

# Innovations

Basic and Applied Sciences Magazine

Fall 2014 Vol. 2, No. 1

## MTSU's SPIDERMAN

How "Spill Doctor" Ryan Otter found truth in the ashes of Tennessee's worst environmental disaster

**MIDDLE  
TENNESSEE**  
STATE UNIVERSITY



# Innovations

Fall 2014 Vol. 2, No. 1

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# Rethinking the Basics



This edition of *Innovations* reveals yet again that MTSU is a thriving, innovative research community, which now includes excellent facilities to support faculty and students. Inside the new 250,000-square-foot Science Building, research in areas such as botanical medicine,

among many other specialties, is making MTSU an emerging leader in research and graduate education in Tennessee.

As proud as I am of the ever-higher levels of research being conducted, I am equally proud of the outstanding teaching happening in our college, which benefits the more than 13,000 students who enroll annually in biology, chemistry, and other science courses. Our instructional emphasis includes a mammoth effort in recent years to redesign how we structure and deliver some General Education courses in which too many students were struggling. With much effort and painstaking faculty review, these courses have been overhauled in an effort to increase attendance, engagement, and eventual success.

Change of any type can seem daunting and difficult at first, and no doubt requires patience and perseverance to see through to a successful conclusion. When faculty members put their heads together to collectively redesign General Education courses, the inherent problems and pitfalls that often accompany change need to be overcome. Such difficulties are compounded by the larger implications of the redesign, including the need to accommodate additional stakeholders, as well as the sheer complexity of the task at hand. No longer do we just need to consider our own patch of grass, we need to think about the student experience holistically.

Despite its complexity and daunting nature, though, course redesign offers the greatest potential for change through the range of possibilities it presents. It gives the institution the chance to develop richer and more integrated and holistic learning experiences; to consider what a well-rounded, successful graduate might look

like; and how to best support students as they move toward future success.

Below are examples of course redesign throughout the college:

- The Geosciences Department redesign team has flipped classrooms for some Introduction to Earth Science sections. A flipped classroom is a form of blended learning in which students learn new content online by watching video lectures, usually at home, and doing what used to be homework (assigned problems) in class, with teachers offering more personalized guidance and interaction and less lecturing.
- The Chemistry, Biology, and Math Department teams have redesigned their General Education courses using POGIL (Process-Oriented Guided-Inquiry Learning) to enhance the student experience. POGIL is a method devised to teach process skills (such as collaboration and written expression) as well as content using an inquiry-based approach.

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## Course redesign offers the **greatest potential for change** through the **range of possibilities it presents.**

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- The Engineering Technology Department has reshaped Engineering Economy as a blended course to enhance the learning experience. This is an approach in which a student learns, at least in part, through online delivery of content and instruction with some element of student control over time, place, path, or pace.

Mark my words—this is not grade inflation. It's taking a good look in the mirror and doing what's right by our hardworking students. That's why I'm so proud of our college's efforts in this regard. At the heart of course redesign in CBAS is sound pedagogical practice that shifts the nature of the teaching-learning enterprise—making it more active and learner-centered, with the primary goal of changing passive note-takers into active learners in order to enhance their chances for success.

In my mind, this thorough rethinking of course design is just another expression of what we mean at MTSU when we say, "We are True Blue!"

—Bud Fischer, dean



# FROM THE GROUND UP

THE NEW SCIENCE BUILDING  
CHANGES THE GAME FOR  
RESEARCH AND LEARNING

BY DREW RUBLE



## The brand-new, state-of-the-art, \$147-million Science Building opened to students this summer.

With more than 250,000 square feet of teaching, faculty and student research laboratories, and collaborative learning spaces for the more than 13,000 students who enroll annually in biology, chemistry, and other science courses, the new building is the biggest improvement ever for science education and research at MTSU.

Life for students enrolled in science classes “just got infinitely better,” says Dr. Elliot Altman, head of the Ph.D. program in molecular biosciences. It’s better for faculty as well. Historically, research has not been a strong component of MTSU’s mission, but that has been changing dramatically in recent years. And the new building is a game-changer for the University’s research capabilities.

The following pages offer a brief glimpse inside the new building and some perspectives from the past.

Clearly, it’s time to get to work. There’s a lot of science to be done.

*(continued on page 6)*



## Remembering the Past

### The new Science Building occupies ground where memories were made.

MTSU’s new Science Building was built on the site of four former dormitories that hold cherished memories for many alumni.

Wood Hall was a women’s residence built in 1964 and named for prominent alumnus Randall C. Wood (’41), founder of Dot Records and creator of Gallatin-based Randy’s Record Shop, which grew to become the world’s largest mail-order record business. Wood gave a generous gift of \$40,000 in 1961 that led to the drafting of a charter by alumnus and Rutherford and Cannon County chancellor Whitney Stegall (’37) for the Middle Tennessee State College Loan, Scholarship, and Development Foundation, the University’s first fundraising unit and a precursor of the Development and Foundation Office now housed in the Wood-Stegall Center.

Felder Hall was a women’s residence also built in 1964 and named for Evelyn Felder, a house mother during the ’40s.

The fall 1965 *Mid-Stater* reported that Felder, who came to campus in 1946 as director of residence halls, “endeared herself to hundreds of young Raiders and Raiderettes, as she was unexcelled in playing the mother-away-from-home.”

Gore Hall and Clement Hall were men’s residences built in 1965 and named for former U.S. senator and MTSU alum Albert Gore (’32) and former governor Frank Clement. Gore’s election to the U.S. Senate in 1952 and Clement’s election as governor the same year are considered major turning points in Tennessee political history, shifting power in the state away from longtime Memphis political boss E. H. Crump.

Memorial plaques will be placed at the site of the new Science Building to commemorate the dormitories and those whose names they once bore.





## Old Stomping Grounds

### Older science buildings will get a financial shot in the arm and some new tenants.

The Wiser-Patten and Davis Science Buildings (built in 1932 and 1967, respectively) comprise a combined 75,332 net square feet. They house memories for generations of graduates who are now working in science fields or those who simply took science courses as undergraduates in them.

What will become of these two structures?

“That is always the question I get when I am out and about in town and see alumni who studied in those spaces,” says Bud Fischer, dean of the College of Basic and Applied Sciences (CBAS).

Fischer says the older buildings will be renovated and put to good use. He believes that renovation is as important as starting operations in the new, modern building.

“This is important to me and to the history of this institution,” Fischer says. “These two buildings’ lives are being brought back to usefulness.”

The buildings will be emptied in January 2015. Renovation schedules call for them to be ready for reopening by May 2016 (though Fischer hopes they will be ready as early as January 2016). MTSU will spend about \$20 million to get the job done, Fischer says.

Details of who will move into the buildings and precisely where they will be are still a bit fluid, but some decisions have already been made. The Physics and Astronomy Department will take over the second and third floors and part of the first floor of the Wiser-Patten Building. The rest of Wiser-Patten will house the Forensic Science program and components of the Sociology and Anthropology Department.

The Davis Building will house the Geosciences Department, which recently moved from the College of Liberal Arts to CBAS. Geosciences’ departure from Kirksey Old Main will open space in MTSU’s oldest and most beloved building for expansion of the Math and Computer Science Departments.

The Davis Building will house the Center for Cedar Glade Studies, the Center for Environmental Education, and the new CBAS advising center.





## More than Brick and Mortar

### Now that the new science building is open, is there anything special planned for it?

A college education means more than accumulating credits. Students don't spend all their time in a classroom. College is also about being exposed to cultures, perspectives, and lives different than your own.

Many ongoing events and special programs are already scheduled for the new Science Building. Here are a few examples of what to expect in the coming year.

**Guest lectures.** MTSU's ability to attract national and world figures to speak on campus is a crucial part of the academic experience. Upcoming speakers sponsored by CBAS include 1996 Nobel Prize-winning chemist **Sir Harry Kroto**, who will visit just days after the Science Building officially opens. His Nobel Prize was awarded primarily for his codiscovery of buckminsterfullerene, a form of pure carbon better known as "buckyballs." Kroto teaches at Florida State University. Also, alum **Cynthia L. Chappell** ('71, '76), who has been working in the fight against infectious diseases worldwide for 25 years, will speak later this fall. Chappell is senior associate dean for academic affairs at the University of Texas Health Science Center in Houston.

**Frontline nights.** Students will be invited to watch episodes of PBS's *Frontline*, which explores and illuminates critical issues regarding business, health, society, politics, and war; and then have a professor lead them in discussion.

**Movie nights.** Open to the community, movie nights will include science-related films and activities for young students and families. 🌱



# GOOD <sup>as</sup> GOLD

Dr. Charles Chusuei's technology could transform patient care in emergency rooms and health centers worldwide

by Michael Burgin

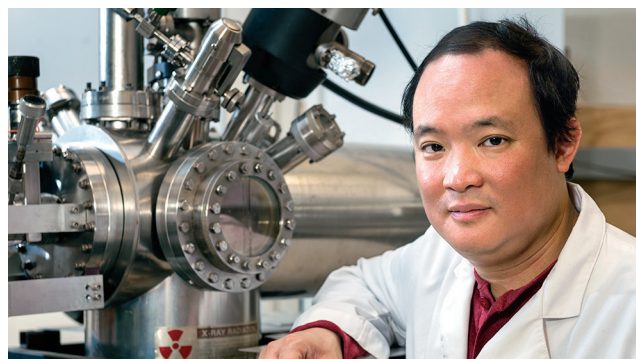
PRIOR TO THE OPENING OF THE NEW SCIENCE BUILDING, on the bottom floor of Wiser-Patten Science Hall, past a lecture hall and a few smaller classrooms and teachers' offices, one used to find the home base of Dr. Charles C. Chusuei and his team of student researchers. At first glance, the lab was pretty much what one would expect. A number of small workstations, some whiteboards, and a desk or two populated the periphery of the room. Stacked in one corner, there were a number of large, unopened boxes. A bulky piece of equipment dominated the center. Most scientists and many students in the field would have recognized the instrument as an X-ray photoelectron spectrometer, a machine that allows for nondestructive elemental analysis. It's a vital tool in the associate professor of chemistry's current line of research. Of course, give a layperson, someone who doesn't know a spectrometer from a chromatograph, a few moments to look around, and you probably would have heard the following question: "Is that a hand drill?"

