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DEPARTMENT OF
MECHANICAL, AEROSPACE &
BIOMEDICAL ENGINEERING

Alumni Newsletter

UT Research Offers Hope for Heart Valve Patients



MABE graduate student Shirin Masjedi applies a saline solution to rat cells so they can be dyed and viewed through a microscope.

Also in this issue...

MABE Opens Hall of Fame, MABE Celebrates 18 Nearly Continuous Months in Space, UT Leads Institute for Advanced Composites Manufacturing Innovation, Peter Hoffman Establishes Endowment.

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From the Department Head



As you may have heard in the news, lots of good things are going on with national recognition and ties to MABE. Barry "Butch" Wilmore and Scott Kelley have both been featured in national news as the previous and current commanders of the International Space Station respectively, commander Kelly was also recognized at the latest State of the Union Address before his one year mission started. What many people don't know is that the University of Tennessee Space Institute in Tullahoma (which has numerous faculty in MABE at that location as well) has awarded master's degrees

to nine students who have become astronauts. All of these headlines as well as other ongoing upgrades of our program were rewarded this year with a strong boost of nine spots, putting us up to 30th among all public universities in the latest *U.S. News and World Report* graduate program rankings in Aerospace Engineering.

The other big news this year is President Obama's announcement that the University of Tennessee will lead the \$259 million Institute for Advanced Composites Manufacturing Innovation, or IACMI. Several faculty affiliated with MABE played key roles in this amazing accomplishment, which falls on the heels of partnership in the \$140 million Michigan-based Lightweight Innovations for Tomorrow (LIFT) initiative. The department, with Oak Ridge National Lab, is without a doubt establishing itself as a national leader in advanced manufacturing.

Academically, we continue to recruit some of the best undergraduate students. Approximately 30% of our undergraduates made the Dean's list for the Fall 2014, which is a wonderful accomplishment. There are multiple faculty achievements as well that are featured in this issue, with more to come in future newsletters. I am extremely excited about the future of all three programs in this department, and expect much continued growth and improvement moving forward. For more rapid information, I encourage you to join our Facebook page.

Another source of pride for the department you can read about in this issue is the recent announcement of the inaugural class of the MABE Hall of Fame. These are four individuals who have reached the top of their profession and we are honored to count them as alumni and friends.

Finally, please keep sending us your pictures and sharing stories of your days at UT! These stories often get the most response from alumni, so please keep in touch, and send us some memories of your days at Big Orange!

Thanks again for taking the time to find out what's going on in MABE. I look forward to hearing from you and invite you to get in touch and stay connected.

Best regards,

Matthew Mench

@MABEDeptHead

Give to MABE: Volsconnect.com/MABE

MABE Opens Hall of Fame

This spring the MABE department opened its Hall of Fame, the first in the College of Engineering, to recognize and honor alumni who have made great contributions to the engineering field.

The inaugural class includes a chancellor, an astronaut, an automotive pioneer, and a former ASME president.

"The four inaugural hall of fame class members truly reached the top of their professions and have had profound positive impacts on so many people's lives, said Matthew Mench, MABE department head. "We are grateful for all they have done to represent our department."

The Hall of Fame is meant to honor those alumni and friends of the department who have contributed greatly to the engineering profession, and positively reflected this on the University of Tennessee, the College of Engineering, and the department.

"The development of a hall of fame for our department is long overdue," said Mench. "There are many wonderful examples of incredible engineers that could have been selected, and it was very difficult to choose the first four."

The inaugural class were formally inducted into the Hall of Fame at the MABE spring awards banquet.

Hall of Fame Inaugural Class



Rinehart S. Bright

Rinehart Bright received his BS in mechanical engineering in 1936. He worked his way through college by shoveling coal to help heat residence halls on campus. Bright had a career that spanned more than twenty-five years at Chrysler Corporation. His profession had him designing and manufacturing automobiles in New Orleans, Indiana, and

Detroit. He was credited as a pioneer in innovating the use of interchangeable parts across different vehicle platforms, a practice that is still in use today. He retired as vice president of Chrysler in 1977. Bright was the 1974 recipient of the Nathan W. Dougherty Award and served on the university's Development Council. He passed away in 2006.



Richard Rosenberg

Richard Rosenberg received his BS in mechanical engineering in 1954. He served at Oak Ridge National Laboratory, Westinghouse, and General Atomic in the course of his career and was a member of several mechanical engineering societies. Rosenberg was president of the national American Society of Mechanical Engineers (ASME) from 1987-1988 and received both the Dedicated Service Award

and Centennial Medallion from the group in 1988. He was named San Diego Engineer of the Year in 1988. In 2003, Rosenberg was named Honorary Member of ASME for his contributions to the engineering profession, an honor bestowed upon only 350 people since its inception in 1880.



Henry W. Hartsfield

Henry "Hank" Hartsfield received his MS in engineering science in 1971. He was UT's first astronaut, earning selection in 1969. He won NASA Distinguished Service Medals in 1982 and 1988; NASA Space Flight Medals in 1982, 1984, and 1985; the NASA Exceptional Service Medal in 1988; and was inducted into the US Astronaut Hall of Fame

in 2006 with more than 480 hours spent in space. Hartsfield passed away in 2014.



William T. Snyder

William Snyder received his BS in mechanical engineering in 1954 and advanced degrees at Northwestern University. He served as head of the UT Engineering Science and Mechanics Dept. in 1970, served as dean of the UT College of Engineering from 1983 to 1992 before becoming chancellor of the University, a role he held until 2001. Snyder was the 2001 recipient of the Nathan Dougherty

Award and the 1989 recipient of the University of Tennessee National Alumni Association Public Service Award.

