ARKANSAS INGENUITY

FROM THE COLLEGE OF ENGINEERING AT THE UNIVERSITY OF ARKANSAS • SPRING 2007

Focus on Sustainability

UNIVERSITY of ARKANSAS 1871

IMAGINATION • INNOVATION • INSPIRATION

Ashok Saxena
Dean of Engineering
Distinguished Professor
of Materials Science
College of Engineering

According to Wikipedia, "Sustainability is an attempt to provide the best outcomes for human and natural environments both now and into indefinite future." We can all agree about the positive outcomes of technology in improving human conditions and lately in providing technical solutions for preserving the natural environment.

In the same breath, we can argue that the global consumption of technological products raises concerns about the world's future and sustainability. Technological advancements and advantages make it hard to imagine a world without adequate electric power to run our air conditioners and heaters, automobiles, computers, and microwave ovens; especially, with promises flying about alternative energy solutions such as biofuels, solar and wind energy and even abundant nuclear power.

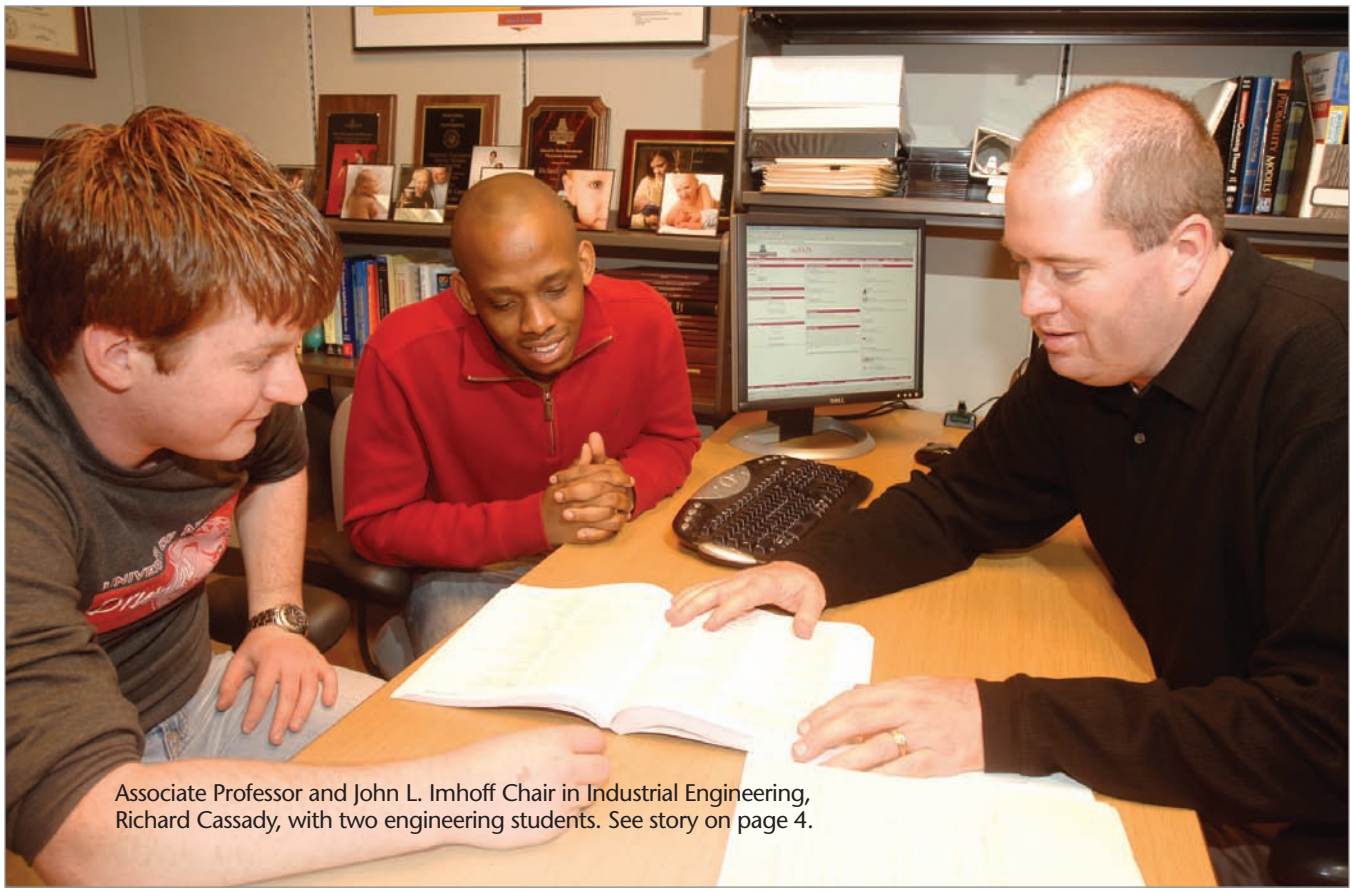
In some ways, achieving sustainability is a classical engineering challenge. Engineers are trained to work in environments with multiple constraints, requiring compromises in order to efficiently meet challenges. In the past, only a small fraction of the world's population was consuming seemingly unlimited global resources. As population has increased and the economic prosperity has spread into the more populous areas, there is higher demand for products and performance, and sustainability of all natural resources can no longer be ignored.

Worldwide, the carbon emission crossed the 7 billion ton mark in 2004. In just five countries (USA, Japan, Germany, China and India), the total oil consumption rose to about 38 million barrels per day and coal consumption in terms of emitting pollutants in the air rose to the equivalent of 1.9 billion barrels of oil per day in 2004, according to the World Watch Institute. The rates of growth are even more alarming in the developing countries where carbon emissions have almost doubled in 15 years. Definitive data now exists linking carbon emissions to a variety of climate changes in which the extreme weather patterns are becoming more frequent and intense.

At the College of Engineering, sustainability is being addressed through graduate and undergraduate research, and in undergraduate design courses. The research ranges from improving efficiency of solar cells, to organic semiconductors to developing conversion technologies for environmentally conscious and renewable biofuels using agricultural products to environmental remediation of soil and ground water. Researchers are pursuing a less expensive, longer lasting battery design based on nanotechnology. Such products will undoubtedly contribute to the overall sustainability goal. The use of high temperature materials to improve energy conversion efficiency of gas turbines and coal-fired power plants where these incremental improvements have potentially a huge impact on carbon emissions is also being explored.

The National Academy of Engineering has said, "Engineering practices must incorporate attention to sustainable technology, and engineers need to be educated to consider issues of sustainability in all aspects of design and manufacturing."

Here at the University of Arkansas College of Engineering we are doing exactly that.



Associate Professor and John L. Imhoff Chair in Industrial Engineering, Richard Cassady, with two engineering students. See story on page 4.

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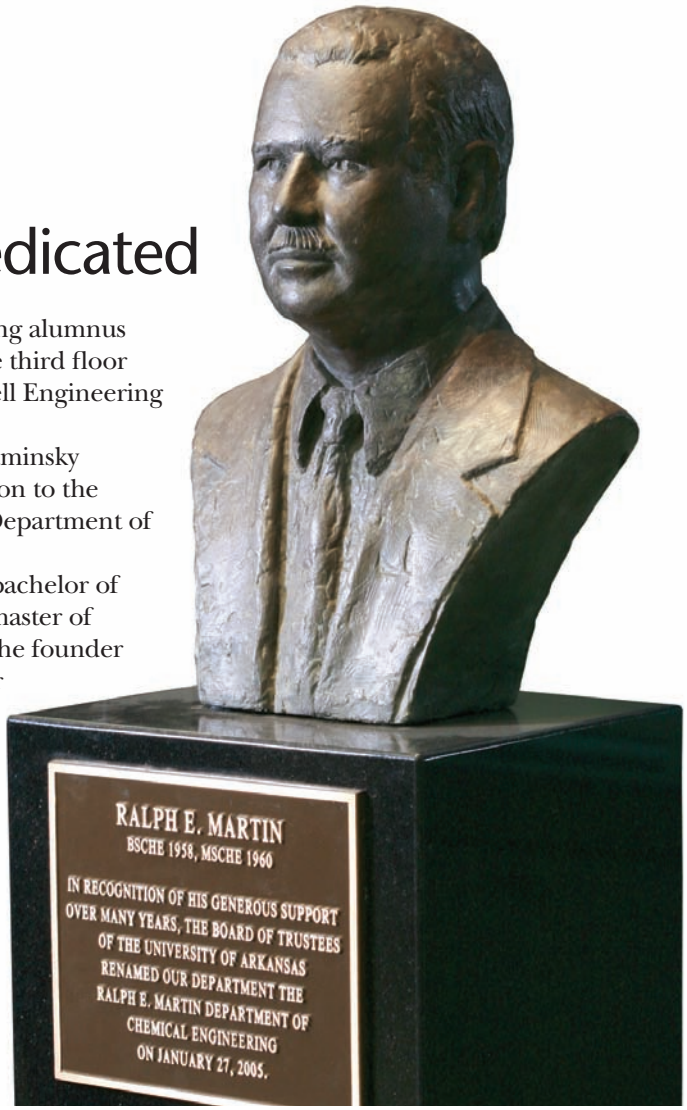
Ralph E. Martin bust dedicated



A bust of University of Arkansas College of Engineering alumnus and benefactor Ralph E. Martin has been erected in the third floor foyer of the Department of Chemical Engineering at Bell Engineering Center.

