

OLE MISS



ENGINEER

2019



**MISSISSIPPI
MADE**

BEHIND THE COVER

MISSISSIPPI MADE

Dean Puleo, along with representatives of the Dean's Honor Roll, Chancellor's Honor Roll and Engineering Leadership Council, are pictured on the cover. These representatives come from all over the world. They share the experience of being on the Ole Miss Circle in a beautiful 100-year-old building, pursuing excellence every day. One can claim to be a self-made man or woman, but what an enriching experience to be "Made in Mississippi." Borrowing the words of a colleague from the Center for Manufacturing Excellence in a congratulatory post to graduates last year, "Now go out and make the world a better place!"



FROM THE EDITOR

In the 2019 edition of *Ole Miss Engineer*, you will find 32 references to hometowns, co-op and alumni jobs, industries and research activities in our great state of Mississippi. As a Mississippian for 50 years, I count it a privilege to know or know of people from every county and most towns and cities in Mississippi. I love this state and the people that make it what it is! I have often thought we should stop promoting this hidden gem altogether because the charm of this great place is that it still truly is the Hospitality State.

According to a Simon & Schuster article written by Richard Grant titled "Morgan Freeman and the Meaning of Life," people often asked Freeman why he would choose to live in Mississippi when he was rich and famous and could live anywhere in the world. "Because I can live anywhere I want, and this is where I want to live," he said.

As 1988's Miss Hospitality, proudly wearing my tiara to all the local ribbon-cutting events in support of new businesses in Oxford, it's just wonderful to see many of those companies still thriving 30 years later. And the memory of my Miss Hospitality speech of state stats and bragging rights comes to mind as we go to press with this magazine. Would you believe me if I told you I wore a William Faulkner book for my representative costume in the state pageant, custom-designed by my high school physics teacher to have a mechanically operated front cover revealing a Faulkner quote? It's true.

Today, Mississippi is known for more than hospitable hometown connections, pageants, magnolia trees, mockingbirds, largemouth bass, and being the birthplace of America's music as proclaimed on our car tags by B.B. King's legendary guitar "Lucille." From my view, it is also a beautiful state overflowing with potential to change the world.

I hope you enjoy this year's magazine.

Marni

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Dear Alumni and Friends,

As I pass my six-month anniversary as dean of the School of Engineering, I begin by expressing my sincere appreciation for the warm reception that my wife, Sue, and I received during our transition to Oxford. We are excited to be part of the Ole Miss Engineering family.

Starting work just a few weeks after fall classes began, I was deluged by information for a good portion of the semester, and I eagerly tried to take in as much as possible. Experiencing tailgating the Ole Miss way was a tremendous opportunity to meet alumni, friends, students, staff and faculty. Your generous greetings and words of encouragement were energizing. Your passion for the school and university is inspiring.

Before moving on to the focus of this issue, please join me in thanking Alex Cheng for his stewardship of the School of Engineering for almost a decade. Tremendous growth occurred during this time, with the number of undergraduate students more than doubling. Professor Cheng's service to Ole Miss Engineering is sincerely appreciated.

The theme for this year's edition of *Ole Miss Engineer* amalgamates elements of several previous issues. "Mississippi Made" was selected to convey the picture of people from across the world connecting in Oxford to be prepared for transformative careers, many related to manufacturing. Regardless of whether the students are native Mississippians, they attend Ole Miss to be shaped in ways that allow them to contribute to the betterment of the state, country and world.

I describe graduates of Ole Miss Engineering as T-shaped professionals. If you are not familiar with this expression, the upright of the capital letter T reflects technical abilities, while the crossbar represents transferrable (or universal) skills. Our graduates excel not only within their discipline (i.e., a good engineer, computer scientist or geologist), but they are also prepared for critical thinking, communication, teamwork,

ENGINEERS & COMPUTER SCIENTISTS IN THE MISSISSIPPI WORKFORCE

All Computer & Mathematical Occupations **11,810 = avg. salary \$67,820**
 Computer Systems Analysts **1,860 = \$66,040**
 Network and Computer Systems Administrators **1,250 = \$72,630**
 Computer User Support Specialists **2,380 = \$45,520**
 All Architecture and Engineering Occupations **14,959 = \$73,690**
 Civil Engineers **1,490 = \$84,950**
 Electrical Engineers **1,250 = \$95,320**
 Mechanical Engineers **1,160 = \$91,360**

OLE MISS ENGINEERS IN THE WORKFORCE

School of Engineering alumni are in all 50 states, the District of Columbia and several countries. May 2018 graduates are in 23 states and two countries.

1848 University of Mississippi
FOUNDED

1900
School of Engineering
FOUNDED



1,443
Undergraduate Enrollment

1,590
Total Enrollment



289
degrees awarded: 2017-18

87% FRESHMAN
RETENTION
28.5 FRESHMAN ACT
COMPOSITE AVERAGE
3.77 HIGH SCHOOL
GPA

FACULTY
55 **17**
TENURED/TENURE TRACK INSTRUCTIONAL

RESEARCH CENTERS

Center for Graphene
Research & Innovation
Mississippi Mineral
Resources Institute
National Center for Computational
Hydroscience & Engineering

ACCLAIM



TOP 50
in percentage of women
tenured/tenure-track faculty

**ONLY Geological Engineering
program in the 12-state region**
AL, AR, GA, KS, LA, MD, MS, OK,
SC, TN, VA, WV

leadership and the like, which enable them to collaborate across disciplines and rise to prominent positions in their workplace. As clichéd as it may read, our alumni are problem solvers who are equipped to continue learning, adapt and grow in this ever-changing world.

Recognizing the important role of STEM (science, technology, engineering and math) careers in advancing the economy and improving lives, we believe in a holistic approach to university-industry engagement. This type of involvement spans a continuum of interactions, ranging from employment of students/graduates to sponsoring student organizations and capstone projects to collaborative research to partnerships. As you will read in this magazine, Ole Miss Engineering graduates contribute to many of the target industries in Mississippi, including advanced manufacturing, aerospace, automotive, energy, health care and shipbuilding, and we seek to expand our footprint in these areas.

I am excited for the future of Ole Miss Engineering. As we “double down” on preparing T-shaped professionals, we also have great opportunities to develop our graduate and research programs. Research and innovation are key drivers of the Mississippi economy. Our students and alumni create technologies and algorithms that address some of the biggest challenges we face in energy, environment, infrastructure, security and health, as you will see in some of the department articles in this issue.

In closing, please stop by if you are in Oxford. I have enjoyed visiting with the alumni and friends who have dropped in and would be delighted to meet you.

Hotty Toddy!



DAVE PULEO

Dean of Engineering
Professor of Biomedical Engineering



**SCHOOL OF
ENGINEERING**

UNIVERSITY OF MISSISSIPPI | 1900

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Dear Alumni and Friends,

I am humbled and elated to serve as the School of Engineering's development officer. While I am only two months into my position, I've already perceived a great sense of pride from the faculty, staff and students who make this school so critically important to the university and the state of Mississippi.

On my first day of work, I attended a retreat for the chairs and directors of the engineering school. I was immediately impressed with their passion for their chosen careers and their appreciation of the students whom they teach. They understand just how much influence our students will have on our state and nation upon matriculating from this great institution.

None of this, of course, is possible without the financial generosity of our donors. It is through your continued support that we are able to provide our faculty and students with facilities that prepare what Dean Puleo calls our T-shaped professionals. As we all know, technology is rapidly changing, and the needs for our growing program will continue to evolve. Through your support, we can and will make the School of Engineering one of the finest educational programs in the South.

If I may assist you in any way, please contact me at 662-915-3087 or gjcarter@olemiss.edu, or visit the University of Mississippi Foundation website, umfoundation.givingfuel.com/engineering. I look forward to visiting with you and exploring ways to match your interests and passions with the needs of the School of Engineering.

I know you will enjoy this year's edition of *Ole Miss Engineer* as it highlights the great contributions our graduates make each day.

Sincerely,



GREG CARTER
Associate Director of Development
for the School of Engineering





MISSISSIPPI MADE

UM prepares engineers and scientists
for versatile careers in state's target
industries

— By Bill Dabney —

Now, more than ever, globally recognized corporations are choosing to call Mississippi home – each building a workforce peppered with Mississippi-made engineers and creating a presence that powerfully fuels the economy in the state and beyond.

Advanced manufacturing, aerospace, agribusiness, automotive, forestry/energy, health care, shipbuilding and tourism/film – these are the eight business sectors the state of Mississippi has identified as its primary industries.

“Our graduates often become leaders in these areas, contributing significantly to the economic engine of the state,” said Dave Puleo, dean of the University of Mississippi

School of Engineering. “Students come from all over Mississippi to study here and often enjoy long, rewarding careers in one of the industries that keeps their home state growing strong. Likewise, nonresident students are increasingly choosing to work in, or give back to, the state they grew to love while they studied at Ole Miss.”

Take a look at the stories of a few alumni who, after gaining their education and experience in Mississippi, chose careers in the state’s target industries. These graduates now contribute to Mississippi’s economic prosperity and growth through work that transforms and improves the world around them.



“
I hope my education will lead me to helping Mississippi improve through advancing manufacturing’s already growing supply-chain operations planning.

”
WARD WINSTEAD

ADVANCED MANUFACTURING

As a continuous improvement engineer, Joseph Reed identifies process gaps and wastes by working closely with shop floor associates at Milwaukee Electric Tool Corp’s distribution center in Olive Branch.

Milwaukee Tool designs, manufactures and distributes heavy-duty power tools and accessories to the everyday trades professional.

“I use data to support every new change that I implement,” said Reed (BSME 17),

of Oxford. “I create new system-driven processes in our facility that help eliminate operator variation. This ensures all operators are following the same standardized process with minimal waste. Every project I work on must meet the needs of our business by having a positive customer impact or by having a substantial return on investment.”

The “strategic win” projects – those that are easy to implement but also have a sizable business impact – are plentiful, meaning Reed’s biggest challenge is identifying what projects should be prioritized.



REED

Submitted photo

It's exciting work, he said.

"I learn something new every day. In order for me to successfully do my job, I have to approach my job with a 'never satisfied, always improving' mindset."

Reed said his education was crucial to his success in the profession.

"The Center for Manufacturing Excellence separated me from the rest of the crowd at work, and it still shows today. My mechanical engineering degree definitely taught me how to problem-solve while having strict attention to detail."

Even within the same discipline or company, engineers' responsibilities can be quite different. For example, UM sophomore mechanical engineering major Ward Winstead of Pelahatchie is an intern for Milwaukee Tool in Jackson, yet he and Reed play vastly different roles.

"I work as a manufacturing engineer for new product development, so I design process flows, line layouts and fixtures to prepare the facility to efficiently produce new products," Winstead said. "I also work as a production engineer for one of the existing manufacturing lines in the plant."

Winstead confirms that Mississippi-made engineers can greatly affect the state's economy through their work at Milwaukee Tool.

"Milwaukee Tool has many investments in the state of Mississippi. With manufacturing facilities in Jackson, Greenwood and the distribution center in Olive Branch, the company gives jobs to over 1,000 Mississippians," he said. "With so many new products coming to Jackson, we are creating even more jobs for people in the central Mississippi area."

Winstead enjoys being able to design and learn the process for development of new products while also helping to discover modern efficiencies in manufacturing. After graduating from Ole Miss, he plans to remain in his home state, giving back.

"I hope my education will lead me to helping Mississippi improve through advancing manufacturing's already growing supply-chain operations planning."



WINSTEAD

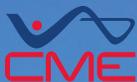
Submitted photo

AEROSPACE

Mechanical engineer Stephen Richardson's 25-year career has had a direct effect on space exploration. The 1991 UM graduate is a team lead responsible for technical oversight of the structural design and analyses associated with NASA's newest launch vehicle.

"My team is looking at the different types of pyrotechnic devices used on launch vehicles, including those necessary for separation during ascent," said Richardson, adding that he's also responsible for oversight of the vehicle's destruct system, which would possibly be deployed if the vehicle ventures off course. Additionally, Richardson's team is charged with assessing any debris released during ascent that could critically damage the rocket.

"At Ole Miss, we had a strong emphasis in structures and on working in a team environment," Richardson said, giving credit to his education for preparing him for the career he's enjoyed. "I've primarily worked in the field of launch vehicle structures, so I think I was ready to come out of college and function in the field,



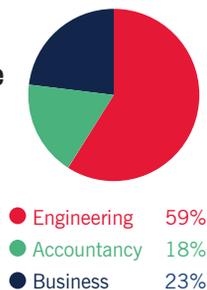
Haley Barbour Center for Manufacturing Excellence
THE UNIVERSITY OF MISSISSIPPI

olemiss.edu/CME

Majors

CME students major in three different academic schools

- Biomedical Engineering
- Chemical Engineering
- Computer and Information Science
- Electrical Engineering
- Mechanical Engineering
- General Engineering
- Accountancy
- Business



Salary

Average Starting Salary for May 2018 Graduates

\$65,200

Gender

Who is in the CME?



“
I enjoyed getting to work
on hardware that’s actually
going to go into space.
”

ANNIE CATHERINE RICHARDSON

collaborating with other engineers on the work we do.”

Richardson’s daughter, Annie Catherine Richardson, is a UM Class of 2020 student who recently completed a two-term co-op (see page 14) at NASA’s Marshall Space Flight Center in Huntsville, Alabama, where her dad works.

