

ARKANSAS

SUMMER 2015



ENGINEER

Engineering Transportation



UNIVERSITY OF
ARKANSAS
COLLEGE OF
ENGINEERING





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Getting There

U of A engineering researchers are working to make sure that goods and people travel safely and efficiently.

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Student Researchers

Graduate and undergraduate students play an important role in our transportation research.

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Alumnus Profile: Grady Harvell (BSCE '72)

Grady Harvell, president of AFCO Steel, works with the university in many ways, including providing support for transportation research.

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Cover: Highway 109, Clarksville Bridge

Left: Interstate 30, near Benton

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John English
Dean of the College of Engineering
Irma F. and Raymond F. Giffels
Endowed Chair in Engineering

Welcome to the Summer 2015 issue of Arkansas Engineer! The theme of this issue is transportation, which is one of our strongest research areas. As you can see, we have many faculty and students working in this field, and their research topics range from finding ways to make more durable concrete to developing tools that can make entire transportation networks more efficient.

One of the great things about this research is the direct and immediate impact it has on our state, region and country. Our researchers work closely with the Arkansas State Highway and Transportation Department, other government agencies and members of industry. That means that every new discovery can be provided directly to Arkansans. The result is safer and more efficient ways to travel and to transport the goods we need.

Many of our alumni work in the transportation industry, and ties with them are another important part of our transportation research mission. Grady Harvell, president of AFCO Steel and chair of the College of Engineering Dean's Advisory Council, understands the importance of having a strong transportation research program. Grady has been a tireless supporter of the College of Engineering. You can read about his career and his work with one of our faculty members in this issue of the magazine.

I am also happy to announce our updated strategic plan. It's a simple document, but don't be fooled by that. Behind this list of strategies and objectives is teamwork and faculty leadership, and this document points the way to our future, along with key metrics that will ensure we are staying on the right path. As this plan moves into action, I will be meeting regularly with the Strategic Planning Council to make sure we are following and updating the plan, as well as keeping the college accountable to the intent of the plan. Furthermore, I will be reporting progress to the College of Engineering Dean's Advisory Council each year.

I would like to thank professor Craig Thompson, who led the strategic planning committee and professor Greg Parnell, who continues to work on the plan. You can read more about the process that went into this plan on our website.

Along with the new strategic plan, we're also rolling out a new college tagline: "Preparing you for your tomorrow." Our director of recruiting came up with this, and it perfectly captures the mission of the college. We prepare students for careers as engineers, but the message does not end there. As a college, we also strive to give our faculty, staff and alumni the resources they need to grow and develop in their careers.

This issue of the magazine is packed with stories about faculty, students and alumni who are busy preparing for whatever tomorrow brings. We love celebrating these successes. Earlier this spring, we honored another group of fantastic alumni. Among them are Hugh Brewer and Jim Hefley, our latest Hall of Fame inductees. These two alumni have achieved great things over their careers, and even after retiring, they are devoting themselves to worthwhile causes and supporting their alma mater. All our alumni have interesting stories to tell, and we would love to hear yours! Send your news to records@arkansasalumni.org or drop us a line at engrcomm@uark.edu.

A handwritten signature in black ink, appearing to be the name 'John English'. The signature is stylized with a large, looping initial 'J' and a long, horizontal flourish extending to the right.

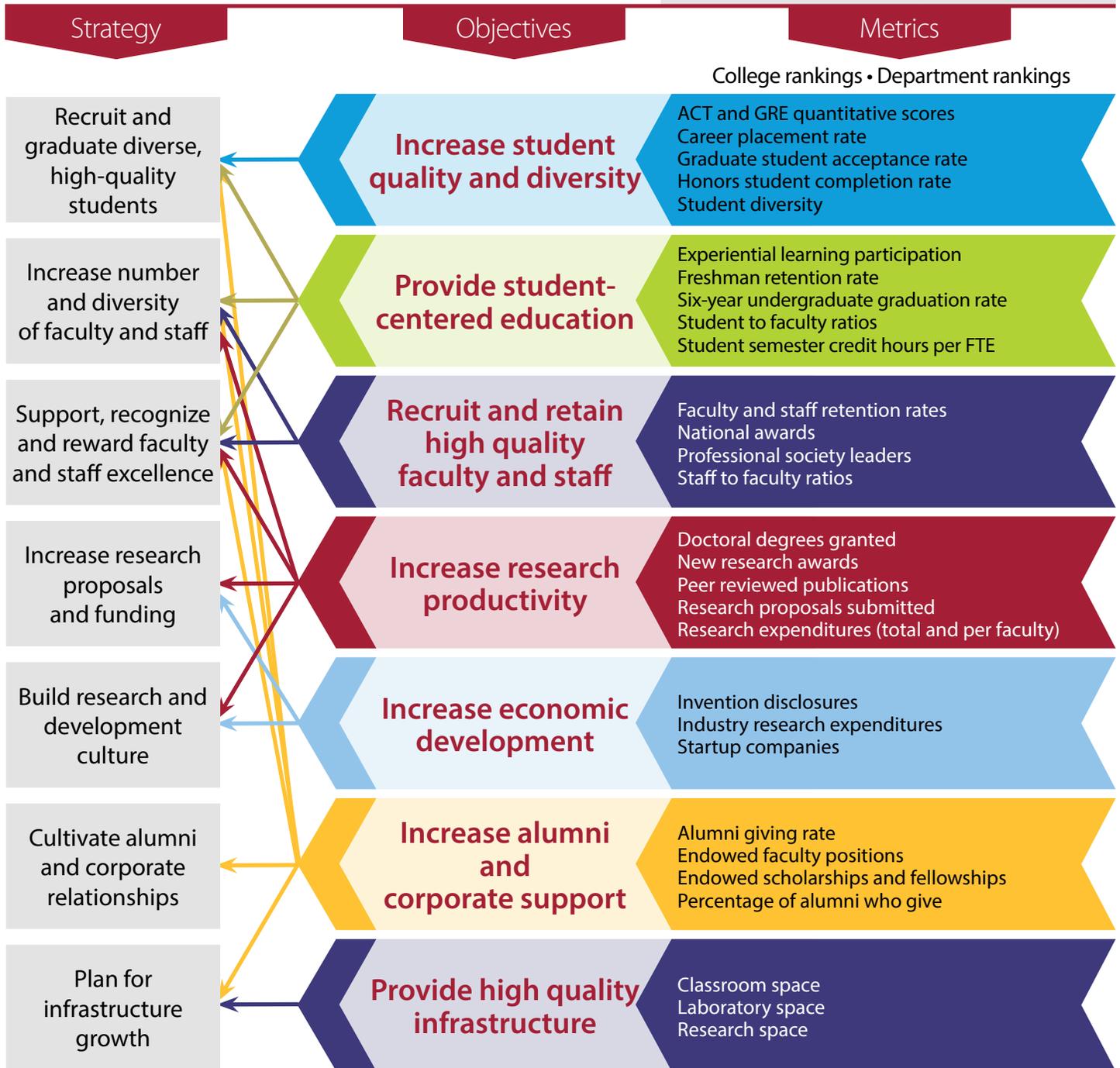
College of Engineering Strategic Plan

Preparing You for Your Tomorrow

College of Engineering Vision: Pursue excellence in research, scholarship, and education, ensuring personal and professional growth for future generations of engineering leaders who will stimulate prosperity for Arkansas, the nation and the world.

2021 Balanced Growth Goals

- Top 50 ranking among public universities
- 3500 undergraduate students
- 1000 master's students
- 350 doctoral students
- 135 tenure-track faculty members
- 65 clinical and research faculty members
- 240 staff members
- \$300,000 in research expenditures per faculty



College of Engineering Benefits from Buerger Gift

Three scholarships will be established in three colleges at the University of Arkansas thanks to N.W. “Chip” Buerger and Frances Vestal of Dripping Springs, Texas. Buerger is contributing a \$500,000 planned gift that will benefit numerous students by creating endowed scholarships in the College of Engineering, in addition to the J. William Fulbright College of Arts and Sciences and the Sam M. Walton College of Business.

“Mr. Buerger is an outstanding friend of the University of Arkansas, and scholarship support is an excellent investment in our success,” said Chris Wyrick, vice chancellor for university advancement. “Student support is essential to increasing the number of bachelor’s degree holders in our state, and this gift will allow us to continue to attract the best and brightest – and to retain them as well. We appreciate Mr. Buerger recognizing this need and impacting multiple colleges with this generous gift.”

The N.W. “Chip” Buerger Endowed Scholarship in Engineering will provide financial assistance to undergraduate engineering students demonstrating financial need.

“Engineering was chosen because of the basic discipline of the field and the different methods of problem solving that have served me well in my three careers,” said Buerger.

Born in Boston and raised in Kingston, Ontario, and Carmel, California, Buerger earned a Bachelor of Science in Engineering from the U.S. Naval Academy and an M.B.A. from George Washington University. After being deployed for two tours abroad during the Vietnam War, Buerger became a professor at the National Defense Intelligence College, now the National Intelligence University, in Washington, D.C.

When Buerger eventually resigned from the Navy, he was recruited by IBM and subsequently created a construction company on the side, building custom homes. After leaving IBM to concentrate on his growing company, his primary building focus switched to ranches.