It is (a Black and Decker, in fact). It's also a makeshift stepper motor for a homemade ultra-high vacuum sample transfer system. With the assistance of Rick Taylor, lab director in the Department of Engineering Technology, and the machine shop in the Voorhies Engineering Technology Building, Chusuei used the drill, a gearbox, a threaded rod, and machined pieces of aluminum to build a device the components of which would normally cost about \$1,000 to buy new.

There were plenty of other examples of Chusuei's combination of thrift and inventiveness—a fish tank pump substituted for the Wiser-Patten building's lack of dedicated pipes for chilled water. It was one of many drawbacks to the 46-year-old building—those boxes in the corner were actually equipment with technical and safety specs that barred them from being installed in Wiser-Patten. In a field where research ambitions often far outstrip existing facility technology and available funding, it's not uncommon to find professors who are equal part bargain hunters and

MacGyver. Chusuei, who arrived at MTSU in 2010, could count on one of those variables changing though—the \$147 million, state-of-the-art science building opened for instruction in 2014—but that didn't mean he was just waiting around. Quite the opposite, Chusuei and his student researchers have been busy developing a technology that could transform patient care in emergency rooms and health centers throughout the world.

As a result, over the past few years, that cluttered room, with its combination of brand-new, unpacked equipment in waiting and cobbled-together scientific apparatuses in use—not to mention the man standing in the middle of it all—have represented the exciting present and potential-filled future of science research at MTSU as surely as the now open new building that was being built a few hundred yards away.



## Not So Common Sense

As with most scientific research, discoveries with big applications often boil down to thinking small. Really small. Yet it also involves the detection of something one can find a bottle of in almost every home—hydrogen peroxide. It turns out that bubbling stalwart of home-based health care is also a natural byproduct of the biochemistry of all living organisms. The ability to monitor hydrogen peroxide on a molecular level has a host of practical applications in fields as diverse as health care (early cancer detection) and food service (spoilage detection). As a result, researchers have developed a variety of nanotech-based sensors. For the most part, those technologies have used sensors



dependent on carbon nanotubes (CNT) coated with oxides derived from precious metals—gold, palladium, ruthenium, etc. As the word “precious” suggests, it’s not cheap to use such metals. But just as with his lab’s ultra-high vacuum sample transfer system, Dr. Chusuei found that the expensive way to do things was hardly the only way. In an effort to establish a cheaper biosensing material, Chusuei turned to zinc.

“A common theme of nanotechnology is determining how material size and shape affects chemical reactivity,” Chusuei explains. “Our research team has shown that zinc oxide (ZnO) shape selection in the nanocomposite formulation (involving carbon nanotubes) dramatically improves its biosensing properties.”

## The Goldilocks Standard

An earth-rich element, zinc is much more abundant and, therefore, cheaper than the precious set. But in order to establish it as a viable substitute, Chusuei and his team first needed to control the shape of the ZnO compound itself. (The more complete the coverage by the ZnO of the CNT, the better the sensor.) “It was a lot like the fairy tale *Goldilocks and the Three Bears*,” Chusuei says. In the end, working the ZnO into its ideal shape required many things being “just right.” It required, among other things, finding just the right temperature (90 degrees Celsius) of the solution in which the suspended ZnO nanoparticles were formed and the pH (7.365) for maximum reactivity, as well as establishing just the right amount of time for sonication (the application of sound energy to agitate the solution).

With the bulk of the research completed—and with the right balance struck—it’s actually a rather simple procedure to replicate, but as Chusuei’s patent application shows, it wasn’t an obvious one. The real-world potential of the research has Chusuei and his students excited. The cheaper the materials, the more widespread the possible application of the technology.

“If we can attach this biosensor in a portable electrochemical cell, then people can easily detect the presence of [certain compounds] in their body whenever and wherever they want,” says grad student Anup Deb, who learned of Dr. Chusuei’s research while an undergraduate at the University of Dhaka, in Bangladesh.

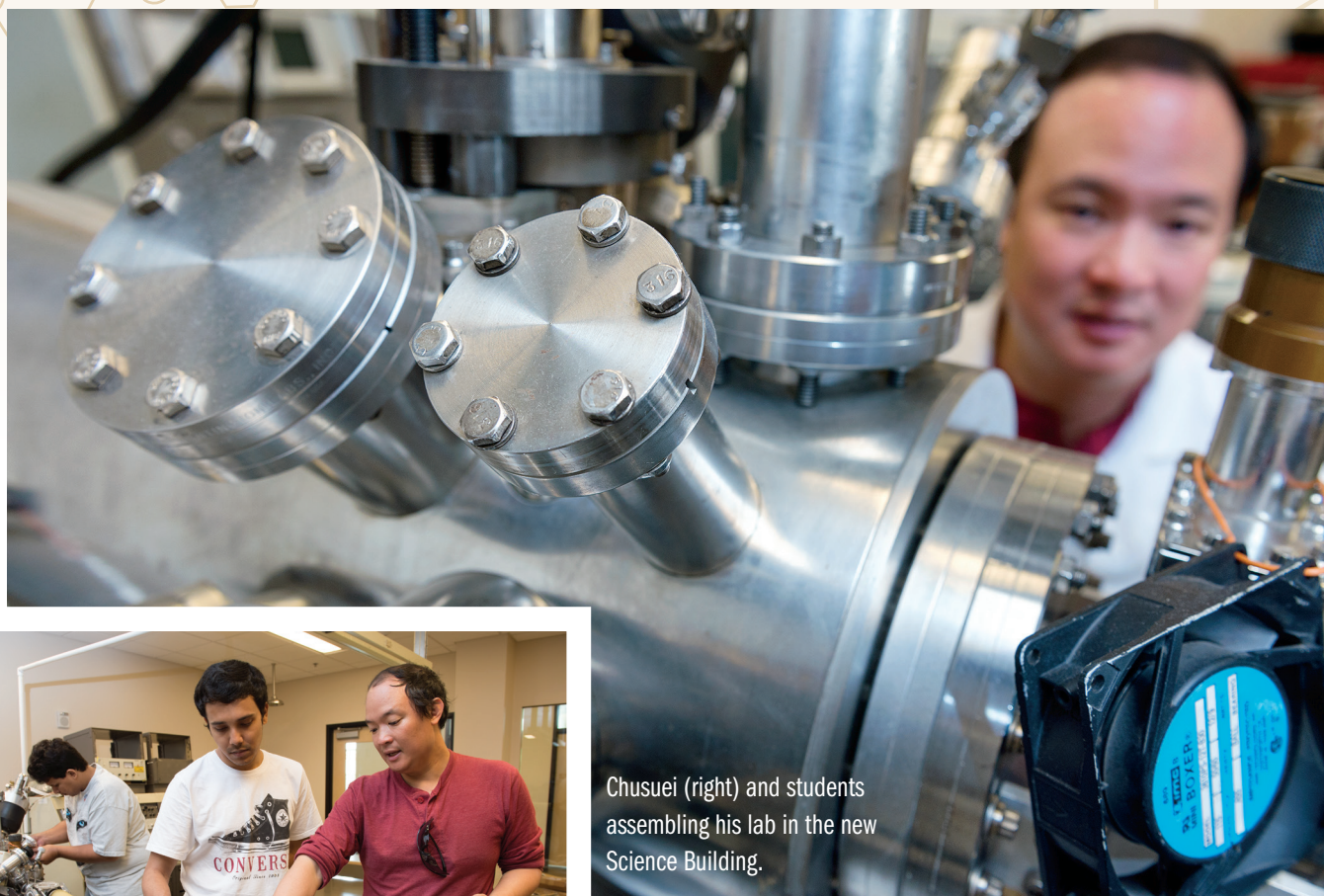
“What I’m doing now contributes to the effort to create a cancer-free community,” says Mulugeta Wayu, a Ph.D. candidate in the University’s Molecular Biosciences program who came to

(continued on page 10)

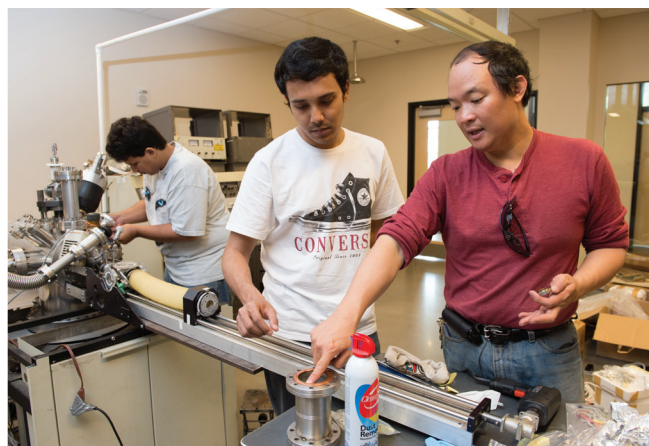




(As Good as Gold continued from page 9)



Chusuei (right) and students assembling his lab in the new Science Building.



the United States after spending years as a research scientist in Ethiopia.

Cancer is not the only affliction potentially addressed by the research of Chusuei and his students, nor is hydrogen peroxide the only substance detectable. Another vein of inquiry includes the detection of lactic acid, a marker for anaerobic respiration (the presence of which can indicate that a patient is not breathing well or getting enough oxygen). Such sensors could detect signs of physical distress that show up well “before changes in heart rate or blood pressure would be registered,” Chusuei points out.

Even with so much established, there remain plenty of practical questions and intriguing pathways for follow-up research. “Now it becomes a question of how low you can go,” Chusuei says. As

with most things nanotech, the smaller one gets, the wider the applications. (There’s also the question of testing and gauging the toxicity of the resulting sensors.) The lab’s success with ZnO has also led to research with other non-precious-metal-based compounds. Anita Saha, a senior biochemistry major, is working with cerium oxide to detect acetaminophen.