The bust was created by Fayetteville sculptor Hank Kaminsky in honor of Martin, who in 2005, made a gift of $5 million to the College of Engineering to endow the Ralph E. Martin Department of Chemical Engineering.

Martin, a native of Eureka Springs, graduated with a bachelor of science degree in chemical engineering in 1958 and a master of science degree in chemical engineering in 1960. He is the founder of PetroFac Inc., of Tyler, Texas, a single-source supplier for the hydrocarbon-processing industry that grew into an international corporation. Currently retired, Martin holds patents for the treatment of emulsions, the desalinization of brackish waters and the desalinization of crude oil. Martin also founded Eagles Bluff, a country club and residential community on Lake Palestine in Bullard, Texas.

Martin is a member of the College of Engineering Hall of Fame and has provided leadership as a member of the College of Engineering Advisory Council and the College of Engineering Campaign for the Twenty-First Century Committee.

Researchers develop performance metrics for RFID Gen-2 protocol

Engineering researchers at the University of Arkansas have developed a novel mathematical model that describes how radio-frequency-identification readers capture tag data on a single inquiry.

Kazem Sohraby, professor of electrical engineering, and Chonggang Wang, post-doctoral fellow in the department of electrical engineering also developed two critical performance metrics to measure capacity of a single RFID reader environment.

"As far as we know, this is the first quantitative analysis of the performance of the Gen-2 protocol," Sohraby said.

Radio frequency identification, also referred to as RFID, is a wireless technology that uses radio communication to identify objects with a unique electrical identity. Like bar codes, RFID is used to identify items. Unlike bar codes, which must be brought close to the scanner for reading, RFID tags are read when they are within the proximity of a transmitted radio signal. The technology has applications for business and industry, including retailers, suppliers and transportation providers.

EPCglobal Inc., the organization that sets international RFID standards, recently ratified a new technical protocol, referred to as Gen-2, for RFID passive tags. The new protocol provides advanced features to improve performance and security. Major corporations, including Wal-Mart Stores Inc., have converted to the Gen-2 protocol.

The researchers' mathematical model – known as Discrete-Time Markov Chain – helped them discover that the algorithms used to facilitate communication between the individual reader and tags can achieve a reading rate that is very close to the highest possible rate of successful tag identification for a single inquiry. Wang developed two critical performance metrics – Successful Tag Identification Rate and Tag Identification Speed – to measure RFID system capacity for a single inquiry.

Sohraby described the Discrete-Time Markov Chain model as a breakthrough in RFID quantitative analysis and predicted that the two performance metrics will become industry standards for measuring RFID system capacity and reliability.

UA and Fayetteville to host Solar Splash 2007

The University of Arkansas solar boat team will defend its world title this summer as Lake Fayetteville plays host to Solar Splash June 13-17, 2007.

The Arkansas team took the title of world champion last year, as the university and city hosted the worldwide competition for the first time in its 13-year history. Organizers of the event liked the venue so much they have agreed to hold the competition in Northwest Arkansas for the next five years.

UA mechanical and electrical engineering students are busy working together to prepare Arkansas' boat for competition this year, as teams from around the country and beyond get ready to bring their boats to Fayetteville.

Solar Splash 2006

Fifteen teams from the United States, Canada and Puerto Rico competed in last year's events. This year more teams are expected to be a part of the competition.

Each boat will be required to operate on a combination of natural and stored solar power.

During the five-day event, teams will participate in five on-the-water competitive events. On-site competitions will also include visual displays and workmanship. On-the-water competitions include qualifying the boat in both the low speed and high speed configurations, a 300 meter sprint double elimination event, and a 4 hour endurance event. The Solar Slalom, another part of the on-the-water competition, involves a combination of speed and maneuverability.

Engineering Advisory Council selects new members

The following individuals have been elected to serve on the Engineering Advisory Council for the University of Arkansas' College Of Engineering:

Mr. Prakash R. Jalihal

Originally from India, Jalihal completed his M.S. degree in industrial engineering at the University of Arkansas in 1971 and joined Walter Smiley's company, Systematics. He has remained with the company through its sale to Fidelity National Financial in 2003, when it was renamed Fidelity Information Services (FIS). In March 2006, FIS merged with another information services firm, Centergy, which is listed on the New York Stock Exchange under ticker symbol FIS. Clients include Citigroup, JPMorganChase, and other major financial houses. The FIS website claims the company's software processes 50 percent of U.S. residential mortgages, and its 2004 annual report showed the company had over $1 billion in revenues that year. Jalihal is currently the senior vice president at FIS. He was named to the Arkansas Business Journal's 2006 "Arkansas Power List."

Mr. Jack A. Giles

Originally from Texarkana, Giles worked for Texas Instruments for almost 20 years before joining Ron Ragland to start REMEC. Remec Defense and Space, which manufactures aeronautical search and navigation equipment, was spun off from its parent company in 2005. It was initially an operating group of REMEC, which produces specialized equipment for wireless networks. In 2005, Cobham Defense Electronic Systems Corporation (operating in the United States under the name of its American subsidiary, Chelton Microwave Corp) acquired REMEC Defense and Space.

Giles earned his bachelors in mechanical engineering at the UA in 1965. He is a member of the Arkansas Academy of Mechanical Engineers and Arkansas Alumni Association's "Alumni Hall Wall of Fame" and is a donor for Alumni Hall and Old Main Tile.

A Freshman Approach

Stronger starts, higher retention are goals of new initiatives

New freshman center is part of program to boost retention and graduation rates

Engineering school is no walk in the park. Just ask some of the 45 percent of all first-time freshman engineering students at the UA who don't return to engineering for their sophomore year.

To improve the freshman retention rate, the College of Engineering will launch a new Freshman Engineering Program this fall aimed at providing comprehensive support. It will be housed in a new Freshman Engineering Center in Engineering Hall, said Richard Cassady, director of the program.

"With the quality of students we have coming in, our retention rates should be higher," said Cassady, who holds the John L. Imhoff Endowed Chair in Industrial Engineering.

"We believe the new freshman program can make a significant difference."

Freshmen face a number of challenges in engineering school, including the demanding course work, rigorous class schedules, and the same responsibilities of living on their own that confront all college freshmen. Engineering freshmen are typically students who were at or near the top of their classes in high school – accustomed to success. Many become discouraged when they discover that making top grades as engineering students isn't so easy.

"It's a big jump from high school," said Erin Fritsche, a December graduate of the college's undergraduate industrial engineering program. "I have seen a lot of my classmates give up on it and switch to other majors."

Three hundred to 400 freshmen enter the college each year. About 40 percent of them go on to graduate with an engineering degree within six years, said Ashok Saxena, dean of the College of Engineering. This graduation rate is comparable to the national average in engineering, but Saxena isn't satisfied and thinks the college can do much better.

"If we can help them through that freshman year, then we feel like our overall graduation rate will improve substantially," Saxena said. He said the new freshman program is a "bold" approach.

A place to call home

Work starts this summer to renovate 5,500 square feet of the third floor of Engineering Hall into the Freshman Engineering Center. The $300,000 construction project should be complete by the time fall classes start in mid-August.

The center will consist of a reception area, a computer lab, study lounge, group study rooms, and an area to be used for a peer mentoring program. The idea is to create a place where freshmen feel support and a sense of belonging – a space that is comfortable and roomy.

