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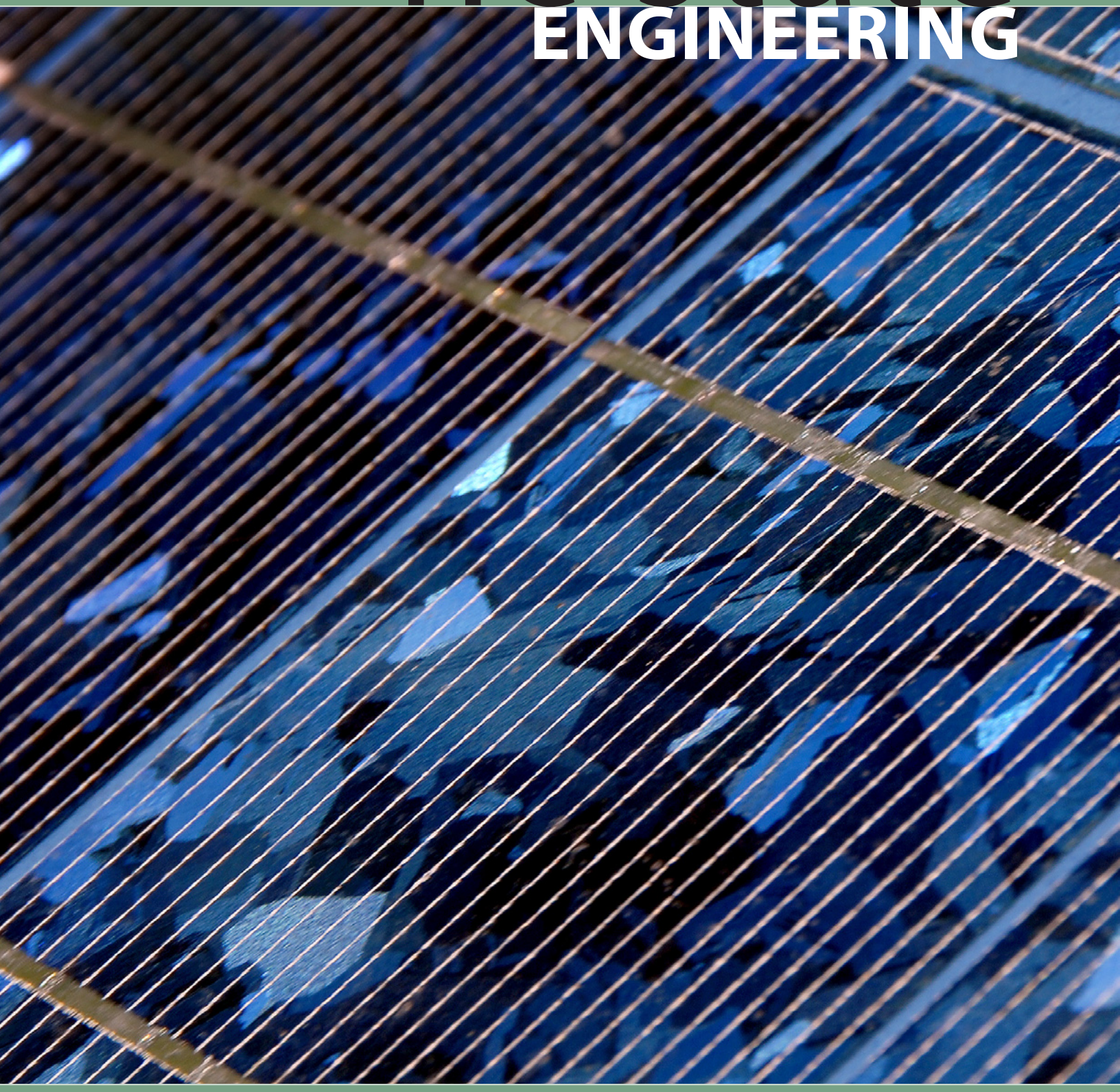

Fall 2007 • Engineering in the 21st Century: Energy + Environment

From the Dean of Engineering

Louis A. Martin-Vega

As I start my second year as Dean of our College, it is with great pleasure that I reflect on the journey that we have embarked upon to move into the very top-tier of colleges of engineering world-wide and the steps we have already taken in pursuit of this goal.

Foremost among our activities was a series of "Meet the Dean" events scheduled across the state and nation to open a dialogue with our alumni on the vision for the future of the College. Encased within the theme of "Engineering in the 21st Century," these events confirmed the very strong endorsement and support that we have from our alumni for the achievement of our goals and objectives. In this and subsequent issues we will expand on the messages discussed at these events: interdisciplinary research and education, integration of research and education, diversity, increased emphasis on K-12, outreach, international and extension activities, and most importantly, an emphasis on assuring that the "E" in "Engineering" means "Excitement" for all of our students.

Interdisciplinary research and education provides our students with opportunities that strengthen the breadth and depth of their educational experience and catalyzes their potential to become leaders in discovery and innovation. It is also critical to assuring that our graduates and faculty continue to play leading roles in the economic development of North Carolina and our country. These areas include the transcendental technologies of bioengineering, nanotechnology, information and communication technologies as well as areas of societal challenges and need such as energy and environmental systems, health systems, critical infrastructure and security, transportation and logistics, advanced materials and manufacturing, robotics and sensors technologies, and service sector engineering.

A central part of our vision is the integration of research and education as an essential component of the education of our undergraduate students. Early exposure to research and the opportunity to work alongside graduate students and professors inspires undergraduates to think beyond textbook facts and figures. It encourages their creativity and instills in them a level of self-confidence that motivates many to consider graduate education and the pursuit of highly innovative career paths. The organizations that drive our economy need engineers who are not only capabable of meeting current employment needs but are also creators of the "jobs of tomorrow." We are educating these future engineers today.

While there are many reasons to believe that the future is very bright for the College, two significant contributors to our optimism are the success we have attained in the recruitment of new faculty and the support that we have received from the state legislature. Twenty-four outstanding new faculty, including six new female faculty members, have joined our College in 2007-08, and we are very excited about the prospects that their remarkable talents will provide in the years to come. We have also recently learned that the North Carolina General Assembly has passed a budget that supports many of our initiatives, including funding for the completion of Engineering Building III on Centennial Campus and recurring funding for increased faculty. We are delighted with this important show of support and are already working to leverage this support to improve our college.

You may have noticed that this issue of our magazine arrived earlier this year and that it is no longer titled *Engineering Frontline*. The name change to *NC State Engineering*, the trimmed content and the biannual distribution are all part of a strategic effort to improve communication with our 47,000 alumni. Our plan is to select a thrust area to highlight for each issue. In this issue we are pleased to support our university's commitment to making 2007-08 the "Year of Energy" at NC State by focusing on accomplishments of our faculty, students and staff in the area of "Energy and the Environment." We hope that this series will inspire and engage you and further fuel your pride and passion for your College.

Thank you again for your support and all that you are doing on behalf of our students, faculty and staff. I sincerely hope that you enjoy this issue of *NC State Engineering*, and I look forward to a continued dialogue with you on the future of our College.

– *Louis A. Martin-Vega*
Dean, College of Engineering

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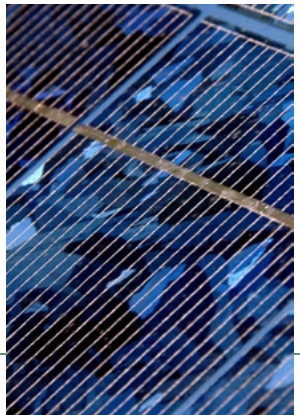

About the cover

The cover image is a close-up view of a solar photovoltaic (PV) panel that uses silicon crystals grown and sliced in layers to generate electricity. Solar energy represents just one area of research conducted in the College of Engineering that reflects our theme for the issue – Energy + Environment. The solar panel pictured is located at the North Carolina Solar Center, see article on page 16. *(Photo: Roger Winstead)*

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Alumni, you can update your contact information online at **www.engr.ncsu.edu/ncef/registration**,

or send address corrections to NC State Engineering Foundation Inc. at the address above,

or call 919.515.7458, toll free: 866.316.4057

Denis Cormier examines a part created by the Arcam A2. *(Photo: Roger Winstead)*

College of Engineering welcomes 24 new faculty

The College of Engineering welcomes 24 new faculty members, including six new women faculty members and two new distinguished professors. Dr. Paul Cohen is the first Edgar S. Woolard Distinguished Professor and head of the Edward P. Fitts Department of Industrial and Systems Engineering; and Dr. Reha Uzsoy has accepted the Clifton A. Anderson Distinguished Professorship in Industrial and Systems Engineering.

The 2007-08 class of new faculty are Dr. Paul Dayton and Dr. Michael Gamcsik in the Department of Biomedical Engineering; Dr. Wesley Henderson and Dr. Kirill Efimenko in the Department of Chemical and Biomolecular Engineering; Dr. Min Liu and Dr. Jie Yu in the Department of Civil, Construction, and Environmental Engineering; Dr. Kemafor Anyanwu, Dr. Xiaohui Gu and Dr. Nagiza Samatova in the Department of Computer Science; Dr. David Schurig and Dr. James Tuck in the Department of Electrical and Computer Engineering; Dr. Brian Denton and Dr. Julie Ivy in the Edward P. Fitts Department of Industrial and Systems Engineering; Dr. Joseph Tracy, Dr. Yaroslava Yingling and Dr. Yuntian Zhu in the Department of Materials Science and Engineering; Dr. Tiegang Fang, Dr. Hong Luo and Dr. Yong Zhu in the Department of Mechanical and Aerospace Engineering; and Dr. Jacob Eapen, Dr. Hany Abdel Khalik and Dr. Steven Shannon in the Department of Nuclear Engineering.