Dr. Chusuei’s laboratory is now housed in a shiny new science building. The low-energy electron diffractometer, liquid nitrogen generator, and quadrupole mass analyzer—to name a few of those brand-new pieces of equipment still in boxes—have been unpacked and put to long-awaited use. It’s exciting to consider, and no doubt the state-of-the-art facility makes a host of scientific processes easier and new discoveries possible. Nonetheless, the most crucial ingredients to the University’s future success as a research institution were already in place in the form of Dr. Chusuei, his colleagues, and all the student researchers under their direction. Oh, and that hand drill masquerading as a stepper motor. 🌀



# Thinking Outside the BOX



**One MTSU alumnus helps keep grocers  
(and recycling companies) in the green**

by Drew Ruble

You've just polished off that half-gallon of chocolate ice cream in your freezer. What should you do with the leftover container? Is it recyclable? Or what about that paper cup once full of latte from your favorite coffee shop?

Until recently, the answer probably would have been "not really." Packaging for frozen foods uses plastic barrier liners to stop liquids from leaking and help preservation. Because plastic clogs filters at paper mills, recycling is economically unattractive to big corporations.

That's all changing, thanks in part to alumnus Christopher R. Tilton ('79), an agribusiness major turned scientist and entrepreneur. Today, tens of millions of grocery products are packaged in more environmentally friendly materials he designed and patented.

How has he done it? A veteran of the packaging business (his first job after graduation was director of sales for a packaging company in Conyers, Ga.), Tilton cofounded California-based Smart Planet Technologies, which replaces plastic coatings with higher-density mineral composites that separate easily from paper in a recycling mill, keeping them, unlike plastics, out of landfills. It's good green science when you consider that the Environmental Protection Agency says Americans generated about 251 million tons of trash in 2012 but recycled and composted only about 87 million tons. That's just a 34.5 percent recycling rate.

*(continued on page 12)*

*(Thinking Outside the Box continued from page 11)*

“Right now, almost all plastic-coated packaging—coffee cups, ice cream cartons, frozen food boxes—are not wanted by recycling mills because it corrupts their process and damages their equipment. So 98 percent of it is going to a landfill,” Tilton says. “We want to avoid the landfill. Since our ‘earth-coated’ boards are re-processable at the paper mill, they are now willing to pay for those fibers.”

Make no mistake, finding a solution that made financial sense for corporations, rather than orchestrating an environmental crusade, was the tipping point in successfully commercializing Tilton’s product.



Christopher R. Tilton

“We’ve provided an incentive for material recycling companies to collect it and sell it,” he says. “That’s key to flipping any industry. That’s ultimately how you drive the infrastructure for collection.”

In addition, Tilton’s mineral substitutes

are six to eight times cheaper than plastic, which encourages food makers to replace resin coatings on the front end.

“Again, companies do not move to a more environmentally friendly product if it costs more,” Tilton says bluntly. “To change an industry, you’ve got to be able, on a large scale, to reduce costs. From our perspective, from a recycling perspective, that’s an enormous accomplishment. We’re very, very proud of that.”

## A Coat of Many Patents

Over the past five years since cofounding Smart Planet, Tilton has developed, patented, trademarked, and commercialized his EarthCoating technology. He is the sole inventor on all his patents and over more than two decades has acquired more than 40 consumer-packaging patents and patents pending.

The number of Tilton’s business successes has grown over the past year and a half. His company makes money by licensing the core technology to large companies such

as International Paper (IP), the largest packaging company in the world, which pays royalties for the use of Tilton’s intellectual property. Earlier this year, IP’s coated paperboard division created carton and cup products in two of their lines, which, with Tilton’s technology, improves yield and reduces plastic while offering the same barrier properties.

Whole Foods Market recently introduced 100 percent recycled paperboard deli boxes using EarthCoating in Colorado, Idaho, Kansas, New Mexico, and Utah. Stores offer consumers two environmentally friendly types of containers for salad bar and hot food selections.

Newark Recycled Paperboard Solutions, a world leader in the manufacture of recycled paperboard, recently partnered with Smart Planet to evaluate the use of EarthCoating in its processes. Johnny Gold, Newark’s senior vice president, said in a press release that “the rates of recycling of folding cartons, paper cups, and corrugated materials all stand to benefit from this technology. If the pilot runs prove successful, this will be an exciting development for the recycling industry.”

Smart Planet recently teamed with Print Winner to make paper hot cups using EarthCoating commercially available following successful recyclability and repulpability testing at Georgia Tech’s Institute of Paper Science and Technology.

By taking on investors to help him with funding for research, development, and commercialization, Tilton is today one of 86 shareholders of his private company. He expects Smart Planet to go public in the next year or so, depending on how the commercial push goes.

## A Little Knowledge Is a Powerful Thing

One of Tilton’s passions is finding environmental solutions. Another is inspiring young people to pursue their academic interests and, eventually, careers in science and engineering.

Tilton’s advice to MTSU students is to not be intimidated about pursuing a degree in science, math, or engineering even if they aren’t A students. He believes those fields of study are essential to business success.

“You don’t have to be academic wonder in the disciplines of science or engineering to really enjoy the advantages of that knowledge,” Tilton says. “So what you have is a lot of



potentially great entrepreneurs who have great ideas but, because they don't have basic knowledge of the science, they don't have a portal through which to act on those ideas."

Tilton describes himself as someone who was not a top student but who gained enough academic knowledge in the science disciplines to be able to open his mind to ideas and creativity.

**"MTSU was an absolutely essential part of my life. I don't think I could have done it without the University."**

"Most successful entrepreneurs weren't necessarily academic successes, but they have taken the time and given the effort to study those hard disciplines of science to provide themselves a window of opportunity to be successful," he says.

### He Is True Blue

Although based in California and decades deep into a corporate career that now includes ushering in a revolution in barrier packaging, Tilton remains devoted to MTSU and

eager to sing the praises of the University. The oldest of seven children (his mother, Sally Tilton, still lives in Murfreesboro; his father, Lowell, is deceased), Tilton was the first on either side of his family to get a college degree. (See the sidebar below on Tilton's family connections to MTSU.)

The Warren County high school grad worked full time throughout college to pay for his education. He started as a dishwasher at Shoney's on Broad Street and finished as store manager at a now shuttered Shoney's near the interstate. Tilton was an ROTC Distinguished Military Student (and graduate) and president of the Pershing Rifles Drill Team, and he was a regular member of color guards for MTSU sports. (More recently, he was the 2002–2003 president of the ROTC Alumni Association. He finished his Army service as a lieutenant colonel of field artillery in 2006.)

Tilton says the support of faculty and staff at MTSU was crucial to his success as a student.

"MTSU was an absolutely essential part of my life. I don't think I could have done it without the University. I really don't. I don't know where my life would have gone. I am deeply grateful," he says. "I look at the decision to go here initially as one of the best decisions I have ever made." 🌿

## All in the Family

Tilton's wife, **Cynthia**, was a student at MTSU. The couple met and married in Murfreesboro just before his graduation. She finished her education later and is now a registered nurse in the ICU at Hoag Hospital in Newport Beach, Calif. The couple has three children—Elizabeth, Michael, and Kimberly—who are all college grads.

His younger brother **Craig** ('82) graduated with a B.S. and later got his master's degree. He taught high school chemistry for over 20 years and will soon complete his education to become a physical therapist.

Another brother, **Chuck** ('87), was also an ROTC graduate and became an assistant professor in the MTSU Military Science Department. He recently took charge of the Tennessee Army National Guard's 117th Regional Training Institute in Smyrna.

**Hope Fisher**, Tilton's sister-in-law, is married to **Pete Fisher** ('87), general manager of the Grand Ole Opry and one of MTSU's most prominent graduates.

Tilton's brother-in-law **Larry Sims** ('72) is owner of Sims Realty, located on the town square in Murfreesboro. His son, **Robert Tory Sims**, also graduated from MTSU.

Tilton's sister-in-law, **Shelly Tilton**, graduated from MTSU Nursing School and is an RN working for the Murfreesboro School District.

Tilton's oldest daughter, **Elizabeth Tilton** ('04) is a digital specialist with newspaper giant Gannett in Murfreesboro.

Tilton's niece, **Hanna Tilton**, graduated from MTSU. His nephew, **Matthew Tilton**, is a senior at MTSU, where he is enrolled in ROTC and is currently in Afghanistan. His wife, **Noona Tilton**, graduated from MTSU last year. 🌿



# Basic Highlights

A look at recent awards, events, and accomplishments

## Physics and Astronomy



### Calling Her Shot

Lady Raider Ebony Rowe, 2013–14 C-USA Player of the Year, recently graduated as the most prolific scorer and rebounder in school history. Off the court, she racked up an equally impressive portfolio of academic awards, and her GPA as a Physics major hovered between 3.6 and 3.7. Rowe could have played professionally, but she decided to study mechanical engineering at Georgia Tech.

### A Look Back

Archibald Belcher (1870–1924) was one of the original 18 faculty members at Middle Tennessee State Normal School in 1911. Chemistry professor Martin V. Stewart is writing a book about Belcher, the institution's first physical science teacher, as part of writing a history of the Department of Chemistry.

## Computer Science

### Google IT

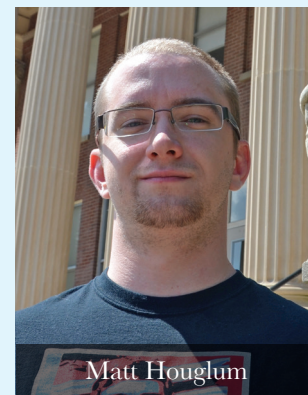
Nathan Reale and Matt Houghlum are the latest computer science alumni to tap the career pipeline to Google. In April and May of 2014, respectively, they landed full-time positions with the Web services giant.

"It is very difficult to get hired at Google, and the fact that a major company like Google is hiring our students is indicative of the quality of the education being offered in the Department of Computer Science at MTSU," said Chrisila Pettey, department chair.

Reale, 24, of Franklin, and Houghlum, 24, of Christiana, join other computer science alumni, including Micah Chasteen, at Google. Chasteen has worked for Google for two years, and he spoke to the computer science student organization in February 2014.

"His topic was getting a job with IT companies, but mostly Google," said Reale. "I applied the next day."

