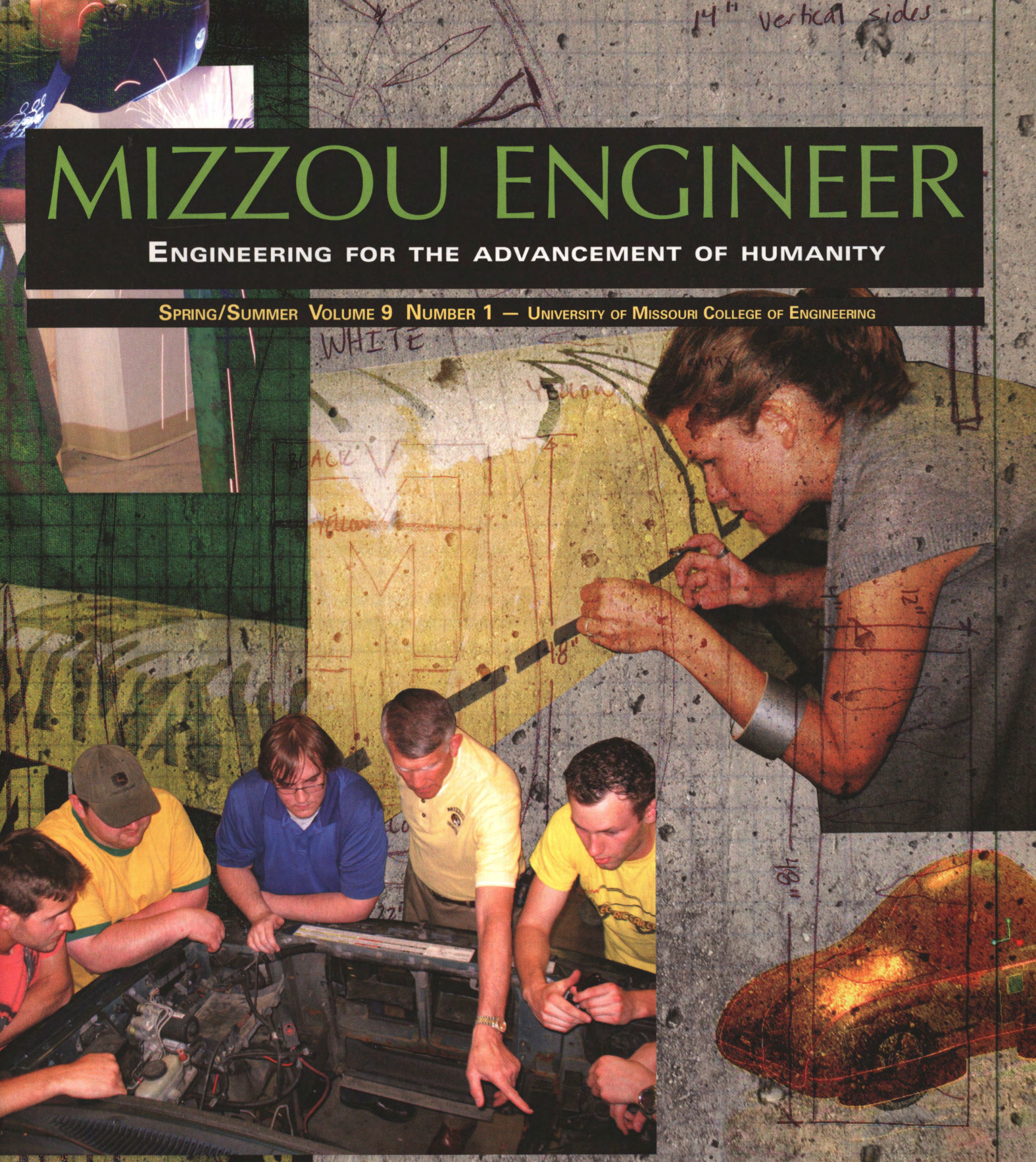
# MIZZOU ENGINEER

ENGINEERING FOR THE ADVANCEMENT OF HUMANITY

SPRING/SUMMER VOLUME 9 NUMBER 1 — UNIVERSITY OF MISSOURI COLLEGE OF ENGINEERING




## ENGINEERING IN THE SPIRIT OF COMPETITION

**MIZZOU ENGINEER**

*Engineering for the advancement of humanity*

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**MIZZOU ENGINEER is a biannual alumni magazine. It is our intent to capture moments in time that communicate glimpses of the past, present and future of the MU College of Engineering. We hope it also renews old acquaintances and friendships, spawns volunteerism and encourages philanthropy.**

**Questions, comments and suggestions for future articles are welcome. Please send them to the Engineering Advancement Office at umcengrdev@missouri.edu**

**This magazine is funded by the Mizzou Engineering Office of Advancement.**

Alumni, friends and the MU family,

In my three-plus years as the College of Engineering's editor, I've had the opportunity to write about dozens of students and their various extracurricular activities. To say that I am impressed by them — their talent, energy and ambition — is beyond an understatement.

In addition to class time and time spent in the lab, the engineering curriculum requires even the most gifted of students to invest plenty of time studying. Those who opt to take advantage of undergraduate research opportunities, and who get involved in any of the special interest or academic clubs and organizations, subdivide their time even further.

Engineering students additionally have the opportunity to join a number of engineering skill-based student competition teams and can become as involved as they like.

Certainly the professional engineering organizations that sponsor student competitions want participants to enjoy themselves, but at the same time, these competitions prepare students for future careers, building competence and confidence.

Working as part of a team requires that members apply the theoretical information presented in class to solve real engineering problems.

The same teamwork and communication skills that are necessary to successfully participate on a student team also are necessary skills in the engineering workplace. And regulations for nearly every competition require that students report on their approaches to projects, their methodologies and outcomes — also good practice of aptitudes that make graduates stand out to potential employers.

Participation on competition teams adds a unique element to the engineering college experience. It also can be a lot of fun and team members often become lifetime friends.

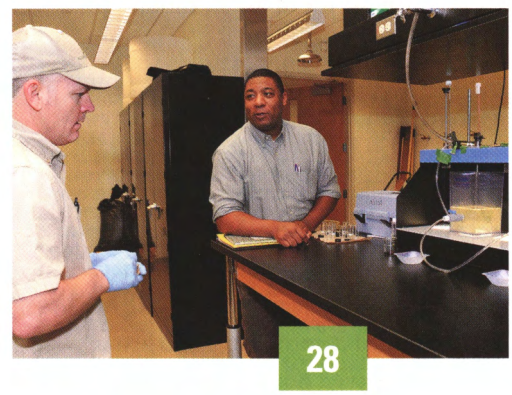
It was nothing short of a pleasure to interview team leaders, attend team organizational meetings, take photos and write about engineering team members' experiences for this issue of the magazine. I'm sure I'll be writing about their professional accomplishments as alumni in the near future.

Jan Wiese-Fales

MIZZOU ENGINEER
spring/summer 2010
volume 9 number 1






## Of Note



**Photos top to bottom: Mizzou Engineering's hydrogen car team shares a meal during their trip to Houston, Tex., for the Shell Eco-Marathon Challenge. A green glowing Mizzou emblem provides a unique example of the surface energy assisted porous films developed as part Professor Shubhra Gangopadhyay's biosensor research. Mechanical engineering student Brian Graybill works with the College of Engineering's rapid prototyping machine. Graduate student Dan David and Assistant Professor Enos Inniss discuss water analysis results.**

**Cover design by Michele Pais**

## Biosensors to provide rapid detection of salmonella

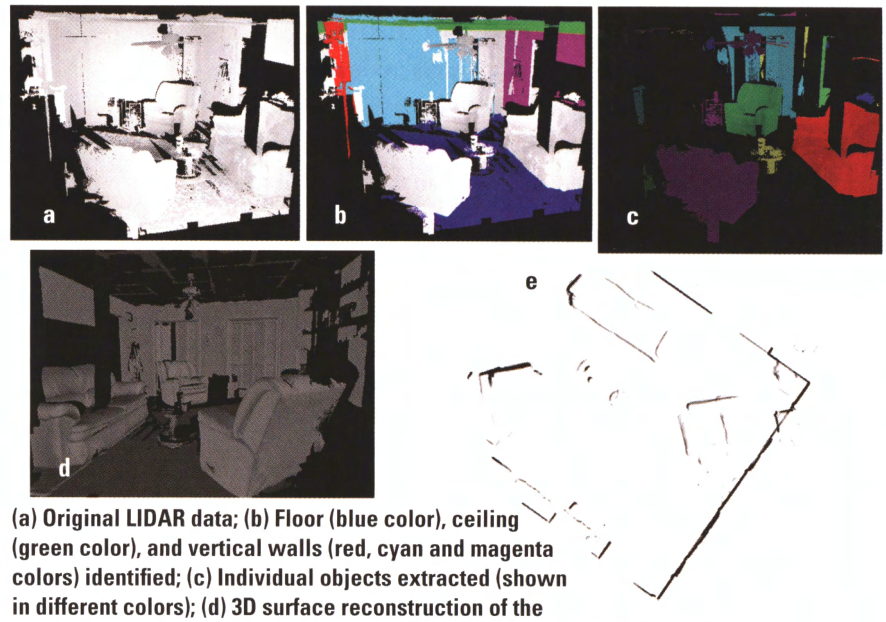
A novel device conceptualized by Mahmoud Almasri, assistant professor in electrical and computer engineering at the University of Missouri, holds promise for testing food for salmonella with rapid results.

Each year, 40,000 cases of salmonella are reported in the United States, although the Centers for Disease Control believes that contaminated food may be responsible for up to 35 times that many.

Though the Food and Drug Administration requires that samples of potentially at-risk foodstuffs be tested, results from prevailing procedures may take up to a week to complete. Various bacteria detection biosensors, including microelectrical mechanical systems (MEMS), have reduced detection time to just a few days or even hours, but Almasri's device decreases detection time even further.

"With the MEMS device we are working on, the sensing surface area to volume ratio is significantly increased," Almasri said, explaining the advantage of his design.

In addition to being efficient and accurate, the device will be much smaller, lighter and less expensive than current array units, with its portability contributing to its integration into field-testing.




**(a) Original LIDAR data; (b) Floor (blue color), ceiling (green color), and vertical walls (red, cyan and magenta colors) identified; (c) Individual objects extracted (shown in different colors); (d) 3D surface reconstruction of the Maerz Residence Family Room. (a), (b), and (c) are three different views of the building; (e) Floor plan of the Maerz Residence Family Room.**

## Robot may improve rescue missions

Ye Duan, associate professor of computer science in the MU College of Engineering has developed software for a robot with a laser sensor that can enter dangerous structures to assess the structure's stability and locate people within.

"We are developing computer graphics visualization software to allow the user to interactively navigate the 3D data captured from the robot's scans," said Ye Duan. "I worked with my students to develop computer software that helps the user to analyze the data and conduct virtual navigation, so they can have an idea of the structure before they enter it. The technology could save the lives of disaster victims and responders."

The remote-controlled robot, built by researchers at the Missouri University of Science and Technology, is designed to remotely transport a Light Detection and Ranging unit (LIDAR) so that responders, such as police, military, firefighters, and search and rescue teams, can know more about dangerous structures before entering. The robot takes multiple scans and the software forms the data points into sophisticated 3D maps that can show individual objects, create floorplans and color-code areas inside the structure for stability.

"Although the software and the robot can help in emergency situations, it could be commercialized for a variety of uses," Duan said. "This system could be used for routine structure inspections, and also could allow the military to perform unmanned terrain acquisition to reduce wartime casualties."

The researchers now are working on a proposal to make the robot faster and smaller than the current model, which resembles the NASA rovers sent to Mars, which weigh about 200 lbs.

Duan's research has been published in International Journal of CAD/CAM. The robot recently was named on the list of Kiplinger's "8 Robots That Will Change Your Life."

## Carlos Sun receives MoDOT award for research contributions

The Missouri Department of Transportation (MoDOT) named Carlos Sun its 2010 Innovative Researcher of the Year for his evaluation of the Gateway Guide's Motorist Assist and Emergency Response Program.

Sun, associate professor in civil and environmental engineering at the University of Missouri, evaluated data compiled by the Highway Patrol on traffic incidents, including the type and severity of each one, in order to determine the effectiveness of Motorist Assist.

Sun said while Motorist Assist cannot prevent primary crashes, its benefit was "dramatic" to secondary crashes, those that result from congestion or other things related to a primary crash. Specifically, he found that the benefit-cost ratio of the Motorist Assist program was 38 to one.

Motorist Assist helps move stranded motorists off the freeway in order to improve traffic flow and save the public time, money and lives, according to MoDOT's website.

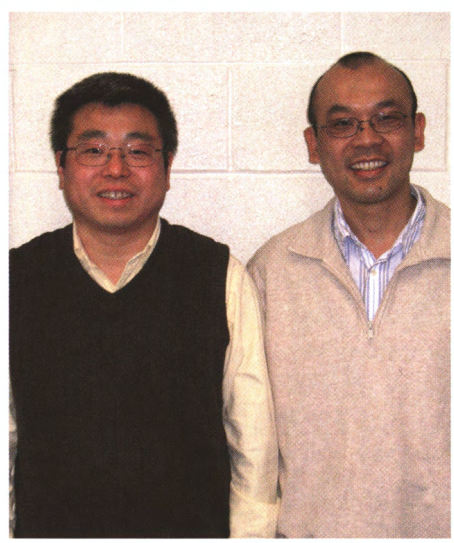
Workers in 12 trucks patrol St. Louis-area interstates seven days a week and can change tires, provide gasoline and aid in other minor repairs. They can also call for further help and act as a barrier between the motorist and the freeway until the situation is resolved.

"Without Motorist Assist, there wouldn't be people who patrol the roads, incident management wouldn't be as timely or efficient and clearance times would be longer," Sun said.

Longer clearance times increase motorists' exposure to crashes, cause greater congestion and increase the potential safety risk to other motorists.

The Motorist Assist program began in 1993 with five trucks. It now covers six interstate highways, including all of I-170, and one freeway, according to its website. Operators stop at any vehicle that seems to be having trouble and respond to calls within 20 minutes in most cases.

Sun said his Achievement Award was a surprise. "We try to do the best job we can in our research," he said. "I am really thankful for it, but it's not something we expect, we just try to do a good job.



## Sequencing of soybean genome adds potential to research

Nearly 5,000 years after the first written reference to soy appeared on a list of Chinese plants, the legume's genome has been sequenced.

Researchers at the University of Missouri were part of the large multidisciplinary team of scientists from academia and business that successfully untangled soybean's genetic code, paving the way to improve soybeans' performance as a foodstuff — for both humans and animals — and its potential use as a biofuel. Research may additionally increase soybean use in production of products now largely dependent on petroleum, including such products as plastics, lubricants and solvents.

The effort, spearheaded at MU by Gary Stacey, a professor of plant sciences and director of the Center for Sustainable Energy, also included two engineering faculty members: James C. Dowell Professor Dong Xu, who chairs the Computer Science Department, and Jianlin Cheng, an assistant professor in both computer science and the MU Informatics Institute.

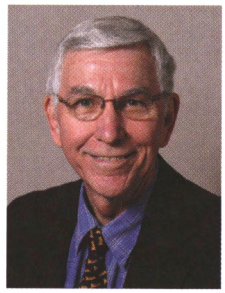
"Gene sequencing gives you a whole picture of the plant. A billion nucleotides, 60,000 genes — it's like a periodic table; it provides the foundation for other work," said Xu, explaining that while others generated the genomic data, he and Cheng analyzed it to see what genes were expressed in the case of various soybean attributes and environmental conditions.

"Genes are responsible for all of a plant's traits," Cheng explained. "For example, some mutants or variants will be more drought resistant. Improving this trait in soybeans would have a fundamental agricultural impact."

Increased yields, higher oil and protein content and resistance to pathogens are all areas of research that will potentially benefit from gene identification.

## Kiger named ASCE Fellow

Sam Kiger, associate dean of research for the University of Missouri College of Engineering, was elected a fellow by the American Society of Civil Engineers (ASCE) in October 2009, after being a member for over 30 years.



Kiger has been awarded a Lifetime Achievement Award in Shock and Vibration Effects, was recognized as the 1985 U.S. Army Corps of Engineers Researcher of the Year for his work in explosion resistant structural analysis and design, and has co-authored over 100 technical papers and reports.

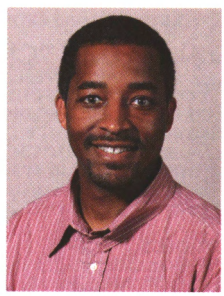
Kiger came to Mizzou in 1995 as professor and chair of civil engineering and currently serves as associate dean of research.

"I've always kept my hand in academia and teaching because I really enjoy it," Kiger said.

At present, his research is focusing on projects related to explosion resistant windows and the effects of explosives on cable stayed bridges.

## Triplett receives Kemper Fellowship for Teaching

University of Missouri Chancellor Brady Deaton and Commerce Bank Chairman Jim Schatz awarded a 2010 William T. Kemper Fellowship for Teaching Excellence to Gregory Triplett, assistant professor of electrical and computer engineering in the MU College of Engineering.