College of Engineering gets first US large-format EBM machine

This summer the College of Engineering took delivery of a large-format Electron Beam Melting (EBM) machine – the first of its kind in the US. The new machine gives researchers large-format rapid manufacturing capabilities unequaled anywhere in the nation. The new Arcam A2 EBM machine joins the first Arcam EBM system, which was the first of its kind in the US, making NC State the first and only university with two EBM machines.

Housed in the Edward P. Fitts Department of Industrial and Systems Engineering, the Arcam A2 will allow engineers to design and produce three-dimensional (3-D) parts for aerospace-related research projects.

“We are excited about this new machine because it can make parts nearly twice as large as our current EBM,” said Dr. Denis Cormier, associate professor of industrial and systems engineering and leader of the rapid manufacturing group at NC State.

The purchase of the Arcam A2 received support from the Golden LEAF Foundation as part of an Aerospace Alliance Initiative grant to NC State’s Institute for Maintenance Science and Technology (IMST) to help businesses in North Carolina make parts for the naval air depot at Cherry Point and the US Coast Guard air repair and service center in Elizabeth City.

EBM parts can be produced in days, and there is very little waste because the excess metal is recycled. According to an IMST case study, the cost of forging a Boeing 82918 Fan Duct Aft Hinge would be $7,427, and the delivery lead time would be months; the cost of fabricating the part on-demand with an EBM machine would be approximately $2,500, and delivery lead time would be days.

Cormier will devote the Arcam A2 to projects requiring powdered titanium. The older unit, the Arcam EBM S12, will be devoted to making aluminum parts for DRS Technical Services and NASA and other materials for a variety of projects, including biomedical engineering projects. For more information on the new Arcam A2, visit **www.engr.ncsu.edu/news/**.

NC State engineer visits site of I-35 bridge collapse

Gregory W. Lucier, research engineer from the National Science Foundation (NSF) Industry/University Cooperative Research Center (I/UCRC) on Repair of Buildings and Bridges with Composites (RB^2C) within the Department of Civil, Construction, and Environmental Engineering at NC State, was part of a four-person joint university research team to visit the site of the Minneapolis I-35 bridge collapse three days after the tragedy occurred on August 1. Joined by researchers from the NSF I/UCRC on Intelligent Maintenance Systems (IMS) at the University of Cincinnati, Lucier visited the site at the request of the NSF.

Researchers from the two centers have been working to more effectively predict and prevent bridge failures through the use of advanced methods, materials and technologies. Leading the project from NC State are Dr. Sami Rizkalla, Distinguished Professor of Civil and Construction Engineering and director of the Constructed Facilities Laboratory and the RB^2C; Dr. Mihail L. Sichitiu, associate professor of electrical and computer engineering; and Dr. Rudra Dutta, associate professor of computer science.

The researchers are working to accurately quantify and predict bridge deterioration by developing a telematic (the sending, receiving and storage of information via telecommunication devices) platform for bridge monitoring and health prognostics. They plan to integrate the extensive research on physics of bridge damages and instrumentation of bridge monitoring systems conducted at the RB^2C center with the Watchdog Agent®, a remote monitoring and prognostic technology developed by the IMS center. Their research is intended to help prevent such tragedies as the Minneapolis I-35 bridge collapse.

Greg Lucier visited the site of the Minneapolis I-35 bridge collapse and took this photograph of the truss from an adjacent pedestrian bridge. *(Photo: Greg Lucier)*

College of Engineering achieves campaign goal

The College of Engineering at NC State University announced this week that it has reached 100 percent of its $225 million *Achieve!* Campaign goal 12 months ahead of schedule.

"Reaching this goal has energized the college and the engineering foundation," said Ben Hughes, executive director of the NC State Engineering Foundation Inc. (NCSEF). "But we continue working to achieve full funding for each of the campaign categories, including areas of greatest need such as scholarships and fellowships."

Currently the NCSEF is at 100 percent or better in three of seven areas of concentration: Faculty Research, Program Development, and Facilities and Equipment. The areas of Scholarships, Fellowships, Faculty Support and Unrestricted Gifts still have unmet needs. The current college total is $225,923,446.

For more information about the NC State Engineering Foundation Inc. and the *Achieve!* Campaign, visit **www.engr.ncsu.edu/foundation**.

Fats into fuel

NC State innovation leads to 'green' technology that can power jets

Larry Stikeleather (right) and Tim Turner helped develop the biofuels process that turns fats into fuel.

New biofuels technology developed by NC State engineers has the potential to turn virtually any fat source – vegetable oils, oils from animal fat and even oils from algae – into fuel to power jet airplanes.

The technology – called Centia™, which is derived from *crudus potentia*, or "green power" in Latin – is "100 percent green," as no petroleum-derived products are added to the process. Centia™ can also be used to make additives for cold-weather biodiesel fuels and holds the potential to fuel automobiles that currently run on gasoline.

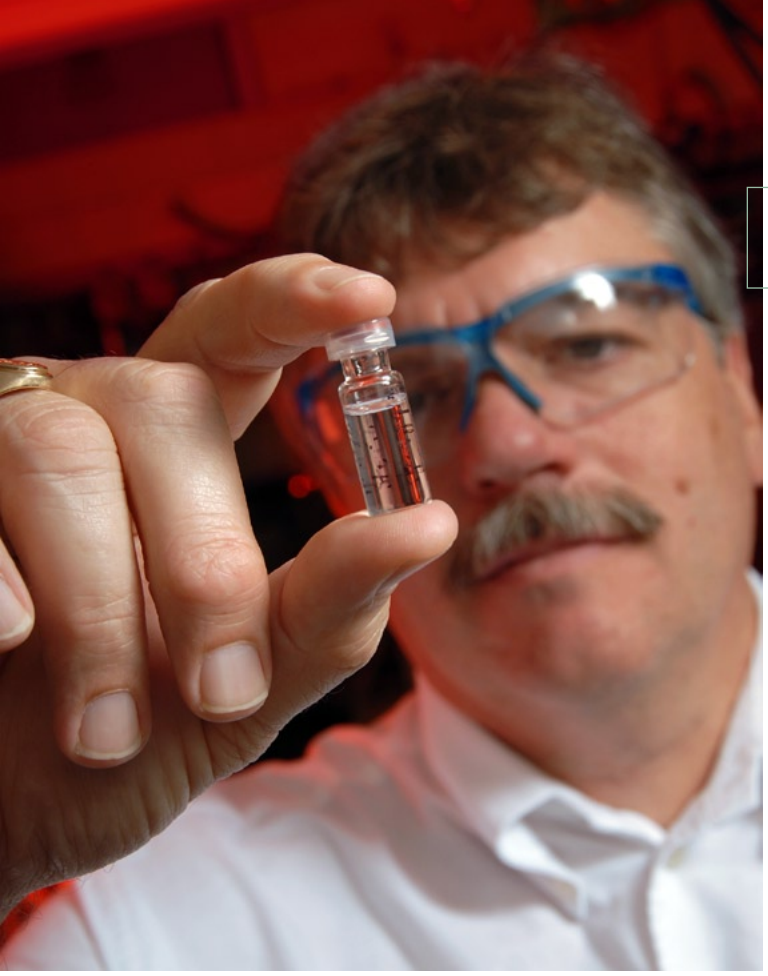
NC State received provisional patents to use the process to convert fats into jet fuel or additives for cold-weather biodiesel fuels. Diversified Energy Corp., a privately held Arizona company specializing in the development of advanced alternative and renewable energy technologies and projects, has licensed the technology.

Dr. William Roberts, professor of mechanical and aerospace engineering and director of the Applied Energy Research Laboratory at NC State, developed the biofuels process with Dr. Henry Lamb, associate professor of chemical and biomolecular engineering; Dr. Larry Stikeleather, professor of biological and agricultural engineering; and Tim Turner of Turner Engineering in Carrboro, N.C.

It really does take a rocket scientist to make jet fuel, especially out of oils or agricultural crops.

Roberts says that besides being "100 percent green," the new technology has some key advantages over other biofuel projects.

"We can take virtually any lipid-based feedstock or raw material with a fat source – including what is perceived as low-quality feedstock like cooking grease – and turn it into



Henry Lamb displays a vial of petroleum-free jet fuel. *(Photos: Roger Winstead)*

virtually any fuel," Roberts says. "Using low-quality feedstock is typically 30 percent less costly than using corn or canola oils to make fuel. And we're not competing directly with the food supply, like ethanol-based fuels that are made from corn."

The fuel created by the new process also burns cleaner, so it's better for the environment, Roberts says. There is no soot or particulate matter associated with fuel from fats.

According to Roberts, the Centia™ process puts to use what other biodiesel processes throw away. Converting feedstock into fuel produces a low-value commodity – glycerol – as a by-product. Rather than discarding glycerol as waste like most biodiesel plants do, the NC State engineers' process burns glycerol cleanly and efficiently to provide some of the process' requisite high temperatures.

"Instead of composting the glycerol as waste, we use it as an integral part of the fuel-making process," Roberts says.

It really does take a rocket scientist to make jet fuel, especially out of oils or agricultural crops, Roberts says. The physical and chemical properties of traditional biodiesel fuels, such as combustion characteristics and viscosity, don't match the stringent requirements required of jet fuels, making biodiesel unacceptable for the task.

"Jet fuel travels at 25,000 to 35,000 feet where temperatures can reach 70 degrees below zero Fahrenheit, so it needs to flow better in cold temperatures," Roberts says.