Reale will work on projects at Google's Mountain View, California, operations near San Francisco. Houghlum will be an enterprise technical solutions engineer in Seattle. At MTSU, Houghlum was on a student team that developed an Android mobile app for students to provide easy access to a variety of University information.





# Chemistry

## Connecting the Dots

Chemistry chair Greg Van Patten has been awarded \$120,000 from the National Science Foundation to study new kinds of semiconductor quantum dots.

Van Patten is among many researchers who believe these small particles may be keys in treating cancer or curbing the energy crisis, among other applications. Van Patten is interested in quantum dots' implications for solar energy conversion—from lighting to digital display to energy to biomedicine to quantum computers.



## Good Recognition

A member of the Lady Raiders basketball team won the 2014 President's Award, the most prestigious honor given to an MTSU student. Laken Leonard of Whitleyville, Tennessee, received the award during the annual CBAS Awards Day in April 2014. Recipients must exemplify superior character, honor, and achievement.

Leonard was also among 16 C-USA athletes to earn winter Spirit of Service honors for her involvement with the Fellowship of Christian Athletes, Student-Athlete Advisory Committee, Greenhouse Ministries, Special Olympics, and more. She graduated with a degree in biochemistry (pre-pharmacy) and is now enrolled at Belmont University's College of Pharmacy. She started 16 games for the 29–5 regular season and tournament champion Lady Raiders, averaging 6.7 points per game.



Dr. Brad Bartel and Laken Leonard

## Girl Power

Chemistry professor Judith Iriarte-Gross was named the inaugural winner of the ATHENA International Leadership Award. RutherfordCABLE, a women-in-business network, presented the award in May 2014.

Iriarte-Gross has led the charge to make young women across Tennessee aware of careers in science, technology, engineering, and mathematics (STEM). One of her recent efforts was launching the first Engineering Technology Girl Day at MTSU. Fifty girls from Oakland, Cannon County, Smyrna, and other high schools heard from STEM professionals and worked on projects that included making a cellphone charger out of a small metal box and building a green-energy windmill. The keynote speaker was alumna Bobbie Jo Meredith ('06), an engineering manager at Schneider Electric in Smyrna.

# Geosciences

## New Digs

On July 1, Geosciences officially moved from the College of Liberal Arts to become the 11th department in CBAS. MTSU has one of the South's largest undergraduate geoscience programs.

Department chair Warner Cribb said, "We're excited to be in Basic and Applied Sciences. It's a natural fit. Our graduate program always has worked under the associate dean (Saeed Foroudastan) with the M.S. in Professional Science program."

Cribb added, "All cultural and regional geography [students] have moved to . . . Liberal Arts."

*(continued on page 16)*



## Mapping History

Students displayed “Geography of Hate” maps and documentation in Nashville earlier this year. Ian Murray and Jordan Brasher delivered presentations at the Holocaust Remembrance Day commemoration in April 2014 in the State Senate Chambers. Murray and Charles Hunt Jr. also participated in videoconferences at Vanderbilt’s Virtual Campus. Assistant Professor Patricia Boda’s cartography class used GIS and manual map-making for “Geography of Hate” projects. Each student was required to use maps to show locations where genocide either has or is taking place.

Brasher, a Geoscience major from Milan and president of the Geography Club, chronicled the Trail of Tears. Brasher’s great-great grandmother was Cherokee. Murray, a native of Spring Hill who graduated in 2013, traced the path of a Holocaust survivor through Europe during World War II. Hunt, a Geography minor from Lebanon, compared the exodus of Jews from Europe during and after World War II with the current conflict on the West Bank and Gaza Strip.

Much research is being done using satellite imagery and mapping to identify human rights abuse before it occurs. Danielle Kahane-Kaminsky, executive director of the Tennessee Holocaust Commission, said she hopes MTSU can make a connection with Yale University Genocide Studies, which she said is at the forefront of using this technology.

## Environmental Science

### True Blue Team Green

Team Music City, comprising students and faculty in CBAS, the College of Behavioral and Health Sciences, the School of Engineering at Vanderbilt, and partners from Habitat Nashville, was selected to compete in Solar Decathlon 2015, a U.S. Department of Energy event that challenges students to design and build a functioning solar-powered house.

Twenty teams from colleges and universities across the world have started the nearly two-year process of building. Students in Construction Management, Interior Design, and Engineering Technology will be involved in the building of a house on Vanderbilt’s campus that is less than 1,000 square feet. Solar Decathlon is named for the 10 contests designed to gauge how well built, livable, and affordable the houses are.

## Concrete Industry Management

### Hard Evidence



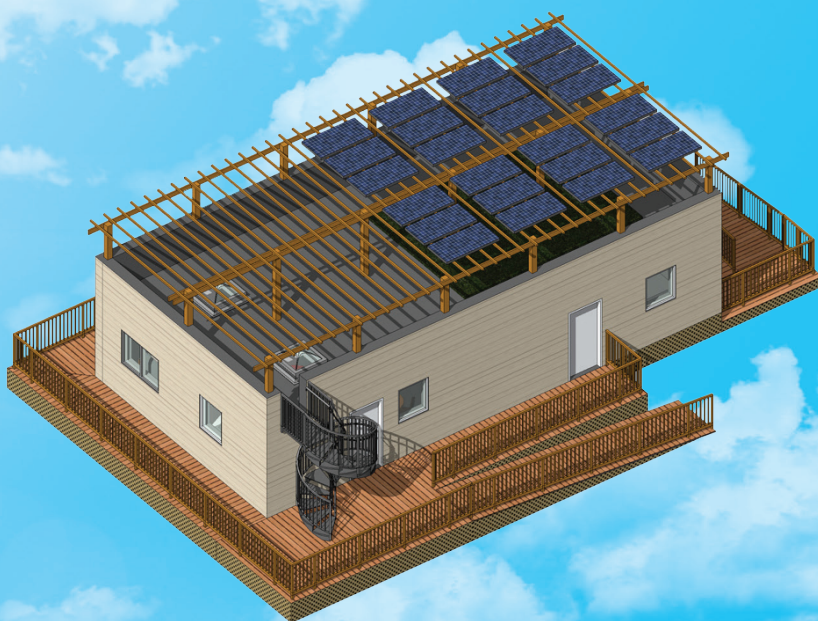
Heather Brown

MTSU’s nationally recognized Concrete Industry Management (CIM) program recently received new grants totaling more than \$200,000 from the Tennessee Department of Transportation (TDOT). Zhifu Yang and Marcus Knight were principal investigators.

Heather Brown, chair, works with TDOT on projects such as gauging the life expectancy of roads and bridges and selecting the correct concrete

for construction. CIM also investigates new materials for certain projects. Grants from TDOT support research, which often involves undergrads.

“It’s pretty unusual, nationally, to see students involved in state transportation projects like this,” says Dean Bud Fischer. “It allows our students to do hands-on research activity, which is also important for the state.”





# Military Science

## Making the Leap

John Harris ('74) can't count the number of times he stood atop Forrest Hall and stepped off into empty space, supported by only a rope and confidence in his fellow ROTC cadets. Visiting MTSU four decades later, he was astonished to see students doing the same drill.

Harris was a member of the Blue Raider Battalion who went on to an eventful career including service in Saudi Arabia and Kuwait. He retired as a lieutenant colonel and was among donors that made MTSU's first freestanding rappelling tower possible. The Tennessee National Guard also contributed. The wooden tower's highest station, 44 feet up, is twice as high as Forrest Hall. Its cantilevered top deck—with no footholds, just air below—allows cadets to simulate rappelling from a helicopter. Exits on multiple levels mimic leaping from windows or doorways.

Since the ROTC program began in 1950, seventeen Blue Raider Battalion alumni have risen to the rank of general, earning MTSU the nickname "cradle of generals."

*(continued on page 18)*





## A Soldier's Salute

Senior ROTC cadet Teana Harle, Blue Raider Cadet Battalion commander, represented MTSU at the prestigious Army Cadet Command George C. Marshall Awards and Leadership Seminar in April 2014 at Virginia Military Institute in Lexington, Virginia.

Harle, set to graduate in December with a Psychology degree, will be commissioned as a second lieutenant just before receiving her diploma. She plans to join the Tennessee National Guard. Harle is married to fellow cadet Scott Harle, who was among nine senior cadets commissioned last spring.

Alumnus and U.S. Army Lt. Gen. William "Bill" Phillips of Bell Buckle joined President Sidney A. McPhee and Dean Bud Fischer at the spring commissioning ceremony. Phillips was also a spring commencement speaker.



Teana Harle

## Agribusiness/Agriscience

### Past and Future Farmer

Professor Cliff Ricketts received a National Future Farmers of America VIP citation this year, one of only nine others.

Ricketts has guided more than 300 agriculture education majors to teaching careers. He is a judge for the National Agriscience Fair and an evaluator of American FFA Degree applications. In 2013, a Ricketts-led team got national attention when it made a coast-to-coast drive using just solar energy and hydrogen from water.

### An Inspired Gift

While watching Super Bowl XLVII in February 2013, alumna Linda Overton ('72) decided to make an endowed gift to the University. Her inspiration was the now-famous commercial for Dodge trucks featuring the late Paul Harvey's narration.

"At the end of the commercial, there was a beautiful landscape, and it showed a farmer," said Overton, who lives in Dothan, Alabama. "Paul Harvey says, '... So God made a farmer.' It just really hit me."

Overton established the Billie and Burton Towry and Linda Lane-Overton Scholarship for students from either Lincoln County or Blanche High Schools who want to pursue agriculture. She grew up in rural Lincoln County, where her parents Billie and Burton Towry, operated Towry Enterprises, including a

cotton gin, a granary, and a long-haul trucking company. In cotton and grain seasons, her parents worked the office, located in the Kirkland community.

Overton presented the first \$1,000 scholarship to Haley Cobb, an Agribusiness and Mass Comm (public relations) double major. "This has been a fantastic opportunity," said Cobb. "Coming from a small farming family, having any help to pay for college is a relief for me and my parents."

### Two Centuries and Counting

Katherine Batey Whitt ('01) and Brandon Whitt ('02) won the national Young Farmers and Ranchers Achievement Award from the American Farm Bureau Federation earlier this year. Winners are chosen based on growth and financial progress, Farm Bureau leadership, and contributions outside the Farm Bureau. The couple was presented with an "MTSU Blue" GMC Sierra.