There, as a student trainee in engineering, she worked in the Aerosciences branch, performing analyses that helped the aeroacoustic group remove faulty wind-tunnel data. During her second term, she worked in the Structural Dynamics Test Lab, where she participated in vibration testing using shaker tables to test hardware destined for the space station. She also participated in pyroshock testing,

which involved subjecting a test article to a blast from an explosive.

“I enjoyed getting to work on hardware that’s actually going to go into space.”

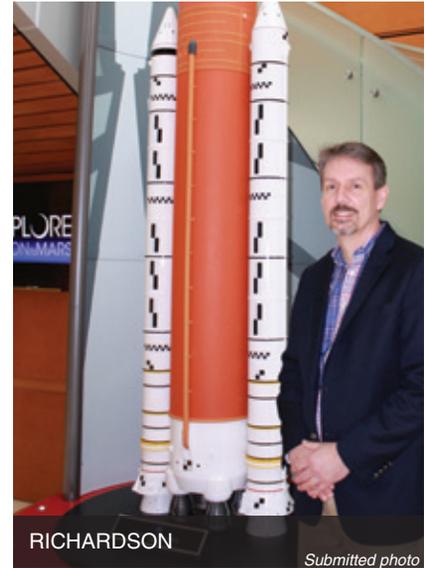
Annie Catherine Richardson founded the Ole Miss student branch of the American Institute of Aeronautics and Astronautics, which is the professional organization for the aerospace industry. Like her dad, she said her UM education helped prepare her to work at NASA.

“I took the fluid mechanics class before I entered into the work I was doing, which happened to be fluid-intensive,” she said, adding that other UM classes gave her the foundation she needed to understand more advanced topics encountered during her co-op.

Stephen Richardson takes pride in the work he and other engineers are doing on behalf of the U.S. space program.

“One of our goals is to go back to the moon and then to go on to Mars,” he said. “So just the reality that humanity can go out and achieve things we haven’t done before is inspiring to me.”

NASA influences Mississippi’s economy via its John C. Stennis Space Center.



“In Mississippi is where we test the engines for each flight during their development phase,” he said. “Also, the launch vehicles have components supplied by Mississippi vendors. I’m sure other pieces of hardware on the space launch system being developed at Stennis also involve Mississippi suppliers.”

AGRIBUSINESS

Agriculture plays a significant role in not only Mississippi’s history but current economic infrastructure throughout the Delta region especially. Research efforts that result in better yield, higher nutritional quality, reduced operational costs and improved environmental impact are all issues of high interest to the agribusiness industry. New findings about aquifer recharge, water that moves from the land surface into the saturated zone, could lead to future benefits for Mississippi in agribusiness. Read more about this research on page 36.

For more than a decade, students and researchers in the Department of Geology and Geological Engineering have been studying oxbow lakes as a potential source of recharge. Professor Gregg Davidson and

a series of graduate students have made countless trips to Sky Lake, an ancient meander loop of the Ohio-Mississippi River system that contains some of the state’s largest and oldest cypress trees.

Most consider recharge from oxbow lakes to be minimal because of the clays and silts that coat and seal the bottoms. But many of these lakes have extensive forested wetlands, with root systems and fallen limbs that may provide conduits for water flow as they decay.

Evidence for recharge until recently was largely indirect. In the past year, however, a thesis project by Michael Gratzler (BSGE 16, MS 18) of Collierville, Tennessee, produced definitive evidence that recharge to the aquifer beneath this lake is substantial when the lake fills with water.

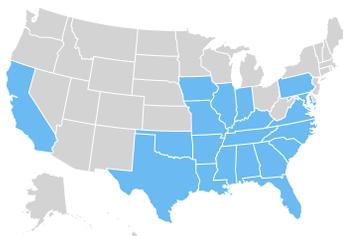
Wells drilled inside and around the lake logged water-level changes after a pro-

longed dry spell ended, and lake levels rose by more than 12 feet. The abrupt rise in lake level was matched by corresponding rises in wetland piezometers and nearby wells, resulting in a groundwater mound beneath the lake. For a time, the flow of groundwater, which normally flows east, reversed on the upstream side of the mound and flowed west.

“This has major implications for groundwater management in the region,” Davidson said. “The Delta is riddled with these wetland systems. Groundwater models that have ignored them up to now will need to start considering them as sources. These findings also mean there may be new ways to facilitate enhanced recharge. If water levels in oxbow lakes are kept high during the winter, we may see far more recharge than possible with other artificial recharge efforts.”

Geography

Students come from 20 different states



Co-op/Internship & Placement

Co-op/Internship Participation



Placement after College
Full-Time & Graduate School



Avg. Cost Savings for
Companies through
Co-op/Internship Projects

\$3.18M



TAYLOR

Submitted photo

AUTOMOTIVE

Elizabeth Taylor (BSChE 11), a native of Grenada, said her Ole Miss education was foundational to her work as a quality engineering specialist who keeps drivers and their passengers safe.

Taylor lives in Oxford and works for Toyota North America's Corolla plant in Blue Springs.

"The tools that I developed in school allow me to critically analyze processes and parts before a vehicle goes into production," said Taylor. "I get to directly impact a vehicle that will end up on a road with someone's loved one. I put the customer — and my family! — before the business. I didn't just learn 'how' while at Ole Miss, but I also learned to ask, 'Should I?'"

Taylor said she believes the Ole Miss School of Engineering produces well-rounded professionals.

"I earned more than just a degree from Ole Miss; my professors spent a lot of time on ethics and safety, and those concepts impact my day-to-day decision making. This line of thinking ultimately impacts the industries and customers we serve."

Taylor works on the pilot team with Toyota, ensuring suppliers can produce good parts as Toyota prepares for its 2020 Corolla model launch.

"I love that every day is different," she said. "I never know what challenge I will face when I walk in the door. I love being able to work closely with suppliers; it's fascinating to visit supplier facilities and see the detail that goes into every single part."

What are her challenges?

"Honestly, time," she said. "There's never enough time in the day to solve every problem. It sounds crazy, but the hardest thing to do is to walk away from a problem at the end of the day. I really do love my job so much that sometimes it's hard to go home!"

Taylor said she feels honored to work for a company that affects Mississippi's economy.

Since 2011, when Toyota began production in Mississippi, the global company has created thousands of jobs, providing income for more than 2,000 Mississippi families, with a payroll of \$115.5 million in 2018. Additionally, Toyota encourages and honors volunteerism and donations. In 2018, for example, Toyota team members volunteered nearly 7,000 hours, and corporate donations reached \$4.25 million in support of nonprofits and \$50 million in support of education.

To date, Toyota has invested \$1.2 billion in the thriving Blue Springs plant.

“
I love that every day is different.
”

ELIZABETH TAYLOR

FORESTRY & ENERGY

Barrett Green (BSCE 90) of Franklinton, Louisiana, found his niche in revenue management, asset management and commercial transactions after graduation from Ole Miss.

As vice president over commercial operations for Entergy Wholesale Commodities in Houston, Texas, Green works for the company's nonutility side, which owns independent power plants and trades in the wholesale market. Entergy also supplies electricity to Louisiana, Arkansas, most of Mississippi and East Texas.

"In 2018, EWC had revenues slightly over \$1.4 billion," he said. "My team deals with managing the price risk of those sales through derivative and hedging transactions as well as the daily scheduling and settlement of those sales. We also have an asset management and commercial transaction role for the assets in the portfolio."

Green said he enjoys working collaboratively with his team to find creative ways to deal with complex problems — the most pressing of which is EWC's decision to discontinue its current business.

"The impact of hydraulic fracturing for development of shale gas has dropped the price for our product by half, and most of these assets will be shut down as a result," Green said, adding that he will help oversee the shutdown and plans for site remediation.

The process will take years, Green said. Through it, he will continue to rely on his past experience and knowledge base.

"The thing that was helpful about my Ole Miss education in engineering was the approach to understanding fundamentals and that even

fundamentals can change over time. That is probably easiest to see in the material science area, where our best theories for how things worked 30 years ago are not our best theories today," Green said.

"The idea, which ran across several professors, is that you have to always be thinking about where the theory might not apply anymore and that while you might get three points



HILLIARD

Submitted photo

taken off a test for an error, in the real world, a building might fall down because of that error.

“You have to learn to deal with the chaotic and nonlinear too, and you learn to come back to a framework and ask questions like, ‘What do we know? What are we assuming? Why do we think the assumption holds? How big an impact is it if the assumption does not hold?’” he continued. “It is not *what* you learn; it is that you learn *how* to learn.”

In a very different role, Henry Walker (BSEE 76), a native of Louisville, Mississippi, worked in the forestry industry.

Walker loved his job with International Paper Co., the world’s largest forest products company with more than 56,000 employees. He served IP for more than 36 years, significantly influencing diversity within the company before retiring in 2012.

“**An engineering education can give you the intellectual tools to design new widgets, repurpose old gadgets and discover new laws of nature.**”

HENRY WALKER

“An engineering education can give you the intellectual tools to design new widgets, repurpose old gadgets and discover new laws of nature,” Walker said, adding that his UM education taught him the value of teamwork, determination and that “if you can make it here, you can be successful anywhere.”

And so he was.

After graduating from Ole Miss, Walker began working at IP’s Natchez mill as a member of the plant engineering staff. There, he was promoted to senior design engineer before moving to the company’s



financial side as purchasing supervisor in 1987.

In addition to serving in several supervisory roles related to purchasing, he served as coordinator of the mill’s diversity program from 1988 to 2003. The program became award winning under his watch and his greatest career achievement, Walker said.

“I really enjoyed managing the Minority/Women-Owned Business Development Diversity Program. I met a lot of people inside and outside of International Paper. It was indeed a challenge to integrate new vendors into the supply chain without destroying old relationships.”

In 2003, Walker transferred to IP’s corporate headquarters in Memphis, where he was a contract negotiator responsible for corporate purchases related to information technology, technology and telecommunications.

When considering the role of a professional engineer, corporate security likely doesn’t come to mind. But Al Hilliard, IT and operation technology (OT) program services executive for ExxonMobil in Houston, Texas, is responsible for delivering services that provide secure, enhanced capabilities in the company’s industrial control systems.

What does that mean?

“Protecting the corporation from cyber threats,” said Hilliard (BSCS 83), who grew up in Hernando. “It also means enabling business lines with leading-edge technologies to develop and deliver quality energy and chemical products to the world in a very dynamic and constantly changing business environment.”

After Ole Miss, Hilliard was commissioned into the U.S. Air Force to serve as an information systems officer. In 1988, he joined Mobil Oil Co. in Dallas as a database application developer where he worked on the company’s first client-server application. He has since held numerous technical, leadership and management positions within IT, supporting business functions across the companies’ various channels. He has helped implement several enterprise-wide SAP solutions and has worked in 16 countries.

Although ExxonMobil is headquartered in Texas, the global company has a significant impact on the Mississippi-made engineer’s home state.

“Energy is the life blood of any modern society. So my company plays a significant role in an indirect way by providing energy to help improve Mississippi,” Hilliard said, adding that ExxonMobil also hires many graduates of the state’s colleges and universities.

HEALTH CARE

“**W**hen I was in school, while biomedical engineering was a known major, there wasn’t a lot of information out there regarding what you can actually do with that degree,” said Chris Patterson (BSME 02), a native of Cape Girardeau, Missouri, who lives in Olive

Branch. “But these days, there’s a huge industry in health care with really interesting roles for engineers – device design, software algorithm development for large data crunching, augmented reality for surgeries and procedures, and many more.”

Throughout his career, Patterson’s education has helped him support wellness on a global scale. Now in a position that’s more closely related to marketing than mechanical engineering, he works in

Memphis for Medtronic PLC, the world’s largest medical device company.

With 80,000 employees – over 7,500 of which are research scientists and engineers – Medtronic is best known for the design and production of pacemakers, diabetic insulin pumps and heart stents. But Patterson is marketing director over the company’s degenerative spine business, which builds and markets spinal rods, screws, artificial discs and more.

continued on pg. 12

"I'm responsible for about \$1 billion in global sales, so no pressure," Patterson said, laughing. "I develop the business-segment strategy from a product, portfolio and procedural perspective for the degenerative spine. So that covers devices and therapies used in the neck and low back."

Medtronic's impact on the Mississippi economy is significant, Patterson said.

"You get health care sales, so that's driving the health care industry; because you're having surgeries, you're impacting the hospital P&L and hospital balance sheets to be able to continue to provide service to their communities; and you're impacting the lives of the patients being treated. So, not only are you helping the health care and hospital side, you're also helping people get back to work and lead a more productive life.

"There's a good number of people who live in Mississippi — employees and patients alike. It not only helps the economy but also the community," he continued.

“
I'm responsible for about \$1 billion in global sales, so no pressure.
”

CHRIS PATTERSON

"We encourage volunteer work by all the employees so there are a lot of projects, such as the food bank, Ronald McDonald House and playground cleanup."

In 2009, Patterson served as chief engineer, leading a team of 15 other engineers to develop the implants and instruments associated with Medtronic's flagship rod and screw system. Company revenue from

the project continues to top \$500 million a year.

"Just because it's 2019 doesn't mean there's no innovation left in the world," he said. "There's plenty of innovation needed from engineers in order to drive technology advances and to drive future economies. The biggest thing we can do as engineers is not only drive the U.S. economy but also the global economy because there are still so many countries and regions that are underdeveloped where we can make a huge impact in the lives of people worldwide. So while the U.S. is still a major portion of our revenue, the global footprint and global economy is actually helping to diversify our business."