The Centia™ process comprises four steps, Roberts explains. First, the engineers use high temperatures and high water pressure to strip off the so-called free fatty acids from the accumulated feedstock of oils and fats, or triglycerides. Next, the engineers place the free fatty acids in a reactor to perform the decarboxylation step; that is, carbon dioxide is taken off the free fatty acids. Depending on the feedstock used, the scientists are left with alkanes, or straight-chain hydrocarbons of either 15 or 17 carbon atoms.

"After these first two steps, which are always the same no matter which fuel you want, we can make any fuel we want to make," Roberts says. "In the last two steps, we can change the recipe based on the fuel output desired."

In the last two steps, the engineers break up the straight chains into molecules with branches, making them more compact and changing their chemical and physical characteristics. Jet fuel and biodiesel fuel require a mixture of molecules with between 10 and 14 carbon atoms, while gasoline requires only 8 carbon atoms, so the engineers can control the process to elicit exactly the type of fuel they desire.

Finally, the engineers make some other chemical tweaks to create the desired fuel. The glycerol by-product is burned off to provide heat for the various processes involved.

"We produce one-and-a-half billion gallons of animal fats annually, which is about half of the amount of vegetable oil produced yearly," Roberts says. "Animal fats are harder to work with, but cheaper. Last year, for the first time ever, fuel costs in the aviation industry exceeded labor costs. We think the aviation industry is keen on finding alternatives to petroleum-based jet fuel." ■

Chemical recycling converts post-consumer bottle-grade plastic into resin suitable for food-grade applications

NC State engineers develop new plastics recycling technology

Chemical engineers at NC State have developed a more efficient way to chemically recycle your soda bottles back into new ones.

Polyethylene terephthalate (PET) is a common plastic used in beverage bottles. Most beverage bottles collected for recycling are reprocessed into non-food products such as fiber and strapping. Only a small percentage of beverage bottles is reprocessed into food-grade PET – plastic packaging, including beverage bottles. Although there is a demand for recycled bottle-grade PET, the high cost of cleaning post-consumer beverage bottles, strict FDA requirements and old technology have favored the use of virgin PET over recycled bottle PET in the manufacturing of beverage bottles.

As part of a National Science Foundation grant, Dr. George W. Roberts, retired professor of chemical and biomolecular engineering, Dr. Saad A. Khan, professor of chemical and biomolecular engineering, and Joan Patterson, doctoral student in chemical and biomolecular engineering, have developed a new chemical reprocessing method that can more efficiently convert post-consumer bottle-grade PET into a resin suitable for food-grade applications.

All plastics are synthetic polymers, high-molecular-weight chemical compounds, made up of linked subunits of molecules called monomers. Combining of monomers to form a polymer is called polymerization. Reversing the process is called depolymerization.

Joan Patterson pours PET pellets into a twin-screw extruder by way of the blue hopper above. *(Photos: Becky Kirkland)*

Roberts, Khan and Patterson have demonstrated that they can take PET and depolymerize it back to target levels and end up with a material that can be cleaned and repolymerized into bottle-grade PET.

Instead of the awkward and energy-consuming batch processing tried by some recyclers, the new depolymerization process runs continuously in a machine called a twin-screw extruder.

"We think the process is very energy efficient, largely because it operates continuously. There are large energy losses associated with the old technology of throwing [PET] in an autoclave, heating it up, holding it for five hours, and cooling the autoclave down. The main energy here is to drive the extruder screws," Roberts said.

The extruder is capable of handling a large amount of polymer in a very short time. According to Roberts, the chemistry of the new process is fairly well known.

"We take this high-molecular-weight polymer and break it up into shorter segments by reacting it with ethylene glycol. Once we have the shorter segments, the viscosity of the material is significantly reduced. We can take out any solid, liquid or vapor impurities and wind up with a material that can be sent through a normal polymerization process. What we don't do is go all the way back to the raw materials from which PET is made. We go back to an intermediate stage – a low-molecular-weight polymer called an oligomer."

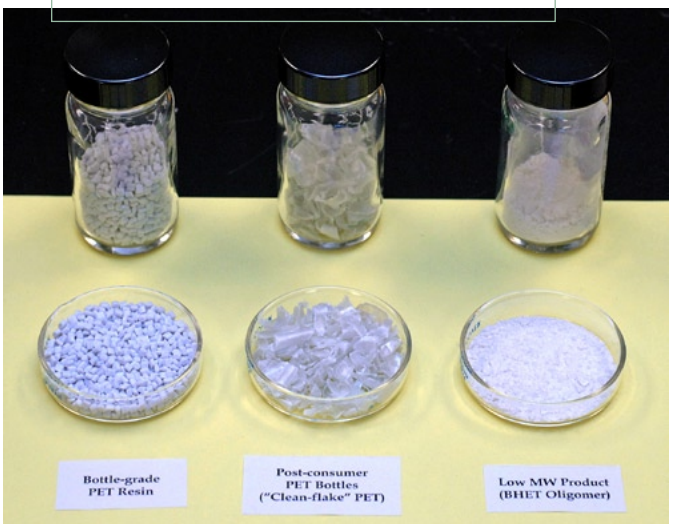
Roberts explained that although they can go back to the monomer stage, there is no need to. "We think it is more economical to make the oligomer because most polyester processes involve two stages, and the second stage starts with an oligomer."

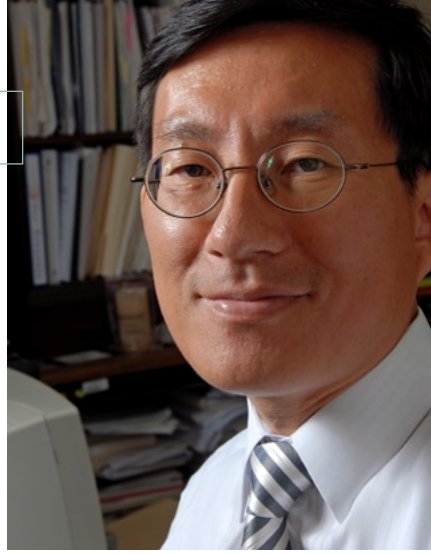
The technology is nearly ready for commercialization. Final testing with clean flake PET (ground and washed post-consumer bottles) remains to be done. Dr. Ronald A. DiFelice, president of DPoly Systems, is working with NC State University to commercialize the new technology. DiFelice started DPoly Systems in July 2006. The company is one of four startups to receive a 2007 grant from the North Carolina Innovative Development for Economic Advancement (NC IDEA) as part of NC IDEA's commitment to economic development across North Carolina. The funds are designed to help companies move closer to commercialization.

"The process has broad appeal to plastics recyclers," said DiFelice. "In addition to being applicable to polyesters, the process can be used to depolymerize post-consumer polycarbonates [e.g., plastic used in shatterproof windows] and nylons. The business model is to finish validating the technology and then work with partners to integrate it into high-volume recycling processes."

According to DiFelice, demand for post-consumer PET is increasing, and there are a number of companies chemically reprocessing PET that would be interested in incorporating this new technology into their line because of the opportunity for increased efficiency and an increase in the value of the end product. This new process results in resin that is purer and therefore more valuable to processors that incorporate post-consumer PET into their products. ■

The new chemical reprocessing method can convert post-consumer PET bottles (center) into a material called a low-molecular-weight oligomer (right), which is suitable for recycling into bottle-grade PET resin (left).





Man-Sung Yim

NC State, UNC engineers explore ways to reduce nuclear waste hazards

Ancient alchemists sought to transmute lead into gold. The conversion of one element into another proved to be a futile endeavor for these primitive chemists, but modern scientists and engineers are able to transmute chemical elements through nuclear reactions. Engineers at NC State University and UNC-Chapel Hill are conducting research to mitigate the potential hazards of nuclear waste through transmutation and other waste management schemes.

Dr. Man-Sung Yim, associate professor of nuclear engineering at NC State, and Dr. David M. McNelis, research professor of environmental sciences and engineering at the UNC Institute for the Environment, are investigating ways to manage radioactive waste. The Russell Family Foundation is funding much of this research.

Certain radioactive isotopes – radioisotopes – in nuclear waste, such as Plutonium-239 and Iodine-129, have long half-lives of many thousands of years. Plutonium-239, a nuclear product, has a half-life of 24,110 years, and Iodine-129, a residue of atomic fission, has a half-life of 16.7 million years. These extremely toxic radioisotopes and others can be converted into short-lived or stable isotopes by bombarding them with a stream of neutrons in various kinds of reactors and accelerators.

"Hit an atom with a neutron, the atom absorbs the neutron," Yim explained.

Isotopes are different forms of a chemical element with the same number of protons but a different number of neutrons. The process of converting one kind of isotope into another by changing the number of neutrons is called nuclear transmutation. Although the short-lived isotopes may still be radioactive, their half-lives can be a matter of days or even hours as opposed to thousands of years. Nuclear transmutation, then, has the potential of reducing the storage demands of radiotoxic waste.

One of Yim's current projects examines the storage capacity of radioactive waste at the planned Yucca Mountain repository, located within a former nuclear test site and designated as the first geologic repository for spent nuclear fuel and high-level radioactive waste.

Graduate students – advised by Yim and McNelis and supported by the Russell Family Foundation – developed an analytical decay heat model for the site to represent spent nuclear fuel and performed a thermal loading analysis to show that the Yucca Mountain repository's planned capacity is not enough to accommodate the future generation of spent nuclear fuel without implementing nuclear transmutation or expanding the size of the repository. This kind of information is important for the US Department of Energy because in 2010 they will recommend to Congress whether there is a need for a second repository.

In addition to the analytical decay heat model and thermal loading analysis for the Yucca Mountain repository, the team is involved in several other radioactive waste management projects, including collaborating with the Kurchatov Institute in Moscow on applying risk assessment and management techniques to the cleanup of radioactive waste at former weapons complex sites.