Katherine's parents, John L. and Melissa Batey, are also alumni, and John L. and Brandon run Batey Farms, an eighth-generation family farm started in 1807.

(Basic Highlights continued on page 30)





# Better by Design

**The new Mechatronics Engineering major is a promising leap forward for the Department of Engineering Technology**

by Randy Weiler and Drew Ruble

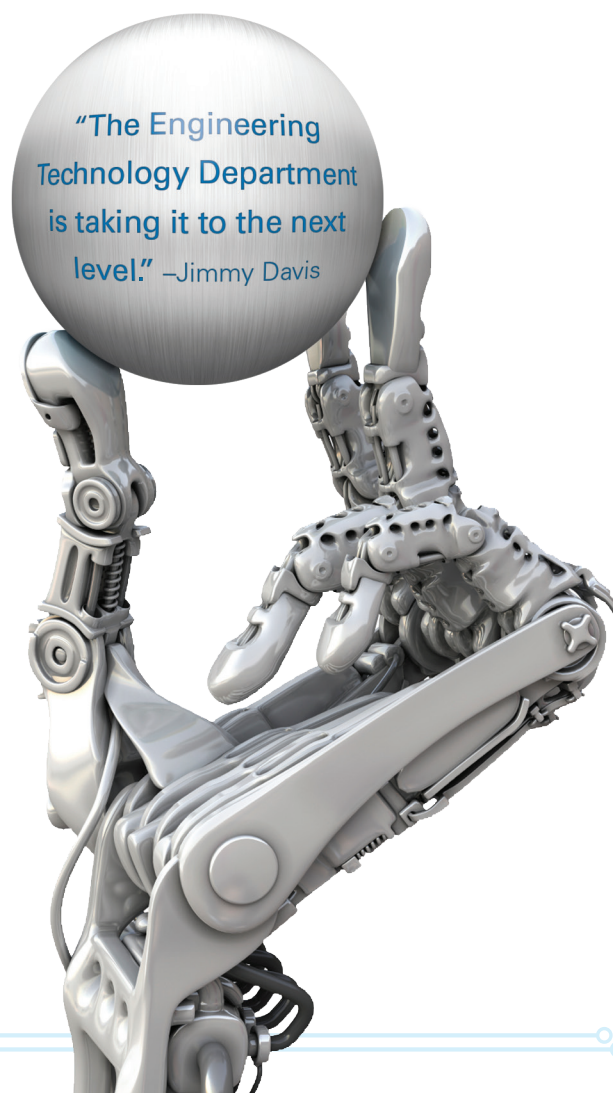
Mobile robots that can move traffic safety barrels for road repairs, freeing workers from a dangerous task. Surgical robots that let doctors perform operations through small incisions or get enhanced views of abdominal cavities. Specialized robots for planetary exploration. All are examples of mechatronics systems.

Mechatronics is a design process that combines mechanical, electrical, and robotic work with computer programming and control systems. Programs in mechatronics are based on a three-level international certification system created by Siemens AG, a German engineering company.

In summer 2013, MTSU began a mechatronics engineering program. That fall, the first donation—\$15,000 from the southeast chapter of the International Beverage Packaging Association to endow student scholarships—was received. Why the support? Chapter member Jimmy Davis, a 2010 MTSU alumnus, past president of the Engineering Technology Advisory Board, and owner of the Murfreesboro-based Davis Groupe, which supplies machinery, tools, and parts to Toyota, General Motors, and Nissan, among others, describes the new program as a “game-changer. . . The Engineering Technology Department is taking it to the next level,” Davis says.

Bud Fischer, CBAS dean, agrees. “It’s created a program that’s designed by industry that creates an engineer who has the ability to do multiple types of engineering,” he says.

*(continued on page 20)*





*(Better by Design continued from page 19)*

According to Fischer, mechatronics fits MTSU and its Engineering Technology Department to a tee. “It’s taking the theories of engineering and putting them into practice, making it truly applied engineering,” he says. “It fits us so well because it is a degree in engineering that has a huge hands-on component, which is what we really are and really what engineering technology is.”

## Manufacturing’s New Landscape

There’s a high demand for skilled workers to maintain and repair mechatronic systems. People trained and certified in mechatronics engineering can expect high-growth opportunities and wages.

Engineering Technology chair Walter Boles said President Sidney A. McPhee encouraged him as far back as 2011, noting that Motlow College had a mechatronics program “and we should get involved.”

Boles and other University officials had attended meetings where representatives from Nissan and Bridgestone were emphasizing that, worldwide, there’s a shortage of people with these qualifications. “We need to pump people into the workforce,” Boles says.

State senator Bill Ketron (‘76), a small-business owner and a member of the Engineering Technology Advisory Board, says the economic impact of the new program will be significant. “Once we start training these young people and the industries and manufacturing concerns realize there’s a good, trained, and educated workforce for their needs, they’ll start locating here,” he says.

A key aspect of the major is the range of partnerships involved. Collaborators include Motlow College, Rutherford County Schools and elected officials, and companies such as Nissan North America, Bridgestone Americas Tire Operation, Yates Services, and Siemens.

Potential connections to high schools and community colleges were also important to the mechatronics proposal. State decision makers in higher education liked the seamless transition from high school to community college to MTSU mechatronics studies, with those at Motlow receiving the first two Siemens certifications and moving on to another at MTSU. It also didn’t hurt that industry leaders pushed it.

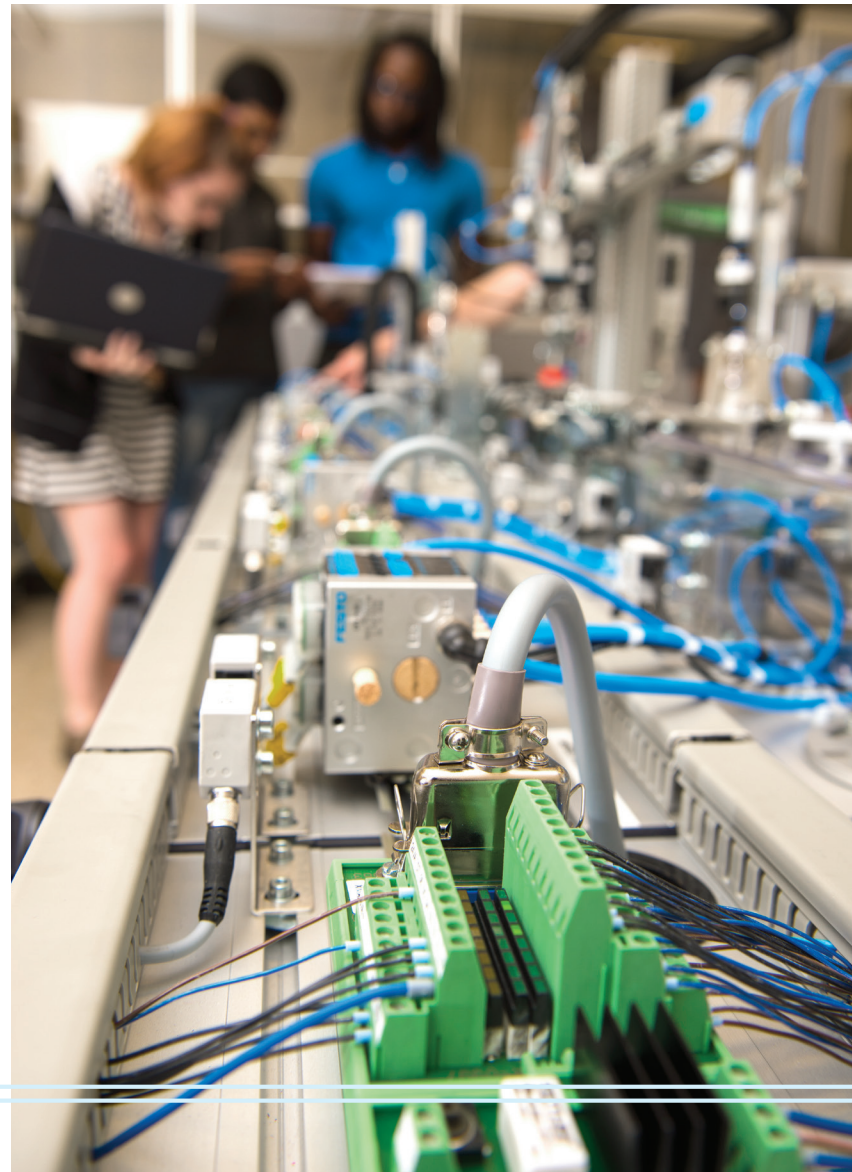
The department now has \$500,000 in mechatronic and automation equipment in a Voorhies Engineering Technology Building laboratory space.

## Case in Point

The ink had barely dried on the Tennessee Higher Education Commission’s approval for the Mechatronics Engineering major when things began to stir in the Department of Engineering Technology. Telephones began ringing, and emails began arriving in the offices of Boles and Ahad Nasab, the program’s coordinator, less than a day after TBR approval.

Several days later, Nasab was meeting with students interested in the degree program. “This is not one of those things where if you build it, they will come,” Nasab says. “They are already here.”

More than 50 students were in the program by the end of fall 2013. Currently, 595 undergraduate and 25 graduate students are majoring in engineering technology disciplines.





Michigan native Dallas Trahan planned to study business at Michigan State University. He eventually dropped out, took a year off, and moved with a friend to Nashville, where he found full-time work with a soft drink company.

Trahan, 20, says he started attending MTSU "because it was affordable and close by." His academic interest had been electromechanical engineering until he learned that MTSU was considering adding mechatronics engineering. When he heard the program was official, he scheduled a meeting with Nasab.

"I want to be a person who can do everything," Trahan says. "Mechatronics seems to be the way to go. A lot more opportunities could arise; a lot more doors can open than with just an engineering technology degree. With mechatronics, you can do what you want."

Trahan says he believes mechatronics engineering "will be the most valuable degree I could get here."