In December 2018, at the Medtronic holiday event, Patterson was able to meet patients whose lives have been changed by the company's products.

"It was unbelievable," he said. "Seeing that gives you energy and a sense of purpose."



POWELL

Submitted photo

SHIPBUILDING

Trey Powell (BSCE 14, MS 16) grew up in the town where he now works. Home to Ingalls Shipbuilding, one of the state's largest employers, the small, coastal Mississippi town of Pascagoula boasts global impact on the economy.

As a structural engineer in the company's Hull Technical - Foundations division, Powell helps support the "floating cities" on which the men and women of the U.S. armed forces live and work.

Ingalls is a government defense contractor that builds several ship classes for the U.S. Navy and Coast Guard.

"I enjoy the variety of the structural engineering projects I get to be a part of," Powell said.

Now, his job includes designing and shock-qualifying every structural foundation for equipment on board a particular ship.

Powell said Ole Miss prepared him to serve his home state by giving him a well-rounded education and by fostering collaboration.

"My education has certainly given me the technical understanding that

is necessary in order to excel in my career. Beyond that, it has given me the confidence to branch out and learn concepts or disciplines I am not as familiar with.

"Additionally, Ole Miss gave me the ability to seek challenges and collaborate with others to provide a meaningful solution. Just because a particular design has been utilized for a particular system for many years on a certain ship class does not mean it cannot be improved or at a minimum investigated for improvement."

Powell said he is most proud of a new design he helped innovate for the foundations of line-shaft bearings. The product will be used on all LHA (Landing Helicopter Assault)-class ships going forward.

"A previous design was utilized for about 25 years that was effective, but difficult to fabricate and required a lot of detailed drawings. The new design is much easier to fabricate and will potentially eliminate several issues that were encountered with the previous design," Powell said. "I learned a great deal from this project, and it also gave me the opportunity to show Ingalls what an Ole Miss engineer is capable of!"

TOURISM & FILM

Sarah Farris (BSEE 12) found her purpose in helping people stay safe on roller coasters and other rides. She's worked six years for Guardian Manufacturing, a company that integrates systems in the entertainment industry among others.

"I'm not what people typically think an engineer working in an industrial field looks like, so it gives me the opportunity to show younger girls — or anyone — that they really can chase whatever they want to do, even if it doesn't seem typical," said Farris, a Nashville, Tennessee, native whose job took her to Melbourne, Florida, after Ole Miss.

Because Universal Studios hired Guardian to support its Wizarding World of Harry Potter attraction, Farris spends many of her workdays at the amusement park. When the company needed to perform a complete control-system overhaul on the attraction, Farris initially was responsible for programming and startup of the ride supervisory system and later additionally served as the on-site coordinator and project manager.

"Guardian was also responsible for the flame-control system for the fire-breathing dragon in Diagon Alley, which I assisted with, and I also did the motion programming for several of the land effects in the Wizarding World."

One of her favorite career moments occurred during a return flight to Orlando when Farris happened to be seated beside an elementary school girl who was visibly excited to be going to Universal Studios.

"She pulls out a magazine about the Wizarding World, points to a picture of one of the signature land effects that help add magic to the park, and asks, 'So you helped make that?' and I got to answer yes. Even if she has no interest in becoming an engineer, it was so cool to know I was given an opportunity to help her see that you can have a job creating something you love."

Farris said she's always been interested in the way engineering and technology are used to tell a story and how engineering and creativity can go hand in hand — an interest supported by her UM education.

"I'm passionate about storytelling," she said. "I arrived at Ole Miss at the perfect time, right as they were putting into place a cinema program to go along with their other outstanding media departments.

“**So engineers aren't just building machines or buildings, we also get to work with artists and designers to help bring really cool and beautiful things to life.**”

”
SARAH FARRIS

So while my engineering professors were challenging me to develop my problem-solving skills and come up with solutions to technical problems, I was also learning how technology can be used to tell stories

through film editing and production classes.”

Farris said she believes Mississippi-made engineers have the opportunity to help the state's economy by financially supporting the institution that trained them and by bringing ideas to life within the state.

"When you break it all down, a creative engineering solution is where the 'magic' happens. Ole Miss gave me the opportunity to earn an engineering degree while also further developing my creative side. So engineers aren't just building machines or buildings, we also get to work with artists and designers to help bring really cool and beautiful things to life."

And that goal — achieving something never before accomplished — is one in which all engineers, despite their varied roles, can find commonality. ✨



FARRIS

Submitted photo



Submitted photos

Co-op Is Worth It

CO-OP ALLOWS STUDENTS TO APPLY PRINCIPLES LEARNED IN CLASS

By Megan Miller

This spring, the University of Mississippi School of Engineering’s co-op program has doubled in size, enrolling 28 students from various departments within the school. Students are working in various industries including oil and gas, automotive manufacturing, space exploration, and defense. Through participation in co-op, students gain valuable work experience and make lasting professional connections.

“Doing a co-op is worth it!” said mechanical engineering student Annie Catherine Richardson, when asked to reflect on her co-op with NASA. “Graduating in four years isn’t as important as job experience, and sometimes the best way to get a job with



RICHARDSON
Submitted photo

a certain company (or federal agency) is to co-op there. Getting a break from engineering classes is refreshing, too. You can come back, better understanding how the principles you learn in your classes are applied. A co-op will give you insights that a short summer internship just can’t.”

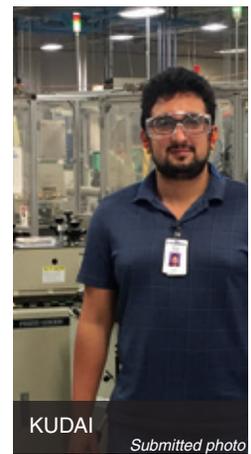
In addition to experiencing the “real world” for the first time, co-op students have the opportunity to put what they’ve learned in the classroom into practice. Aamir Kudai, a recent computer science graduate, worked for BorgWarner in Water Valley. He is a strong believer in the co-op program and participated in it for several semesters.

“Participating in co-op is very important for a student before he graduates,” Kudai said. “When the student learns materials taught from the classroom, he does understand what is being taught but is not able to relate it to how it will be used in the industry. Switching back and forth from school to co-op helps students understand where to plug in the skills learned in school.”

Co-op students work side by side with full-time engineers and report that the

real-world experience is the most valuable takeaway from their co-op experience. Some co-op positions lead to full-time job offers, but even without a full-time offer, students complete a co-op with six months or more of professional experience and a growing network of colleagues.

Students from all engineering disciplines have the opportunity to participate in a co-op. The School of Engineering hosts a career fair every semester where students can meet with company representatives interested in hiring students. For more information on the co-op program or upcoming campus recruiting events, please contact Megan Miller (megan2@olemiss.edu). ⚙️



KUDAI
Submitted photo

25%
participants are female

STATES	PAY RANGE	
	Percentage	Rate
MISSISSIPPI ••••• 21 students	11.6%	\$25+/hour
TENNESSEE ••••• 5 students	34.6%	\$20-\$25/hour
FLORIDA ••••• 1 student	53.8%	\$15-\$20/hour
WISCONSIN ••••• 1 student		

Priceless Experience

ELECTRICAL ENGINEERING UNDERGRADS BENEFIT FROM MENTORSHIPS

By George Atkins

Four years after attending the University of Mississippi's Summer College for High School Students, Erin Bratu is working on her senior thesis as she prepares to graduate from the Sally McDonnell Barksdale Honors College. She is being mentored by Dwight Waddell, associate professor of electrical engineering and director of the biomedical engineering program.

Bratu is seeking admission to an electrical engineering graduate program in hopes of continuing research into the biomedical field specializing in signals processing for biomedical applications. She hopes to pursue research in minimally or noninvasive biomedical technologies for use in treatments and therapies for neurological disorders such as drug-resistant epilepsy.

Salvatore Mastromatteo is working with electrical engineering professor Alexander Yakovlev on an antenna cloaking project.

"During my junior year, Dr. Yakovlev approached me and asked if I would like to do a research project with him in electromagnetics; I happily accepted," Mastromatteo said.

"Since then, my understanding of the subject area has grown immensely, I have gained experience with professional software, and I decided to pursue the subject for my career. The amount of

knowledge gained through the one-on-one interactions with Dr. Yakovlev is priceless and helped me to secure a job as an RF engineer. I have enjoyed every moment of the research, and because of it and my professor, I have found my calling."

Distinguished Professor John Daigle is the principal investigator of "Analysis of Bluetooth Low-Energy Beacons." Fellow researchers include three senior electrical engineering majors: Alyson Parsons of Bowling Green, Kentucky; Kunal Yadav of Saptari, Nepal; and Bailee Bellevue of Mandeville, Louisiana. George Humphrey, a telecommunications graduate student from Ridgeland, is also part of the team.

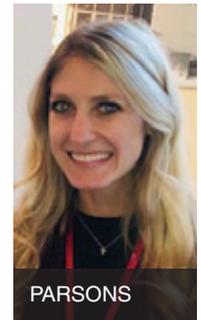
Bellevue and Jake McCall were selected for the 2019 C Spire-Nokia Bell Labs Fellowship Program. The program offers college juniors and seniors majoring in computer science and electrical or computer engineering at UM opportunities to conduct relevant industry research alongside some of the world's leading scientists, engineers and technologists. 



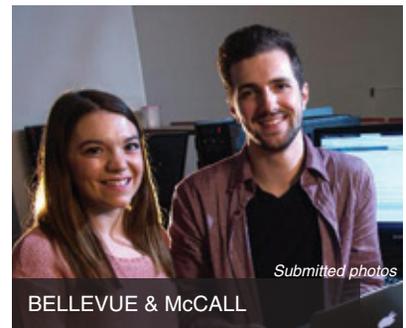
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Submitted photos

FINISH LINE: DOCTORAL STUDENTS By George Atkins

"My research expertise and the knowledge I gained from Ole Miss landed me a job offer from Qualcomm Inc., headquartered in San Diego, California. I look forward to working as a senior systems engineer in the areas of 5G and beyond. All these achievements would have been impossible without the unparalleled guidance from my adviser Professor Lei Cao and the continuous support from the Department of Electrical Engineering." — Amrit Kharel

"The primary objective of my Ph.D. research is to develop a new content-delivery protocol for deep-space missions so that more efficient communication between distant spacecraft and the Deep Space Network stations could be achieved. Working on this grant enabled me to learn some of the latest research and development in this field, which would not have been possible without strong guidance from Professor John N. Daigle." — Rojina Adhikary

continued on pg. 33

Engineers Without Borders-UM Travels to Ecuador

TEAMS GO FOR FACT-FINDING MISSION IN 2018,
TO COMPLETE WATER SUPPLY PROJECT IN 2019

By Edwin Smith and Paul Scovazzo



Senior Luke Cowart uses satellite-assisted surveying equipment to lay out potential water pipelines for the community. *Submitted photo*

Members of the University of Mississippi chapter of Engineers Without Borders recently traveled to the Ecuadorian highland community of 25 de Diciembre to complete the second phase of a project to increase the water supply to the 800-member township.

Consisting of six students and two faculty advisers who led the trip — Paul Scovazzo, associate professor of chemical engineering, and Robert Holt, professor of geology and geological engineering — the EWB-UM team worked at an altitude higher than 2 miles.

The first phase, called the “adoption” process, was completed on Jan. 25, 2018.

“This adoption process is similar to a client hiring a consulting firm,” Scovazzo said. “EWB-UM has committed to be 25 de Diciembre’s consulting firm for at least five years, and we are committed to engineer projects that the community wants.”

Engineers Without Borders-USA runs service learning projects, so the goals of the winter intersession trip, which ran Jan. 4-19, were to create knowledge and build deeper understanding and relationships between the community and EWB-UM.

“Service learning assumes that engineering is learned by doing and professionalism built by serving others,” Scovazzo said. “This is the best part of working with EWB.”

EWB-UM’s first field trip to Ecuador in May 2018 consisted of fact finding. The undergraduates on this trip were the first ambassadors of Ole Miss to the 25 de Diciembre community. Chemical engineering senior Olivia Wagg and David Thomas (BSME 18), assisted by Rita Loza, an EWB international mentor, interviewed households, medical professionals and school officials.

“

Lugging the EM-31 through the highlands was no easy task, but it sure was easier than chasing the llama that we tried to strap it to.

”

LUKE COWART

Wagg reported that 30 percent of the community’s children have water-related illness and averaged two hours daily just fetching water.

Meanwhile, mechanical engineering majors Jack Holiman and William Horner and civil engineering major Benjamin Koltai spent their time gathering on-site information on geology, water sources and water quality. They were assisted by Dennis Powers, UM adjunct professor of geology and geological engineering.

During the January 2019 winter intersession, undergraduate and graduate students learned how to use high technology combined with standard engineering fieldwork techniques to determine the location and levels of groundwater for potential new community water sources.

Geological engineering majors Luke Cowart and Boltin Teeter and mechanical engineering majors John Mark Huff and Lena Turner installed 14 groundwater monitoring probes and surveyed potential water delivery pipeline routes. In addition to learning how to use traditional surveying total stations, the students used satellite-assisted surveying methods. Geology graduate students Wesley Bluvstein and Zach Bray mentored the undergraduates and performed electromagnetic ground conductivity to help map the subsurface groundwater resources using an EM-31 meter.

“Lugging the EM-31 through the highlands was no easy task, but it sure was easier than chasing the llama that we tried to strap it to,” Cowart said.

