest, as they say, is history.

Although their job duties vary, the brothers interact in a unique way that greatly benefits the students in the College of Engineering. As director of the Senior Design Center, Bob Fornaro works with students who are taking their senior design course, a semester-long experience during which students tackle real-world projects. Gene Fornaro's work at IES provides an essential connection for finding projects for the students to work on. "IES has a long history of working with industry — we have one foot in the industrial world and one foot in academia," says Gene Fornaro.

These close ties with industry are invaluable when it comes to matching students with senior design projects. Each semester the Fornaros work together to place about 90 students, usually in teams, with appropriate companies whose leaders have expressed a desire to participate.

The program has been extremely rewarding — a "win-win" situation for students and industry. A client from the Charlotte area was so satisfied with the result of the students' project that the company funded additional work for NC State senior design students over the next two semesters. In that case, after two teams of students completed a software prototype for the client, he decided he wanted it developed further. The students continued to work on the development phase over the summer.

Congratulations to NC State Students for Outstanding Achievements!



TEAM AEROPACK



ASME



TEAM SCIOCCO

▲ (Photos clockwise from upper left) Team AeroPack — a group of students in chemical engineering, mechanical and aerospace engineering, and pulp and paper science — took first place piloting a hang glider with paper wings at Kitty Hawk, NC, in Energy Challenge 2003. Students Trey Hathaway, Josh McCall, Jody Moss, Daphne Wang, Sarah Mertens, Bryan Ransom, and Brandon Teague made their own paper and sail without wasting resources. (Photo by advisor Dr. Richard Spontak)

▲ NC State's ASME students placed first in the ASME Interregionals. In the intraregionals, they received a perfect score of 1,000. With advisor Dr. Richard Johnson are Aryn Bergman, Elizabeth Baldwin, Nicole Kaufman, Nathan Block, and department head Dr. Mohammad Noori. (Photo by Kathi McBlief)

▲ Aerospace Engineering seniors in Team Sciocco, Tiffany Berry, Matthew Eldredge, Steven Floyd, Benjamin Hess, Todd Lion, Scott Rewerts, Michael Schoen, and Glen Spadin, placed first in an AIAA competition in Kill Devil Hills, NC, for their design, a 6.5-ft. aircraft that can carry a bulky avionics payload. Faculty advisor was Dr. Charles Hall. Todd Lion shows the winning design. (Photo by team leader Glen Spadin)

▲ NC State's computer science students — the only US finalists — placed third in the IEEE Computer Society International Design Competition with "Diet Download," which uses a bar code scanner and PDA to help someone follow a diet plan. Left to right are Nathan Green, Jeremy Maness, J. R. Wilson, Buck Webb and mentors Margaret Heil and Dr. Robert Fornaro. (Photo by Stacy Saul, IEEE Computer Society)



DIET DOWNLOAD



Sometimes the senior design students garner top recognition for the university with their work. In spring 2003 a group designed a scanner call "Diet Download" (see page 26), which won third place in an international competition. Bob Fornaro was one of the faculty advisors for this team that was the only group from the U.S. to make it to the finals.

"IES HAS A LONG HISTORY OF WORKING WITH
INDUSTRY — WE HAVE ONE FOOT IN THE
INDUSTRIAL WORLD AND ONE FOOT IN ACADEMIA."

According to Gene Fornaro, relationships developed through the senior design programs often create employment potential for students after they graduate. Another program that

Bob Fornaro is involved in, ePartners, also sponsors senior design projects and fosters collaborations between the business community and the Department of Computer Science. Both programs provide students with unparalleled opportunities to practice their skills under the guidance of mentors from both the university and industry.

Strengthening the connections between NC State and industry is one aspect of his job that Gene Fornaro finds very rewarding. "I've always been attracted to the mission of service," he said. "I also enjoy sharing the knowledge I have in real-world industrial situations."

What started as a conversation at a beach house has blossomed into a productive partnership for both the brothers and the students at NC State ■



Daniel joins Minority Engineering Programs

Angelitha L. Daniel was appointed assistant director of minority programs for the College of Engineering effective June 15. Before coming to NC State, she served as recruiter for the minority engineering program at the University of Pittsburgh for five years.



Felder receives two ASEE honors

Dr. Richard M. Felder, Hoechst Celanese professor emeritus of chemical engineering, has been awarded the Lifetime Achievement Award in Chemical Engineering Pedagogical Scholarship of the American Society for Engineering Education (ASEE), Chemical Engineering Division, and ASEE's William Elgin Wickenden Award.