Yim and McNelis acknowledge that nuclear transmutation is not an easy solution. According to Yim, any transmutation scheme must also consider time, proliferation prevention, economics, safety and impact on the repository. Despite these challenges, Yim and McNelis are dedicated to finding optimal technological solutions for managing radioactive waste to meet current and future needs. ■

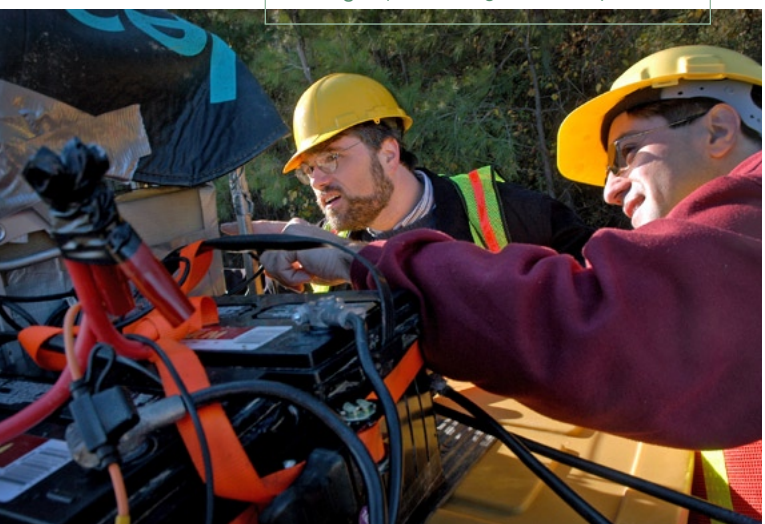
NC State engineer improves emissions data, creates model of vehicle emissions fingerprint

What is your emissions fingerprint?

We've all heard about the importance of reducing our carbon footprint. But in a society that is vehicle dependent, what is the impact of our driving style or our traffic patterns on how much energy we consume and pollution our cars and trucks put into the environment?

At NC State University, Dr. Chris Frey, professor of civil engineering, Dr. Nagui Rouphail, professor of civil engineering, and a team of students, are working to improve the modeling of energy use and emissions for various vehicles to create microscale models that can better determine the emissions fingerprint of vehicles, based on driving styles, traffic patterns and road grades.

To gather data for the microscale models, Frey and his students used emissions-measuring equipment attached to 10 different vehicles. They drove during different times of day, traveling high-traffic routes and alternative routes in the Research Triangle area. In addition to getting data for each vehicle, they also measured the effects of different kinds of driving behaviors – accelerating, decelerating and cruising under a wide variety of speeds.



Chris Frey (left) checks the work of his graduate students as they perform emissions testing on a NCDOT tractor working on a new road in West Raleigh. *(Photo: Roger Winstead)*

The models can be used to predict fuel use and emissions levels based on speed, acceleration and road grade. They can also be used to help determine the effects of routes, road grade and traffic patterns on the emissions produced by certain types of vehicles.

The carbon released to the environment by any vehicle is directly tied to the amount of fuel consumed and is easy to estimate on an aggregated basis. However, fuel use varies widely during portions of a trip and is influenced by driver behavior, roadway type, speed and acceleration. The estimation of variations in emissions is even more complex and depends on driver behavior, duty cycles and engine operation.

"The biggest air quality problem in an area like ours is ozone in the lowest layer of the atmosphere, where we breathe," says Frey. "This ozone is formed by chemical reactions of nitrogen oxides and hydrocarbons in the atmosphere. These are produced in large part by diesel- and gasoline-powered engines. Diesel engines produce more nitrogen oxides, and gasoline engines produce more hydrocarbons."

In a second, parallel project, Frey is working with Dr. William Rasdorf, professor of civil engineering, to study the energy use and emissions of construction vehicles such as backhoes, bulldozers, excavators, front end loaders and motor graders. The work includes evaluation of the effect of duty cycles on vehicle emissions and comparison of B20 biodiesel and petroleum diesel fuels.

Frey points out that ozone is a regional issue and that both on-road and non-road vehicles contribute approximately half of the emissions that lead to ozone formation. The models developed by the team can be used to develop new traffic patterns that could reduce vehicle emissions. ■

Multidisciplinary team produces cost-effective alternative fuels

Engineering students at NC State develop new techniques to produce ethanol and methanol from renewable sources

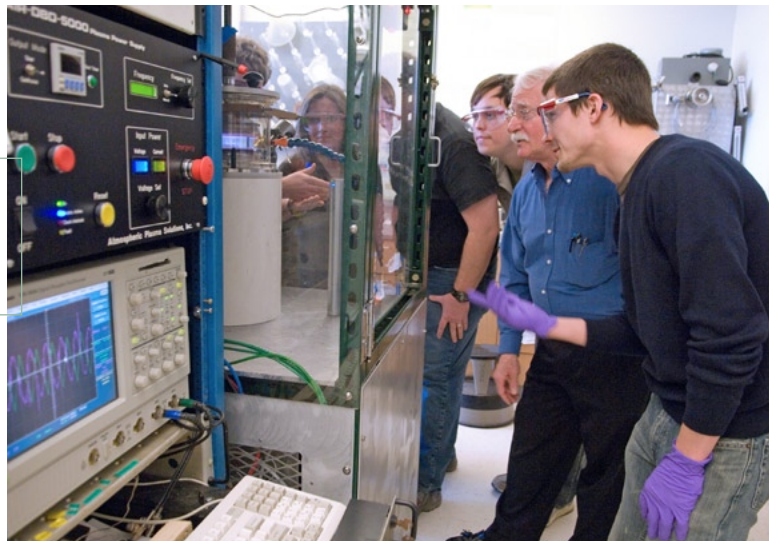
At NC State, student researchers within the Institute for Maintenance Science and Technology (IMST) have developed new, cost-effective techniques using atmospheric plasma processing to produce ethanol from wood and other biomass and to capture methane, a greenhouse gas, and convert it into methanol.

Six students tackling these renewable energy projects are W. Patrick Davis, doctoral student in materials science and engineering (MSE); Casey O. Holder, MSE junior; Matthew R. King, senior in geology; Christopher J. Oldham, MSE doctoral student; Steven Disseler, senior in physics; and Kristina N. Marshall, MSE senior. The students are directed in their effort by Dr. Jerome J. Cuomo, Distinguished Research Professor in the Department of Materials Science and Engineering and director of IMST, and Bob Roth, also in the Department of Materials Science and Engineering.

Both techniques rely on atmospheric plasma (AP) processing to produce ethanol and methanol. Plasma is a highly ionized gas that responds to electric and magnetic fields. Under the right conditions, it can produce chemical reactions capable of modifying the surface of materials. The AP process makes use of a unique power supply that is able to produce atmospheric plasma in air, allowing for continuous processing at lower power for greater process efficiency.

"The AP process cuts the cost of equipment," King said. "The process can be run continuously and scaled to meet any process requirements."

Oldham, King and Disseler led the project to convert biomass to ethanol using AP processing. Traditional techniques such as acid hydrolysis and enzymatic hydrolysis have been used to disrupt the biomass structure, but they can be harsh, inefficient and energy-intensive. Corn stover, wood chips, switchgrass and other forms of biomass treated as waste are renewable resources. Converting these forms of biomass to produce ethanol in a more efficient, cost-effective way would help alleviate competing demands on corn to supply ethanol, food and feed.



Observing a reaction in the atmospheric plasma chamber are (l to r) Kristina Marshall, Patrick Davis, Christopher Oldham, Jerome Cuomo and Matthew King. *(Photos: Becky Kirkland)*

The atmospheric plasma chamber is key to the more efficient, cost-effective process developed by the team.

"Our first trial was to put some wood into the AP chamber," Cuomo said. A few simple tests demonstrated ethanol production in the samples treated in the AP chamber.

With limited financial resources, the student researchers, on their own initiative, drew on the expertise of the university at large to help them conduct more rigorous research. Collaborating with the students are Dr. Jay J. Cheng, associate professor of biological and agricultural engineering; Dr. Simon E. Lappi, laboratory supervisor in the Department of Chemistry; Dr. Denis R. Cormier, associate professor of industrial and systems engineering; Dr. Mike Williams, professor of poultry science; Dr. Hasan Jameel, professor of wood and paper science; Kurt Creamer, engineering research associate in poultry science; Dr. H. Henry Lamb, associate professor of chemical and biomolecular engineering; and Dr. Lisa O. Dean, U.S. Department of Agriculture food technologist in the Department of Food Science.

These professors, along with their graduate students, provided training, equipment, analyses and even Southern Pine wood chips to the biomass research team as they worked to form and then refine their AP technique.

After 18 months of research, the team came up with a more efficient and cost-effective method of disrupting the biomass structure with AP. They call their technique "plasma-enhanced soft hydrolysis." The technique pairs a dilute acid hydrolysis pretreatment with AP and has shown greater than 50 percent improvement in the production of fermentable sugars. The students presented their findings at the American Vacuum Society 53rd Annual International Symposium in San Francisco in November 2006. NC State's Office of Technology Transfer (OTT) has filed a provisional application for patent for their technique and is pursuing a non-provisional application for patent and seeking partners interested in commercializing this technology.

In addition to the biomass project, the students are working on the conversion of hog waste into methanol. Davis, Marshall and Holder lead this project. In partnership with Orbit Energy Inc., IMST received a Phase I Small Business Technology Transfer (STTR) research grant from the U.S. Department of Energy. Orbit Energy, a local start-up company, provides technologies for converting organic waste into methane and carbon dioxide. The goal of the STTR project is to develop a means of capturing and converting these gases into higher value organics such as methanol.