Other tasks for this second trip included the installation of a weather station at the 25 de Diciembre school. With the station, donated by EWB-UM, the community’s students can help record rainfall and track the water balance for their water sources. EWB-UM also trained some of the community members to operate the new groundwater monitoring probes and record all measurements.

“This is a great learning opportunity for both EWB members and this community,” Holt said. “Working together, 25 de Diciembre and EWB can solve the community’s water needs for decades to come.”

Turner said her biggest takeaway was seeing how integral the community was to the success of the project.

“All of the technical work would be in vain without the necessary involvement,” she said. “The political portion of the project allowed the team to go beyond applying technical knowledge. Consequently, we gained a better understanding of the multifaceted role of engineers.”

The workday during the winter intersession trip typically started at 7:30 a.m. with a team family-style breakfast and a



Engineers Without Borders-UM students John Mark Huff (left), Lena Turner and Boltin Teeter install groundwater monitoring probes during their recent trip to 25 de Diciembre in Ecuador. *Submitted photo*

review of the task assignments for the day. The day ended with a family-style dinner and a review of lessons learned.

“We had an excellent team for this fieldwork,” Holt said. “We accomplished all our goals for this trip despite the difficulties of working at high altitudes. The students worked as a team and learned on the job. It was a pleasure to work with them.”

The trip took the team members from their safe and cozy lives of book learning and threw them into a place that challenged their worldview, taught them life skills and gave them an opportunity to change the lives of others, Huff said.

EWB-UM is a student-led organization chartered in 2007. Students and professors from all engineering school departments have collaborated on the organization’s projects.

In the past 10 years, the chapter worked in the Hedome Village in Togo, West Africa. During this decade, it completed a new schoolhouse and installed a deep water well to deliver safe drinking water to a children’s hospital.

The chapter is over 100 members strong and made up of students from all over the world, of all backgrounds and in all academic majors. The common bond: the strong desire to help others and improve communities across all borders around the globe. ✨

EWB would like to thank NCPA for the loan of field equipment critical to the success of this assessment trip.



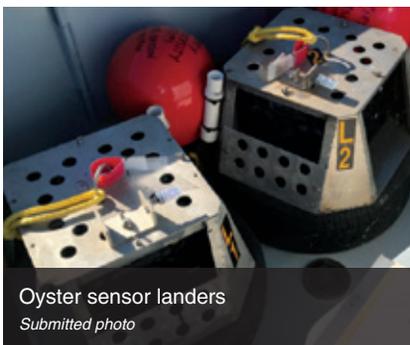
Lander Adaptation

MMRI DEVELOPS LANDERS FOR A VARIETY OF PROJECTS

By Allison I. Woolsey

The marine technology division of the Mississippi Mineral Resources Institute, or MMRI, has fabricated seafloor equipment for over 20 years. In recent years, the need for in situ monitoring of the seafloor has necessitated the use of benthic landers by scientists wanting to capture biological, geological or chemical characteristics at seafloor areas of interest.

Landers are typically composed of instrumentation, floats for recovery and a durable frame to withstand the harsh seafloor environment for months or years at a time if needed. An expendable weight held by a release mechanism is commonly used to anchor a lander on the seafloor during operations. Releasing the weight via an acoustic command causes the lander to float to the surface for retrieval. For each design, MMRI collaborates with scientists to develop marine systems specialized to their project needs.



Oyster sensor landers
Submitted photo

After the Macondo well blowout, scientists of the ECOGIG (Ecosystem Impacts of Oil and Gas Inputs to the Gulf) consortium, funded by the Gulf of Mexico Research Initiative, needed to better understand the deep-sea environmental impacts of hydrocarbon release, both natural seepage and leaks caused by humans. Platforms for seafloor hydrocarbon experiments were developed to house chemical sensors, seafloor probes, water current meters and communications equipment.

A remotely operated vehicle, or ROV, also operated by MMRI, positioned removable sensors connected to a lander near natural hydrocarbon and biological features after the lander was deployed to the seafloor. Each lander served as a moveable seafloor observing station over 1,000 meters below the surface of the Gulf.

Another lander was developed to recover biological samples collected near shipwrecks and other human-made structures. The goal of this study, funded by Defense Advanced Research Projects Agency's Biological Technology Office, was to determine if human-made steel structures on the seafloor exude a distinct signature that can be detected in microbial DNA to determine the duration on the seafloor and origin of the structure.

MMRI worked with Leila Hamdan's lab in the School of Ocean Science

and Engineering at the University of Southern Mississippi to produce a series of landers capable of bringing microbial experiments back from the seafloor. A commercial ROV deployed each lander and over 500 feet of line, which connected to several experiment cylinders that attracted microbes. After a four-month deployment, the landers and their arrays were safely recovered after each was commanded to the surface acoustically.

With oyster production off the coast of Mississippi declining in recent years, the need to understand the ocean conditions affecting oysters has given rise to the opportunity to create oyster sensor landers. Oysters were used as biosensors for monitoring their health during changing ocean conditions. Sensors for measuring water conditions were also housed within the platform.

This type of lander was made with low cost in mind since 11 of these platforms were made for monitoring a large area, and equipment theft is an issue within the Mississippi Sound. An aluminum exterior protected the sensors with a milk crate interior to house layers of oysters, all mounted atop a round rubber base to keep the platform above the fine-grained sediment when deployed.

MMRI has been adaptable to the changing scientific needs with lander design. For more information, visit mmri.olemiss.edu or contact the director of MMRI, Greg Easson, at 662-915-7320. ✨

MMRI PROFILE: RON COUNTS

By Edwin Smith

Ronald (Ron) Counts, the new associate director of the Mississippi Mineral Resources Institute, or MMRI, is a Quaternary scientist and a geomorphologist who studies sediments and landforms using geologic mapping, ground penetrating radar and optically stimulated luminescence geochronology to understand the dynamics between surficial processes, paleoenvironmental change and landscape evolution.

Counts is particularly interested in understanding landscape responses to tectonic, climatic and anthropogenic perturbations by applying numerical dating techniques to quantify rates, magnitudes, and the timing of geologic processes and events.

Prior to joining Ole Miss, he was a U.S. Geological Survey, or USGS, research geologist with the Eastern Geology and Paleoclimate Science Center in Reston, Virginia, for two years, a Mendenhall postdoctoral fellow for two years and a geologic mapper at the Kentucky Geological Survey for 12 years.

Recently his research has focused on the paleoseismology of Quaternary faults in intraplate seismic zones, and he has active research projects in the New Madrid, Wabash Valley and East Tennessee seismic zones as well as the Charleston, South Carolina, area. These separate projects are collaborations with researchers from the University of Memphis, University of Kentucky, University of Tennessee and the USGS.

Counts has just started a new project in collaboration with the Arkansas Geological Survey to date the gravels on Crowley's Ridge using cosmogenic burial dating of gravel and zircon dating of a previously unrecognized ash layer, which could provide new insights into the initiation of the New Madrid seismic zone. He also has plans to resume a project in the Central Virginia seismic zone that he started while working at the USGS.

He is also a strong advocate of geologic mapping, which has practical applications for a variety of issues and topics that include the identification of mineral and aggregate resources, the identification and protection of groundwater recharge zones, water quality and water supply issues, the identification of seismic hazards, planning for urban expansion and development, and planning emergency responses for disasters.



Ron Counts leads a Midwest Friends of the Pleistocene field trip in southern Indiana. Submitted photo

NEW MAPPING PROJECT

Using funding from the USGS, the MMRI will create a geological map, assess mineral resources and investigate natural hazards of the Charleston, Mississippi, area. Counts, will team with the M Partner program at the University of Mississippi to complete the project.

A key aspect of the project is to provide field and mapping experience for a graduate student from the Department of Geology and Geological Engineering. The Charleston area was selected for the project based on the need to more fully understand the age and origin of the upland gravels that are present in many areas along the bluff line that separates the upland areas of Mississippi from the Delta and the needs of the M Partner community of Charleston.

Using a combination of field and laboratory data, Counts and the graduate student will gather data on the extent, thickness and characteristics of the gravels and associated sediments. This resource assessment may prove to be an economic resource for the Charleston area, an economically depressed area of Mississippi. The project is scheduled to begin June 1, 2019 and be completed by May 2020. ✨

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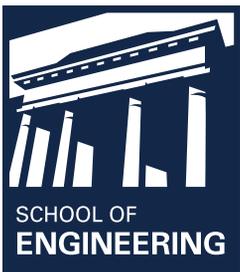
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Burgeoning Field

BIOMEDICAL ENGINEERING POISED TO BECOME SEVENTH DEPARTMENT IN SCHOOL OF ENGINEERING

By Dwight Waddell

In April 2019, Mississippi's Institutions of Higher Learning will vote to approve the transition of the University of Mississippi's biomedical engineering program into a department.

Since 2016, the program has transformed from an idea into a burgeoning presence on campus. With more than 100 incoming students over the last two academic years and another large incoming freshman class expected for 2019-20, biomedical engineering is on track to become one of the largest engineering departments.

Brevard Hall will serve as the academic home of the new department with renovations expected to commence summer 2019.

Updates to the third floor will include new educational space for the senior design course as well as a large "maker space," which will allow students to work together to design, build and learn in a shared environment. These spaces will encourage multidisciplinary learning, which has long been a hallmark of biomedical engineering.

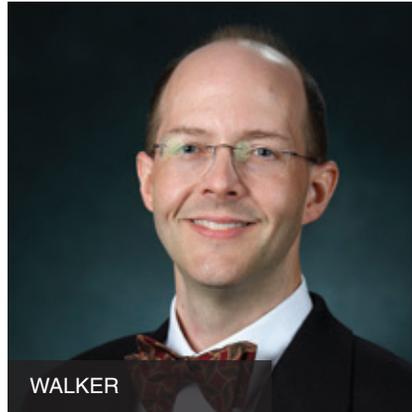
State-of-the-art laboratory space within UM's Thad Cochran Research Center also supports the research of biomedical engineering faculty.



Submitted photo

Departmental efforts will be aided by a growing faculty with expertise across a broad spectrum:

Glenn Walker, associate professor of biomedical engineering and undergraduate coordinator, has years of experience in the design of biomedical microdevices and bio-microelectromechanical systems.



WALKER

Nikki Reinemann, an Ole Miss graduate, returns after completing her doctorate at Vanderbilt, and she will perform research at the interface of molecular biology, physics and engineering to better understand fundamental mechanisms of life and disease.



REINEMANN

Thomas Werfel, also a Vanderbilt graduate and postdoctoral researcher, arrives at Ole Miss with the goal of harnessing nanotechnology and cancer biology techniques to develop novel biomaterials for drug delivery.



WERFEL

Submitted photos

The new faculty is rounded out by the founding director of the biomedical engineering program, Dwight Waddell, who also leads the cognition and neuromechanics research lab.

David Puleo, recently named dean of the UM School of Engineering, is also a biomedical engineer and will maintain his academic home in the new department. ✨

\$88,042

MEDIAN ANNUAL SALARY
IN 2017 (Bureau of Labor Statistics, 2017)

Universities: \$71,230

Research & Development: \$102,590

Pharmaceuticals: \$98,610

Medical Equipment

Manufacturing:

\$94,990

7%
GROWTH RATE
THROUGH 2026

CAREERS IN:



ACADEMIA

- independent research
- mold next-gen scientists
- career flexibility

INDUSTRY

- medical devices
 - biotech
- pharmaceuticals
- diagnostic testing
 - imaging
- entrepreneurial endeavors

CLINICAL MEDICINE

- work in hospitals as part of medical team
- minimally invasive surgery
 - rehabilitation

GOVERNMENT & POLICY

- state and federal labs
- scientific policy and standards

OLE MISS BME STUDENTS

50%
FEMALE



NEW BIOMEDICAL ENGINEERING SOCIETY CHAPTER

NEW HOME IN BREVARD HALL



ChE 4-1-1: 6 QUESTIONS FOR... Brenna Sit

Senior offers advice to incoming
chemical engineering students

Interview by
Adam Smith

During her time at the University of Mississippi, Brenna Sit of Brandon, Mississippi, has achieved nearly every academic honor available to an engineering major, including being named a Taylor medalist as a junior and being named UM's 2019 Mississippi Engineering Society Outstanding Senior. She graciously agreed to answer some questions about her time at UM and offer some advice to incoming students interested in chemical engineering.

1

Why did you choose to come to UM and study chemical engineering?

When I was in high school, I really enjoyed chemistry and math, and I chose to study chemical engineering because it combines these subjects and applies them to real-world processes. Deciding to study chemical engineering at UM was an easy choice for me. Both of my parents came to UM for their undergraduate degrees, and my dad, a mechanical engineering graduate, encouraged me to come to UM because he said the UM School of Engineering not only taught the technical knowledge for engineering but also, more importantly, really taught students how to be good problem solvers.

2

What was the most valuable experience you had as a student in the School of Engineering?

The most valuable experience I had was working on a team in ChE 307, one of the beginning chemical engineering classes. I was assigned to be on a team with two students who were new to the chemical engineering program and whom I had never met. It was the first time I had been given a semesterlong project, and working with this team taught me so many lessons. Firstly, it showed me how a good team is structured. I learned how valuable it was to meet in person regularly and how team members could learn from each other. It also taught me the importance of planning and how to become more efficient with my time. We would spend hours stuck on one problem only to discover that we had not even made the right assumptions at the beginning of the problem. From this, we learned to plan contingency time together in case we needed it and to ask for clarifications earlier to become quicker at problem solving. Secondly, I made my best friend in college from this team by getting to know my team members. This team experience taught me lessons that I would apply to all of my teams in the following years and allowed me to find a close friendship I never expected.