—Kathy Williams

UT Celebrates 18 Nearly Continuous Months of Alumni in Space



Left to right: NASA astronauts and UTSI alumni Scott Kelly and Barry Wilmore

In September 2014, NASA astronaut and UTSI alumnus Barry Wilmore launched to the International Space Station (ISS) from the Baikonur Cosmodrome in Kazakhstan. He returned to Earth in March. Just two weeks after Wilmore's return from the ISS, fellow NASA astronaut and UTSI alumnus Scott Kelly departed for the space station.

Wilmore is a 1994 graduate of the UT Space Institute (UTSI) where he received his master's degree in aviation systems. He traveled to the space station with two Russian Federal Space Agency cosmonauts and served as a flight engineer for ISS Expedition 41 until he assumed command of ISS Expedition 42 in November.

During his six-month stay at the space station, Wilmore conducted experiments and completed three scheduled spacewalks. He also recorded a welcome address for high school students visiting UT as part of Engineer's Day. His time in space was chronicled on the ISS Instagram account. This was Wilmore's second visit to the space station. He piloted space shuttle Atlantis in 2009.

Kelly graduated from UTSI with his master's degree in aviation systems in 1996, two years after Wilmore. In March, he also launched to the ISS from the Baikonur Cosmodrome in Kazakhstan. Kelly will stay aboard the ISS for one year, returning to Earth March 2016. According to NASA, this is the longest space mission that has been assigned to a NASA astronaut. He will be onboard the ISS from Expedition 43 through 46.

Kelly's identical twin is former astronaut and current SpaceX consultant Mark Kelly. NASA will study them both while Scott is at the space station in order to learn more about the impact of spaceflight on the human body. They are the only siblings who have traveled to space.

Kelly was First Lady Michelle Obama's guest at the State of the Union Address January 20, and he was featured on the cover of Time magazine's December 29, 2014/January 5, 2015 double issue. This is Kelly's fourth space flight.

Kelly and Wilmore are two of the nine current and former astronauts who are UTSI alumni.

- Amanda Andrews

Research Being Done to Determine if Surgery Helps Children with Cerebral Palsy



Misagh Mansouri and Dr. Jeffrey Reinbolt

A child with cerebral palsy can have surgery done in which the rectus femoris muscle is disconnected from the front of the knee and reattached to the back of the leg.

The surgery can improve muscle function and the child's mobility or it could make the child more likely to lose balance and fall during tripping. The surgery has inconsistent outcomes and currently there is no way to know which children with cerebral palsy will benefit from the surgery.

Misagh Mansouri, a PhD student in MABE, and his advisor, Jeffrey Reinbolt, an assistant professor in MABE are currently researching the procedure and its effects. In a couple of years, thanks to this research, doctors may be able to predict which children will benefit from the surgery and which will be better off without it.

Mansouri combined two software programs to create a computer model that shows how the brain controls the way these children's bodies move when they walk. He used data collected by Gillette Children's Specialty Healthcare, a non-profit hospital in Minnesota that is an internationally recognized leader in diagnosis and treatment of children who have disabilities and complex medical conditions. The data showed how specific children would move before and after the surgery.

"A lot of study has been given to how the surgery affects the range of motion, but we wanted to know if and how that translates into actual dynamics of balance in children with cerebral palsy," Mansouri said. "Using the real-world data from our collaborations at the Gillette Children's Hospital, we created patient specific models of children with cerebral palsy for both pre- and post-surgery and with different crouch postures."

"Simulations can complement experiments to become a great asset to health care professionals," Reinbolt said. "We are working on using patient-specific simulations to improve not only treatment of movement disorders, but interactions between people and the environment as well."

Mansouri and his team, which included researchers from UT, Stanford, and the University of Australia, found with the simulation that "children who had the surgery were more likely to lose balance and fall during tripping than ones who did not, regardless of degree of crouched posture and whether they had the surgery on one side or both sides of their knees," Mansouri said.

"There are certainly more studies to be done and factors to be tested, but these results indicate that rectus femoris plays an intrinsic role in postural response to any challenges relating to balance."

Mansouri's research can hopefully translate into doctors someday being able to enter measurements into a computer to see if a child is a good candidate for the surgery.

Mansouri graduates in May but hopes to continue working on the project, adding details to see if gender and age of the children affect the outcome, and how other types of motion are affected.

The research was funded by the National Institutes of Health and the National Science Foundation.

-Kathy Williams



Misagh Mansouri giving an interview on NPR radio

Peter Hoffman Establishes Endowment



Peter Hoffman

UTSI alum Peter Hoffman has established the Louis R. and Ann S. Hoffman Endowment to provide engineering students who need financial assistance the opportunity to enter and complete an engineering program in MABE.

The endowment is named in honor of Hoffman's parents who instilled in him the importance of education.

"I have enjoyed a successful professional career and I owe much of my success to the preparation my BS from UT and MS from UTSI gave me," Hoffman said. "I felt it was the right time to give back to

the university in a more substantial way to recognize the benefits I have enjoyed from my UT education."

The Boeing Company, where Hoffman works as Vice President of Intellectual Property Management, is contributing a portion of the endowment through the company's gift match program.

Establishing the endowment has had a personal impact on Hoffman. "I expected it to be very transactional but I have found that the act of giving has helped personalize my relationship with the College of Engineering," Hoffman said. "Combined with my participation on the College of Engineering Board of Advisors, I feel like my relationship with UT has reached a level I have not previously experienced."

Hoffman encourages all alumni to contribute to the College of Engineering as soon as they have a secure job. "The impact of even a modest contribution is significant and the good feeling you get by giving back to the university is worth every dollar," Hoffman said.

To make a contribution to the College of Engineering visit [enr.utk.edu/give](http://engr.utk.edu/give) or call 865-974-2779.