Gardner wins ASEE Glenn Murphy Award

Dr. Robin P. Gardner, ChE '56, MSChE '58, professor of nuclear and chemical engineering and director of the Center for Engineering Applications of Radioisotopes, received the 2003 Glenn Murphy Award from the American Society of Engineering Education (ASEE).



Johnston receives Bloem Award

Dr. David W. Johnston, CE '66, MSCE '68, PhDCE '72, professor and associate head of civil, construction, and environmental engineering, received the American Concrete Institute Delmar L. Bloem Award for Distinguished Service.



Ollis receives UNC System outstanding teaching award

Dr. David F. Ollis, Distinguished Professor of chemical engineering, won the Award for Excellence in Teaching from the University of North Carolina Board of Governors. Ollis is one of 16 educators – one from each UNC campus – to receive the award presented by UNC President Molly Corbett Broad and Board of Governors Chairman J. Bradley Wilson. Winners received a prize of \$7,500 and a bronze medallion.



Hauser receives Holladay Medal

The NC State University Board of Trustees has awarded the Alexander Quarles Holladay Medal for Excellence to five faculty members in recognition of their outstanding careers at NC State. One of this year's honorees is Dr. John R. Hauser, EE '60, Distinguished Professor of Electronic Materials and Devices. The Holladay Medal is the highest honor bestowed on a faculty member by the trustees and the university. The medal was presented during the university's Honors Baccalaureate and Celebration of Academic Excellence on May 15, 2003.



Trew receives named professorship

Dr. Robert J. Trew has been named the Alton and Mildred Lancaster Distinguished Professor of Electrical and Computer Engineering, effective April 1, 2003. He has served as head of electrical and computer engineering at NC State since January 1, 2003.



Misra selected for NAE Frontiers of Engineering

Dr. Veena Misra, EE '90, MSEE '92, PhDEE '95, associate professor of electrical and computer engineering, has been selected to participate in the National Academy of Engineering's Frontiers of Engineering program September 18 through 20 in Irvine, California. The program brings together 83 of the nation's top young engineers for discussions on topics including environmental engineering, nanotechnology, counterterrorism technologies and biomolecular computing.



Muth and Haugh selected as ONR Young Investigators

Dr. John F. Muth (top), assistant professor of electrical and computer engineering, and Dr. Jason M. Haugh, ChE '74, assistant professor of chemical engineering, have been selected as Office of Naval Research (ONR) Young Investigators. The program draws on young scientists and engineers who show "exceptional promise for outstanding research and teaching careers."



Stone receives Frank M. Masters Award

Dr. John R. Stone, associate professor of civil, construction, and environmental engineering, received the Frank M. Masters Transportation Engineering Award.



Turinsky receives top honor from ANS

Dr. Paul J. Turinsky, professor and head of nuclear engineering, was selected to receive the American Nuclear Society's Eugene P. Wigner Reactor Physicist Award, the highest international award in the field.