"We want it to be a home away from home," Cassady said. "So, by creating a common space where the freshmen can gather together, hopefully they'll be able to adjust to their academic life and encourage each other."

Fritsche and three other classmates, Luke Shelton, A.J.

Snyder and Kyle Kimpel, designed the freshman center as a senior project.

"We had some limitations because it is an 80–year-old building, and so we couldn't do certain things with the historic sections," Fritsche said. "But we were pretty pleased with how we were able to open up some space and make it feel less confined."

The college will hire two new staff members to manage the center, provide help with orientation, academic advising and help in general ways with the adjustments most freshmen have in college, Cassady said.

"But we want to especially focus on those students in the middle and provide them with the help and resources to ensure their success."

A program of support

Freshmen will take two newly created Introduction to Engineering courses that cover a variety of engineering fields, career opportunities and some basic study skills, Cassady said.

"What we're really going to do is teach them how to be engineering students so they won't fall through the cracks," Cassady said. "It's all about being proactive in providing them with the right kind of support, giving them just a little more attention."

Freshmen will be placed in groups of 20 to 25 students of similar academic levels, and those peer groups will have coordinated class schedules to give them a sense of community and facilitate bonding. They will also meet with student mentors on a weekly basis.

Cassady said the program is not always needed by every freshman – some students will succeed regardless of circumstances, while others, unfortunately, will fail even with the new program.

"But we want to especially focus on those students in the middle and provide them with the help and resources to ensure their success," he said.

Student retention is a common concern at engineering schools nationwide, Cassady said. A committee of more than a dozen faculty representatives from departments throughout the College of Engineering and the Fulbright College of Arts and Sciences started studying the problem in the fall of 2005. It looked at freshman programs at Texas A&M University, Arizona State University and the University of Pittsburgh.

Saxena said he hopes to see improvements in freshman retention rates as early as fall 2008. The goal is to increase freshman retention from 55 percent to 75 percent and increase the six-year graduation rate to 50 percent.

"My hope is that in the long run we will do even better," Saxena said.

Engineering Alumni Ambassadors: Spreading the Word about Engineering

University of Arkansas College of Engineering alumni are stepping up to help Arkansas attract "the best and the brightest" engineering students of tomorrow by volunteering their time and experience on behalf of the engineering recruitment program.

The Engineering Alumni Ambassadors corps is a nationwide group of committed engineering graduates who volunteer to speak at college fairs and high schools in their vicinity to introduce students to the benefits of an engineering education. In most cases, this involves explaining what sort of work different kinds of engineers do, what opportunities are open to engineering graduates and what steps students can take to ensure they prepare themselves for the rigors of a college engineering experience. During the admissions season of December to March, engineering ambassadors also may volunteer to act as "closers" who spend time interviewing prospective students and helping the College of Engineering attract a greater number of well qualified students to the UA engineering program.

Alumni involvement is a key component to combating waning student interest in engineering and science subjects – a nationwide trend that threatens American competitiveness in the global economy. The University of Arkansas College of Engineering has set ambitious recruitment goals, hoping to reach 1,800 undergraduate engineering students enrolled by 2010, and approximately 700 graduate students enrolled in engineering MS and PhD programs by that date. Achieving these goals will require the support of our many alumni volunteers in addition to the college's dedicated recruiting program.

"Many high school students today just aren't well informed about what engineers do," said Bryan Hill, associate director of recruitment, retention and diversity for the College of Engineering. "It makes a world of difference to have someone from their neighborhood – or even their hometown – come and talk to them about why engineering is such a smart choice to study."

Also key is the enthusiasm UA graduates have for talking about the benefits of studying engineering in Fayetteville. "Our graduates are definitely our best advertising," said Carol Gattis, director of recruitment, retention and diversity. "They know better than anyone that studying engineering at the University of Arkansas is a stepping-stone to great opportunities in any number of industries. They are able to share that experience in a way that gets students excited about the possibilities engineering might hold for them."

To learn more about the Engineering Alumni Ambassadors program – or to volunteer – please contact Peggy Gabriel at pgabriel@uark.edu or 479-575-6764.

Engineering's Recruitment, Retention and Student Affairs Team (L to R): Thomas Carter, Bryan Hill and Director Carol Gattis.

Peers prove to be the key in fight for retaining students

Many of the students who enroll in the College of Engineering were the highest ranked student in their high school class. The thought of making a "C" is beyond their comprehension. But that first semester at the University of Arkansas can be a real eye opener.

Far too many students become discouraged and leave school or move to a different major. However, some upperclassmen who have weathered the storm, and know that success in pursuing an engineering degree is not quite so daunting a task as it first seems, are stepping up to the plate to make a difference.

In the fall of 2005, the college initiated a pilot peer mentoring program to match incoming freshmen with upperclassmen in hopes of helping to support the new recruits and retain them in the college. The program was so overwhelmingly popular and successful that a full-scale peer mentoring effort was launched for fall 2006. This fell directly in line with a push from Chancellor John White to improve retention campuswide.

When the program opened last fall 140 freshmen signed up. They have each been assigned to one of the 12 mentors who meet with them each week to talk about issues ranging from taking tests to roommate problems to feeling homesick.

"The mentors help to put things in perspective for the new students," said Bryan Hill, associate director of recruitment, retention and diversity. "When the freshmen come in they are unable to see ahead, they can only see what's happening right now and it doesn't always feel very good."

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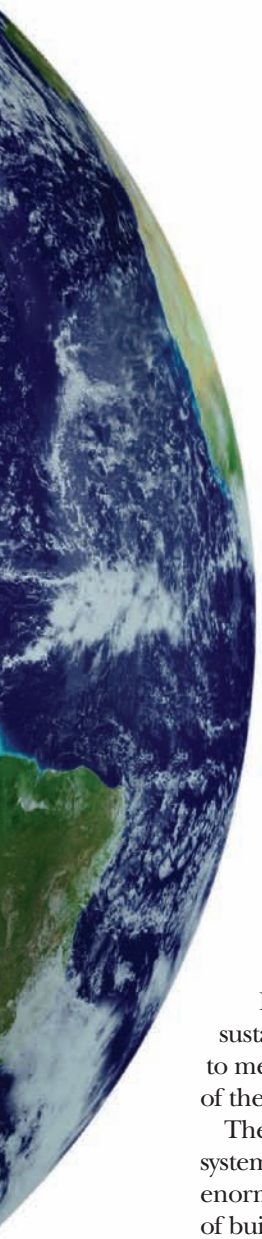
Hill said it takes time for the mentors and mentees to be comfortable with one another, but after about three or four weeks they become friends and confidants, and more at ease working together. One of the original mentors from the 2005 pilot program, Abraham Lachowsky, a senior industrial engineering student, is the coordinator of the peer mentoring program this year. Hill said after the first round of students completed the program as mentees, they were eager to be mentors by their sophomore year.

Hill said the peer mentoring program is based on some of the best components of several academic programs nationwide, as well as a corporate model.

"We can see that it is making a world of difference in the success of our students and their interest in staying in the college," said Carol Gattis, director of recruitment, retention, honors and diversity. "The students can help each other in ways we adults could never make happen."



Making a mark

"Sustainability is the recognition of the moral obligation that future generations' prosperity should not be sacrificed for short-term gain today."

– Greg Thoma, professor of chemical engineering, UA College of Engineering

College of Engineering researchers explore the roots and solutions of sustainability

Some scholars call it a moral movement. Others consider it more of an ethic – a rising sense of responsibility. Some say it is driven by politics while others contend it is a kind of techno theology. A "green" awareness. An obligation. A trend.

And some people say it's just a new catchword for something that has been going on for a long time.

By whatever definition, everyone agrees that sustainability is a big deal these days. And that the move toward sustainability is a necessary and good thing. It is a re-gearing of our approach to how we adapt our environment to meet our societal needs, and, more importantly perhaps, how we adapt our needs and behaviors to the needs of the natural environment.