- Kathy Williams

UT Engineering Receives \$37 Million In-kind Grant from Siemens PLM Software



The University of Tennessee, Knoxville, has received an in-kind software grant from Siemens PLM Software estimated at \$37 million for use in the College of Engineering.

The grant gives students access to the same technology used by automotive manufacturers, aerospace developers, and high-tech electronics companies.

The software will be used by the EcoCAR3 program, led by MABE Research Associate Professor David "Butch" Irick, who serves as faculty adviser for the team.

"It is certainly no understatement to say that a grant of this nature is a major boost," said Wayne Davis, dean of the College of Engineering. "This will certainly make a difference to the efforts of Butch Irick and his students working on EcoCAR3."

The software—specifically NX™ software for computer-aided engineering and Teamcenter® for Product Lifecycle Management, or PLM—will be used by UT's EcoCar3 team as it begins the first year of its competition. PLM software does exactly what the name implies by helping oversee the life of a product from the drawing board to eventual retirement.

Irick and his students have participated in all but one of the Advanced Vehicle Technology Competitions over the past twenty years, and contributions such as Siemens' have proved critical over that time.

"Having support like this grant makes taking part in the EcoCAR competition a reality," said Irick. "It would be extremely challenging, to say the least, without the generosity of companies like Siemens."

Siemens PLM Software's academic program encourages teaching and development across academic levels.

An in-kind grant serves as a way for corporations to provide much-needed resources or material to programs by eliminating the extra step of having to use traditional monetary grants for purchasing.

For Siemens, supporting programs like UT's provides the added benefit of ensuring that the best and brightest students in the US have a better chance to compete with those from universities around the world.

"Siemens PLM Software is dedicated to helping develop the next generation of highly trained and highly qualified engineers and technologists," said Bill Boswell, the company's senior director of partner strategy. "Our academic partnership with UT encourages students to pursue careers that will revitalize manufacturing in the US and around the world."

The EcoCAR3 competition is focused on the ability of university teams to take a Chevrolet Camaro and convert it into a hybrid vehicle without sacrificing any of the "muscle car" persona that the auto conveys.

Tennessee is one of sixteen schools in the competition, which pairs engineering students with business and communications students as part of the overall team goal of designing, marketing, and advertising the vehicle.

- David Goddard

UT Engineering Research Offers Hope for Heart Valve Patients

There could soon be new hope for those facing one of humanity's biggest health issues, thanks to research from the University of Tennessee, Knoxville, College of Engineering.

Cardiovascular diseases are the world's number one cause of death, with some estimates indicating that as many as one-third of the planet's deaths in a given year are attributable to some form of the disease.

While heart valve disease is only one of many afflictions falling under that heading, its widespread impact—affecting up to thirty percent of the elderly population in developed countries alone—makes it a key component of the overall problem of heart-related ailments.

Zannatul Ferdous, an assistant professor in UT's Department of Mechanical, Aerospace, and Biomedical Engineering, leads a research team addressing the issue, thanks in part to a BRIGE—Broadening Participation Research Initiation Grants in Engineering—grant from the National Science Foundation.

"Currently, the treatment option for valve disease is mainly end-stage replacement or repair surgeries, and no early treatment or detection options exist," said Ferdous. "The goal of our lab is to understand these diseases and develop alternate treatment options such as functional tissue-engineered heart valves."

One of the main issues with heart valves that the group is focusing on is what is known as calcification, a process where calcium deposits build up on the valves, eventually restricting the flow of blood through the heart.

By studying the root causes of calcification and constructing new heart valves through tissue engineering—using cells to construct organic human tissue—Ferdous and her group aim to eventually develop calcification-proof valves.

Perhaps the best way to fully understand the role of heart valves is to picture an intersection with a traffic light.

If the signal lights function normally, traffic will start and stop in an orderly fashion, heading in the correct direction at a normal pace. If the lights malfunction, traffic can mix, leading to chaotic or even deadly consequences.

In the same way, heart valves make sure blood flows at the right pace and in the right direction with each pulse of the heart. When a valve fails it can lead to blood leaking between chambers or even block off circulation completely.

"We are tackling calcification head-on, looking at risk factors from everything like age and gender to chemical factors and cell characteristics," said Ferdous. "At the same time, we are developing custom devices that will allow us to truly mimic all the forces at play in the heart."

"This will be a significant improvement."

- David Goddard



MABE graduate student Shirin Masjedi applies a saline solution to rat cells so they can be dyed and viewed through a microscope.



Shirin Masjedi, left, and Dr. Zannatul Ferdous view calcified aortic cells of rats. Ferdous' team of students are researching how to use tissue-engineering to build a heart valve that can resist calcification.



Graduate student Ying Lei prepares aortic pig cells to be put under mechanical forces to simulate bodily conditions.

Photos from the Knoxville News Sentinel/2015

White House Picks UT to Lead National Composites Manufacturing Institute



President Barack Obama (right) and Vice President Joe Biden (left) announce UT's leadership of IACMI at the Techmer PM plastics fabrication company in Clinton, Tennessee, in January 2015.

In January, President Obama announced that the University of Tennessee, Knoxville, will lead the Institute for Advanced Composites Manufacturing Innovation, or IACMI, a \$259 million public-private partnership. The Institute reflects a \$70 million commitment from the U.S. Department of Energy and \$189 million from IACMI's partners.

Supported by the Department of Energy's Advanced Manufacturing Office in the Office of Energy Efficiency and Renewable Energy, IACMI joins four other institutes backed by the Obama administration in a recent push to accelerate advanced manufacturing.

The selected team, a 122-member consortium, connects the world's leading manufacturers across the supply chain with universities and national laboratories pioneering advanced composites technology development and research.

Established as a nonprofit 501(c)(3) in Tennessee by the UT Research Foundation, IACMI has received a \$15 million commitment from the Tennessee Department of Economic and Community Development as part of an effort to facilitate breakthroughs in manufacturing and materials.