“I have benefitted greatly in my career by educational opportunities,” said Buerger. “My endowment to the university, hopefully, will allow students the opportunity to get an education that will help them all their lives and will be the base of their careers. I hope my contribution will help the university grow and continue to attract deserving bright students.

“I really do admire and respect the university,” he continued. “The growth of the campus and the academic programs over the past five years has been impressive.”

Frances Vestal Buerger was involved with Chi Omega sorority, and she and Buerger are life members of the Arkansas Alumni Association and both are included in the Towers of Old Main, a recognition society for the university’s most generous benefactors.

Sartorius Joins Development and External Relations Team



Kelly Sartorius, Ph.D.

Kelly Sartorius has been named the new senior director of development and external relations for the College of Engineering. Sartorius comes to the university from Washington University in St. Louis.

“I am delighted to welcome Dr. Sartorius to the College of Engineering,” said English. “In her new role with us, she will manage the private giving strategy for the College of Engineering and provide oversight and management of our external relations activities. I know she will excel in this role and will be a fantastic addition to our development team.”

Sartorius spent nearly four years with Washington University and was responsible for their alumni and development program for the Graduate School of Arts and Sciences, as well as arts and sciences donors in key areas of the country. She worked closely with the dean of the Graduate School and the dean of the faculty of arts and sciences to support their \$2.2 billion campaign.

Prior to that, she spent eight years with the Kansas State University Foundation and the K-State College of Engineering, where she led a team of four staff members and coordinated their Engineering College Advisory Council.

“We are excited to welcome Kelly to the University of Arkansas development team and are fortunate to have found a candidate who understands a college of engineering and its fundraising needs,” said Katy Nelson-Ginder, assistant vice chancellor for development. “Her technical expertise and experience, as well as her successful track record of raising private gift support, will be tremendous assets to the role.”

Sartorius holds a bachelor of arts in journalism and mass communication from Kansas State University, a bachelor of arts in history from Wichita State University, a master of arts in American Studies from the University of Maryland with a graduate certificate in women’s studies and a doctorate in history from Kansas State University.

She has had extensive teaching involvement with the Council for the Advancement and Support of Education and has served on the faculty for several of the organization’s conferences.

“Engineering is so important to America’s future success,” Sartorius said. “It’s an honor to play a role in making it possible for deserving students to afford a top-notch engineering education at Arkansas.”

Fayetteville Couple Donates \$100,000 for Electrical Engineering Scholarships



Hugh and Martha Brewer

Alumni Hugh and Martha Brewer of Fayetteville are creating the Hugh and Martha Brewer Endowed Scholarship in Electrical Engineering at the University of Arkansas with a \$100,000 gift. This scholarship is in addition to a bequest made to the department for the Hugh and Martha Brewer Academic Enrichment Fund in Electrical Engineering in 2004.

Hugh Brewer is a Fort Smith native who transferred to the University of Arkansas after attending Arkansas Tech University. Brewer worked throughout his college career to fund his degree and graduated in 1959. Professor Bryan Webb served as his mentor and adviser in the College of Engineering and helped him extensively during that time.

Brewer spent his career as an engineer with the Southwestern Electric Power Co. and McClelland Engineers before purchasing Upchurch Electrical Supply Co. in 1970, where he served as the president and chief executive officer until his retirement.

In recognition of his successful career and dedication to his community, Brewer was given the Community Service Award from the Arkansas Alumni Association in 2014. He was inducted into the College of Engineering Hall of Fame, the college's highest honor, in April.

Martha Rice Brewer grew up in Clarksville and moved to Fort Smith for high school, where she met Hugh. After graduating with her Bachelor of Arts in 1958, she later went on to earn a Master of Arts in history as well, both from the J. William Fulbright College of Arts and Sciences.

Because of Hugh's experience working through college, the Brewers felt compelled to give back and help other students who might be facing similar circumstances. "I wouldn't be anywhere near where I am or what I am today without my degree from the University of Arkansas," Hugh said. Martha added, "He received help along the way, and we wanted to help someone else."

Undergraduate students who are majoring in electrical engineering and enrolled full-time will be eligible for the Hugh and Martha Brewer Endowed Scholarship in Electrical Engineering. Consideration will be based equally on merit and financial need, and the scholarship may be renewed as long as the recipient maintains a 3.0 cumulative grade point average and submits a scholarship application each year.

The Brewers are members of the University of Arkansas Chancellor's Society, life members of the Arkansas Alumni Association and recognized as Thoroughbreds for their consecutive years of giving. They are also included in the Towers of Old Main, a recognition society for the university's most generous benefactors.

Alumni Impact

Many of our alumni have used their engineering skills to start their own companies, and many of these companies are creating new technologies and contributing to the state's economy.

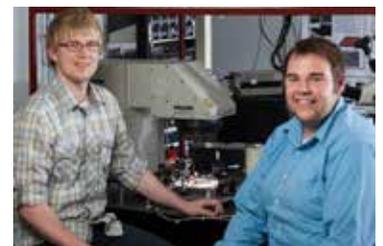
Boston Mountain Biotech, a company founded by chemical engineering graduate Ellen Brune, is marketing a method that will simplify the pharmaceutical production of proteins used in drugs that treat a variety of diseases and health conditions. The U.S. Patent and Trademark Office has issued a full patent for this technology.



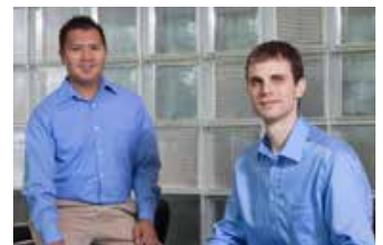
VisualLogistic Technologies Inc., a start-up company in Fayetteville founded by graduates of the University of Arkansas, has developed an updated model of its traffic warning system for potential use by the Arkansas State Highway and Transportation Department. The company's Automated Detection and Alert system is comprised of a network of sensors that detects traffic congestion and other hazardous conditions. These sensors then wirelessly communicate the information to adjoining nodes, notifying drivers in advance of the hazard. The AHTD purchased 12 nodes of the system in 2013 for a Transportation Research Committee project and installed them over a three-mile stretch of Interstate 40 near Russellville in January 2014.



Picasolar, a solar startup company affiliated with the University of Arkansas, finished in a first-place tie at the SXSW Eco Startup Showcase, a fast-paced pitch competition featuring top emerging firms from around the world. Picasolar founder, Douglas Hutchings, is a graduate of the microelectronics-photonics program. The company was also named a finalist for the prestigious Edison Award.



The National Science Foundation has awarded a \$741,221 grant to **cycleWood Solutions Inc.**, a technology company affiliated with the University of Arkansas. Founders Nhiem Cao and Kevin Oden are both graduates of the College of Engineering.



The company recently signed an exclusive agreement to produce a line of eco-friendly waste pickup bags for pet owners.





Mahboubeh Madadi, industrial engineering graduate student

Engineering Student Uses Data in the Fight Against Breast Cancer

Breast cancer is the second most common cancer and cause of cancer death in women. Early detection and proper treatment are proven to increase the chances of survival, yet experts disagree on age and frequency standards for cancer screening. That conflicting guidance can be confusing for patients and could result in some women skipping screening altogether.

Along with her advisor, assistant professor Shengfan Zhang, industrial engineering graduate student Mahboubeh Madadi is using data mining along with statistical and computational modeling techniques to solve this puzzle. Through the use of survey data, they are able to identify the best general approach to breast cancer screening. Their ultimate goal is much more ambitious: To create a personalized system of breast cancer screening, one in which a doctor and patient sit down together and work out a customized plan based on the patient's risk factors, preferences and which approach the data say works best. Madadi's research involves using a method called the partially observable Markov decision process to determine which screening process works best for both individuals and the general population.

Madadi's work was recognized at the 2014 conference of the Institute for Operations Research and Management Sciences in November. She received second place in the Interactive Sessions Competition and was among the finalists in INFORMS' Minority Issues Forum poster competition.

Student Achievements

During the first week of December, 66 computer engineering and computer science students volunteered at elementary schools, teaching kids the basics of writing computer code. Happy Hollow Elementary School, Butterfield Trail Elementary School, and Vandergriff Elementary School participated in the Hour of Code program as part of Computer Science Education Week. Code.org, a national organization that promotes computer science, sponsors this program.

Three biological and agricultural engineering graduate students, **Zach Callaway**, **Sardar Abdullah** and **Lizhou Xu**, won three of six awards in the research paper competition during the Arkansas Association of Food Protection annual meeting in September.

Civil engineering students **Braden Davidson** and **Matthew Watters** placed third in the Mortar Workability Competition at the American Concrete Institute fall convention in Washington, DC.

Richard Deschenes Jr. presented his poster on pavement Alkali-Silica reactions in Arkansas at the 2014 Mack-Blackwell Advisory Board Meeting and received the 2014 Jack Buffington Outstanding Student Poster Award.

Civil engineering student **Ryan DuChanois** was awarded a \$50,000 fellowship for undergraduate research through the U.S. Environmental Protection Agency's Greater Research Opportunities Undergraduate Student Fellowship program.

Jeremy Dunklin, a graduate student in chemical engineering, and **Gregory Forcherio**, a graduate student in microelectronics-photonics, received 2014 travel scholarships from SPIE, the international society for optics and photonics. Their research adviser is D. Keith Roper, associate professor of chemical engineering and holder of the Charles W. Oxford Endowed Professorship in Emerging Technologies.