"The key here," Oldham said, "is that, as a greenhouse gas, methane is 20 times more harmful to the atmosphere than carbon dioxide, and people don't really talk about that. We're taking that methane and making valuable alcohols and chemicals." ■

Undergrads in the Research Lab

There are 15 undergraduates working directly for Cuomo at IMST. "I rarely deny an undergrad who asks for work," he said. As a consequence, Cuomo's undergraduate students get opportunities usually available only to graduate students. King not only had an opportunity to participate in graduate-level research, he also wrote research proposals and helped prepare a provisional application for patent. He plans to continue his work with Cuomo as a graduate student.

Their work also makes these students attractive to potential employers. Marshall, who is graduating this year, has worked for Cuomo for two years. She's been involved in multiple projects and has received a number of job interviews. "I've applied for eight jobs, and I've heard from five within a week of applying to them." Another student, Holder, has a summer internship at Micron Technology, a semiconductor company in Boise, Idaho.

Meet the Dean

Dean Martin-Vega shares vision for the College of Engineering with alumni and friends across the country

Louis Martin-Vega

During the spring semester, the College of Engineering sponsored 11 Meet the Dean events across the country. The events were designed to share with alumni and friends the goals and aspirations we have for the college – a crucial first step toward reaffirming with alumni the high degree of pride and passion we all feel for the college.

The tour encouraged a valuable dialogue about how we can build a strong culture of alumni volunteerism and support and attract the resources that will help us realize the vision for NC State Engineering. We hope to continue the conversation and to facilitate further your connection to the college and your fellow alumni. Special thanks goes to those alumni who served as co-hosts for the events and helped make them a reality.

Throughout the Meet the Dean events, we asked alumni and friends to:

- ***Be an advocate for the engineering profession*** – Engineering is a foundation for a broad variety of exciting career paths, with the common goal of solving problems for society's benefit. The profession is crucial in the global, knowledge-based economy, particularly as many studies suggest that our nation faces a looming shortfall of engineers. For a flagship engineering program like NC State's,

NC State Engineering Foundation Board member Scot Wingo (MS CPE '92) and his wife, Kris, visited with Dean Martin-Vega at the final Meet the Dean event held in Raleigh on May 1, 2007. *(Photo: Becky Kirkland)*

it will be important to market the profession and its inherent excitement in order to attract the best and brightest students. To do that effectively, we need your help. After hearing your passion on this point, we are building a volunteer network to enhance our existing outreach efforts.

- ***Be an advocate for NC State's College of Engineering*** – Spread the word about NC State Engineering to key audiences such as legislators and fellow alumni. You can volunteer to lead your company's recruiting efforts at NC State, which is a source of high-achieving engineering talent. Participate in targeted efforts to recruit the best students to attend the College of Engineering at NC State. These are just a few of the examples of ways that you can most effectively advocate for your college.
- ***Invest in NC State's College of Engineering*** – We ask that alumni invest in the College of Engineering. Whether you are a young alum or further along in your career and capable of giving to the Dean's Circle, it is important to give every year. The rate of alumni giving has a direct impact on the rankings, and NC State currently lags behind our peers in that category. We also trail many of our peers in the size of our endowment. Gifts to the endowment make the biggest impact on our college's reputation and continued improvement. The state and university have made significant commitments to the college that provide us with an opportunity for advancement. The support of alumni and friends will leverage those commitments in ways that will sustain and enhance opportunities for students and faculty.

The response to these messages has been very positive and has greatly influenced our efforts to strengthen alumni relations. We hope to engage you through the COE website as we work for the future of the profession and for NC State Engineering. Please take the time to investigate the site, register and participate. Sign up for email news updates from the College. Share your news with us, and with your fellow alumni, through the Class Notes section. Learn how you can volunteer in ways that will benefit the profession, the College, its students or your own company. ■

Update your information: www.engr.ncsu.edu/foundation/forms/update.php

Volunteer: www.engr.ncsu.edu/ncef/forms/volunteer.php

Meet The Dean Hosts

November 30, 2006 - Raleigh, NC > Dr. & Mrs. Joseph Archie, Jr. '68 • Sepi & Farzia Asefnia '93 • Dr. & Mrs. Calvin Carter, Jr. '77 • Mr. & Mrs. Thomas Church, Jr. '64 • Mr. Wayne Clark (friend) • Mr. & Mrs. Joseph Colson, Jr. '68 • Mr. & Mrs. Michael Creed '73 • Mr. & Mrs. Justus Everette '76 • Mr. & Mrs. Glenn Futrell '63 • Mr. & Mrs. Ramey Kemp, Jr. '65 • Gayle & Dwain Lanier '82 • Dr. & Mrs. Charles Manning, Jr. '67 • Mr. & Mrs. James Williamson '86 • **January 11, 2007 - Wilmington, NC >** Mr. Ron Brown '74 • Mr. Paul Burton '61 • Mr. Ken Dull '85 • Mr. Jack Erdody '67 • Ms. Nicole Holmes '94 • **Jan. 18, 2007 - Winston-Salem, NC >** Mr. Marcus Crotts '53 • Mr. Richard Harrington '77 • Mr. Don Lamonds '78 • Mr. Ed Scott '65 • Mr. Tim Scronce '87 • Mr. Edwin Welch, Jr. '99 • Mr. Ron Morgan '78 • **Feb. 8, 2007 - Washington, DC >** Mr. Ray Sparrow '78 • Mr. Wayne Day '65 • Mr. Bill Dean '88 • Mr. Tom McPherson '76 • **February 21, 2007 - Houston, TX >** Mr. John Chambard '97 • Mr. Frank Culberson '60 • Mr. Ned Hill '90 • Mr. Clyde Moore '50 • Mr. Roger Owens '69 • Mr. Gilbert W. Smith '49 • Mr. Carl Stutts '68 • Mrs. Theresa Snyder '85 • **February 22, 2007 - Dallas, TX >** Mr. Greg Schwartz '87 • Mr. Frank Culberson '60 • **March 14, 2007 - San Jose, CA >** Mr. Christopher Crump '78 • Mr. Bobby Johnson '77 • Mr. William Parks '49 • Mr. Ken Watkins '71 • **April 5, 2007 - Greensboro, NC >** Mr. Quint Barefoot '85 • Mr. Willie Bullock '74 • Mr. Jimmy Clark '74 • Mr. E.O. Ferrell '66 • Mr. Rob Kennerly '76 • Mr. Phil Kennett '62 • Mr. Bob Mackey '72 • Mr. David Parker '68 • Mr. Bob Rhodes '60 • Mr. Norm Samet '59 • Mr. Tim Scronce '87 • Mr. Ken Stevens '72 • **April 12, 2007 - Atlanta, GA >** Mr. Jeff Buffo '86 • Mr. Bill Bullock '57 • Mr. Richard Little '65 • Mr. Roger Scovil '51 • **April 24, 2007 - Charlotte, NC >** Mr. Penn Cassels '60 • Mr. Kim L. Craven '77 • Mr. Otis Crowder '70 • Mr. Ed Ernst '75 • Mr. Jesse Fearrington '73 • Mr. Tom Forshaw '66 • Mr. Tim Holleman '71 • Dr. Charles R. Manning Jr. '78 • Mr. Ron Pendred '76 • Mr. Larry Petty '54 • Mr. Chris Rolfe '72 • Mr. Ron Sherrill '70 • Mr. J. Philip Sweet '76 • Mr. Bill Vernon '74 • Mr. Craig Wardlaw (friend) • Mr. & Mrs. H.G. Warren Jr. '84 • Mr. Ed Weisiger Jr. '82 • Mr. Mark Wyatt '80 • **May 1, 2007 - Raleigh, NC >** Mr. Scot Wingo '92 • Mr. Tim Clancy (friend) • Mr. Joe Doman '87 • Dr. Allen Eberhardt '72 • Mr. Donnie Goins '85 • Mr. Steven Kuekes '81 • Mrs. Suzanne Gordon '75 • Mr. Ralph Gordon '72 • Mr. Henry Liles '74 • Mr. Smedes York '63 • Mr. Jack McDonald (friend) • Mr. Robert Meares '74 • Dr. Francis P. O'Dell '75 • Mr. Dan Perry '77 • Mr. Stuart Phoenix '76 • Mr. John Simmons '65 • Mr. Ross Lampe Jr. '77 • Mr. Willy Stewart '81 • Mr. Tim Scronce '87 • Dr. Robert E. Troxler '83 • Mr. Ed Vick '56 • Mr. Ed White '78 • Mr. Chuck Wilson '65 • Mr. Marc Reese '84 • Mr. Bob Wright '68 •

Frank Mueller's super-computing cluster of eight Sony Playstation 3 units is capable of high-performance computing and running the latest computer games. *(Photo: Roger Winstead)*

NC State engineer creates first academic Playstation 3 computing cluster

Dr. Frank Mueller releases the power of the Playstation3 for science and education

The Sony Playstation 3, Xbox and Nintendo Wii have captivated a generation of computer gamers with bold graphics and rapid-fire animation. Who could have guessed that these high-tech toys could do more than play games? At NC State, Dr. Frank Mueller imagined using the power of the new Sony Playstation 3 (PS3) to create a high-powered computing environment for a fraction of the cost of the supercomputers on the market.

Mueller, an associate professor of computer science, has built a supercomputing cluster capable of both high-performance computing and running the latest in computer gaming. His cluster of eight Sony PS3 machines – the first such academic cluster in the world – packs the power of a small supercomputer, but at a total cost of about $5,000, it costs less than some desktop computers that have only a fraction of the computing power.

"Clusters are not new to the computing world," says Mueller. "Places like Google, the stock market, automotive design companies and scientists use clusters, but this is the first academic computing cluster built from Playstation 3s."