"This project places the university and its partners in a unique position to strengthen Tennessee's economy," said UT Chancellor Jimmy G. Cheek. "We are very honored to have been selected for this role in shaping the future of composites manufacturing through IACMI. This will build upon our deep collaborations with our consortium partners and spark innovation and growth within our nation's industries."

The Institutes are regionally organized around five focus areas: vehicles (Michigan); wind turbines (Colorado); compressed gas storage (Ohio); design, modeling and simulation (Indiana); and composite materials and processing technology (Tennessee supported by Kentucky).

"The UT Research Foundation's involvement to establish IACMI was critical to the project's success and will further the university's efforts to boost our state's economic development through the creation of new intellectual property," said David Millhorn, UT Research Foundation president and CEO, and UT System executive vice president and vice president for research.

IACMI includes founding partners in Tennessee (University of Tennessee and Oak Ridge National Laboratory), Colorado (National Renewable Energy Laboratory), Indiana (Purdue University), Michigan (Michigan State University), Ohio (University of Dayton Research Institute) and Kentucky (University of Kentucky).

Contributors come from many sectors

The Institute will focus on advanced fiber-reinforced polymer composites that combine strong fibers with tough plastics to yield materials that are lighter and stronger than steel.

The Institute has received commitments from large charter corporate contributors such as those with critical connection to the automotive composites supply chain like Ford, Volkswagen, Dow Chemical Company and DowAksa; premium members with national manufacturing impact like Boeing and Lockheed Martin; and small and medium enterprises like Strongwell Corporation, the world's leading pultrusion company, and Local Motors, the world's leading 3D-printed car company, which are both innovation drivers and local to East Tennessee. More than ninety companies across the supply chain support the project.



The 3D printed Shelby Cobra printed with the help of MABE'S Dr. Butch Irick. The Cobra will be housed at The Smithsonian.



UT Knoxville Chancellor Jimmy G. Cheek, right, stands with Martin Keller, associate laboratory director at Oak Ridge National Laboratory, in front of a Shelby Cobra printed as a collaboration between ORNL and UT personnel.

While advanced composites are used in selected industries such as aircraft, military vehicles, satellites, and luxury cars, these materials remain expensive, require large amounts of energy to manufacture and are difficult to recycle. IACMI aims to overcome these barriers by developing low-cost, high-production, energy-efficient manufacturing and recycling processes for the composites sector.

"This has brought together unprecedented commitment from state governments, industry, and research institutions to develop the workforce, create jobs and increase global manufacturing competitiveness in advanced polymer composites," said new IACMI CEO Craig Blue, a joint ORNL-UT MABE faculty member. "Our state partners include the top five states for automotive employment and companies representing seventy percent of US automotive manufacturing."

"This opportunity adds to the momentum we've already built as a leader in this field," said Wayne Davis, dean of UT's College of Engineering. "This selection, along with our Governor's Chairs, our strategic focus on advanced manufacturing, and our faculty's applied research into woven composites, carbon fiber, and residual stress in composites, all serve to showcase our strategic place in the field of advanced materials. We look forward to our role in advancing manufacturing innovation."

Helping manufacturing go green

The plan also dovetails with the DOE's Clean Energy Manufacturing Initiative by encouraging collaboration and

moving ahead with production methods and materials that require less energy and resources.

"IACMI will be a significant catalyst in advanced composites materials and manufacturing innovation," said Taylor Eighmy, UT vice chancellor for research and engagement, principal investigator of the project and co-chair of the Institute's board of directors.

"We are grateful to the US Department of Energy and President Obama for this opportunity and will build on our extensive and long-standing partnerships to hit the ground running."

How is IACMI relevant to MABE

MABE has strong background in advanced materials manufacturing, modeling, and testing. MABE professors and their graduate students will have the opportunity to collaborate with a large consortium of industries, other university partners, Oak Ridge National Laboratory, and state agencies to reduce technical risk and develop a robust supply chain for advanced composite materials in automotive, wind turbines and compressed gas storage application. In addition, the undergraduate students will have ability to embed themselves within the participating industries and get trained on the real-life manufacturing process design and deployment of polymer matrix composites.

Department Notes

Brooks to join Icebreaker cruise to North Pole



Steve Brooks

UTSI Associate Professor Steve Brooks will be onboard our nation's largest icebreaker, the Coast Guard Ship "Healy", when it makes its first trip to the North Pole this year. Brooks will be onboard to study the transport of deposition of air pollutants to the Arctic Ocean. The cruise represents only the second time that a US ship will venture that far into the Arctic Sea ice.

The study is funded by the National Science Foundation as part of the international Geotraces program that aims to improve the understanding of biogeochemical cycles and large-scale inputs of contaminants to the ocean environment. Scientists from thirty-five nations have been involved in the program, which is designed to study all major ocean basins over the next decade. This Arctic cruise is coordinated with scientists and icebreakers from the US, Canada, Germany and Norway.

The Icebreaker Healy will depart the Aleutian Islands in August on the fifty-five-day cruise that will transit the Bering Sea and Bering Strait before entering the Arctic Ocean and proceeding to rendezvous with the German Icebreaker, Polar Stern, at the North Pole. The study will sample particulate and gaseous pollutants, and some of these same contaminants within the sea ice and surface waters. A contaminant of major concern is mercury, which is transported by the air to the Arctic. Mercury levels in Arctic wildlife are rising at a disturbing rate. Mercury is a highly toxic element that is transported primarily as a gas in the atmosphere. After deposition the element is absorbed and accumulated in the food chain, causing feeding and reproductive problems for top-level predators, such as beluga whales and polar bears.