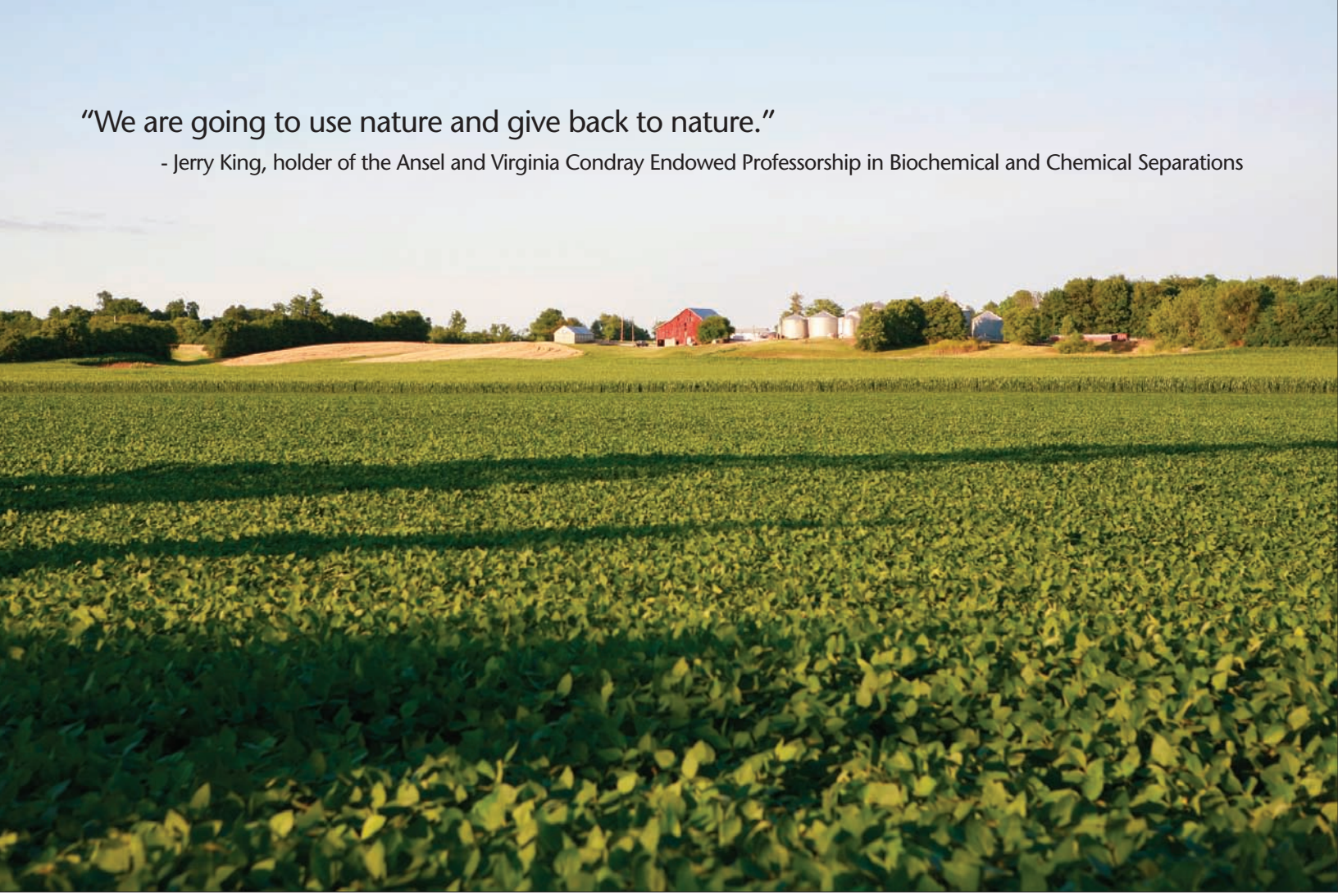
The built environment consists of buildings, the transportation grid, and water collection and treatment systems. It supports mankind's economy and our way of life. It also consumes enormous resources and produces enormous waste. A substantial percentage of the materials produced globally each year go into the construction of buildings, which then use a significant amount of energy to operate. Maintaining the aging infrastructure in the developed world is stressing our ability to keep systems viable. At the same time, a growth surge in the developing world is surpassing by far the capacity of those regions to build the necessary infrastructure.

Water can no longer be thought of as an infinite resource. It has become a dominant cause of societal friction around the globe. In the developed world, the competing needs for water for industry, agriculture, and municipal systems produce conflict as the groundwater supplies are depleted. In the developing world, a general undersupply of clean water is one of the greatest hindrances of building sustainable economies. As many as 2 billion people worldwide lack access to clean water. Tens of thousands die from water-borne diseases on a daily basis.

Furthermore, society's manner of using natural resources – our technologies – roll everything into one giant interdependent system. For instance, water is a significant ingredient in energy generation, and significant amounts of energy are required in the production of clean water.

Apparently something has got to give – and it's best if it is not the Earth's natural resources.

Enter Sustainability.



"We are going to use nature and give back to nature."

- Jerry King, holder of the Ansel and Virginia Condray Endowed Professorship in Biochemical and Chemical Separations

Sustainability is not – cannot be – the domain of any one group of thinkers or doers. By necessity it crosses numerous lines both in and out of academia: the environmental and biological sciences, agriculture, business, social science, philosophy, the corporate world, government at all levels, the media.

But a huge role belongs to the various disciplines in engineering.

"Sustainability, in a big sense, is supposed to infuse everything we do as engineers – it's always been that way," said Kevin Hall, professor and chairman of the Department of Civil Engineering.

As the world's needs change, engineering practices change with it, Hall said.

"It just makes a lot of sense," Hall said, "that what we design and build now can be sustained – not to become obsolete and disposed of at some point.

"For engineers, it's about how we use technology to extend the life of products, restore, renew and reuse the natural resources to meet people's goals over the long run."

At the UA College of Engineering, sustainability is a point of emphasis and a strength. Sustainability is evident throughout the research labs as well as in the classrooms.

But technology is not a complete answer.

Any new idea in technology must also make good sense economically, for the business world, if it is going to contribute to sustainability, Hall said. If engineers come up with a better mouse trap but it costs twice as much to build, who would want to build it?

"Business is going to drive this thing. We, the engineers in academia and research as well as in the private sector, are going to develop new technologies, but they won't mean much until business puts them into practice," he said.

Furthermore, the amount of money in government research and development pales in comparison with corporate R&D money. That's why Hall said he was so pleased with what Wal-Mart Stores, Inc. is doing these days in adopting sustainable practices, including some projects that involve UA engineers.

"Wal-Mart deserves a lot of credit for recognizing the good business sense of sustainability," he said. "Plus it shows the rest of the corporate world that sustainability really works."

It creates a cycling momentum that gives sustainability the appearance of, actually, a movement.

"As more and more corporations embrace the financial and social benefits of sustainability, more grant money becomes available," said Ashok Saxena, dean of the College of Engineering.

"It gives us a great deal of opportunity to provide new solutions," Saxena said. "So it is a self-perpetuating arrangement, and a situation in which everyone wins."

Improving extraction processes with "friendly" natural processes

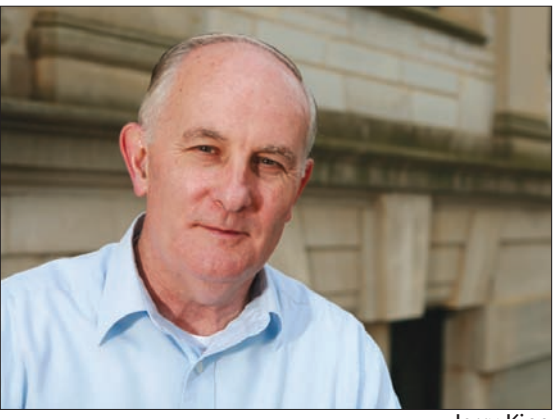
Several UA researchers are running projects that use an earth-friendly "critical fluid technology," using green fluids instead of chemicals, to extract added-value products from foods before they are consumed, or crops before those same crops are converted to biofuels such as ethanol.

Jerry King, holder of the Ansel and Virginia Condray Endowed Professorship in Biochemical and Chemical Separations, is one of the pioneers of critical fluid technology. It is a completely green process, King said, that uses either water (subcritical fluid) or carbon dioxide gas (supercritical fluid) held at high temperatures and high pressures to extract substances from biomass. For instance, the process has been used to remove caffeine from coffee, fat from meat, and pesticides from fruits and vegetables. It can replace the use of organic solvents, which results in expensive hazardous waste and often leaves a chemical residue in the products.

"We've been working on this for a lot longer than 'sustainability' has been a catchword," King said. "But it fits right in. We are going to use nature and give back to nature."