Deaton, Schatz and a group of professors, administrators and staff paid a surprise visit to Triplett's classroom to honor him with the fellowship, which includes a $10,000 award. Fellowships are awarded to five outstanding teachers at the University of Missouri each year.

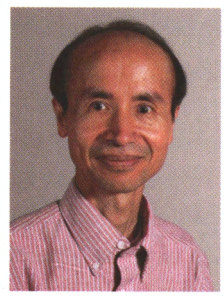
Triplett has been teaching in the Department of Electrical and Computer Engineering since 2004.

"Just to be nominated would have been enough for me," said Triplett. "The Kemper Award confers honor on people who have really strived to be better teachers — not the best; you're never the best because you're always making efforts to improve."

The William T. Kemper Fellowships for Teaching Excellence were established in 1991 with a $500,000 gift. Kemper, a 1926 MU graduate, was a well-known civic leader in Kansas City until his death in 1989.

## Hsieh honored by professional organizations

On the heels of his May election as a fellow with the Institute of Food Technologists (IFT), University of Missouri Biological Engineering Professor Fu-Hung Hsieh also was elected a fellow of the American Society of Agricultural and Biological Engineers (ASABE).



IFT recognized Hsieh for his efforts as a teacher and mentor, as well as his development of a food extrusion research program at MU. ASABE is conferring honors upon him for the innovative contributions he has made to food processing technologies, as well as his talents as an educator.

Hsieh, who is largely responsible for the establishment of MU's food engineering emphasis option, also serves as co-leader of the Bioprocessing and Biosensing Center in MU's Food for the 21st Century research program.

"Dr. Hsieh is one of the pioneers in the field of food engineering. He was brought to MU to start our teaching and research programs in the area," said Jinglu Tan, James C. Dowell professor and chair of biological engineering, as well as director of the Division of Food Systems and Bioengineering.

"I am honored to be named a fellow of ASABE," said Hsieh.

## Zhuang named IEEE Fellow

The Institute of Electrical and Electronics Engineers (IEEE) named Professor Xinhua Zhuang a fellow, for his work in image processing, computer vision and image coding.

IEEE Fellow status is granted to engineers who demonstrate proficiency and distinction in their profession. The organization elevates only a fraction of its 375,000 members to fellow each year. The selections never exceed one tenth of one percent of its voting membership.

Zhuang, C.W. LaPierre professor of computer science, began the research that earned him the honor after he immigrated to the United States from China in 1983. His pioneering work in multidimensional signal processing had substantial impacts in image processing, computer vision and image coding.

In recent years, Zhuang has worked extensively with the China program, promoting Mizzou to prospective Chinese students. He also has organized a number of international conferences.

Zhuang is grateful for the recognition of what he's achieved. "I'm pretty happy," he said.

## Office for Student Development launched

Recent construction that transformed the reception area of the College of Engineering's administrative offices, the Heritage Room and the vacated copy center into a suite to house the Office of Student Development occurred in a flurry of activity over a few weeks' time. But the schemes, dreams and plans that laid a foundation and launched a variety of programs that will be administered through the office have been brewing for months.

"This office will serve as an umbrella for activities we are orchestrating to enhance our undergraduate program in order to make our students more successful as students and as engineers," said Lex Akers, associate dean for academic programs. "I'm pleased that Dean Thompson has allowed us to reconfigure the space to encompass these programs. It will really enhance students' experiences."

The Freshman Enrichment Program will work with Engineering Career Services to sponsor workshops and bring in speakers from industry to discuss various components of professional development with freshmen.

Academic monitoring also will be a component of the freshman program. MU's math department has agreed to work with Mizzou Engineering to track freshmen progress by providing first-year student grades to the Enrichment Office at the semester quarter. Anyone with a score of C-minus or below will be required to meet with faculty and staff hired to assist with the program.

In addition to offering engineering majors scheduled tutoring sessions in Lafferre Hall and in two dorms that host engineering Freshmen Interest Groups (FIGs) and Learning Communities, the Office for Student Enrichment launched online tutoring in the spring.

Additionally, tutorials are recorded and saved so that students taking advantage of electronic tutoring options can click on a subject and choose from a list of pre-recorded tutorials covering major concept areas within classes. Students may avail themselves of this resource any time of the day or night.

Plans are in the works to offer Mizzou Engineering students travel abroad opportunities through the office next year.

## Two tapped to serve as commencement marshals

Two of the University of Missouri's student marshals for the graduate school commencement ceremony were engineering students.

Craig Weilbacher of biological engineering was selected to serve as the doctoral marshal and Shuai Ding of industrial engineering was the masters marshal.

The marshals are selected from a pool of nominations based on their academic performance and their contributions to graduate education at MU.

## Computer science teams up with Shanghai University for undergraduate degree

In November, the University of Missouri Computer Science Department increased its global connections when College of Engineering and MU administrators met with officials from Shanghai University to discuss implementation of a cooperative agreement between the two schools.

A cooperative program between the two universities creates a coordinated undergraduate degree program whereby top-ranked Chinese computer science students attend classes at Shanghai University for the first two years of their degree programs and then complete their undergraduate degrees in the computer science program in MU's College of Engineering.

"By doing joint projects with China, we will have more cultural exchange," said Xinhua Zhuang, a C.W. LaPierre Professer in computer science whose connections to China have been instrumental in setting up the program.

Jill Ford, engineering's head of student enrichment, will work closely with the Chinese students to help them integrate into the college and beyond. "We want the students to have a positive experience on campus and in the community, in addition to their college work," said Ford.

# Recognition for a career of service

by Kaitlin Motley

James Keller, an R.L. Tatum professor for the University of Missouri's College of Engineering, and a curators' professor in the electrical and computer engineering and computer science departments, will accept a meritorious service award from the Institute for Electronics and Electrical Engineers (IEEE) in Barcelona this year.

IEEE awards members for "outstanding and sustained service to the aims and objectives" of the organization.

"It's a nice award, because you don't get much for volunteering," Keller said. "This is like 'hey, you've been in the trenches for a long time slugging it out, and we noticed.' I'm happy to get it."

Keller belongs to the Computer Intelligence Society within IEEE, and served as editor or associate editor on a number of transactions. He was the vice president for publications for the society and introduced two new transactions in his four-year term.

He also is on the administrative committee (AdCom), similar to a board of directors, and served as program chair on several conferences. He additionally served on the awards committee until someone nominated him for the service award and he had to be removed.

"I've benefited from being an editor and getting travel opportunities," Keller said. "I have very, very dear friends all around the world. I've been very grateful for the opportunities I've had. So by volunteering on committees and things, I get to give back."

Keller is a distinguished lecturer in computer information systems, which has provided him opportunities to make presentations nationally and internationally.

"It's a great program," he said. "I just love doing this. I've been all over the world.

"People who don't do service are missing out," Keller said. "They don't get to experience diversity and make use of it."

Before Keller was an accomplished engineer, he was a self-described "math guy." After he completed a bachelor's degree in mathematics at the University of Missouri-St. Louis, his father pushed for him to get a job as an actuary. Instead Keller went to graduate school.

"I figured I'd get a master's and then maybe I'd teach math at a junior college," Keller said. But he went on to receive a doctorate in mathematics from the University of Missouri in 1978.

"I sort of stumbled my way through the degrees," Keller said. "I never had an educational plan, I just did what seemed interesting to me."

His interests eventually led him to engineering.

"Really pure math is like art," Keller said. "But I always had an application flavor to my thinking."

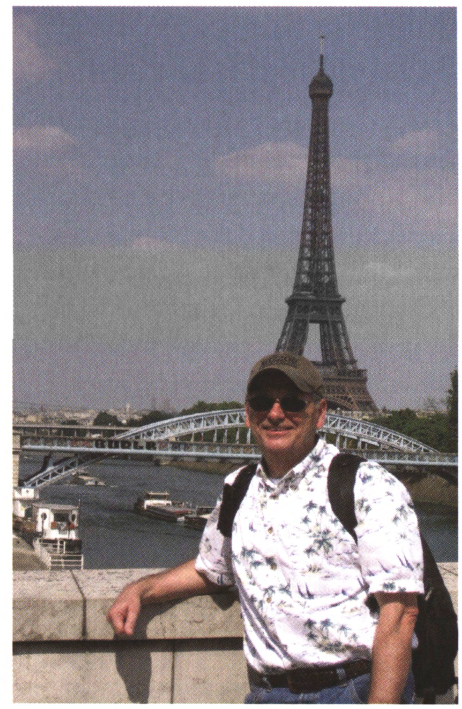
After working a non-regular position in biological engineering, Keller got a regular teaching job with the university in the electrical engineering department.

"You know, they say don't hire your own, but I always claimed I had been in a different college so it was okay," he said.

Keller has been teaching ever since. Well, teaching, traveling, mentoring and swashbuckling.

Every year, Keller comes to class dressed as a pirate in honor of Talk Like a Pirate Day — September 19.

He said although he tries to keep a lot of mathematical rigor in his teaching because of his background, he also tries to keep it light as much as possible. He even adopted his own pirate name, generated from a website: Red Sam Rackham.



**James Keller, a curators' professor in electrical and computer engineering — shown here in Paris where he served as visiting professor at l'Universite de Pierre et Marie Curie (LIP6) this summer — is being presented with a meritorious service award from the Institute for Electronics and Electrical Engineers (IEEE).**

His unabashed personality contributes to his uniqueness as a professor and certainly plays a role in the many successful relationships he's fostered around the world and at MU.

"I've had a great group of colleagues and students," Keller said.

He said he mentored Raghu Krishnapuram, now a researcher for IBM, and Paul Gader, a professor at the University of Florida. He also mentored Marjorie Skubic, currently an electrical and computer engineering professor at MU.

"I feel good about mentoring both students and young faculty," Keller said, adding that it's great when he goes places and bumps into students who have found success.

He said after he's gone, that's what he wants people to remember about him.

"I would want people to say, 'well, I can't remember much about Keller, but his students are really good.' "

NSF Early Career Development Program

# Career Award

## Pinar Akcora

by Anita Neal Harrison • photo by L.G. Patterson

Pinar Akcora, assistant professor of chemical engineering at the University of Missouri, has received a prestigious National Science Foundation CAREER Award. Her winning research explores a simplified method for assembling nanomaterials with multiple functions for use in devices requiring enhanced mechanical and electrical properties. The applications for this method, should it prove effective, would be diverse, ranging from new energetic materials to self-healing of reinforced materials.

Akcora is working with "polymer decorated iron oxide nanoparticles." She is exploring how interactions at the molecular level of these nanoparticles can be "tuned" for desired functions through changing various characteristics of the nanoparticles — including their size and surface chemistry. She is also exploring the effect of external magnetic fields on these nanostructures. Her goal is to understand and then to manipulate the self-assembly mechanism that allows nanoparticles to arrange into three-dimensional nanostructures. The results will have an impact on the design of new nanocomposites that could be stimuli-responsive — "smart" materials that change their conductivity and transduction properties in response to their environments.

Within the course of this five-year project, Akcora plans to educate and work with high school science teachers by offering research experiences in her laboratory to develop a collaborative science project for high school science curricula. Additionally, to foster the interest of underrepresented students in science, research and engineering, she will work with the Society of Women Engineers and disseminate her research findings in their local and regional meetings and outreach activities. She will integrate her research activities into teaching of polymer science and will also actively engage undergraduate students in research.

Akcora says she was "very, very happy," when she got the call about her win, especially since she received the CAREER award on her first application. She said she also is happy for the professional recognition she has received.

Beyond the accolades, Akcora is even more pleased with the opportunity the award provides to pursue interesting, meaningful research.

"I am researching an alternative, easier approach for self-assembly of nanoparticles," she said. "I just want to show that this works."


# Engineering's competition teams

by Jan Wiese-Fales

Mizzou Engineering's competition teams are student run and student managed — each with an advisor to give advice, encouragement and to accompany teams on the road. Students conceptualize their own "products," raise their own funds, largely through corporate-sponsorship, and spend time working together to make the strongest, most efficient, most serviceable, fastest, best constructed, highest precision, coolest or smartest product. Following competition guidelines to the letter, and how they go about it also is part of what is judged.

Conversations with each team leader provided these snapshots of engineering's 2009-2010 competition teams.

## Basic Utility Vehicle (BUV) Team

**Team captain: James Berlin**
**Advisor: Sherif El-Gizawy, professor of mechanical and aerospace engineering**
**Competition: April 16-17, 2010 ,in Zionsville, Indiana, sponsored by the Institute for Affordable Transportation**

Reflecting on their second-place finish at this year's Basic Utility Vehicle (BUV) Student Design Competition, Mizzou Engineering's team captain James Berlin is thinking ahead to next year.

"Our low speed cost us more than enough points to win first place. With even an average speed, we could have easily been in first by a mile," Berlin, a senior in mechanical engineering, observed. "That will be a main focus next year."

BUVs are simple, low-cost workhorse vehicles designed and built to compete in events that mimic challenging road conditions in developing countries such as mud pits, ditches and gullies. Endurance also is key since service stations are all but non-existent in these largely rural areas

The competition's sponsoring agency, the Institute for Affordable Transportation (IAT), strives to improve the lives of the world's poor with simple, low-cost transportation. BUVs transform lives, and by sponsoring a design competition for college students, IAT is able to tap the minds and capabilities of college students for vehicle innovation.

"They're looking for novel ideas to go into their BUVs," said Berlin. "Since we're one of the only teams doing hydraulics, they're very interested in our design."


Berlin said that the team built their BUV from scratch last year giving Matt Haseltine credit for the lion's share of the fabrication.

"We used the same vehicle this year and modified it to meet the new requirements," said Berlin, alterations that amounted to making the vehicle more farm-friendly. "We added a water tank, the capability to use a three-point hitch with a chisel plow, and a belly-mounted tine, used for tilling.

"I'm no farmer," he added, "so it's all new to me."

"The main thing about our vehicle was its consistency. We met every single requirement and excelled in a couple of them. The judges get to drive it, and the Cadillac suspension on the front scored high," said Berlin.

Being on the team has provided Berlin with real world experience and has enhanced his leadership skills.

"There were a lot of connections that needed to be made and it required keeping people happy even when working with opposing mindsets."

Like all good leaders, Berlin goes out of his way to credit his teammates for their contributions: Tony Bellacina and Josh Swanigan were major contributors to the fabrication and Kami Cheney, the only woman on the team, was the best welder.

Perry/Legend Collision Repair Center in Columbia provides a home for the team, and owner Bill Rajewski "helps out a lot," according to Berlin. The team's association with the shop and its owner add to the real world experience of a student competition team.

Berlin says he has big plans for next year. He said the team will field entries in both the main class and the open class competitions, the latter of which has fewer restrictions. He's looking at "tweels," which are flexible wheels that won't require as much of a suspension system and, in conjunction with a custom frame and drive system, will greatly lighten the open class vehicle.

"The thing about the BUV team is that there's not such a strict hierarchy as some of the other teams. If you want to start working on the vehicle itself, you can, even if you're a freshman," Berlin said. "We're a smaller, more relaxed team and we encourage anyone to join us."

## ChemE Car Team

**Captain: Beau Rothwell**

**Advisor: Matthew Bernards, assistant professor of chemical engineering**

**Regional Competition: April 9, 2010, in Ames, Iowa, sponsored by the American Institute of Chemical Engineers**

"Out of the 13 schools that competed, we finished fourth in the actual competition — only one and a half feet behind the third place team — and finished third in the poster competition," said Rothwell. "This was our first year competing, and we beat nine other schools that had competed in previous years, so it was successful in my book," said Mizzou Engineering's ChemE Car Team captain, Beau Rothwell.

The American Institute of Chemical Engineer's ChemE Car competition requires participating teams to design and build a vehicle that is chemically powered, though the reaction used to propel entries is up to each individual team. All of the little vehicle's components must fit into a 6.2-inch by 4.7-inch by 2.7-inch box, and safety is a key qualifying issue.

"We don't know the exact distance the car has to travel until we get to the competition. It can be anywhere from 50 to 100 feet, so we have to calculate the amount of reactant necessary to get the car to go that distance," Rothwell said. "And the car has to be able to carry a load — water — and we don't know beforehand what that will be either," added the freshman chemical engineering student.


"We're using a mix of hydrogen peroxide and potassium iodine. It creates oxygen and pushes the piston to create

our driving force," said Tyson Miller, a senior chemical engineering student who is past president of the team.

"We did a lot of runs and got accurate results," said Miller. For testing, we focused on the middle range, varying the amount of peroxide we use."

The repetition paid off.

"Dr. Bernards is our advisor. He's enthusiastic and he cares about us doing well," said Rothwell of the support the team received.

"We were sponsored by Honeywell," he added. "There is a cap of $2,000 that we can spend on the car, and the company's gift of $2,500 helped us out with t-shirts and the trip.

"What we're doing isn't hard, but it gets us more involved. I got to know so many more upperclassmen and more professors. It was a great way for me to get my foot in the door," Rothwell said.