### A Professor's Perspective

Nasab joined the faculty in 1991. He holds master's and doctoral degrees in mechanical engineering from Georgia Tech, one of the nation's top engineering schools. His research interests in robots and automation made him a natural to lead the program.

In July 2013, after TBR approved the program, but before the Tennessee Higher Education Commission okayed it, Nasab attended a Siemens Level 1-A certification workshop in Pennsylvania. He traveled to Berlin in August for a Level 1-B workshop and to conduct talks on developing MTSU's Level 3 certification. Nasab says MTSU and Siemens will work closely on development of the Level 3 certification, which requires a bachelor's degree. "Once the model and the requirements are developed, the resulting methods and literature will be distributed worldwide for others to consider Level 3 certification."

### The Bottom Line

Developing more intelligent mechanisms that can improve quality of life and solve some of the world's most intractable problems is a never-ending pursuit. The Engineering Technology Department can now apply its considerable resources to that important effort. 🌐

## Looking East

MTSU added an international partner with expertise in mechatronics engineering through a pact signed in spring 2014 with Shanghai Second Polytechnic University (SSPU).

President Sidney A. McPhee and President Yu Tao of SSPU signed a memorandum of understanding to allow the universities to exchange students and faculty and develop joint research projects.

"We hope this agreement will lead to collaboration and cooperation between your engineering programs and our new mechatronics program," McPhee said after touring SSPU's laboratories. "There is much we could learn from each other."



*Good Exchange: President Sidney A. McPhee toured one of Shanghai Second Polytechnic University's engineering laboratories during his early 2014 visit to the Chinese university.*

The Chinese institution was founded in 1960 with an enrollment of about 20,000 students. Engineering is the main discipline among its 31 undergraduate programs, and it specializes in teaching the manufacture of motor vehicles and aircraft and energy generation.

Yu said his university has cooperative agreements with institutions in Australia, Sweden, Great Britain, France, and Thailand and with 50 of the world's top 500 business enterprises, including Siemens and Volkswagen.

McPhee said that MTSU and Tennessee connections to Siemens and Volkswagen should help the universities collaborate in joint studies and research to prepare students for work in such industries. 🌐



# MTSU's SPILL DOCTOR

HOW “SPILL DOCTOR” RYAN OTTER FOUND TRUTH IN THE ASHES OF TENNESSEE’S WORST ENVIRONMENTAL DISASTER

by Allison Gorman

**In early 2009, Dr. Ryan Otter (Biology) stood awestruck on the banks of the Emory River in Roane County. What two months earlier had been a serene fishing alcove now looked like a lunar landscape or a present-day Pompeii. Under his boots, where there should have been vegetation, there was gray sludge. And the water in the alcove was simply gone, displaced by wet fly ash, a thick chemical stew that had spilled into the river when an earthen retention pond ruptured at the TVA Kingston Fossil Plant.**

“It was amazing, the volume of this thing,” Otter says. “I mean, it was a billion gallons of fly ash that clogged up a river. It looked like a war zone. And I thought, ‘This is a billion gallons of something that we know contains metals that can be toxic. How can this not be catastrophic?’”

That’s the kind of loaded question Otter doesn’t allow himself—or his students—to ask. An ardent “science nerd,” he’s all about design and data: assume nothing, develop a bulletproof experiment, and see what the numbers reveal.





However, the scope of the spill was unlike anything Otter, an environmental toxicologist, had ever seen. It was also unlike anything the United States had ever seen. The slurry blanketed everything in its path, pushing homes off foundations, choking two tributaries of the Tennessee River, and burying a 300-acre ecosystem.

For the people who lost their homes, the event was a life-changing disaster. But for the area's quieter (and far more numerous) residents—the water and land animals—the prognosis wasn't so clear. Despite the ubiquity of fossil fuel plants worldwide, Otter says, there had been very little research on fly ash, a byproduct of coal combustion that contains trace amounts of many potentially dangerous elements, including arsenic, lead, and mercury.

Weeks after the spill, Otter joined a coordinated effort of several agencies to answer a slightly different version of his gut-level question: Is this an environmental catastrophe?

He found the answer in an unexpected place, and that answer surprised everyone.

*(continued on page 24)*







## COMPLEXITY AND CONFLUENCE

Nearly six years after the Kingston spill, cleanup is ongoing. It's projected to cost \$1.2 billion and is slated for completion in 2015. Environmental monitoring of the site will continue for years afterward.

Scientific analysis of the spill has involved university researchers, federal and state government agencies, and private consultants.

Otter was initially called to the scene by the Tennessee Wildlife Resources Agency, which asked him to study the effects of dredging on mussels. Then he was connected with TVA and Oak Ridge National Laboratory (ORNL), which asked him to test fish for toxins to help gauge immediate and future implications of the spill.

He says the project was the most complicated he has ever worked on, and not just because of its massive scale. There were also the complex dynamics of the Emory River, which

regularly runs backward when water is released from Melton Hill Dam on the Clinch River, which merges with the Emory. "The water literally goes back and forth, depending on what the dam is doing," Otter says. "I had divers in the water who were three miles upstream of the spill, and they were sitting in ash."

And while the Emory was relatively clean before the spill, the Clinch has long been polluted by runoff from ORNL. Researchers had to find out whether the toxins they found came from fly ash or from previous contamination. Then, in 2010, widespread flooding of the Tennessee River system further muddied the waters.

"All this made the hydrology crazy," Otter says.

## SPIDERS AND THE FLY

Otter's test subjects were problematic, too. When analyses of toxin levels in fish proved inconclusive, he knew he needed a different animal—something whose diet was more closely connected with the fly ash. Then he remembered his Ph.D. work with researchers from the Environmental Protection Agency, who used a commonly found spider to measure contamination at polluted sites. The spiders are ideal indicators, he says, because they have high fat levels that store toxins.

The spiders, known as long-jawed orb weavers, are easy to find on any riverbank in the country. Shy and harmless, they hide in trees near the water during the day, and at night they spin webs to catch mosquitoes, black flies, and other bugs that live in and

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**"SO THESE SPIDERS ARE REALLY COOL INDICATORS. THEY CAN TELL A STORY ABOUT WHAT'S GOING ON IN THE WATER AND HOW MUCH [CONTAMINATION] IS LEAVING THE WATER TO COME ONTO THE LAND."**

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feed on sediment. With the help of two students, Otter spent two days on the river, shaking tree branches and bagging several hundred spiders, which he sent to a lab for chemical analysis.

Otter says he tries to conduct research with no expectations about the outcome. But when the lab results came in, he was as shocked as anyone. The spiders tested negative for every toxin but selenium—levels of which, while concerning, weren't "off the charts," he says. Further field and controlled studies supported his initial findings. Apparently, the other toxins had bound with carbon in the fly ash and settled, uneaten, on the river bottom.



While media images of the Kingston site were terrifying, the spiders told a more accurate story. Because they bridge the ecosystems of river and land, says Otter, spiders reveal more than most animals can.

"All fish can tell you is the impact on fish . . . and how contamination moves through water systems in one way," he says. "But how is that contamination impacting things on the land? Fish can't really help with that."

Long-jawed orb weavers aren't the only creatures that eat aquatic bugs, he says. So do birds and bats, which then become part of the terrestrial food chain. "So these spiders are really cool indicators," Otter says. "They can tell a story about what's going on in the water and how much is leaving the water to come onto the land."

## College by the Book

Ryan Otter might think of himself as a science nerd, but his students think of him as a guy they can go to for advice. Since he joined the Department of Biology in 2007, Otter has spent many office hours talking to rudderless students about strategies for college success and guiding them toward fulfilling careers. He's given so much advice, in fact, that he wrote a book on the subject, *How to Win at the Game of College*.

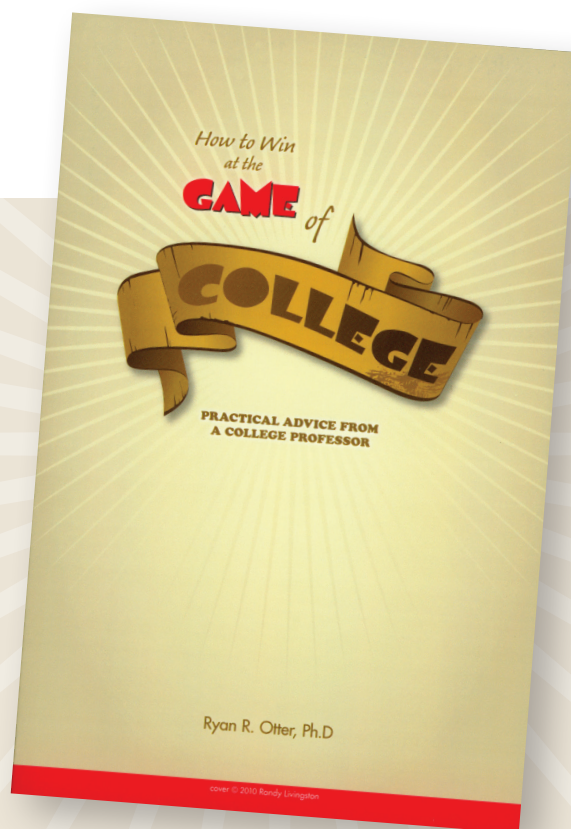
Otter sees himself in these students, who have been told they need a degree to get a job but who don't know how to find their way or even where the path will lead.

"That was me," he says. "I went to college with no idea what I was doing." As a zoology major at Michigan State, he plugged away at his classes, driven by the vague promise that a degree equals a good job and good money. "Then I started looking at the data and I thought, 'I don't think that this is very accurate. I don't see a diploma setting me up for what I think it's going to.'"

As all scientists know, the data doesn't lie. The trend Otter discovered when he ran the numbers still holds true: there are more college graduates than there are jobs for them. While graduation is critical, it doesn't guarantee a job, much less a rewarding career. So college student Otter developed a detailed game plan to get where he wanted to go.