Brooks has studied the atmospheric transport and deposition of contaminants to the polar regions for many years and has led ground, ship and aircraft-based scientific studies at the South Pole, the Greenland icecap, Arctic Alaska, and the Arctic and Antarctic Sea ice environments. He has been awarded the US Navy Arctic Service Ribbon and the U.S. Antarctic Service Medal, and he is the Head of Flight Operations at UTSI.

- Steve Brooks



Reinbolt Receives Southeastern Conference Faculty Travel Grant



Jeffrey Reinbolt

MABE Assistant Professor Jeffrey Reinbolt received a Southeastern Conference (SEC) Faculty Travel Grant, which will be used to offset his travel expenses to the University of Kentucky.

The SEC Faculty Travel Grant Program is part of the SECU academic initiative that works to promote and advance the academic achievements of SEC universities.

The goal of the program is to stimulate scholarly initiatives between SEC universities by encouraging SEC faculty to exchange ideas, develop grant proposals, and conduct research in their areas of interest.

Reinbolt made his first visit to the University of Kentucky in April and will be collaborating with Assistant Professor Brian Noehren.

"While visiting the University of Kentucky, my goal is to formalize collaborations with SEC partners and train in clinical, biomechanics, and motor control processes," Reinbolt explained. "I also want to receive hands-on education in data collection, develop and apply computational tools for subject-specific simulations, and pursue research on an objective method to determine optimal subject-specific techniques to reduced injury and improve rehabilitation."

Reinbolt hopes his visit will impact how the SEC collaborators conduct clinical research and will initiate future collaborative research projects.

- Kathy Williams

Irick and Johnson Receive CoE Awards



Butch Irick



Jackie Johnson

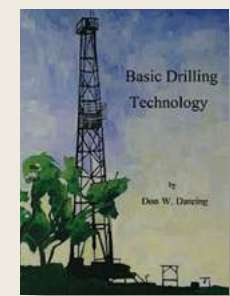
Congratulations to MABE Professors Butch Irick and Jackie Johnson, who were honored at the College of Engineering's Annual Award Banquet in April 2014.

Irick received the Charles Edward Ferris Faculty Award, given to a faculty member who has a distinguished record of research and teaching in the area of technology advancement and is involved in the community.

Johnson received the CoE Professional Promise in Research Award, given to faculty members with an exceptional record of research activity, whose efforts clearly contribute to the overall mission of the college. The awards were established to recognize and reward superior research.

- Kathy Williams

Dareing Publishes New Book



Professor Emeritus Don W. Dareing has written a new textbook - *Basic Drilling Technology* (2015). The book is designed for undergraduate and graduate level students and for those entering the petroleum industry from other disciplines.

Basic Drilling Technology presents optimum drilling practices in terms of engineering fundamentals with applications. Rotary drilling hydraulics is expanded to include performance features and operating requirements of positive displacement motors and drilling turbines. PDC and natural diamond cutter wear, caused by

heat, is related to cutter density, spacing and bit profiles to show how bit design affects the performance of rigid body drill bits. Additionally, methods of controlling the three modes of drillstring vibration are explained in terms of source of excitation and frequency tuning, and drilling economics is discussed in parallel with the reliability bottom hole drilling tools. The mathematics of directional navigation along with tools for directional control is also explained.

Beginning late spring, *Basic Drilling Technology* will be published under the title *Advance Drilling Engineering*.

Dareing has written four books during his career and he is working on a fifth book, *Engineering Practice*.

TerMaath Receives Penn State 2014 Outstanding Scholar Alumni Mentor Award

Assistant Professor Stephanie TerMaath is the recipient of the Pennsylvania State University Schreyer Honors College 2014 Outstanding Scholar Alumni Mentor Award. The Scholar Alumni Society established the award in 2009 to honor alumni who serve as program mentors. The award is presented to one mentor each fall.

More than 1,800 students are currently enrolled in the Schreyer Honors College. The college's Mentor a Scholar program connects program alumni, such as TerMaath, with current Schreyer students. Alumni give their time, provide counsel, and share their experiences as part of the mentoring program.

TerMaath has actively mentored two Schreyer honors students each year for the past two years, and she was nominated for the award by two of her mentees. The students are grateful for the impact she has had on their development into young professionals.

"If there were a textbook approach on how mentors should interact with their mentees, Dr. TerMaath would be featured," the first nominee said.

Another scholar said he was, "beyond lucky to have been paired with her."

TerMaath received her bachelor's degree from Penn State with honors in civil engineering. While at Penn State, she was an honors scholar. Her mentor was Penn State Professor Emeritus Harry West. TerMaath went on to earn her master's degree from Purdue University and her doctoral degree from Cornell University. She joined the MABE Department from UT's Department of Civil and Environmental Engineering last year.



Left to right: Penn State Professor Emeritus Harry West, MABE Assistant Professor Stephanie TerMaath and Penn State honors student Manny Esteves

- Amanda Andrews

Sarles wins 3M Non-Tenured Faculty Award



Andy Sarles

Assistant Professor Andy Sarles has received the 2015 3M Non-Tenured Faculty Award, which recognizes outstanding new faculty who excel in research, experience, and academic leadership.

The award is administered by 3M's Research and Development Community in partnership with 3M's Community Giving Program. For more than twenty-five years, the award has been given to help outstanding new faculty achieve tenure, remain in a teaching position, and conduct research.

Sarles was recognized for his project entitled, "Liquid-infused, mechanically activated porous materials for tunable transports." The work is focused on understanding how to make stretchable materials that are infused with liquids to create active pores (i.e. ones that can open or close based on the state of stretch).

"This work relates to my other research projects focused on synthetic cell membranes, which exhibit many mechanisms for tunable transport, including mechanically-activated poration," Sarles said. "In year one, we will develop and apply finite element modeling methods for understanding how both the shape of a pore changes in response to stretch and how the infusing liquid wets to the walls of the pore as it is deformed by the stretch."