Anderson named Faculty Senior Scholar

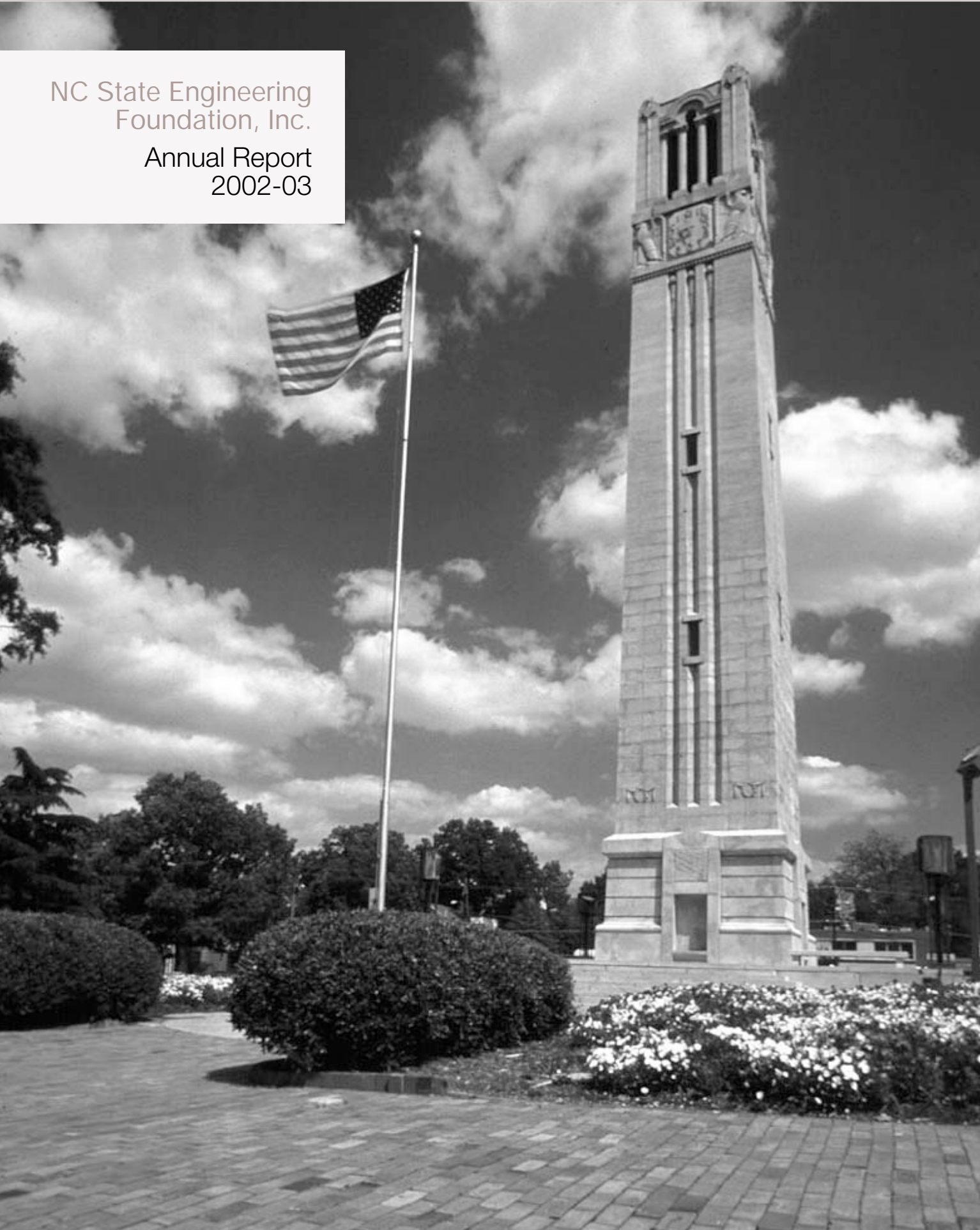


Dean Nino Masnari congratulates scholar Ben Anderson.

(Photo: Kathi McBlief)

Ben Logan Anderson, a junior majoring in both computer engineering and electrical engineering, received the College of Engineering Faculty Senior Scholar for 2003-04. Anderson has received numerous awards, including the Amelia Mitta Scholarship, the Lockheed Martin Scholarship and the Navy ROTC award. After graduation,

he plans to attend the Navy's Nuclear Power School. Later he hopes to earn advanced degrees in electrical engineering and ultimately become a professor at the Naval Academy in Annapolis, Maryland.



letter from the
executive director



Ben Hughes

Once again it is my privilege to express the College’s gratitude to our many alumni and friends who have contributed to making the College of Engineering at NC State the vibrant and well-respected institution we are today. There is no question that this was among the most challenging years we have ever experienced. Low returns from the equity markets and the generally sluggish economy affected our ability to generate operating income at the level we have enjoyed in previous years. In spite of those challenges, you, our alumni and closest friends, provided the College with \$7.6 million in current financial support and another \$11.6 million in pledges, deferred gifts and gifts-in-kind. Your generosity helped offset market losses and, as a result, the market value of the Foundation’s total assets remains strong at just under \$40 million (as of June 30, 2003). We are pleased and encouraged by this success and extend our gratitude to all of those listed on the following pages that made it possible.

We are especially pleased with the progress in addressing one of our most critical needs — endowed faculty support. Several new professorships were established this year, and we are working on several more, which we hope to complete in the near future. In addition, we received a few bequests of a very significant size. I call your attention to the article in this section that details the importance and method of making such gifts through your estate. I also encourage you to visit our recently enhanced website — www.engr.ncsu.edu/ncef — for even more information.

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

— Ben Hughes
Executive Director
Development and College Relations

volunteers

NC State Engineering
Foundation, Inc.
Board of Directors
2002-2003

Quint M. Barefoot, CHE '85
Consultant, Self-Employed

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Mulkey delivers Entrepreneurs Lecture



Barbara Mulkey

Barbara H. Mulkey (CE '77, MSCE '84), President and CEO of Mulkey Engineers & Consultants, gave a lecture as part of the Entrepreneurs' Lecture Series on October 14 at the McKimmon Center. The lecture, "Barbara Mulkey: From Kitchen Table Leadership to Boardroom Success," was followed by a reception. ■

Scholarship/Fellowship Dinner Held

The Seventh Annual Engineering Endowed Scholarship/Fellowship Dinner was held March 21, 2003, at the Brownstone Hotel in Raleigh. Sponsored by the NC State Engineering Foundation, the event brings together donors and student recipients of endowed scholarships and fellowships to celebrate academic achievement and private support. Approximately 290 donors and recipients gathered for the dinner in 2003.