## Electric Car Club

**President: Stuart Lloyd-Smith**

**Advisors: Marty Walker, director of administrative services for the College of Engineering, and Leon Schumacher, professor of agricultural systems management**

Mizzou Engineering's Electric Car Club grew out of a pervasive interest in those associated with the College of Engineering toward alternative energy sources of all kinds. Things really fell into place when a private donor made a gift of a Ford Explorer to the team. Bringing itself up to speed with no past history, the team has embarked on their mission to turn the internal combustion machine into one that cruises on current.

"We're aiming for a vehicle that can travel 100 miles at highway speeds," said Stuart Lloyd-Smith, president of MU's newest — and eventual — competition team. At initial meetings, students divided themselves up into focus committees,


including motor, battery, wiring and modeling. Lloyd-Smith was elected president, and publicity and recruitment chairs were named.

Lloyd-Smith said the club initially intended to do the easiest thing they could, which was to adapt the car to run on a direct current (DC) battery system. However, a presentation to the group by Greg Engel, an associate professor in the electrical engineering department, convinced them that alternating current (AC) — which uses central distribution — was a better choice.

"Dr. Engel said that we should reconsider because even though AC is more costly, it's more efficient. He encouraged us to go for the gold with the highest efficiency possible," said Lloyd-Smith.

"If all of our previous ideas were on one piece of paper, he would have burned it," the senior mechanical engineer added, laughing. "We've completely changed paths."

"We've learned a lot from do-it-yourself forums online, and the Electric Automotive Association has invited us to some of their meetings where they talk about cars," said Lloyd-Smith. "It's good for us as a group. By attending these meetings, we get new ideas. Maybe we'll try something that no one else has ever done."

The team spent the semester working through a myriad of choices. As with all student groups, their ability to move forward depends on consensus, fundraising and often on the generosity of companies who are willing to support them with donations of equipment and "parts." And though they stalled on obtaining a motor, a company that makes electrical moni-

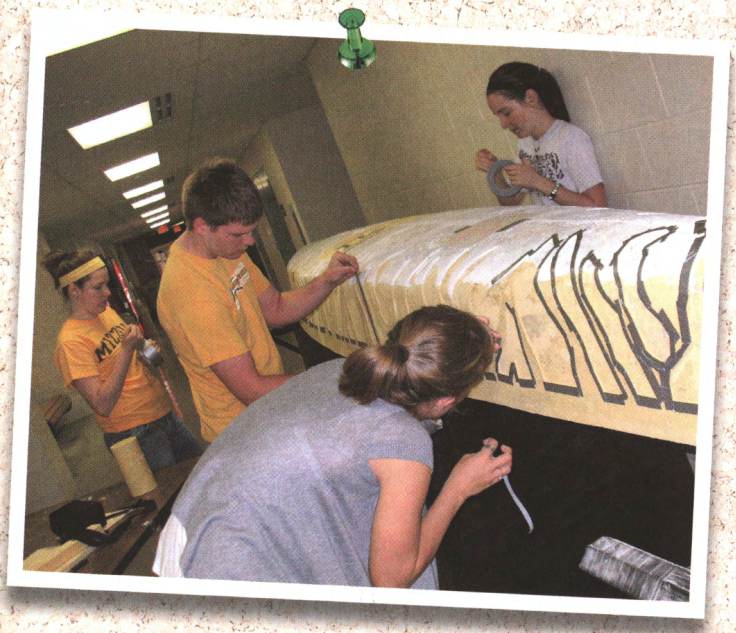
toring systems — MiMOD of Lee Summit, Mo. — came to a meeting, demonstrated their product and pledged to donate one of the touch screen, in-dash devices that allows access to all of the electrical systems.

Progress also includes the addition of manual steering, weight reduction (removal of exhaust heat shields, and fuel tank), construction of a speedometer from scratch and the creation of a vacuum system for the brakes.

"For a lot of us, this is the industry that we might eventually work in. We're making great connections," Lloyd-Smith said.

The group plans to continue working on the vehicle through the summer.

"Our goal is to create the most efficient and safe vehicle that we can," Lloyd-Smith said. "It's an ongoing process."



## Concrete Canoe Team

**Co-captains: Chelsea Smith and Adam Frankenberg**
**Advisor: Vellore Gopalaratnam, professor of civil and environmental engineering**
**Competition: April 24-25, 2010, in Norman, Oklahoma, sponsored by the American Society of Civil Engineers**

"This is the most work we've ever put into a canoe," said Chelsea Smith, co-captain of Mizzou Engineering's Concrete Canoe Team, alluding to the wooden mold the team constructed to "cast" the canoe, and the vehicle's elaborate design.

"The mold was Adam's ingenious idea. It comes apart in four pieces and is completely reusable," said Smith of the innovation of co-captain Adam Frankenberg. "It was a great way to perfect our final product and leave something for the next generation of concrete canoers."


American Society of Civil Engineers (ASCE) concrete canoe competitors are scored in four equally weighted categories: a design technical paper, an oral presentation, the final product and race results. MU's team took second for its oral presentation and came in third overall out of a field of eleven district teams.

"The concrete we use had to meet certain specs. They're all about sustainability and this year, 50 percent of the aggregates we used had to be recycled," Smith said. "We used Poraver® and Cenospheres." Both spherical glass aggregates, the former is made from recycled glass and the latter is a byproduct of coal-burning power plants.

"We had a hard time getting the strength we needed. We cast cylinders of different mixes and tested them for compressive strength," said Smith. She estimates that the team's final product weighs just over 200 pounds.

The intricate detailing on this year's canoe added to the overall time the team spent on the project. Hand-cut rubber "tiger stripes" were applied to the sides of the canoe mold and covered with concrete that had been dyed gold, except for the belly of the canoe. It was cast in white concrete — to mimic a tiger's tummy. The team taped off each of the indents left by the rubber stripes and filled them with black-dyed concrete. The final product is very handsomely Bengal.

"Working with friends on the team is fun, and so is competition," Smith said. "You make a lot of connections, as far as careers go, and the networking is good.

"And it is a really interesting application of concrete."

## Formula Car Team

**Co-presidents: Ryan Sobotka and Trevor Stohl**

**Advisor: Marty Walker, director of administrative services for the College of Engineering**

**Competition: June 16-19, 2010 in Fontana, California, sponsored by the Society of Automotive Engineers**

"I was born to be an engineer," said FSAE team co-president Ryan Sobotka said, explaining the appeal of the FSAE team. "As a kid I played with legos and erector sets. I took my mom's hair dryer apart. Everything mechanical fascinates me."

Sobotka believes that one of the greatest benefits of the FSAE team is the experience he is gaining. "Everything that you do out in the field is done by our team," he said. "I can put the stuff I learn in class into practice. It has also added to my ability to talk to the CEOs of companies and it's helped me get my name out there."

Though the team's competition isn't until June, design and construction of the vehicle was completed by late in March, with plenty of time to work out any kinks such as those that have plagued past years' teams.

A mechanical engineering sophomore, Sobotka serves as the team's chief production engineer. "This year's design was all new," he said. "We changed a whole lot of things, which is always scary. This is the first year we've used an aeropackage, which adds wings to the front and back of the car. As it runs, the wings push the car down, increasing traction.

"Will Cook and his capstone group worked on the aeropackage, and Michael Moore installed a cool data communications network," Sobotka said in praise of his teammates' contributions, explaining that with the new communications module a single wire and an electronic data screen has replaced a tangle of wires. The new system also will communicate wirelessly with the pit crew.

Completing construction early will allow for plenty of trial runs to test the new vehicle. The team recently had an opportunity to do just that at Southern Illinois University in Edwardsville, competing against Washington University and two of SIU's teams in a competition that mirrors the FSAE-sponsored event in June.

Mizzou Engineering's team won all four events, completing the 82-yard acceleration test in 4.3 seconds. The other events include a skid pad in which vehicles do two figure eights on circles with 50-foot diameters, with performance testing on the second turn; an auto cross track run that is timed; and a 13.66 mile endurance test with a 3-minute driver change in the middle.

"This team is everything to me," said Sobotka. "Our workshop is my place to study, and I put the stuff I learn in class into practice there. Last summer I spent 40 hours a week there on top of my 40-hour per week job. I've been spending 20 hours a week on the car during the school year.

"It's important to me to be there as much as I can," Sobotka added. "I just keep looking for things and fixing them."

## Geotechnical Challenge Team

**Captain: Sarah Grant**

**Advisor: John Bowders, associate professor of civil and environmental engineering**

**National Competition: February 23, 2010, in West Palm Beach, Florida, sponsored by the American Society of Civil Engineers (ASCE)**

**Regional Competition: April 24-25, 2010, in Norman, Oklahoma, sponsored by ASCE**

"You have to write a design paper to be accepted to the national competition," said Sarah Grant, captain of Mizzou Engineering's Geotechnical Challenge Team, better known as the GeoWall Team. "We worked mainly

over Christmas break and came in first in that category, against 15 teams."

Overall, the team came in second place at the national event — one point down from the winning team — though they have won it three times in the last five years. The national event is not related to the regional competition, which they attended and won in April.

The GeoWall is a scale model, reinforced soil wall that consists of a plywood box filled with sand, and a poster board retaining wall that is reinforced with paper woven through it. Teams are judged on their analysis paper, the wall's ability to carry the surface load, the amount of reinforcement they use and how long it takes them to build and reinforce the wall.

"It was a little trickier this year. It's the first year they didn't supply us with the competition sand," said Grant of the regional event, sponsored by the American Society of Civil Engineers, April 24-25, in Norman, Okla. "We tried to cover as many bases as possible by designing it for different kinds of sand, changing the angle of friction and adding more reinforcement."

This also was the first year teams were required to build the wall for an ideal factor of safety.

"In the past, our wall would hold 250 pounds, but this time we were to optimize the design to hold 50 pounds, and if it held over 100 pounds we would be penalized," said Grant.

"Next year the rules change again and we can use any materials, so it will be a bigger challenge," said the civil engineering senior. "I'll be here next year, so I can still be on the team."

Grant explained that four four-member teams compete at a time, with 30 minutes for the assembly stage, 30 minutes to cut the kraft paper supports and 30 minutes to set it all up.

"We use every last minute. One mistake and your wall will fail," Grant said. "We've always used compaction, but now our secrets are out and all the teams do it."

Grant said she enjoys competing on the team because it gives invaluable hands-on application of what she learns in her classes and because of the networking at the conferences.

"You learn so much from it and you get to know other students and professors. It's a lot of work, but the competition is worth it in the long run," Grant said.

"It's such a different feeling than sports. It's mind competition."

## Mizzou Hydrogen Car Team

### Society for Development of Alternative Energy

**President:** Forrest Meyen

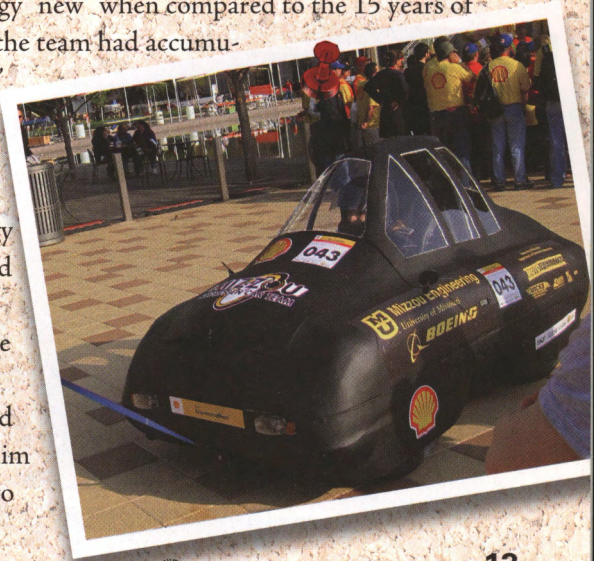
**Advisor:** Rick Whelove, mechanical and aerospace engineering resident instructor

**Competition:** 2010 Shell Eco-Marathon Challenge, March 26-28, 2010, in Houston, Texas

"This year went really well overall," said Forrest Meyen, president of the Mizzou Hydrogen Car team.

Mizzou's student chapter of the Society for the Development of Alternative Energy concentrated on solar cars up until five years ago, and last year's Tigergen I was the team's first hydrogen vehicle. Meyen, a senior majoring in both biological and mechanical engineering, said, "Tigergen I was designed to run an endurance course across the United States, like the solar car races, and thus the design was similar to that of a solar car.

"Tigergen II was required to be much smaller and lighter. We are learning a lot about the new fuel system. Even though we are on our second version of the car we still consider hydrogen technology "new" when compared to the 15 years of knowledge that the team had accumulated with solar," he added.




A third year veteran of the alternative energy team, Meyen said he originally joined because he liked the sound of the project and because it gave him an opportunity to

experience engineering outside of the classroom. "Being on the team gave me a good feel for engineering," he said

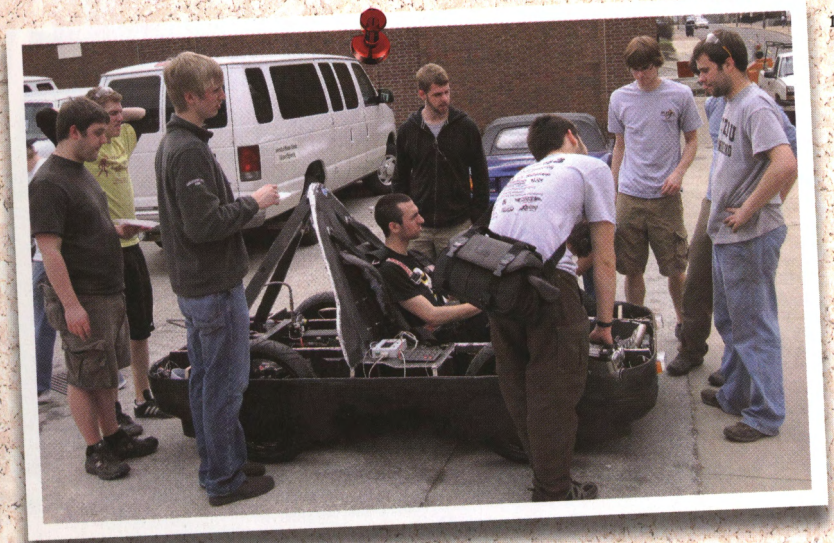
"The team is set up like a company with a long-term project cycle," said Meyen, adding that the group is divided into "departments" including chemical, mechanical, electrical and strategy. Weekly meetings featured updates from each of the subdivisions and, in the spirit of camaraderie and plain old fun, the "team player of the week" received a small yellow foam car that recipients each embellished. Mini license plates, LED headlights and a "flux capacitor" are a few things that were added to the little foam mascot.


"It all came together in the end, but we had to be very careful with our money," said Meyen. "We had to set priorities based on the time line of the project."

It was a race to the finish line to complete Tigergen II to take part in the Shell Eco-Marathon Challenge in Houston, March 26-28. Entered in the Urban Concept category as a vehicle that closely mimics conventional vehicles, it was the only hydrogen-fueled entry.

However, problems plagued the team. The driveshaft broke at 5 a.m. on the day of departure. Once there, it was discovered that fuel fittings were leaking, and a back-up fuel cell also eventually failed. And the car's electrical systems experienced a spate of malfunctions. "However," as team member Alex Hansen wrote in his final report, "thanks to sleepless nights, excellent engineering and sheer power of will, we were able to overcome these obstacles, and the car passed inspection in time to race."

Three attempts around the track all ended in fuel cell malfunctions, but, Meyen reported, "Overall Tigergen II raced 18 laps, about 11 miles. The fuel efficiency was calculated by race officials to be 480 miles per gallon, surpassing the winning vehicle by over 40 miles per hour."



Judges presented the team with the "Perseverance in the Face of Adversity Award" noting that "despite operating without sleep, they showed a can-do attitude and kept smiling each day at the Shell Eco-Marathon." The award came with a check for $500.

"A lot of things made it really successful," said Meyen. "We got to talk to teams from all over the country. It allowed us to get a lot of different ideas that we can use. Everyone who went to the race came back energized for next year."

The current priority for the team is to document their progress — what they tried and why, what worked and what didn't — so that the next teams won't be starting from scratch.

Meyen predicts that the hydrogen car's strategy "department" will be very busy next year.

"We plan to optimize the chassis and suspension, increasing the length and giving the driver more room," he said. "One of the senior capstone projects will be a telemetry system for the car," he added, noting that the team will be building Tigergen III as they work to improve the performance of Tigergen II.

"I said that I would shave off my beard if we got first place, and Bryce Guinn pointed out that the $500 check we received said first place for perseverance," Meyen said as he rubbed his chin stubble, which is staging a rapid comeback — just like the Tigergen team.

## Unmanned Aerial Vehicle Team

**Co-presidents: Daniel Nabelek and Joe Ondrus**

**Advisor: Jim Fisher, resident instructor in electrical and computer engineering**

**Competition: In September 2010, will compete against the Missouri University Science and Technology's team, sponsored by Institute of Electrical and Electronics Engineers (IEEE)**

Emerging technologies and their potential applications are the impetus for Mizzou Engineering's newest competition team — the Unmanned Aerial Vehicle Team (UAV) Team.

"One of my goals throughout high school was to work in aerospace, and I like the applications in electrical engineering," said team co-president Daniel Nabelek, explaining his particular interest in the team.