The potential impact of this work extends into multiple scientific fields and the potential outcome is a new class of liquid-infused materials for tunable transport properties that can be applied to filtering, water purification, sensing, drug-delivery, thermal transport, and self-healing.

Sarles received his PhD in mechanical engineering at Virginia Tech in 2010, his master's degree in mechanical engineering from Virginia Tech in 2006, and his bachelor's degree in mechanical engineering from the University of Tennessee in 2004. He joined the MABE faculty in 2011.

- Kathy Williams

Schmisser Receives 2014 Outstanding Aerospace Engineers Award



John Schmisser standing outside of the Neil Armstrong Hall of Fame at Purdue

H. H. Arnold Chair and Professor John Schmisser was one of nine graduates of the School of Aeronautics and Astronautics to be honored as a 2014 Outstanding Aerospace Engineer at Purdue University during an awards banquet on November 7, 2014.

The Purdue University designation Outstanding Aerospace Engineer recognizes the professional contributions of graduates from the School of Aeronautics and Astronautics and thanks them for the recognition that their success brings to Purdue and the school.

Criteria for the award state that recipients must have demonstrated excellence in industry, academia, governmental service, or other endeavors that reflect the value of an aerospace engineering degree.

"My education at Purdue not only provided a strong scientific engineering foundation, but also contributed to a variety of opportunities throughout my career. The Aerospace community appreciates the enduring excellence of the School of Aeronautics and Astronautics and being a Boilermaker has had its advantages," Schmisser said.

Schmisser graduated from Purdue University with a PhD in Aeronautics and Astronautics in 1997 after earning his Bachelor of Science in 1990 and Master of Science in 1992 in Aerospace Engineering from the University of Texas at Austin. Schmisser joined the MABE department in August 2014 and is teaching and leading research at the University of Tennessee Space Institute.

Prior to joining the faculty, Schmisser was the Chief of the Energy, Power & Propulsion Sciences Division and Program Manager for Aerothermodynamics within the Air Force Office of Scientific Research (AFOSR). During his tenure at AFOSR, Schmisser initiated and led a national strategic research plan which has guided the research efforts of multiple federal agencies, championed the transition of basic research capabilities that have advanced flagship national hypersonics technology programs and transformed test and evaluation capabilities, and envisioned the HIFiRE program which unifies the efforts of AFRL, NASA, and the Australian DSTO to advance fundamental hypersonic science and technology via flight research.

Schmisser is active within the professional community including having served as Chair of the AIAA Fluid Dynamics Technical Committee and a NATO Science and Technology Organization working group. He is also a frequent keynote speaker at a variety of scientific meetings. He is a Fellow of the American Institute of Aeronautics and Astronautics (2012) and the Air Force Research Laboratory (2013) and is the 2008 recipient of the Air Force Science and Engineering Award in Research Management.

- Barbara Birdsong

Circuits on Demand: UT Engineer Prints Electrical Components on Paper



Dr. Anming Hu

One of humankind's biggest technological steps was the ability to print words on paper.

Now, thanks to MABE assistant professor Anming Hu, it's technology itself that is being printed.

Hu has researched a way to print circuits on paper, the main impact of which could be a decrease in cost and an increase in portability for any number of devices.

"Being able to design the circuit you want and then print it out allows for more responsive designs, easier control, and lower costs," said Hu. "The ability to print out the exact circuit you need the moment you need it can revolutionize a number of things."

One of the biggest advancements made possible by the technology could be in the world of medicine.

Currently, endless numbers of people suffer from a disease or affliction that requires them to frequently check in with a doctor or conduct medical testing. Diabetics, for example, rely on daily finger pricks to test their blood sugar levels.

With a paper circuit enclosed in a liquid-proof barrier, those same patients could one day have a sensor implanted in them that could not only detect when their levels were out of kilter, but also signal itself to release insulin into their body.

"Being able to have an enclosed waterproof system with its own power source would open up a lot of areas medically,"

said Hu. "Right now, the focus is on being able to make the lines that form the circuit smaller."

The easiest way to picture how Hu's system works is to think of an inkjet printer, but replace the ink cartridge with one that dispenses liquid metal.

Hu's team tested more than thirty different types of paper before realizing that standard inkjet paper worked as well as anything, and was cheaper than most to secure.

The metal they use, on the other hand, is anything but ordinary.

"We use silver to make the nanowire," said Hu. "It's still much cheaper than making electric circuits the 'normal' way, and it holds up far better than copper, which has a tendency to oxidize too quickly."

Hu's team was able to fold the paper-thin circuit 5,000 times with a high level of functionality still intact, answering questions about the durability of the finished product.

While medical uses could have the most day-to-day impact for such circuits, their flexibility and ease of use means anything electronic could benefit.

"The global applications for this will drive development in a long-term way," said Hu. "For now we will focus on improving the mechanics of this new type of additive manufacturing, working on multiple-nozzle printing, things of that nature."

The research has already gotten plenty of attention, with the *American Chemical Society Journal Applied Materials & Interfaces* publishing the team's work and several other scientific journals taking note.

- David Goddard

Student News

Myrick and Pridgen Awarded Chancellor's Fellowship



Left to right: Justin Myrick, Graduate Program Director Kivanc Ekici and Max Pridgen

Graduate students Justin Myrick and James Max Pridgen are recipients of the 2014 Chancellor's Fellowship.

The prestigious fellowship offered by the MABE Department provides \$25,000 plus tuition per year to recipients so they may pursue high-impact research as part of their doctoral work.

"Only the top PhD candidates are considered for the fellowship," Graduate Program Director Kivanc Ekici said. "It allows for greater research flexibility because it alleviates the stress of finding funding for both the student and his advisor."