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

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



Joyce and Jacob Williamson greet their scholars, Alan Boyd and Bradley Rouse. (Photo: Becky Kirkland)

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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, 2003. For information about including the College of Engineering in your estate plans — or if you have already done so and would like to become a member of the Pullen Society — contact David Nolan, Director of Development, NC State Engineering Foundation, (919) 515-7458, (866) 316-4057 toll free, or david_nolan@ncsu.edu or Joan DeBruin, Director of Gift Planning, Campus Box 7501, NC State University, Raleigh, NC 27695-7501, (919) 515-9076, or joan_debruin@ncsu.edu.

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Phyllis and Glenn Futrell talk with Dean Nino Masnari at the 2002 Dean's Circle dinner. (Photo: Sheri Thomas)

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Dean Nino Masnari (right) greets Dean's Circle member Henry C. ("Hank") Thomas. (Photo: Sheri Thomas)

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Deanna Silsby and Jeffrey Spanner meet donors Tempie and Benny Furr (center), whose scholarship was established in memory of their daughter Jane Leigh Furr. (Photo: Becky Kirkland)

Whitted elected to National Academy of Engineering

J. Turner Whitted (PhDEE '78), senior researcher, Hardware Devices and Graphics, Microsoft Corporation, Redmond, Washington, was elected to the National Academy of Engineering in 2003 in recognition of his work in recursive ray tracing. Whitted is acknowledged as one of the pioneers in three-dimensional computer graphics and was the first to apply the concept of ray-tracing to global illumination in computer graphics. He is cofounder and former director of Numerical Design Limited. He served as an adjunct professor of computer science at UNC-Chapel Hill from 1983 to 2001. A pilot and avid sailor, he is a strong supporter of NC State engineering. He and his wife, Cathleen, live in Carnation, Washington; they have a second home in Pittsboro, North Carolina. You can read more about him as a featured alumnus on this website: www.ece.ncsu.edu/alumni. ■



Turner Whitted (Photo: Margaret Hudacko)

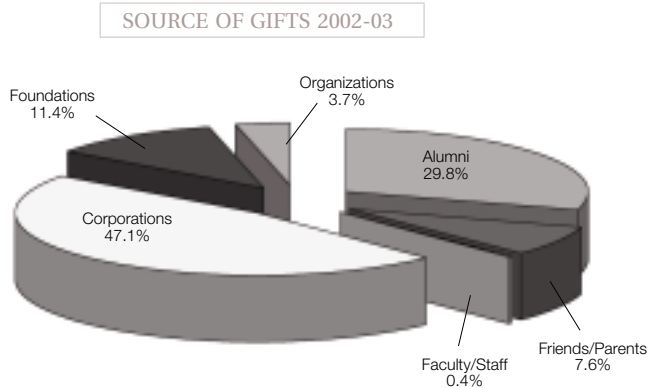
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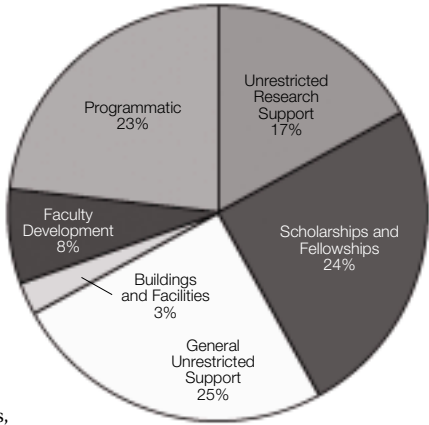
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Weisiger endows professorship in construction engineering



Edward I. Weisiger Jr. endowed the Edward I. Weisiger Professorship in Construction Engineering to honor his father and to support the College of Engineering at NC State. *(Photo: Jane A. Werner, Carolina Tractor)*

Edward I. Weisiger Jr. (IE '82) of Charlotte, president of Carolina Tractor, has a vision for the future of construction engineering. “I’d like to see new methods of delivery of facilities and infrastructure,” he said. “A professorship in the College of Engineering could improve the design/build process. It would involve areas of transportation planning, new

means of construction delivery and expedited construction methods, all of which would impact savings in time and dollars.”