A junior majoring in electrical and computer engineering, Nabelek also serves as the vice-president for the Institute of Electrical and Electronics Engineer's (IEEE) student chapter and is in the process of forming a student chapter of the Aerospace and Electronic Systems Society (AESS), to be the second of its kind in the country. Members of the group were introduced to AESS by 2000 MU electrical engineering alumnus Jim Leonard. The organization provided seed money to launch Mizzou's UAV team.

Nabelek describes UAVs as mini-airplanes with five- to six-foot-wingspans, not unlike remote-controlled model planes. However, besides lacking a pilot in the cockpit, UAVs also have no ground control team. The vehicle's entire mission and its responses must be programmed into its systems. That includes its interaction with the various external stimuli it encounters on its run.

"UAVs have to be big enough to carry all of the operating systems and a payload," Nabelek explained, adding that in competition, the challenge is to search the perimeters of a grid for a predetermined target. "It has lots of applications," he said of the technology, which now is largely utilized by the defense industry for its lack of risk to human life.

Nabelek said the first meeting for the team drew a crowd of 60 interested students who have now subdivided themselves into several committees, based on the various systems that must work together to assure the vehicle successfully completes its mission, with a chief design engineer to monitor them all.

"It's very hands-on, and allows lots of people to work together on one project," Nabelek said. "I've been learning a lot about the design process."

Few UAV teams exist so Mizzou UAV's first competition will be against the only other IEEE Region Five team, that of the Missouri University of Science and Technology. "We feel a bit of a crunch," Nabelek said of the event scheduled for September. "Rolla has done this once before, but some of us will be around over the summer to work on it."

The winner of the competition will be funded by AESS to attend the 2011 UAV Challenge, known as Outback Rescue, in Queensland, Australia.

Entrants are judged on flight safety documentation, pretest flight demonstrations, take off, the search within specified parameters for a dummy (dubbed "Outback Joe"), and then the delivery of the payload — a bottle of water — close to Joe without hitting him. No one claimed the competition's $50,000 prize in 2009. And though they won't attend this year's competition, it will be closely monitored. In 2011, Nabelek and teammates may have the opportunity to travel down under with Mizzou Engineering's newest competition team.

## Seismic Design Team

**Captain: Matt Wheeler**

**Advisor: Sarah Orton, assistant professor of civil and environmental engineering**

**Competition: February 3 to 6, 2010, in San Francisco, California, sponsored by the Earthquake Engineering Research Institute.**

"The premise of the seismic design competition is that we build a tower as an office building for the judges, who are our 'clients'," said Matt Wheeler, team captain of Mizzou Engineering's Seismic Design Team in reference to the team's February competition in San Francisco. "It had to be economical and to still have the ability to withstand earthquakes," added the civil engineering senior.

"We came up with a design that represented solid construction techniques," said Don Spradling of the team's five-foot balsa wood model, assembled with wood glue.

"We built 90

percent of it using just three different pieces," added the civil engineering major who participated on the three-year-old team for the first time this year.

The competition, sponsored by the Earthquake Engineering Research Institute (EERI), pitted the MU team against 21 other teams. Each was scored on a five-minute presentation; a project poster; architectural aesthetics; the model's weight and construction costs; the income potential of the "office building"; and the structure's performance during a series of three increasingly strong earthquakes.

"The model is put on a shake table with sensors on the top and bottom," Spradling explained. "Our structure weighed 2.6 pounds and was loaded with 30 pounds on the top."

"The idea is to make it flexible in order to compartmentalize damage," said Wheeler, explaining that as an office building, if the damage is restricted to smaller areas, the less financial impact it has on the building's owner.

The team's model fared well in the first two quakes but in the third more powerful simulated quake, waves were added and the structure suffered 20 percent damage at the base, a common occurrence for most teams.

A 20 percent bonus was awarded for accurate performance predictions, a category in which Wheeler said the team did phenomenally well. Overall, the team took an impressive second place.

"Our structure represented what they were looking for and our predictions were right-on," said Wheeler.

"Competitions like this get undergraduates thinking about designing for seismic activity," said Spradling. "Sure, it's balsa wood and it's pretty simple, but it could foster ideas for the future."

"Being on the team has been an extraordinarily valuable, fun, challenging and interesting experience for me personally and professionally," Wheeler said.

## Steel Bridge Team

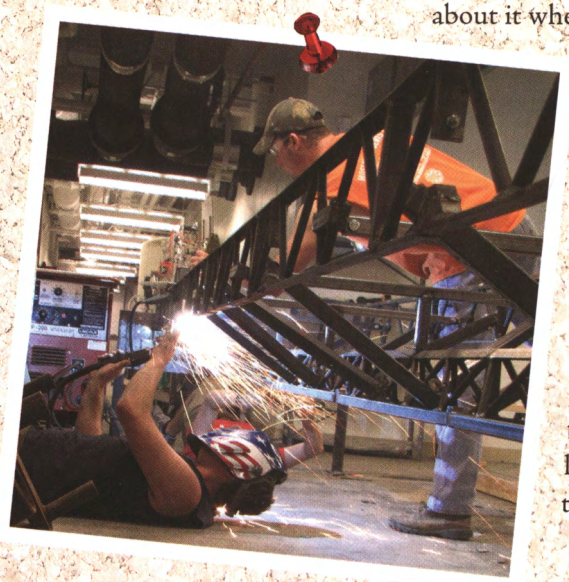
**President: Michael Stagg**

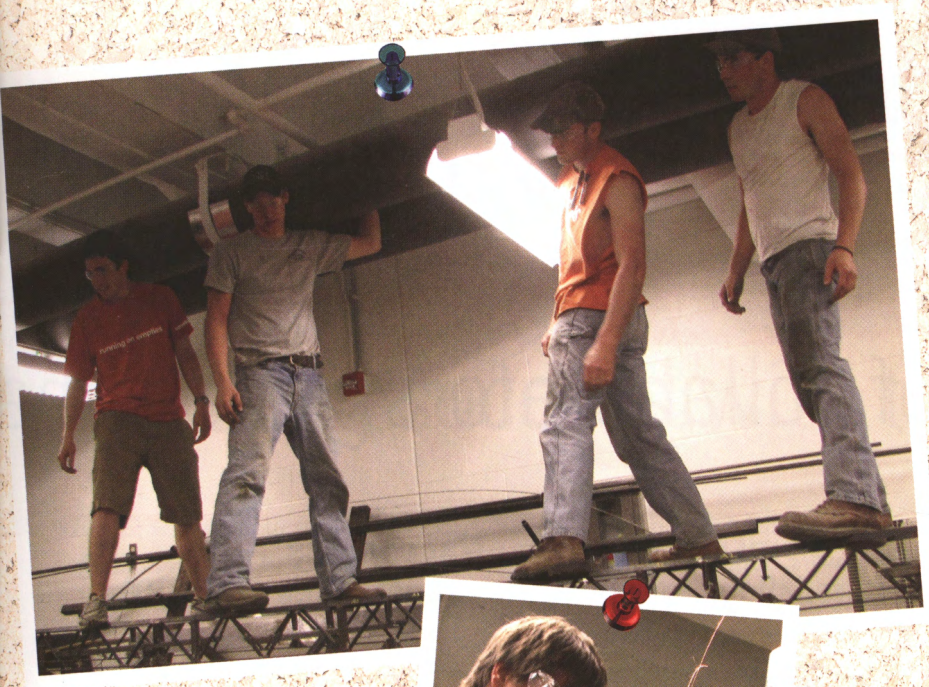
**Advisor: Hani Salim, associate professor of civil and environmental engineering**

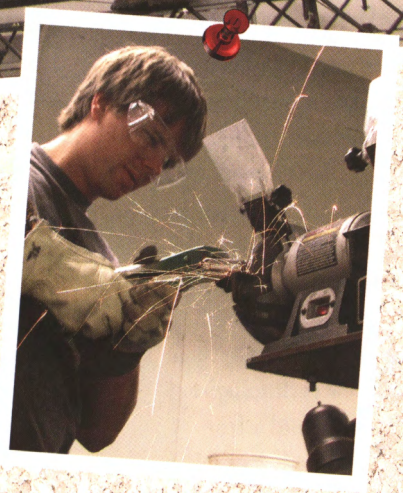
**Regional Competition: April 24-25, 2010, in Norman, Oklahoma, sponsored by the American Society of Civil Engineers**

"As the president of the steel bridge team, I oversee everything. I'm good at leading the team, motivating them and planning events, but there are guys on the team who trump me on doing the design," said Michael Stagg, Mizzou Engineering's ASCE Steel Bridge Team president. "The same for the construction. That's done mainly by guys that were raised on farms who can just look at a plan and do it."

Stagg, a senior in civil and environmental engineering, has been on the team since his freshman year. He first heard about it when he was in high school and then at a Mizzou Engineering Summer Camp. He was the only freshman to join the team that year. "I learned more the first two







years on the team than I did in my classes," he said.

Explaining the process the team goes through each year, Stagg said everyone throws out ideas and then they model them and test them in AutoCAD. The team spends the first semester designing and the second constructing the bridge, which unassembled must fit into a box that is three-and-a-half feet long and six inches in height and depth.

Steel bridge judging criteria includes construction speed, economy, and structure weight, strength and efficiency. "The rules change every year and are 35 pages long," said Stagg. "The process mimics real life, but on a smaller scale," he added, explaining that efficiency is key. "The more people and more pieces, and the longer it takes, means more money."

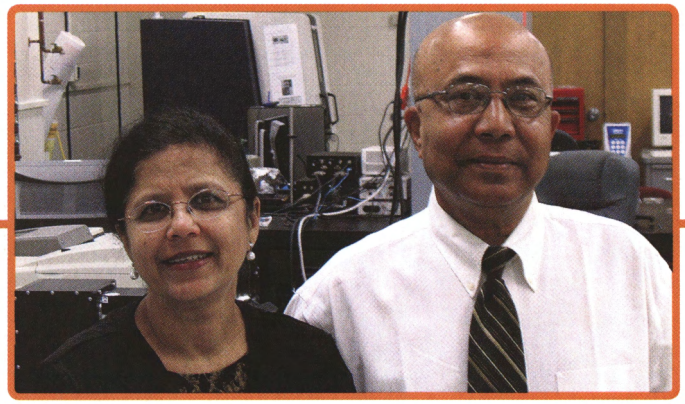
When the team was ready to build their bridge, they had narrowed their options to two designs. "One was extremely boring, but it would have guaranteed results and one was unique and is unlike anything we've seen," said Stagg, noting that they chose the latter. "Why go with a sure thing when you can try something new and different?"

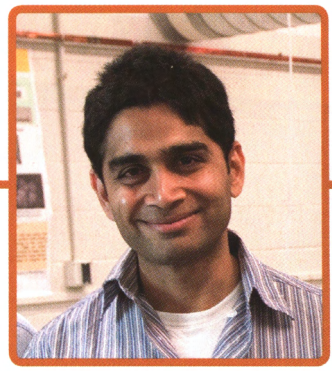
Stagg said the competition is a valuable learning experience in and of itself. "All of the teams have the same 35 pages of rules and the designs are so different. It just shows you how many ways here are to solve the same problem. It has given me a much more complete understanding of how things work in the real world; how engineers work together.

"Engineering is such a vast subject," Stagg added. "But all engineers are taught a way of thinking and working. It's a whole different way of looking at things.

"Even if we don't make it to nationals, there are a couple of guys on the team who have worked especially hard who I'd like to send. There you really are seeing the best," Stagg said.

*Thanks to Jashin Lin and Marty Walker for photos of the SAE team; Rick Whelove for photos of the hydrogen car team; Matt Walker for his photos of the seismic design team, Jashin Lin for her photos of the steel bridge team and others who provided snapshots.*





# In the company of collaborators, researcho

by Jan Wiese-Fales • photos by L. G. Patterson

Shubhra Gangopadhyay's diminutive stature belies her ferocity when it comes to finding answers and getting results, a characteristic she attributes to her husband Keshab's support. "He taught me to stand up for what I believe in," she said.

As successful research/faculty members at Texas Tech in the late 1990s, the couple realized through Shubhra's affiliations with researchers elsewhere that there were promising applications for biosensors that utilized her porous nanomaterial research. But difficulties connecting with biologist collaborators caused them to turn to the University of Missouri, lured by MU's life science program as evidenced though an earlier collaboration Shubhra had with Kevin Gillis, an MU biological engineering professor.

During her second interview for a faculty position in electrical engineering, the C.W. LaPierre endowed chair professor met and connected with Sheila Grant, one of Gillis' colleagues in biological engineering.

"My work with sensing mechanisms such as FRET [fluorescence resonance energy transfer], anti-body based biosensors and peptide based biosensors were a perfect mechanism to interface with her NPO [nanoporous organosilicate] platforms," Grant said.

Grant's passion for the work and the women's complimentary backgrounds sold Shubhra on MU, and in 2001, the Gangopadhyays moved to mid-Missouri where they have worked tirelessly in a variety of endeavors. Support from the College of Engineering, collaborations with other researchers, and millions of dollars in research funding from the National Science Foundation, the U.S. Army and the National Institutes of Health that have resulted in the discovery and development of novel nanoparticle applications have combined to make the couple's efforts extraordinarily fruitful.

As a result of their work, funding entities have access to new technologies. MU has gained recognition and a fee-based Nano MEMS semiconductor lab is available to outside research. Dozens of students and colleagues have benefited from research associations, and the Gangopadhyays have started two companies to commercialize their inventions, with potential benefits for industry, the military, the environment and AIDS patients in impoverished countries.

And now, said Keshab Gangopadhyay, a research professor in electrical and computer engineering and an adjunct professor with the Nuclear Science and Engineering Institute, another piece is about to fall into place: economic development in the form of jobs

"Things are so complex these days," he said. "We have a holistic approach, where the whole is more than the sum of its parts. It takes different people playing different roles to make everything work."

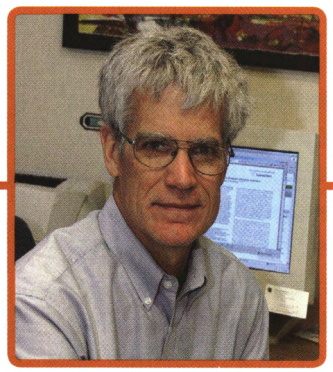
## Nanoporous organosilicates (NPO)

"I had initial data on the NPOs before I came to MU, but without access to a high-resolution transmission electron microscope, I couldn't really see what was happening," Shubhra said, explaining that MU's College of Veterinary Medicine has such a microscope, enabling her to see what was going on at the nanoparticle level. "We're talking about something the size of a few atoms," she said.

Shubhra credits her then-graduate research assistant Venumadhav Korampally, with working backward through the process to optimize these films through a radically new approach using organosilicate nanoparticles. His successful work to synthesize and use them to create crack-resistant films that were thick enough for the necessary applications was not a trivial undertaking.

Now a research assistant professor with the Nano MEMS Center, Korampally said he worked three years to uncover the secrets of the NPO films that spontaneously form through an entropy-driven process for their anti-reflective, anti-fog properties and for their increased luminescence capabilities when doped with dyes. The former is of interest in applications such as coatings for aircraft windows, and the latter is the





# rs have big success with tiny particles

basis for sensor applications.

"I was jubilant," he said of his successful breakthrough at the end of 2006.

"We were working to develop nanoparticle films with a water core waveguide," Korampally said, comparing the technology to both fiber optics and a sponge.

Shubhra pronounced it "a nanoparticle that is going places."

## One nanoparticle - many research collaborations

A first opportunity for nanoparticle-based films came in 2006 when the U.S. Army provided $5 million for several nanomaterial-based projects with defense applications, including fluorescence-based sensor platforms for the detection of chemical and biological agents. This provided Shubhra's group with the opportunity to fabricate fluorescence-based sensing microchips.

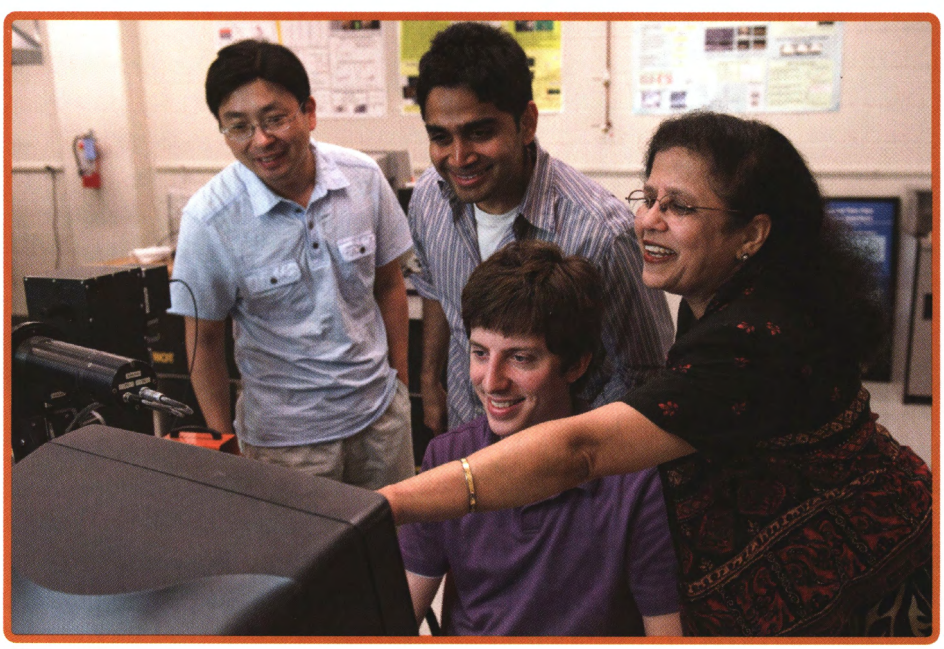
The second opportunity for the nanoparticle-that-could came in 2008 in the form of a two-year, $250,000 subcontract from InnoSense LLC. The California-based company is interested in developing the hydrophobic properties and superior strengths of the organosilicate nanoparticles for its antifog and abrasion resistant properties.