Mueller's PS3 cluster was realized after he spent a few hours one day in early January driving from store to store to purchase the eight machines. When he had collected all eight, he returned to his lab at NC State and set to work building a supercomputing cluster.

"Scientific computing is just number crunching, which the PS3s are very good at given the Cell processor and deploying them in a cluster," says Mueller. "Right now one limitation is the 256 megabyte RAM memory constraint, but it might be possible to retrofit more RAM. We just haven't cracked the case and explored that option yet." Another problem lies in limited speed for double-precision calculations required by scientific applications, but announcements for the next-generation Cell processor address this issue.

"In the computing world there is a list of the top 500 fastest computers," says Mueller. Currently the fastest is BlueGene/L, a supercomputer with over 130,000 processors at Lawrence Livermore National Laboratory. The PS3 cluster at NC State does not break into the top 500, but Mueller estimates that with approximately 10,000 PS3 machines anyone could create the fastest computer in the world – albeit limited by single-precision capabilities and networking constraints.

The Sony PS3 allows the Linux operating system to be installed, and IBM designed the programming environment for programming the Cell processor (including eight vectorization units), which combined tremendous computing power within a single PS3. According to Mueller, each PS3 unit contains six operational special-purpose cores for number crunching and one general-purpose core that is two-way multithreaded in its configuration, so the eight machines clustered have 64 logical processors, providing plenty of number-crunching ability.

"January 3 is the 'birthdate' of this cluster," says Mueller. "Of course, here at NC State we will use it for educational purposes and for research. We are working with scientists to determine the needs and how our cluster can be used to their benefit, and our computer science faculty is already using the cluster to teach classes in operating systems, with parallel systems, compilers and gaming likely to follow." ■

Next-generation computing linked to NC State Engineering

In the world of gaming and fast computers, integrated circuit designers create the magical chips that give game boxes the speed to produce lightning fast video stream and realistic action that challenge players. They also explore the next generation of computing, pushing to expand the capabilities of computers.

Producing a highly qualified workforce to feed high tech industry is important to the economy of the Research Triangle area and to North Carolina. The College of Engineering at NC State has produced more than 150 graduates in its innovative chip design program. These graduates make up a specialized work force that helps attract companies like Qualcom, nVidia, Rambus, IBM, RFMD and Analog Devices that offer excellent work environments and competitive salaries.

Designing chips for high-performance computing requires an expert knowledge of circuitry, a familiarity with the properties of silicon chips, a vivid imagination, a healthy dose of curiosity and professors with these same qualities. Dr. Paul Franzon, Distinguished Graduate Professor of Electrical and Computer Engineering, and his colleagues in the Department of Electrical and Computer Engineering fit the bill. The core faculty in the department include Dr. Kevin Gard, Dr. Rhett Davis, Dr. Xun Liu and Dr. Christal Gordon.

Graduates of the program, Lei Luo (PhDEE '05), Fredy Quan (MSEE '96) and John Wilson (PhDEE '03), work for Rambus, a leading technology licensing company specializing in the invention and design of high-speed chip interfaces. All three graduates cite Franzon as the one who most influenced them. His website offers tips on what courses to take and why master's and Ph.D. degrees are important in the chip design world.

"I followed his advice from his website for a year before I ever met [Dr. Franzon]," said Luo. "At the end of that year, I went to him and said 'you've been advising me for a year, and I want to be in your program.' And he looked at my work and accepted me."

Franzon continues to be involved in the work of his former students, giving presentations at most of the major chip design companies and at conferences and seminars. According to Quan, both Franzon and the graduates of the program are well-known in the industry.

"He is very influential in the chip design world," said Wilson. "That is one reason he is such a great teacher. He is as enthusiastic about chip design as his students are."

The North Carolina Solar Center advances renewable energy in NC and beyond

Steve Kalland heads the NC Solar Center, established in 1988 and operated by the College of Engineering. *(Photo: Roger Winstead)*

Center celebrates 20 years of leadership in renewable energy

In the 20 years since its founding, the North Carolina Solar Center has expanded to become the state's leading center for renewable energy, energy efficiency, alternative fuels technology and public policy. Able to draw on resources and expertise across the college and university, the NC Solar Center provides research, education, technical assistance and policy analysis to help make sustainable energy part of North Carolina's future.

"We are nationally recognized for our Database of State Incentives for Renewables in Efficiency – the DSIRE project [dsireusa.org]," said Stephen S. Kalland, executive director of the center. "We get over 100,000 unique visitors each month to that site. This database is used for all kinds of market analysis and research studies that look at which types of incentives work and which ones don't."

The center provides policy analysis and technical assistance to state officials and other agencies, including NC GreenPower, the NC Strategic Plan for Biofuels Leadership, the NC Biomass Council, the NC Strategic Plan for Biofuels Leadership and the NC Climate Change Commission's technical workshops.

"We are a place where many different disciplines of the university come together in a way that makes real-world applications possible," said Kalland. "Our intent is to design something that someone needs, make sure it is economically viable, figure out what kinds of regulations or policies are necessary to make it work and educate the public so that they are aware of opportunities to use it."

The NC Solar Center has also become a link that helps pull in industries from other countries. For example, the solar water and heating industry in Europe has been calling the center within the last year because North Carolina has good tax incentives, which were drafted by NC Solar Center staff. According to Kalland, these companies are interested in opening up a market in North Carolina. Since these companies need a certain skill set, the NC Solar Center is an excellent partner to help ensure there will be an educated workforce available.

The NC Solar Center educates beyond industry personnel by sponsoring K-12 programs that bring together stakeholders from around the state to discuss issues pertaining to these alternative energy resources.

"We cover a lot of ground," Kalland said. "We really haven't been just a solar center in a number of years. We're really a renewable energy center that focuses on the full gambit of energy efficiency, clean transportation, green building and renewable power." ■

Industrial Extension Service works toward 1B4NC goal

One year into the campaign, IES marks $250 million toward $1 billion goal

What kind of organization would take such a public risk and announce to the world that in five years (from 2006 through 2010) it will provide services to North Carolina businesses worth $1 billion? The Industrial Extension Service (IES) at NC State has done just that, and since the beginning of 2006, more than $250 million of value was placed on its services by a portion of the companies who received those services.

Large firms such as Tyco, Moen and Eaton, along with smaller companies such as Dixon Quick Coupling in Charlotte and IndusCo in Greensboro, have reported significant value of the IES services they received. The Manufacturing Extension Partnership, the federal program that supports NC State's IES, surveys clients after the completion of a project. The purpose is to gauge how much was created in productivity and efficiency, jobs saved or sales increased. In the past five years, MEP has recorded IES impact at a half billion dollars in services, prompting IES administrators to begin the 1B4NC campaign that aims to double the services provided in the state over the next five years.

IES is the state-wide arm of NC State University's College of Engineering that partners with business and industry to transfer knowledge and technology that lowers costs, improves quality and shortens lead times, through assistance with programs such as quality management systems; Six Sigma; lean; energy assessments; and environmental, health and safety expertise.

Companies that report an economic impact of $1 million or greater are recognized with an award. A recent recipient, Southern Vinyl Manufacturing, LLC, in Kinston, reported an economic value of at least $2.4 million on a lean project it began with help of IES. Company owners Dean Ervin and Rod Matthews spoke of the tangible benefits of waste reduction, quality improvements and shorter delivery time. Since the inception of lean manufacturing, the company has tripled employment and has vowed to never lay off an employee due to a leaner environment.

For more information on the 1B4NC initiative, visit **www.ies.ncsu.edu/1B4NC/**, or to find an IES representative in your area, call 1.800.227.0264. ■

FACULTY
spotlight

Antón testifies at congressional hearing on SSN privacy

Annie Antón

Dr. Annie Antón, associate professor of computer science, served as an expert witness at a Congressional Hearing on protecting the privacy of social security numbers (SSNs) from identity theft. The hearing was held by the House Committee on Ways and Means Subcommittee on Social Security in June.

Antón testified on behalf of the US Public Policy Committee of the Association for Computing Machinery. Her testimony included information that the theft of social security numbers has become the primary tool for stealing an individual's identity, enabling criminals to unlock access to credit, banking accounts and other services. She urged Congress to strengthen the privacy of SSNs to prevent fraud.

An advisor to the Department of Homeland Security's Data Privacy and Integrity Advisory Committee, Antón proposed that Congress adopt policies that combine business procedures and information technology to help protect SSNs and reduce the nation's reliance on SSNs for identification.

Nationally recognized for her work on privacy and legal compliance in software-based information systems, homeland security and analyses of recent security breaches, Antón is the founder and director of ThePrivacyPlace.org.

Carbonell receives prestigious Holladay Medal

Ruben Carbonell

Dr. Ruben G. Carbonell, Frank Hawkins Kenan Distinguished Professor of Chemical and Biomolecular Engineering, was among four NC State faculty members to receive the Alexander Quarles Holladay Medal for Excellence. The Holladay Medal is the highest honor bestowed on a faculty member by the university and the NC State University Board of Trustees.

Carbonell's research has resulted in more than 190 publications, 22 patents and more than $22 million in research funding. He has advised more than 70 master's and doctoral students and 33 postdoctoral students and visiting faculty. His recent work in bioseparations led to the identification of a specific ligand for the prion protein responsible for mad cow disease in humans. This ligand is being used to remove prion protein from blood products.

A paper describing the research was published in the December 23/30 version of *The Lancet*. The filter device developed from this research will be manufactured under the trade name P-Captt® Filter by MacoPharma. The device has received CE Mark regulatory approval in Europe.

