

Innovations

Basic and Applied Sciences Magazine

Fall 2015 Vol. 3, No. 1



Ready for **LIFTOFF**

MTSU'S NEW UNMANNED AIRCRAFT SYSTEMS PROGRAM, ONE OF JUST FIVE IN THE NATION, PREPARES STUDENTS TO TAKE FLIGHT IN A BURGEONING INDUSTRY.

MIDDLE
TENNESSEE
STATE UNIVERSITY

Innovations

Fall 2015 Vol. 3, No. 1

University Editor

Drew Ruble

Contributing Editors

Sarah Brookfield, Darby D. Campbell,
Bill Fisher, Sheron Neeley

Lead Writer

Randy Weiler

Contributing Writers

Allison Gorman, Katie Porterfield

Designer

Brian Evans

Director of Creative and Visual Services

Kara Hooper

University Photographers

Andy Heidt, J. Intintoli

University President

Dr. Sidney A. McPhee

University Provost

Dr. Brad Bartel

Dean of Basic and Applied Sciences

Dr. Bud Fischer

Vice President, Marketing and Communications

Andrew Oppmann

Special thanks to

Nicole Chitty, Marlene Lawson, Nancy Miller

Cover photo by J. Intintoli

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The Present Is So Bright



As I embark on my fourth academic year as dean of the College of Basic and Applied Sciences, I am more proud than ever before of our college's increase in student growth and retention, of our tremendous student and faculty research, and of our outstanding facilities.

The College of Basic and Applied Sciences

has grown to become the largest college on campus, with more than 5,100 undergraduate and graduate majors, 215 faculty members, and 57 staff members. Our college actually had an uptick in both enrollment and retention this past year, added two new majors for undergraduate students, and redesigned a number of majors to meet the need of workforce demands in Tennessee. We are proud to be the only university in the state that now offers a four-year Mechatronics Engineering degree and only the fifth university nationwide to offer Unmanned Aircraft Systems as a new undergraduate program this fall. We also continue to offer innovative programs that include Actuarial Sciences, Forensic Science, Environmental Sustainability and Technology, and Horse Science.

I am incredibly proud that over the last three years, **our research dollars have grown from \$10.4 million to \$21 million in grants**. From improving patient care in emergency rooms nationwide to alternative fuels research to investigating the effects of a coal ash spill using spiders, our faculty and

students are making amazing discoveries every day. I would love the opportunity to show you some of the incredible research being done here, and I encourage you to contact me directly about making a campus visit.

Last year, we opened a state-of-the-art, \$147-million science building with 257,000 square feet of research space, teaching and laboratory classrooms, and lecture halls. This brand-new space can accommodate more than 2,000 students per hour. We are also renovating MTSU's historic science buildings: Wiser-Patten Science Hall, which opened in 1932, and Davis Science Building, which was built in 1967. Each of these buildings is closed while a \$20 million renovation is completed to repurpose and modernize the teaching and research space housed there. With these renovations, MTSU will have some of the best, if not the best, science facilities in the entire southeastern United States, offering students a wide variety of innovative programs, hands-on research opportunities, and state-of-the-art learning environments.

I am proud to say I work alongside an outstanding faculty and staff wholly committed to student success. That commitment has led to extraordinary strides in improving the student experience, increasing research funding, and raising the overall standards for our college. If you haven't been to campus lately, I invite you to come and take a tour and learn more about the great work being accomplished here. This isn't the same place it was just a few years ago, and I think you will be proud, along with me, of what we have become—a college striving to be the best we can be.

True Blue!

Dr. Bud Fischer, Dean

Students in a lab in the new Science Building.





MTSU's new Unmanned Aircraft Systems Operations concentration, one of just five in the nation, prepares students to take flight in a burgeoning, billion-dollar industry.

Story by Allison Gorman
Photos by J. Intintoli

Ready for **LIFTOFF**



Unmanned aircraft leapt from the pages of science fiction into mainstream news following 9/11 as the military began to rapidly enhance the technology's capabilities. The word *drone* appeared in headlines that discussed hobbyists' use of low-flying models and in ones debating the legal implications of prototypes used for military and government purposes.

In MTSU's Department of Aerospace, use of the word *drone* is discouraged. That's because the common nickname for what's officially called unmanned aircraft systems (UAS) has nothing to do with the commercial UAS industry, which is both literally and figuratively taking off and leaving heavy political baggage and playthings behind.

From search-and-rescue operations to public utilities monitoring to archeological mapping, the applications for UAS are multiplying so rapidly that the Federal Aviation Administration (FAA) is scrambling to establish regulations for their commercial use. Meanwhile, the demand is rising, and the still-evolving business is expected to inject \$82 billion and more than 100,000 jobs into the U.S. economy over the next decade, according to the Association for Unmanned Vehicle Systems International (AUVSI).

There's a burgeoning job market on the horizon, and MTSU is already preparing students to fill those positions through Aerospace's newly launched bachelor's degree in UAS Operations, one of only five such programs in the nation.

Others are clamoring to join in, though.

(Continued on page 6)

RACE TO THE TOP

According to Doug Campbell, manager of the UAS Operations concentration, there are at least 10 other programs (including minors and associate's degrees) presently in the planning stages across the nation.

The growth is due to industry demand.

"UAS is one of the fastest-growing areas in aviation today," said recently retired chair of the Aerospace Department Dr. Ron Ferrara. "It's in a period of flux right now, waiting on FAA interpretations and rulemaking, but there are a number of diverse areas that UAS will be applied to, and more and more companies are becoming involved." *[Editor's Note: Dr. Wendy Beckman was named interim chair in 2015.]*

MTSU, always a pioneer in aerospace education, started planning its UAS program in 2009, back when NextGen, a top-to-bottom modernization of how the FAA manages the national airspace, was in the early stages of development. While NextGen is still in the works, the Department of Aerospace is once again ahead of the curve, having launched its UAS program this fall, with anticipated enrollment of about 30 students.

During the multiyear preparation for the program, Aerospace faculty members were busy forging

research partnerships and collaborating with industry experts and municipalities to get students UAS experience and connections. In 2011, MTSU made history when it entered an educational partnership with the U.S. Army for UAS studies (see sidebar at right). That same year, the University offered its first UAS course.

MTSU, ALWAYS A PIONEER IN AEROSPACE EDUCATION, STARTED PLANNING ITS UAS PROGRAM IN 2009.

These collaborations are crucial for student success, according to Campbell. He would know—as a former Navy officer and pilot with an FAA commercial certificate who also has military experience flying both manned and unmanned aircraft, he is no stranger to the field.

"We're preparing our students according to what the industry wants to hire and the standards that the industry is looking for, so they'll have no problem getting out and finding a job," Campbell said.

Ferrara also views this commitment to student success as a departmental responsibility.

Aerospace students, working with UAS Operations manager Doug Campbell (at the controls), fly a controlled UAS device on MTSU property.



"It's incumbent on a department like ours to have our students educated in those areas, so they're available when the market does present itself."

BUMPER CROP

As for the commercial applications of UAS, the sky's the limit. However, the industry in which UAS has made the greatest headway so far is firmly planted on the ground—agriculture.

Unmanned aircraft allow large-scale farmers to monitor their crops remotely. This sort of "precision agriculture" is the specialty of Farmspace Systems LLC, a West Tennessee company with whom MTSU does collaborative research.

Like other experts in the industry, Derick Seaton, now vice president of aviation operations for Farmspace, has been an advisor to the department since the inception of the UAS program. This kind of involvement, Campbell said, will give MTSU graduates an advantage since the degree program was developed with real-time input. And because of these relationships, even students taking introductory UAS courses have already gained field experience working with Farmspace and other partners.

Seaton, a retired Air Force officer, said that during the six years he's worked with MTSU, he's witnessed a boom in civilian applications of what had been a strictly military technology. He said the key to tapping into that boom is recognizing that UAS are just means of collecting data—"flying circuit boards," as Campbell calls them.

"From the industry standpoint, it's about the sensor and the information that you gain from that sensor," Seaton said. Whether the sensor is a GoPro shooting video or an infrared device seeking heat signatures, "the unmanned aircraft is simply a platform for being able to gather that information."

LEARNING CURVE

The perception of UAS as an information platform for commercial use is still unfamiliar to the general public. This may be due to the unresolved status of commercial airspace regulations regarding UAS. People know what they've seen, which is hobbyist and military use. That understanding, Campbell said, provides a narrow view of a technology poised to bring precision and efficiency to many civilian operations and revolutionize entire industries.

Ferrara sees the value of UAS in crises, like hostage situations; and UAS are already allowed for some

(Continued on page 8)

GOOD ENLISTMENT

Following the attack on Pearl Harbor, Middle Tennessee State College hosted a military-run, campus-based flight training program for pilots. In the decades that followed, the college became Middle Tennessee State University and the flight program became the Department of Aerospace.

In 2011, old allies reunited with the forging of a new educational partnership—this time between MTSU and the U.S. Army's Unmanned Aircraft Systems (UAS) Program Office in Huntsville, Alabama.

Much like the earlier pairing, the impetus for the growth of UAS flight technology occurred in the wake of national tragedy, the aftermath of the 9/11 attacks. However, the new collaboration, announced during a UAS conference in the nation's capital, had a different motivation. The Army partnership on unmanned studies, the first of its kind, established that MTSU would provide testing and research, while the Army would supply UAS technology to the University.