3

What advice would you give to a freshman thinking about majoring in chemical engineering at UM?

My advice to a freshman thinking about majoring in chemical engineering at UM would be to understand that chemical engineering is challenging and requires a lot of work but to not let this be intimidating. I would advise him/her to be prepared to become a great planner and to work with other students and faculty often. If he/she does this, studying chemical engineering at UM will be both an achievable goal and a rewarding experience.

4

Was there anything you did not do or wish you did more of while you were an engineering student at UM?

One thing I wish I did was be involved with the UM chapter of Engineers Without Borders and, ultimately, travel to Togo in West Africa to help on one of their projects. During freshman and sophomore year, I became involved with many other organizations, and I did not join EWB in fear that I would be overcommitting myself and not truly be an active member. However, looking back, I wish I had joined because it would have been a unique opportunity to apply engineering to directly impact a country in need.

6

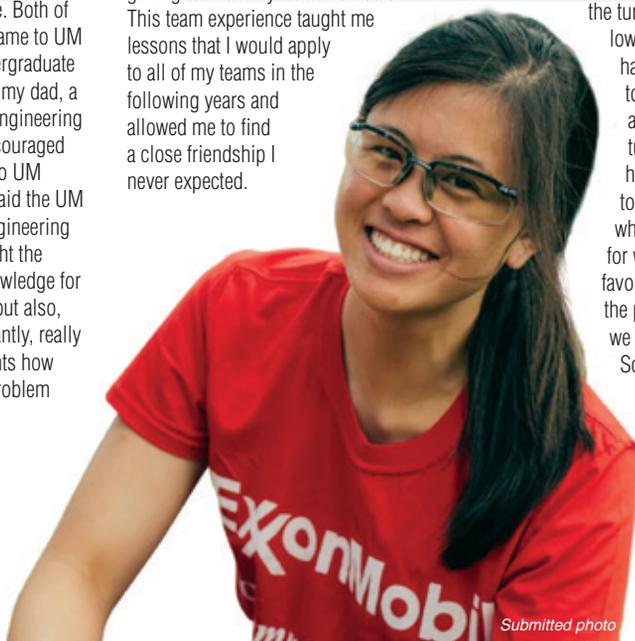
Is there anything else you want future UM ChEs to know?

The best things about the UM ChE department are the people and the focus on people. I want to encourage future UM ChEs to get to know the ChE faculty and to truly learn and see the value of teamwork. The UM ChE faculty members constantly show that they sincerely care for the ChE students and are a trusted source of knowledge, career advice and life advice, so I would definitely encourage every future UM ChE to take advantage of their open-door policies. Secondly, I would encourage future UM ChEs to focus on striving to make the most of every team that they have over the years in ChE. This includes ensuring that all team members are meeting in person consistently even when schedules are hard to arrange, listening to every team member's ideas, and being patient with each other. By doing this in many different teams in the UM ChE program, I have learned from other students, been humbled by ideas that are far better than mine, made lifelong friends and gained an appreciation for people, in general. I hope many future ChEs can have the same experience. ✨

5

What is your favorite memory of your time at UM?

I have many great memories from my years at UM, but my favorite one is from Engineering Trivia Night. Every year, Tau Beta Pi and the Engineering Student Body Leadership Council host a Trivia Night at a local pub as one of the activities for National Engineers Week. As an officer in Tau Beta Pi, I helped organize the event. I was nervous that the turnout for the event would be low because it is sometimes hard to get college students to come to academic events after hours. However, the turnout was amazing. We had attendance of at least 50 to 75 engineering students, who talked about the night for weeks to come. It is my favorite memory because it was the picture of the community we have in the Ole Miss School of Engineering. I got to be a part of an event where students from all disciplines of engineering came together, showed their competitive side and really enjoyed playing rounds of trivia.



Submitted photo

Stop the Heat!

RESEARCHERS WORK ON FOOD PACKAGING THAT PROTECTS AGAINST HOT WEATHER

By Brenda Prager

Food packaging, maybe surprisingly, is a “hot topic” for scientific researchers, and actually represents a highly complex material with many requirements built in to ensure optimal quality and safety of the packaged food.

Packaging comes in many varieties such as plastics or polymers; paper; heavily coated cardboards; and tins. While the progress in modern, scientific packaging has been quite significant, new markets and hence higher demands from the packaging itself continue to evolve.

One area of interest is maintaining food quality and safety during transportation, particularly over long distances and often excessive environmental changes, such as heat, which are not always well controlled. Brenda Hutton-Prager and Esteban Urena-Benavides, University of Mississippi assistant professors of chemical engineering, received a USDA National Institute of Food and Agriculture seed grant last June through the AFRI: Agricultural

and Food Research Initiative (Award No. 2018-67022-27972). This two-year, \$150,000 grant fell into the category of “Nanotechnology for Agricultural and Food Systems (Program A1511), and therefore is focusing on the use of nanoparticles to prepare multifunctional coatings onto cellulose substrates for food packaging.

Hutton-Prager and Urena-Benavides, together with graduate student Anas Al-Abri, are concentrating their efforts on coming up with a thermal barrier coating by introducing two types of nanoparticles:

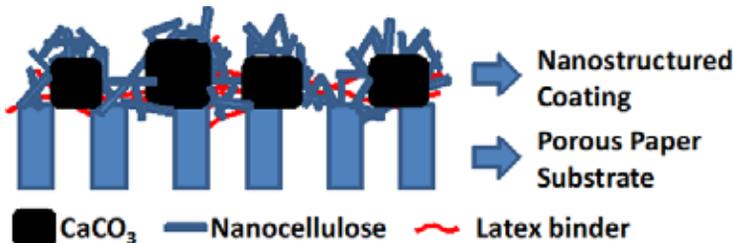


Anas Al-Abri prepares the ChemInstruments coater to apply coating formulation to a paper substrate. Submitted photo

cellulose nanocrystals (CNC) and cellulose nanofibers (CNF) into a typical paper-coating formulation containing calcium carbonate pigment.

Modifying an existing formulation will hopefully allow its adoption into future manufacturing processes. CNC and

continued on pg. 40



Schematic representation of coating’s hierarchical structure with nano- and micro-scale features.

4

→

ABET ACCREDITED PROGRAM SINCE 1954

EMPHASIS AREAS
IN ADDITION TO THE STANDARD
CHEMICAL ENGINEERING OPTION

BIOTECHNOLOGY

ENVIRONMENTAL

MANUFACTURING & MATERIALS

PRE-MED PATHWAY

42%

FEMALE

H.S. GPA

3.91

FRESHMAN CLASS AVERAGE 2018-19

ACT SCORE

30.1

FRESHMAN CLASS AVERAGE 2018-19



Ahmed Al-Ostaz (second from left), UM professor of civil engineering, with Sir Konstantin Sergeevich Novoselov, the 2010 Nobel Prize winner in physics for his research in graphene; Kari Hjelt, head of the Graphene Flagship, <https://graphene-flagship.eu/>; and Zina Cinker, executive director of the National Graphene Association, <https://www.nationalgrapheneassociation.com/>, during his visit to the University of Manchester last summer. Submitted photo

Graphene Center Growth Continues

RESEARCH AND INNOVATION LAB FOR WONDER MATERIAL EXPANDS EXPONENTIALLY

By Edwin Smith

Eighteen months after its inception, the Center for Graphene Research and Innovation at the University of Mississippi continues to bridge the gap between university-based science and discovery and industry-led innovations and applications for graphene.

UM established the center in October 2017 to advance translational science and engineering of graphene-based technologies. Ahmed Al-Ostaz, professor of civil engineering, was then named as the director.

“Under the leadership of Dr. Al-Ostaz, I see the great and everlasting impact of the Center for Graphene Research and Innovation on the civil engineering department, the School of Engineering, Ole Miss and the state of Mississippi,” said Jacob Najjar, chair and professor of civil engineering. “It is very gratifying to know that one of our outstanding faculty is leading this UM center of excellence.”

A form of carbon made of a single layer of atoms, graphene was first isolated and described by scientists in 2004. The material is incredibly strong and flexible, and its conductivity lends it to a broad range of applications ranging from manufacturing to electronics to medicine. Graphene is heralded for having significant growth potential across a number of market segments.

During the past few years, graphene-related research conducted at UM has included computational physical chemistry; photovoltaic solar cells; drug, protein and gene delivery; electromagnetic applications, including perfect absorbers, high-impedance surfaces, subwavelength imaging, hyperlenses, plasmonic waveguides, cloaking/invisibility and reduction of interference in antennas; and nanocomposites for defense, homeland security, aerospace and structural application.

Graphene has a number of applications, such as reinforcement in composites, energy conversion and storage,

thermal conductors, electronics, anticorrosion coatings and paints, and drug and gene delivery to human diseases and medical devices.

In addition to graphene and graphene-like materials, Al-Ostaz’s research has encompassed other micro- and nanoscale materials during the last 20 years. Because of his outstanding scholarly achievements, Al-Ostaz was named the recipient of many notable UM recognitions. These honors include the 2013 School of Engineering Outstanding Faculty Award, 2012 School of Engineering Senior Faculty Research Award and 2010 School of Engineering Junior Faculty Research Award.

The center partners with a number of public and private entities, including the Oxford-based National Graphene Association. The association provides a networking and information platform to expedite the integration of graphene into the commercial arena. ✨

Highlights

2018 Civil Engineering Alumnus Awards: Jessica Dilley and Chas Smithers

Senior design student space Carrier 121 renovated to provide students with a dedicated space to concentrate on their design project tasks.

Degrees awarded in 2018: 34 B.S., three M.S. and two doctorates

Six May/August 2018 graduates joined the M.S. in civil engineering graduate program.

CE faculty field trips to enhance the department's research activities: the U.S. Army Engineer Research and Development Center (March 2018) and the Mississippi Department of Transportation (April 2018)

Latin honors for May 2018 graduation:
Chandler South, Ruoxi Wang (cum laude)
Torkel Nord Bjaerneman (magna cum laude)
Holly Pitts (summa cum laude)



CE Senior Design class for fall 2018

Submitted photo

Faculty News

- Associate professor Hunain Alkhatib received the 2018 School of Engineering Faculty Service Award.
- Professor Ahmed Al-Ostaz finished his term as the co-lead for the UM Disaster Resilience Constellation.
- Associate professor Elizabeth Ervin received an SEC Faculty Travel Grant to visit the University of Arkansas in Fayetteville. The two-day event in September included research meetings and facility tours as well as graduate student recruitment.
- Associate professor Chris Mullen held his second Study USA Bridges of New York experiential learning course in May 2018, improving technical components and adding new sites including visiting the fifth-longest arch bridge in the world (longer than Sydney Harbour), 13th-longest cable suspension bridge in the world (longer than Golden Gate) and new cable-stayed bridge over the Hudson River.
- Jacob Najjar, professor and department chair, contributed two invited presentations: one at the University of Mississippi Medical Center on the "Use of Artificial Neural Networks in Data-Based Science" and one at University of California Irvine on "Artificial Neural Networks-Based Modeling."
- Instructor Grace Rushing continued her outstanding work as faculty adviser for our UM American Society of Civil Engineers student chapter.

- Associate professor Cris Surbeck has completed her term as president of ASCE's Environmental and Water Resources Institute and will spend another year on the governing board as past president.
- Professor Waheed Uddin presented a keynote lecture at the international workshop "Sustainability Assessment of Transportation Infrastructure" at the University of Pisa, Italy, July 16-17, 2018.
- Assistant professor Hakan Yasarer supervised research activities for a number of graduate students (M.S. and Ph.D.) as well as undergraduate students.



CE Department 2019 – "The Family"

Submitted photo

18:1

RATIO

STUDENT-TO-FACULTY



UM
DIVERSITY &
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AWARD



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THE SCHOOL OF ENGINEERING



CE FEMALE
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IN THE NATION

ABET ACCREDITED PROGRAM SINCE 1949

Role Model

CONRAD CUNNINGHAM RETIRES AFTER A DISTINGUISHED CAREER OF INVESTING IN OTHERS

By Chloe Parrish and Marni Kendrick

H. Conrad Cunningham, professor of computer and information science and former department chair, has enjoyed a 30-year career at the University of Mississippi.

During his time on campus, Cunningham has worn many hats in his department. After receiving a doctoral degree in computer science from Washington University in St. Louis, he joined the university as an assistant professor of computer science in August 1989.

Cunningham said he knew the university was a great fit.

"I enjoyed my interview here at Ole Miss. I wanted to be able to do both research and teaching and wanted an institution with a doctoral program. I felt I could contribute positively to the department's programs."

The department noticed Cunningham's love for the school as well. He was promoted to associate professor in 1995 and full professor in 2006, and served as department chair from May 2001 through June 2015. Cunningham is the department's longest-serving chair and second longest-serving faculty member.

Like many computer science departments nationally, low undergraduate enrollment was an issue for the department in the early 2000s. Instead of being frustrated with this issue, Cunningham worked with his colleagues to expand the Ph.D. and research programs.

"We sought to respond to that situation in a positive way," Cunningham said. "We shifted the emphasis of our



graduate program from being a mostly master's-level program to one with about half Ph.D. students. By retaining strong M.S. students in our Ph.D. program and by recruiting young faculty with a strong research focus, we were able to grow our research and doctoral programs. The Ph.D. program is still smaller than we would prefer, but it is in a good position to grow further."