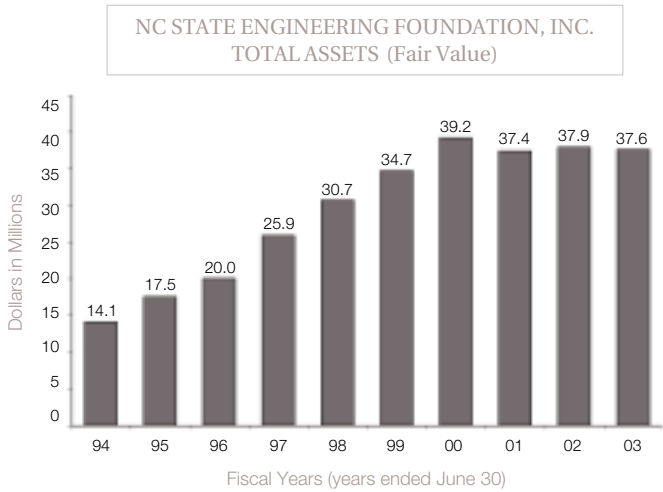
To help make his vision a reality, Weisiger has donated \$333,000 to NC State’s College of Engineering to endow such a professorship in construction engineering. The gift will be matched by \$167,000 from the State of North Carolina – Distinguished Professorship Endowment Trust Fund, making the total amount of the gift \$500,000. The professorship will be named the Edward I. Weisiger Professorship in Construction Engineering and will honor Weisiger’s father, Edward I. Weisiger (ME '54).

[see Weisiger, page 46]

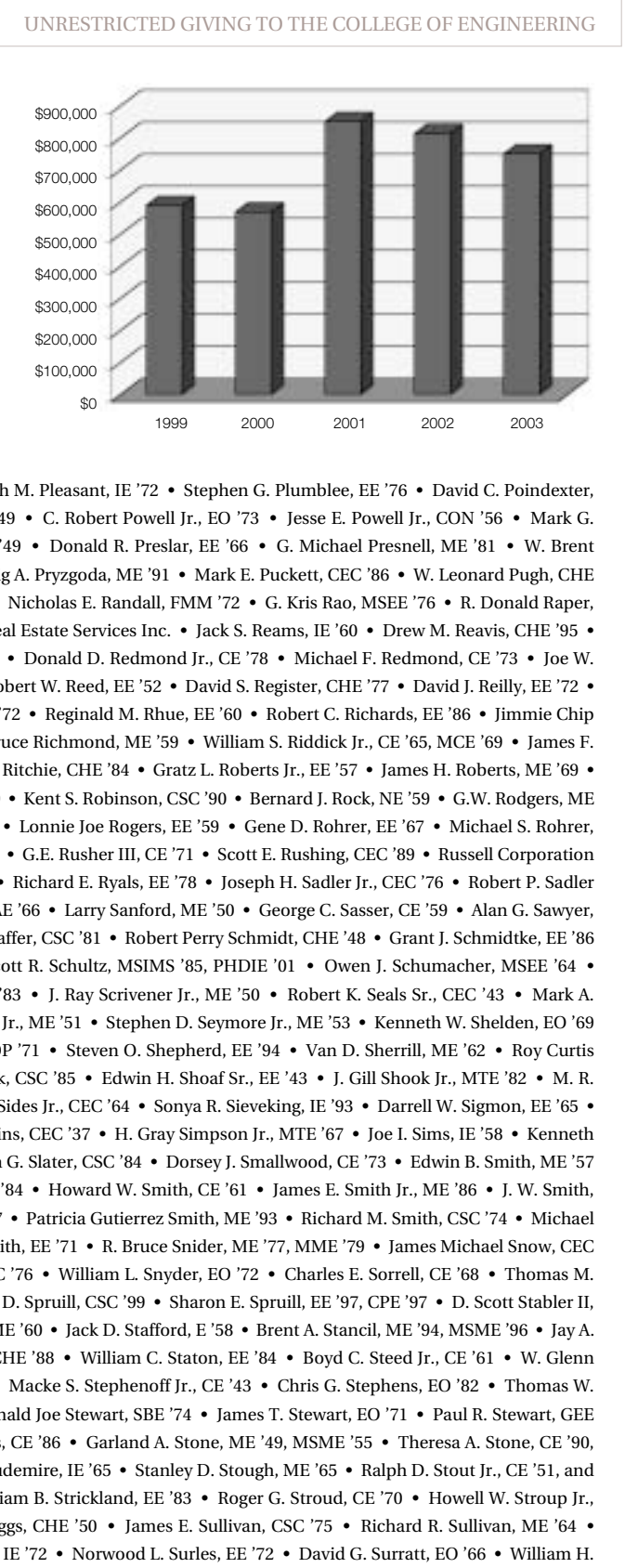
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alumnus Ed White – a study in success



Ed White

If you could repeat your years in the College of Engineering at NC State, would you change anything? Would you take the same courses, or shift your focus? Ed White (EO ’78) would focus on greater breadth of course-work, including more communication and humanities courses. “Engineering taught me to think logically and look for solutions,” he said, “but you can never get far from needing good communication skills.” White’s unique career path since his days at NC State has reflected this breadth of experience, and he has always sought to balance technological expertise with communication skills in his professional relationships.