Myrick graduated Summa Cum Laude from David Lipscomb University with a bachelor's degree in mechanical

engineering and a minor in applied mathematics. He is pursuing his doctoral degree in mechanical engineering and is currently working in the heat transfer lab for Professor Majid Keyhani doing experimental investigation of inverse heat conduction through calibration integral equations.

"I am so grateful to my adviser, Dr. Keyhani, and the department, for the opportunity to come to study here at the University of Tennessee," Myrick said. "It means so much that the department believes in me enough to award me this very generous fellowship. I look forward to contributing to this academic community in the coming years."

Pridgen graduated Magna Cum Laude from UT with a bachelor's degree in mechanical engineering. He is pursuing his doctoral degree in mechanical engineering and is currently studying graphene applications in vanadium redox flow batteries. His advisor is Magnavox Professor Kenneth Kihm.

"I have really appreciated the generosity and honor the university has bestowed upon me," Pridgen said. "Receiving the fellowship has allowed me to focus on my research and education with an alleviated financial burden. It has also helped in gaining the trust and respect of fellow researchers."

"The fellowship offer came at a time when I was uncertain of my future not only at the University of Tennessee but for my career as a whole. The Chancellor's Fellowship helped to cement my interest in research and academic excellence."

- Amanda Andrews

McCormick Part of Boyd Venture Challenge Winning Company

In November, student startup company Catalyst Cycling LLC was a repeat winner in the Boyd Venture Challenge and was awarded \$10,000 seed money for winning the pitch competition.

The Catalyst Cycling team is comprised of mechanical engineering sophomore Nick McCormick, mathematics junior Zach McCormick, and computer science junior Justin Clarke. Their company, which sells innovative cycling parts and accessories, is already gaining market traction with their carbon fiber wheel covers. They intend to use the \$10,000 to finalize the designs of two additional products, the Time Capsule and Wheel System.

The Boyd Venture Challenge is a seed fund grant conducted in the fall and spring semesters each year. Any UT student-owned (doctoral, masters, undergraduate) business is eligible to apply, and it is open to all UTK students regardless of academic discipline or degree program. To qualify for the grant money, each business must be legally established and the student owner(s) must be enrolled in a UT degree program at the time of application.

The Boyd Challenge was created with funds from Randy Boyd, president and CEO of Radio Systems Corp. Since its inception in 2011, twenty student-owned companies have been awarded a total of \$142,000 in seed capital.

Ashraf Gandomi Receives ASME Honor



Yasser Ashraf Gandomi

ME PhD student Yasser Ashraf Gandomi received the East Tennessee ASME Honor for Service to the UTK Student Section due to his notable and recognizable contributions to the well-being of the UTK Student Section. Ashraf Gandomi's visibility, dedication, and hard work in maintaining the UTK chapter made him a clear choice for the honor. Ashraf Gandomi has been president of the UTK ASME Student Chapter since fall 2012.



Daniel Stone is COE's Featured Student of the Week



Daniel Stone

On November 21, 2014, MABE ME student Daniel Stone was featured as the College of Engineering's Student of the Week.

Stone, who accepted a co-op at Duke Energy located at Crystal River, Florida, describes the department he worked in and what his main responsibilities were.

"I worked in Outage and Maintenance Services," he said. "My responsibilities: When I first arrived on site, I studied piping and instrumentation diagrams and walked down each system at the plant. I eventually began writing engineering-change work packages for various maintenance projects at the plant. I traveled to Crystal River, Florida on two separate occasions during outage season to assist two boiler inspections. I also assisted four heat recovery steam generator inspections at Hines (the plant where I was located). I worked with the traveling maintenance crew when they arrived at Hines to inspect the steam turbine valve on one steam turbine. I learned the duties of the project managers whom I worked alongside."

The most valuable benefit Stone received during his co-op assignment was actual maintainability experience in the electric utility industry.

"I learned what it takes to be a project manager, how to act in the office environment, the importance of relationships and communication," said Stone. "The experience I have gained is sure to give me a leg up against the competition when it comes time to search for a job after graduation."

- Kathy Williams

Nguyen Wins Best Student Paper at SMASIS

BME PhD student MaryAnne Nguyen won a Best Student Paper award in the Bioinspired Smart Materials Symposium at the ASME Smart Materials, Adaptive Structures, and Intelligent Systems (SMASIS) Conference in Newport, Rhode Island, last September.

Nguyen works in the Bioinspired Materials and Transduction Laboratory that is directed by MABE Assistant Professor Andy Sarles.

Her award-winning paper is entitled "Micro-encapsulation and tuning of biomolecular unit cell networks."

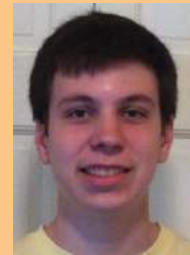
Nguyen was recognized at a banquet that was held on September 9.

- Kathy Williams



MaryAnne Nguyen

Twickler and Crouch receive scholarships



William Twickler



Keith Crouch

The Society of Maintenance and Reliability Professionals (SMRP) recently awarded William Twickler and Keith Crouch with scholarships.

Twickler, a senior in mechanical engineering, received the 2014-2015 SMRP Higher Standards Scholarship Award,

and Crouch, who received his BS in mechanical engineering, received the SMRP Dorothy and Jack Nichols Scholarship.

Crouch is currently pursuing his MS in Reliability and Maintainability Engineering.

To be considered for the \$2,000 award, students must have a minimum 3.0 grade point average, demonstrated work experience in reliability or maintainability, and demonstrated leadership ability, among other things.

Twickler plans to use the scholarship to finish his undergraduate education.

Crouch plans to use the scholarship to finish his degree and continue to strive for more cost-effective manufacturing.

SMRP awards three scholarships annually.