Electrical engineering students **John George** and **Kristopher "Cody" Johnson** each received the Power and Energy Society Scholarship from the Institute of Electrical and Electronics Engineers.

Recent biomedical engineering graduate **Gage Greening** developed a new, non-invasive tool for early diagnosis of oral cancer in his honors thesis. Greening is now a graduate student at the U of A, and recently published part of his honors undergraduate research in the *Journal of Biomedical Optics*, one of the top journals in his field.

Anna Irwin, a junior majoring in computer science, recently spent 21 hours helping to create an Android app as part of the Google Hackathon. The hackathon, which was organized through the Society of Women in Engineering conference, brought together around

This Mobile App Responds to Your Feelings

Tingxin Yan, assistant professor of computer science and computer engineering, and doctoral student Jon Hammer have developed a system that can sense what a mobile phone user is doing and feeling and optimize the phone's performance accordingly.

Yan and Hammer's system relies on information that is already stored by the phone, such as which apps are being used, which notifications are being sent and how the user is reacting to notifications. A machine learning algorithm processes this data and prescribes the phone's response. So if a user is responding to emails but ignoring social media notifications, the phone might use this information to conclude that the user is at work and adjust by making work-related notifications and applications more prominent.

By using only existing data, this app is also more efficient than other apps that detect user activity through hardware sensors. A pedometer can use the phone's accelerometer or GPS system to detect a user's movements, for example. But relying on these tools can drain the phone's battery and use up significant amounts of data. Yan and Hammer's system, which doesn't use hardware, uses less energy and data.

Yan and Hammer have implemented a demonstration version of their system on an Android phone, and they plan to develop a complete open source system that app developers can use to make their own applications. Yan and Hammer received the Best Poster award at the 2014 Mobisys Conference in June. MobiSys is a leading conference on mobile system research.



50 computer science students to show off their creativity and programming skills.

Industrial engineering doctoral students **Emre Kirac** and **Mahboubeh Madadi** received second place in the Interactive Sessions Competition at the annual conference of the Institute for Operations Research and Management Sciences. Doctoral student **Mina Hadianniasar** was selected as a finalist in the Case and Teaching Material Competition.

Russell Locetta, a junior Honors College student majoring in mechanical engineering, was recently selected to be a member of the American Society of Mechanical Engineers Petroleum Division Collegiate Council. Locetta was one of 26 students selected from universities in North America. This is the first time a mechanical engineering student from the University of Arkansas has been a member of the council.

Stephanie Maxwell, a senior majoring in civil engineering, and **Andrew Stephens**, a sophomore majoring in biological and agricultural engineering, were recently awarded the Beaver Water District Joe Steele and Hardy Croxton Memorial Scholarship.

Industrial engineering doctoral students **Furkan Oztanriseven** and co-author **Mehmet Serdar Kilinc** received second place in the student paper competition at the annual conference of the American Society for Engineering Management.

Philip Turner, chemical engineering graduate student, received first place in the graduate student poster competition at the 2014 Midwest Section Conference of the American Society for Engineering Education. Civil engineering graduate student **German Perez** received second place.

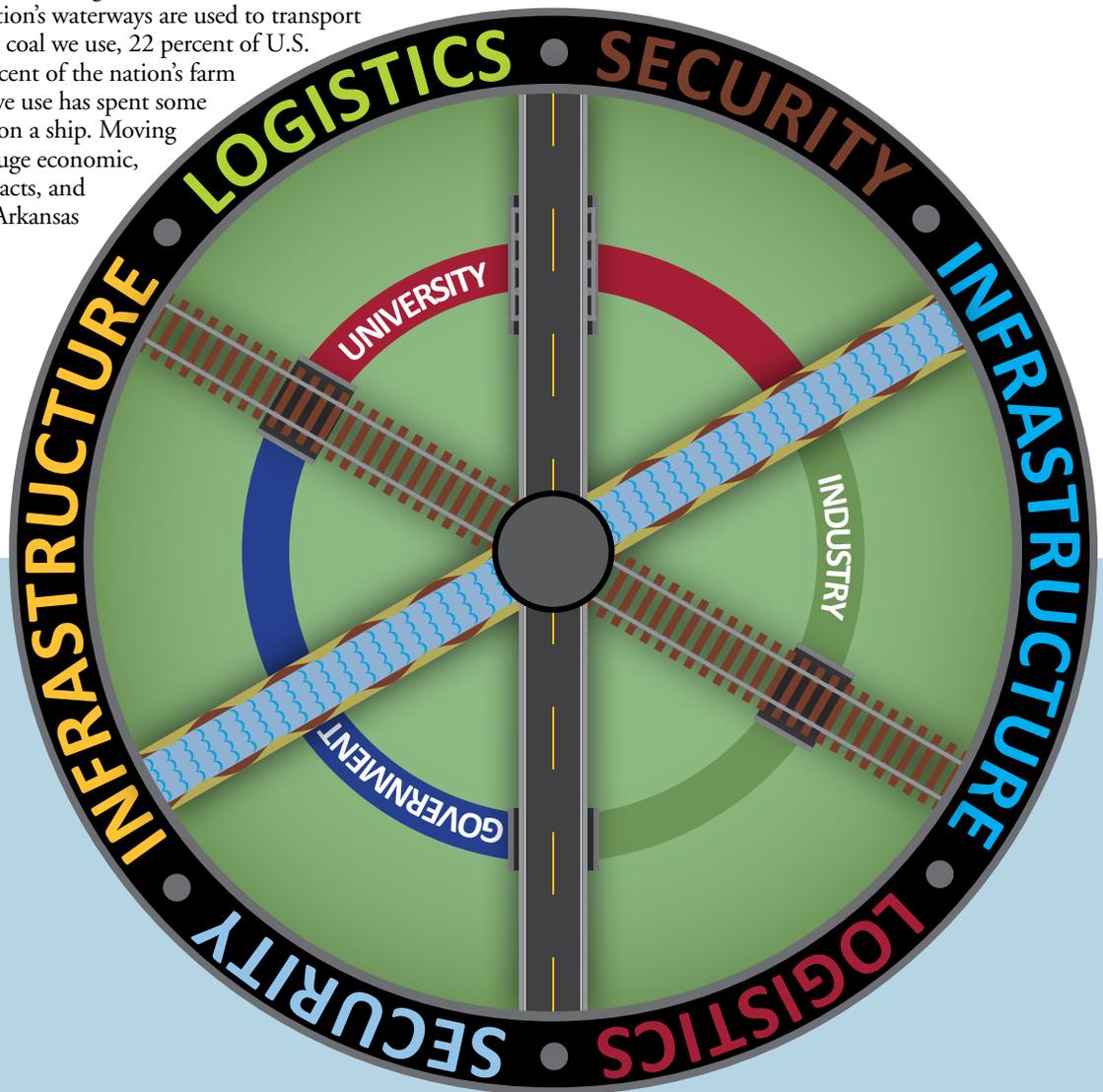
Kaylee Smith, an undergraduate in chemical engineering, was awarded a Statewide Undergraduate Research Fellowship grant. She also won third place in her division at the poster session at the American Institute of Chemical Engineers meeting in November.

Five seniors from the Department of Civil Engineering received engineering scholarships from the Arkansas Good Roads Transportation Council.



Getting There: Transportation Research *at the* University of Arkansas

Transportation touches every aspect of our lives, and the numbers make it clear that our nation's rail, road and waterway infrastructure is vital to our way of life. Forty percent of our country's freight by volume travels by rail, according to the Association of American Railroads, and the nation's waterways are used to transport approximately 20 percent of the coal we use, 22 percent of U.S. petroleum products, and 60 percent of the nation's farm exports. Almost every product we use has spent some time in a truck, on a rail car, or on a ship. Moving products and people can have huge economic, environmental and security impacts, and researchers at the University of Arkansas are looking at several of these.





Multiple Modes

Researchers at the U of A primarily focus on three modes of transportation: roads, rail and waterways. Each of these transportation avenues plays a vital role in our society, and each has unique safety, economic and environmental impacts.

Roads

Roads and bridges are so ubiquitous that it is easy to take them for granted. The American Society of Civil Engineers recently gave the nation's roads a grade of D and our bridges a grade of C+ in its 2013 Report Card for America's Infrastructure. According to ASCE, "Currently, 32 percent of America's major roads are in poor or mediocre condition, costing U.S. motorists who are traveling on deficient pavement \$67 billion a year, or \$324 per motorist, in additional repairs and operating costs."

One key to keeping our roads and bridges safe is testing to determine their current condition. The challenge in testing this infrastructure is that much of the damage in these concrete and steel structures occurs in the form of tiny cracks underneath the surface. Detecting these cracks before they compromise the structure is a problem that U of A researchers are working to solve.

Clinton Wood, assistant professor of civil engineering, is exploring the use of a method called the Multi-Channel Analysis of Surface Waves, or MASW, to look for signs of deterioration in pavements and bridge decks. MASW is a non-destructive method, which can be used to determine engineering properties without the need to dismantle or otherwise damage the larger structure or engineering system. Currently, this method is used primarily in earthquake engineering, where researchers often use sledgehammers or vibroseis trucks to generate stress waves at the ground surface. The interaction of these stress waves with the materials below are monitored with vibration sensors at the surface. The measured data from this process provides information about the stiffness and layering of the underlying materials. Because cracking and other pavement deterioration would reduce the stiffness of the pavement, results from MASW testing on pavements could detect



Photo courtesy of the Arkansas State Highway and Transportation Department

these changes before the damage to the pavement is visible or becomes a safety threat.