Part of King's work uses the technology to extract antioxidant products from grapes. Human use of antioxidants is popular as a dietary supplement in fighting coronary artery disease, some cancers, Alzheimer's disease and some forms of arthritis. In recent years there has been a rising awareness of the medicinal benefits of red wine, which is of course made from grapes. The antioxidant-grape research is funded by a USDA-CSREES grant to King and Luke Howard, professor in the Department of Food Science.

"We have the capability now, in our lab right here in Fayetteville, to use these processes to extract antioxidants and other products from a variety of crops, and to convert the left-over residues to higher value bio-renewable products," King said.


Jerry King

Another aspect of King's research involves coupling the "green" processing agents in consecutive extraction-reaction steps for the conversion of biomass and industrial waste products into fuels and higher-value chemicals. In collaboration with research teams in Japan and Germany, he is using compressed water and carbon dioxide with "natural" enzymes to produce feedstocks for the production of bioethanol and biodiesel as well as other chemicals. This sustainable technology platform is being applied to the recycling of waste plastics, conversion of animal-based protein wastes into value-added chemicals, and rice hulls into glucose.

The development of biofuels has been a hallmark of the sustainability movement. The great challenge is to make biofuel production a cost-feasible enterprise, since the cost of fossil fuels – even at their rising price – remains cheaper.


Julie Carrier

Julie Carrier, associate professor of biological and agricultural engineering, and Ed Clausen, Ray C. Adam Endowed Chair in Chemical Engineering, combined their two primary areas of study in a possible solution for the biofuel economic equation. Carrier's work concentrates on extraction of added-value products using critical fluid technology, and Clausen's work concentrates on converting crops to biofuels.

Specific to Arkansas, switchgrass is a starch-based crop that grows tall and in abundance, making it a good biofuel crop much like corn. Carrier and Clausen have successfully used subcritical fluid to extract antioxidants from switchgrass. Their studies have shown the extraction process leaves no measurable loss of energy potential when the crop is later converted to cellulose ethanol.

"Instead of just throwing away a product, which would get burned up, we're getting some additional value products," Clausen said.

Dietary supplements are a multi-billion dollar industry. Clausen and Carrier believe the increased value of the crop – to the farmer, the supplements business, and the biofuel market – could be the factor that pushes biofuel production toward real feasibility.

Carrier and Clausen are working on another project that hopes to extract a product known as saponins from the bark of mimosa trees. Saponins can be fed to chickens to kill growth-inhibiting organisms in chickens' stomachs.

"If this works," Carrier said, "the saponins are a natural product that can be used as a food additive in the chicken industry."

Restoring nature's processes to build better communities

"I just love this place where I live," says Marty Matlock, associate professor of biological and agricultural engineering.

Fayetteville and the rest of northwest Arkansas has "deep community," which, Matlock explained, means the people in the towns know each other and engage one another in common spaces like neighborhoods and parks. And that supports healthy human behavior and a high quality of life.

"That's what sustainability means to me," Matlock said. "It's not political, it's ethical. It's a cultural recognition that we can't keep doing what we've been doing if we intend to pass on a high quality of life to future generations."

Matlock is passionately involved in sustainability projects that seek to restore the hydrologic regime – natural landscape water processes – in urban settings. Because doing so will save money in the costs of water treatment, save resources, support urban wildlife such as songbirds, and make our communities more aesthetically pleasing – now and later.

Marty Matlock

Those things we have been doing that we need to stop, he said, have to do with overbuilding communities in ways that disrupt and overstretch the natural services we depend on.

Matlock's focus is water. Specifically, how the natural water system is harmed by the use of too much concrete and not enough green space, and how ecological engineering can reverse the harm that has been done. Harm such as allowing streams to overflow from storm water or run dry during summers. When that occurs, the stream beds become cut too deep causing the streams to "blow out" and halt the natural processes of flood control, nutrient cycling, carbon cycling, disinfection and biotic regulation.

Today's urban growth includes a wide variety of water features, and usually plenty of them. But currently they empty into drainage ditches. Too much water moves too fast and does not return to the ground for natural filtration and subsurface storage.

"So we are looking to redesign our landscapes to make those hydrologic features empty into greenways and back into the ground and our natural stream system," Matlock said.

It's a balancing act.

"We want streams to convey frequent flows within their channels – this supports healthy and competent geomorphic and ecosystem processes," he said.

High flows – less frequent events, typically two-year events – should be allowed to spill out of the banks into the flood plain. These high flows carry most of the pollutants and sediment, and have the most erosive potential. They will settle out in the floodplain to be treated by natural filtration.

Matlock is working on a collaborative project with the city of Fayetteville, the local chapter of Habitat for Humanity, and the University of Arkansas' Community Design Center, to design and plan a new "human ecosystem," a model community built with Low Impact Development (LID) technologies, guided by principles of sustainability. Matlock's LID watershed modeling includes such features as: 1) shared streets, based on a model known as the Dutch woonerf, in which the street is designed as a garden), 2) integrated storm water management system using ecological engineering approaches such as rain gardens, green streets, bioswales, and infiltration trenches, and 3) pervious street surface systems.

"What these engineered features will do is send rain water back into subsurface storage instead of running down the curbs into a drainage ditch," Matlock said. Urban planning still needs concrete drainage ditches to channel away heavy rain from a storm, he said, but the hydrologic regime needs to be restored from the steady rains that typically occur five to 10 times each year.

"If we can enhance the natural processes of evaporation and transpiration, infiltration and subsurface storage, we'll reduce the negative impact on our streams, and that will enhance the rest of the ecosystem," he said.

Aaron Gabriel, assistant director of the UA Community Design Center, said, "Marty brings a holistic approach to the work and provides an ecological conceptual framework that is inherently sustainable – not one which merely applies sustainable technologies. Through his work with the UACDC, he has helped illuminate the undervalued role of ecology and the ecological engineer in developing sustainable cities."

Neighborhood planning began this year with anticipated construction starting in 2008, Matlock said. In addition to the university's Community Design Center and Ecological Engineering Group, team partners include Fayetteville-based McClelland Consulting Engineers for landscape architecture and civil engineering, Habitat for Humanity of Washington County, and the city of Fayetteville. The grant does not fund research, but does allow the university to expand its outreach services to the state of Arkansas through community education and demonstration projects.

If Fayetteville eventually adopts into its codes the ideas and models in this project, it will join Seattle and Portland in being the nation's leading cities to sponsor LID infrastructure as an alternative to costly civil infrastructure

"... we can craft a world for our children and grandchildren that we'll be proud to leave them."

- Marty Matlock, associate professor of biological and agricultural engineering

for storm water management. The grant that supports the project also obliges the team to produce an LID manual for use by planners, developers and designers across Arkansas.

In previous projects in Rogers and Warren, Ark., Matlock worked with researchers in the Ecological Engineering Group and the Community Design Center to create a design for stream restoration that included riffle-pool-glide flow structures, native plants for bank stabilization and hydrologic regime modification to restore summer flow. Final designs incorporated park-like settings around the creeks.

Ecological engineering is a new but rapidly growing discipline. It is emerging from the integration of many areas of practice, including agricultural and environmental engineering, ecosystem management, restoration ecology, ecosystem modeling, and urban planning.

Northwest Arkansas is a perfect living laboratory for Matlock's ecological engineering, he said. The accelerated rate of urban growth in the region makes the demand obvious. But also, he said, the area enjoys a robust community of citizens who care about and are committed to making the world a better place.

"These (ecological engineering) ideas are not novel – we've known about the benefits of the hydrologic regime for a long time," he said. "But now there is an awakening to the impact we're having on our landscape, and a new awareness, a cultural concern, that we have the chance to use tried-and-true methods to make things better. The community leaders around here are very supportive."

"Growth is not intrinsically negative, particularly if it has restorative and regenerative capacities," said Stephen Luoni, director of the UA Community Design Center and the Steven L. Anderson Chair in Architecture and Urban Studies. According to a recent Brookings Institution study, he said, 80 percent of the "built environment" in the year 2050 does not yet exist. What that means to Matlock is that today's urban planners and engineers have a great opportunity to dramatically influence the future of the built environment.

"It's good news to me," he said. "If we can aggressively define what we call the 'good' in this process, we can craft a world for our children and grandchildren that we'll be proud to leave them. I'm optimistic."

Making rainwater go further for Wal-Mart and the Amazon Region

Thomas Soerens dedicates his time and talents to capturing rainfall and making better and safer use of it.