After graduation White worked at Westinghouse for a number of years in a product development group, where he got involved designing software for metering equipment.

“I learned a lot working at a large company like Westinghouse, including both product manufacturing processes and the importance of communication skills in business,” he said. In 1980 White founded UTS, a two-man startup that grew over the next 16 years to a worldwide supplier for commercial electric and gas utility meters. Along the way White and his research engineers developed unique products that revolutionized utility metering systems, including software for remote meter reading.

“We were fortunate to produce a needed product that solved a problem for industry,” he said. “We found our marketing niche.”

In 1996 UTS merged with Itron, a company in Spokane, Washington, that focused on residential customers. Combining UTS’ commercial focus with Itron’s residential market strength created a \$350 million company that serves 70

percent of residential and 70 percent of large power companies’ needs in the U.S.

“I wouldn’t have believed it if you had told me 25 years ago that I would be in the software business,” he said. “It worked out well for me and just goes to show that you never know what opportunities are going to come your way.”

White’s career has taken a new twist recently. After retiring from Itron in the late 1990s, he began looking for something outside of the technical world. He also wanted to come home to Raleigh after so many years of extensive business travel. He started White Ventures LLC, which is the development company directing Town Hall Commons in Morrisville, a \$200 million project. According to White, Town Hall Commons will be a true mixed-use development, with commercial, residential and governmental agencies together in a community.

“WE WERE FORTUNATE TO PRODUCE A NEEDED PRODUCT THAT SOLVED A PROBLEM FOR INDUSTRY. WE FOUND OUR MARKETING NICHE.”

In addition, White has become more involved with his *alma mater*— he is a member of the NC State Engineering Foundation Board of Directors and a participant in Coalition 2000. White has become an invaluable leader, and his philanthropy follows his involvement. Last year he established a charitable remainder trust (CRT), a gift vehicle that provides the donor with income for life or a term of years and passes the remainder to charity. White wants the trust to support two important priorities: scholarships and professorships.

“I’d definitely recommend a CRT to others,” he said. “This is a way to do something that has a real impact for the College, and it’s a good element of a financial plan for the donor.”

White’s connection to NC State does not end there. His daughter, Jacklyn, is a junior majoring in communications. ■

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Weisiger, continued from page 41.

Both father and son are former members of the NC State Engineering Foundation Board of Directors; the father is a 1995 Distinguished Engineering Alumnus, past president of the Wolfpack Club and past chairman of the NC State University Board of Trustees. He served as director of Wachovia Bank and Trust Company in Charlotte for almost 25 years. Both Weisigers now live in Charlotte and work together at Carolina Tractor, a dealer for Caterpillar; Ed Weisiger Jr. is president and CEO, and his father serves as chairman.

The Weisiger family history in engineering goes back several generations; Ed Weisiger Jr.’s grandfather was also an engineer, having received his degree in civil engineering from the University of South Carolina in 1918.

This generous endowment comes at a crucial time and provides much-needed support for one of the College’s top priorities — recruiting and retaining top faculty, who are instrumental to our students’ success. Increasing the number of endowed professorships is one of the most promising ways to meet this goal, and the Edward I. Weisiger Professorship in Construction Engineering represents a major leap forward in this important endeavor. ■

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An endowment is created through the establishment of a permanent fund that is invested and managed. A portion of annual income generated is used to carry out the donor’s designated purpose. Income earned in excess of the annual amount spent is added back into the endowment so that it continues to grow and maintain its purchasing power for future generations. The following permanent endowments benefit the College of Engineering at NC State: [continued on page 48]

engineering across the generations — one family of NCSU grads, many career paths

Just as one person’s engineering career can take many turns over the years, so can the engineering careers of one family. Diversity is the name of the game for the Meares family of Raleigh. The family’s connection to NC State engineering began in the 1920s and continued in the fall of 1942 when Merlin A. (“Patches”) Meares (ME ’47) arrived on campus.

“I had only been to Raleigh twice before the day my parents brought me up to campus and returned home to Chadburn in Columbus County,” he said. “Colonel Harrelson told us in an orientation class to shake hands with the man on our right and left and that only one of us would graduate!” Meares did

Other family members who attended NC State were Matthew Meares’ maternal great grandfather, Sigfried “Sig” Schafer, from 1918-20 (electrical engineering) and Robert’s brother, Paul Meares (EO ’77).

graduate, though, after a two-year hiatus during the war, with a degree in mechanical engineering. He went to work for North Carolina Equipment Company — which became A. E. Finley & Associates — where he moved into sales after two years in engineering. His successful career with A. E. Finley culminated in presidency of the company from 1987 to 1999, when he retired. Meares’ activities with NC State have included serving on the NC State alumni board of directors,



Merlin (Patches) Meares (left) and his son Robert are two NC State graduates whose engineering degrees took them in very different directions.