Methods like MASW could revolutionize pavement testing, but right now, much of the testing is done the old-fashioned way—by drilling into roads and taking core samples, then analyzing these in the lab. Because taking samples damages the road and disrupts traffic, researchers take as few as they can, often using only three samples in tests. Andrew Braham, assistant professor of civil engineering, is looking for ways to optimize current sampling methods. Using computer simulation, he plans to determine the best number of samples for testing. He is also looking for ways to use fewer or smaller samples and still obtain accurate results.

Roads face other threats, as well. Roads in hilly or mountainous places can be damaged by mudslides or rock falls when slopes near them are compromised by fire or rainfall. Richard Coffman, assistant





Photo courtesy of the Arkansas State Highway and Transportation Department

professor of civil engineering, is using a specialized device called a ground-based radar interferometer, which produces detailed images of slopes. By comparing these images over time, Coffman can monitor the stability of slopes and determine whether measures are needed to protect the road. In another project, Coffman is working to develop risk profiles that characterize the likelihood of mudslides or rock falls following a wildfire.

Identifying threats is a first step, and other researchers are working on ways to repair damage to bridges, roads and other infrastructure.

Gary Prinz, assistant professor of civil engineering, is investigating ways to prolong the lives of steel bridges. As bridges age, the stress of traffic can lead to fatigue damage, often in regions where the steel members are connected. This fatigue process is also compounded by environmental factors, such as metal corrosion. Prinz is investigating corrosion resistant retrofits through the use of pre-stressed carbon fiber reinforced polymer plates, to shift the stress away from these weak spots and lengthen the time before more invasive repairs are needed.

Civil engineering professor Micah Hale studies a problem called alkali silica reaction, or ASR. Silica, an acidic material found in most types of rocks and sand used to make concrete, can react with the alkaline chemicals in cement to form a gel. This gel attracts water and then expands, causing cracks in the concrete. Hale and his students are investigating the use of several materials, including silane sealer, linseed oil and elastomeric paint, to treat concrete that is affected by ASR. These treatments will prevent the concrete from absorbing water, and they will allow the water inside the concrete to escape. These researchers are also evaluating concrete additives that can prevent ASR before it happens.

Braham is also conducting research on a process called full-depth reclamation, which could be a more sustainable way to repair asphalt

roads. In full-depth reclamation, special equipment is used to tear up the road, grind the materials and mix them with binder to increase the structural capacity of the road. The process can be done at the construction site, which removes the need to transport waste out or new materials in. Braham is testing and refining the process in several locations in Arkansas where roads have been compromised by

heavy logging and hydraulic fracturing equipment. Using full-depth reclamation could help these roads withstand more frequent and heavier loads.

Other research projects are looking at ways to produce pavement materials that are more robust, more sustainable and more economical. One way to do this is to add materials to asphalt mixtures that can make them perform better and last longer. Researchers including Braham and Stacy Williams, associate research professor of civil engineering, test different additives to see how they perform in different amounts and different circumstances.

Paneer Selvam, University Professor of civil engineering and holder of the James T. Womble Endowed Professorship in Computational Mechanics and Nanotechnology Modeling, is looking at concrete on a different level. Using his expertise in nanoscience, Selvam examined the atomic structure of calcium silicon hydrate, the compound produced when cement is mixed with water. Selvam explained that by investigating how this material behaves at the nano level, researchers can determine how to improve the performance of the material.

Other researchers take a broader view, looking at the logistics of road transportation. By using mathematical and statistical modelling, industrial engineers can identify the most efficient ways to move goods across the country, and they can predict the effect that disruptions will have on a system. This is important because events ranging from highway accidents to large weather events to terrorist activity could have a huge effect on industry's ability to transport the goods we need. Chase Rainwater, assistant professor of industrial engineering, is working with a large trucking company to develop a decision-making tool that would address this issue. Rainwater's project will help the company understand what parts of their network pose the highest risk of operational losses in the case of a system disruption.

Rail

In the United States, rail transport moves more freight than any other method. Moving freight by rail is energy efficient, and it is safer than road transportation. The Federal Railroad Administration points to rail transport as a solution to several challenges, including road congestion, highway fatalities, fuel consumption, greenhouse gases and public infrastructure costs. Rail transport is an integral part of our transportation system, but travel by rail presents some logistical challenges.

Unlike roads, which blanket every region of the country, rail transportation is confined to existing tracks. Also, trains can only be loaded and unloaded at special facilities. Goods that have extra handling requirements, such as refrigeration, put even more restrictions on the system. Increasing the efficiency of this system requires complicated statistical modelling and optimization. Several industrial engineering researchers are focusing on this.

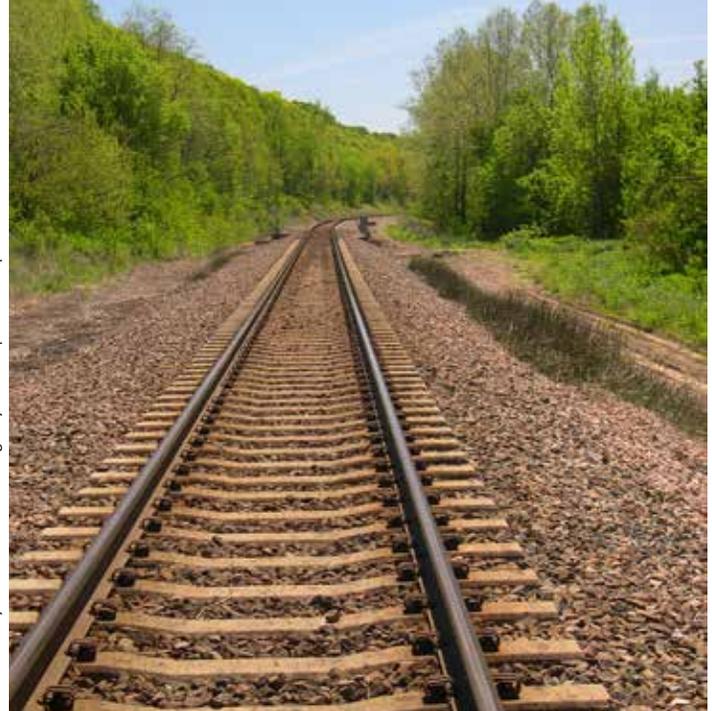
Justin Chimka, associate professor of industrial engineering, has inventoried Arkansas shortline and regional rail and transload facilities as a first step in improving rail transport in the state. By collecting information about these resources and engaging



key stakeholders such as the Arkansas Economic Development Commission, the Arkansas State Highway and Transportation Department and the shortline and regional rail companies, Chimka hopes to eventually develop a plan to strategically and economically increase the capacity of these rail systems.

Another challenge of rail transportation is the disruption caused by things like weather, accidents, maintenance problems or other events that shut down portions of track. Industrial engineering department head Ed Pohl, holder of the Twenty-First Century Professorship in Engineering, is working on a tool that will help rail companies respond to disruptions while saving time and money. His project models the rail system and finds routes that maximize efficiency while minimizing the risk of disruptions. In the case of a disruption, his tool can provide the most efficient alternate route.

Photo courtesy of the Arkansas State Highway and Transportation Department



Waterways

Water is the oldest means of carrying large amounts of freight over long distances, and it is still used quite often today. Ships and barges carry freight not just over the oceans, but also along inland waterways—the rivers and lakes that cross our nation. A single barge can hold as much cargo as 15 rail cars or 60 trucks, making it economical and environmentally friendly. However, like rail, waterway transportation has logistical challenges.



Photo courtesy of the Arkansas state Highway and Transportation Department

Vessels that travel on water need to have navigable water levels, so most waterways use a system of locks and dams, which manage water levels in places where the elevation of a waterway changes. In addition, waterways must be dredged regularly. In this process, sediment is removed from the bottom of the river to deepen the waterway. Water transportation must be planned around regular dredging schedules and lock maintenance schedules, but, as with rail transport, unforeseen accidents or other disruptions can cause serious delays for this type of transportation.

Rainwater and Kelly Sullivan, assistant professor of industrial engineering are conducting research that will help the U.S. Army

Corps of Engineers schedule dredging projects. Many factors must be considered when dredging is scheduled: the frequency that dredging is needed in different locations, the availability of dredging equipment and also the environmental impact of dredging on the wildlife in the river.

Using data on water levels at different points, Sullivan is creating a computer model that will produce a list of dredging projects. The system can generate dredging schedules over a long period, such as the entire year, or it can generate short-term schedules that change often. Rainwater is working on a tool that can allocate the necessary equipment for these projects. These tools can help the country save energy and time by optimizing the schedule for this maintenance, as well as minimizing the disruption to waterway traffic.

Chimka is also conducting research to identify what kind of effect disruptions have on the economy. Recently, the corps of engineers published data on how many commodities traveled through locks in the past ten years, along with data about when these locks were available, and when they were closed for scheduled or unscheduled maintenance. Using this data, Chimka can determine what effect locks have on the economy. Chimka is using data analysis and modeling. With this approach, he can look at commodities traffic as a variable that is affected by lock availability and identify how changes in one affects the other.