InnoSense received National Science Foundation Small Business Tech Transfer (NSF STTR) funding and partnered with Shubhra to further develop and test the coatings for potential clients such as Boeing. They are additionally interested in making the process as inexpensive as possible.

Korampally's nanoparticle also has been put to work in its detective role as a sensor platform with the successful funding of two additional projects, both with MU collaborations.

Annette Sobel, who serves as MU's assistant to the provost for strategic opportunities, provided invaluable assistance in writing a successful funding proposal to the U.S. Army-affiliated Leonard Wood Institute (LWI) for nanosensor biological and chemical agent detection.

Sobel, a former major general with



**Professor Shubhra Gangopadhyay, far right, points at optical modeling of nanoporous organosilicate films, happy for the "good news" she and her group find in the data. From left, doctoral student Sangho Bok, Research Assistant Professor Venu Korampally and doctoral student Chase Darr.**

**At top, l. to r., MU research collaborators working with NPO film sensors include, Electrical Engineering Professors Shubhra and Keshab Gangopadhyay, Electrical Engineering Research Assistant Professor Venu Korampally, Biological Engineering Professor Sheila Grant, Assistant Professor in Medical Pharmacology and Physiology at MU's Dalton Cardiovascular Research Center, Luis Polo-Parada and Biochemistry Professor William Folk.**

the National Guard, said she is able to serve as subject matter specialist in areas of critical need for the military. She has co-authored a dozen proposals to military entities.

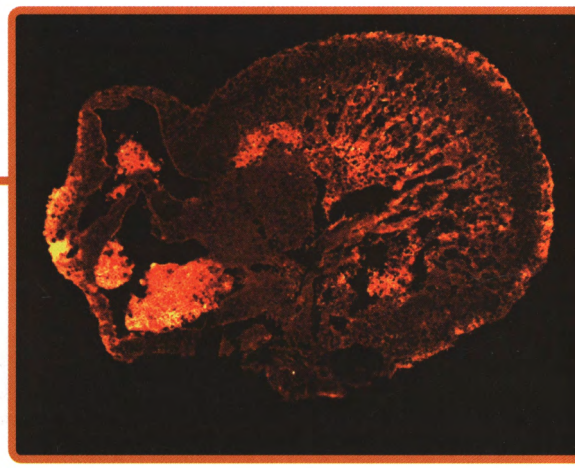
"This [chem/bio detection] research is a big need for the military," Sobel said. "Its force protection capabilities are of great importance to them."

LWI awarded $540,000 to Shubhra and Korampally to develop real time, field deployable sensor platforms to detect the presence of botulinum and TNT. Collaborators include Grant, Luis Polo-Parada, an MU neurobiologist who serves as an assistant professor in medical pharmacology and physiology and is a researcher at MU's Dalton Cardiovascular Research Center, Bal Ram Singh, director of the Botulinum Research Center at the University of Massachusetts, and Keshab, who serves as president of NEMS/MEMS Works, LLC, one of the Gangopadhyays' companies responsible for licensing the nanoparticle technology from the university.

In Shubhra's lab, collaborator Korampally is overseeing the development and optimization of the NPO-based sensor platforms. UMASS is providing surrogate test materials and will test the sensors with actual botulinum. Grant is working with binding the proteins, and Polo-Parada's lab is working on a mobile detection unit.

A student research team consisting of biological engineering senior Bryant Harris and doctoral bioengineering student Chase Darr, have been working between the MU labs.

"The key to the students' success is dual advisors," Shubhra said in reference to Polo-Parada's and Grant's essential roles in the project. "I give Sheila a lot of credit for teaching me biology. I learn through my colleagues and students. No one in my group had a biology background."



"This is interdisciplinary research," said Keshab. "Some things we don't understand, but if you talk to people, you can work through it."

Describing the basic goal of the sensor project, Darr said, "What we're trying to do is to get a change in fluorescence with a change in concentration of the toxin."

"We start with a silicon wafer as a substrate," Harris explained. "We spin nanoparticles onto the surface and do a heat treatment to create pores and then functionalize them with carboxyl groups so as to attach biological sensing probes."

Fluorescing peptides specific to Botulinum — and in the case of TNT, fluorescent anti-bodies — attach to the protein-functionalized surface, which in turn attach to the surrogate toxins.

"On the five-by-five millimeter chip there could be millions of proteins. You can't see them, even with a microscope.

**Above left, Research Assistant Professor Venu Korampally looks at atomic force microscope surface images of organoporous nanoparticles. The image that fills his screen is of an area two microns in width, smaller than a human hair.**

**Above, Korampally and doctoral student Sangho Bok look at nanoporous films in the college's Nano MEMS fabrication lab. The films, spontaneously patterned through a surface energy assisted technique they invented, will be used to pattern hundreds of sensing microarrays on a single chem-bio detection chip, seen at right.**

**Far left, novel dye-doped nanoparticles — synthesized in the lab — are highly fluorescent with exceptional long-term stability and are currently being applied for sensor development and immunofluorescence imaging, at right is an image of a glowing chicken heart made possible with the attachment of these nanoparticles.**

Once you add the toxin, it cuts the protein and the loss in fluorescence can be measured," said Darr.

"We are getting some good results," said Polo-Parada, who is working to develop the mobile detection unit that he has named "The Cube." It is about the size of an old Brownie camera.

"This small device will replace an entire microscope that could cost thousands of dollars, yet it costs only $1,600," he said. "It can send information by cell phone and the Internet.

"Many times you challenge what is known with nanotechnology. Materials at nanoscale have different properties," Polo-Parada said.

Shubhra praises Polo-Parada's work on the project and his mentoring of the students. She met him when she gave a talk at Dalton. Afterwards, she said, he approached her and said he would be interested in working with her.

"If we don't use these technologies, they just sit on a shelf," Polo-Parada said. "You need to find the people you are comfortable working with and do so. That's how things get done."

The other collaborative research effort on the MU campus that utilizes the NPO platform is a $100,000 Tibotec Pharmaceutical Reach Initiative (Research and Education in HIV/AIDS for Resource-Poor Countries) awarded to MU Biochemistry Professor William Folk.

Folk had been hoping to develop collaboration with someone in nanotechnology and signal detection when he and Shubhra crossed paths at a function meant to introduce physicians and engineers for potential interdisciplinary research.

Folk's research focus involves plant-based medicines that African HIV/AIDS sufferers use to treat the symptoms of their disease.

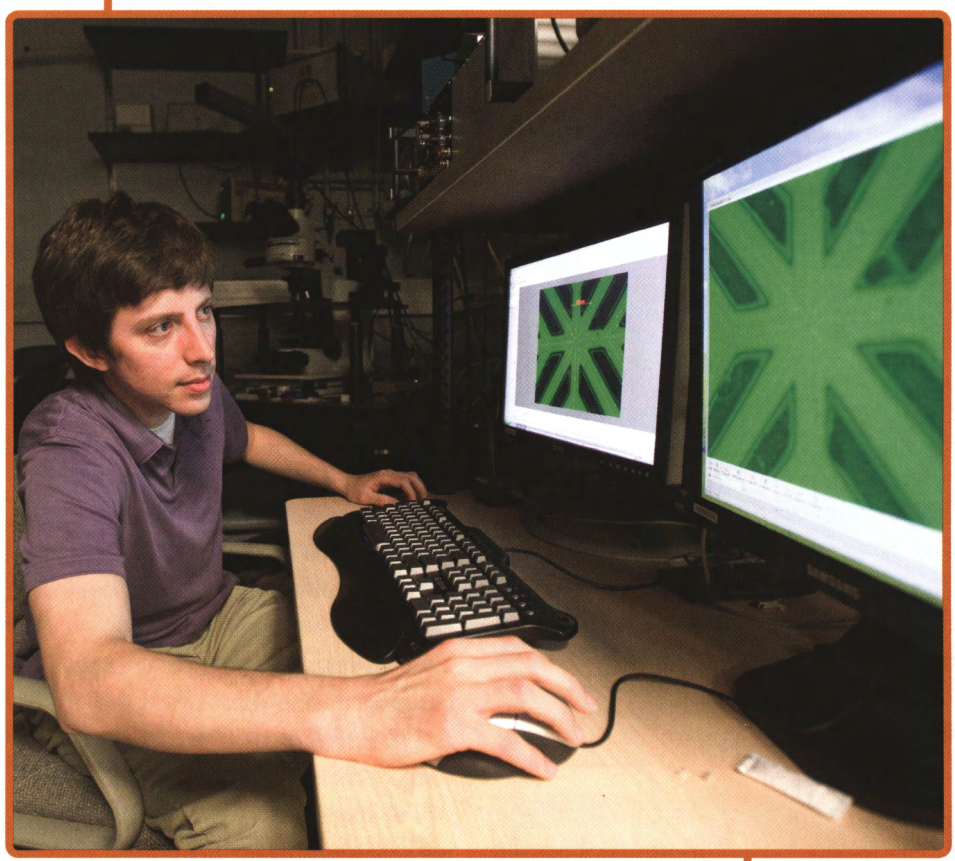
"I've spent many, many years looking at traditional medicines," he said. "Most of the world relies on experience, guesswork and superstition to guide their treatment."

Folk said that after all this time, a clinical trial is being conducted to assess the usefulness of the plant *Sutherlandia frutescens* in the treatment HIV/AIDS, but that there is so much more that needs to be done.

"What is needed is a simple robust, diagnostic device that will allow individuals to manage their health with both traditional medicines and Western drugs," Folk said. "We don't know how our drugs react or interfere with each other.

"I think the tools Shubhra is working on have particular applications that make them suited for this purpose," he said.

Shubhra alerted Folk to the talents of engineering doctoral student Sagho Bok, and to an NIH "Biodetective" training grant intended to improve tools




**At top, doctoral student Chase Darr reviews images of the fluorescing nanoporous organosilicate biosensor films being developed with funding from the Leonard Wood Institute to detect the presence of TNT and botulinum. Above, Professor Luis Polo-Parada of MU's Dalton Research Center, shows the wireless sensors he is developing to use in conjunction with the sensor films to make the detection of hazardous materials both portable and nearly instantaneous.**

for healthcare. This funding allowed Folk to hire Bok to work in his lab.

"I am using NPO films and dye-doped nanoparticles to detect the activity of one enzyme," said Bok. "We are attempting to use them with a dip-stick-based diagnostic device similar to a pregnancy test using urine samples."

The enzyme referred to by Bok is cytochrome P3A4 (CYP3A4). CYP3A4 metabolizes endogenous cortisol to 6β-hydroxycortisol (6β-OHC), which is excreted in the urine. The ratio of cortisol and 6β-OHC can serve as an in vivo indicator of CYP3A4 levels.

Knowledge on the enzyme level is particularly important for HIV-positive individuals relying on anti-retroviral drugs to manage their HIV disease, and also relying upon traditional medicines for other healthcare needs, which may cause herb-drug/drug-drug interactions. The enzyme level in terms of the ratio of cortisol and 6β-OHC can be measured in urine with the NPO test.

Also an important collaborator in this project is Purnendu Dasgupta, Jenkins Garrett professor and chairman in the department of chemistry and biochemistry at the University of Texas-Arlington. An expert in chemical sensors, Dasgupta inspired Bok to improve the sensitivity and detection limit of his fluorescent nanoparticles through web meetings and discussions.

"Sango has put our efforts on a solid foundation," said Folk. "I've enjoyed working with him."

A number of additional interdisciplinary funding proposals utilizing the NPO platform have been submitted. "We do not care who is the primary investigator," Shubhra said. "The main thing is that we need to support these projects and hopefully some will get funded."

## Commercialization

Another important area of research for the Gangopadhyays' is nanoenergetic materials, primarily with defense applications.

"In 2004, we started NEMS/MEMS Works LLC," said Keshab. "We realized that although nanoparticle research was new, there would be applications and real products that could be ready."

"We are at the stage when we could go really big, bridging the gap to real commercialization," he added, saying that they had completed Phases I and II of their Small Business Innovation Research (SBIR) funding in the amount of $850,000, and are proceeding to Phase III: putting the products on the market.

Steve Apperson, vice-president of NEMS/MEMS, completed his doctoral in Shubhra's lab characterizing nanoenergetic materials and their applications in medicine, defense and sensing technologies licensed to the company by MU.

The U. S. Army's Engineering Research and Development Center (ERDC), in Vicksburg, Miss., recently provided $275,000 for collaboration between NEMS/MEMS and MU to develop an NPO-based prototype sensor for detection of ground water contaminants. The microdevice platform for environmental sensing offers another possible avenue for commercialization. The Gangopadhyays credit the efforts of MU alumnus Jeff Steevens, an ERDC scientist, for the success of their proposal.

Another promising collaboration is one with Don Nissanka, an engineer by training and a highly successful businessman formerly affiliated with Kokam batteries. Nissanka approached the Gangopadhyays with expressed interest in partnering with them on nanotechnology for defense and commercial products.

Nissanka recently started a new company that will work with NEMS/MEMS on a project for which they intend to raise up to $12 million dollars. Nissanka and Keshab have approached many in the defense industry aiming to convince them to take a look at the capabilities of their energetic nanotechnologies.

Keshab also is optimistic about a potential opportunity to offer their nano products on the Sigma-Aldrich website. The company is an international leader in life science and technology products.

The Gangopadhyays' second company, Nanos Technologies LLC, was incorporated in 2009. It is the company for all of their research that is not related to nanoenergetics, including their sensor and anti-reflective, anti-fog applications. The NPO technology has been licensed to Nanos Technologies exclusively. Bok, who was awarded a doctorate in May, will be working for the company.

Nanos Technologies is investigating additional technologies, among them biomedical imaging, food safety and global healthcare, Keshab said.

"We really believe in the work that Bill Folk is doing and would like to make this a non-profit component of NanosTech," Keshab said.

The Gangopadhays are very interested in economic development and are committed to keeping their business operations in Missouri to give back to MU and the state that has provided them with such opportunity.

Both NEMS/MEMS Works and Nanos Technologies are members of the recently established Nano Technology Enterprise Consortium (NTEC).

"Things are going well. I see no reason that we should not succeed," Keshab said.

## Giving Credit

Beyond their successful funding and research collaborations, the Gangopadhayays give credit to the role the staff and students who have worked with them has had in their success.