One of the associate professor of civil engineering's projects has broad implications for sustainable water usage on a national or even global scale because it involves Wal-Mart and Sam's Club stores, with potential for serving as a model for other green-minded companies that might join the sustainability movement. Two other projects take Soerens and others to Central America and South America to focus on the development of eco-friendly rainwater filtration systems and other practices to improve water quality.

It's so basic. Nature provides us with rainwater. The engineer's principles of sustainability compel us to make the most of it.

When the Department of Civil Engineering was asked to become a part of Wal-Mart's site sustainability network, Soerens took the lead on the rainwater harvesting and water treatment studies. Later he was tapped to be a part of a design team building a rainwater collection system for a new Sam's Club in Fayetteville.

Once it is finished, the new Sam's Club in Fayetteville will be the first store of its type to use a system that captures rainwater from the roof of the building and stores it in tanks to be used for irrigation and cooling, Soerens said. Furthermore, the system will collect and store condensation from the building's cooling system during the warmer seasons.

The design team's challenge was to reduce the amount of treated water used to irrigate the site.

"There is no need to use treated water for watering trees, grass, bushes, etc.," Soerens said.

"Wal-Mart has made this and other sustainable practices part of its business model," Soerens said. "Not only is it good for the environment, it also makes good business sense because it will save money over the long run."


Thomas Soerens

His job was to use rainfall data to determine how much water could be collected, and, so, how much less water would have to be purchased from the public water works, in this case the city of Fayetteville.

The system was designed to use two 36,000-gallon tanks located outside of the building to store the collected rainfall. An economic study is under way, Soerens said, to determine the long-term cost savings of the system and whether it is financially sustainable.

"If it's not economically feasible, then it's not sustainable," he said. And the economics of the system will vary in different parts of the country. Soerens and the rest of the task force are developing prototypes and guidelines for rainwater collection in various regions of the country.

"In the more arid regions of the country, like the Southwest, the system might pay for itself more quickly because water is less plentiful, more costly, and the cost of treating water is higher," he said.

The prototype can be configured to use larger or smaller storage tanks, depending on a region's annual rainfall and the economic calculations. It's still early in the project, Soerens said, but the plan is that the concept will spread not only to other future Sam's Club and Wal-Mart stores, but also to Wal-Mart vendor companies, and show enough impact to be attractive to any other type of business.

"I'm working with a group of students to do a similar system at the UA Physical Plant's heating and cooling facility across the street (on Dickson, in Fayetteville)," he said.

Kevin Hall, chairman of the UA Department of Civil Engineering, said Wal-Mart's move to merge sustainable technologies with business practices is significant because the private sector will have the greatest impact in the sustainability movement.

"Having Wal-Mart, as the world's largest retailer, take a leadership role in sustainability provides great momentum," Hall said, "and illustrates that sustainable practices need not negatively impact the bottom line."

Soerens is president of the Northwest Arkansas chapter of Engineers Without Borders, which means he is ready to travel and donate his time and knowledge toward helping people in underdeveloped countries. He is involved in two projects that require a good hat and some sunscreen, along with his expertise in sustainable water systems.

In 2004, he was asked to develop a rainwater collection system with biosand filtration to help resolve unhealthy water use habits among people in the Colombian Amazon. In a tour of villages on the Amazon River in Colombia and Peru, he and a pastor host observed that few villages had rainwater collection barrels, and where there were barrels, they were either not used or not maintained. People drank and used brown, cloudy water directly from the river. There were numerous stories of children who had died as a result of waterborne diseases.

Soerens and a senior design team from the UA Civil Engineering Department tested a biosand filter and compared it with results from a regular sand filter. The biosand system is not allowed to completely drain, and the regular filter is allowed to drain. The biosand filter was superior, removing 100 percent of fecal coliforms from the water. In June 2005, he led a team to the village of Zaragoza, Colombia, and installed a rainwater collection system with the biosand filter at a church, as a test.

"It was a success, so we were asked to go ahead and build the same type of system on some schools, clinics and community buildings in other villages," Soerens said. In August 2006, he was joined by UA alumnus John Lawrence (BS 1975, MS 2002) in setting up five more systems in five additional villages.

Soerens' other Latin America-based project is part of a UA academic interdisciplinary program of community development and international service learning. It takes him to Belize this summer, a country with limited resources, historical deprivation, and cultural alienation. The project uses a holistic approach to understanding the complexity of challenges facing the people of such an environment.

The problems in Belize that Soerens will address relate mostly to unsanitary practices in water usage. It's largely a problem in public health knowledge, he said.

"For instance, they might drink water from a well located just a few feet from a septic system," Soerens said. "Mainly we need to educate them about the problem with drinking the well water."

It's another facet of this rather broad concept called sustainability – adapting humans to their environment instead of the other way around.

Making energy more efficient and accessible

Energy is the lifeline of the industrialized world and the foundation of a high standard of living. The vast majority of the energy we depend on is from fossil fuels – a finite source that, when we burn it, is also harmful to the environment. Less than 10 percent of current energy resources are renewable. Meanwhile the demand grows at an exponential rate.

Juan Balda

Researchers in the Department of Electrical Engineering are working in several areas to address what is perceived to be, from a sustainability viewpoint, an amassing energy crisis.

Recycled Energy

Juan Balda, professor of electrical engineering, is working through the National Center for Reliable Electric Power Transmission to develop power electronics interfaces for renewable energy sources and solutions under the heading "Combined Heat and Power."

CHP refers to the use of wasted heat to generate electric power using microturbines. Heat from an industrial furnace, for instance, can be channeled to a system of microturbines to generate new power. In Balda's project, this "recycling" of energy, along with the use of renewable energy sources such as a wind-powered generator, make use of power electronics to interface with the power grid.


Roy McCann

Ideally, an industrial facility making use of renewable energy sources and wasted heat could generate most, if not all, of its required electric power. In some cases excess power could be sold to the local electric utility.

Greater Efficiencies

Roy McCann, associate professor of electrical engineering, is developing a new type of generator that is more efficient in producing electric power. It uses a fundamentally new method of designing and operating electric motors and generators by embedding magnetic field micro-electromechanical sensors inside the motor, including the rotating components, to directly monitor and adjust the operation to maintain a maximized level of electrical efficiency.

Existing generator technologies rely on taking a few external measurements such as voltage, speed and current. Recent advances in permanent magnet materials and electrical steels have made possible further improvements in energy efficiency. However, maximum efficiencies are possible only by knowing the instantaneous magnetic fields inside the generator. The inclusion of embedded sensors and control techniques developed from this research enables these energy efficiency gains to be achieved by providing the required information of internal magnetic fields. This work also benefits electric motor efficiency, which is important for electric and hybrid-electric vehicle propulsion applications as a means to reduce dependency on fossil fuels.


Hameed Nasem

Developing Renewable Sources

Hameed Naseem, professor of electrical engineering, has spent much of his career developing solar cells. Among the benefits of solar energy are: it is practically an infinite source; it can be generated at the point-of-use, so doesn't need a power grid and there is no loss of energy in transmission; it converts directly into electricity; and it is harmless to the environment.

Naseem's current work is the refinement and improvement of solar cells for a process called Photovoltaic Power Generation. It uses semiconductors and solar cells constructed of silicon – made of sand – the second-most abundant material in the earth's crust.

Latest improvements include the development of thinner, less expensive types of silicon wafers and films that absorb more light, Naseem said. His patented method uses a low-temperature process of metal-induced crystallization. Older methods use a high-temperature process that causes a wafer "bowing" problem, he said.

Student selected to study abroad at the University of Dundee

Jordan Greenlee, a junior electrical engineering student, spent his spring semester at the University of Dundee, Scotland.

A grant from the National Science Foundation to Magda El-Shenawee, associate professor in electrical engineering, made the study abroad opportunity possible.

El-Shenawee has been working on path breaking research that applies her expertise in landmine detection to discovering a better way to find breast cancer tumors. Greenlee's research in Scotland will supplement the breast cancer research and help to establish research collaboration with University of Dundee.


submitted

Jordan Greenlee in front of the Broughty Castle in Scotland.

Upon returning from Scotland, Greenlee will register for an honors thesis and work under El- Shenawee's supervision to continue her research. He will also travel to Washington D.C. to present a report on his findings.

Jamie Hestekin named to Turpin Professorship

Jamie Hestekin has been appointed to the Jim Turpin Professorship in Chemical and Biological Separations. The professorship was created to attract a leader in research involving the separation of value-added products from biological feedstock. Candidates are solicited from a national pool. Hestekin, who joined the university in the fall of 2006, holds a Ph.D. from the University of Kentucky and B.S. in chemical engineering from the University of Minnesota, Deluth.


