mabe

Spring 2019 • Alumni Newsletter

MECHANICAL, AEROSPACE & BIOMEDICAL ENGINEERING

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On the cover: Mallory Beil of the Tennessee Volunteers during the meet between the Virginia Cavaliers and the Tennessee Volunteers at the Aquatics and Fitness Center in Charlottesville, VA. Photo By John Golliher/Tennessee Athletics.

From the **Department Head**

Thanks for reading the spring 2019 issue of our alumni magazine. I hope you enjoy it!

The college and our department have continued to expand their global impact and reputation. Evidence for the positive momentum is everywhere. If you have not been back to campus in the last few years, I can tell you that it is nearly completely transformed and becoming more beautiful every month. Our undergraduate and graduate programs continue to expand to record levels, and we have been recruiting stronger faculty, students, and staff. I am excited we will have up to five new faculty starting this summer in areas of national strategic importance including manufacturing, aerospace engineering, and hypersonics.

As our faculty and research programs have grown at both UTSI and on the Knoxville campus, the investments we've made have transformed our facilities as well, including the addition of modern wind-tunnels, a high quality MABE Makerlab that includes industrial-quality metal and plastic large-format printers, CNC machines, and other superior subtractive manufacturing tooling. This lab will soon be expanding and we plan to invest in an all new manufacturing training and engineering design facility in the coming year that will give our students a design-build-test experience that is second to none.

We are also hiring new staff to handle our continued growth, and enhancing training and advising services to students. None of these efforts would be possible without your help. The generosity of our alumni and friends have absolutely empowered this transformation and included over $10 million in direct monetary gifts and pledges since 2016 alone. The impact of this generosity will be felt for generations to come, and I want to again thank everyone who has contributed. I am continually amazed by the generosity of our alumni. All gifts, small and large, have made a difference in our ability to shape the education and experiences of our students and provide our faculty with the facilities and resources they need to be internationally recognized in their field.

In this issue, you'll read more great stories about how MABE is having national impact. UT was chosen as one of 12 universities to compete in the 10th Advanced Vehicle Technology Competition. This competition extends our department's quarter-century of participation in the competition. This iteration will require our students to reengineer a 2019 Chevrolet Blazer into a hybrid electric, semi-autonomous vehicle.

Also in this issue is a story on how MABE Professor Bill Hamel and graduate students J. Logan McNeil and Micah Folsom traveled to Japan to attend a conference on nuclear decommissioning of the Fukushima Daiichi nuclear power facility.

Finally, please keep sending pictures and stories of your time at Big Orange—we love to share your memories with the entire MABE family! I look forward to hearing from you and invite you to get in touch and stay connected.

Best regards,

Matthew Mench

UT's EcoCAR team.

Trail Blazers:

UT Again at Forefront of EcoCAR Competition

Writing and photography by Whitney Brothers.

A team from UT has yet again been chosen to participate in the EcoCAR Mobility Challenge, an Advanced Vehicle Technology Competition (AVTC) managed by Argonne National Laboratory and sponsored by the US Department of Energy, General Motors, and MathWorks.

UT is one of twelve North American universities chosen to participate. Since 1988, UT has participated in ten AVTCs.

This new challenge prompts university students to reengineer a 2019 Chevrolet Blazer into a hybrid electric, semi-autonomous vehicle. Students will incorporate advanced propulsion systems, electrification, and connected and automated vehicle technology that will improve the energy efficiency, safety, and consumer appeal of vehicles, specifically for the carsharing market.

Led by MABE Research Assistant Professor **David "Butch" Irick**, a team of undergraduate and graduate students from the Tickle College of Engineering, College of Communication and Information, and Haslam College of Business will participate in the four-year multidisciplinary competition.

"AVTCs provide our students with career opportunities and prepare them for embarking on their engineering future," said Irick. "UT has a strong background in propulsion systems development; however, the connected and autonomous vehicle (CAV) technology component of this competition will be a new challenge."

UT students benefit from a hands-on experience with concept design, risk assessment, and technical work in vehicle propulsion, automated vehicle systems, and electrical systems. Using the Chevrolet Blazer donated by General Motors, the team will use onboard sensors and wireless communication from the vehicles' surrounding environment to improve overall operation efficiency in the connected urban environment of the future.

In the first year, the team will decide on a vehicle architecture to develop through research and simulations. In the second and third years, the students will apply their findings to the Blazer in a tangible manner to develop a hybrid electric Blazer with CAV capability. At the end of each year, the twelve teams will compete against one another in more than a dozen static and dynamic events. Teams will follow a real-world vehicle development process to meet rigorous technical constraints throughout the four-year competition, which will conclude in the summer of 2022.

"This competition gives me the opportunity to gain experience with the automotive industry while still in school," said Dean Blanks, project manager for UT's team. "As someone pursing an interdisciplinary career with engineering and business, EcoCAR allows me to apply principles learned in the classroom to a wide range of real-world challenges."

The challenge builds on a 30-year history of AVTCs provided by DOE. EcoCAR aims to develop a highly-skilled workforce that can meet our nation's future energy and mobility challenges. For more information on EcoCAR, the participating schools, or the competition sponsors, visit **avtcseries.org**.

UT-Led Hydrogen Research Earns $2 Million Grant

By David Goddard.

UT and Oak Ridge National Laboratory are part of a team whose breakthrough in fuel cell and hydrogen technology was awarded $2 million in funding from the US Department of Energy.

Hydrogen is increasingly recognized as a potential energy carrier with growing applications in vehicles, grid modernization, energy storage, fuel production, metal refining, and other areas.

Although great strides have been made in recent years in the technology of fuel cells and electrolyzers—the component that breaks water into gas—widespread implementation of hydrogen-generating components has been limited by cost, and they remain more expensive than natural gas.

That's where the new project comes into play.

"Almost all electrolyzers use catalysts to split water into oxygen and hydrogen, with the hydrogen then serving as a fuel source for a fuel cell or other process," said project leader Feng-Yuan Zhang, a MABE associate professor who is located at UT Space Institute. "What we are doing is using a new type of thin electrodes that are much more efficient in that conversion, reducing costs."

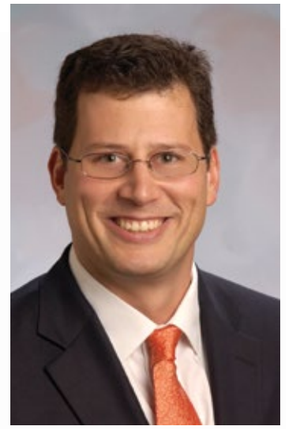
Central to the process are proton exchange membrane (PEM) electrolyzer cells. The electrodes and cell design are key to splitting water into hydrogen and oxygen following electrolysis. The proposed work, which builds on previous research done in Zhang's lab, will more efficiently convert the water into its constituent gases.

This new concept will make use of advanced manufacturing technology to design specifically chosen patterns for the layer, allowing hydrogen to be produced more efficiently than through conventional electrolysis and at a purer level than through natural gas reformation.

"Achieving low-cost hydrogen generation from electrolysis is a critical component to provide efficient energy storage from the growing renewable energy sources on the grid, which do not produce power in concert with demand," said MABE Department Head Matthew Mench, co-principal investigator on the project.

> "Adoption of energy storage via electrolysis, while providing hydrogen for automotive or other applications, can offer a smarter path forward that can be scaled as renewables and fuel cell use increase."—Mench

The project was one of 28 hydrogen-focused initiatives selected by the DOE with a total of $38 million in funding across all projects, highlighting the importance of the gas to the nation.



Matthew Mench

Feng Zhang

A Clinical Approach

By David Goddard. Photography by Randall Brown.

Neurological disorders such as Parkinson's, Alzheimer's, and multiple sclerosis have stricken humans throughout history, with the first real efforts to understand and treat coming in the last couple of centuries.

Though much has been learned about them, there remains no cure, only the treatment of the symptoms associated with them.