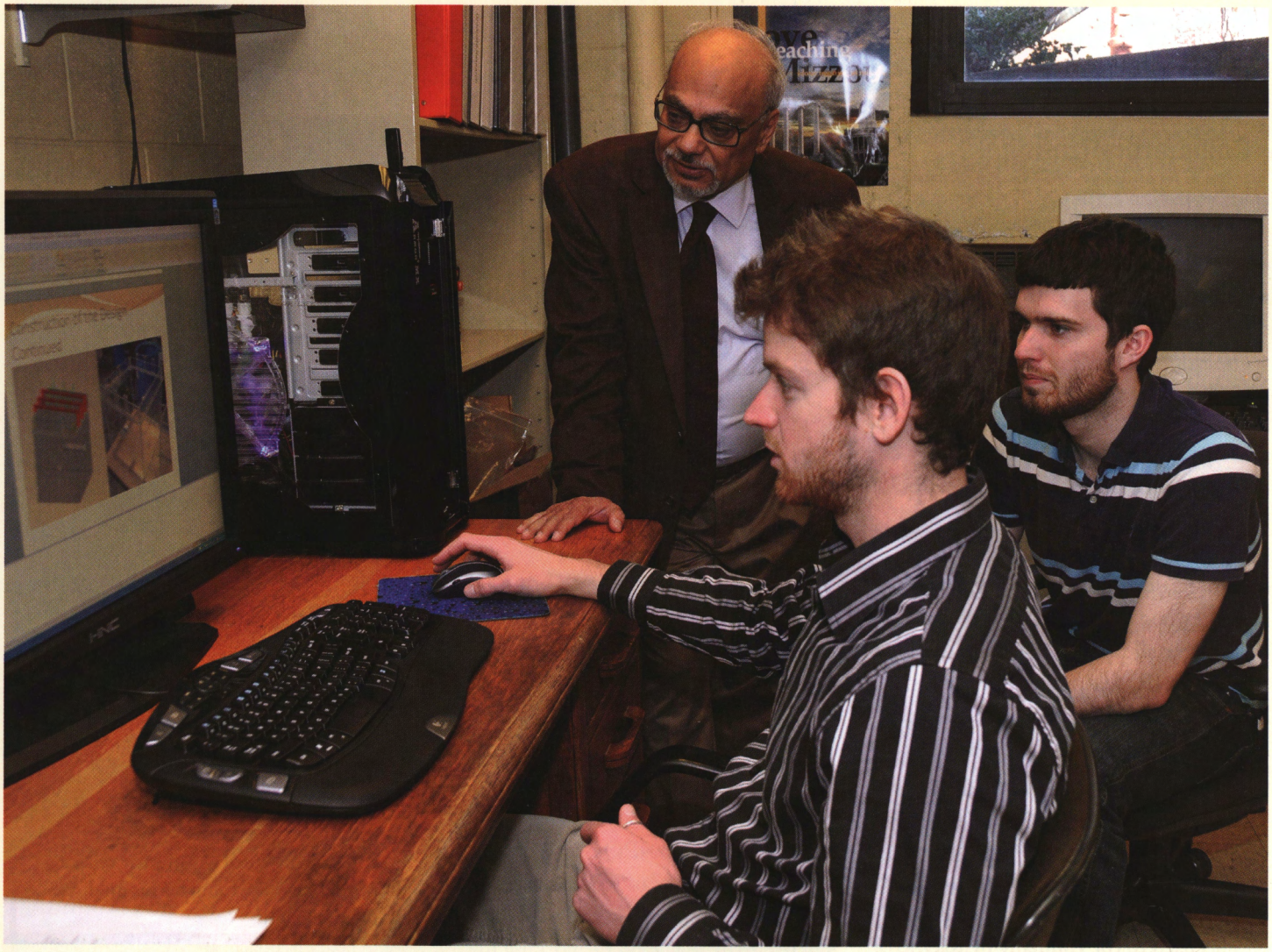
"The College of Engineering has encouraged collaboration and also provides support with people like Shelley Hilton, Monica Frank and Jan Rudeen, who makes everything run smoothly," Shubhra said. Their respective roles are grant writer, grants and contract specialist and administrative associate.

"The tremendous progress made in the NPO research also is due to many students working tirelessly to boost this technology to the next level," she said.

Somik Mukherjee, a recent Westminster College graduate, has worked for the last four summers with Korampally and Bok in developing the technology. He joined MU as a graduate student because he believes that these tiny particles doped with dye can enhance the efficiency of solar cells, a project he is pursuing for his graduate research work.

Jake Fischbach, an MU electrical engineering graduate, is helping Korampally with coating projects; Steven Hamm, who worked as an undergraduate, is now a master's student utilizing NPO particles in his device for nuclear-based electric power generation; and Sami Pathan, a Rockbridge high school student, has aided Korampally for the last two years testing the NPO-based coatings.

MU staff partnerships have boosted the commercialization aspect of the Gangopadhyay's novel nanomaterials. Gregg Scheller, MU's director of entrepreneurship and industry relations, has mentored Keshab in developing business plans and carrying out the negotiation processes. Wayne McDaniel, senior licensing and business development associate, and Jim Gann, director of technology business development with MU Extension's Small Business Development Center, have provided invaluable support as well.



# Research gives mechanical engineering students a taste of real world design and manufacturing

by Jan Wiese-Fales • photos by Dory Colbert

Sherif El-Gizawy has been a mechanical engineer and professor for more than 30 years, and for the past 23 of them he has taught and conducted research in his area of expertise — design and manufacturing — at the University of Missouri.

Much of the research that he and his students have tackled has been conducted in partnership with private industry. El-Gizawy's research focuses on developing mechanistic-based models. These models are used to make essential predictions of quality and damage management in materials that, during fabrication, are subjected to severe process environment due to thermal and mechanical loading. His work characteristically has a strong experimental component, but leads to predictions that are essential to process and product design methodologies.

"One of our strengths is the team approach because that is how the students will work in industry," El-Gizawy said. "That is also why companies such as Boeing, Honeywell, Hubbell, 3M, Schneider Electric, Stratasys, I Tech D& M and others keep coming back.

"They have performance issues with product or manufacturing system design that need to be addressed and we have the knowledge and manpower to find solutions. We decided from the very beginning that we would be partners and they welcomed this idea."

El-Gizawy's industry-university partnerships include a 20-year affiliation with The Boeing Company, an international leader in the fields of aerospace, commercial and military aircraft engineering.

"I enjoy working with Sherif and Boeing has funded his work for a number of years," said Gregg Bogucki a 1976 gradu-

ate of Mizzou Engineering now working at Boeing Research & Technology, the company's advanced, central research, technology and innovation organization. "The students also are a pleasure to work with."

El-Gizawy and his student research teams have successfully worked through a variety of challenges posed by Boeing, and as different as each may be, their approach is basically the same.

"We do functional decompositions," El-Gizawy said. "We identify all sub-systems and what their different functions are. It makes us identify the key factors that affect the design.

"We use modern design tools such as quality function deployment (QFD) that incorporates the voice of the customer — Boeing and their supply chain — into the design process."

Currently, two fuel system projects for Boeing are being investigated for performance optimization by MU research teams. In addition, a third ongoing Boeing project focuses on materials, processing and structure system design for durability and cost, a project that parallels El-Gizawy's personal research area.

The Boeing project involves design and optimization of digitally manufactured aerospace components, through a process known as rapid manufacturing that utilizes fused deposition modeling (FDM), though El-Gizawy's student researchers also are looking at additional applications as part of their mentor's personal research.

All research teams meet with Dr. El-Gizawy on a weekly basis to report on progress and exchange ideas.

"I learn with my students," El-Gizawy said.

"We have very good students at MU, and that has encouraged me to stay here. I don't believe I could find better students anywhere."

## Industry capstone projects

As team leader of a research group working on one of the fuel system projects, Zane Smith said for the first few weeks he worked closely with Boeing as he and fellow seniors Jacob Atchley, Jordan Harsell and Timothy Kemp decided how to approach construction of a model.

"Building the tank ourselves was a big deal. It was hands-on manufacturing. I'd never even had any experience with power tools," said Smith.

The research team was in frequent contact with Boeing through Web conferences to give updates on their work and to have their questions answered, which Smith said was very helpful as well as an eye-opening view into the real world of industry.

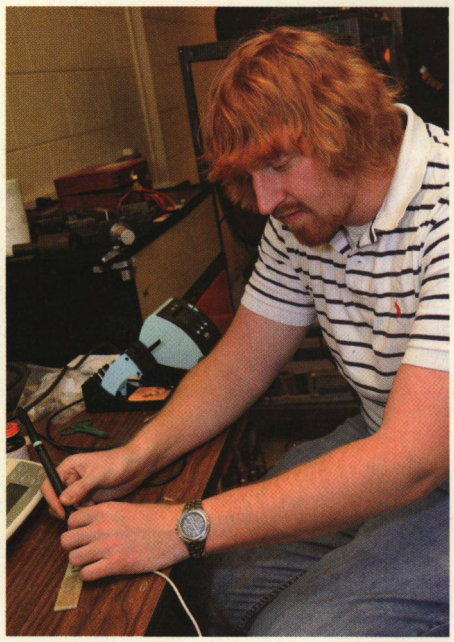
Consultations with Mizzou Engineering technicians Rex Gish and Rich Oberto were also invaluable in the process. Both Smith and El-Gizawy praised the techs' involvement in this project and others.

"Unlike a regular class, you get to see your design come to life. When we actually got it to run, it was like Christmas," said Smith.

The project is set to continue for two more semesters with another research team. Smith, who has accepted a full-time job with 3M, has agreed to get the next group of students started.

"I'm really interested in seeing the outcome," he said.

Michael Heins, a senior in mechanical engineering, has been working in El-Gizawy's lab as an honors research assistant since last fall. He and the team, working on the second Boeing fuel system project, made their presentation to the Industry Advisory Council (IAC) of Mechanical and Aerospace Engineering at semester's end. The work will continue even as he is off to the University of Arizona this fall to study law. He has wanted to be a lawyer since he was in sixth grade and aims to work in the area of intellectual property, but said that a career in engineering as a fallback is a very good thing.



**Above, mechanical engineering senior Clayton Zak, readies a fused deposition modeling (FDM) sample for testing in Professor Sherif El-Gizawy's lab. At left, El-Gizawy reviews capstone project progress with seniors Brian Graybill and Michael Hines.**

"I've really enjoyed working with Dr. El-Gizawy. He is not as interested in the highly theoretical concepts. He understands the real world applications and working with companies," said Heins. "He understands what they want."

Domenic Marcello, a fuel thermal systems engineer with Boeing who is working with the capstone groups on both of the company's projects, said that it was his first time interfacing with students and that it has been a good experience.

"It's been a pretty good set-up. It was a learning experience for me, different from my daily routine, but it worked out really well," he said. "We had good milestones and it was good for the students."


## Direct digital manufacturing

With the standard manufacturing method of injection molding, companies must spend up to $100,000 for a mold when they need new parts. These are molds that can't be produced overnight.

"With the new methods we are testing, no special tools are needed to produce parts. We are working to develop the process and redesign the product to match the process," El-Gizawy said.

The process he refers to is known as fused deposition modeling (FDM). It is a new materials processing technique that makes use of information technology and layered manufacturing (LM) methods. FDM is suitable for rapid manufacturing of functional products required for small production volume where tooling costs must be kept at a minimum level. Aerospace companies like Boeing, and biomedical industries are potential users of the developed technology. El-Gizawy's research is exploring the possibilities of the latter application.

In May, El-Gizawy gave a presentation on his FDM research at the The Society for the Advancement of Material and Process Engineering (SAMPE) International Conference and Exhibition held in Seattle, Washington.

"FDM of functional products makes it necessary for the selected process to deliver parts with the needed geometrical

**At top, mechanical engineering graduate student Joe Cardona loads a fused deposition modeling (FDM) sample into a testing machine in Professor Sherif El-Gizawy's lab. At left, El-Gizawy and Brian Sabart, a senior applications engineer for Direct Dial with STRATASYS, Inc., one of El-Gizawy's collaborators, pose with one of the company's new products in front of their FDM machine at the Society for the Advancement of Material and Process Engineering (SAMPE) International Conference and Exhibition held in Seattle, Washington, May 17-21, 2010, where El-Gizawy gave a presentation on his research.**

and physical specifications that will satisfy function requirements," El-Gizawy said.

"As the tolerances on the variation of part size, shape, and integrity become tighter for FDM-built products, the need for prior determination of process-induced properties and microstructure is felt even more in the industry," he added.

El-Gizawy's lab is developing reliable product and process design models for FDM technology and evaluating the functionality of rapid manufactured products for strength and stiffness under different service conditions. Two mechanical engineering graduate students, Brian Graybill and Joe Cardona, and mechanical engineering senior Clayton Zak, have worked as a team with El-Gizawy to model and optimize the FDM process.

"We are attempting to understand and optimize FDM so that it can be used for rapid manufacturing of functional products," Graybill surmised.

Currently, the process of selective laser sintering (SLS) is used, in which a powder is bound in a cross section each time the laser traces over it. But, Graybill said, there are difficulties with SLS. The optics are complicated and fabrication time is increased because the product cools slowly.

"With FDM," Graybill said, "the build material can be a liquid so the process is easier and material selection is broader. We are doing modeling and testing of materials and results are coming in quickly."

"We are looking at the end result — whether the process can be used in real parts and how they would behave in real conditions, characterizing it with a finite element analysis to see if the parts will fail," said Zak.

Graybill likened the process to detective work. "You can ask all the questions in the world but what's important is asking the right questions," he said.

"It's tested as a bulk material," said Cardona. "We attach a strain gauge to samples and run a tensile test until it fails. It measures strain, force and displacement. Using Excel, I can take the data and extract material properties for analytical modeling."

The research group also has scanned the material under an electron microscope to determine the material's porosity.

"It's nice to see results after all of our testing. It helps that it actually worked," said Zak of the team's success.

Currently the technology and materials are expensive, but if only a small number of parts are necessary and they could be manufactured overnight with FDM, in the long run, the process would save time and money.

"If the process were to become robust enough you could do a CT scan of a hip and build a replacement specifically for that person," said Graybill, referencing research being conducted by El-Gizawy.

"You could do things like build a single part for damaged vehicle like a military humvee and repair it immediately", he added.

"I can foresee the future of this process, and it's something like Star Trek," said Cardona. "You have one of these machines and you need something — say a shovel — and you push a button and come back in a short time and you have a shovel.

"I like the idea of getting to work on something new and that the work will contribute to society in a positive manner," Cardona added. "The sky is the limit with this technology."

"Research like this is what excites students," El-Gizawy said of the work being conducted in his lab.

"I love teaching. It is a rewarding profession," he reflected. "My grandfather was a teacher. My mother was a teacher. If you need to learn something well, teach it."

*Editor's note:* Graybill and Cardona completed their master's degrees in May. The former is weighing his options and the later is exploring the job market. Zak is headed to law school with an interest in patent law.


**Mechanical and Aerospace Engineering Professor Sherif El-Gizawy poses with his research team, from left, senior Clayton Zak, El-Gizawy, senior Michael Heins, graduate student Brian Graybill, graduate student Joe Cardona, senior Bryant Kagay, senior Zane Smith and senior James Berlin.**

**Missouri Water Resources Research Center**

# Helping Missouri communities with water safety choices

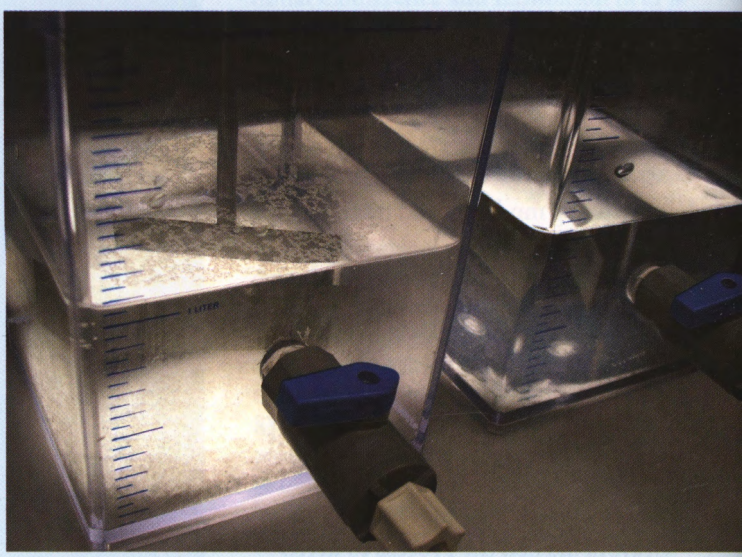
by Anita Neal Harrison

There are a lot of public water operators who would like to blow some steam right now.

Their frustrations flow from tightened federal regulations on certain "disinfection byproducts," suspected cancer-causing chemicals created in the water treatment process. Public water suppliers aren't steamed with the Environmental Protection Agency for regulating a health risk; they are frustrated because they don't know what to do to purge the threat.

"The problem is we can't turn around and start adding our disinfectant byproduct remover — there isn't one," said Everett Baker, an environmental engineer with the Missouri Department of Natural Resources who works with communities to ensure they are in compliance. "We're equally frustrated at the Department [of Natural Resources] because we understand communities are willing to comply but don't know what to do. It's a lot easier to get into compliance when you know what to do to get into compliance."

That is where Mizzou engineers can relieve some of the



**Water being tested is slowly churned in "jars," allowing clumps to form and unwanted solids to settle out, transforming turbid water into clear water. Missouri Water Resources Center is helping locales comply with new regulations**

pressure. Faculty and students at the Missouri Water Resources Research Center are collaborating with communities to understand how the byproducts are formed and to optimize their removal.

"We're helping communities to evaluate appropriate strategies," said Enos Inniss, a civil and environmental engineering assistant professor who is leading a project involving three northeastern Missouri communities. "There's a list of things you could do, so we're working with these communities to evaluate which ones are most appropriate for their water systems."

Nationwide, small communities are having the most trouble meeting the new standards. Big cities with a big customer base have the resources either to hire private firms to research solutions or to bring in expensive technologies, such as reverse osmosis systems.