Matthew Meares is involved in the construction of a wind farm consisting of 27 GE wind turbines in South Dakota.

the Campaign for Excellence steering committee, the board of directors of the Friends of the Library and the board of directors of the Wolfpack Club. He was awarded the 2002 Menscer Cup in recognition of his lifelong service to the university.

Patches’ son Robert E. Meares (EE ’74) took a very different direction with his engineering degree. He was good in math so electrical engineering seemed a logical choice. Computers were a brand new field then, and Robert wanted to design them. Following a master’s degree in computer science, he went to work for IBM in Raleigh, where he’s been ever since. One of Robert’s most notable contributions is the development of the bar scan customer identification cards that are now commonly used in grocery stores. “All the grocery stores are using the IBM software that I originally wrote to handle the cards,” he said.

The youngest generation of Meares engineers is Matthew A. Meares (ME/LAF ’00). He has been interested in renewable energy, especially solar power, since childhood. “I decided on mechanical engineering because the Solar Center at NC State is part of that department, and I loved the thermo classes,” he said. Since graduation he has worked in renewable energy, and as president of his company, Southeastern Winds LLC, Matthew splits his time among North Carolina, Tennessee and South Dakota, where he is directing the construction of a wind farm consisting of 27 General Electric wind turbines.

Even though the Meares family members took very different career paths, they all knew that NC State was the place to be for their education. “We grew up as State fans, and we were all of an engineering mindset. We liked working with numbers and working out problems so it was pretty obvious for Matthew and me that we were going to be in some kind of scientific or engineering field,” said Robert Meares. “NC State was a logical choice.” ■

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gifts

The College of Engineering wishes to thank the following corporations for their generous gifts during 2002-03:

Progress Energy — \$235,500 to support a wide variety of programs, including more annually funded scholarships than any other corporate donor (see story on page 50).

Duke Energy Corporation — \$174,500 for scholarships, teaching labs, PUL-STAR reactor, nuclear engineering high school outreach, graduate student recruitment, undergraduate summer research fellowships, event sponsorship, library acquisitions and more.

NC State’s engineers get jobs in a downturn economy
— Well-rounded grads heavily recruited by Northrop Grumman ES, Baltimore

At a time when graduating seniors in the class of 2003 faced the worst hiring slump in two decades, Northrop Grumman Electronic Systems (ES) of Baltimore, Maryland, hired an astounding 30 new starts at North Carolina State University alone. Many corporations have been cutting back on hiring of new graduates, and most 2003 seniors across the US graduated jobless. So what does it take to be one of the select few to receive a job offer? An edge.

In the case of Northrop Grumman ES, that edge comes in the form of “strong, outstanding, ready-to-work graduates,” according to Northrup Grumman’s Eric Pearson, manager of engineering staff development. Pearson is especially interested in well-rounded individuals, such as those who are graduates of NC State’s Benjamin Franklin Scholars program, in which students are double majors in engineering and humanities.

Such graduates are naturals for Northrop Grumman’s Professional Development Program with leadership develop-

Curtiss-Wright Corporation — \$75,000 endowment established for the Curtiss-Wright Centennial of Flight Scholarship program.

Shell Oil Company Foundation — \$45,000 to the Department of Chemical Engineering, for a joint industry research project, “Basic Principles and Control of Crude Oil Emulsion Formation” and for unrestricted use.

The Boeing Company — \$43,200 for scholarships, student organizations and NC State’s hosting of the Southeast Regional Aerospace Student Conference.

Alcoa — \$43,000 to support two diversity-related projects.

Northrop Grumman Corporation — \$42,000 for senior design projects and scholarships.

The BASF Corporation — \$40,000 (final portion of a \$125,00 pledge) for renovation of the BASF Lecture Hall in Riddick Laboratories. BASF also has donated \$15,.000 to support scholarships, student chapters and the Department of Chemical Engineering.

Square D Company — \$35,000 for scholarships and student organizations. ■

ment option, a program in which new hires are eligible to apply for the leadership option as they rotate through a series of specialized units for the first year of employment.

“Ben Franklin scholars are the kind of multidiscipline engineers I search for and train for strong leadership positions that will guarantee the future of Northrop Grumman,” Pearson stated. “With this option, it is our intent to provide leadership training so these new employees can be successful leaders in three to five years, whereas in the past this opportunity wouldn’t happen until after ten or more years of employment.”