Hanrahan Brings Neural Experience to the Classroom

Now, researchers including lecturer Sara Hanrahan have combined neuroscience with engineering, opening up new avenues in the quest for a cure in the process.

"People don't necessarily equate engineering with the biomedical field, but there is a tremendous amount of overlap and potential," Hanrahan said. "Having an engineering background allows you to design biomedical devices with a better knowledge of materials, the pros and cons of different designs, and to anticipate and overcome problems."

Hanrahan has the double advantage of having spent four years at the Colorado Neurological Institute and the Swedish Medical Center before coming to UT in 2018. Her experience with neurosurgery has positioned her to see neural disorders from both a medical and practical standpoint, which, in turn, gives her students insight into what it is really like to work in biomedical engineering.

It's also led to her developing a possible treatment for Parkinson's patients that calls upon her dual experience.

"Deep brain stimulation has long held promise as a way to diminish the effects of Parkinson's, but it can still be improved." Hanrahan said. "The big challenges are integrating materials into the body that it won't reject, controlling infection, and targeting specific tissues to open up new avenues of treatment."

The evolving technology has an enormous upside, but, like most medical breakthroughs, there are clinical trials and federal guidelines governing adaptation. While Hanrahan's clinical expertise is good news for patients, her role as an educator is the latest sign of biomedical engineering's expansion at UT.

New breakthroughs in materials and devices have helped expand the field's reach both within engineering colleges and in clinical settings.

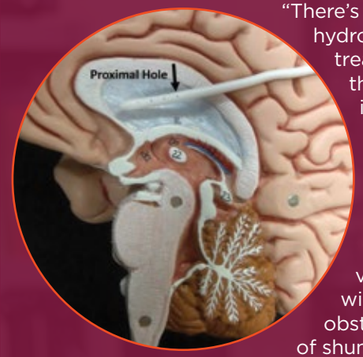
"I'm really excited in the interest and growth of biomedical engineering," Hanrahan said. "My goal is to help our undergrads at UT understand what the best path is for them, whether it's grad school, medical school, or working in a medical field. It's about setting them up for the future."

For Hanrahan and MABE, that future is bright.

Hitting Close to HOME

By David Goddard.

A team of researchers led by MABE's Stephanie TerMaath, UT's Jessie Rogers Zeanah Faculty Fellow, is making promising strides in the treatment of hydrocephalus—a debilitating and sometimes fatal condition caused by an excess of cerebrospinal fluid surrounding the brain and spinal cord—by engineering an alternative to a device currently used to relieve symptoms.



"There's no cure for hydrocephalus right now, only treatment of the effects through a surgically implanted device called a shunt," TerMaath said. "Unfortunately, shunts have a high rate of failure, requiring more surgeries for revision. We're developing a new ventricular catheter that will be more resistant to obstruction, a common cause of shunt failure."

Cerebrospinal fluid provides immune support, regulates circulation, and cushions the head and spine.

However, if that fluid fails to be absorbed naturally or if an excess is produced, it can cause severe problems with vision, coordination, and mental abilities, even death, if left untreated.

Their approach has gained them national recognition—the National Institutes of Health is now funding the research through an R15 grant—but the project also hits home on a more personal level.

"Many members of our team, including the students, either have an implanted shunt themselves or have a family member who does," said TerMaath, who has undergone six brain surgeries in the past 10 years. "The onset of symptoms due to shunt failure is so sudden that one moment you can be fine, and the next you can be in the operating room. Our team understands the debilitation that accompanies hydrocephalus, and that serves as even more motivation."

According to the Hydrocephalus Association, one million Americans suffer from the condition, occurrence in newborns—once in every 1,000 births—makes it as common as Down's syndrome and more prevalent than spina bifida or tumors.

TerMaath joined with assistant professor and fellow department member James Coder, Taylor Erwin and Ryan Glasby from the UT-Oak Ridge National Laboratory Joint Institute for Computational Sciences, and UT Medical Center neurosurgeon James Killeffer to form a multidisciplinary team to address all aspects of the project, from computational modeling to surgical implantation.

The catheter they are designing will have optimal fluid flow dynamics that minimize the likelihood of both internal and external blockages.

For those suffering from hydrocephalus, it offers something else: hope.

Student Notes

Schwartz Wins First Place in AIAA Student Competition

Matthew Schwartz, a graduate research assistant at UTSI, won first place in the AIAA International Student Competition at the annual AIAA Sci-Tech Convention held in San Diego, California, in January. The event was a follow up competition from an AIAA Student Competition he won in 2018. His presentation is entitled "Characterization of Near–Muzzle Ballistic Flow fields using High-speed Shadowgraphy." Schwartz is pursuing his Master's degree in aerospace engineering and is part of the High-Speed Original Research and Innovation Zone (HORIZON) Research Group led by MABE's B.H. Goethert Professor and H.H. Arnold Chair John Schmisseur.

Golter Receives Inaugural McGhee Tyson Airport Aerospace Engineering Scholarship

By Kathy Williams.

Samantha Golter is the first recipient of the McGhee Tyson Airport Aerospace Engineering Scholarship at the University of Tennessee.

McGhee Tyson Airport created the scholarship to support future aerospace professionals as well as partner with UT.

Golter, a junior in MABE, used the scholarship to fund her trip to the Society of Women Engineers (SWE) Conference held in Minneapolis last October. Attending the conference allowed Golter to strengthen her connections with companies she is interested in working for after graduation, attend educational sessions and keynote presentations, and network with leaders in the aerospace industry. She also had the opportunity to reconnect with some former co-workers from Boeing where she interned last summer.

Golter's inspiration to become an engineer came from her dad. "I was raised in an environment where fixing broken possessions was always preferable to throwing them away or replacing them," said Golter. "I have always been surrounded by the engineering mindset."

Her interest in space began during her senior year of high school when she took a class where the detection of gravitational waves was frequently discussed. "I was captivated by discovery," said Golter. "I became curious about space and the fact that, collectively, the human race has so little knowledge about phenomena beyond the scope of our own planet. Choosing aerospace engineering as my major was the best decision I have made," said Golter.

Sam Golter with Howard Vogel, Chairman of the McGhee Tyson Airport Board of Commissioners.

Golter currently serves as a college ambassador and teaching assistant for the Honors Engineering Fundamentals program. She also serves on the provost's Student Advisory Committee and is a member of the Engineering Honors program, AIAA, and SWE. She is mentoring two students through SWE's mentoring program and held two chair positions within the society last year. Golter also worked as an undergraduate researcher for Jessie Rogers Zeanah Faculty Fellow Stephanie TerMaath.

The SpacePort America Team (l–r) Nicholas Crowder, Conner Barnhill, Drew Nickel, Peter Tarle, and AJ Condra condut a successful test flight.

UT Team Heading to Spaceport America Cup

By David Goddard.

Educators often talk about encouraging their students to shoot for the stars. For a team of UT students, that saying takes on a different meaning.

"As part of the Spaceport America Cup team, we are launching a rocket that will carry a payload to study microbes at high altitudes and determine how, if at all, life in the upper atmosphere differs from life on the ground," said **Robert Nickel**, aerospace engineering major and president of the Student Space Technology Association and leader of UT's Spaceport America Cup team.

Nickel said that the team hopes to achieve that goal by characterizing bioaerosols suspended in air, such as viruses, bacteria, pollen, and others. With such a complex goal, the team has called upon students with expertise in biology, physics, chemistry, and, of course, engineering.

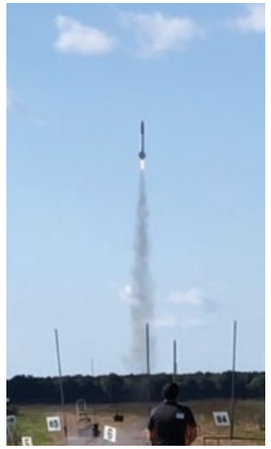
"We've worked on rockets and rocket teams for several years, but we decided to take part in the Spaceport America Cup because we'll get to implement what we've learned on a larger, more complex hybrid rocket," said **Connor Barnhill**, also a senior in aerospace engineering. "This competition not only allows us to see how our previous research works for larger-scale engines, but also allows us to collect meaningful, groundbreaking data while also fulfilling the senior design requirement."