This relationship, in combination with civilian partnerships, with firms like Farmspace, places MTSU in the unusual position of working with both the governmental and commercial sides of UAS.

Dr. Sidney A. McPhee chats with Lt. Col. Robb Walker following a signing of a partnership agreement between the U.S. Army and MTSU involving unmanned vehicles.



READY FOR LIFTOFF (Continued from page 7)

municipal purposes, including law enforcement. They've also proven their worth for emergency management. Just last spring, UAS were used in Texas to help locate people and livestock swept away by floodwaters. Larger unmanned aircraft can even carry a lightweight lead line to someone awaiting rescue.

Campbell sees potential for their use in a wide range of industries, from real estate to archeology to cinematography. He anticipates UAS being used for surveying and mapping and for monitoring water and power lines to forestall breaks and outages. When such problems do happen, he said, the aircraft can assess them so utility crews can be dispatched in the right numbers with the right equipment. And for public safety departments, he said, UAS can serve as far less expensive alternatives to helicopters.

A HYBRID APPROACH

Such applications require precision, so it's no surprise there's a strong tech component to the interdisciplinary hours required in the UAS Operations program. In fact, the concentration encompasses many components spanning several disciplines.

SKY HIGH

Modern agriculture, sometimes called precision agriculture, has made great technological strides in recent years, led by acronym-filled advancements like GPS (Global Positioning Systems), GIS (Geographic Information Systems), GMO (Genetically Modified Organisms), and UAV/UAS (Unmanned Aerial Vehicles/Systems). Dr. Song Cui was hired two years ago to lead MTSU into national prominence in this cutting-edge field. His focus on working with the MTSU Aerospace Department to develop sophisticated UAS technology is already yielding impressive results. Cui recently landed one of the largest new grants at MTSU, valued at \$299,899, to enhance UAS-based precision agriculture education by integrating research, teaching, and outreach in Tennessee. This is MTSU's first award with the new United States Department of Agriculture Non-Land Grant Colleges of Agriculture designation. This award is a result of combining MTSU's strength in agriculture and aerospace with a focus on precision agriculture and has the potential to create a center of expertise in the use of unmanned aircraft in agriculture. UT-Martin is a partner in this award.

"We differentiate ourselves [from other UAS programs] because our curriculum is multidimensional," Ferrara said. "We use computer technology. We use agriculture. We use mapping and engineering technology for design and implementation. Everybody has a specific expertise. It's virtually a University-wide effort, although it's housed in the Aerospace Department."

MTSU IS LEADING THE WAY AS ONE OF ONLY FIVE AMERICAN UNIVERSITIES OFFERING A BACHELOR'S DEGREE IN UAS.

That last point is critical, because commercial UAS operators are still pilots, and earning a pilot's license is a core part of the curriculum. As Seaton puts it, "Automation does not take the place of piloting skills."

Pilot training isn't required for UAS hobbyists, who are restricted to low, line-of-sight flying in limited areas. But Ferrara said operating a UAS in the national

Assistant Professor Song Cui demonstrates UAS at MTSU's Guy James Farm.



Photo by Andy Heidt

airspace—400 feet and above—will require a minimum of a private pilot's license or a UAS certificate, which the FAA hasn't defined yet. (For now, commercial use of UAS requires a special exemption from the FAA.)

"Once you get into the national airspace, you're amongst commercial airliners, private pilots, corporate aircraft—everybody's flying around out there," Ferrara said. "You can't just put a UAS in the middle of that without any knowledge of operating procedures, regulations, limitations, restrictions, and all that."

Students will study electronics and microprocessors, learn how to program UAS and modify their autopilot capabilities, and become familiar with geographic information systems and remote sensing. They'll study business and agriculture and have opportunities for multidisciplinary expeditions, such as the one Campbell led last winter to Argentina, where the national airspace is less restricted, to study how UAS can be used in agriculture.

In essence, the curriculum covers everything required to design, operate, or maintain UAS—and then turn that knowledge into a cutting-edge career.

BRIGHT HORIZON

As one of only five American universities offering a bachelor's in UAS, MTSU is leading the way. But even as more universities come aboard, MTSU's comprehensive, multidisciplinary program, along with its strong industry partnerships, will give its graduates an edge.

Well, that and the department's state-of-the-art training facilities, which will put Aerospace students right where they need to be when NextGen's UAS regulations are implemented. Although the exact date for UAS integration is not yet cleared for takeoff, MTSU is ready.

"We have a bit of an advantage," Ferrara said with a smile. "I mean, when they talk about integrating UAS into the airspace system, we have an air traffic control simulator downstairs that's the best in the world. We can simulate integration."

That kind of foresight is what people have come to expect from the Aerospace Department, which always has its eye on the horizon. ☺

Aerospace students Todd Toombs, Nathan Martin, and Tori Hawkins work on a UAS device in the BAS Building.



A+ SCIENCE



Architect's rendering of the renovated science buildings.

\$20 million in renovations promises to restore the life and usefulness of MTSU's two older science facilities

by Randy Weiler

There's a definitive gleam in Bud Fischer's blue eyes these days, and it's because the good news just keeps coming for MTSU's College of Basic and Applied Sciences (CBAS).

Fischer, hired as dean of the CBAS in 2012, celebrated the opening of MTSU's much-needed \$147-million new Science Building in the summer of 2014. Now he eagerly awaits completion of \$20 million worth of renovations to rejuvenate MTSU's two older science buildings.

"This has been an incredibly exciting time for the College of Basic and Applied Sciences," Fischer said. "We've opened a new Science Building. And immediately after opening that, we've pretty much gone straight to renovations involving the Wiser-Patten and Davis Science Buildings."

PROJECT



Campus planning officials anticipate the two buildings will reopen before the start of spring semester in 2017. When they do, Fischer said, MTSU's combined science facilities will rank among the finest in the nation.

IN WITH THE OLD . . . AND THE NEW

The oldest of the science buildings, Wiser-Patten Science Hall opened in 1932 and cost \$225,000. Over the next three decades, MTSU's student population grew so much the state invested \$1.7 million to construct Davis Science Building in 1967. Combined, the two buildings have a total of 117,000 gross square feet of space.

MTSU's enrollment almost quadrupled over the next 45 years, but with no increase in physical space for science

education. That all changed in 2014, when MTSU's new, 250,000-gross-square-foot Science Building opened.

The space and renovations are much needed. The College of Basic and Applied Sciences boasted more than 5,100 majors in fall 2015. It has approximately 215 faculty members. In total, science courses produce about 60,000 credit hours annually at MTSU. More than 10,000 students, both majors and nonmajors, enroll in biology, chemistry, and physical science courses each year.

In recent years, MTSU has annually granted as many as 700 degrees in biology, chemistry, and related fields. That number is expected to rise in the future as a result of new and renovated science facilities.

(Continued on page 12)

So, while Fischer is excited about occupying the new Science Building, which serves as primary home to the Biology and Chemistry departments, he said "recouping" the two older buildings is equally thrilling.

"With these renovations, we will now have what I consider some of the best science facilities in the Southeast, and maybe the country, offering students a wide variety of innovative programs and innovative research spaces as well as what I think are innovative learning environments," Fischer said.

GAINING MOMENTUM

State funds from the original Science Building project have already been allocated for the renovation project, which will benefit, directly or indirectly, all of the CBAS's 11 departments in addition to some departments from other campus academic units.

A longtime member of the CBAS, the Department of Physics and Astronomy will see great gains from the renovations, significantly expanding its footprint across multiple floors of both buildings. Geosciences—the newest department in the college—will gain a new home. Formerly part of the College of Liberal Arts, it will relocate from its current home in Kirksey Old Main (KOM) to the second floor of Davis Science.

Warner Cribb, chair of Geosciences, describes MTSU's oldest building as "solid," but said KOM "does not offer the space or infrastructure" the department needs. "Moving to Davis will enable the department to assign discipline-specific teaching and research spaces to the faculty and students."

Among the academic programs slated for space are some from outside the College of Basic and Applied Sciences, including three from the College of Liberal Arts. The Public History Ph.D. program will share lab space with the Sociology and Anthropology Department, whose faculty members are eagerly awaiting the upgrade.

"With new lab space, we'll have an opportunity to show off more of the great things we already do and to improve

our visibility within the community and across middle Tennessee and the rest of our state," said Shannon Hodge, an associate professor in the Department of Sociology and Anthropology.

"We have a good record of placing our students in jobs within our profession and in top-notch graduate schools, and we feel this is a direct result of the student research opportunities those students have taken on," Hodge said. "Having this new lab space will give our students better facilities and more room to pursue their independent projects, and we expect even better outcomes for our future graduates because of it."

The Forensic Science program will relocate from Todd Hall to the first floor of Wiser-Patten. With it comes FIRE—the Forensic Institute for Research and Education—comprising an elite squadron of students interested in forensic science careers. Noted forensics expert Dr. Hugh Berryman directs the FIRE operation, which is commonly called on to provide assistance at crime scenes across Tennessee.

"FIRE is totally out of space, and I have no lab at this time," said Berryman, who frequently travels to Nashville to use the Davidson County Medical Examiner's lab for the analysis of forensic skeletal cases. "This move will provide both. Lab space on this campus will greatly facilitate forensic work and student training."