Martin-Vega named National Hispanic Scientist of the Year

Louis Martin-Vega

Dr. Louis A. Martin-Vega, dean of engineering at NC State, has been named the Museum of Science & Industry's (MOSI) 2007 National Hispanic Scientist of the Year. The award will be presented in Tampa, Fla., on October 6, 2007.

Of Puerto-Rican descent, Martin-Vega has held several prestigious national positions including being the first Hispanic to serve as acting head of the Engineering Directorate at the National Science Foundation (NSF) and director of NSF's Division of Design, Manufacture and Industrial Innovation.

A fellow of the Institute of Industrial Engineers (IIE), he is currently serving as president of IIE. Among his numerous awards and honors, Martin-Vega received the Albert Holtzman Distinguished Educator Award from the Institute of Industrial Engineers in 1999 and the Hispanic Engineer National Achievement Award (HENAC) in the college education category in 2000. Martin-Vega is a fellow of the Society of Manufacturing Engineers; a member of the Pan American Academy of Engineering and the National Engineering Deans Council, as well as several other engineering societies and organizations.

For more information, visit **www.engr.ncsu.edu/news/news_articles/M-V.html**.

Davis receives NSF Career Award

Rhett Davis

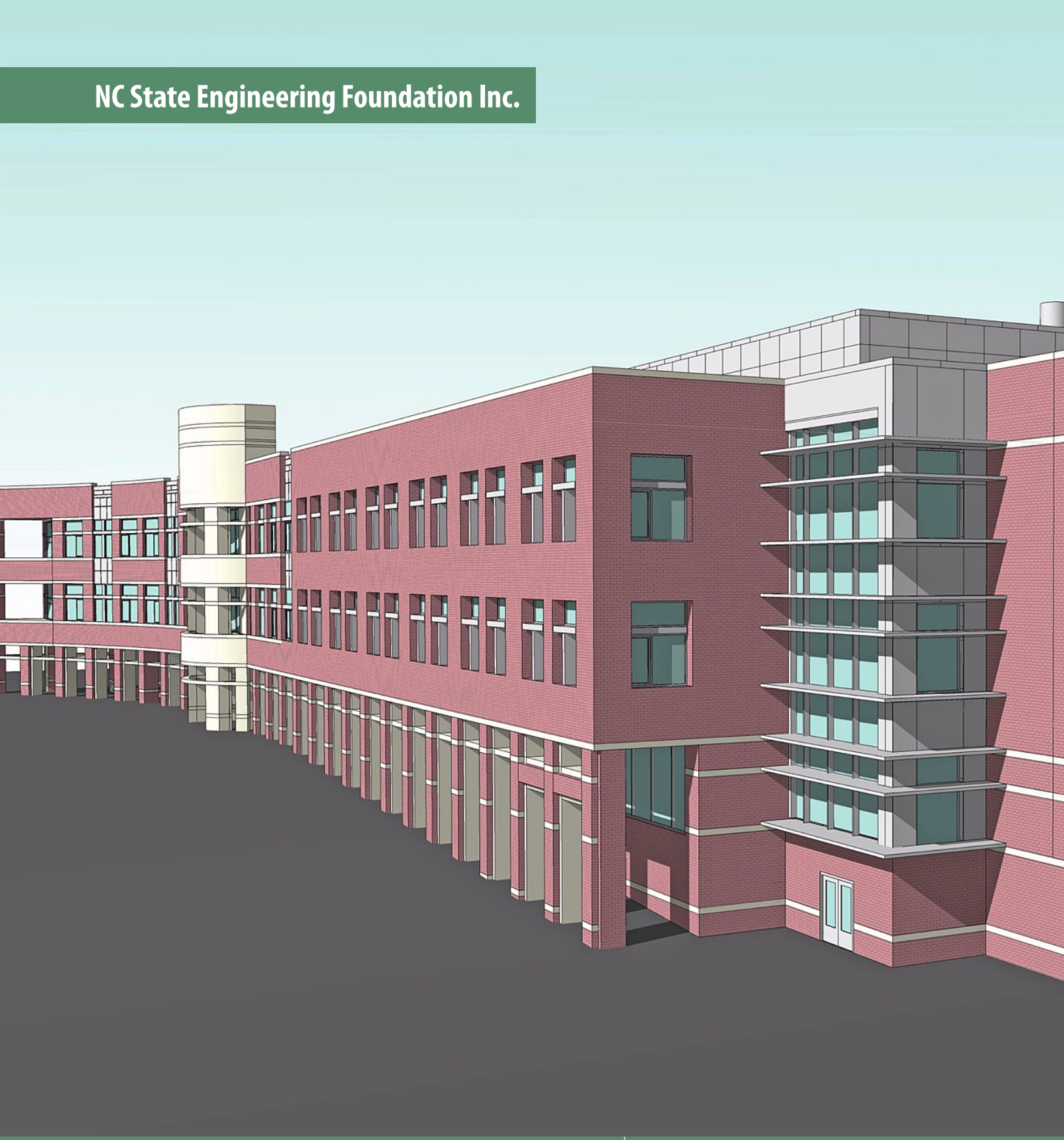
Dr. W. Rhett Davis, assistant professor of electrical engineering, has received a Faculty Early Career Development (Career) Award from the National Science Foundation (NSF). The award is one of the highest honors given by NSF to young university faculty in science and engineering.

The NSF will provide $409,643 in funding over a five-year period to support Davis' research project entitled, "Career: Design Methodologies for Three-Dimensional Integrated Circuits." The project involves the stacking of chips vertically, often referred to as three-dimensional integrated circuits (3D ICs), which promises to alleviate the high cost of manufacturing equipment by reusing existing equipment. The goal is to discover and document design techniques that will improve the speed of 3D ICs.

Davis also plans to develop a free design kit for the latest integrated circuit technology, partner with a local community center and national education foundation to promote interest in low-cost electronics among disadvantaged children and develop a nationally distributed workshop curriculum to build a wireless-controlled robot and crystal radios.

Davis received his Ph.D. in electrical engineering from the University of California at Berkley in 2002 and joined the College of Engineering faculty that same year.

NC State Engineering Foundation Inc.



Engineering Building III

From the executive director

Ben Hughes

Dear Alumni and Friends,

The arrival of Dean Louis Martin-Vega, with his high energy and enthusiasm for the College, has sparked a new initiative to meet, engage and reconnect in meaningful ways with many of our loyal alumni and friends of the College.

Throughout the spring, we organized and conducted Meet the Dean events in various locations across the state and nation. Our alumni, including many first-time volunteers, served as the events' sponsors and hosts. Crowds responded very favorably to the Dean's vision of advancing our College into the top tier of public engineering colleges in the nation. "What can we do for the College?" was a common question following the Dean's always energetic and compelling presentation. An important part of his message was that to achieve its goals the College needs to build the strongest possible culture of alumni volunteerism and support. (For more on the events, see page 12.) In fact, the percentage of our alumni who give to the College is a key metric used to determine national rankings. Said another way, by giving to the College you can directly influence the value of your own degree.

Another important way our alumni have worked on behalf of the College has been the strategic interaction they had with their legislators in seeking a major new appropriation that would significantly increase the growth of the College of Engineering. Throughout the spring and early summer of 2007, NC State Engineering alumni made important personal contacts with legislators to make the case that an enhanced College of Engineering would greatly benefit the economic development of our state. In late July, the North Carolina General Assembly approved funding to increase new faculty hires and to expand the size of the planned Engineering Building III.

These appropriations will be vital to fulfilling the Dean's bold vision for us to become one of the top ranked public colleges of engineering in the nation. Translating your personal loyalty, pride and commitment as NC State engineers into giving of your time and resources to the College can provide a crucial advantage as we compete with peer institutions that also aspire to build faculty and facilities. Your time and financial investments in the College are more important than ever before as we seek to optimize these unprecedented funding commitments made by the state and the University.

Thank you very much for all of your generous contributions to the College over the past fiscal year. As we enter into the final year of the *Achieve!* Campaign, we hope that more of our loyal alumni will give at higher levels, providing the unrestricted funding that will play such a crucial role in realizing our shared vision for the College.

– Ben Hughes
Executive Director, Development and College Relations

Volunteers

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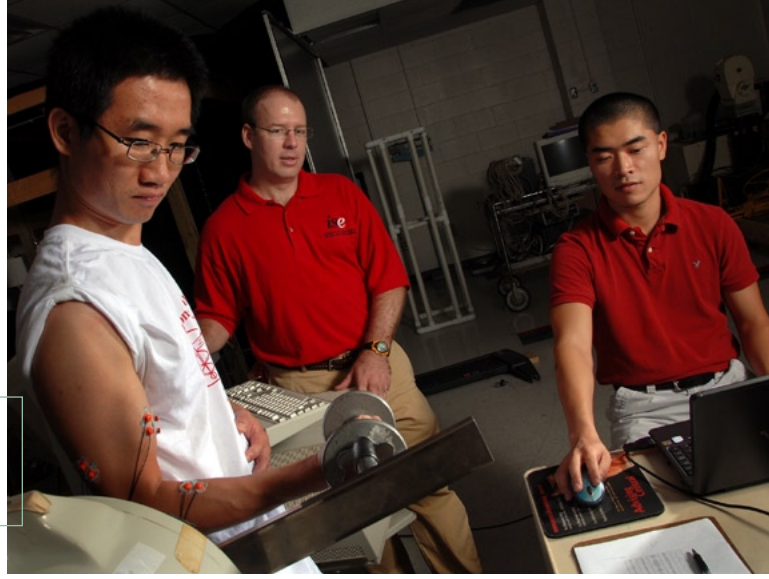
The College of Engineering and the NC State Engineering Foundation Inc. gratefully acknowledge the generosity of our alumni and friends. Your loyal support is vital to the college and makes a tremendous impact on all facets of university life.