Industrial engineering professor Heather Nachtmann is developing a decision support tool for shipping companies and the U.S. Coast Guard to determine how to handle barge cargo when a disruption occurs. Many events disrupt traffic on waterways. When water levels are too high or too low, or when locks or bridges get damaged, the waterways can be blocked for days or weeks until navigation is restored. In this case, barges can wait on the water or unload their cargo at the nearest port, but the best option is not always clear.

Nachtmann's tool will prioritize the barge traffic according to what kind of cargo each barge is carrying. The tool provides a schedule of which barges should be unloaded and which terminals they should access. Nachtmann explained that the need to expand this tool to ocean-going vessels became clear after Hurricane Sandy in 2012 when ship captains in the New York area were contacting the Coast Guard for assistance.



Multimodal

One way to increase the efficiency of the transportation system is to make use of intermodal or multimodal transportation. A multimodal transportation system combines the advantages of roads, rail and waterways. For example, cargo could be shipped across the ocean and up a river to a port, where it is loaded onto a truck and transported to a rail loading facility, sent across the country on a train and then unloaded at another facility, put back on truck, and taken to a warehouse for distribution. For this system to work, cargo must be shipped in standard containers, which can be transferred from barges to trains to trucks without affecting the contents inside.

The Physical Internet Initiative is a movement to increase the efficiency of intermodal transportation systems by applying the foundational principles of the internet to the field of logistics and transportation. On the internet, uniquely labeled bits of information are sent between uniquely labeled users. The information network of

the internet operates separately from the companies, organizations and individuals who are sending and receiving the information, and the infrastructure of the internet is standardized—anyone with a web browser can access it equally. Applying these principles to the transportation industry would greatly increase the reliability and efficiency of that industry, but it would take a huge amount of cooperation and coordination.

Rainwater is conducting research to support this need. His project, which is funded by several corporate sponsors as well as the National Science Foundation, asks what would be gained if companies shared space on trucks and warehouses. This space-sharing, along with standardized container sizes, would make it easier to maximize the amount of commodities that could be moved, while minimizing the cost and time it takes to move them. Rainwater explained that the university could play an important role in setting up a system like this. As an outside arbitrator, a public institution like the U of A could help companies coordinate without having to share trade secrets with each other.

Multiple Players—the Centers that Support Transportation Research

The transportation research that takes place at the College of Engineering has an immediate effect in the world beyond the lab. Thanks to collaborations between researchers, government and industry, these projects provide improvements and tools that affect the lives of Arkansans now and in the future.

Many of these relationships are built through the College of Engineering's transportation centers.

Center for Training Transportation Professionals

The CTPP performs all of the training and certification required for Arkansas State Highway and Transportation Department employees and contractors whose jobs will involve quality control testing on highway construction projects. The center trains up to 500 workers a year. In addition, the center provides a link between the university, the state and the transportation industry. Students can serve as test proctors, which gives them hands-on experience, as well as opportunities to network with highway department professionals and transportation contractors. In addition, civil engineering researchers can make important industry contacts through the center.

Center of Excellence in Logistics and Distribution

CELDi is a National Science Foundation Industry/University Cooperative Research Center. At CELDi, U of A faculty members collaborate with Clemson University, Virginia Tech, the University of California, Berkeley and the University of Missouri. The researchers work with members of industry on projects that improve logistics and distribution—helping industry transport and track their products efficiently. CELDi's member organizations include Bayer HealthCare, Lockheed Martin Aircraft & Logistics Center, the Missouri and

Oklahoma departments of transportation, Sam's Club and Walmart Stores, Inc. This relationship between industry and research ensures that the university produces results that industry can use immediately.

Maritime Transportation Research and Education Center

MarTREC focuses on maritime and multimodal logistics management, construction of resilient and sustainable multimodal infrastructure, and the creation and promotion of livable coastal and river-valley communities with effective emergency management systems. The consortium consists of the University of Arkansas, Jackson State University, Louisiana State University and the University of New Orleans. MarTREC's advisory board includes representatives from government organizations such as the Arkansas State Highway and Transportation Department, the U.S. Coast Guard and the U.S. Army Corps of Engineers, as well as representatives from the transportation industry. It has received a total of \$3.7 million in funding from the U.S. Department of Transportation.

Southern Plains Transportation Center

The U of A is one of eight university members of this consortium, which investigates solutions for climate-related transportation challenges, such as extreme temperatures and freeze-thaw cycles. Because water and temperatures can affect the pavement that makes up our roads and bridges, the work of researchers in this center is vital to ensuring that our transportation infrastructure can withstand threats from weather. The SPTC supports much of the pavement and infrastructure-related research in the college. Other university members include the University of Oklahoma, which is the lead institution, Oklahoma State University, Langston University, Louisiana Tech University, the University of New Mexico, the University of Texas at El Paso and Texas Tech University.



Student Researchers

Students, at the undergraduate and graduate levels, are a vital part of the university's research mission. By participating in research, students gain hands-on application of the information they learn in the classroom. These research opportunities also help them to discover their interests and passions and can even help to fund their education.

Nidhi Saxena, a graduate student from Hyderabad, India, is collecting data on all U.S. waterways to determine how lock performance and usage is affecting the economy. Saxena's graduate assistantship is funded by assistant professor Justin Chimka's project. She explained that research often presents challenges. "Right now, we're dealing with the difficulty of missing data," Saxena said. "We have to figure out data mining techniques to get a proper subset for data analysis," she explained.



Several students are also working with assistant professor Andrew Braham in the asphalt lab at the Engineering Research Center. **Erica Yeung**, an undergraduate senior from Miami, Oklahoma, is researching asphalt emulsion, a new kind of asphalt that saves on energy and cost. Yeung explained that she found a passion for transportation through working in the asphalt lab. "Asphalt is a lot more than I thought it would be," she said. "There's a lot of chemistry involved in it as well as structural aspects. The opportunity I was provided with at the lab made it much more interesting. It's just been really fun, although I'm still not used to the smell of it," she remarked with a laugh.



Sadie Smith, a graduate student from Conway, Arkansas, also conducts research in the asphalt lab. She is working on a pavement

recycling technique called full depth reclamation. This technique seeks to solve the problem of deteriorating roads by creating a new, stronger base as a foundation for roads. Smith and Yeung are combining their research to find an ideal temperature and pressure for asphalt emulsion.



Civil engineering graduate student **Ricky Deschenes** is working with professor Micah Hale. They are looking for ways to repair cracking on the barrier wall on Interstate 540, just north of the Bobby Hopper tunnel. This wall is affected by a process called an alkali silica reaction. Deschenes and other researchers are monitoring the degree of cracking on the wall and testing several methods of reducing the amount of moisture inside the concrete. Deschenes has also gained experience by participating in concrete testing at the Center for Training Transportation Professionals.



Sydney Dickson, a senior Honors College student, was attracted to the University of Arkansas in part because of the opportunity to participate in research. Dickson conducted her honors research on concrete cracking in a study called "Alkali Silica Reaction Mitigation Using High Volume Class C Fly Ash." Her research earned Dickson a fellowship from the American Concrete Institute. She presented her honors thesis in England this past fall. "My research and the opportunity to present it internationally has helped tremendously in my professional development," she said.



Alumnus Profile:

Grady Harvell

President, AFCO Steel

One of the many ways Grady Harvell (left) supports the university is through collaborations with researchers like assistant professor Gary Prinz (right).



Grady Harvell began his career at AFCO Steel in 1972, directly after graduating with a civil engineering degree from the U of A. The steel fabrication company drew Harvell because of its reputation, and he has stayed for 43 years because of the opportunities provided for professional growth and the ability to remain in his native state of Arkansas.

“AFCO was noted at the time for having a strong engineering background. The owners and managers had engineering degrees, and the company had a strong engineering culture,” Harvell explained.

One of his first tasks as an AFCO employee was to set up a computer based estimating department. At that time, everything at AFCO was done by slide rule or paper, and switching to computers was a huge shift, but Harvell explained that he got plenty of support and help. “It was my good fortune to work with a lot of good people whose sole interest was in making the company better.”