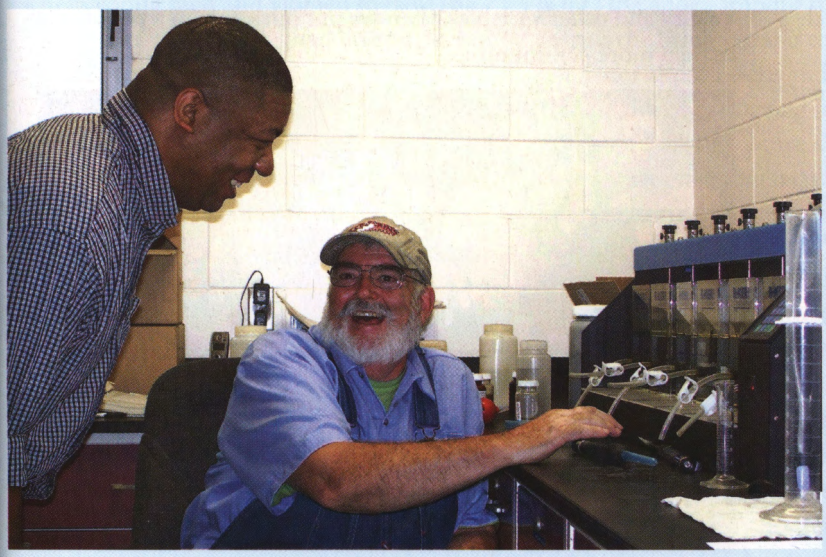
Realizing small communities don't have those kinds of resources, the federal government created a national network of eight Environmental Protection Agency Technology Assistance Centers. These centers provide low-cost assistance and expertise to small communities struggling to meet the new standards. One of these centers, the Missouri Technology Assistance Center (MOTAC), is housed in the College of Engineering-affiliated Missouri Water Resources Research Center, and it is through MOTAC grants that Inniss is helping three northeast Missouri communities, Monroe City, Trenton and Marceline, discover exactly where and how the unwanted disinfection byproducts are entering their water systems.

The basics are already understood: Disinfection byproducts result when chlorine and other disinfectants combine with naturally occurring organic materials in the water, such as decaying leaves. As doing without the disinfectants is not an option — the public frowns on cholera, typhoid and other such outbreaks — Mizzou engineers are focusing on managing the organic "precursors" that react with chlorine to form the unwanted, regulated byproducts.

"A lot of the methods we're looking at are to prevent or at least lower the formation of the disinfection byproducts [as opposed to removing them after formation]," says Inniss, who earned his PhD in civil engineering at the University of Notre Dame and spent six years at the University of Texas at San Antonio before coming to MU in 2007. "If we can lower the amount of precursors that are present, then we don't have to make adjustments to the chlorine dosage."

For the three northeastern Missouri communities taking part in MOTAC's "Small Systems Assistance Field Program," the plan to lower disinfection byproduct levels has two phases. In the first, Inniss and his team of graduate students took water samples throughout the water systems, starting with points of raw water acquisition and going through the treatment process, water towers and distribution pipes. Then the team used specialized equipment back in Inniss' lab at MU, equipment purchased with EPA grant monies, to determine the levels of organic precursors at each sampled point, as well as the levels of trihalomethanes and haloacetic acids, the two types of disinfectant byproducts regulated by the EPA.

That gave Inniss and his team detailed profiles that showed the potential for byproduct formation, as well as the actual byproduct levels, at each stage of the water system, which in turn allowed the researchers to locate optimal points for treatment. Those findings brought them to the second project stage, which



**Professor of civil and environmental engineering, Enos Inniss, discusses expectations of "jar" results with Roger Sullivan, chief operator of the Marceline, Mo., water treatment plant.**

**Master's student Colleen Kenny, at left, and undergraduate Jessica Waller are working to cross-check all available treatments to eliminate potential harmful chemicals in drinking water.**

is still ongoing and focuses on evaluating different treatment strategies. Because every system begins with different raw water quality, uses different treatments and distributes water in different ways, what works really well for one water system might not work at all for another.

As Inniss and his team go through the list of potential treatments for each community, no one is expecting to find a silver bullet; instead, Inniss expects most communities will have to do a combination of treatments, and some might have to make adjustments throughout the year to accommodate seasonal water changes. However, a general technique he is exploring now is "enhanced coagulation." Treatment facilities already use coagulation, a chemical/physical process in which either iron or aluminum salts are added to the water to cause particles to become more attracted to each other. The water is then slowly churned, allowing clumps to form and unwanted solids — some visible, some not — to settle out, transforming turbid water into clear water.

That process also helps remove some of the precursors, but to optimize the effect, operators will need to add more iron or aluminum salts before churning, thus the name "enhanced coagulation."

Another tactic Inniss is researching is using activated carbons to absorb the precursors; because there are several activated carbons on the market, he is running experiments to see which kinds work best for the different waters.

All of the methods Inniss and his team are exploring have been proven effective somewhere; innovation for them is limited to potentially new combinations of treatments. However, other researchers with the center are exploring new methods. Dr. Tom Clevenger, a civil and environmental engineering professor and director of the Missouri Water Resources Research Center, mentions he's excited about a nanocarbon material impregnated with iron that a Mizzou Engineering grad student developed to remove arsenic.

"It's really a super-material," Clevenger said. "It was so-so effective for the intended purpose, but I think it might have potential for removing these precursors. If we got really lucky and it worked, then that would be a breakthrough, in my opinion."

Helping communities sort through their options is a service that separates the University from a certified lab, which can also provide communities with profiles of their systems.

"The lab will send back: 'Here are the results. You interpret what you want to do from here,' " Inniss explained. "When I go and meet with the community, I say, 'This is what we did, this is what we found, these are some of the things we learned, and these are some of the things we think you can do.' That's where the communities that have chosen to use the university are getting an extra benefit from the relationship."

It's a benefit Donnie Parsons, superintendent of utilities at the Monroe City Water Treatment Facility, appreciates.

"I get to be involved," he said of the process. "We help collect samples, we know where they are collecting, and we are able to run comparison tests at the same time. It just helps our operators out to be involved in the study and to see results, what the water was doing that day, at that temperature."

Echoing this sentiment is Roger Sullivan, chief operator of the Marceline Water Treatment Plant. He said, "I'm able to make suggestions, 'Let's try this or try that or not use this, if possible,' so it's a real partnership between us, the University of Missouri and the Department of Natural Resources."

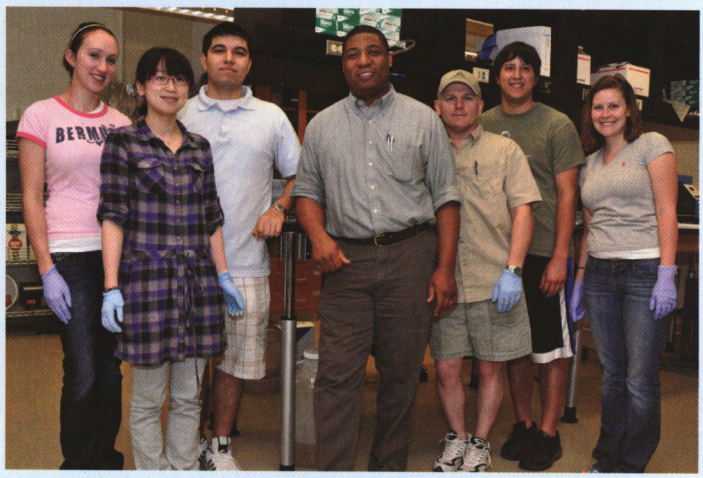
Sullivan also points out the financial advantage of teaming up with Mizzou Engineering, an advantage that can add up to tens of thousands of dollars.

"We're a town of 2,500," he said, after mentioning the cost benefit. "It doesn't take long to figure out who you're going to go with."

Inniss anticipates the project communities won't be the only ones to benefit from the research. He's hoping to unravel mysteries concerning which precursors react to create which byproducts, along with how and in what conditions.

"There are still a lot of questions that need to be answered, and the minutia of the details that we're looking at from that perspective are not what the communities need," he said. "They need to know, ' If I do this with my water, will I see a reduction in disinfection byproducts?'

"We're able to give them that information, but then we also start asking why: 'Why does this strategy work for Community X but a different strategy works for Community Y?' As we start getting a better feel for how the different strategies tie to water quality and other variables, then we put ourselves in a position to help more communities."



**Civil and Environmental assistant professor Enos Inniss poses with his lab assistants, from left, Colleen Kenny, Juan Wu, Ronald Smith, Inniss, Dan David, Will Scheidt and Katy Dickherber.**

# Generous gift to build chemical engineering graduate program

Since earning his bachelor's degree in chemical engineering from the University of Missouri in 1968, Robert Holtsmith said he has been blessed with a successful career, not to mention a 43-year marriage to a woman — Dorcas (Hoffman) Holtsmith A&S '67 — he met at MU. His strong ties to MU and his gratitude to the College of Engineering made joining the Chemical Engineering Department's Industrial Advisory Board (IAB) an easy choice.

As a board member, Holtsmith witnessed firsthand the efforts of promising new faculty members to grow the Chemical Engineering Department's graduate program. Seeing that he could make a difference, the retired Conoco manager made a $100 thousand gift, in two $50 thousand installments, to the department's graduate program to help recruit top-notch students.

"The education I received here served me well in my career and life. There's only so much engineering you can do on your own, and the broad education that I got at MU was very good," said Holtsmith. "When I saw the work the department was doing and the chance to help young men and women to have the same experience that I had, I thought I would return the favor."

Matthew Bernards, an assistant professor in chemical engineering since 2008, and chair of chemical engineering's graduate admissions and recruiting committee, said that one of the main issues in attracting top students is the stipend they are offered, and that typically the best students migrate to universities with larger offers.

"That's where Bob stepped in. He gave us some flexibility to provide incentives to search out those gifted students," said Bernards, explaining that enticing bright young graduate students to join the department's research teams provides benefits in the lab, but also helps the department overall.

"Recruiting students from top-20 programs raises our reputation," Bernards added.

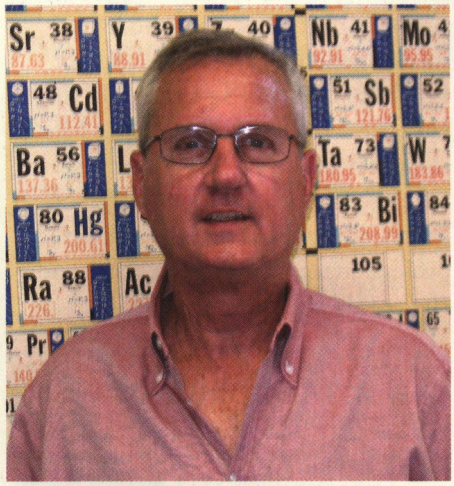
Patrick Pinhero, an associate professor and director of graduate studies in chemical engineering who joined the faculty in 2007, said, "A strong graduate program benefits chemical engineering as a whole, including the undergraduates. It complements our undergraduate program by bringing greater access to cutting-edge research, and increases faculty and student visibility through publications and awards. This further enhances the department overall by improving our reputation and our rankings, which translates into more employment opportunities, higher salaries, and ultimately proud and successful alumni."

Since joining the faculty, both Bernards and Pinhero have made a concerted effort to make outside contacts and to spread the word in chemical engineering professional and academic circles about the opportunities at MU. Holtsmith's gift gave them added leverage.

Holtsmith emphasized the fact that his gift is not an endowment; that he wants the entire amount to be used to recruit the brightest and the best. "My gift is not about bricks and mortar and I don't care about having my name on a plaque," he said. "I care about the chemical engineering faculty, and I am interested in attracting good students to help them."

The target for the Holtsmith Fellowship is a domestic student from an ABET-accredited university with a competitive GRE score and a 3.0 GPA. Fellowships add $5 thousand per year to the university's stipend, for up to five years of research.

The department's first Holtsmith Fellow is Kevin Zurick, a graduate of Rose Hulman University who joined Bernards' research team in the August 2009.




**Bob Holtsmith, a 1968 chemical engineering alumnus, has made a $100 thousand gift to be used to recruit promising chemical engineering graduate students.**

The St. Louis native said he applied to graduate programs that were close to home and that he took a close look at MU because he liked Bernards' research.

"I had a couple of other offers, but the full tuition offer and the Holtsmith Fellowship helped a lot," said Zurick, who is happy with his choice. "It's going pretty well and Dr. Bernards is great to work with."

"The department has always enjoyed strong support from our alumni and friends," said Baolin Deng, C.W. LaPierre professor in civil and environmental engineering and chemical engineering chair. "The gift from Bob and Dorcas Holtsmith is another great example, and will greatly help the department while we strive to enhance our graduate and research program."

Pinhero points out that since he arrived, the number of graduate students in the program has increased from a dozen to around 25. "There's activity in the labs; there are people in the hallways. This is a long-term, uphill process to change the status quo, and we are winning," he said.

"Bob's donation opened the door," said Bernards.

## 1960s

**A.K. Rosenhan, BS ME '62,** of Mississippi State, Miss., received fellow membership from the Institution of Fire Engineers, headquartered in England. Retired from the faculty at Mississippi State University, he now serves as fire services coordinator for Oktibbeha County, Miss. He is a registered professional engineer in six states and a chartered engineer in the UK.

## 1970s

**Larry W. Frevert, BS CEE '70,** of Kansas City, Mo., was named a 2010 Top Ten Public Works Leader of the Year by the American Public Works Association for his career-long dedication and service, professionalism and expertise in public works infrastructure. Frevert, who has worked more than 40 years in the public works field, currently works for HDR Engineering, Inc., with company-wide responsibility for business development with local governments and local responsibility for marketing in the water business group. The MU College of Engineering named Frevert a Missouri Honor Award recipient in 2009. He is a member of the Dean of Engineering's Advisory Committee and past-president of the college's alumni organization.

**Lammert B. "Bert" Otten, PhD EE '73,** of Monze, Zambia, was featured in the careers section of the Institute of Electronics and Electrical Engineers February 2010 Spectrum magazine. Otten was profiled for the work he is doing to solve problems that improve the lives of Zambians, using the materials at hand. "As an engineer," he said in the article, "you're co-creating with God to make life better for people." The MU College of Engineering named Otten a Missouri Honor Award recipient in 2009.

**Jerry L. Jost, BS ChE '70,** was named 2010 Small Business Person of the year in eastern Missouri by the St. Louis Small Business Association. Jost is the founder and president of Jost Chemical based in Overland.

**Dale E. Klein, BS ME'70, MS ME '71, PhD '77,** was elected to the board of directors for Pinnacle West Capital Corporation. He serves as a professor of mechanical engineering at the University of Texas-Austin where he also is associate vice president for research and associate director of the university's Energy Institute. Klein served as chairman of the U.S. Nuclear Regulatory Commission from 2006 to 2009. He received a Missouri Honor Award for Distinguished Service from the MU College of Engineering in 1996, and an MU Alumni Award in 1998. He and his wife Virginia live in Arlington, Va.

## 1980s

**Kevin L. Keith, BS CEE '82,** of New Bloomfield, Mo., assumed the interim director position for the Missouri Department of Transportation in April. He has been MoDOT's chief engineer since 2001. Highlights of his career include construction of the new Missouri River Bridge at Jefferson City, Mo., and his role as project manager of the Ozark Mountain Highroad. He and his wife, Lori, have two children.

## 1990s

**Randall L. "Randy" Dews, BS MAE '92,** Lincoln, Neb., was named guest of honor for the 105th Kingdom of Callaway supper, held March 16, 2010 ,on the William Woods campus in Fulton, Mo. He works as inside sales engineer/ project manager for Experitec, Inc., in Lenexa, Kan. He and his wife, Heather, have two children.

**Terry R. Royer, BS MAE '92,** of Alpharetta, Ga., was named CEO of Winergy Drive Systems, effective April 1, 2010. He will have primary responsibility for sales and continued development of the Winergy businesses, as well as for the assembly plant and materials function in Elgin, Ill.

**Rebecca A. Lynn, BS ChE '96,** has been named a principal for Morgenthaler Ventures in Menlo Park, Ca. In addition to her degree from MU, she earned a JD/MBA from the Haas School of Business and U.C. Berkeley School of Law at the University of California at Berkeley. She lives with her husband, Terrance.

## 2000s

**Ardie E. Mansouri, BS CEE '08,** of Fenton, Mo., joined Horner & Shifrin, Inc., as an engineer in the Structural Engineering Department. Previously, he served as a project management assistant for a $90 million periodic inspection of levees program, funded by the American Recovery and Reinvestment Act.

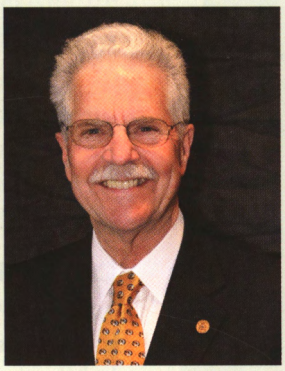
# Deaths

## 1930s

**Leo A. Scott, AB A&S '31, BS CHE '31,** of Southbury, Ct., died May 14, 2010. He began his career as an assistant chemist for Colgate Palmolive Co, and retired as vice president for manufacturing worldwide. Scott received a College of Engineering Missouri Honor Award in 1965. He is survived by one brother, **Vincent L. Scott ChE '43,** one son and two daughters.

# Alumni recognized for distinguished careers and service

Ward A. Chambers



Donald L. Flora

Albert Garcia III

Each year the College of Engineering presents alumni selected from a pool of nominees with its highest honor, the Missouri Honor Award for Distinguished Service. In 2010, three were so honored.

**WARD A. CHAMBERS** is a practicing cardiologist and directs the international health and medical education efforts for the University of Nebraska Medical Center (UNMC). In this position, he develops and oversees student and resident exchange programs with international medical education institutions. Each year more than 500 UNMC students attend an international experience in Guatemala, China, India and Russia among other countries, with as many foreign students coming to UNMC for an international experience.