The remaining space in the renovated buildings includes spots for two of MTSU's most recognized research centers. The Center for Environmental Education and Center for Cedar Glade Studies, now in the Fairview Building off Greenland Drive, will occupy a portion of the first floor of Davis Science.

ENHANCING STUDENT SUCCESS

The renovations are being made with students in mind.

The nearly 20 academic advisors working for the College of Basic and Applied Sciences now operate in cramped quarters inside Keathley University Center. As part of the renovations, the first floor of Davis Science will house a new student advising suite to provide easier student

BY THE NUMBERS:

THE COLLEGE OF BASIC AND APPLIED SCIENCES



CBAS had more than 5,100 majors in fall 2015.



Science courses produce about 60,000 credit hours annually at MTSU.



It has approximately 215 faculty members.



More than 10,000 students, both majors and nonmajors, enroll in biology, chemistry, and physical science courses each year.

access and offer greater privacy during meetings between advisors, students, and their parents.

Collaborative learning is also key, and the updated buildings will offer a more student-friendly environment than what now exists. One of the "cool parts" of the renovation, according to Fischer, is the "soft space" available "where students can have discussions, work together, and hang out."

Rising senior Lindsey Blankenship, a Physics and Mathematics double major from Lexington, Tennessee, is excited to see the University make significant upgrades.

"WITH THESE RENOVATIONS, WE WILL NOW HAVE WHAT I CONSIDER SOME OF THE BEST SCIENCE FACILITIES IN THE SOUTHEAST, AND MAYBE THE COUNTRY . . ."

"While I am a little disappointed that I won't be around to experience the renovated buildings myself," she said, "I hope to swing by to have a look around in the future."

Geosciences alumnus Richard Anderson ('08), now a mine geologist for the Doe Run Company, spent virtually all his class time in Kirksey Old Main.

"Geosciences getting more space and lab space is great," Anderson said. "It's great to see the department grow. KOM is a beautiful old building. I enjoyed my time there. But Geosciences is crunched for space. KOM is crowded with [geological] samples. That department can grow, and that is a good thing."

Anderson's wife and fellow alum Samantha ('07, '09), an environmental programs manager at the Doe Run Company, spent lots of time in Davis Science as a Chemistry major and also in and around Wiser-Patten for physics classes and use of the observatory.

"I'm glad to see MTSU preserve the old buildings," she said. "A lot of us have a lot of great memories. Many of us took physics classes, and we used the observatory. For a lot of us, we called it home."

Fischer, who credits President Sidney A. McPhee for doing "an amazing job" with the overall science facilities enhancement initiative, said the historical aspect of the older buildings will be maintained despite renovations.

"We're still keeping parts of those buildings that will remind the alumni of the history, their time spent in those buildings,"



The largest classroom in Davis Science during renovation.

he said, specifically citing plans for the front steps of Wiser-Patten to remain as they are.

That said, significant changes and modern design approaches are coming that will be eye-catching to say the least. Upgrades will allow compliance with the Americans with Disabilities Act within both buildings and include installation of new elevators in both. A largely glass walking connector between the two buildings will create a new central entrance and a fresh new look.

A BETTER PLACE FOR ALL

Fischer is eager to share the good news about the program, and said that for top high school and transfer science students in Tennessee, it simply makes sense to come to MTSU. "The programs are growing and getting better and better. The quality of education is better," he said. "It's not just a building for middle Tennessee. It's a building for all of Tennessee."

In concert with the new \$147-million Science Building, the renovations of the older buildings set the stage for a modern student learning experience that builds upon and surpasses what MTSU science students experienced in past decades.

The improvements are sure to help MTSU prepare more teachers for math and science in K-12 schools, create additional science graduates to fill high-technology jobs, and enhance the economy of our region and state. They will also make MTSU more competitive for research projects, science scholarship, and entrepreneurial efforts.

It's little wonder that Fischer is so eager to see it all come to pass. ☺

Basic Highlights

A look at recent awards, events, and accomplishments

Aerospace



True Blue Pilots

This picture was taken May 7, 2015, in Yuma, Arizona, following a Marine Corps' Change of Command Ceremony, during which Lt. Col. William M. "Bill" Maples assumed command of VMA Attack Squadron 211: Wake Island Avengers. From left to right are Dr. Wallace R. Maples, retired chair of the MTSU Aerospace Department; Captain Anthony Defurio (PA), MTSU Aerospace graduate now serving in VMA 211; Lt. Col. William M. Maples (Murfreesboro), new squadron commander; and Lt. Col. Bart Haynes (Murfreesboro). The three men in uniform are graduates of MTSU Aerospace and are Harrier pilots, flying the once-revolutionary "jump jets" capable of vertical takeoff and landing. A fourth pilot, Tommy Johns (not pictured), also from Murfreesboro, was a Harrier pilot who left the service at the end of his first tour. The Marine Corps is the smallest military unit, so multiple pilots from the same university in one unit is unusual. "To have four Marines to become Harrier pilots from MTSU," said Col. Maples, "is simply unbelievable."

Pilot of the Program

Dr. Ron Ferrara retired in 2015 after a lengthy tenure at MTSU that included two stints as chair of the Aerospace Department, first from 1993 to 2000 and again from 2012 to 2015. Ferrara, whose aviation background and MTSU career began in maintenance in the Flight Operations Center at Murfreesboro Airport, oversaw curriculum, personnel, faculty workloads, airport operations, maintenance of aircraft, and more, including contracts with Murfreesboro Airport and the city, property leases, and the University's close relationship with the Federal Aviation Administration (FAA) and the Transportation Security Administration (TSA).

Another Airborne Alum

In her first semester at MTSU in 1998, Demetria N. "Dina" Elosiebo ('02) was the only African American and the only woman in her aviation class. Now, 1st Lt. Elosiebo is a rotary wing pilot of Army Black Hawk helicopters in the District of Columbia National Guard. A platoon leader with an air ambulance unit in the D.C. area, she flies two or three times a week and stays in a constant state of readiness. Her unit hoists people from difficult-to-reach places with as little as one hour's notice and cares for the critically injured en route to hospitals. She's the first African American woman in her current post. She became a Black Hawk pilot in February 2014 at age 33.



Ron Ferrara and MTSU President Sidney A. McPhee



Demetria Elosiebo

Agribusiness/Agriscience



Warren Gill

Passing the Torch

School of Agribusiness and Agriscience director Dr. Warren Gill, 64, stepped down, moving to the classroom as full professor with tenure. Gill said he plans to focus on his research and teaching classes. During Gill's eight years leading the school, it grew from 300 to nearly 500 undergraduate and graduate students. Dr.

Jessica Carter was named interim director. In the spring, College of Basic and Applied Sciences Dean Bud Fischer recognized Gill, Aerospace chair Ron Ferrara, and Department of Military Science professor Joel Miller, all of whom were stepping down from their leadership positions.

Pulp Science

Dr. Rhonda Hoffman, professor of Horse Science, was a consultant on carbohydrate nutrition for a study conducted at the University of Sao Paulo in Brazil. The researchers found that citrus pulp could make up as much as 28 percent of a horse's diet. A byproduct of Brazil's orange juice industry, citrus pulp is inexpensive and readily available. The horses in the study found it both palatable and easily digestible, and none rejected the pulp.



Elizabeth Jones caring for a foal at MTSU's Horse Science facility.

Water Works

MTSU and the Tennessee Department of Environment and Conservation (TDEC) announced a partnership in April 2015 that will expand individual opportunities for earning course credit and certifications through TDEC's Fleming Training Center in Murfreesboro, online, and at other statewide locations. "Fleming Training Center offers cutting-edge technology and advanced classes in a variety of water areas, and this partnership will allow traditional and nontraditional students to take full advantage," TDEC commissioner Bob Martineau said. "Having qualified candidates for these jobs is essential for protecting public health and the environment."

According to the Bureau of Labor Statistics, the water supply and sanitation sector is expected to experience an employment growth rate of 45 percent in coming years due to regulations, infrastructure growth, security, and customer demands. "Water and wastewater operators in Tennessee have completed extensive training and passed a comprehensive exam through the Fleming Training Center in order to be certified," said Brandon Hulette, director of the center. "This partnership will allow MTSU to recognize the level of expertise certified operators in Tennessee have acquired." MTSU officials said this is a comprehensive plan that provides degree paths for both traditional-age students preparing to enter the workforce and for adult learners who are already in the water and wastewater industries. "Producing highly skilled graduates is a critical mission for the 21st century workforce and we're pleased this partnership will do just that," said President Sidney A. McPhee.

Under the partnership, the traditional college pathway will be a four-year degree program on campus with a major in Environmental Sustainability and Technology. The program is designed to meet the unique knowledge base and skill-set needs of water resource operators. It also supports Tennessee's initiative to increase the percentage of Tennesseans with postsecondary degrees from 32 to 55 percent. "This collaborative effort is a perfect example of the innovation that Tennessee needs," said Mike Krause, executive director of the "Drive to 55" in the office of Governor Bill Haslam. "We commend MTSU for continually seeking ways to contribute to the community and the state."