While studies such as theirs are currently available via balloon or motorized aircraft, Nickel said the advantage that the team has is that they can provide more accuracy.

"Current methods face the challenge of maintaining a sterile environment traveling to the target altitude," Nickel said. "With our rocket, we are able to sterilize the surface of the rocket through transonic or supersonic flight, allowing us to sample only the target microbes."

First held in 2017, Spaceport America Cup bills itself as "the world's largest intercollegiate rocket engineering conference and competition," with teams coming to New Mexico from across the US and around the world.

"This was one of only two competitions that allow you to develop your own engine, but the other one made you pick from one of five payloads, whereas Spaceport America leaves that up to the teams," Nickel said. "Because of that, mechanical, aerospace, and electrical engineers can develop the rocket, tracking and recovery electronics, and the rocket engine it flies on, while the payload could be opened up to other disciplines."



UT's team will launch three experimental payloads: High Altitude Rocket Assisted Micro-Organism Capture, which serves as the primary payload, an experimental avionics package complete with GPS and telemetry, and a subscale cubesat (a miniature satellite) being developed by one of the team sponsors.

This year's competition will be held June 18–22 in Las Cruces, New Mexico, with the first day serving as a conference, followed by field tests, launches, and an awards ceremony. Last year, more than 1,500 students participated. Sponsors include aviation giants Boeing, Aerojet Rocketdyne, Northrop Grumman, SpaceX, and Virgin Galactic, meaning students will get to network with one another while possibly impressing potential employers.

Not a bad way to launch a career.

MABE Student and Professor Get Firsthand Look at Fukushima Power Plant

By Elan Young and David Goddard.

Doctoral student **Logan McNeil** recently took part in one of the first academic tours of the Fukushima Daiichi Nuclear Power Plant in Japan, which was crippled by a devastating tsunami in 2011.

Along with MABE Professor **Bill Hamel** and nuclear engineering student **Micah Folsom**, McNeil was part of a select group invited to Japan to attend a conference about technology used to decommission the reactors, including robots, sensors, and other electronics.

The Fukushima disaster, which left three of the reactors in meltdown status, is considered the worst nuclear accident since the 1986 Chernobyl meltdown in what was then the Soviet Union.

"We heard presentations about site recovery and the remaining technical challenges Japan faces in returning the environment—as close as possible—to its original condition," said Hamel, who spoke at the conference. "Seeing the effort that the Japanese people have put forth is a tribute to their commitment to restore the area, but it will be a number of decades before that is complete."

The students talked about the "surreal" nature of driving around the destroyed complex and looking up to see the high-water mark left by the tsunami.

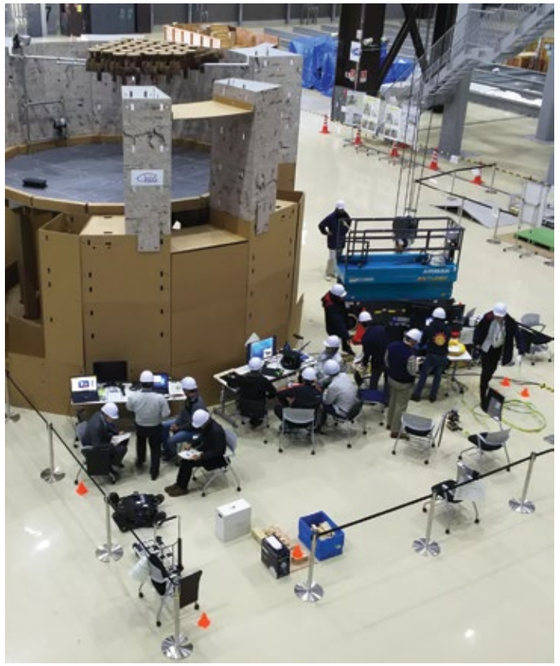
"The day we visited the plant itself was really an eerie experience," said McNeil. "It was like seeing a city frozen in time, where houses had been abandoned, streets had been fenced off, and vehicles and equipment were left untouched for almost eight years."

As a mechanical engineering major, McNeil said that, while the radioactive nature of the plant was certainly a concern, he was more taken about by the sheer amount of destruction that the earthquake and tsunami had left.

In addition to seeing the reactor buildings up close, the students saw the impressive infrastructure built for the cleanup effort, including massive arrays of tanks holding contaminated water.

Students also spent time learning about robotics at Japan Atomic Energy Agency's (JAEA) Naraha Center for Remote Control Technology Development and at the University of Tokyo, working with students using software to perform 3D scene reconstruction and radiation transport simulations.

JAEA provided financial support for the trip, which included two students each from the University of California at Berkeley, McMaster University in Canada, and the University of Tokyo.



MABE Duo Helps NSBE Team Secure Best-Ever Placement

By David Goddard.

A team of Engineering Vols set a new standard for excellence last fall, becoming the first team from UT to win the Academic Technology Bowl at the National Society of Black Engineers Region 3 Conference in Montgomery, Alabama.

The NSBE team after their third-place finish at the national convention.

By design, the team was composed of students from varying disciplines within the college, including two sophomores from mechanical engineering: **Kassidy Boone** and **Shannon Sharp**.

"We saw having the different backgrounds as an advantage to us in the competition because it made us able to divide and conquer study topics as we prepared to compete," said Boone, who currently serves as TORCH chair for UT's group. "Though we weren't all familiar with all of the topics presented, we were able to learn from each other's mistakes and better prepare for the competition."

Categories included mathematics, statics, computer science, thermodynamics, mechanics of materials, and NSBE history, with the event itself split into two rounds.

While everything turned out great for UT in the end, Boone said the first round was anything but, with UT's team trailing the other squads. Slowly but surely, the team pulled itself back into contention, eventually winning on the final question.

"Our team kept its composure and made an amazing comeback at the end," Sharp said. "When they announced that we had won, we went crazy and celebrated ecstatically for UT's win."

In addition to Boone and Sharp, other team members included:

> **Kendra Jackson**, senior in civil engineering and NSBE president
>
> **Mubuso Nkosi**, junior in chemical engineering and NSBE vice president
>
> **Hunter Mann**, junior in computer engineering and NSBE telecommunication chair
>
> **Talecia Dyson**, senior in civil engineering and NSBE secretary

Founded in 1975, NSBE has more than 29,900 members, making it one of the largest student groups in the country.

Both students said the experience brought the team closer together, showed what is possible through both NSBE and the college, and served as a credit to Travis Griffin, the Fred D. Brown Jr. Director of Engineering Diversity Programs and team mentor.

"NSBE at UT is so much more than a campus organization," Sharp said. "Since my freshman year, it has been the place where I can easily meet new people and make valuable relationships, has pushed me to be a better student, friend, and future engineer, and perhaps most of all, has given me professional development and opportunities to gain leadership."

Boone echoed that sentiment, pointing out many of those same platitudes, and adding that she views UT's NSBE chapter as "nothing less than a family," and that she looks forward to what the group can accomplish in the future.

Thanks to their win, they moved on to compete at the national convention in late March where they placed third.

> "We saw having the different backgrounds as an advantage to us in the competition because it made us able to divide and conquer study topics as we prepared to compete."
>
> — Kassidy Boone

Engineering is aA

Family Affair for Simran DayalA

Writing and photography by Randall Brown.

Simran Dayal arrived at UT just in time to celebrate her 18th birthday. Her parents accompanied her on the long journey from their home in Delhi, India, and the family spent the day getting to know campus.

“That was the most memorable day to me,” she said. “It symbolized a major cultural shift in my life.”

Dayal received admission offers from multiple universities, but she was most impressed by the cultural and academic heritage at UT, and by the scenic beauty of Knoxville. She decided this is where she would pursue her degree in biomedical engineering.