Harvell became general sales manager for AFCO in 1980 and was promoted to executive vice president in 1992. In 2002, Joe Brown, the chairman of AFCO, and the Brown family sold the company to W&W Steel of Oklahoma City. Harvell became president of AFCO at that time. Even though the company had changed hands, Harvell explained that AFCO remained the same business with the same people. As president, he is most proud of the fact that W&W and AFCO have remained solid companies that

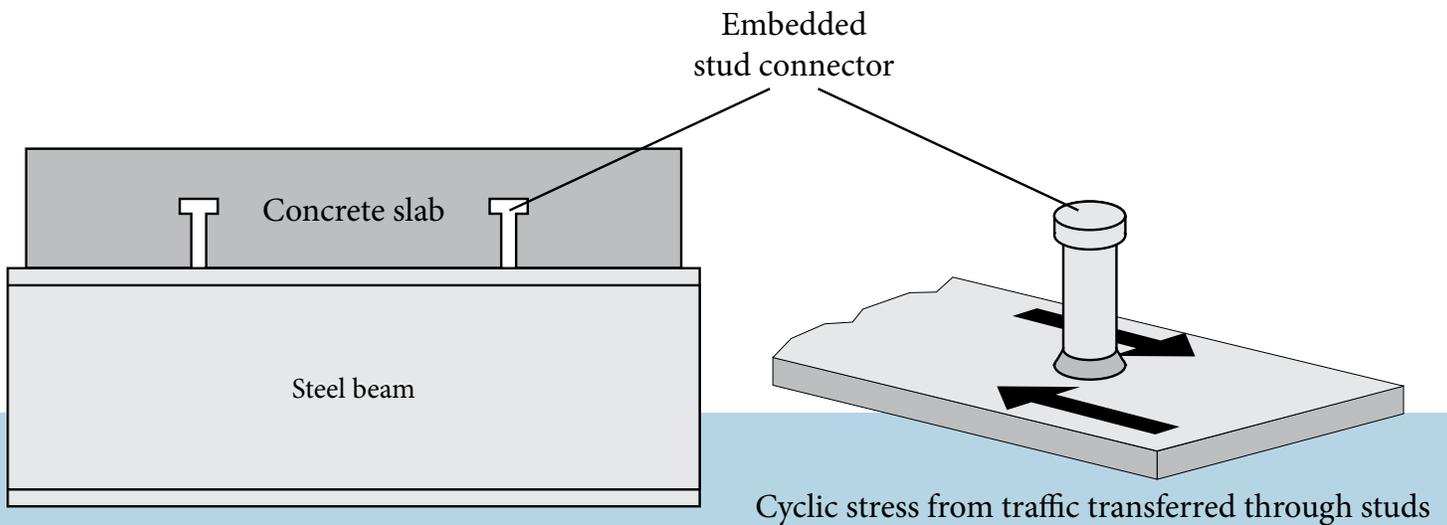
provide good jobs, even during the recession in the past decade.

Harvell has a strong relationship with his alma mater, both professionally and personally. AFCO fabricated the steel for the North End Zone facility and for the 2001 Razorback Stadium & Skybox Expansion on the east side and south end zone. AFCO also supports research at the U of A, because Harvell recognizes that new discoveries about steel infrastructure would benefit his industry as well as improve engineering education.

Harvell is working with civil engineering assistant professor Gary Prinz to investigate more efficient methods of connecting steel to concrete in bridges. Most bridges are built by pouring concrete over steel beams. These beams have steel shear studs on the top flange to develop composite action with the concrete deck, holding the two materials together. The number of studs was determined by research that was conducted in the 1960s.

The current U.S. code requires the use of many studs, more than standards in places like Europe and Japan. If bridges can be built safely with fewer studs, the cost of steel bridges nationwide could be reduced. Also, if studs could be grouped together instead of covering the entire surface of the beam, this would allow construction companies to fabricate the concrete decks of bridges ahead of time, leaving holes for the studs, which would save time and money.

Prinz’s expertise is in the area of fatigue and fracture of steel



This diagram shows how studs connect steel beams to concrete slabs.

structures. By performing additional experiments and using advanced statistical methods with existing experimental data, he hopes to make a case that the current standards should be reevaluated.

The relationship between research and industry has several benefits for each side. The steel fabrication industry gets the advantage of research-proven methods while Prinz is able to provide a research education for his students. “Grady is a major supporter of steel and steel research,” said Prinz. “He’s willing to do anything he can to make steel more efficient and economical, including investing in research. He understands that the research process is often important for getting practical things into industry.”

Relationships with industry also benefit the university. Harvell has a stake in making sure the U of A’s civil engineering facilities are state of the art, in order to attract researchers like Prinz and give them the labs they need to do their work. “You can have great players,” he explained, “but without a stadium, they can’t win games.” This drive to help his alma mater grow has led Harvell to engage with the civil engineering department to consider a modern structures research lab, and it is his hope that this need will soon be met.

Harvell’s personal connection with the university began when he was invited to join the Arkansas Academy of Civil Engineering. He became active in that group’s scholarship fundraising activities and eventually became president of the Academy. “As a student, I got a

Harvell has a stake in making sure the U of A’s civil engineering facilities are state-of-the-art, in order to attract top researchers and give them the labs they need to do their work. “You can have great players,” he explained, “but without a stadium, they can’t win games.”

scholarship from a civil engineering alumnus, and that helped me stay in school,” said Harvell, who has endowed a scholarship in his parents’ honor. The Harvell Family Scholarship supports one civil engineering student every year.

When Ashok Saxena, who was dean of the college at the time, asked Harvell to serve on the dean’s advisory council, he saw it as another way to stay involved and give back to the university he loves. In 2014, Dean English asked Harvell to serve as chairman. “I am very honored,” he said. “And I look forward to continuing to work with Dean English. I encourage everyone who has received a degree from the U of A to continue a tradition of giving back any way they can, either financially, or through devoting time and energy. Engineers do that very well.”



High school students learn about the College of Engineering during the annual Razorback Reveal event.



Teams from Arkansas, Mississippi, Oklahoma and Texas made up of undergraduate students from underrepresented groups competed in the Alley Scholars Shark Tank Business Plan Challenge at the University of Arkansas in February. The competition is part of the fourth annual Alley Scholars Summit hosted at the university by the College of Engineering, the Sam M. Walton College of Business and the J. William Fulbright College of Arts and Sciences.



In September, Congressman Steve Womack visited the lab of Magda El-Shenawee, professor of electrical engineering, to learn about terahertz imaging research at the College of Engineering. During his visit, Womack learned about a potential medical application of terahertz imaging for breast cancer treatment. Researchers in El-Shenawee's lab are developing a process to test tissue from lumpectomies during surgery in order to improve patient outcomes.



Faculty, staff and administrators from Galgotias University in India visited the University of Arkansas in September. The goal of the visit was to explore opportunities for collaboration under an existing memorandum of understanding between the U of A and Galgotias. The U of A is partnering with Georgia Institute of Technology to seek funding for an exchange program with Galgotias.



Recent graduates of the College of Engineering returned to campus for the first meeting of the Engineering Early Career Alumni Council. The college formed the council to learn from alumni how to improve students' preparation for the workforce. Members have completed their degrees in the last 10 years. Top: Andrew Bailey; Ben Onukwube; Brian Henderson, director of employer relations; John English, dean; Zach Heller; Lauren Moore. Bottom: Megan Peters; Kevin Carlson; Rhett Heeb; Wiwat Leebhaisomboon; Eric Specking, director of undergraduate recruitment.





At the Science, Technology, Engineering and Math (STEM) Career Fair, students get a chance to network with employers and learn about job prospects. This semester, the fair attracted 75 engineering employers and over 500 students seeking internships, co-op positions and full-time employment opportunities.



Engine Week is back at the College of Engineering. This year's events included "Dipping with the Deans." John English, dean of engineering, along with assistant deans Colleen Briney, Bryan Hill, Thomas Carter III, and associate dean Heather Nachtmann, served up ice cream and fun for engineering students. Engine Week also featured a State of the College address from Dean English, several engineering competitions, presentations and a dance marathon benefiting Hogs for Hope.



News:

The U of A's online engineering programs, including a Master of Science in Engineering degree and a Master of Science in Electrical Engineering degree, were ranked No. 29 among online graduate engineering programs and No. 23 for engineering programs at public universities by U.S. News & World Report.

John Gauch, computer science and computer engineering professor at the University of Arkansas, helped create an introductory programming class for high school students in Arkansas. The creation of this course was in response to the Computer Science House Bill 1183, which calls for Arkansas high schools to offer coding classes. At the end of January, Gauch served on the 2015 Arkansas Computer Science Coding Course Committee. The committee of teachers, curriculum specialists and higher education representatives created a framework for the new course, "Essentials of Computer Programming."

University of Arkansas professors **Marty Matlock** and **Greg Thoma** led a sustainability workshop at the 2015 International Production and Processing Expo in Atlanta, Georgia. Matlock, executive director of the U of A Office for Sustainability, and Greg Thoma, the Bates Teaching Professor in the Ralph E. Martin Department of Chemical Engineering, led the Animal Agriculture Sustainability Summit during the poultry industry's largest trade show.

BlueInGreen LLC, a water-quality management firm affiliated with the University of Arkansas, has reached an agreement with the city of Fayetteville to more effectively and efficiently disinfect wastewater before it is discharged back into the environment.

Awards and Recognition:

Micah Hale, associate department head of civil engineering, is one of four faculty members at the University of Arkansas who have been selected as a 2014-15 SEC Academic Leadership Development Program fellows.

Bryan Hill, assistant dean for student recruitment, honors and international programs in the College of Engineering, is one of the three finalists selected for the 2014 GEDC Airbus Diversity Award. The \$10,000 award is sponsored by Airbus, a leading aircraft manufacturer, and the Global Engineering Dean's Council.

Alan Mantooth, Distinguished Professor of electrical engineering and holder of the Twenty-First Century Endowed Chair in Mixed-Signal IC Design and CAD, was one of Arkansas Research Alliance's five inaugural fellows.

At the annual conference of the Institute for Operations Research and Management Sciences, **Greg Parnell**, research professor, received the Frank P. Ramsey medal, the highest award of the Data Analysis Society.

Heather Nachtmann, professor of industrial engineering and associate dean for research for the College of Engineering, was elected by the American Society for Engineering Management to a four year position which rotates from secretary, president-elect, president to past-president.

Darin Nutter, professor of mechanical engineering, received the Midwest Section Outstanding Teaching Award from the American Society for Engineering Education.