(Continued on page 16)

Biology

Resident Expert

In April of 2015, *The Huffington Post* published an article about conservation efforts in the Brazilian Atlantic Forest, which represents one of the most important and endangered ecosystems in the world. Front and center in the article was MTSU's own Dr. Andrew Brower, a world-renowned expert on Nymphalid butterflies. The article opens with Brower addressing a room full of students, researchers and naturalists—all of whom were there, in one form or another, to study butterflies and moths—at the Serra Bonita Reserve, located in the Atlantic Forest, or Mata Atlântica, of Bahía, Brazil. Scientists estimate that 11,000 species of butterflies and moths live at Serra Bonita, the same number found in the U.S. and Canada combined. According to the article, with only eight percent of the original ecosystem remaining, the Atlantic Forest of Brazil urgently needs all the conservation help it can get “and the next generation of scientists is ready to help.” Separately, in October 2014, Brower was quoted in a *National Geographic* article about a new study finding that Monarch butterflies owe their long-distance migrations to one gene honed for efficient flight.



Chemistry

Gift that Keeps on Giving

More than a half-century of devoted service and giving to the University at which they attended, worked, and still love as alumni has come full circle for Dan and Margaret Scott.

MTSU honored the longtime contributors and Murfreesboro residents with the naming of the Dr. Dan and Margaret Scott Chemistry Department Office during a ceremony attended by dozens of supporters this past May. MTSU officials said the Scotts were chosen because of their significant contributions of both time and money and because of their impact on the University.

Dan Scott served as department chair for 11 of his 37 years in higher education before retiring in 1992. Margaret Scott retired as an associate professor in collection management—acquisitions in James E. Walker Library the same year. Scott, a 1950 graduate of then Middle Tennessee State College, said he was very thankful for the recognition.

“It makes me think everything I did all 37 years was recognized,” he said. “I just enjoyed my years at MTSU, and I tried to help in every way I can.” Margaret Scott, who earned her bachelor’s and master’s degrees from MTSU, said it is “an honor to be recognized for contributions we’ve made in the past.” Former MTSU President Sam Ingram recognized the couple for their academic

and philanthropic efforts and their friendship through the years. “They’re student-oriented. They understand that higher ed is not about what the institution can do for faculty and administrators,” Ingram said, “but whether or not it can achieve the mission it has, and that is to take students who are eligible to attend and give them the information, skills, and knowledge they need to be more successful adults and human beings in life.” The Dan D. Scott Endowed Scholarship for Chemistry majors was established in 2008. Margaret Scott received the King-Hampton Award in 1993 for significant contributions to the advancement of women at MTSU.



Computer Science

In Demand

The MTSU Computer Science department is now the largest computer science program in Tennessee with more than 400 majors. Graduates are in demand and work at international corporations such as Google and Nashville-based HCA Healthcare. The department is working with industry partners to host MTSU's first ever hack-a-thon, providing corporations the opportunity to work side-by-side with students to solve programming problems and invent new products.

Dr. Chrisila Pettet chairs the department. Each year, Computer Science students successfully compete in various competitions, such as the ACM Regional Programming Contest (fifth place in 2012) and the Deloitte Mobile Challenge (second and third places in 2013).



Engineering Technology

Moon Shot

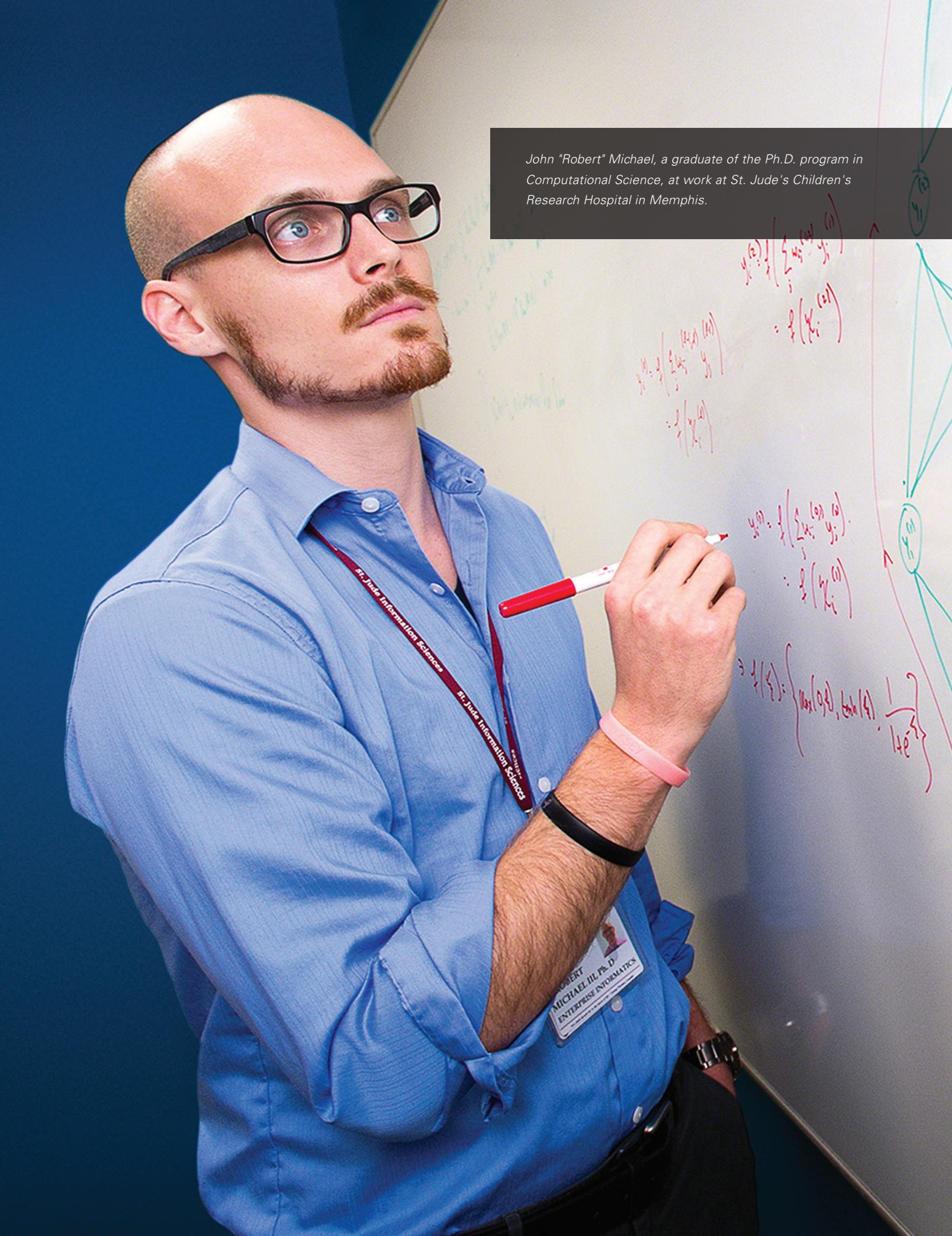
The MTSU Experimental Vehicles lunar rover team regained its status as best in the nation with a 5-minute-plus finish April 18 at the U.S. Space and Rocket Center half-mile obstacle course in Huntsville, Alabama. The student-built rover nicknamed "The Beast" placed third overall behind entries from two European universities in the NASA Human Exploration Rover Challenge. The event is held annually for university and high school teams to encourage research and development of new technology for future mission planning and crewed space missions. Dean Bud Fischer, College of Basic and Applied Sciences, said "These types of hands-on experiences, which allow students to apply what they've learned in the classroom to applied problems, are what make the College of Basic and Applied Sciences at MTSU the place to be for STEM [science, technology, engineering, and math]."

Murfreesboro's Central Magnet School, which relies on MTSU for parts, machining, and advising, placed 11th in the high school division. The Experimental Vehicles Formula Hybrid MTSU team later competed for the first time in the Society of Automotive Engineers Collegiate Design Series event held at New Hampshire Motor Speedway in Loudon, New Hampshire. Judges awarded the team the top presentation with the highest score in the nine-year history of the event. Earlier this year, MTSU's solar boat team, using a solar boat they nicknamed "True Blue," placed second to host Cedarville University in a 16-team national competition on Lake George Wyth in Dayton, Ohio.

(Continued on page 30)

NASA U.S. Space and Rocket officials award the overall third-place trophy to the MTSU lunar rover team.





John "Robert" Michael, a graduate of the Ph.D. program in Computational Science, at work at St. Jude's Children's Research Hospital in Memphis.

$$\begin{aligned} y^{(2)} &= f \left(\sum_{i=1}^{n_1} w_i^{(1)} y_i^{(1)} \right) \\ &= f \left(\sum_{i=1}^{n_1} w_i^{(1)} \right) \\ &\vdots \\ y^{(l)} &= f \left(\sum_{i=1}^{n_{l-1}} w_i^{(l-1)} y_i^{(l-1)} \right) \\ &= f \left(\sum_{i=1}^{n_{l-1}} w_i^{(l-1)} \right) \\ &\vdots \\ y^{(L)} &= f \left(\sum_{i=1}^{n_L} w_i^{(L)} y_i^{(L)} \right) \end{aligned}$$

ROBERT
MICHAEL III, PH.D.
ENTERPRISE INFORMATICS

True Blue LETTERMEN

MTSU's three science Ph.D. programs, launched five years ago, come of age

by Drew Ruble

The winners of MTSU's 2015 Business Plan Competition, sponsored by the Wright Travel Chair of Entrepreneurship and open to any enrolled MTSU student or alum, included a current student and a recent graduate of the Molecular Biosciences Ph.D. program. Their winning entry was Salomon's House, a startup whose ambitious mission is to discover disease-curing compounds that will be attractive to the pharmaceutical industry.