“Coming to the United States, which is thousands of miles away from my home, was an exciting experience for both my parents and me,” said Dayal, whose parents stayed in town for two weeks to share the new experience. “The faculty, staff, and the students were extremely cooperative and made us feel as a part of the Vol family.”

A longtime interest in the natural sciences led her to enter a field combining engineering and medical disciplines, and personal experience inspired her as well.

“My initial motivation to pursue biomedical engineering came from my father, who has Type-2 diabetes,” said Dayal. “There are millions of people who are affected by similar diseases which have no permanent cure today. I believe that a degree in biomedical engineering will enable me to develop skills that I can apply to invent breakthrough technologies at affordable cost which will be accessible to the poorest of the poor.”

Her focus toward this goal is in the area of tissue engineering, regenerative medicine, and biomaterials. She gained practical experience with these during her sophomore year when she returned to India to work at the Textile Research & Application Development Centre.

“I received hands-on experience to work on different processes and the manufacturing machinery of textiles,” said Dayal. “Textiles these days are used as biomaterials in the area of tissue engineering. This experience exposed me to the environment of an R&D center, and reinforced the importance of using scientific fundamentals for the development of a product.”

Last year, she was named Outstanding Junior in Biomedical Engineering for her efforts in class and in the field.

“I had a mixed feeling of ecstasy and surprise when I first received the news,” said Dayal. “It was a delightful moment to get recognized for my hard work and perseverance. I felt thankful to my parents and my professors who supported me throughout the journey and believed in me.”

Since her first day at UT, Dayal has explored more of the area’s culture, enjoying bowling, movies, and concerts in downtown Knoxville—and a taste of home at nearby Indian restaurants.

“I enjoyed the cultural and intellectual diversity,” she said. “The teaching faculty is extremely good and they always were ready to provide help. My colleagues were also supportive and sharing in nature.”

The nurturing atmosphere and support of her fellow Engineering Vols adds to Dayal’s momentum towards earning a PhD after her graduation in 2019.

“Additionally, I want to thank my academic advisers for their valued guidance,” she said. “The university has provided me an excellent environment to pursue my professional and social objectives—ultimately leading me to become a more responsible citizen.”

Engineering and Marketing Take Off Like a Rocket

Writing and photography by Randall Brown.

The Marketing 462 team knew it was going to need an engineer when it launched a plan to build a better rocket stove. They reached out to Department Head Matthew Mench and Todd Reeves, director of the college’s Engineering Professional Practice program, to find a student who fit the task.

Enter aerospace engineering student **Robert Nickel**, who knows a thing or two about actual rockets.

“For the last few years, I have led the Hybrid Rocket Development Team for the Student Space Technology Association,” said Nickel, who brought multiple skills to the table. “When I started collaborating with the marketing department, they were in need of a student with experience in CAD modeling to help prepare files for their 3D-printed rocket stove.”

And what is a rocket stove, anyway? It’s a do-it-yourself design that many outdoor enthusiasts assemble in their backyards with welded scrap material.

> **“It is called a rocket stove because the design sucks in air at a fast rate, which produces a rocket-like noise.”**
> **—Luke Whitehead**

Their task was to design a more efficient stove and have it 3D-printed by their project partner, local alumnus-owned company Volunteer Aerospace.

The heat from the fire in a rocket stove creates a convective current that pulls more air into the device, which efficiently burns more of the fuel away, minimizing smoke and embers.

“Since Robert has CAD experience and heat-transfer knowledge, he was able to fill the knowledge gap on what sort of designs would work and what would not,” said Whitehead, a business student on the team. “It allowed us to focus more on other features that would add to marketability—user friendliness, etc.”

Nickel modeled the airflow and heat transfer through the rocket and also identified other features to improve the heating of a small cooking pot.

“The end result was a double-walled rocket stove, using air inside the wall to insulate the stove and reduce heat loss,” said Nickel. He also added a turbine to swirl the incoming air, further enhancing the efficient burn.

“Such a design would be difficult with traditional manufacturing techniques, as the stove would have to be made in several pieces, then welded or bolted together,” he said. “But additive manufacturing allows for the entire stove to be printed in one piece.”

The mix of marketing and engineering gave both students new insight into their respective fields and the possibilities of future collaboration.

“This was a great opportunity to put several engineering skills I’ve developed through my years at UT to use in a real-world project,” said Nickel. “I was able to utilize concepts learned experimenting with hybrid rocket propulsion to improve combustion in the limited space available in the stove.”

“We each got a better appreciation for what the other colleges can bring to the table,” said Whitehead. “As a business student, I tend to think in terms of what will sell, but sometimes do not stop to think about the engineering that must go into products.”

Resistance Reimagined

By David Goddard. Photography by Kelsey McConachie.

There's a revolution brewing in competitive swimming, and it traces its roots back to a MABE project.

A team of recent MABE graduates invented a swim resistance device under the guidance of Associate Professor Emeritus J.A.M. Boulet's senior design course, which presented real-world problems to teams of students.

UT swimming and diving associate coach Lance Asti brought one such project to the department.

Asti said that resistance devices that help instructors teach their swim teams are “very expensive, very bulky, cumbersome, and time-consuming,” requiring weights to be moved and machines to be reset for each individual.

The team’s frustration with the current selection of contraptions led to Asti submitting it to MABE, where fate intervened.

“Students in the class made a list of what our strengths were and Dr. Boulet created teams out of those lists so that each unit would be a mix of those abilities,” said Kelsey McConachie, who served on the project. “We pulled topics out of a hat, so it was literally the luck of the draw that we wound up working on this.”

The “this” that McConachie, Isaac Nolan, Thao Strong, and Ryan Tinker worked on was a solution to Asti and the swim team’s dreams: a resistance device that is far more user friendly than past systems.

Nolan, an avid hunter and outdoorsman, kept coming back to the idea of a fishing reel; Small, compact, and mobile, reels are essentially a pulley system that could meet both the needs of the swimmers as well as answering the key wants of the coaches.

Coordinating with Asti over the course of a year, the students tested prototypes in the pool with UT swimmers, settling on a final device.

“The feedback from the team was invaluable,” McConachie said. “None of us were that familiar with competitive swimming, so we had to lean heavily on the team for information that helped us shape the prototype and for information on how it was performing.”

Housed in a small rectangular box are two compartments containing the mechanical components, with an external section which allows swimmers to choose resistance levels.

Once connected to the diving platform as an anchor, the device enables two swimmers to use it simultaneously—even self-reeling at the end of use—and can be adjusted for any pool.

> “Once we started to have success with it, the team suggested it might be worthy of a patent, so we got in touch with the UT Research Foundation and it took off from there,” McConachie said.

In fact, the team’s device became the first undergraduate project to be licensed by UTRF and was purchased by a sporting goods company that hopes to bring it to market.

“This group of students developed a solution to a specific problem identified by the customer,” remarks UTRF Vice President Maha Krishnamurthy. “We couldn’t be more excited that this is UTRF’s first undergraduate technology to be licensed and cannot wait for the product to go to market sometime next year.”

While seeing their work become commercially viable was special for the team, McConachie said that the process was personally redeeming for her in a different way.

“You spend so much time as an undergraduate learning concepts and theory, so it was neat to put it all together in a tangible way,” McConachie said. “It made us all feel like we’d moved from class work to ‘true engineering.’ To end your academic career that way is awesome.”

McConachie said that the team has continued to stay in touch and is working with the sporting goods company to perfect a final product for market.

The swimmer is attached by a harness to the box that provides effective resistance.

A Helping Paw

Johnson, dogs, help residents find closure after hurricanes

By Kathy Williams.

On October 10, 2018, Hurricane Michael made landfall in the Florida Panhandle causing catastrophic damage to Mexico Beach and Panama City. The hurricane was the strongest storm on record in the Panhandle and was the third most intense Atlantic hurricane to make landfall in the US in terms of pressure since 1969. The 155 mph winds flattened numerous homes and felled countless trees.

The aftermath of the storm was horrific with streets filled with piles of debris and ruins, power outages, and hundreds of missing persons.