The relationship between corporations and universities is mutually beneficial; graduates of this program are highly attractive job candidates for many engineering industries, and students need jobs. The growing and successful association between Northrup Grumman and North Carolina State University exemplifies the importance of building such partnerships. ■

Thanks for the Memories

You spent a lot of time here at NC State. Ah, the stories you could tell! Share your recollections about a favorite professor, event that changed your life, wildest prank ever pulled (or maybe just the second wildest — we don’t want to have to take back that diploma!), or anything pertaining to your days at NC State, and we’ll post it on our Memories website:

www.engr.ncsu.edu/news/memories

Send stories to brinson@ncsu.edu. Be sure to include your name, major, and class year.

Progress Energy supports College of Engineering



Buddy Cline (ME '68), vice president of Distribution Engineering and Operations for Progress Energy, meets Progress Energy scholarship recipients (left to right) Justin Goad, Jonathan Miller, Maaz Aziz, Alex Yacoub and David Forgeng. *Photo: Kathi McBlief*

Progress Energy is a company with a long-standing, strong connection to the College of Engineering at NC State. They support a wide variety of programs, including more annually funded scholarships than any other corporate donor. Progress Energy has also given generously to endowments for students and faculty, vital unrestricted funding, and gifts for upgrading facilities, including renovation of the Mechanical and Aerospace Engineering student lounge in Broughton Hall and providing a modern lecture hall in Burlington Nuclear Engineering Laboratories. Total giving for the College of Engineering in 2003 was \$235,500. In addition, Progress Energy has been a stalwart supporter at NC State of engineering student associations, as well as a major benefactor of the Benjamin Franklin scholars program, a highly selective, dual-degree program between the College of Engineering and the College of Humanities and Social Sciences.

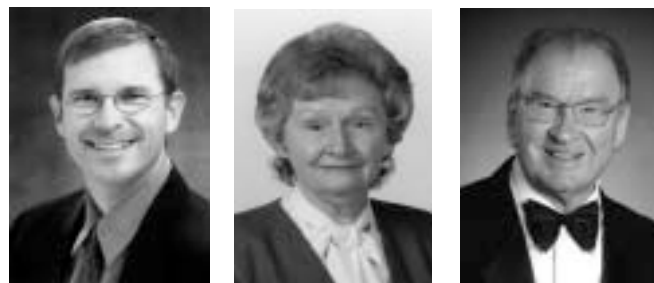
Dr. William L. Roberts, associate professor of mechanical and aerospace engineering, was the first recipient of the Progress Energy Endowed Faculty Fellow Award. Roberts used the proceeds to support one undergraduate student

and one high school intern in aerospace engineering; the results of the research conducted by these students was presented at a national conference, bringing recognition to both the university and the company.

Progress Energy also has an active recruiting program on campus. Students secure good jobs upon graduation, and Progress Energy finds exceptional employees, such as John Maclaga (EE '95, Multidisciplinary Studies '95), a Benjamin Franklin graduate of NC State and now a field engineer in Aberdeen, North Carolina. According to Maclaga, "Progress Energy is a great place to work — lots of challenges and change as well as very talented people." ■

Distinguished Engineering Alumni named

The College salutes its Distinguished Engineering Alumni for 2003: Keith Collins, Computer Science '82; Anna Clyde Fraker, MS Metallurgical Engineering '61, PhD Ceramic Engineering '67; and Jerry Mann, Mechanical Engineering '52. The award recognizes alumni whose accomplishments have furthered their field and who have brought honor to their *alma mater*. Recipients were honored at a banquet held October 30 at the Capital City Club in Raleigh. You can read more about these distinguished alumni: www.engr.ncsu.edu/news/awards/dea2003.html ■



Distinguished Engineering Alumni (left to right): Keith Collins, Anna Clyde Fraker and Jerry Mann. *(Photos courtesy of awardees)*

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 the nearly \$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 over \$19 million in support of the College of Engineering in fiscal 2002-03.

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

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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 outlets.

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.

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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!

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. Likewise, 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: 51,000 copies were printed at a cost of \$41,995, or 84¢ per copy.

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Keep in Touch and Win Free Wolfpack Tickets!

Engineering alumni, update your information for a chance to win free Wolfpack basketball tickets! Just take a moment to fill out the registration form: www.engr.ncsu.edu/ncsf/registration and make sure you fill in your email address.

That way, you'll be able to receive the College of Engineering's electronic newsletter — Engineering Frontline-Online (you can always unsubscribe, and we won't give out your address) — plus, you'll be eligible to win four free tickets to a Wolfpack basketball game!

GO PACK!

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