The win speaks volumes about the quality of students of MTSU's science Ph.D. programs—Molecular Biosciences, Computational Science, and Mathematics and Science Education. When launched five years ago, some naysayers questioned if the three postsecondary programs would be any good, produce results, or supply graduates other universities would want to hire. Today, the proof is in the pudding. A recently-concluded external review shed a very positive light on the three programs—specifically their scientific productivity as measured by the number of scientific papers published, the number of grants applied for and awarded, and the number of academic talks given (all of which Ph.D. students are required to achieve to graduate). "The external reviewers thought we were perfectly on track on all metrics," said Dr. John Wallin, director of the Ph.D. program in Computational Science. "It certainly provided external validation of what we are doing and the impact it is having." The three programs are to a large extent self-funding, and most Ph.D. students are also teaching assistants. The instruction they provide is vital to the University's bottom line.

Perhaps the best way to show the success of the programs, though, is through the stories of current doctoral students and recent graduates who are making waves in the science community. The following pages offer a glimpse of just some (but certainly not all) of the success stories coming out of MTSU's science Ph.D. programs.

(Continued on page 20)



John "Robert"
Michael



Raymond "Cori"
Hendon



Vijay Koju

COMPUTATIONAL SCIENCE

John "Robert" Michael, a graduate of the Ph.D. program in Computational Science, works at St. Jude's Children's Research Hospital in Memphis as a high-performance computing specialist. In that position, Michael "helps scientists implement their research projects on cutting-edge technologies such as Hadoop, CUDA, and Infiniband on a cluster composed of 5,000+ cores and 38+ TB of RAM spread across more than 250 compute nodes." In layman's terms, he takes large amounts of data sets from St. Jude's and figures out how to turn them into useful knowledge for the hospital. "I am taking the skills I learned at MTSU and helping scientists in various fields solve similarly challenging problems," he said.

How high-growth is the field Michael now works in? Type "data science" into the job search toolbar on www.indeed.com and 100,000 plus jobs will pop up, with salary distributions typically starting at \$50,000 per year and with about 25,000 jobs offering six-figure salaries.

Michael, who hails from middle Tennessee, received his undergraduate and master's degrees from MTSU. As a student, he worked on validating an approximation which has been used extensively by the quantum physics community for about 40 years and had been unchallenged due to resource constraints. Through high-performance computing, Michael and a team of collaborators were able to create a simulation that modeled the physics involved in the approximation, research that resulted in three publications and presentations in the U.S., Switzerland, and Slovakia.

At press time, Raymond "Cori" Hendon was in the process of finishing his Ph.D. work in Computational Science at MTSU. He has already secured a postdoctoral position at Los Alamos National Laboratory in New Mexico.

For the past few summers, Hendon worked as a graduate assistant at Los Alamos, developing new analytic and semianalytic solutions to the equations of hydrodynamics with heat conduction. These multiphysics solutions are implemented as test problems for the verification of physics simulation software developed at Los Alamos and run on their supercomputers such as Cielo and the soon-to-be-finished Trinity, which is projected to rank among the five fastest computers in the world. "These new solutions contribute to the rigorous verification of the lab's top-of-the-line physics codes," Hendon said, "providing the confidence needed to accomplish its mission of solving national security challenges through scientific excellence."

"WE HAVE SEEN THE GROWTH MINDSET ASSOCIATED WITH LEARNING-ORIENTED GOALS."

A Murfreesboro native, Hendon's permanent position at Los Alamos will be in the lab's XCP-8 group, a computational physics position working in the area of verification and validation, or, said another way, taking complex computer codes and making sure they actually get the right answers.

Last but not least, current Computational Science Ph.D. student Vijay Koju, who is from Nepal, has also been working at a lab here in Tennessee. Koju has spent each of the past two summers interning at Oak Ridge National Laboratory in east Tennessee working in computational modeling of depth-resolved characterization of biomedical scattering sampled using Monte Carlo simulation. Koju has also been working on computational modeling of highly sensitive grating-coupled Bloch surface wave-based biosensors, which are used in detecting the refractive index change in a biochemical analyte due to the binding between protein molecules.

MOLECULAR BIOSCIENCES

Eric Vick, a 2014 graduate of the Ph.D. program in Molecular Biosciences, is a second-year medical student at the University of Tennessee College of Medicine in Memphis.

"My experience in immunology at MTSU motivated me to find ways to bring new therapies directly to patients," Vick said. "More directly, I am working in the drug discovery lab of Dr. Daruka Mahadevan for the development of novel immunotherapies for lymphoma and ideally implementing some of them in a phase I clinical trial before I graduate medical school."

While at MTSU, Vick worked on the pathogenesis of the bacteria *Gardnerella vaginalis*. He also teamed on research of the specific proteins that the bacteria were recruited in mammalian monocytes in response to infection, resulting in the publication in the *Journal of Reproductive Immunology* and the presentation of a \$500 Young Investigator Award at the American Society for Reproductive Immunology Annual Meeting.

Vick serves as chief executive scientific officer for Salomon's House, a biotechnology and drug discovery company that recently won the MTSU business plan competition. Based on the square in downtown Murfreesboro, the company plans to begin its first round of financing soon.

MATHEMATICS AND SCIENCE EDUCATION

Natasha Gerstenschlager graduated from the Ph.D. program in Mathematics and Science Education with a concentration in Mathematics Education in August 2015. This fall semester, she began her new position as an assistant professor in mathematics education at Western Kentucky University.

Gerstenschlager's dissertation, "Implementing Reform-Oriented Statistics in the Middle Grades: Teacher Support Structures," looked at implementation fidelity and what supports the teacher identified as necessary for

implementation. Results from this study indicated that several barriers to implementation fidelity existed, including subject matter. These results have implications for the research community, indicating that stronger support is needed for those who will be teaching this content in mathematics courses.

Current Mathematics and Science Education Ph.D. student James "Chris" Willingham works as a graduate assistant for the Implementing Mathematical Practices and Content into Teaching Project, also known as Project IMPACT. Now in its third year, IMPACT is dedicated to providing professional development for K-8 mathematics teachers through a partnership between MTSU and the school districts of five surrounding counties. Willingham is also a teaching assistant focused on courses in the MTeach program, which helps former mathematics- and science-related degree seekers transition their focus to teaching those subjects instead.

Research Willingham has been involved with at MTSU examines how the mindset of individual mathematics teachers influences their engagement in professional development. Building on work suggesting that individuals subscribe to either a growth or fixed mindset regarding personal attributes, his research has uncovered that teachers of the two mindsets establish substantially different goals for themselves and their students and that they respond to challenges to these goals in different ways. The work offers a promising new route to support teacher growth through awareness and intervention related to mindset.

"We have seen the growth mindset associated with learning-oriented goals, a focus on mathematical understanding and sense-making, and increased effort and persistence in the face of challenges," Willingham said. "In contrast, the fixed mindset was affiliated with performance-oriented goals, a focus on solutions rather than important mathematical practices, and frustration or disengagement with difficult ideas." *



Eric Vick



Natasha
Gerstenschlager



James "Chris"
Willingham

From Grass to GLASS

A CLOSER LOOK AT MTSU'S LAND OF MILK (AND HONEY)

by Darby D. Campbell

ACROSS AMERICA, there is a growing movement to "buy local." Locavores, as they've branded themselves, champion the idea that when you buy local, your food is fresher and you reduce your carbon footprint and support your local infrastructure.

For MTSU students and Agribusiness/Agriscience staff, it doesn't get much more local than MTSU's Experiential Learning and Research Center (ELRC) at Guy James Farm, just six miles east of the main campus.

The center has 435 acres of gorgeous Tennessee farm country with a \$2.7 million state-of-the-art dairy, a registered Angus herd, a swine herd, student gardens that include horticulture hoop houses, and an apiary for beehives. There, students get hands-on experience working on a farm and caring for animals morning to night: feeding, milking, checking their health, and even playing with them. About 30 students a year are hired part-time to work at the MTSU Farm Lab.

GOT MILK?