Professor **Jackie Johnson** and her search dogs Gizmo and **Crush** (pictured above) were deployed to help find possible survivors trapped in the rubble or bodies of those killed by the storm.

Johnson, a K9 handler for the Federal Emergency Management Agency (FEMA) Urban Search and Rescue Tennessee Task Force 1, spent 11 days helping with search and rescue efforts in Mexico Beach, one of the hardest-hit areas by Hurricane Michael.

Johnson is on call every third month to help if the Task Force is deployed. There are 28 Task Forces in the


Photo by earthobservatory.nasa.gov

US and who gets deployed depends on geography, a national rotation, and the rotation within each Task Force. “As individuals, we don’t deploy often, but the team deploys 2-3 times per year to the big events,” said Johnson. “In general, I personally will deploy to a big event every one to two years interspersed with a few local human remains searches.”

“Hurricane Michael was the biggest event I have been to and the most rewarding, the scale of damage was enormous,” added Johnson.

Both dogs Johnson deployed with are certified by FEMA, with Gizmo being a live find disaster dog and Crush being a human remains dog.

The dogs are trained to alert by barking if they are on a search and think they may have found a survivor or body.

“My job on the rubble pile is to point to where the rescue crews should dig and move on,” said Johnson. “I may or may not hear if they found anyone, and I don’t in general see any human remains although we train with human remains and sometimes whole bodies.”

A great deal of the work during the deployment was searching without finding anyone, termed blank areas; they also had some positive finds and were able to bring some closure to the families.

Crush is a Belgian Malinois and belongs to Johnson. Gizmo is a black Labrador and belongs to the Task Force and lives with another handler, but Johnson certified with him so she was deployable while certifying her own dog.

There are fewer than 400 dogs in the US certified by FEMA and Crush was certified only four days before they were deployed to Florida.

Johnson started search and rescue in 2005 with a German Shepherd named Largo as a live find wilderness search dog. Over the years, she has had several dogs and trained a couple for the Task Force.

The dogs go through two years of extensive training to be certified.

She recently certified her own live find disaster dog, a pit-collie rescue named Coco. She is currently training a Malinois/Dutch Shepherd mix named Gabby. “She is a former drug dog, but decided she didn’t like drugs,” said Johnson.

Johnson is honored that she and her dogs were able to help after Hurricane Michael and experience firsthand how all of the training she and the dogs have gone through pays off.

Dean's List Fall 2018

Summa Cum Laude

Aerospace Engineering

Teague A. Aarant
Camille E. Bergin
Christopher J. Busic
Matthew B. Carter
Ethan M. Cerrito
Brian G. Coulter
Nicholas D. Crowder
Jonathan A. Dixon
Iliane S. Domenech
Isaac W. Grant
Timothy L. Grizzel
Jesse R. Groves
Jacob A. Hale
Trenton S. Henderson
Cooper C. Jenkins
Gavin W. Jones
William A. Jones
Ryan E. Kelly
Shelby Y. Ledbetter
Ethan Long
Connor M. Lynch
Jeffrey M. Martell
Spencer T. McDonald
Samuel R. Pankratz
Sang Hyeok Park
Samantha L. Ramsey
Carl N. Reeves
Chapel R. Rice
Cayse D. Rogers
Caleb J. Ross
Benjamin B. Rubera
Colter W. Russell
Harrison G. Shay
Tyler M. Sundstrom
Tyler R. Sussmane
Matthew R. Trainer
Charles D. Wallen
Samuel B. Walters
Colby D. Warden
Caleb E. Weatherly
Stewart R. Whaley
Andrew T. Wilcox
Jeongmin A. You
Alicja Zeligowska

Biomedical Engineering

Ahmad Alharithy
Jami E. Anderson
Zachary D. Barnette
Alexander H. Barrett
Nicole J. Beautz
Taylor A. Berger
Samantha Z. Bratcher
Sarah P. Brock
James N. Corbitt
Lainee N. Darrow
Simran Dayal
Aissata Diallo
Noah B. Dover
Ashlee N. Durthaler
Joshua D. Duzan
Omar N. Elkhayyat
Sarah Enani
McKenzie R. England
Brett M. Evans
Rachel D. Fisher
Grace N. Forbes
Christopher R. Forsyth
Brooke L. Fortune
Kayla B. Franklin
Eleni Golloshi
Jordan L. Grant
Anneka J. Granvold
Casey N. Gredzieleski
Nathaniel L. Hauser
Carson D. Helton
Megan E. Hines
Gillian E. Holcomb
Mykenna C. Horchak
Victoria R. Howard
Elizabeth A. Jelinek
Lauren T. Jennings
Emma D. Johnson
Justin T. Karl
Caitlyn H. Kicza
Becka Lynn A. Klein
Matthew R. Kushnir
Samantha N. Lange
Brittani A. Lopez
Delaina K. McDonald
Sarah A. Meeks
Miroslava I. Migovich
Courtney C. Mobbs
Bradley S. Moore
Courtney A. Nakamura
Gabriel M. Niebel
Caleb H. Noe
Christopher B. O'Brien
John W. Oberman
Hannah N. Olsen
Caitlyn B. Parsons
Megan E. Pitz
Jamie Pouncey
Solomon J. Price
Noah P. Robison
Matthew M. Rowe
Benjamin L. Savitz
Jillian M. Schwendeman
Kelsie Shea
Micah A. Shirran
Elijah D. Smith
Kaitlin A. Smith
Luke M. Stanley
Kaitlyn A. Stephens
Carli M. Stewart
Katherine E. Stiles
Mitchell T. Stockinger
Reagan E. Toll
Mckayla L. Torbett
Carmelo V. Venero
Guy D. Waggoner
Virginia L. Webster
Lauren E. Williams
Steven G. Wilmoth

Mechanical Engineering

Alexander W. Arbogast
Chad F. Arnold
Griffin S. Bedell
Miranda Bedics
Nathan T. Bingham
Dana M. Bjorn
William J. Blankenship
Samuel Botto
William A. Botts
Leegan M. Boudreau
Mallory N. Bowers
William R. Bowers
Carter W. Breeding
Donovan L. Briley
Erin Brown
Jesse R. Buckley
Michael J. Buckley
Michael W. Burnside
Jesse Butler
Rory M. Butler
Joseph A. Camacho
Amy L. Carpenetti
Ryan M. Carter
Dakota Cauthen
Austin S. Chapel
Zane Chapman
Elijah P. Charles
Caleb J. Cook
Corey R. Crawford
Ian A. Daffron
Adam T. Daniel
Austin M. Davis
Tanner C. Davis
William P. Davis
Alexandra N. Defilippis
Edward Deiderich
Abigail L. Digsby
Daniel R. Dirscherl
Emma A. Drum
Alexandra Dubuc
Colton T. Duckworth
Ryan J. Dunaway
Ryan J. Durkee
Zackary W. Emery
William C. Fair
Garrett D. Foust
Christopher J. Fowler
Corinne E. Gerhold
Aniket A. Ghare
Joseph C. Goble
Conner W. Godbold
Grayson D. Gregory
Clark A. Hall
Shannon M. Hall
Justin H. Harmon
Carlton L. Harwood
Grant D. Hay
Jeremy L. Hensley
Ashley A. Herbers
Sarah R. Higginbotham
Lauren C. Hunter
William A. Hunter
Zaky G. Hussein
Sabrina N. Iezzi
Bethany D. Jones
William E. Kerr
Cheyanne N. King
Benjamin L. Koudelka
Kurtis A. Kuipers
Rebecca R. Laughon
Seunghyun Lee
Brooks M. Leftwich
Isaiah G. Linkous
Benjamin R. Luffman
Jacob T. Maine
Matthew B. McAmis
Elijah D. McDearman
Landen G. McDonald
Zebulon G. McReynolds
Iris N. Melara Guzman
Kirillos Mikhaiel
Sheridan A. Monroe
Clamon M. Moody
James A. Moore
Jamison N. Murphree
Ian E. Murray
Zachary B. Nolan
Liam F. Page
Junsung Park
Seth T. Parker
Steven D. Patrick
Taylor N. Patterson
Sebastian Sanchez
Richard L. Sarten
Shannon R. Sharp
Connor J. Shelander
Samantha B. Shoffner
Dustin V. Shults
Jeremy A. Siler
Maximilian Smith
Brandon T. Solsbee
John P. Spires
Eilish Stanek
Richard H. Swan
Samuel C. Swayne
Riley S. Tavassoli
Benjamin F. Thieme
John F. Thress
Elliott C. Thurman
Barrett S. Tillman
Mitchell A. Trotsky
Parker E. Trulove
Ethan C. Vals
Eric J. Vercellone
John A. Ward
Steven R. Williams
Jackson K. Wilt
Gennick J. Yoshioka
Preston M. Young
Jonah F. Zahn