Ed Pohl, head of the industrial engineering department, was

elected to a three-year term serving as the south central regional director for the American Society for Engineering Management.

Chase Rainwater, assistant professor of industrial engineering and **Douglas Spearot**, associate professor of mechanical engineering and holder of the Twenty-First Century Professorship in Mechanical Engineering, attended the National Academy of Engineering's Frontiers in Engineering Education Symposium in Irvine, CA. This by-invitation symposium was composed of premier educators in all disciplines of engineering and discussed current trends and future needs in engineering education.

D. Keith Roper has been appointed leader of the Engineering Research Centers Program and the Network for Computational Nanotechnology in the Engineering Division of Engineering Education and Centers at the National Science Foundation.

Lalit Verma, head of the Department of Biological and Agricultural Engineering at the University of Arkansas, was inducted into the Hall of Fame of the Biological Systems Engineering Department at the University of Nebraska-Lincoln, where he received his doctorate.

The NSF Center of Excellence in GRid-connected Advanced Power Electronic Systems (GRAPES) received a \$200,000 Innovative Managing Director Grant from the National Science Foundation. GRAPES' managing director is **T.A. Walton**.

Wenchao Zhou, assistant professor of mechanical engineering, received the 2013-2014 Emerald Engineering

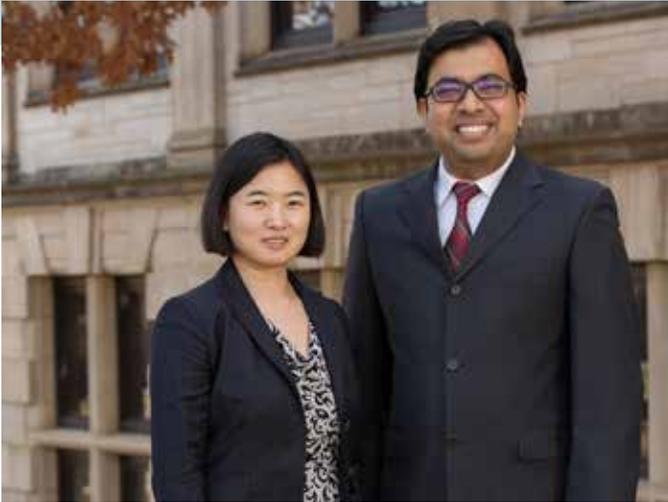
Outstanding Doctoral Research Highly Commended Award in the category of Additive Manufacturing.

Research:

A U.S. Patent titled "Separatome-based Protein Expression and Purification Platform" was assigned to the board of trustees of the University of Arkansas and the University of Pittsburgh. **Ellen Brune** is a 2013 chemical engineering graduate whose start-up company, Boston Mountain Biotech, is marketing the method. In addition to Brune, other inventors named on the patent are **Bob Beitle**, professor of chemical engineering and associate vice provost for research and economic development at the U of A; **Ralph Henry**, Distinguished Professor of biological sciences at the U of A; **Mohammad Ataai**, professor of chemical engineering at the University of Pittsburgh; and **Patrick Bartlow**, a scientist at Janssen Research and Development, a subsidiary of Johnson & Johnson.

Michelle Bernhardt, assistant professor of civil engineering, has received a three-year grant for \$340,035 from the National Institute of Standards and Technology, a technology agency within the U.S. Department of Commerce. Bernhardt will develop discrete element method simulations that can be used to examine the metal powder behavior in direct metal laser sintering devices, one of the techniques known as additive manufacturing or 3D printing.

Christophe Bobda, an associate professor of computer science and computer engineering, is co-editor of Distributed Embedded Smart Cameras. The newly released textbook covers the architecture, design and applications of a new



Two Engineering Faculty Members Receive NSF CAREER Awards

Kartik Balachandran, assistant professor of biomedical engineering, and Jing Yang, assistant professor of electrical engineering, have received awards from the Faculty Early Career Development Program of the National Science Foundation. This distinguished award,

known as the CAREER award, supports junior faculty who have demonstrated an ability to integrate outstanding research with excellent teaching. Balachandran and Yang each received a grant of \$500,000.

In his research, Balachandran looks at how mechanical forces affect body tissues. Using photolithography and nanoscale techniques, Balachandran engineers tissue-mimics that recapitulate the structure and properties of human tissues. He then tests the response of these materials to different stresses and forces. Using these methods, he can examine the effects of everything from war injuries to high blood pressure.

Yang's award supports her research developing sensing and transmission systems for energy-harvesting, wireless sensor networks. These networks use energy from sources such as solar power and wind power to collect and transmit vast amounts of data. Yang is working on a set of algorithms that will lead to the design of new systems that can dynamically and intelligently allocate these inconsistent and scarce energy sources to collect and transmit the most informative data samples. She uses two distinct but related approaches, one driven by energy, the other by data.

wave of cameras, known as smart cameras, which analyze video data internally and thus limit the amount of data that needs to be sent to remote servers.

Richard Coffman, assistant professor of civil engineering, has received \$1.14 million in funding to develop a decision support system for assessing areas at risk for mudslides or rock falls caused by the effects of wildfires.

The National Center for Reliable Electric Power Transmission, in cooperation with APEI, has received approval for a second year of funding from the Department of Energy for a project on wide bandgap inverters for under-the-hood electric vehicle traction drives. This project has been of great importance to both NCREPT and APEI and has resulted in the construction of a 100 HP, 8000 RPM dynamometer, which will expand both NCREPT's research and testing capabilities.

The University of Arkansas is the lead institution for a new \$786,407 grant from the U.S. Department of Energy to investigate strategies to minimize volumetric swelling in metallic nuclear fuels. The research has the potential to increase the safety and efficiency of nuclear reactors for power generation. Principal investigator **Paul Millett**, assistant professor of mechanical engineering, will work with researchers at the Georgia Institute of Technology, Texas A&M University and the Idaho National Laboratory.

The Maritime Transportation Research and Education Center (MarTREC) has received an additional \$1.4 million from the U.S. Department of Transportation. Researchers at the center focus on maritime and multimodal logistics, construction of resilient and sustainable multimodal infrastructure and the creation and promotion of livable coastal and river-valley

communities with effective emergency management systems.

Ranil Wickramasinghe, professor of chemical engineering and **Xianghong Qian**, associate professor of biomedical engineering, received a grant of \$280,000 for a period of three years from the Binational Agricultural Research and Development Fund. They are collaborating with researchers at Technion in Israel on a project to study the use of self-cleaning membranes in agricultural water treatment.

Two biomedical engineering professors at have received a three-year, \$395,722 grant from the National Science Foundation to study how brain cells respond to traumatic injury. Assistant professors **Jeffrey Wolchok** and **Kartik Balachandran** and their team are trying to determine if neuron-supporting cells known as astrocytes create a degenerative

extracellular environment after traumatic injuries.

Fisher Yu, associate professor of electrical engineering, and colleagues **Wei Du**, postdoctoral fellow in the Department of Electrical Engineering; **Benjamin Conley**, doctoral student in the microelectronics-photonics graduate program; and **Hameed Naseem**, professor of electrical engineering, have fabricated a new semiconductor material, germanium tin deposited in layers on a substrate of silicon, that could be used to build better and less expensive infrared cameras for smartphones and vehicles.



CLASS NOTES

D. NEWTON WHITE JR. BSCE'74 MSCE'76 and Linda Kay White BSE'74 MED'75, Hot Springs, celebrated their 40th wedding anniversary on May 19, 2014. Newton is a professional engineer and the chief executive officer and owner of Instrument and Supply Inc., a 35-plus year firm in Hot Springs. Linda is a retired special educator.

ROD FORD BSME'83, Little Rock, has founded and is the managing partner of XCelebrate Capital, a seed stage venture capital fund focused on early stage investment of technology startup companies in the Mid-South.

REBECCA D. MOUROT BSCHÉ'03 and Joshua M. Mourot BSCHÉ'03, Seattle, WA, announce the birth of their second son, Luke Alexander, born Aug. 18, 2014. Luke joins his older brother, Gage.

JONATHAN MAX ELY BSCE'05, has joined the city of Fayetteville's engineering division as a development and construction manager. He is a licensed professional engineer and is a LEED accredited professional.

IN MEMORIAM

NOEL P. LANE BSCHÉ'42, Macomb, IL, June 16, 2014. He spent his entire professional career working for Shell Oil Company. Survivors: his wife, Mary Jane BSHE'41, three children, three grandchildren, and one great-grandson.

GARNETT L. RABENECK BSME'43, Decatur, GA, July 2, 2014. He retired from Lockheed Martin in 1988 after 34 years. Survivors: his wife, Nelda, one son, one daughter and six grandchildren.

ROBERT F. OATES BSCE'44, Jonesboro, Oct. 19, 2014. A U.S. Navy veteran, he worked for AFCO Steel in Little Rock for 40 years. Survivors: his wife, Martha, one son, one daughter, five grandchildren and nine great-grandchildren.

JOHN C. BLACKSHIRE BSCHÉ'47, Fayetteville, Sept. 18, 2014. A U.S. Army Reserve and U.S. Navy veteran, he worked as an engineer, the owner of a seed operation and as a certified public accountant. Survivors: his wife, Helen, one son, one daughter, three grandchildren, two great-grandchildren and one sister.