A primary product at the farm is milk. MTSU is the only school in the state where students milk the cows and process the milk that on-campus students drink. They also haul the milk from the dairy, which boasts computerized equipment capable of milking as many as 350 cows, to the milk processing plant on campus. Under the supervision of manager Liz Troup, the milk is lab-tested to check for antibiotics, pasteurized and homogenized, then packaged

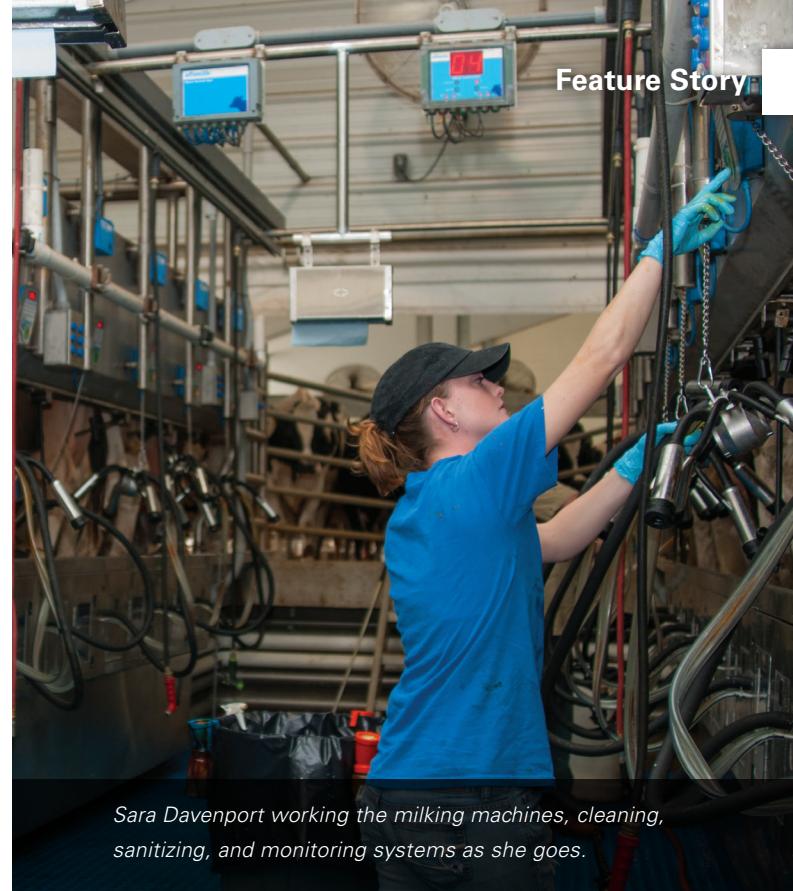




for delivery to campus cafeterias. Milk consumption on campus is about 3,800 pounds per week, or one-third of the dairy's production. The remaining milk is sold to the Maryland and Virginia Milk Producers Cooperative Association, which markets milk mainly for dairy-farm families from Pennsylvania to Alabama. So the next time you sit down to drink a glass of MTSU's famous chocolate milk at McCallie dining hall (MTSU's chocolate milk has won national awards), rest assured, it doesn't get any fresher.

FARM TO TABLE

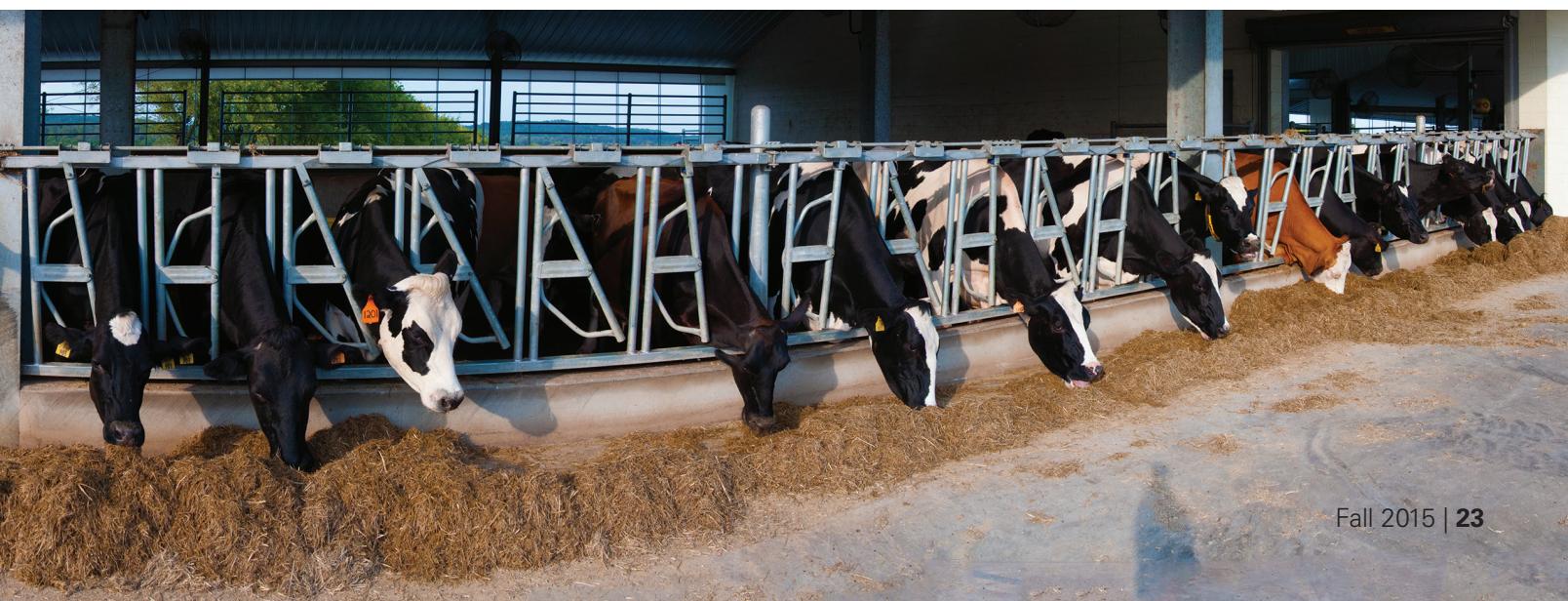
Milk isn't the only product coming off the farm. Matthew Wade, farm laboratory director, oversees students assisting with the 15 hives and the production of raw honey, which is sold year-round (or until they run out) at the Stark Agriscience and Agriculture Center and seasonally at the MTSU Student Farmers Market. The program inherited beehives started in the 1920s. Plant and soil science students, led by assistant professor of horticulture Dr. Nate Phillips,



grow produce for the farmers market. Open in the summer and, depending on the season, for other brief periods, the market is a great place to find local raw honey, plants, flowers, fruits, and veggies. Bounty fresh from the farm also includes cabbage, onions, tomatoes, kohlrabi, corn, okra, eggplant, beans, watermelon, cantaloupe, and peppers.

QUEST FOR STUDENT SUCCESS

The Experimental Learning and Research Center is a teaching facility, where pre-veterinary students and Animal Science majors get hands-on opportunities to learn about animal production and prepare for in-demand careers in Tennessee's large food processing industry. **True Blue!** ☘





SOLID Leadership

by Katie Porterfield

MTSU's Concrete Industry Management Department, the first of its kind in the U.S. and, perhaps, the world, is led by **Dr. Heather Brown**, a woman who has defied stereotypes and carved out a solid reputation in the industry.

Between 2011 and 2013, China, which has been building whole cities to accommodate population growth, consumed 6.6 gigatons of concrete—more than the U.S. used in the entire 20th century.

That fact, uncovered by population and energy researcher Vaclav Smil, prompted business magnate Bill Gates to write about it on his blog, which in turn drew worldwide media attention to Smil's analysis. *Forbes* magazine wrote, "Look at what the U.S. built between 1901 and 2000: all those skyscrapers, the Interstate, the Hoover Dam, the list goes on and on, but all that concrete only amounted to 4.5 gigatons."

That's not to say the U.S. isn't still building. Concrete is a \$200 billion industry with 500,000 people employed in a variety of careers working with this "liquid rock."

Though easy to take for granted, concrete has been the cornerstone of engineering for centuries, from the

Roman Empire to the development of modern-day skyscrapers. So how is all of this relevant to MTSU?

Although other MTSU departments tend to grab more headlines, the Concrete Industry Management Department (CIM) may be MTSU's most well known. Throughout the nation, the CIM program is recognized as the first and finest of its kind. The concrete industry helped fashion the program at MTSU nearly two decades ago. It has been the template for every other university program like it in the U.S.

From cutting-edge research to almost guaranteeing student success and job placement to the recent rollout of a new executive M.B.A. designed in concert with industry, the CIM program is one of the University's biggest success stories. Adding interest to the mix is that steering the department is a woman who has defied stereotypes and carved out a solid reputation in the national concrete industry.

A Firm Foundation

As a little girl, Heather Brown was a tomboy. Her specialty? Building. In addition to crafting Lego masterpieces, she also built forts out of snow, wood, and even leaves. So, when she took a test in ninth grade that indicated she was well-suited for civil engineering, she bought into the idea. She attended Tennessee Tech University and earned a bachelor's, master's, and doctorate in the subject.

(Continued on page 26)

Dr. Heather Brown, chair of the Concrete Industry Management (CIM) Department, next to the iconic CIM-built Horseshoe in Walnut Grove.



Solid Leadership (*Continued from page 24*)

Today, as chair of the CIM Department, Brown does more than just recruit students who think of themselves as master builders (or who may have scored well on one of those career aptitude tests). She also promises to give them chances to find a career in the high-growth, science-driven concrete industry.

"In recent graduating classes, I've had four jobs for every graduate," Brown said. "I've had 200 jobs and 50 kids to take them."

According to Brown, that number will continue to climb as the booming construction industry expands for at least the next five years and perhaps the next decade. But these job openings aren't for laborers who place and finish concrete. Brown's students fill a wide variety of jobs in the industry, from sales or quality control to production management or contracting.

"Our degree was started for the management side of the business," Brown said, using the pitch she delivers to parents of prospective students. "Our industry, which continues to be a partner, dreamt this whole thing up because they realized they were not getting college-educated kids to enter concrete construction and production."

Cementing a Reputation

MTSU, with its already well-known academic programs such as Recording Industry, Horse Science, Agribusiness/Agriscience, and Aerospace, seemed the perfect fit for a CIM program. In 1995, industry representatives started pushing for the first four-year bachelor's degree dedicated to the development of managers for the concrete industry. They convinced MTSU officials that CIM was a degree that would open doors for students.

"The industry saw a need, and there wasn't a university in the entire country that had a degree focused on concrete construction," Brown said. "MTSU, unlike many other universities they approached, had open arms and took them in and said, 'We can work together; we can be a partner.'"