"[College is] just like any other game that you want to win," he says. "You have to know who the other players are; you have to know what the rules are; and you have to have a

Thanks in great part to Ryan Otter, there's no longer a dearth of research on the environmental effects of fly ash. (His phone rang in early 2014, when a pipe ruptured at a Duke Energy fly ash pond in North Carolina.) And while his work on the Kingston spill site is complete, he's just beginning his research with long-jawed orb weavers, which he considers invaluable but overlooked subjects in the study of food-chain dynamics. "They can tell a huge story that typically has not been told," he says. 🌿



strategy." The plan worked for him, and at MTSU he began sharing it with students. He didn't write it down until 2010, when his wife suggested that a book would save him time in the long run.

The book turned into a resource-packed website, [TheCollegeGameProject.org](http://TheCollegeGameProject.org), with the tagline "Be Weird" (statistically weird, he explains.) The website has led to speaking engagements across the country.

Okay, call him a science nerd. But call his book and website great tools for playing and excelling in the college game. 🌿



# BUILDING BLOCKS

**The new Science Building rests on a foundation of giving from people like Gayle and Dwayne Duke and Alec Clark**

by Bill Lewis

## **Gayle and Dwayne Duke**

Gayle Duke ('65) helped Neil Armstrong reach the moon. Now her love for MTSU will help generations of students who will study in the new Science Building reach for the stars.


Duke and her husband, Dwayne, are including the University in their estate. It will endow scholarship funding in CBAS for students who, like Gayle, are the first in their families to go to college.

"We want to provide an education for first-generation students and give them an opportunity to pass it on to the next generation," she says.

She understands the value of a degree in the sciences. After graduating with a degree in mathematics and the experience of taking the first computer science class ever offered by the University, Gayle joined IBM in Huntsville, Alabama, where NASA was taking the first steps toward the moon.

*(continued on page 28)*



A photograph of an elderly couple, Gayle and Dwayne Duke, standing in front of a large, blue, cylindrical object, which is the instrument unit of a Saturn V launch vehicle. The woman on the left has short blonde hair and is wearing a blue quilted jacket with a black collar and cuffs over a black top. She is also wearing a necklace and a bracelet. The man on the right has white hair and is wearing a light blue button-down shirt with a small yellow logo on the chest and dark trousers. The background shows the interior of a museum with other exhibits visible in the distance.

**With This Ring:** Gayle and Dwayne Duke stand beneath the instrument unit, the “brains” of the Saturn V launch vehicle, on display at the U.S. Space & Rocket Center in Huntsville, Alabama. While at IBM, the Dukes were integral to the development of this “brain,” which contained the navigation, guidance, control, and sequencing equipment for the Apollo spacecraft.



*(Building Blocks continued from page 26)*

"President Kennedy had decided we were going to the moon. It was exciting—such a special time," Gayle says.

She recalls working on an Apollo flight control computer with 16 kilobytes of memory to help guide the moon capsule on its round-trip journey of more than 475,000 miles. (Today's smartphones have up to 32 gigabytes of capacity.)

During her career, she worked on Skylab (the first U.S. space station), Spacelab, and the space shuttles. Joining the space program shaped Gayle's life in an unexpected way. At a party in Huntsville (which could be described as the Silicon Valley of its day, with 2,000 mostly young people working for IBM alone), she met Dwayne, who was a programmer for IBM and worked on the development of the Saturn V rocket.

If circumstances had been different, they might never have met or had the adventure of a lifetime in the space program. Dwayne came from a background that emphasized hard work and self-reliance but not necessarily a college education. Gayle was the first in her family to graduate from college. Dwayne's grateful to IBM for hiring him before he finished his degree, which he earned at the University of Alabama–Huntsville. At MTSU, Gayle had the support of mentors whose encouragement helped her graduate in just three years. Her work-study scholarship helped make college possible.

She was barely aware she was one of just a handful of women studying mathematics, much less pioneering the then-exotic field of computer science. "I always had professors I could go talk to. You felt cared for," she says.

That experience gave her the confidence to rise through the ranks at IBM, where she found herself managing a department of male engineers. "I've never been one to be intimidated," Gayle says.

She and Dwayne know that their scholarship support for CBAS students can help open doors for others. "As a state school, MTSU attracts many first-generation students. Many of them come from where we come from. This is a way of giving them a chance," Dwayne says.

Encouraging students to enter STEM-related (science, technology, engineering, math) fields can also help Nashville-area employers. Each year, 800 or more technology-related jobs go unfilled in the region. There aren't enough graduates to fill them. "Nashville is begging for people," Gayle says. "It's mind-boggling."

## Alee Clark

Many of those people will get training in the classrooms and labs of the new Science Building, including the state-of-the-art analytical chemistry laboratory named in honor of Gale Jefferson Clark, whose passions were teaching and conducting research and who was instrumental in planning the new building.



"My husband loved teaching, and he loved using chemistry to benefit people," Alee Clark says. "He loved the analysis and detection of harmful pollutants."

Dr. Clark died in 2008. A gift from his estate will help fund the lab, which he helped plan.

Alee Clark previously made a gift of the couple's first house in Murfreesboro. The proceeds fund a graduate chemistry scholarship.

"It's a small house, but it's full of memories," she says.

Her husband joined MTSU in 1969, the year they married and he received his Ph.D. from Vanderbilt. Dr. Clark retired in 2006 after serving four department chairs, three deans, and six University presidents.

Alee chose to include funding for the lab in her estate as a way to help recruit the best students.

"That's the mission of the University, the quality of the education the students receive," she says. "Over the years, my husband saw MTSU grow in many ways—physically, academically, and professionally. I wanted to support that moving forward into the future."



She hopes the next generation will share her husband's passion. She recalls finding him at his desk in his home office at 3:00 a.m. and the hours he would spend meeting with technicians and calibrating new lab instruments when they were delivered to the University.

"MTSU was his heart, and he loved it," Alee says.

Dr. Clark brought that kind of drive and joy to every aspect of life, whether he was in the classroom, at the controls of a light airplane on a cross-country adventure, going camping, playing a musical instrument, or singing in the choir.


Time was precious to Clark, who underwent treatment for cancer while he was a college student. The doctors gave

him little hope of surviving, but he wasn't discouraged.

"He didn't miss any school," says Alee. "He had great perseverance."

The radiation treatments that saved his life exacted a price: forty-seven years later, in 2008, his lungs were so weakened he could not survive treatment for a heart condition.

Dr. Clark never saw the new Science Building, but Alee is sure he would be pleased. The lab named in his honor is on the third floor.

"I got a tour—had my photo made in a hardhat and a yellow vest during construction," Alee says. "It's amazing." 

**“My husband loved teaching,  
and he loved using chemistry  
to benefit people,”** —Alee Clark

Good Chemistry: Alee Clark in the new lab that bears her late husband's name.



## Aerospace



*Sidney A. McPhee with members of the U.S. Navy Blue Angels at the Great Tennessee Air Show in Smyrna.*

### Part of the Show

The Aerospace Department was presenting sponsor for the U.S. Navy's Blue Angels precision flight team at the Great Tennessee Air Show in Smyrna in June. About 25 faculty and students worked a display tent that featured two training planes. Tyler Babb, assistant professor, organized the effort. President Sidney A. McPhee and Bud Fischer, CBAS dean, spent time with students and faculty at the tent.

"It's very appropriate for MTSU, one of the premier aerospace universities in the country, to have a very visible and prominent role at one of the nation's top air shows," McPhee said.

Maj. Brandon Cordill (USMC) and PR1 Curtis Matthews (U.S. Navy), both Blue Angels, spoke to an overflow crowd at MTSU the week of the show.

### Up, Up and Away

MTSU and the Civil Air Patrol's Tennessee Wing agreed to a new partnership in May 2014 to expand aerospace education for high school students in the Air Force auxiliary cadet program. "MTSU's leadership in aerospace education and its state-of-the-art training facilities will help us to develop unique and compelling opportunities for our cadets," said Tennessee Wing commander Col. Bill Lane. "This partnership has great potential for both of our organizations."

MTSU's ties with the Civil Air Patrol (CAP) go back to 1948, when the CAP's Middle Tennessee State College Squadron was organized. Trained on campus, pilots in the group were known for search-and-rescue work. The squadron operated on campus until 1953.



*Sidney A. McPhee and Col. Bill Lane*





## A Fitting Legacy

The Shanda Carney Fanning Aviation Memorial Scholarship was established in honor of Fanning, an alumna and UPS pilot who died in 2013 when the UPS plane she was copiloting crashed in Birmingham, Alabama. The fastest scholarship to reach \$50,000 in MTSU history, it was awarded for the first time this spring. Whitney Dix ('99), also a pilot and a dispatch manager with Southwest Airlines, was devastated by her best friend Fanning's death. She led the drive to establish the scholarship.

"Shanda was my best friend for 18 years, and I want her name to live on at MTSU," Dix said. "We shared a love of aviation and our alma mater. MTSU and the Aerospace Department were a huge part of who we became as individuals and ultimately shaped our lives, our friendship, and our careers."

Donations can be made at [www.mtsu.edu/fanningscholarship](http://www.mtsu.edu/fanningscholarship).

## Research Partners

The presidents of MTSU and Alabama A&M–Huntsville (AAMU) signed a memorandum of understanding in 2013 that encourages greater collaboration in scientific research. MTSU will provide AAMU students access to programs in engineering management, computational science, and aerospace, while AAMU will accept MTSU students in engineering. The three-year agreement builds on previous ventures between the two universities: both are partners in a consortium for a federal unmanned aircraft systems test site and a National Science Foundation-funded Partnership for Innovation in Technology.

## Biology

### Native Plants

Siti Hidayati (Biology adjunct) traveled to her native Indonesia in 2013 and 2014 as part of a Fulbright faculty award to do research on rafflesia, a flowering plant. The five-month study took Hidayati, fellow professor Agus Susatya, and two students to a rain forest on the island of Sumatra.

### Going International

Led by Professor Anthony Farone, five graduate students went to Chile last year to work with high school students and with researchers at the University of Santiago. Students Nicholas Chamberlain, Ashley Cole, Corbett Ouellette, Rachel Lytle, and Eric Vick participated as part of a National Science Foundation grant.

*(continued on page 32)*

## The Future Is So Fulbright

Graduate student Jennifer Elizabeth Benetti-Longhini is headed to Brazil in 2015 on a Fulbright fellowship. She is a butterfly researcher whose mentor is Professor Andrew Brower. Her data will be integrated with the findings of collaborators as part of a project aiming to model the natural history of the Amazon region.