This positive perspective has led to an increase in student enrollment in the department's programs in recent years. Although the recent growth has stretched resources, the current chair of the computer and information science department, Dawn Wilkins, acknowledges Cunningham's contributions.

"I appreciate Conrad's efforts that moved the department forward and the

“I appreciate Conrad's efforts that moved the department forward and the stable, thoughtful leadership he provided during his 14 years as chair.”

DAWN WILKINS

Invisibility Cloak

INVISIBLE ANTENNAS OPEN UP NEW FRONTIER IN WIRELESS COMMUNICATIONS

By George Atkins

Making antennas that operate in close frequencies invisible to each other brings numerous opportunities in defense and commercial applications. Electrical engineering professor Alexander Yakovlev has been leading this research on metasurface cloaks for the past three years.



Submitted photo

YAKOVLEV

At microwave frequencies, an ever-increasing demand in wireless communication capacity has led to a larger number and denser spacing of antennas in a system. For example, multiple-input

multiple-out antennas and large-scale array antennas are either widely used in existing communication systems (Wi-Fi, LTE, etc.) or will be inevitable in future systems (5G cellular, etc.).

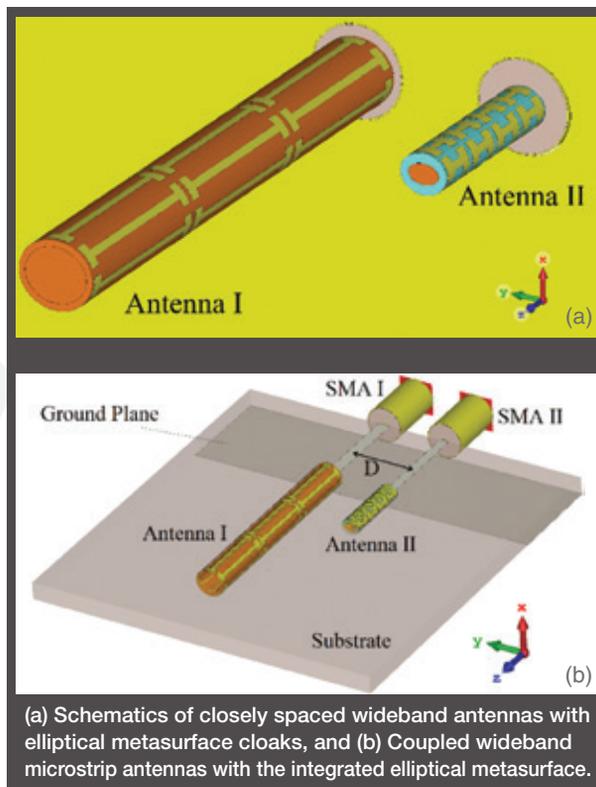
Also, multiple antenna platforms may need to be installed in a compact space on complex structures such as on board ships, aircrafts, submarines, vehicles, cell towers and other platforms. The mutual interaction between closely spaced antennas has been a longstanding challenge, which often severely

hinders antenna performance (such as decreases in antenna gain and distortion of beam patterns).

In the past decade, the idea of an invisibility cloak based on metamaterial/metamaterial concepts has created considerable attention in the physics and engineering communities, which may provide a natural solution for reduction of antenna mutual coupling. In addition, rapid advancement in 3D printing technology has made it possible

to precisely and efficiently implement many artificial electromagnetic structures including metamaterial/metamaterial.

Research supported by Intel Corp., within the National Science Foundation-Broadband Wireless Access and Applications Center industry partners consortium, proposes to investigate novel mantle cloaking techniques based on metasurfaces made of conformal metallo-dielectric structures to greatly reduce mutual coupling of nearby broadband microwave printed antennas



(a) Schematics of closely spaced wideband antennas with elliptical metasurface cloaks, and (b) Coupled wideband microstrip antennas with the integrated elliptical metasurface.

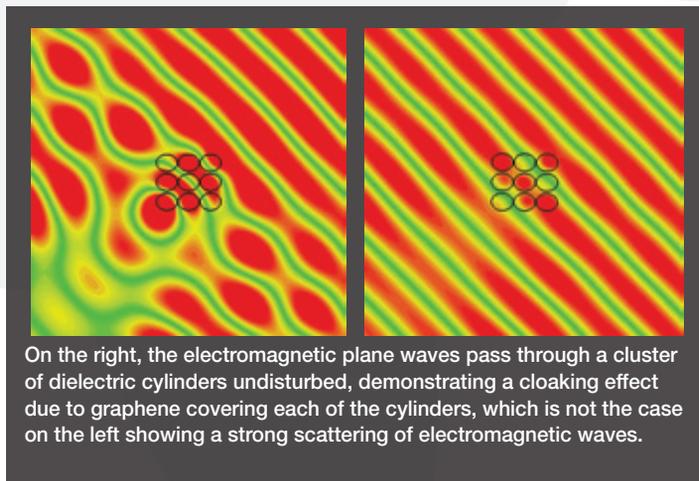
of electromagnetic properties (i.e., permittivity and permeability) will be used to realize the designed broadband printed antennas and antenna arrays with integrated metasurface cloaks for future wireless systems.

As Yakovlev noted, "There is a broad range of exciting antenna applications where mantle cloaks may have a large impact on technology and society, but improved knowledge and understanding of the involved phenomena are greatly needed to explore the full potential of mantle cloak performance and shed new light on its operation in a variety of important antenna applications. We are at a stage of this research in which experimental proof-of-concept demonstrations of these ideas are the necessary next step in the practical realization of these antenna applications."

An example (left) demonstrates the cloaking effect for a cluster of elliptical dielectric cylinders with the use of graphene material as a cloak covering the cylinders with the impinging plane wave at low terahertz frequencies. ✨

and antenna arrays.

Novel 3D printing technology that is potentially capable of fabrication of advanced electromagnetic structures with arbitrary spatial distribution



On the right, the electromagnetic plane waves pass through a cluster of dielectric cylinders undisturbed, demonstrating a cloaking effect due to graphene covering each of the cylinders, which is not the case on the left showing a strong scattering of electromagnetic waves.

Continued

continued from pg. 15 **FINISH LINE**

“Through the next four-and-a-half years, and by the help and support of my supervisors Professor Lei Cao and Professor Vish, I worked on my dissertation titled “MAC-PHY Frameworks for LTE and Wi-Fi Networks Coexistence over the Unlicensed Band.” Recently, I signed a job offer with a company where (I) will be helping in the development of a malicious drone detection system.” — Hadi Kasasbeh

“While working on my Ph.D. in electrical engineering at the University of Mississippi, I have had an unparalleled opportunity to lead and contribute to research in Bayesian inference. This work has explored how we can use probability theory to perform a wide range of tasks, including designing intermodal transportation networks, designing and analyzing loudspeakers, and classifying radar targets for the purpose of missile defense.” — Wesley Henderson

In spring 2012, Qi Liu joined the electrical engineering department and started his study under Paul Goggans’ guidance. In the subsequent two years, by following Professor Goggans’ research notes, he stepped into the world of computational electromagnetics. Recently, he developed a new, accurate and fast 3D CE-FDTD scheme, which will be presented in his dissertation.

BWAC moves to Phase II

The National Science Foundation-supported Industry/University Cooperative Research Center on Broadband Wireless Access and Applications, or BWAC, at the University of Mississippi entered Phase II in September 2018.

The center entered Phase II after successfully completing three years as a site center collaborator in the University of Arizona-led BWAC consortium of five universities and several companies. Raytheon, Intel, FedEx and C Spire have been partners of BWAC at UM in Phase I.

In Phase II, researchers will address spectrum sharing for heterogeneous wireless systems, network optimization to mitigate mutual interference in BLE (low-energy Bluetooth) and Wi-Fi systems, and 3D printing of antennas and the design and fabrication of closely spaced antennas and antenna arrays using elliptical metasurface cloaking. Collaboration with industries in the southeastern U.S. will provide for our students additional co-op and internship opportunities.

Electrical Engineering to offer B.S. in Computer Engineering

The electrical engineering department will admit a freshman class to the newly created Bachelor of Science in Computer Engineering in fall 2019. The computer engineering bachelor’s program prepares students to have an understanding of computer hardware, software and electrical engineering fundamentals, thereby providing knowledge to develop and/or apply many kinds of computing systems such as microprocessors, computers, smartphones and Internet of Things, or IoT, devices.

Students in the program will have knowledge of computer programming languages, hardware description languages, digital logic design, computer organization, electrical and electronics circuit design, and processing of electrical signals. The program will enable our graduates to meet the expected demand for computer engineers in Mississippi and surrounding areas.

Daigle awarded Distinguished Professor honor

Last year, John Daigle was one of three UM faculty to be named an inaugural Distinguished Professor to honor his excellence in teaching, research and professional accomplishments. Daigle joined the faculty in 1994 after earning his bachelor’s degree in electrical engineering from Louisiana Tech University in 1968, his master’s in electrical engineering from Virginia Tech in 1969 and his doctorate of engineering science in operations research from Columbia University in 1977.

He was named an Erskine fellow by the University of Canterbury in New Zealand in 2009, was the 2004 recipient of the Institute of Electrical and Electronics Engineers Communications Society Technical Committee on Computer Communications Outstanding Service Award and was named an IEEE fellow in 1993.



Submitter photo
DAIGLE

SMALL CLASS SIZES

Upper-level EE classes typically have 10-30 students

DEDICATED FACULTY

Faculty advisers take personal interest in students’ progress in the program.

New B.S. in Computer Engineering program starting in fall 2019

Department has clusters of faculty specializing in three areas:
communications, EM/antennas/microwaves, and computer engineering

Industry/University Cooperative Research Center

The department hosts National Science Foundation-supported Broadband Wireless Access and Applications Center

UNDERGRAD RESEARCH

A total of 19 undergraduate students over the last four years gained research experience by working with faculty on sponsored research projects.

CO-OP & INTERNSHIP

The School of Engineering co-op program helps students land internships and co-op opportunities through our industrial partners. At least 10 students per year gain summer internships or co-op experience.

ABET ACCREDITED PROGRAM SINCE 1969

Winning App

ENGINEERING STUDENT'S TUTORING APP WINS TOP PRIZE IN UM BUSINESS COMPETITION

By Molly Ayers

Will Tribble, a University of Mississippi senior engineering major from Charlottesville, Virginia, along with Sam Harres, a UM senior accounting major from Millstadt, Illinois, took an idea conceived in a sandwich shop to win the annual Gillespie Business Plan Competition award in spring 2018.

The competition is organized by the UM School of Business Administration and is open to all students at the university, who are encouraged to exhibit their entrepreneurial spirit and creative ideas.

Frustrated with the expensive and limited tutoring options in Oxford, Tribble and Harres created their own model for a tutoring app that earned them a \$10,000 prize and rent-free office space at Insight Park's Innovation Hub on the Ole Miss campus.

Their creation, Shortwork, is affordable and flexible for students. Shortwork differentiates itself by providing on-demand help for students. For initially \$3 a problem with price breaks for continuing the service, students can simply submit a picture of their homework and receive video instruction from a verified tutor.

"I created it myself," Tribble said about the process of building the app. "I have a cousin that's a professional software engineer, so I communicated with him, taught myself the basics of web development and Googled everything else along the way."

After presenting the idea at the Land Shark Tank Pitch Competition and winning, Tribble and Harres decided to invest in developing the app. Tribble initially discussed the concept with a friend who had placed second at the Gillespie Competition in 2015. He was the one who encouraged entering Shortwork as a launchpad.

When Tribble and Harres won the competition, they still had a year left in



Ken Cyree (left), dean of the UM School of Business Administration, Will Tribble, Sam Harres and Clay Dibrell, executive director of the UM Center for Innovation and Entrepreneurship. Submitted photo

school and never had an opportunity to take Shortwork on full time. Tribble said the project became more of a fourth-tier priority as heavy workloads and graduation plans became more pressing.

While owning a business is the direction Tribble would like to take postgraduation, he also said he believes "there's a lot of benefit in having a reputation as a businessperson before trying to take these [business startups] on."

After graduation, Tribble plans to move to New York to work with Pearson, a publishing and education company, as a content protector. He advises aspiring engineering majors to

take advantage of opportunities and not write themselves off because they think their ideas might be crazy.

"We could be doing homework or all kinds of other things; instead, we're up at 1 in the morning at each other's houses staring at a computer screen for something that we have no idea how it will turn out."

When asked about returning to Shortwork, Tribble said if the opportunity arises and there's time, it's absolutely worth a shot. 🌟

Distinctive Dual Degrees

ENGINEERING-LAW ACCELERATED 3+3 PROGRAM ENDORSED BY JUDGE

By Madelyn Johnson

The University of Mississippi engineering and law schools offer an accelerated 3+3 program for students to earn a Bachelor of Engineering degree and a Juris Doctor in six years. This opportunity gives students the chance to work in technical areas such as patent law and in air and space law.

“We want to take these students who have expressed interest in going to law school and give them a break so that they can get through school faster, especially if the students are pushed for funds or are ready to start their professional lives,” said Jim Greenlee, a judge on the Mississippi Court of Appeals.

Greenlee (BE 74, JD 81) also serves on the Dean’s Engineering Advisory Board. He spent much of his career in civil law and as U.S. attorney for the Northern District of Mississippi.