Jamie Hestekin

He came to the UA from Kraft Foods, where he worked as a senior scientist in the Advanced Separations Group. He developed membrane separation technology for milk products and was responsible for more than 10 internal inventions and five patent applications.

Following his Ph.D. work, Hestekin was a postdoctoral fellow at Argonne National Laboratory in Chicago for almost three years, where he worked on projects to simultaneously increase the speed of desired chemical reactions while separating the productions of those reactions. His research at ANL resulted in three U.S. patent filings.

While at Kentucky, he worked on research that lead to five granted U.S. patents involving the characterizing of the kinetics and selectivity of functionalized membranes with application to removing and recovering heavy metals from water.

In 2006, Hestekin was the chair for the 17th annual meeting of the North American Membrane Society.

Hestekin's wife, Christa, also joined the Department of Chemical Engineering in fall 2006 as an assistant professor. She completed her doctoral degree in chemical engineering at Northwestern University. Her doctoral research developed a method for microchip electrophoresis of DNA.

Ronald L. Rardin named to White Chair in Industrial Engineering

Ronald L. Rardin, a renowned professor and researcher in industrial engineering, has been named as the inaugural incumbent of the John and Mary Lib White Systems Integration Chair in Industrial Engineering.

Rardin, who will also hold the title of distinguished professor, was most recently professor of industrial engineering at Purdue University, where he served as director of the Purdue Energy Modeling Research Groups, an energy planning research initiative, and director of academic programs for the Regenstrief Center for Healthcare Engineering, a research center dedicated to improving quality and accessibility of healthcare by drawing upon expertise in engineering, science, management and social sciences. For three years, beginning in 2000, Rardin was program director for operations research and service enterprise engineering at the National Science Foundation.

"Dr. Rardin's research in healthcare systems engineering presents a fantastic opportunity to be on the cutting edge of addressing some of today's most critical challenges," said Ashok Saxena, dean of the College of Engineering. "We could not be more pleased that a researcher and teacher of his caliber has joined us from one of the highest ranked industrial engineering programs in the country (second in undergraduate and fourth in graduate programs according to *U.S. News and World Report*) and will be a part of our ongoing efforts to offer the best engineering education available to the students of Arkansas."

A native of Kansas, Rardin holds a bachelor of arts in mathematics and political science and a master's degree in public administration of city management from the University of Kansas. He earned his doctoral degree in industrial and systems engineering from the Georgia Institute of Technology and remained there as a faculty member for eight years, before joining Purdue in 1982.


Ronald L. Rardin

Rardin is an award-winning teacher and author, having won Purdue's Pritsker Award for outstanding undergraduate teaching in industrial engineering four times, and authored a comprehensive undergraduate text titled "Optimization in Operations Research," which won the Institute of Industrial Engineers' Book-of-the-Year Award in 1998, as well as a graduate text, "Discrete Optimization."

The John and Mary Lib White Systems Integration Chair was endowed by the UA chancellor and his wife during the Campaign for the Twenty-First Century. The chair was created through a $1.5 million planned gift, which was matched by the Walton Family Charitable Support Foundation.

Former Civil Engineering Head Earns Two Honors

Robert Elliott, a former professor and head of civil engineering at UA, was recently named to the national organization that sets the standards for civil engineering education. He also received the Distinguished Alumnus Award from the University of Illinois, Urbana-Champaign, the top-ranked civil engineering program in the country.


Robert Elliott

Elliott is the latest appointee to the national Committee on the Curricula and Accreditation. The committee is charged with developing and implementing policies and procedures for the establishment and evaluation of undergraduate and graduate curricula in civil engineering. It also brings oversight and guidance for the development of civil engineering program accreditation criteria and evaluation teams used in the accreditation process.

"Program criteria for civil engineering programs are currently undergoing significant change. Dr. Elliott's presence helps ensure that our program remains at the forefront nationally, and that we will continue to offer our students the absolute state-of-the-practice education that employers and graduate schools have come to expect," Kevin Hall, head of the UA Department of Civil Engineering, said.

Notes from the Road: Dean Saxena Visits with Alumni

Engineering College Dean Ashok Saxena took time this winter to travel and visit with alumni in several cities, including Longview, Texas; Memphis, Tenn.; and Hot Springs, Ark. At each stop, alumni from the college and from around the university turned out to present him with a warm Razorback welcome.

This past December in Longview, the East Texas Arkansas Alumni Association gathered for a dinner over which the dean updated alumni on some of the major accomplishments at the college over the past two years. This included an overview of how the Campaign for the Twenty-First Century has enabled engineering to attract an ever-growing number of top faculty from around the country to the University of Arkansas, creating an increasingly challenging classroom and research experience for our students. In between courses the dean was able to garner some first-hand feedback from David

Above, Dean Saxena congratulating the team from Garver Engineers, including Engnineering Advisory Council member and Garver CEO Brock Johnson ('72 BSCE, '81 MSCE), second from left. Below, CEI Engineering Associates celebrate their award with Dean Saxena.

photos submitted

Scott Dicus, Dean Saxena, Joel Wood and Peggy Gabriel visiting in Memphis.

('82 BSIE) and Luanne Brotherton, who report their daughter Sarah – currently a freshman in engineering – was thrilled to be at Arkansas, and is doing well with her first year classes. The East Texas group continues to be a strong source of support to the College of Engineering in the recruitment of students, as well as in corporate support for the college's programs. Special thanks go to Joe Hill ('80 BSEE), Glyn and June Crane, and Terry ('81 BSChE, '82 MSChE) and Vicki Hedden for helping to organize this event.

In January the Dean traveled to Memphis, where he delivered a formal presentation to the members of the Mid-South Arkansas Alumni Association, titled "Educating the Millennials of America," in which he described some of the unique characteristics of the current generation of students heading to college today. He also took time to discuss with the group the importance of preparing students so that they are able to thrive in the global, competitive workplace. "We need to encourage our students to prepare themselves not for their first job out of college," he said, "but rather for a fifty-plus year career in whatever field they choose. We are teaching them to be life-long learners." The Mid-South area will be a focal point of student recruitment in months ahead as the college strives to deepen connections with high schools in the greater Memphis region. Joel and Nancy Wood, Vance ('92 BSIE) and Sherrill Clement, Scott Dicus and Paula Barnes were the alumni masterminds behind that terrific evening.

In February, Dean Saxena was invited to address the Arkansas Chapter of the American Council of Engineering Companies at their annual Engineering Excellence Banquet, held this year in Hot Springs. This event highlights the critical role that professional engineers play in Arkansas' on-going development. The

Notes continued on next page

Alumnus Troy Alley Delivers Martin Luther King Celebration Lecture

On January 25, 2007, engineering alumnus and Dean's Advisory Council member Troy Alley delivered the 2007 Martin Luther King Celebration Lecture, titled "What Matters Most." College of Engineering students were attracted to the lecture for its focus on targeting the factors needed for success in business and in life, with special emphasis on those studying engineering.

submitted

Troy Alley delivering the 2007 MLK Lecture at Bell Engineering Center.

Alley pinpointed four key steps for students to use in approaching the important decisions they need to make: personal sense of purpose; a focus on one's goals; enthusiasm for work and life; and confidence in oneself. All are critical to success, Alley said. For example, in relation to academic progress, Alley encouraged students to start early in developing an academic plan.

"Work with your faculty advisor to create a degree plan," he said, "then make your degree plan part of your life's purpose and goals."

A 1969 graduate of the Electrical Engineering department, Alley began his career with Westinghouse in Baltimore, Md., and worked there from 1968 to 1974. In 1974 he joined ACS & Associates in Ft. Worth, Texas. He continued his educational endeavors in 1976 by completing an MBA at Southern Methodist University in Dallas. From 1976 until 1979 he served as vice president of Galloway & Herron, a commercial real estate brokerage firm in Dallas. Then in 1979 he co-founded Con-Real Support Group, a construction and real estate firm. He continues to serve the company as executive vice president. In 2007 Alley was named by Texas Governor Rick Perry to the Texas Real Estate Commission for a four-year term. He is an active member of the College of Engineering Dean's Advisory Council.

The Martin Luther King Celebration Lecture series is an annual event hosted by each of the colleges and schools at the University of Arkansas campus.