David Owens was a 2013 Fulbright recipient who spent a nine-month teaching assistantship in Brazil last year. Owens is enrolled in the Mathematics and Science Education Ph.D. program.



Jennifer Elizabeth  
Benetti-Longhini



## Engineering Technology



### Moon Glow

An MTSU moon buggy team won the Neil Armstrong Best Design Award at the 2014 NASA Human Exploration Rover Challenge in Huntsville, Alabama. The annual event aims to teach practical design and engineering problem solving. Forty-six teams competed in the college and university division.

### Drive to Succeed

MTSU has partnered with Meliksah and Firat Universities in Turkey to further develop Professor Charles Perry's retrofit wheel-hub motor, which has the potential to cut fuel consumption by half or more by turning vehicles into hybrids powered by gasoline and electricity. Officials believe the partnership will speed the development of the motor into a working, licensed option for manufacturers throughout the world.

### Tech Transfer

Officials from MTSU and Albany Technical College in Georgia signed an agreement allowing students with an associate degree from Albany Tech to transfer to MTSU to study electromechanical engineering. It's the first time MTSU has gone out of state to forge such a partnership.

## Mathematical Sciences

### Do You Compute?

Six Computational Science Ph.D. students headed to national labs as interns this past year. Zach Spears is working in the Computational Fluids division of Naval Research Laboratory in Washington, D.C. Raymond "Cori" Hendon is at Los Alamos National Laboratory. Matthew Wang, Vijay Koju, Viktor Reshniak, and Zane Colgin worked at Oak Ridge National Laboratory this summer.

### Good Concentration

Actuarial Sciences is the newest concentration in the Master of Science in Professional Science program. The discipline trains students to make practical use of probability theory and statistical analysis for managing risks and solving problems in the insurance business. The program has distinguished itself because so many of its students pass industry exams. Lu Xiong, who is scheduled to graduate this fall, is the first MTSU student to pass four actuarial exams.

## Other News of Note

### Rite of Spring

Research and scholarship was celebrated March 17–21 during the eighth annual Scholars Week. The showcase of graduate and undergraduate work concluded with Scholars Day, highlighted by nine performances and 180 posters displayed in the Student Union ballroom.

### Those Who Can, Teach

The MTeach program, designed to encourage talented science, technology, engineering, and mathematics (STEM) students to pursue teaching careers, was recently awarded a \$1.4 million Robert Noyce Teacher Scholarship grant from the National Science Foundation.

The five-year grant has two primary components. First are scholarship awards of \$10,000 to qualified juniors and seniors



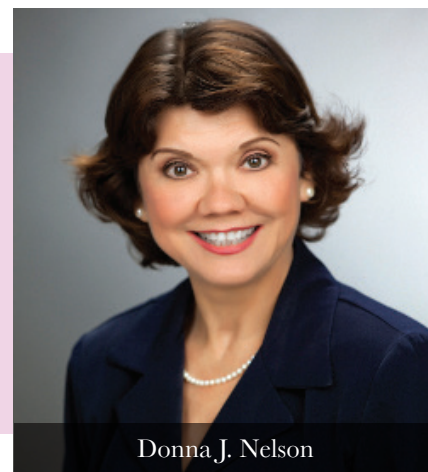
in chemistry, biology and earth science. For each \$10,000 scholarship a student receives, they will be required to teach two years in a high-needs school district. Next, in partnership with Columbia and Volunteer State Community Colleges, the grants will be used to cover the cost for freshmen and sophomores to take a two-credit class to explore teaching at science museums, extended school programs, summer care facilities, and the like.

### Podium Power

Recent speakers sponsored by the College of Basic and Applied Sciences included Donna J. Nelson, a professor of chemistry at the University of Oklahoma, who is better known as a proponent of scientific accuracy in television and film. Nelson was a science advisor for *Breaking Bad*, helping to ensure that all the chemistry featured in the Emmy-winning series appeared real and scientifically accurate.

### Posterizing the Legislature

Ten student researchers were among 61 from across Tennessee to present research at the ninth annual Posters at the Capitol event at the Tennessee State Capitol this spring. One of the ten was Rance Solomon, whose research, “Relative Deformability of Sickled Red Blood Cells,” was chosen for the Washington, D.C., Posters on the Hill exhibit.



Donna J. Nelson

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Learn more at [www.mtsu.edu](http://www.mtsu.edu).



The University Honors College challenges students to excel in their listening, writing, and critical-thinking skills. The Honors College is home to the Buchanan Fellowship program, named in honor of MTSU's Nobel Prize-winning alumnus, Dr. James M. Buchanan. The Buchanan Fellowship, limited to 20 students per year, is the highest award given to entering freshmen.





**O**N THE CAMPUS OF what is today MTSU, in spring 1941, William James “Greg” Gregory, a sharecropper’s son from Smith County, Tennessee, got his first taste of flight. He has never forgotten it.

More than seven decades later, following a distinguished career in aviation that included piloting some of the earliest spy planes in American history and helping develop America’s earliest unmanned (drone) aircraft



models, the 93-year-old Gregory still gets a gleam in his eye when asked about those first experiences flying over campus.

“It was the beginning of my flying career right there,” says Gregory, who now lives in Austin, Texas. “We had an airstrip at that time right behind what was then Jones Hall men’s dorm.”

How smitten was Gregory with taking to the skies? Consider that in the summer of 1941, a young fellow from Alabama ferrying a Taylorcraft to Minneapolis landed at MTSU’s airfield—the strip behind Jones Hall—in need of fuel, food, and rest. Gregory went to dinner with the Alabama traveler that evening, at which time he asked Gregory if he would be interested in piloting his 40-horsepower plane the following day on the next leg of his journey.

“It was probably not a smart thing to do, because I had a test on Monday,” Gregory relates. “But we left early, just at daybreak. We flew all day long—I flew it myself all day long—and landed in Waterloo, Iowa, at dark. Then I got out and got on the highway and started hitchhiking.”

Gregory hitchhiked all night long—and the next day and the next—finally arriving in Nashville at about eleven o’clock on a Sunday night.

“I caught the last bus to Murfreesboro and got there about midnight, and then I got a taxi out to the University,” Gregory relates. “I took a shower and got up the next morning and took my exam, and everything was just normal. Like I said, it was probably not a smart thing to do, but it was indicative of how much I wanted to get a little flying in.”

Even though he never graduated from MTSU—Gregory joined the war effort during his junior year—he says he still feels a “closeness” to the University, saying, “I felt they gave me a start.”

“The war had been going on in Europe for two years, and I had just reached 21, so it seemed like the smart thing to do,” Gregory says. “Because it was not a matter of if, but when we were going to get into the war. And, of course, we did, three months later, in December.”

Gregory cites MTSU’s nascent aerospace efforts at that time for supplying many needed young pilots for the war effort.

“It was a big contribution early on for the government for us to have that kind of training because it gave us a little feel for flying and a stimulation to want to continue to fly.”

After finishing the cadet program, Gregory left MTSU and reported for flight training at Randolph Field in San Antonio on Dec. 7, 1941—the day of the attack on Pearl Harbor.

Soon after, Gregory was an Air Force fighter pilot flying P-38s, B-29s and, later, B-47s in World War II. It was the beginning of a 31-year active duty career in the Air Force that ended with Gregory achieving the rank of

colonel. His highly decorated military career spanned the most significant chapters of aviation development in history. Col. Gregory piloted 55 different airplanes while in the Air Force, including a number of aircraft flown with the U.S. Navy. For instance, he is one of just a few Air Force pilots to attain Aircraft Carrier Qualification, which he accomplished through training on the USS *Lexington*.

Gregory is also connected to some of the most significant military events in modern American history. His biography reads like a research folder for a Tom Clancy novel. An important chapter relates to the Cuban missile crisis, during which Gregory served as a U-2 spy plane pilot and commander of the Air Force/Central Intelligence Agency U-2 collaborative squadron, which used high-resolution cameras to take the first photographs identifying the presence of surface-to-air missiles and the Soviet buildup in Cuba.

“President Eisenhower decided to overfly their country without their permission, and to do that, we had to have an airplane that would fly above 60,000 feet,” Gregory explains. “So the first airplane was the RB-57, and that was the one I got into first, and I was in that program four years. It was the first airplane to fly above 60,000 feet. In fact, it would go about 65,000 feet. And then, after four years in it, I got into the U-2 program, and it would fly even higher.”

As a result of Gregory’s command of the U-2 project, he was awarded the CIA’s Medal of Merit and received a personal letter of commendation from President John F. Kennedy. Gregory’s continued command of top-secret U-2 missions later provided surveillance images detailing the mounting tension in Vietnam.

Years later, Gregory ended up working at the Pentagon from 1967 to 1971 in the area of research and development of the first drone concepts. Gregory completed his undergraduate degree in education from Centenary College and, while stationed at the Pentagon, his master’s degree in international affairs



from George Washington University. He also served as chair of the United Nations Committee on Reconnaissance in Brussels.

Gregory's final Air Force assignment was as vice commandant of the Air Force Institute of Technology at Wright-Patterson Air Force Base. He retired from active duty in 1975. He holds the rare distinction of being awarded four Legions of Merit throughout his career for his service to the Air Force. His military career was followed by 15 years in the Texas attorney general's office as assistant director of workers' compensation.

Today, even at 93, he is in impeccable shape both physically and mentally. Gregory became an avid cyclist at age 72 and has biked across France, Germany, Belgium, and the Netherlands.

His other interests include his 20-year involvement in the University of Texas LAMP Program, for which he developed an endowed scholarship for students in the process of completing teacher certification through the School of Education.



by Drew Ruble

# A FLYING START

At MTSU, Gregory established a scholarship for students from either Trousdale or Macon Counties. He expresses tremendous pride in the University, its growth and promise, and, more specifically, the quality and growth of its aerospace program.

"I'm just proud that they have continued the program from a really tiny little program that we had back then—to something that is really significant. They have a great program," he says. ✿

Col. Greg Gregory's lifelong commitment to aviation brings him back to the campus where his feet first left the ground



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