He believes an engineering undergraduate degree will help students in law school and in practice.

“As engineers, we tend to take everything from a systems approach. The systems approach really works to see what impacts what, and what affects that. It will help you navigate through the maze that can be the law.”

Kelly Bates, a sophomore from Collinsville, Mississippi, is a student in the accelerated program. Bates takes her LSAT at the end of March, and will then apply to the Ole Miss law school. She wants to go into patent law and possibly advocacy law, and said her time in engineering has been beneficial for her.

“The critical thinking and the systems approach I have learned changes the game in taking the LSAT.”

Bates said she is looking forward to being ahead of her classmates.

“Knowing that I will be so young when I graduate, I will have time to figure out what I want to do once I have the law degree.”

Although the School of Engineering was one of the first schools to partner with the School of Law on the Ole Miss campus to offer an accelerated program in 2012-13, other undergraduate programs are now following suit. Law school leadership believes these partnership programs are beneficial as well.

“We are so excited for this program,” said Susan Duncan, dean of the law school. “I think it’s a great opportunity for those students who want to go to law school. The engineering and law



Submitted photo

Kelly Bates and Judge Jim Greenlee

combination is a very special combination; not many people have that.”

Duncan said 40 to 50 students have shown interest in the program this year. She believes the critical thinking and leadership development will be beneficial to the engineering students who obtain the J.D.

For more information on the School of Engineering Accelerated 3+3 program, contact Adam Smith, academic director of general engineering, at aes@olemiss.edu. 🌟

Ole Miss General Engineering

30

Program includes 30 credit hours of course work in emphasis areas outside the School of Engineering

90%

acceptance rate into medical or dental school for applicants since tracking began in 2004

CME

Available degree program for students admitted to the Center for Manufacturing Excellence

SMBHC

Opportunity for cross-disciplinary theses for Honors College students

EMPHASES

Program director advises students in emphases such as pre-med, pre-law, business, manufacturing, military science and naval science



Graduate student Michael Gratzter (left) collects data with the assistance of his father.
Submitted photo



Satellite photo of Sky Lake

Water Shortage

RESEARCHERS LOOK TO ENHANCE RECHARGE TO HELP MISSISSIPPI AGRICULTURE

By Gregg Davidson

For more than a decade, students and researchers in the Department of Geology and Geological Engineering have been studying oxbow lakes as a potential source of recharge. Department chair and professor Gregg Davidson and a series of graduate students have made countless trips to Sky Lake, an ancient meander loop of the Ohio-Mississippi River system that contains some of the state's largest and oldest cypress trees.

Why are they doing this research?

Agriculture in Mississippi is a \$7 billion business, and it all runs on water. If you fall short on your water supply, you fall short on everything.

Water is gaining particular attention in the Delta in northwestern Mississippi. The broad, flat landscape created by the Mississippi River flood plain is prime real estate for crop production.

If looking at annual precipitation, one might never guess that the Delta suffers from water shortages, but there are two problems with the supply from the sky.

“
Agriculture in Mississippi is a \$7 billion business, and it all runs on water.
”

First, most of those rains come in winter and spring, not during the summer when the crops are most thirsty. Second, the fine-grained surface deposits don't allow rainfall to rapidly

soak into the ground, and most of the precipitation runs off into streams and out of the watershed.

To make up for summer water shortages, farmers install wells and irrigate using groundwater. With limited irrigation, natural recharge can keep up with pumping. But when pumping exceeds recharge, the water table starts to drop and concern for long-term sustainability rises — a problem becoming all too common in the Delta.

A large depression has grown in the alluvial aquifer near the center of the Delta, with long-term declines in excess of 20 feet. Streams that once discharged excess groundwater now sit perched above the water table, with some drying up during summer droughts.

A critical step in effective management of the aquifer is understanding how and where water recharges the

aquifer naturally, with hopes that we can enhance that recharge to mitigate further declines. Until recently, recharge was believed to be primarily from the Mississippi River to the west and the bluff hills to the east, with limited recharge via direct infiltration of precipitation or stream losses.

Most consider recharge from oxbow lakes to be minimal because of the clays and silts that coat and seal the bottoms. But many of these lakes have extensive forested wetlands, with root systems and fallen limbs that may provide conduits for water flow as they decay.

Evidence for recharge until recently was largely indirect. In the past year, however, Michael Gratzner's thesis project, co-advised by assistant professor Andrew O'Reilly, produced definitive evidence that recharge to the aquifer beneath this lake is substantial when the lake fills with water.

Wells drilled inside and around the lake logged water-level changes after a

prolonged dry spell ended, and lake levels rose by more than 12 feet. The abrupt rise in lake level was matched by corresponding rises in wetland piezometers and nearby wells, resulting in a groundwater mound beneath the lake. For a time, the flow of groundwater, which normally flows east, reversed on the upstream side of the mound and flowed west.

"This has major implications for groundwater management in the region," Davidson said. "The Delta is riddled with these wetland systems. Groundwater models that have ignored them up to now will need to start considering them as sources. These findings also mean there may be new ways to facilitate enhanced recharge. If water levels in oxbow lakes are kept high during the winter, we may see far more recharge than possible with other artificial recharge efforts." ✨



Geology students Orion Adah and Yannick Wade collect wetland core samples. Submitted photo



Gregg Davidson stands by one of the largest cypress trees in the state of Mississippi. Submitted photo

Geology & Geological Engineering	
33% FEMALE FACULTY	12:1 STUDENT-FACULTY RATIO
Majors: 14% Geology 86% GE	82% OUT-OF-STATE STUDENTS 23% FEMALE STUDENTS
NEWS FLASH!!!  just hired 6 of our graduating students	 One of only 13 accredited programs in GEOLOGICAL ENGINEERING in the nation  ABET accredited

Cutting-Edge Research Provides Insight into Blast and Hazard Mitigation

RESEARCH SHOWS POTENTIAL FOR DEVELOPMENTS IN AREAS OF DEFENSE AND INFRASTRUCTURE

By Damian Stoddard and Raj Rajendran

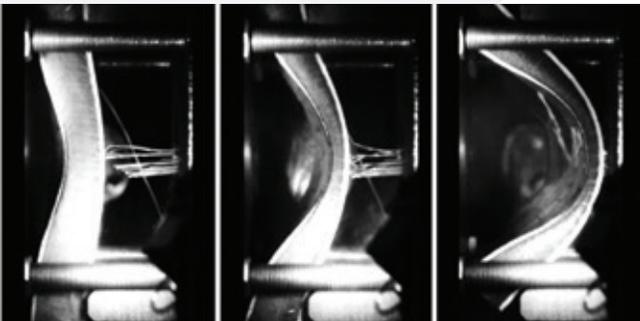
Researchers at the University of Mississippi School of Engineering are uniquely positioned to develop advanced composite panels through the use of a state-of-the-art blast and impact dynamics facility. These explorations will provide understanding for technological innovations in areas such as defense and infrastructure.

A.M. Rajendran and P. Raju Mantena, UM professors of mechanical engineering, were awarded a five-year, multimillion dollar research grant from the Department of Defense based on proposed research surrounding functionally graded composites for blast and hazard mitigation. Their research is in collaboration with Robert Moser from the U.S. Army Corps of Engineers at the Engineer Research and Development Center, as well as researchers from Mississippi State University and the University of Missouri.

The recommended research will focus on a materials by design concept that is inspired by gar fish scale architecture. The functionally graded composites in use are part of a new generation of engineered materials wherein structural features are varied. Many biological structures, such as alligator scales, rely on similar structures due to their strong yet lightweight nature.

This innovative research requires advanced computational modeling. These modeling techniques, along with additive technology and three-dimensional printing, will assist in the development of architectures for blast and hazard alleviation. Researchers will use supercomputers located at the Mississippi Center for Supercomputing Research and the Department of Defense Supercomputing Resource Center.

During this research, fundamental characterization of these structures will be conducted using advanced indentation and microscopic techniques. The design, development and manufacturing of advanced stitched fiber and layered foam-core-based structures will be analyzed for blast and impact loading characteristics.



Energy absorption of sandwich composite beam under shock loading. *Submitted photo*



Raj Rajendran

Submitted photo



Shock tube for performing a blast test configured by Damian Stoddard, workshop supervisor Matt Lowe and graduate student Suman Babu. *Submitted photo*

The fibers used will come from sustainable sources, such as agricultural waste and forest residue. In addition to these fibers, Nanostitch™ vertically aligned carbon nanotube, or VACNT, forest layers will be assessed for crack arrest and damage control. The energy dissipation characteristics associated with carbon nanotubes show potential for designing blast, ballistic and impact-resistant protective structures.

In addition to analyzing the characteristics of these structures, composite system responses will be assessed under conditions such as low-velocity impact and high strain-rate loading. The techniques associated with the examination of vibration and acoustic impedance and ballistic protection will also be used. These strategies will be complemented with controlled diagnostic blast experiments.

The knowledge gained from this research will provide the opportunity for potential developments in infrastructure, homeland security, armor designs for military and civilian use and protective structures that can sustain high-impact debris or other hazardous conditions. ⚙️

Undergraduates conduct blast and impact dynamics research

By Damian Stoddard and Raj Rajendran

In real life, several situations occur where materials are subjected to abrupt or sudden loading such as a space-debris collision into space structures, high-speed collision of automobiles, birds hitting airplane canopies or engines, bullet penetration into armor, explosion due to an improvised explosive device (IED) on military vehicles and collapse of buildings due to truck bombs.

It has been scientifically proven that most structural materials become significantly stronger under very high pressure and loading rate. In the design analysis of impact-induced failure of structures, the dynamics strength becomes an important material property!

The good news is that we can measure them experimentally using a wave mechanics-driven unique apparatus, such as the Split-Hopkinson pressure bar (SHPB) or Kolsky bar. At Ole Miss, a unique million-dollar Blast and Impact Dynamics Laboratory has been developed using major federal grants during this decade. In our blast laboratory, we can take videos of fracturing materials using high-speed cameras at a frame rate of one million pictures per second!

In the mechanical engineering department, our undergraduate students are actively conducting research to understand how a wide variety of materials, such as wood, glass, metals and cement, break or fail under high strain rate (or loading rate). Since fall 2017, more than 25 undergraduate mechanical engineering students have been assisting with ongoing research at the lab.

These undergraduates have become an integral part of research conducted on lightweight wood-based composites, 3D printed metals, metallic foams and ballistic panels. Students are obtaining technical skills in experimental techniques, data collection, data analysis, SHPB theory, high-speed photography and digital image correlation.

Working with the assistance of the Blast and Impact Dynamics Laboratory staff, students completing an honors thesis from the Sally

McDonnell Barksdale Honors College select a material of their choosing and develop an experimental testing matrix to test various parameters.

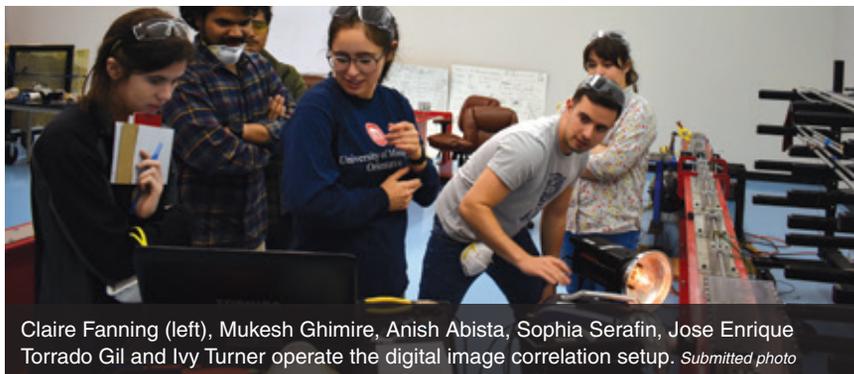
Experimental testing and data analysis is completed with the help of other undergraduate students. In conjunction with the data, high-speed photography collected by students gives valuable insight into the failure mechanics of the materials tested.

The process will advance development of more impact- and blast-resistant components and structures, as well as further students' understanding of high strain rate testing, strain rate sensitivity and dynamic testing. The high-speed video collected by the students is no easy feat, due to the short time frame of the test, but it allows students to test their engineering skills. Students are also learning valuable knowledge about digital image correlation using GOM Correlate software to analyze the full strain field results of the experiment and compare with results obtained from the SHPB analysis.

Data analyzed by the students are compiled and analyzed to obtain valuable understanding and insight into the dynamic response of various materials. The information obtained progresses the knowledge, understanding and development of advanced impact mitigating materials to prevent injury and loss of life during sudden catastrophic events such as an explosion.

Not only are students participating in the research process by collecting data, analyzing results and gathering high-speed images, but they are also assisting the journal article writing and submission process. The data that are collected, results that are analyzed and high-speed images that are gathered are all directly used for upcoming journal articles.