Chambers earned a bachelor's degree in electrical engineering at the University of Missouri in 1967 and master's degrees in both electrical engineering and physiology at the University of Nebraska-Lincoln in 1970 and 1973, respectively. In 1973, he received a doctorate of medicine from the University of Nebraska Medical Center and a specialization in cardiology from Baylor University in Houston in 1977.

Chambers is a member of Tigers of the Corn and the Institute of Electrical Engineers and Electronics. He additionally serves as the president of the MU College of Engineering Foundation. He is a consultant for the FAA Cardiology Panel on Aviation Medicine, and also volunteers his time helping inner city youth as a dedicated mentor to underprivileged teenagers.

**DONALD L. FLORA** is the president of Flora & Associates, Inc., specializing in consulting and management in the field of health care, and also serves as general manager for the Mid America Kidney Stone Association Partnership's (MAKSA) mobile lithotripsy service.

Flora earned a bachelor's degree in industrial engineering in 1966 and master's degrees in industrial engineering and public health — health services management — in 1968 and 1971, respectively.

In addition to being inducted into the 2008 inaugural class of Mizzou Engineering's IMSE Hall of Fame, Flora serves on the Dean of Engineering's Advisory Committee, chairs the college's Public Policy Advisory Council and has served in various capacities for the Mizzou Alumni Association, the Kansas Chapter Mizzou Alumni Association and the Kansas City Tiger Club. He is currently a member of the Jefferson Club Board of Trustees and the Chancellor's Fund for Excellence.

**ALBERT GARCIA III** is a program manager for AMEC Earth and Environmental Services, an engineering consulting firm. He also is a Rear Admiral in the Civil Engineer Corps of the United States Navy Reserve. He currently serves as Deputy Chief of Civil Engineers, Deputy Commander Naval Facilities Engineering Command.

After earning his bachelor's degree in agricultural engineering from the University of Missouri in 1977 in the Naval ROTC program, he went on to receive his master's degree from San Jose State University in 1981. Following a period of active duty in the Navy, he returned to the University of Missouri to earn a doctorate in environmental engineering in 1984.

Throughout his career, Garcia has answered several recalls to duty with the Seabees. In 2003, he commanded Task Force Charlie of the Marine Expeditionary Force Engineering Group as part of Operation Iraqi Freedom.

A registered engineer in 18 states, Garcia is a member of the Dean of Engineering's Advisory Committee.

## NOMINATE A DESERVING ALUMNUS!

Know someone with outstanding professional accomplishments in the Engineering field? Or with a strong record of service to your alma mater? Help us recognize them! Nominations are being accepted for the Missouri Honor Award for Distinguished Service in Engineering and for the James "Bud" Moulder Distinguished Alumni Award.

**Nomination forms can be found online via the college's website at http://engineering.missouri.edu/alumni/.**

***Deadline for nominations is September 1, 2010.***

**Society of Women Engineers (SWE) faculty advisor, far left, joins SWE's 2010 Ada Wilson Lecturer, Shelly Zumsteg, second from right, and Zumsteg's twin daughters, Leslie, in red, a senior at the University of Wyoming studying kinesiology, and Rachael, in green, a biological engineering senior at MU and president of Mizzou Engineering's SWE chapter.**

## Shelly Zumsteg delivers Ada Wilson lecture

As an industrial engineering senior in 1980, Shelly Zumsteg planned the College of Engineering's Green Tea. Little did she know that 30 years later, she would be the event's guest speaker. Nor had Zumsteg an inkling that her appearance as the Society of Women Engineer's Ada Wilson guest lecturer at the 2010 Green Tea would be at the invitation of one of her own twin daughters, a biological engineering senior at MU, Rachael Fischer.

Zumsteg's life work has been as a project engineer in telecommunications. After graduating, she took a job with Western Electric, or "Ma Bell," she called it. "I had the same phone number for 20 years, but Bell Telephone became AT&T in 1984 and Lucent Technologies in 1996. In 2000, I began working for a spin-off company, Avaya."

Zumsteg was laid off in 2002, but has returned twice as a contractor working in her area of expertise, new product introduction, "from design on paper to the product that goes out the door."

"You need to know yourself," she advised the Green Tea audience of mostly young women. With impending careers, potential marriages and other post-college changes in their lives, she continued, they were poised on the brink of making some life altering, possibly long-term decisions. "How will you select?" she asked.

"What motivates you? What challenges your mind?" Zumsteg asked, ticking off what should be considered when making these choices, including such things as core values, family, spirituality, employment goals, hobbies and leisure time.

Both of Zumsteg's parents were schoolteachers. Her enjoyment of the family's annual two-week vacations made recreational travel a priority in her life. (She is two states shy of completing her "bucket list" goal to visit all 50 states.) Zumsteg and her husband specifically took jobs in Colorado where they could play on the weekends even if they couldn't get away for longer trips.

"Life is a journey. Don't be afraid to ask for directions," she said. "And make time to enjoy the scenery.

"It's not work versus life, but finding a balance between the two that's important," said Zumsteg.

### 1940s

**Charles H. Fisher, BS ChE '42,** of Tampa, Fla., died March 15, 2010. He attended Park University in Parkville, Mo., before finishing his degree at MU. He worked for the Atomic Energy Commission and the Department of the Interior. He is survived by his wife, Doris, and one daughter.

**Charles H. New, BS EE '47,** of Wilmington, N.C., died Sept. 17, 2009. New spent his life working in the aerospace industry.

**John N. Warfield, BA A&S '48, BS EE '48, MS EE '49,** of Sheffield, Ala., died Nov. 17, 2009. A Missouri native, Warfield completed degrees in mathematics and electrical engineering at MU after serving in WWII. He served on the faculty at George Mason University and as the president of Integrative Services and AJAR Publishing Co. He authored two U.S. patents and several books. He was a Fellow of the International Society for Design and Process Science and a Life Fellow of the Institute for Electricians and Electrical Engineers (IEEE). He received the IEEE Third Millennium and Centennial Medals. He is survived by his wife, Rosamond, and three children.

### 1950s

**Raymond H. Tyler, BS CEE '50,** of Monroe, La., died April 30, 2010. Drafted into the army a year after graduating from high school in Granite City, Ill., he was wounded in France and received the Purple Heart. After graduating from MU, he worked for national Steel, Dittco, in Monroe, La., and Warnock Herschey. He is survived by his wife, Ruth.

**Gordon W. Hays, BS ME '52,** of Midlothian, Va., died July 4, 2009. Originally from St. Louis, Hays was an accomplished mechanical engineer, an investor and a champion skeet shooter. He is survived by his wife of 57 years, Barbara, and three children.

**Marvin D. Hall, BS AgE '57,** of Macomb, Ill., died May 19, 2008. He had retired from the University of Illinois where he worked as an area agricultural engineer in extension. He is survived by his wife of 57 years, Nan.

**Raymond L. Puckett, BS ME '57,** of St. Bonifacius, Minn., died February 11, 2010. Born in Jefferson City, Mo., he was licensed as a professional engineer in three states and worked for various telephone companies during his career. He is survived by his wife, Rita, and four children.

## 1970s

**Lester A. Stumpe, BS CEE '71, MS '75,** of Cleveland Heights, Ohio, died March 7, 2010. He graduated from high school in Washington, Mo., before coming to MU. As manager of watershed programs for the Northeast Ohio Regional Sewer District for 29 years, he dedicated his professional life to the restoration of urban watersheds. He is survived by his wife, Marcia, and three children. Stumpe's sister, Ruth Brent Tofle, is department chair and a professor in the Department of Architectural Studies at MU.

**Robert M. Franke, BS EE '77, MS EE '79,** of Columbia, Mo., died April 23, 2010. He was last employed by Kraft Foods.

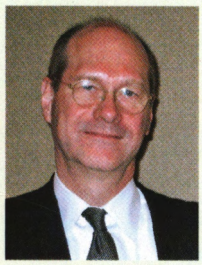
## 1980s

**James R. Casstevens, BS ME '86,** of Columbia, Mo., died January 21, 2010. Born in Mt. Clemens, Mich., he moved to Missouri in his teens and after graduating from MU, he worked at UMKC before moving to Columbia to serve as a database administrator for what is now MU's Division of IT.

# Structural engineer honored by MUEAO

by John Conway, MUEAO

**William F. Baker** was awarded the University of Missouri Engineering Alumni Organization's 2010 Citation of Merit award for outstanding achievement and meritorious service in engineering. Baker was honored at a luncheon on March 20 on the university campus.



Baker is the structural and civil engineering partner for Skidmore, Owings, and Merrill LLP, an award-winning architectural, urban planning, interior design and engineering firm responsible for notable structures worldwide.

Baker earned a bachelor's degree in civil engineering at the University of Missouri in 1975, and a master's degree in structural engineering from the University of Illinois in 1980.

Among his many achievements, Baker developed the buttressed core structural system for the Burj Khalifa in Dubai, the tallest man-made structure in the world.

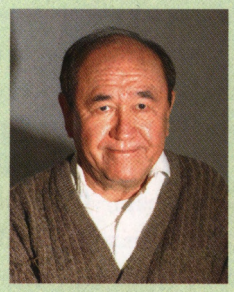
He also spearheaded the structural design for Chicago's AT&T Corporate Center and the 92-story Trump International Hotel and Tower.

Baker is the 2008 recipient of the Fazlur Rahman Khan Medal from the Council on Tall Buildings and Urban Habitat for excellence in design and for his contribution to the urban environment. In 2009, he received the Fritz Leonhardt Prize for outstanding achievements in structural engineering.

On May 13, the Institution of Structural Engineers in London awarded Baker the Gold Medal, the Institution's highest accolade.

**Professor Emeritus, Henry Liu •1936 to 2009**

Just months after he learned he had been awarded a 2009 Purpose Prize — granted to social innovators who use their post-retirement years to establish an "encore career" — Professor Emeritus Henry Liu, died in a car accident Tuesday, Dec. 1, 2009. He was 73.



Liu taught in the civil engineering department at the University of Missouri beginning in 1965. Over the course of his fruitful career, he directed over 30 research projects, received seven U.S. patents and published in excess of 100 papers as well as three books.

Liu retired as a full professor in 2001 to start the Freight Pipeline Company, a research and development firm located in Columbia, to focus on inventing, developing and bringing to commercial use new technologies that were energy-efficient, environmentally friendly and cost effective.

Fly-ash bricks Liu developed from coal plant waste materials have been extraordinarily successful. The bricks were selected by both Time Magazine and Popular Science as one of the top inventions of 2007, and also received a 2008 Best Innovation Award from the EPA.

After his death, his oldest son, Jerry Liu, took over as CEO of the company, which has changed its name to EcologicTech. In addition to the bricks, technology which was licensed and is being produced commercially by CalStar Products of Racine, Wisc., the company is pursuing "biomass tablets" to be used in the cellulosic ethanol and power plant industries, and additional fly ash building materials.

Liu, a kind and generous man, was dedicated to the betterment of society through research and is sadly missed by all who knew him.

He is survived by his wife, Susie, and three sons, Jerry, Jason and Jeff Liu.

## Career Engineer Alan Canfield

# The right man for the job: fast work on an anti-IED mine roller saves lives

"I'm always looking at that next hard problem," said Alan Canfield, a 1991 mechanical engineering graduate who works as the counter-IED program manager at the Panama City division of the Naval Surface Warfare Center.

A Navy civilian, Canfield said he originally worked on Marine Corps land mine and expeditionary warfare projects, but that he was called upon in 2005 to change gears to work on the escalating improvised explosive device (IED) threats in Iraq.

"The IEDs that troops were encountering were as varied as your imagination, more broad than what we'd ever come up against before," he said, explaining that in addition to remote control devices, more and more IEDs relied on pressure plates and trip wires.

"I had to quickly build a multi-disciplinary team," Canfield said.

What his team of 40 in-house personnel and 60 independent contractors in the Panama City area came up with is the Panama City Mine Roller System, a unit that is attached to the front of tactical vehicles to both detonate mines and absorb their shocks.

"After the first call, we had a prototype on the ground in 90 days. It took a hit and was destroyed in a week," Canfield said. "But we continually design, build, test, design, build, test. We've done nearly 100 field upgrades, building new components, and retrofitting as we go. A rapid prototyping process is vital."

**Alan Canfield poses in front of the Panama City Mine Roller, designed and built by his team at the Naval Surface Warfare Center in Panama City. The equipment is credited with saving the lives of many soldiers by protecting them from improvised explosive devices – IEDs.**

Canfield and crew at the Panama City center are a one-stop-shop, which allows for instantaneous modifications with an efficiency that would not be possible if the Navy and Marine Corps were working solely with private contractors.

The program is fully resourced and funded by the Marine Corps and Canfield's team has produced and fielded over 500 Mine Rollers. The team was faced with additional challenges over the past year as the Iraq system, made to navigate primarily on flat surfaces, didn't have the same mobility in Afghanistan.

"Everyone and everything is focused on the war fighter," said Canfield. "It can be really stressful. We worry about our effectiveness and about providing the best protection without hindering their progress. My team and I have made numerous trips to Iraq and Afghanistan to provide training and receive direct war fighter feedback."

"It's pretty rewarding work," Canfield said, "and there are lots of opportunities to travel and move around in this line of work for the Navy."

Canfield received his master's degree in mechanical engineering from the University of Florida. He met his wife Gina 10 years ago when she was working as an officer in an Air Force research lab, where she now works as a postdoc.

"I always wanted to be an engineer. I thought about an appointment to the Air Force Academy or Naval Academy, but I was attracted to Mizzou when I attended the Missouri Scholars Academy there my sophomore year of high school," Canfield said. "The state scholarships didn't hurt, either."

"In my heart I'm an ME, "said Canfield. "I think I was meant to do this."

**Editor's note: On April 28, 2010, Project Director Alan Canfield and the 18 Naval Surface Warfare Center Panama City Division scientists and engineers that work for him received the Naval Sea Systems Command Technical Award for their work on the Panama City Mine Roller.**

## CAREER ENGINEER Q & A

**■ What do you consider the greatest achievement of your career so far?**

I can humbly say that my greatest achievement so far has been leading the development and fielding of the Marine Corps mine roller system. The team I've been fortunate to lead has been responsible for avoiding many hundreds of casualties in Iraq and Afghanistan.

**■ What is your fondest memory of your days as a student in the College of Engineering?**

Looking back, it is almost a blur. I fondly recall the stress and pressure of the senior mechanical engineering design project. We identified a problem, developed a solution, and prepared the report and presentation. Of course, we did 80% of the work in the last two weeks. Our technical solution did not feel as advanced as some other projects, but we nailed the report and presentation and got the "A." I think that was a valuable lesson.

**■ What professor or class most influenced you, and how?**

You probably hear this a lot, but Dr. David Wollersheim had a significant influence on my academic and professional career. From academic advising, classroom instruction, and Engineering Club mentoring, "Doc" pushed us to excel academically and professionally. His promotion of engineering licensure prompted many in our class to take, and pass, the Fundamentals in Engineering before graduating. This prepared me to sit for the PE exam shortly after relocating to Florida. Several of Doc's anecdotes have stuck with me: never stop learning, save for the future, and give back to the community.

**■ What do you do for fun when you're not working?**

My favorite past time is cycling, both road and off-road. A long, hard ride is great to clear your mind. I also enjoy tinkering with the new suspension technologies on off-road bikes, and light-weight high-performance road bike components.

**■ What is your best advice for engineering students?**

First, I would advise current engineering students to soak up everything they can, especially the engineering fundamentals. Second, I recommend involvement in a club or activity requiring interaction with other engineers. Most engineering positions will require interaction with a multi-disciplinary team of managers, engineers, technicians, logisticians, and other specialists. Good grades help you get in the door for an interview, but experience and communication skills will seal the deal. Third, once you secure a position, be sure to listen, understand what is expected, ask questions when needed, and find a way to make a difference for your organization.

## News from Mizzou Engineers

Share your personal and professional news with us. Mail this form to:

**Jan Wiese-Fales, Editor**
**Mizzou Engineering**
**University of Missouri**
**W1006 Lafferre Hall**
**Columbia, MO 65211**

or e-mail: **umcengrdev@missouri.edu**

Name_____

Maiden Name_____

Spouse's Name_____

Class Year_____ Spouse Class Year (i/a)_____

Discipline (AgE, BE, ChE, CEE, CS, ECE, EE, IE, IT, IMSE, MAE)_____

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## Mizzou Engineering Calendar

**JULY 2010**

- 11 Summer Camp
- 18 Summer Camp

**SEPTEMBER 2010**

- 17 MU Engineering Alumni Organization (MUEAO) Golf Tournament
- 18 MUEAO Board Meeting
- 24 Recent Alumni Development Board
- 25 Young Alumni Engineering BBQ

**OCTOBER 2010**

- 15 High School Weekend

**NOVEMBER 2010**

- 11 Engineering Scholarship Dinner
- 12 Dean's Engineering Advisory Council (DEAC) Meeting
- 12 Reception for DEAC Members

For more information about any of these events, please contact Nicole Theberge at 573-844-3426 or thebergen@missouri.edu.

**Mizzou Engineering's student competition teams delegation — with advisor, Professor John Bowders — at the 2010 conference of the American Society of Civil Engineers (ASCE) in Norman, Oklahoma.**