Those same industry folks became teachers, turning out the first graduates in 2000. In 2001, Brown, who'd been a research assistant for the Tennessee Department of Transportation (TDOT) while pursuing her education, agreed to come aboard as a teacher and researcher.

"It was all about concrete, and that's what I'd primarily worked on during my master's and Ph.D., so it was a passion of mine already," Brown said. "I jumped right in, and I loved it."



This year, 10 CIM students (including Nick Langlois, pictured here) traveled to the Dominican Republic to form and pour concrete used to make artificial reefs, which are intended to help promote marine life near a cruise ship port.

In 2006, she became the program director, and in 2011, when CIM became a department in the College of Basic and Applied Sciences, she became its chair. Under her leadership and with the continued support of industry executives now known as the National Steering Committee (NSC), the program has since expanded to other universities (California State University–Chico, New Jersey Institute of Technology, and Texas State University) to better serve industry needs beyond the Southeast. The NSC plans eventually to introduce the program at two more U.S. schools and possibly in foreign countries.

A Concrete Advantage

In 2012, MTSU rolled out the first-ever M.B.A. with a concentration in Concrete Industry Management, offered in conjunction with the Department of Management. Executives or managers from across the nation take online courses for 15 months from business faculty who have received training in the industry.

"This was a huge effort because after we started the four schools, we realized there was a whole level of workforce out there . . . already in concrete but needing that degree to move up in their organization," Brown said.

Comparing it favorably to Belmont University's music business M.B.A. or Vanderbilt University's healthcare M.B.A. in the local market, Brown said the first class of eight students graduated from the M.B.A. program in concrete in March 2014. A second group of six students followed last March, and 10 are expected to follow in January 2016.

Those graduates, along with more than 800 from the undergraduate CIM program, continue to work their way up in a field that is hungry for young people. The average age of a manager in the concrete industry, Brown said, is about 57, and when the recession hit in 2008, managers who'd been expected to retire decided to stay on a bit longer to earn more money.

"In recent graduating classes, I've had four jobs for every graduate," Brown said. **"I've had 200 jobs and 50 kids to take them."**

"There's going to be and has been a big let-go of all of these seasoned professionals, and our guys are just waiting in the wings," Brown said, adding that at least two MTSU alumni have already reached the vice president level after only 10 years.

Nicholas Edwards ('06), director of sales (Eastern U.S.) for Kalyn-Siebert (a company that manufactures custom-engineered transport equipment and trailers), said his experience in the program prepared him for career acceleration and opened doors "beyond description."

"What folks don't realize is we are missing an entire generation . . . within the concrete industry," said Edwards, who is also vice president of the MTSU CIM Patrons Board, a group of local concrete professionals who serve the department and its students with financial, marketing, and mentoring help. "Filling this void with accelerated, adequately prepared individuals was the very vision the founders of the CIM program conceived."

Set in Stone

The future for CIM graduates seems bright, and Brown's plan is to continue to expand the department with its own concrete building. In addition to giving CIM a separate space, the building will showcase the different ways concrete can be used and be a learning lab for students.

"People don't realize that concrete can be made to look like anything else," Brown said.

The proposed new building will look like other red-brick buildings on campus from a distance, Brown said. However, the exterior would be concrete sanded and stained to give the appearance of red brick. The inside of the proposed building will feature translucent concrete, a light-transmitting material that allows, among other things, people with windowless offices to feel as though they have windows to the outside because they see shadows and sunlight.

Brown plans to finance the building with industry money. She's already raised \$2 million and hopes to raise the remaining \$6 million in cash and materials such as steel and rock in time to break ground when the program turns 20 years old next year.

Breaking the Mold

In the meantime, Brown plans to stay busy recruiting students to help industry benefactors fill all those vacant positions.

"I'm just trying to get more students that want to be around construction and have a passion for this," she said.

Perhaps some of those will be women looking to follow in Brown's footsteps.

"When I got into concrete, I was the only girl in the room," Brown said.

(Continued on page 28)



Solid Leadership (*Continued from page 27*)

Today, although the number of females in the industry has grown somewhat, Brown said only 10 percent of her students are women. Such a low percentage reflects the problem of women and girls eschewing science, technology, engineering, and math (STEM).

A 2010 report by the American Association of University Women found that the number of women in science and engineering is growing, but men continue to outnumber women, especially at the upper levels of the professions. It doesn't bode well for research and discovery when half of the human race—for whatever reason—remains outside the arena of science. Nor does it help America fill the STEM jobs that are increasingly available.

Brown would like to see that percentage in her department reach 15 to 20 percent.

"At the end of the day, I can't say, 'Every woman come over to concrete,'" she said, "because you do have to have a certain kind of personality or spunk. You have to have thick skin because it is still very male-dominated and very 'good-old-boy' in nature."

If women are willing to enter that culture, opportunities are there to be had. The industry wants to be more diverse.

"Females are just so different in this world," Brown said. "They are way better at multitasking and diffusing conflicts, and they are really go-getters, so companies who have traditionally hired men get a couple of our girls and say, 'Send us more.' That's good for us, but we still need more to sign up."

One thing is certain: women who decide to give concrete a try at MTSU will have the perfect mentor in Dr. Heather Brown.

From the Ground Up

It's simply hard to imagine a world without concrete. Often overlooked, though, is that there is an underlying science to concrete and its many uses that must be understood in order to be properly applied.

Given concrete's fundamental role in construction and building, the CIM Department at MTSU will likely continue to benefit the concrete industry as it cements the professional prospects of its graduates. ☀

Hard Evidence

In addition to preparing graduates to work in the high-growth field of concrete management, MTSU's program is a powerhouse in research. Much of the research produced by CIM is done by undergraduate students and in time intervals that match the speed of the ever-evolving concrete industry.

"Essentially, we investigate anything to do with concrete floors, roads, elevated slabs, walls, bridges, columns, etc.," said Dr. Heather Brown, chair of the CIM Department. "We are most concerned with durability, utilizing recycled products, economics, and safety."

College of Basic and Applied Sciences dean Bud Fischer said the program regularly receives grants from TDOT for projects such as gauging the life expectancy of roads and bridges and selecting the correct concrete for transportation projects.

"It's pretty unusual nationally to see students involved in state transportation projects like this," said Fischer. "It allows our students to do hands-on research activity, which is also important for the state."

Dr. Heather Brown, CIM chair, demonstrates pervious concrete, which allows rain to pass through, reducing runoff.



Catching a Wave



It's a great time (and a fun time!) to be a part of the College of Basic and Applied Sciences at MTSU. From the excitement surrounding the recent opening of our new, state-of-the-art, 257,000-square-foot, \$147-million Science Building to ongoing renovations to the older Davis Science Building and

Wiser-Patten Science Hall (see page 10) to the additions of new programs including Unmanned Aircraft Systems Operations and Mechatronics Engineering, the college is creating quite a buzz on campus and across our region.

We've also experienced tremendous growth in industry support for our programs. It comes from companies who want to boost our efforts to produce a well-prepared future workforce. They do so, I believe, because they know that MTSU students and graduates are the best workers they can hire.

What exactly makes that the case? There are too many reasons to outline. But two, to me, stand out. First, MTSU produces the lion's share of first-generation college graduates in Tennessee—a student population that tends to be exceptionally focused on taking full advantage of their education. Next, in addition to being enrolled in college full-time, the vast majority of MTSU students already work 10 to 30 hours weekly at a paying job. It's no wonder, then, that the consistent feedback we hear from industry is that they prefer to hire MTSU graduates due to their pre-existing strong work ethics and appreciation for professional opportunity.

We are proud of that reputation and need continued financial support from individuals and industry partners to ensure that our science, technology, engineering, and mathematics (STEM) majors graduate on time and leave prepared to start not just a job but a career. In 2012, MTSU launched its \$80 million Centennial Campaign, the largest fundraising effort in the University's history. The campaign is slated to end later this year. Last year alone, we were fortunate to have 717 donors contribute a total of \$983,035 to the College of Basic and Applied Sciences. Whether these gifts were given to support student scholarships, research being conducted by our

outstanding faculty, or the establishment of an endowed fund, they all made a significant difference for MTSU and the college.

Since joining the college as its development director, I have already enjoyed meeting with many of you during my travels on behalf of the University. I have especially enjoyed hearing your personal MTSU stories. If we haven't met, I hope we meet soon. A travel schedule printed below outlines all the places Dean Bud Fischer and I will be visiting in the coming months. On your next visit to campus, I would especially enjoy showing you around the new Science Building.

Sincerely,

Nicole Chitty, Director of Development

If you are considering making a gift today or wondering how to include MTSU in your estate plans, contact Nicole at (615) 898-5003 or nicole.chitty@mtsu.edu.

Coming to a City Near You!

Dean Bud Fischer and Director of Development Nicole Chitty will be hosting CBAS meet-and-greets on the True Blue Tour as well as alumni dinners in a city near you! We hope you can join us!

September 30, 2015—Atlanta, Ga.

October 3, 2015—Homecoming: MTSU vs. Vanderbilt. Join us at the Alumni tent!

October 14, 2015—Memphis, Tenn.

October 15, 2015—Jackson, Tenn.

October 19, 2015—Johnson City, Tenn.

October 20, 2015—Knoxville, Tenn.