Student researchers add valuable insight into the interpretation of the results of experimentation. The mechanical engineering department is committed to training future researchers through hands-on experiences and theoretical knowledge that will help shape new research fields. ✨



Claire Fanning (left), Mukesh Ghimire, Anish Abista, Sophia Serafin, Jose Enrique Torrado Gil and Ivy Turner operate the digital image correlation setup. Submitted photo

MECHANICAL ENGINEERING

ABET accredited program since 1959

Opportunity for emphasis in manufacturing

STATE-OF-THE-ART BLAST AND DYNAMIC PROPERTIES LAB WITH 3D DIGITAL-IMAGING SYSTEM

New courses on modern topics: Alternative Energy Systems and Mechatronics

Undergraduate enrollment has TRIPLED in past six years

RESEARCH AREAS
multiscale computational modeling of energetic, metallic, bio and composite materials; mechatronics; energy harvesting

UNDERGRADUATE RESEARCH AND CO-OP OPPORTUNITIES

6

new faculty and instructors in past three years

SENIOR CAPSTONE PROJECTS IN INDUSTRY, ASME AND SAE COMPETITIONS

AMREC: A Match for Innovation

PROFESSORS COLLABORATE ON ADDITIVE MANUFACTURING RESEARCH

By Alexander Lopez

Alexander Lopez and Sasan Nouranian, assistant professors of chemical engineering at the University of Mississippi, have joined forces with Shan Jiang, UM assistant professor of mechanical engineering, and Hunain Alkhateb, UM associate professor of civil engineering, to lead a synergistic research and education initiative in the rapidly growing field of additive manufacturing and additive construction.

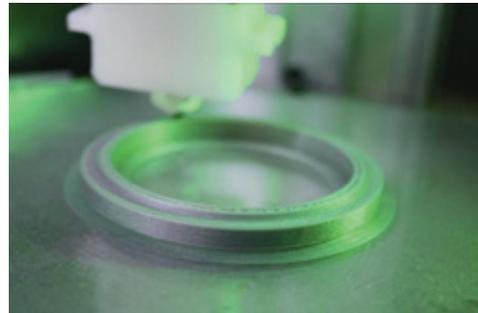


Members of the AMREC Research and Education Team *Submitted photo*

Together, they have established the Additive Manufacturing Research and Education Cluster, or AMREC, within the UM School of Engineering. Their mission is to provide the experimental and computational expertise to expand research in these fields while providing unique transdisciplinary experiences for students to learn and grow within their respective disciplines.

Efforts are focused on the analysis of materials in extreme environments, an area of significant interest to NASA and other federal agencies. A recent research grant from the group, with Alkhateb as principal investigator, will investigate the potential of planetary regolith from lunar and Martian soils to serve as building blocks for interplanetary structures.

This project is being pursued with partner researchers at the Marshall Space Flight Center. However, the vision of AMREC doesn't stop there. It is pursuing partnerships with UM's Graphene Research and Innovation Center to incorporate graphene into different additively manufactured parts as well as several computational projects focused on the energetics of materials in harsh environments.



Polymer extrusion through a DeltaWASP 20 40
Submitted photo

Future projects will venture into the additive manufacturing of biomedical devices, which will serve the newly established biomedical engineering program at the engineering school and provide research collaboration opportunities with the University of Memphis, which is heavily invested in the AM of biomedical parts.

AMREC has also reached out to several local schools with opportunities for K-12 educators to enhance their STEM curriculum through demonstrations and activities focused on the projects in manufacturing happening here at UM. Together, we hope to bring the School of Engineering to the forefront of manufacturing innovation while enriching the lives of our students through the educational opportunities available to them. ✨

CHEMICAL: STOP THE HEAT

continued from pg. 27

CNF are derived from cellulose, and the coating formulation will be coated onto paper substrates to create an effective and environmentally friendly packaging

If this research proves successful, it is possible the technology may be developed into a commercial packaging material.

material. The resulting coated substrate will be tested for its ability to withstand

high heat and moisture loads without decreasing its mechanical strength, all useful properties for packaging.

The scientific reason for employing CNC and CNF is that they will be in the form of aerogels and hence will introduce very small air pockets into the coating. This will subsequently provide insulation properties and also improve water repellency.

Work is well underway with this project. Al-Abri has prepared CNC and CNF in-house; conducted viscosity measurements of the formulations to characterize flow behavior; and

performed static light scattering and zeta-potential measurements to optimize the colloidal suspensions and hence coating formulations.

Continuing work will include performing thermal barrier tests on the optimized coated substrates; exploring different drying regimes to maximize the microporosity of the coating; and conducting dynamic mechanical analysis on the samples. If this research proves successful, it is possible the technology may be developed into a commercial packaging material. ✨

continued from pg. 31

to Jason Hale, director of research development in the UM Office of Research and Sponsored Programs.

“Conrad joined the department the same month I completed my undergraduate degree in computer science at UM. When I returned in 1990 to work on my master’s degree, Conrad was an assistant professor. He was a mentor to me then, and continued to be a mentor as I worked as a software developer in the industry over the next seven years. That mentorship continued when I returned to the University of Mississippi as a staff member in 2000, and has continued to this day.

“What has impressed me most about Conrad over these years is he is conscientious, unusually modest about his own talents and gifts, has a spirit of service, always puts students first and never gives up on a student (myself included). I believe that these traits have come to be the defining marks of leaders and faculty in the CIS department. I have appreciated these traits as a student, a staff member and colleague, and now as a parent.”

“

... he is invested in the long-term success of his students, rather than just performing the bare minimum needed to fulfill his educational obligations.

”

KYLE MOORE

Cunningham’s dedication to students is impressive, agreed Wilkins.

“With 30 years on faculty, Conrad is our department historian. To this day, he keeps in touch with many students and follows their careers.”

These connections are some of Cunningham’s most valued experiences during his career. During his doctoral studies at Washington University, Cunningham benefited from a close working relationship with his mentor and dissertation adviser, Gruia-Catalin Roman, an internationally known researcher in software engineering. Fifteen years later, Cunningham had a similar relationship with his Ph.D. student Yi Liu, now an associate professor at South Dakota State University.

“I have worked with a number of graduate students during the past 30 years, but Yi Liu is the Ph.D. student that I worked most closely with. We had a close professional relationship, this time with me in the role of mentor, guiding her work. It was great to see her get excited about ideas. I fed off her enthusiasm.”

Liu wholeheartedly concurred.

“Dr. Cunningham is an excellent adviser with great wisdom and patience. I enjoyed working on my dissertation research under his supervision. He gave me clear guidance as well as enough freedom to implement my ideas, which was so valuable to a young researcher. During the four years when I was working on my Ph.D. degree at Ole Miss, I learned so much from him, not only on the research topics but also on the attitudes toward work.

“Dr. Cunningham is my role model! After I started my career in academia, I adopted the way Dr. Cunningham worked with me with my own graduate students, which has proved to be successful. In addition to being a great adviser, Dr. Cunningham is a great friend who is always willing to provide advice and help.”

Being an administrator, mentor and professor consumes a lot of time and energy, so Cunningham is looking forward to his retirement. He and his wife, Diana, anticipate more time for travel, volunteer work through their church, and enjoying the sights, sounds and tastes of Oxford.

In addition, Cunningham plans to complete the textbook he is writing.

“I began writing the textbook in summer 2016, but it draws upon my functional programming and software architecture course materials from the past 28 years,” he said. “It is still a work in progress, but I was able to teach the Programming Language Organization course from it the past two years. I want to make the book available inexpensively, so I likely will self-publish the book rather than working with a commercial textbook publisher. After that, I have two or three other book ideas I’d like to pursue.”

Silu Zhang, a computer science Ph.D. student who has taken six courses from Cunningham, had some words of support for his upcoming retirement.

“I wish him a great, happy retirement with his wife. I’m so grateful to him for what he has taught me.” ✨

Promising Future

14 FRESHMEN EARN ENGINEERING SCHOLARSHIPS

By Ryan Upshaw



Fourteen University of Mississippi freshmen have been named recipients of top scholarships in the School of Engineering this fall.

Representing Mississippi, Louisiana, Alabama and Texas, they are this year's Brevard Family, John G. Adler and Harper Johnson scholars. The exceptional group of students posted an average ACT score of 33.4 and an average 3.92 high school grade-point average.

"We are excited to welcome these outstanding students to the School of Engineering," said Ryan Upshaw, assistant dean for student services. Upshaw manages the School of Engineering's recruitment efforts and coordinates the scholarship awarding process. "We look forward to their contributions to the school and to the university."

Aditya Surakanti, a biomedical engineering major from Madison, is a Brevard Scholarship recipient. A STAR student and AP Scholar at Madison Central High School, he participated in the UM Summer College for High School Students engineering program and was part of the MCHS Engineering Academy. He is also a member of the Sally McDonnell Barksdale Honors College.

"I worked hard to receive scholarships to reduce the financial burden for my family," Surakanti said. "When I found out that I was receiving this scholarship, I was elated, and it strengthened my commitment to Ole Miss."

Other Brevard scholars are Wallace "Doc" Herrin of Picayune, Cindy Nguyen of D'Iberville, Henry Seiler of Tupelo and Lauren Skinner of Ocean Springs.

Adler Scholar Spencer Johns of Little Cypress, Texas, hopes to pursue a career in the intelligence community after

studying computer science and participating in the Center for Intelligence and Security Studies. He was named valedictorian at Little Cypress-Mauriceville High School and attended both the Hugh O'Brian Youth Leadership Conference and Texas Boys State. An Eagle Scout, he served as junior class president.

"I was overwhelmed when I received the email notifying me of the award," Johns said. "It meant a lot to me that someone believed enough in my drive and experience that they would help support my further growth."

Additional Adler scholars are Ashton Devall of Ethel, Louisiana, Leah Ladner of Gulfport, Bryson O'Malley of Mathews, Alabama, John Martin Paczak of Madison and Anne Stewart Piazza of Vicksburg.

Harper Johnson scholars are Peyton Lott of Clarksdale, Ajah Singleton of Raymond and Jabria Thompson of Florence.

Ranked third in his class, Lott served as sophomore and junior class president as well as student body president at Lee Academy. He also participated in the Clarksdale Youth Leadership program. He plans to study chemical engineering.

President of the student body at Raymond High School, Singleton was ranked fourth in her class and also served as junior class president and president of the Beta Club. She plans to study biomedical engineering as part of the Honors College.

Thompson earned the status of salutatorian and served as senior class president at Hartfield Academy. She also served as vice president of Mu Alpha Theta and co-captain of the varsity dance team. She plans to study chemical engineering as part of the Honors College. ✨



Outstanding students, faculty and staff celebrated at banquet

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APRIL 11, 2019

ALUMNI AWARDS

Jeff Rish III

(BSCE 77, BSME 78, MS 83, PhD 85)
Engineer of Service Award

Albert Hilliard

(BSCS 83); MS in computer science,
University of Dayton;
EMBA, Baylor University
Engineer of Distinction

SPECIAL RECOGNITION AWARD

Catherine Norris (BSG 16)

Gregory Gomez Humanitarian Service Award

FACULTY/STAFF AWARDS

Lei Cao

Outstanding Faculty Member of the Year

Hunain Alkhateb

Outstanding Faculty Service Award

Adam Smith

Outstanding Faculty Teaching Award

Esteban Urena-Benavides

Outstanding Junior Faculty Research Award

Alexander Yakovlev

Outstanding Senior Faculty Research Award

Aubrey Bolen

Outstanding Staff Award

STUDENT AWARDS

Outstanding Senior Leadership Awards

William Garrett (ME)
Harleigh Huggins (ME)
Colbert Lehr (EE)
Zach Mitchell (BE)
David Rozier (ChE)

Mississippi Engineering Society Award

Brenna Sit (ChE)

David Arnold Award

Colbert Lehr (EE)

Taylor Medals

Jacob Azbell (EE)	David Rozier (ChE)
Anna Braswell (GE)	David Rydeen (CIS)
Claire Cozadd (ChE)	Jeremy Schneider (ChE)
William Garrett (ME)	Abhijaya Shrestha (ME)
Frank Allen Holiman (ME)	Brenna Sit (ChE)
Jordan Houry (ChE)	Philip Thomas (ChE)
Harleigh Huggins (ME)	Ward Toler (ChE)
Colbert Lehr (EE)	Skyler Truong (ChE)
Ethan Luckett (CIS)	Jonathan Vancekhoven (ChE)
Jacob McCall (EE)	

Graduate Achievement Awards

Amrit Kharel (EE), Farzin Rahmani (ChE)

Class Marshal

Harleigh Huggins (ME), David Rozier (ChE)



1. Senior Leadership Award winners: David Rosier (left), Colbert Lehr, Zach Mitchell, William Garrett, Harleigh Huggins
2. Engineer of Distinction Al Hilliard
3. Al Hilliard and family members
4. Engineer of Service Jeff Rish and family members
5. Hunain Alkhateb with former Dean Alex Cheng
6. Wei-Yin Chen (left) and Alexander Yakovlev

Photos by Bill Dabney



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It is common knowledge that Ole Miss engineers have been, and will continue to be, positive change agents throughout the world. The combination of their ingenuity, compassion and drive to solve problems has often been the impetus for real change in the quality of life for so many.

It is this commitment to service and the quest for continuous improvement that highlight the careers of a great many graduates of the School of Engineering at the University of Mississippi.

The Haley Barbour Center for Manufacturing Excellence considers it a privilege and a responsibility to be an active partner with the school and to reinforce these same principles as it educates the next generation of manufacturing leaders of Mississippi and beyond.

The CME strives to offer students hands-on experiences that exhibit the fast-changing, technologically advanced world of manufacturing, while continuing to develop them into leaders prepared to work with, and potentially lead, others.

The center's focus will always be on serving Mississippi first, but the lessons learned within its curriculum and on its factory floor have already benefited people well beyond the Magnolia State. We will endeavor to continue in this responsibility and celebrate with the School of Engineering as we see our students succeed.

— Ryan Miller —
Associate Director of
External Operations, CME

CENTER FOR MANUFACTURING EXCELLENCE