The list of donors for 2006-07 can be viewed online at www.engr.ncsu.edu/foundation/donors/.

FOUNDATION
spotlight



Faculty and students conduct ergonomics research on simulated work activities to prevent occupational injuries. *(Photo: Roger Winstead)*

Duke Energy invests in safety and ergonomics research in the College of Engineering

The College of Engineering at NC State has received $100,000 from Duke Energy to support research in safety and ergonomics within the college. The gift extends Duke Energy's support of research in this area, bringing the total gift to $250,000 this year.

The Duke Energy Safety and Ergonomics Research Endowment Fund supports basic and applied research in safety and ergonomics through the Edward P. Fitts Department of Industrial and Systems Engineering (ISE) and encourages consultation among faculty, students and company officials to understand the unique challenges faced by workers in the electric power industry.

"Our top priority at Duke Energy is to safely and efficiently deliver electricity to our customers," said Ellen Ruff, president of Duke Energy's operations in the Carolinas. "Our safety equation includes finding new ways to reduce our employees' exposure to the risks they face in delivering electricity," added Ruff. "We're looking forward to the benefits of the College of Engineering's research in further ensuring our workers stay healthy and safe."

"The College of Engineering is honored to receive continued support for research programs from Duke Energy," said Dr. Louis Martin-Vega, dean of the college. "Working closely with industry is important for our faculty and students and helps build relationships that benefit the university, the industry and, ultimately, the people of North Carolina."

The Ergonomics Laboratory focuses on research in the areas of occupational ergonomics, occupational safety and human factors engineering and prepares students to become the research scientists and safety and ergonomics practitioners of tomorrow.

"This endowment from Duke Energy will provide support for students and faculty conducting applied research through our laboratory on new ergonomics initiatives in the power industry, as well as development of advanced ergonomics training programs by our Ergonomics Center," said Dr. David Kaber, associate professor of industrial and systems engineering. "We are excited about the opportunity to work with Duke Energy through the endowment to enhance student research experiences and to advance safety in power delivery."

The Duke Energy Safety and Ergonomics Research Endowment Fund will be administered by the NC State Engineering Foundation Inc. ■

Foundation, Council partner for Engineers' Week

The College of Engineering at NC State held annual Engineers' Week (E-Week) activities March 12-16 at various locations both on and off campus. National Engineers' Week was founded in 1951 as a way to unite engineers, engineering students and teachers across the US in a celebration of the engineering profession and its many accomplishments.

NC State events for E-Week included workshops led by alumni and corporate friends. Other activities included a blood drive, hot dog eating contest, egg drop contest and leadership lunch for engineering student organization officers.

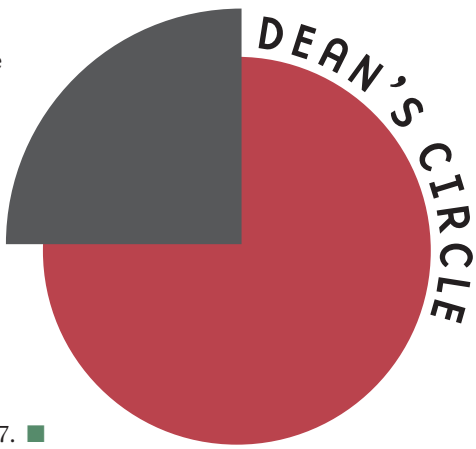
The E -Week sponsorships were provided by Nucor Steel, Philip Morris USA and Progress Energy.

"I believe that E-Week turned out to be a great success," said Casey Fields, 2006-07 Engineers' Council president. "The Engineers' Council set high standards for this event and, with the help of the Engineering Foundation and our engineering organizations, we had a successful event."

The Engineers' Council has already started working on next year's E-Week, with the date corresponding with National Engineers' Week, February 18-22, 2008. ■

Dean's Circle donors increase

The number of Dean's Circle donors increased from 108 to 112 during the past fiscal year. The Dean's Circle is an essential component of the College of Engineering's recruitment strategy. As the college continues to grow its endowments to ensure its long-term strength, the Dean's Circle provides flexibility in using funds that meet the needs of students today. For example, Dean's Circle dollars might be used to provide a scholarship for an incoming freshman or to supplement a scholarship package for a top student. These scholarship resources allow the college to offer competitive financial aid packages that help highly qualified students attend NC State.



To support the Dean's Circle, contact Dave Mainella at 919.515.9957. ■

Ed and Kathy White increase their support for the College of Engineering

Alumnus Ed White (EO '78) and his wife Kathy have made a commitment to add $750,000 to supplement a previous pledge.

"I made this last round of funding to the Charitable Remainder UniTrust because the benefits and rationale used for the initial funding are still here today. This includes sound financial planning using pre-tax dollars to enhance diversity of investments, generate recurring revenue and to strengthen my financial commitment to NC State's College of Engineering," said White.

White is the Chairman of the Board and CEO of Field2Base, a Morrisville-based company that provides software products designed specifically for use on Tablet PCs. They leverage wireless communications, digital photography and the Tablet PC to provide an overall mobile workforce solution for field professionals.

Mitcheltree Scholarship endowment established at NC State

James and Myra Mitcheltree of Simpsonville, S.C., have established a scholarship endowment in the College of Engineering at NC State in memory of their late son, Robert A. Mitcheltree, who died in a car accident on January 6, 2006, at the age of 44. The $50,000 gift will support the Robert A. Mitcheltree Scholarship Fund, which will provide scholarships for undergraduate students enrolled in the Department of Mechanical and Aerospace Engineering at NC State.

Robert Mitcheltree received his bachelor's, master's and doctoral degrees in aerospace engineering from NC State in 1984, 1986 and 1989, respectively. After receiving his Ph.D., Mitcheltree went to work for the NASA Langley Research Center in Hampton, Va., and later moved to California in 2001 to join the Jet Propulsion Laboratory. He played a key role in the design and development of the Mars Pathfinder, Mars Microprobe, Stardust, Mars Exploration Rover and Mars Sample Return projects. One of his most significant achievements was his development of the Mars Sample Return Entry Vehicle. As chief engineer of the sample return capsule, he patented a novel chuteless entry system.

To support this scholarship, contact Dave Mainella at 919.515.9957.

The scholarship will be administered by the NC State Engineering Foundation Inc.

Alumnus Kenneth D. Franklin establishes engineering endowment

Alumnus Kenneth D. Franklin (IE '71) of Cumming, Ga., has endowed a gift of $50,000 to the College of Engineering at NC State. Franklin's gift will establish the Kenneth D. and Wanda B. Franklin Scholarship Endowment.

The endowment will provide annual awards to the winners of the Alpha Pi Mu/Kenneth D. Franklin Outstanding Sophomore Award (formerly known as the Alpha Pi Mu Outstanding Sophomore Award) in the Edward P. Fitts Department of Industrial and Systems Engineering, as well as provide future scholarships for undergraduate students enrolled in the department.

Franklin was the first recipient of the Alpha Pi Mu Outstanding Sophomore Award in 1969.

The endowment will be administered by the NC State Engineering Foundation Inc.

About the Engineering Foundation

The NC State Engineering Foundation Inc. (NCSEF) was organized in 1944 by area industrial and business leaders. The purpose of the foundation was to form a tax-exempt, nonprofit organization to promote and receive monies to support the College of Engineering at North Carolina State University. The NCSEF is governed by a 32-member Board of Directors, which oversees more than $53 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.

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

Your gift to the College of Engineering at North Carolina State University can support a variety of funds, programs and academic endeavors. These many opportunities to give can be tailored to your needs and interests. 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. The College of Engineering appreciates your interest in its giving programs. If you would like more information, you can visit our website at **www.engr.ncsu.edu/foundation** or you can contact us:

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The catalytic convergence

Ten years from now – when the students, faculty and staff of NC State's College of Engineering consider their college's remarkable ascent – this will be considered the moment in time when the college soared to seize its fullest potential. The propellers are these:

- The new dean, Dr. Louis Martin-Vega, arrived in the summer of 2006. Martin-Vega brings to the college an infectious enthusiasm for engineering, a deep appreciation of the college's rich history and a sharp vision for the limitless future of this place and its people.
- The continuing escalation in the talents and abilities possessed by students and faculty, two groups that inspire one another to achieve greatness in the realms of scholarship, research, outreach and innovation.
- The tipping point is the college's transition to Centennial Campus, a national model for seeding technological innovation through the convergence of university research, industry and government all within state-of-the-art facilities. Perhaps no other university setting nationwide so effectively encourages basic research to achieve real-world application.

To take fullest advantage of this moment and achieve our ambitious goals, additional support to build the college's endowment will be required from its stakeholders – the College of Engineering at NC State currently lags behind many of its peers in total endowment. In higher education, nothing is more important to the future than endowments, the building blocks for both institutional stability and innovation.

This is as true for public colleges as for private. Taxpayer funding now accounts for only 41 percent of the university's expenditures. Endowment provides flexibility where state funding falls short and allows the college to take advantage of emerging opportunities.

We invite you to become a catalyst for the college and participate in our shared, unlimited future.

Driverless "Lone Wolf" makes the cut, competes in DARPA event

NC State-sponsored Insight Racing Team's Lotus Elise, dubbed "Lone Wolf," is one of only 36 participants, and the only team from the Carolinas, invited to participate in the Defense Advanced Research Projects Agency (DARPA) Urban Challenge National Qualification Event in October. For more information on "Lone Wolf" and the DARPA Urban Challenge, visit www.engr.ncsu.edu/news/news_articles/darpa-top30.html.

Visit the College of Engineering at North Carolina State University on the Web:

www.engr.ncsu.edu

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