AARON GREEN JR. BSCE'48, Lakewood, CO, Oct. 27, 2014. He was retired from Stearns Rogers Engineering. Survivors: his wife, Margaret, one son, one daughter, one sister, three grandchildren and five great-grandchildren.

HARLAN B. COUNTS BSEE'49, Conyers, GA, Oct. 23, 2014. He served in the U.S. Air Force and worked for the U.S. Geological Survey.

WALTER G. GRAUPNER SR. BSCHÉ'49, Bella Vista, Dec. 1, 2014. He was a U.S. Navy veteran. Survivors: his wife, Dearn, two sons, two daughters, nine grandchildren and one great-grandchild.

ROBERT L. HARRIS JR. BSCHÉ'49, Raleigh, NC, Aug. 8, 2014. He was a U.S. Army Air Corps veteran who joined the faculty at the University of North Carolina in 1973 and managed the Occupational Health Studies Group. Survivors: his wife, Peggy, two sons, one daughter and three grandchildren.

FRANK ALLEN BURKHALTER BSCE'50, Sherwood, Oct. 23, 2014. A World War II veteran, he was a registered land surveyor and licensed professional engineer, working his way up to chief of the structural department for the Little Rock District of the U.S. Army Corps of Engineers. Survivors: his wife, Loyce Ann, five children, nine grandchildren and three great-grandchildren.

ELMER B. CHURCH JR. BSME'50, Bartlett, Aug. 2, 2014. He was a U.S. Army veteran and retired from Firestone. Survivors: his wife, Kathryn, one daughter, one son, one brother and two grandchildren.

ROLAND EDWARD MOORE BSME'50, Springdale, Nov. 13, 2014. A U.S. Air Force veteran, he spent the majority of his career with Texas Eastern Gas Transmission Corp. in Shreveport and later in Houston, retiring as vice president in 1981. Survivors: one son, two daughters, seven grandchildren and one great-granddaughter.

WILBERT E. ROWND SR. BSCE'50, Little Rock, Dec. 14, 2014. He served in the U.S. Coast Guard and the U.S. Navy. He had a 34-year career with the Arkansas State Highway Department. Survivors: his wife, Sue, two daughters, six grandchildren and seven great-grandchildren.

DANIEL J. SCHLEEF BSME'50, Omena, MI, Nov. 26, 2014. He taught mechanical and industrial engineering at the College of Engineering and Applied Science at the University of Cincinnati. He retired in 1993. He was a U.S. Army veteran. Survivors: his wife, Elizabeth, two daughters and one brother.

HAL R. THOMPSON BSIE'51, Starkville, MS, Dec. 23, 2014. He was a U.S. Army veteran, he worked at Union Carbide Corp. in Texas City, TX, leading field maintenance operations for a large chemical manufacturing facility. Survivors: one son, one daughter and five grandchildren.

JAMES H. BENNETT BSCHÉ'53 MS'55, Kenner, LA, July 11, 2014. He retired as a plant manager for DuPont after 42 years and then worked as a tax expert for H&R Block. Survivors: one son, one daughter and one grandson.

FRANK M. BACKSTROM BSCHÉ'54, Valparaiso, IN, Dec. 12, 2014. He made his career with Standard Oil/Amoco then at the Whiting refinery finishing at their Chicago General Office in 1989. Survivors: one daughter, three step-children and five grandchildren.

GLENN C. BANDY MSEE'55, Breckinridge, TX, Nov. 18, 2014. He served in the U.S. Navy. He retired from Texas Instruments after a 36-year career with the company. Survivors: his wife, Jeanelle, three daughters, eight grandchildren and three great-grandchildren.

HAROLD D. MCKINNEY BSME'58, White Hall, Dec. 26, 2014. He was a U.S. Air Force veteran and retired from the Department of Defense with more than 30 years combined military and civilian service. Survivors: four children, seven grandchildren, six great-grandchildren and one sister.

LARRY ORLICEK BSEE'58, Malvern, March 11, 2014. He retired from Reynolds Metals in Hot Spring County in 1993. Survivors: his wife, Diane BA'56, four children, one sister, 10 grandchildren and two great-grandchildren.

JOE CLARK WILSON BSEE'58, Ventura, CA, Nov. 5, 2014. He was a U.S. Navy veteran. Survivors: his wife, Elinor, four children and six grandchildren.

JOHN R. ADDINGTON BSIE'61, Texarkana, TX, Nov. 29, 2014. He held a number of senior level management and industrial engineering positions throughout his 30-year tenure at Red River Army Depot. He served in the Army National Guard. Survivors: his wife, Linda, one son and two grandchildren.

GEORGE C. BROTHERTON BSME'61, Little Rock, Nov. 16, 2014. He worked for Gulf Oil for 25 years and Chevron Oil for two years as a regional manager. He retired from Citgo

Petroleum. Survivors: his wife, Charlotte, one son, one daughter, five grandchildren, six step-grandchildren and two great-grandchildren.

PHILLIP DUVALL BSIE'61 MBA'73 PHD'80, Texarkana, TX, Oct. 1, 2014. He held numerous senior level management and industrial engineering positions for 33 years at Red River Army Depot. He retired as director of ammunition operations. Survivors: his wife, Suzanne, one son, one daughter, one brother, one sister and four grandchildren.

GLEN ALLAN OVERBY BSChE'62, Tampa Bay, FL, May 6, 2014. A U.S. Army veteran, he worked for H&R Block as a tax preparer for 27 years. Survivors: two daughters, five grandchildren, two great-grandchildren and one brother.

LOYD WADE SHERRILL BSEE'62, Overland Park, KS, Nov. 25, 2014. He was an engineer at Black & Veatch in Kansas City, where he retired as a project manager in the Energy Engineering and Construction Division after 35 years of service. He was a U.S. Navy veteran. Survivors: his wife, Ruth, two sons, one daughter, two granddaughters, two sons, three step-grandsons and three great-grandchildren.

JOHN THOMAS HUDMAN BSChE'64, Kerrville, Nov. 7, 2014. He worked as a chemical engineer for Amoco for 25 years. Survivors: his wife, Lois, four daughters, one brother, nine grandchildren and three great-grandchildren.

KENNETH L. GARNER BSIE'72, Baton Rouge, LA, Nov. 26, 2014. A U.S. Army veteran, he retired from Entergy Corp. in 2004. Survivors: his wife, Clydene, one son, one daughter, five grandchildren, his mother, two brothers and one sister.

DENNIS SORRELL JR. BSCE'72, West Memphis, Sept. 7, 2014. He owned and operated Sorrell Consulting Engineers and was a registered professional engineer and land surveyor in both Tennessee and Arkansas for 45 years. Survivors: his mother, two brothers, three sisters, one daughter and one grandson.

JACK W. HAMILTON BSCE'76, Little Rock, Nov. 24, 2014. He began his career with Mehlburger Engineers and retired from the Arkansas Department of Environmental Quality. Survivors: his wife, Claudia, one son, two grandchildren and two sisters.

In Memoriam

CARL GRIFFIS, BSChE '64, MSChE '65, emeritus professor of biological and agricultural engineering, passed away on Friday, Oct. 31, 2014. Griffis came to the U of A in 1968 as an assistant professor of chemical engineering, after spending two years as an engineer with Exxon. He worked in the Department of Agricultural Engineering as a research associate, then an associate professor. In 1983, he became a professor of biological and agricultural engineering. From 1992 until 1997, he served as head of the Department of Biological and Agricultural Engineering, and he served as interim head of that department from 2008 until 2010. Griffis retired in 2011.

During his career, Griffis was recognized several times for his outstanding teaching and research. He received the Teaching Award of Merit from the National Association of Colleges and Teachers of Agriculture and the Imhoff Award for Outstanding Teaching from the College of Engineering. He received the Halliburton Outstanding Teaching Award three times and the Halliburton Outstanding Research Award once. He was named the Outstanding Teacher for the Biological and Agricultural Engineering Department twice, and received the John W. White Award for Outstanding Teaching twice.

"Professor Carl Griffis was a dedicated team-player who always looked out for the best interest of the students, his colleagues, and biological and agricultural engineering alumni," remembered Lalit Verma, head of the Department of Biological and Agricultural Engineering. "His kind, untiring and selfless contributions through teaching, research and service of over 40 years to our department, university and the state of Arkansas will be greatly missed. He was a true gentleman who touched the lives of hundreds of young minds who fondly remember him. Many of his students turned out to be very successful professionals and citizens. Professor Griffis also provided academic leadership to our department at several critical junctures and helped maintain the high-quality programs that contributed to the land-grant mission of this great university."

In an article Griffis wrote about his retirement, he reminisced about his career at the U of A. "I have never wanted to be anywhere else," he said. "My almost 43 years with the University of Arkansas, the College of Agriculture, the Division of Agriculture and the Agricultural Engineering/Biological and Agricultural Engineering Department have been part of the best career I could ever have dreamed about."

Griffis is survived by his wife, Barbara, one brother, one sister, four children and five grandchildren.



GENE LAXSON BSIE'76, Rogers, Jan. 6, 2014. A U.S. Air Force veteran, he worked for the International Paper Company in Pine Bluff and then as a production engineer at the Pine Bluff Arsenal. Survivors: his wife, Muriel, one son, five daughters, five grandchildren and three great-grandchildren.



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