Magna Cum Laude

Aerospace Engineering

Benjamin C. Barnhill
Chad Batten
Abigail L. Chubb
Zackery C. Crum
Sean M. Darling
Coleman R. Davis
Kyle V. Dolwick
Daniel E. Epperson
Marcos Escudero
Grayson T. Foster
Andrew E. Healan
Seth R. Holladay
Ryan A. Massey
Gillian S. McGlothin
Matthew F. McVey
Abhi Mistry
Soham Paul
Nicholas R. Powers
Daniel A. Rudolph
Ethan M. Savey
Edward M. Self
Joshua D. Stephenson
Christopher W. Violet

Biomedical Engineering

Alexandra N. Anthony
Rebecca L. Blackburn
Robert L. Borkoski
Christopher M. Cochran
Tristan A. Davenport
John T. Deinhart
Gehrig Q. Elkins
Madeleine M. Fitts
Emily C. Gable
Sydney M. Garrett
Kellen J. Glasscock
Peyton A. Holman
Kinley A. Koontz
Mitchell J. Langley
Natalie V. Ledezma
Sydni B. Lollar
Olivia A. Lowman
Bryce L. Manner
Andrew J. Miller
Shannone Paik
Michael E. Radick
Carson C. Smith
Lauren A. Smith
Noah D. Stambaugh
Kyle T. Steele
Brady A. Stokes
Adam S. Throgmorton
Christian A. Waksmunski
Gideon M. Wall
Daniel P. Woods

Mechanical Engineering

Demiana Barsoum
Chase A. Blackwell
Kassidy M. Boone
Evalynn C. Borrego
Michael P. Bowman
Nathaniel C. Brandt
William T. Bright
Daniel E. Brimer
Carson D. Buchanan
Andre C. Bucks
William C. Buttrey
Matthew C. Cagle
Christopher J. Cannon
Courtney T. Cartwright
Wilton M. Chapman
Taylor M. Chartier
Connor J. Cooke
William B. Darlington
Riley A. Farnsworth
Jacob M. Foard
Caleb M. Fox
Robert S. Garibay
Mac R. Gasque
Aaron M. Gerhard
Gabriel A. Gonzalez
Gregory M. Gorman
Jacob N. Groothuis
Tucker D. Hall
Nicholas K. Hassler
John K. Heilig
Robert W. Herrell
Jade E. Hills
Joseph T. Hoots
Alexander S. Horton
Dalton I. Houser
Luke E. Ihrig
Noah Johnson
Taylor W. Jordan
Kevin D. Kite
Kelsey N. Klett
Ryan P. Knapp
Rebecca A. Link
Case H. Martin
Joseph S. Mathes
Ellen N. Maye
Michael S. McClanahan
Bradley W. McClure
Garrett T. Mesmer
Mitul N. Mistry
Matthew J. Montgomery
Stephanie K. Paradissis
Tyler N. Patterson
James M. Pearce
Celeste A. Pelletier
Matthew D. Perlov
Thomas M. Pinion
Wade H. Price
Grayson A. Purdy
Yuvraj M. Sriram
Jenna C. Stevens
Carter J. Sutton
William C. Tourville
Steven C. Trimble
Zachary M. Tucker
Juan E. Vidal Murphy
Luke E. Welch
Wilbert E. Wheeler
Tanner O. White
Jesse M. Wilson
Kaifeng Xin
Ethan L. Zook
Nisarg B. Patel
Wade H. Price
Matthew T. Puleo
Joshua R. Reed
Joshua H. Richardson
Ryan B. Rife
Kiel T. Russell
Daniel W. Salyer
Austin J. Taylor
Eric J. Vercellone
John A. Ward
Jackson K. Wilt
Trenton B. Yount

Cum Laude

Aerospace Engineering

Patricia R. Abernathy
Hayden P. Allen
Aidan L. Baird
Matthew E. Bolyard
Adam J. Cain
Noah T. Compton
Quinn Eberhardt
Kenta P. Funada
Nathaniel L. Graham
Samuel D. Henderson
William A. Huffman
David M. Kight
Brett A. Kim
Devon L. Malabey
Garrett T. Mitchell
Caleb M. Morgan
Willie N. Parker
Jason Patel
Raj V. Patel
Killian E. Samuels
Anela L. Shanley
Christian T. Sharpe
James W. Strickland
Ryan A. Tosh
Katherine N. Vasiloff
Daniel M. Wilson
Gabrielle T. Witt

Biomedical Engineering

Sara B. Aboeleneen
Michelle L. Claxton
Ashley N. Drake
Gabriel Isaac
Amalia L. Kappel
Alicia A. Matavosian
Ivy K. Milligan
Tyler P. Morris
Edward Orzechowski
Breanna J. Poteat
Andrew C. Richard
Jakob A. Schlacter
Emily B. Schulman
Taggart C. Stork
Allen R. Swetman
Andrew B. Ten Eyck
Katherine C. Wallace
Gavin L. Warrington

Mechanical Engineering

Ifedayo A. Akinduro
Nabeel K. Baaklini
Shafer L. Beary
Benjamin L. Black
Georgiana S. Blue
Kelly E. Bond
Stephen D. Botto
Taylor Briggs
Jarrett M. Bristol
Austin M. Bryan
Brendan J. Caldwell
Steven B. Campbell
Kevin R. Carini
Robert L. Carlton
Taylor L. Carter
Cole D. Collins
Allan W. Coste
Jordan M. Cummings
Frank Dam
Jonathan R. Dang
Katie S. Davis
Lauren E. Davis
Jacob T. Dearmond
Andrew K. Dove
Cameron T. Eanes
Jared P. Elrod
Richard H. Estey
Eric G. Evans
Evan C. Filson
Thomas J. Frye
Joseph Gauspohl
Robert L. Glass
Robert C. Goeke
Brendan D. Goulde
James C. Grandin
Alexander D. Hadley
Rachel C. Harris
Andrew W. Hatcher
Caleb W. Heffner
Jared J. Hopland
Lee W. Howell
Camryn J. Hurley
Joshua C. Johnson
Tarun K. Kukreja
Zachary G. Latham
Lauren E. Lester
Casey A. Long
Jace A. Lyon
Matthew D. Magee
Jacob Melton
Christopher J. Mobley
Graham Y. Montgomery
Joshua N. Morcos
William J. Nesbit
Tyler J. Newsom
Waleed Z. Nofal
Jacqueline A. Noll
Benjamin J. Ordway
Nicholas J. Pate
Tyler D. Petersen
Frances O. Pfeifer
Joshua B. Phatsadavong
Blake A. Pitman
Luke Randall
Matthew J. Rogers
Dustin J. Samples
Francisco J. Sanchez
Santanna G. Santiago
Cason C. Scarce
Aidan T. Searle
Malay J. Shah
Justin P. Shropshire
Nicholas C. Taylor
Mark R. Terrones
Samuel M. Thomas
Dylan C. Townson
Matthew S. Umsted
Bradley J. Walker
William C. Webb
Peyton M. Whitehead
Jacob M. Wimmer
Trenton B. Yount

Faculty Notes

Uday Vaidya and his team of UT students created the carbon fiber composite beams for the new Friendship Bell Peace Pavilion in Oak Ridge. The team produced the beams over a period of three months from a concept using several manufacturing technologies, including overbraiding carbon fiber and vacuum infusion molding.