Notes continued

Engineering Excellence awards are presented annually by the American Council of Engineering Companies of Arkansas in recognition of engineering achievements demonstrating the highest degree of merit and ingenuity for engineering firms in the state of Arkansas. University of Arkansas alumni were represented in force, many of them the recipients of key awards presented that evening. Key projects that gained recognition at this year's event were:

- Garver Engineers LLC, accepted the Grand Conceptor for their project, World's Longest Pedestrian/Bicycle Bridge, for Pulaski County Government, Central Arkansas. The same project also won in the large entry division in the category of Structural Systems.
- CEI Engineering Associates, Inc. of Bentonville won the award in the category of Special Projects for the project of Pinnacle Hills Promenade Project, for their client, General Growth Properties.
- FTN Associates, Ltd., of Little Rock won in the Water and Wastewater category for their project, Townsends Water Reuse Project, with their client being Townsends of Arkansas.

Dean Saxena with Matt Crafton (L) and Ken Jones of Crafton, Tull & Associates Inc.

In addition, Grand Conceptor Honor Awards were presented to the following two firms:

Notes continued on next page

Julian Stewart Chairs Chancellor's Advisory Board

Julian Stewart (`57 BSCE) has accepted Chancellor John White's invitation to chair the University of Arkansas' newly formed Board of Advisors – an organization that will help guide the institution's advancement and fund-raising efforts.

A long-time donor and friend of the university, Stewart served on the Campaign for the Twenty-First Century Steering Committee and the Executive Committee. He also served as co-chair of the Leadership and Principal Gifts Committee during the Campaign and was also a member of the National Development Council. Stewart was recently honored at the regional level for his service by being named recipient of the Bill Franklin Volunteer of the Year Award from the Council for Advancement and Support of Education, District III.

Nana and Julian Stewart at the 2006 Engineering Alumni Awards Banquet.

Serving as the successor organization to the National Development Council and the Campaign for the Twenty-First Century Steering Committee that headed the effort that raised more than $1 billion, the new board will play a leadership role in the UA's advancement and fund-raising efforts; develop ways and means of expanding public awareness of the needs, programs, growth and development of the university; aid Chancellor White in defining the institutional goals of the university; offer advice on external relations issues; advocate for the university with the state legislature; and help increase the UA presence across the state of Arkansas and in other states and countries where highly successful alumni are concentrated. The Executive Committee of the Board will tap new members in the coming months and membership should total about 60 people when complete. Membership will be composed of past volunteers as well as alumni and friends who have actively supported the university and its many programs.

Notes continued

• Crafton, Tull & Associates for their project, Harmon Avenue Parking Facility, with their client, the Polk Stanley/ Rowland Curzon Porter Architects, LTD.

• McGoodwin, Williams & Yates, Inc. for their project, Benton Farm Lift Station, with their client, Springdale Water Utilities.

Congratulations to all who contributed their talent and effort to the fine work that is attracting attention to Arkansas' engineering profession.

The following day, the dean was treated to an informal luncheon in Hot Springs, organized by Advisory Board member Larry Stephens ('58 BSIE). Fielding questions from Hot Springs area engineering alumni, Dean Saxena was able to address the key issues facing the college and the university as a whole: recruitment, retention, research and diversity. Alumni input and recommendations were collected and recorded, and will help to inform college strategies for achieving the ambitious goals the dean has set for the College of Engineering's future. The conversation turned time and again to the subject of how the college can best serve the students of Arkansas and ensure the continuing strength of the state's engineering profession, with plenty of helpful insights from the alumni gathered.

Brad Hammond ('92 BSCE, '94 MBA) and Dean Saxena at the Engineering Excellence Banquet in Hot Springs.

Progress Toward Our 2010 Goals

Undergraduate Enrollment

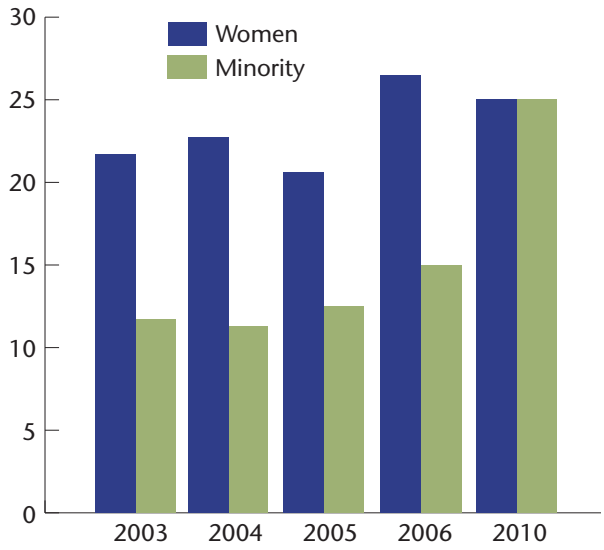
	2000	2001	2002	2003	2004	2005	2006	2010
Undergrad Enrollment	1711	1683	1539	1600	1600	1563	1573	1800
Avg. Freshman ACT	25.9	25.8	26.5	27.0	27.4	27.2	27.6	28.0
Avg. Freshman HSGPA	3.7	3.6	3.7	3.7	3.7	3.62	3.66	3.7

Graduate Enrollment Trends

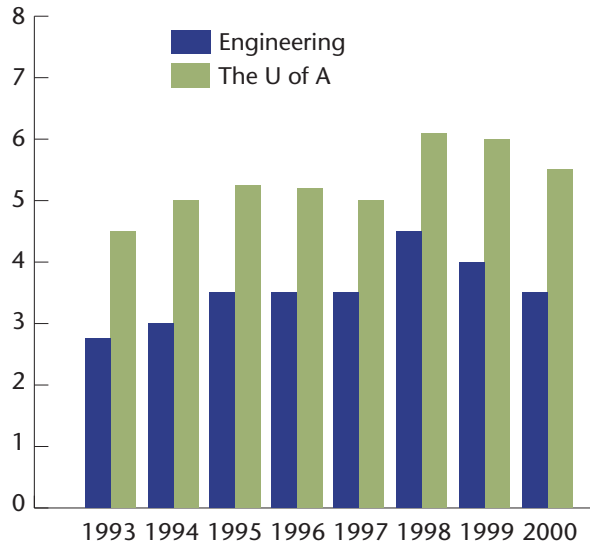
	2000	2001	2002	2003	2004	2005	2006	2010
Ph.D. Enrollment	65	73	89	106	121	130	152	200
M.S. Enrollment (incl. OMGT)	318	335	387	382	438	486	503	500
Total Grad Enrollment	383	408	476	488	520	616	655	700

Diversity Undergraduate Students

Diversity Graduate Students



6-Year Graduate Rate



Research Proposals and Award Summary

	2002	2003	2004	2005	2006	2010
No. of Proposals	191	207	224	271	300	300
$ Value of Proposals (M$)	37.1	39.7	54.7	55.5	70	100
No. of New Awards	88	108	100	100	110	150
$ Value of New Awards (M$)	8.1	9.2	8.8	9.2	21.5	22.5

"To the engineer falls the job of clothing the bare bones of science with life, comfort and hope."

- Herbert Hoover, engineer, and 31st president of the United States

Face to Face with the College of Engineering
Jamar Blackmon

Hometown: Little Rock, Arkansas

Undergraduate education: University of Arkansas, B.S. in computer engineering, and M.S. in engineering (computer science).

Field of study: Currently I am in the general engineering Ph.D. program for multi-disciplinary research. My research involves applications from electrical engineering, biomedical engineering, computer engineering, mechanical engineering, and architecture.

Dissertation topic: Remote Patient Monitoring (Telemedicine)

Expected graduate date: Spring 2009

Career goal: My Ph.D. research will have a very high impact within the healthcare arena. After completing my Ph.D. I plan to go to medical school.

Why engineering: I've always loved the field. The hardest part for me was choosing which area of engineering I would go into.

Why the UA: I am a former athlete here at the UA; I was a member of the men's basketball team. So I was initially interested in the UA because I wanted to play basketball for former coach Nolan Richardson. After researching and learning more about the engineering programs, I felt I was getting the best of both worlds.

Most memorable moment: Being a student-athlete was very tough. My most memorable UA moment was finishing my career as an athlete and my engineering degree as a student in 2004. Up until that point it was by far the most challenging thing I had ever accomplished.

To contact Jamar Blackmon, e-mail jwb05@uark.edu.

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