October 22, 2015—Nashville, Tenn.

October 30, 2015—Chattanooga, Tenn.

November 4, 2015—Huntsville, Ala.

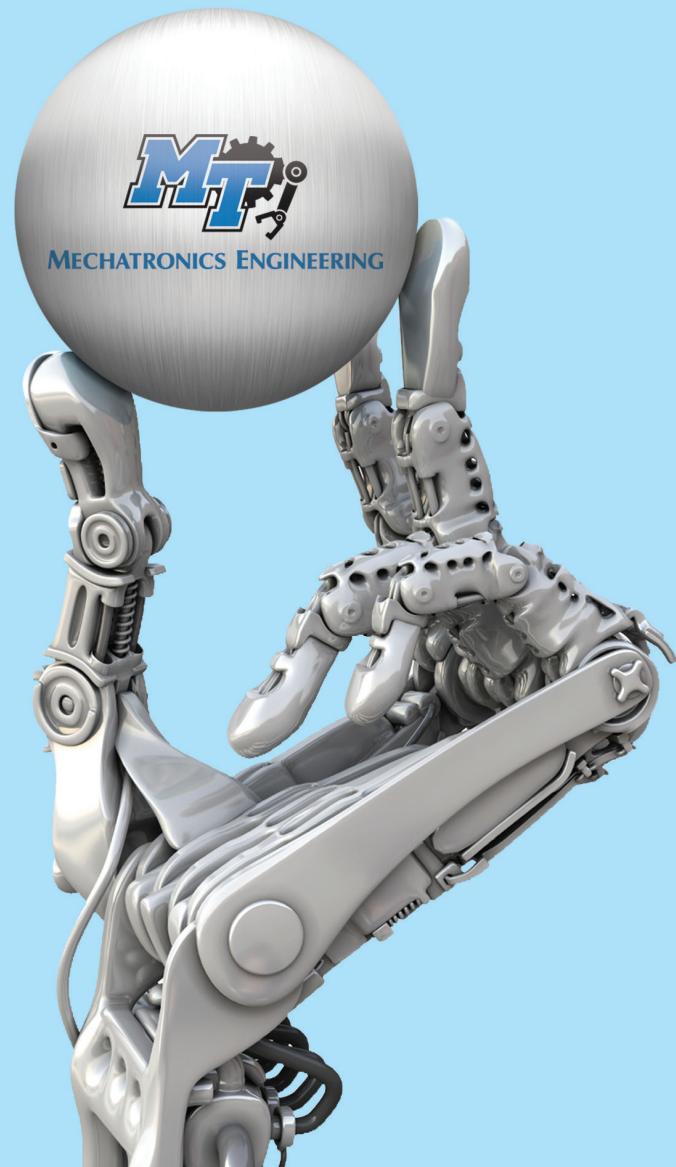
I AM *true*
BLUE

Better by Design

Mechatronics Engineering—a program that combines mechanical, computer, and electrical engineering as well as systems integration and project management—has grown to 235-plus students, making it one of the fastest-growing higher education academic programs in the state. The program also recently celebrated the awarding of a \$614,172 National Science Foundation grant to recruit qualified female and minority applicants. At least 15 incoming freshmen students for each of the next three years will receive scholarship awards for up to \$10,000.

"This is a remarkable achievement," said President Sidney A. McPhee at the time of the announcement of the NSF grant. "Any time the University is in a position to receive such a competitive award, it is something to be proud of" McPhee also said MTSU is fortunate to have "opportunities to collaborate with Siemens, Bridgestone, the Chamber of Commerce, and other companies that are a part of this incredible innovation of a new degree program. This is what MTSU is about—being responsive to the need of our community and making sure we continue to be part of the solution . . . so they'll have the workforce that'll attract industry for the 21st century."

Bridgestone Americas corporate manager Keith Hamilton called the grant announcement "a great day, one of many for MTSU. This has opened a lot of eyes across Tennessee." Hamilton also noted that while the industry statewide needs up to 2,900 engineering graduates yearly, universities are only producing 900 to 1,200.



Geosciences

Eye in the Sky

Dr. Jeremy Aber is among MTSU faculty working with Geosciences majors in the University's geographic information systems (GIS) lab. Through a research grant, Aber is involved in a Board of Regents partnership with Austin Peay State University to conduct geosciences research with the help of undergraduates. Among Aber's planned projects is one that will use blimps, kites, and a digital infrared camera to obtain aerial images. The goal is to monitor vegetation around Murfreesboro's public greenway next to the Stones River.

Other research includes implementing an augmented reality app to expose hidden geographies and using

geotagged Tweets to map various phenomena. His geosciences research taps into a variety of available technologies—from lab resources to cell phones, GPS, Twitter, and even video games. MTSU's GIS lab boasts equipment, technology, and software that Aber said is comparable to those located at major research institutions. Named in honor of retired department chair Dr. Ralph Fullerton, the lab has projects ranging from remote sensing to satellite imaging. Space for research will be increased when the Geosciences Department—CBAS's newest—moves to the renovated Davis Science Building in 2016.

Military Science

Learn and Protect

In January 2015, MTSU students in the Military Science program had the opportunity to gain real-world exposure to sophisticated technology used by the military. The ROTC cadets received training in improvised explosive devices, or IEDs, from site leader Wayne St. Louis and six U.S. Army Forces Command/Fort Campbell counter-IED instructors. The technology included IED robots, hand-held detection devices, mine or metal detectors, and more. "There's an average of more than 600 incidents a month around the world," St. Louis said. "We're here to teach them [cadets] what to look for." Areas of study were divided into three classrooms. One was used for biometrics. Trainer Christopher Siget of Clarksville told the cadets the enemy can be searched by fingerprint, the irises of their eyes, and photographs. "The iris [method] is faster and 99 percent accurate," Siget said. Another classroom featured ground-penetrating radar, land mine detectors, and the Man-Portable Line Charge (MPLC) used for clearing a breach, said trainer John Cameron of Clarksville. A third classroom focused on counter-IED technology such as jammers and remote-controlled defeat devices.

Taking Command

U.S. Army Lt. Col. Jackie McDowell is the new chair of Military Science, guiding the department and ROTC program.

He is a former Green Beret and has spent nearly 25 years with the Army. McDowell and his staff recently received an added boost for training cadets—a six-station obstacle course, built by the Tennessee Army National Guard's 212th Engineering Company out of Paris and Camden, Tennessee, with support from ROTC alumni. It's located on the east side of campus adjacent to the rappelling tower.

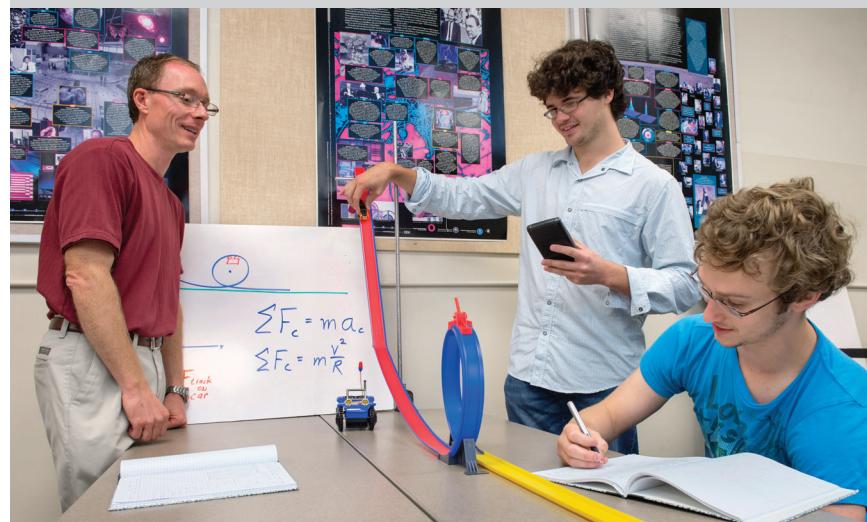
McDowell replaces Lt. Col. Joel Miller, who is now a history professor at the U.S. Military Academy in West Point.

Physics

Supporting the Quest

MTSU's Department of Physics and Astronomy received national recognition from the American Physical Society (APS), a physics and science education advocacy organization. The University was one of three schools honored for improving undergraduate physics education for its students; the others were Indiana University-Purdue University—Fort Wayne and Rochester Institute of Technology. APS called MTSU "among the most successful PhysTEC sites," referring to the Physics Teacher Education Coalition, or PhysTEC, which helps universities develop their physics teacher education programs into national models. Deanna Ratnikova, women and education programs administrator with APS, said choosing MTSU for the honor was due in part to the University "consciously adopting a mission to provide exceptional classroom experiences, career-focused courses, and pathways and intensive research opportunities to prepare students for targeted careers." "It's truly nice to receive national recognition," said Physics Department chair Dr. Ron Henderson, who noted it relates to an on-campus award bestowed by President Sidney A. McPhee in August 2013 as part of the University's Quest for Student Success initiative. "That award [from the president] came in competition with other departments on campus," Henderson said. "The American Physical Society award followed a nationwide search. Every physics department in the country was eligible."

The Department of Physics and Astronomy also anticipates enhancing the student experience through a physical space expansion of up to 75 percent by 2016, following the renovation of Wiser-Patten Science Hall. ☀



Dr. Ron Henderson (left) with physics students Peter Schwartz (middle) and Daniel Bonior (right).

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