Vaidya is the UT-ORNL Governor's Chair for Advanced Composites Manufacturing and chief technology officer for the Institute for Advanced Composites Manufacturing Innovation. The UT team that worked on the project was guided by Stephen Sheriff, process engineer at the Fibers and Composites Manufacturing Facility, and included 15 graduate and 10 undergraduates who work at the facility.

Attendees celebrated the ribbon cutting from the comfortable vantage point of additive-manufactured bench-seat backs created at DOE's Manufacturing Demonstration Facility at Oak Ridge National Laboratory.

Professor **Bill Hamel** received the IEEE Robotics and Automation Society George Saridis Leadership Award in Robotics and Automation at the 2018 IEEE/Robotics Society of Japan International Conference on Robotics and Intelligent Systems held in Madrid, Spain, last October.

This award is the society's top award for leadership, and recognizes outstanding contributions of an individual for his/her exceptional leadership, and dedication that benefit the IEEE Robotics and Automation Society.

Hamel was recognized for his "continued leadership that has significantly contributed to the growth and development of robotics in hazardous environments and to the IEEE Robotics and Automation Society."

Prior to joining MABE, Hamel worked for 31 years at the Oak Ridge National Laboratory where he led and performed research and development in the general areas of robotics, automation, and remote systems for hazardous nuclear, space, and military applications. He is a fellow of IEEE and ASME and received the American Nuclear Society's Ray Goertz award in 2015 for his contributions to robotics and remote handling.

Professor Raja Chatila (right), past president of the IEEE Robotics and Automation Society, and Professor Hamel (left).

Professor **Mark Balas**, who is located at UTSI, received the 2018 AIAA Aerospace, Guidance, Navigation, and Control award. The award is given biennially and is considered a lifetime achievement award. It recognizes individuals who have made important and substantial contributions in the field of guidance, navigation, and control. Balas was nominated for his sustained excellence in developing the frontiers of theory and practice in advanced adaptive control systems. Balas pioneered the study of evolving systems for engineering applications and is the founding director of the UTSI Center for Autonomous and Evolving Systems.

Assistant Professor **Dustin Crouch** was one of four individuals selected from a nationwide pool as a scholar for the Interdisciplinary Rehabilitation Engineering Research Career Development program (IREK12) in Movement and Rehabilitation Sciences. IREK12 is a 5-year program with the goal to recruit and train scholars with engineering and other quantitative backgrounds to become successful rehabilitation scientists in basic, translational, and/or clinical research.

Crouch will receive a financial award this fall that includes one year of salary support and funding to build his research program in rehabilitation science. Additionally, he will meet regularly with clinical and engineering mentors and participate in other events to accelerate his career development.

"I'm very grateful that I was selected for the prestigious IREK12," Crouch said. "The funding provided by the award will cover research expenses and give me more time to focus on research activities as well as help me be a more effective researcher by providing formal professional development training and faculty mentors."

Professor **Hans DeSmidt** is part of the Revolutionary Vertical Lift Technology Advanced Propulsion Team that received the NASA Agency Honor award, one of the highest awards in the agency. The team was recognized at the 2018 Agency Honor and Center Awards Ceremony last September.

The award was given in recognition of the exceptional contributions the team has made to NASA's mission and purpose in the area of rotary-wing aircraft and vertical flight technology.

The team developed innovative technologies that efficiently reduce the main rotor speed between hover and cruise for the next generation of high-speed vertical lift vehicles, overcoming barriers for reduced noise, fuel burn, and operating cost as well as increased speed, payload, and range.

The program was created by forming a collaboration between industry, universities, and government agencies to fulfill NASA's vision for vertical lift vehicles to capitalize and improve unique vertical capabilities to greatly benefit the nation's growing civil flight requirements.

DeSmidt was CO-I on several projects under this program.

Associate Professor **Trevor Moeller** has been named vice-chair of the AIAA Plasmadynamics and Lasers Technical (PD&L) Committee. His two-year term begins in May. Moeller will lead the technical committee's memberships and help the chair run the committee. The committee's scope is physical properties and dynamic behavior of fluids in states of ionization and/or population inversion, with an emphasis on those features and applications of particular importance to the fields of aeronautics, astronautics, and energy.

Alzheimer's® Tennessee
www.alzTennessee.org

Zhao's Group Gets Support from Alzheimer's Tennessee

By David Goddard.

Associate Professor **Xiaopeng Zhao** has spent his career researching the brain and the mysteries it holds. One of his latest efforts focuses on slowing the rate of cognitive decline by giving the brain what amounts to a computer "workout."

"Sustained attention, which we call vigilance, is key to performing certain tasks like driving a vehicle, where any lapse can have tragic consequences," said Zhao. "Our goal is to use computer-based neurofeedback to improve memory and attention in cognitive-impaired people."

Recognizing the potential of the research, Alzheimer's Tennessee has backed the project with $35,000 in support.

"Alzheimer's Tennessee is excited to support this research because it has the potential to help the 110,000 Tennesseans living with Alzheimer's disease right now," said Janice Wade-Whitehead, CEO and president of Alzheimer's Tennessee. "Our mission is to champion research, serve those affected by dementia, and promote brain health. The use of computer technology to potentially slow cognitive decline hits all three of those mission priorities."

Current monitoring efforts are performed through functional magnetic resonance imaging (fMRI), which monitors blood flow in the brain to study brain activity.

Where Zhao's method differs is that it will use an electroencephalogram (EEG)-based interface to study patients, which is far more cost effective, faster, and less inconvenient to patients than standard methods.

All an EEG requires is that the patient slips what looks like a ski mask with sensors over their head for the test.

"We show them a series of images divided into male and female and into indoor and outdoor," said Zhao. "We'll ask them to focus on only one specific type, such as male and indoor, and measure the activity when those images appear versus when the other ones appear."

As the test proceeds, "correct" focus is rewarded with better resolution on the images, while "incorrect" focus results in grainier images, making the person focus, in theory, even harder.

To ensure patients begin with images that are suitable to their current cognitive levels, Zhao has teamed with Associate Professor Yang Jiang at the Sanders-Brown Center on Aging at the University of Kentucky to better evaluate the results.

Emeritus Professor Jack Wasserman Passes Away

Jack Wasserman, who was a professor of engineering science and mechanics and headed the biomedical engineering program at UT, passed away last August at the age of 77.

Wasserman taught at UT for 31 years until his retirement in 2010. During his tenure, he developed course content for several biomedical engineering classes and received numerous departmental, college, and university teaching awards.

Wasserman was involved in the fitness industry for over 20 years. He was a certified water aerobics instructor and director of the water exercise program at Court South fitness center in Knoxville. He enjoyed teaching aquatic fitness classes where he could incorporate engineering and medical concepts into his classes.

In 1997, he teamed up with several other UT professors and developed two aquatic fitness units: the AquaCruiser and the AquaSlider, which helped people move their muscles under water without damaging their joints. The machines were sold to fitness clubs and small medical organizations. In 2003, he developed Fitness Learning Systems to provide quality continuing education eLearning products and services to the health-fitness industries.

Alumni Notes

In Memoriam: Trailblazing Female Engineer Margaret Sanders Drake

Margaret Drake, who our records indicate was among the first female graduates in engineering at UT, passed away last October at the age of 83.

Drake received a bachelor's and master's degree in mechanical engineering at UT, and went on to receive a PhD in mechanical engineering from the University of Kansas, paving the way for women entering the field.

Drake joined the faculty at the Ohio State University in 1979 where she taught thermodynamics, heat transfer, and design for nearly three decades. Drake's love of teaching and travel led her to teach internationally, delivering several lectures in Malaysia through a program with Purdue University.

During retirement she also traveled extensively with People to People to understand heating and engineering challenges in different parts of the world.

Drake served as president of the Columbus, Ohio, chapter of the American Society of Heating, Refrigerating, and Air-Conditioning Engineers for several years and, according to her family, was the first female member of the Richmond, Virginia, chapter.

Parang Retiring After 41 Years with Department

For **Masood Parang**, working at the University of Tennessee has always been about one thing: students.

Parang, the college's associate dean for academic and student affairs, announced his intent to retire in 2019 after 41 years in the college as a faculty member and administrator.

"I just feel like it's time for a new face to hold this position," said Parang, who is also a professor in the Department of Mechanical, Aerospace, and Biomedical Engineering. "I'm the oldest person in the college's administration, and I felt like this period of transition where we've had three deans in less than a year was the perfect time to make this move."

Parang came to UT from the University of Oklahoma, where he earned his bachelor's, master's, and doctoral degrees in 1971, '72, and '75, respectively, and was an assistant professor at the time.

He said he took interest in a job in what was then the Department of Mechanical and Aerospace Engineering after faculty members he knew in the department encouraged him to apply.

Starting as an assistant professor in 1977, Parang eventually became associate head of the department, playing a key role in helping it merge with the Department of Engineering Science and Mechanics in 1996 and laying the early foundation for biomedical engineering, which became an official part of the department in 2004.

"We've undergone a lot of changes, taken on a lot of challenges since I first came to UT," said Parang, who became associate dean in 2004. "Back then, we were primarily a teaching college, meaning we taught students how to do various engineering applications, but we underwent a real sea change and have since become a research-focused institution. That didn't happen overnight, and it didn't happen without careful planning, years of implementing ideas, and faculty buying into the idea."

Through all the changes, Parang has always kept his focus on students and on increasing their opportunities to excel.

As a professor in the mid-90s, he helped students design and conduct experiments with NASA in micro-gravity environments.

To achieve such a setting opened the students up to experiencing a vehicle described as both infamous and awesome, the "vomit comet," a KC-135 plane that flies in a high-arching parabola, giving passengers several seconds of weightlessness as it makes the peak and descends.

"It was a lot of fun for the students, but a very rigorous process," Parang said.

So proud, in fact, that pictures of the teams who took part in the NASA projects adorn his office. What's missing from the photos? Parang himself. As always, students come first.

T&T Scientific Grows into Larger Facility

By Kathy Williams.

T&T Scientific, a medical technology company owned by MABE alumni **Graham Taylor** and **Nima Tamaddoni**, has a new home in Halls, Tennessee. An open house and ribbon cutting ceremony was held in February to celebrate the move to the 15,000-square-foot facility.

(L-R), Nima Tamaddoni and Graham Taylor cut the ribbon at the open house.

Taylor and Tamaddoni met as doctoral students in MABE while working with artificial cell membranes in Assistant Professor Andy Sarles' research lab. They became research teammates and worked together to solve problems and frustrations they had with some of their lab tools. This led to the pair becoming business partners and founding T&T Scientific in 2015, one year before Tamaddoni and Graham graduated with their PhDs in mechanical engineering and biomedical engineering, respectively.

Funds the team won in pitch competitions, including the Boyd Venture Challenge, helped launch the sale of their first product, the LipX Extruder, the world's first single-use disposable liposome extruder, which they manufactured in Tamaddoni's apartment.

A liposome is a spherical vesicle made from the same building blocks as a cell membrane and can be used as a vehicle to administer nutrients and pharmaceutical drugs.

Producing liposomes is usually time consuming, expensive, and prone to contamination, but T&T Scientific's devices are cheaper and ensure cleanliness and sterility while reducing the overall time of use from 45 to 60 minutes to just two minutes.

Nanosizers are now the company's main product, used to make tiny liposomes, which are used in academic research, drug delivery, cosmetics, food, and pharmaceuticals.

"Think about chemotherapy. Current chemo agents are extremely harmful to the human body because they're toxic. It's akin to poison," said Tamaddoni. "But with the ability to tailor the design and architecture of liposomes that encapsulate and hold the chemo agent, drugs can be delivered more directly to the cancerous tumor, causing less damage to healthy tissues."

The company launched a small-scale and large-scale automated extrusion device in 2017 and an additional machine with a different volume capacity in 2018.

They also offer in-house liposome manufacturing and research services.

T&T Scientific now has over 1,000 customers in over 45 countries and is setting up distributors in 25 countries. They moved to their new larger facility to expand their analytical capabilities, and contract research and manufacturing services.

"It's exciting, but not at all surprising, to see Graham and Nima's young company gaining momentum so quickly," said Sarles. "They have smartly positioned T&T Scientific to become a leader in the development, assembly, and characterization of liposome nanoparticles for drug delivery, and their new facility will certainly support their growth and greatly enhance their production capabilities. As their PhD advisor, I was lucky to get to know and work with them during their graduate careers and was routinely impressed by their technical capabilities, creativity, and work ethic. They are great people, and great representatives of MABE, TCE, and UT."

"To have the company become so successful feels absolutely great," said Tamaddoni. "It's just a start for us. We have several plans to continue growing the company every day, and with the same speed."

Their facility is just a short drive from UT and ORNL.

"The amount of supportive knowledge and high-end facilities at ORNL and UT are a key part of our future plans, and we will continue working closely with different labs in both of these institutions," added Tamaddoni.

They already have plans to work with Sarles at UT and Dr. John Katsaras and Pat Collier at ORNL-CNMS on Small Business Innovation Research (SBIR) projects.

They also want to expand their footprint to more countries, institutions, and companies and help make East Tennessee a go-to place for nanotechnology. in medicine and nutrition.

They are working to pass the regulatory burden and become a Current Good Manufacturing Practice (cGMP) and ISO certified to be able to expand their relationships with clients in the pharmaceutical and food institutions.

Send Us Your Photos

Do you have any photographs from your time as a student at UT? If so, we'd love for you to share them with us. MABE is collecting old photos of research projects, lab and classroom spaces, students, faculty, staff, and campus. Please send digital copies to ***williamk@utk.edu***. We look forward to rediscovering our past with your help!

Around the Department

1: UT's BMES Student Chapter leaders worked the MABE booth at the BMES conference in Atlanta, Georgia.

2: Department Head Matthew Mench poses with his senior design team and the golf cart they built for the college.

3: PhD student Denzel Bridges received the Best Student Poster Silver Award at the 2018 ORNL-CNMS project meeting.

4: Freshmen attended MABE's first welcome lunch at Neyland Stadium.

5: UT's AIAA Student Chapter took a group of 43 students to visit the Boeing facility in Charleston, South Carolina.

We Need Your Help!

Our Professional Mentoring program is growing and we need more mentors. If you have professional experience as an engineer, want to give back to MABE with your time, and have a desire to connect with our students and help prepare them for professional careers, you can be a mentor.

For consideration, sign up at *tiny.utk.edu/MABEMentor*

Join Jaqueria.
Join the Journey.

"When you step foot on UT campus, the opportunities are endless, you just have to look for them. I have taken advantage of the Engage Living & Learning Community, the Minority Engineering Scholars program, the National Society of Black Engineers, and Intercollegiate Summer Bridge. These programs helped form me into a successful college student and grew my professional skills. Receiving the Fred D. Brown Jr. Engineering Scholarship is an honor that is allowing me to fulfill my educational goals, focus on my future career, and worry less about financial expenses. I am highly appreciative to my award donors."

— Jaqueria Stout, Fred Brown Scholar, Fall 2018.

Join Jaqueria in guiding our students to become leaders in their fields.
Call 865-974-3011 or visit **giving.utk.edu/mabe**.

TICKLE COLLEGE OF ENGINEERING

DEPARTMENT OF
MECHANICAL, AEROSPACE &
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A group of students attended the AIAA Region II Student Conference and met NASA Astronaut Sunita Williams at the banquet. Williams is a veteran of two space missions and is currently training for the first post-certification mission of Boeing's Starliner spacecraft—the second crewed flight for that vehicle.