- Kathy Williams

Lash participates in the 2014 Transatlantic Program for Young Technology Leaders



Lara Lash

Master's degree student Lara Lash was one of twelve applicants chosen to participate in the 2014 Transatlantic Program for Young Technology Leaders (TAP-YTL) in June 2014.

Lash participated as a member of the aerospace delegation of the TAP-YTL and visited first rate aerospace and aviation technology development and manufacturing facilities throughout Germany. During her eight-day trip, Lash explored how Germany contributes and leads in aerospace/aviation testing and manufacturing through visits with companies such as Rolls-Royce, Airbus, two DLR facilities, and MTU Aero Engines. She gained insight into the international cooperation of the aerospace industry in everything from assembly, manufacturing, design, and testing of both complete systems and components.

Lash said highlights from her trip included "touring Airbus HQ in Hamburg and seeing the manufacturing processes for A320s and A380s fuselages; testing the Hexapod, a large component test rig at the Technical University of Hamburg-Harburg; and seeing the mission control center for the Columbus module, the ISS scientific experiment laboratory at the DLR in Overpoffenhofen." Lash also had the opportunity to take an in depth tour of Burlin and Munich and swim in the fast-moving Eisbach of the Isar River.

Lash is studying aerospace engineering at the University of Tennessee Space Institute under the direction of her advisor, Assistant Professor Trevor Moeller.

- Kathy Williams

Engineer's Day

MABE Celebrates Engineer's Day with NASA Astronaut Barry Wilmore and Competition Wins

The College of Engineering held its annual Engineer's Day event October 23, 2014. A record-breaking 1,700 students from forty-nine high schools across the state came to campus to participate in competitions and to view student-sponsored exhibits. Undergraduate engineering classes were cancelled for the day so that UT engineering students and faculty could interact with visitors through hands-on demonstrations and informal information sessions.

Visiting high school students and current students alike participated in activities, competitions and exhibits as part of the day. Six competitions were available for visiting students, and MABE student organizations contributed exhibits and information booths.

Welcome from NASA astronaut and MABE Alumnus Barry Wilmore

A taped welcome address from NASA astronaut Barry Wilmore kicked things off for the more than 100-year-old event. Wilmore earned his master's degree in aviation systems from the UT Space Institute in 1994. In September last year, he launched to the International Space Station (ISS) from the Baikonur Cosmodrome in Kazakhstan and served as a flight engineer for ISS Expedition 41 until November when he assumed command of Expedition 42.

While aboard the ISS, Wilmore recorded a special message for Engineer's Day visitors. He gave students a tour of the space station while showing off zero-gravity football skills and closed with a dramatic view of Africa from 210 miles above Earth. The address was such a popular draw that a spillover room was made available for viewing after the Cox Auditorium reached capacity.

Competition Wins

Engineering societies and clubs set up information booths and competed in exhibits. Two MABE student organizations participated in exhibit competitions—and won. Exhibit award winners included the Tennessee Tau Eta chapter of Pi Tau Sigma and The Society of Automotive Engineers (SAE).

The honorary mechanical engineering society Pi Tau Sigma won second place in the Class I Exhibit for its booth, "Mechanical Engineering: Many Degrees of Freedom." The exhibit featured general information about the mechanical engineering program, degree topics, intern and co-op information, research opportunities, and senior design projects.

SAE won first place in the Class II Exhibit for "EcoCar: The Future of Transportation." EcoCar is an advanced vehicle technology competition sponsored by the US Department of Energy and General Motors. The UT team was selected in 2014 as one of sixteen universities to participate in the EcoCar 3 competition, which is focused on the ability of university teams to take a Chevrolet Camaro and convert it into a hybrid vehicle without sacrificing any of the "muscle car" persona that the auto conveys.

- David Goddard and Amanda Andrews



NASA astronaut and MABE alumnus Barry Wilmore's welcome from space.



Pi Tau Sigma's second place Class I Exhibit, "Mechanical Engineering: Many Degrees of Freedom".



SAE's first place Class II Exhibit, "EcoCar: The Taped Future of Transportation."

For more information about Engineer's Day, visit www.engr.utk.edu/ed/.

MABE Unveils New Senior Design Suite

The MABE department has recently renovated 2,800 square feet of space in Perkins Hall to form a suite of rooms dedicated to senior design projects. Renovations included painting, moving the student machine shop and workbenches from Dougherty, installing new lockers, and creating a small conference room. Heretofore, workspaces for MABE senior design

teams were scattered in various locations and were frequently at risk of being taken over for other activities. In conjunction with the renovations, three faculty who oversee senior design projects have moved to offices in Perkins Hall. The new arrangements allow for secure storage of tools and parts, ready access to the machine shop, collaboration and consultation

with instructors and easy scheduling of teleconferences with sponsors. This is a significant improvement of facilities used by more than 150 seniors each year in executing their capstone design projects in mechanical, aerospace, and biomedical engineering.

- Toby Boulet



Students working on their senior design projects in the new MABE Senior Design Suite.



The new machine shop available to students working on their senior design projects.

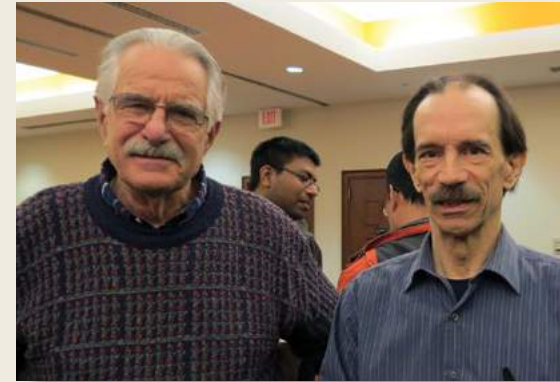
Thank you to MABE Senior Design Sponsors

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Dennis Higdon Retires After 37 Years

In January, MABE faculty, staff, students, and friends gathered at the UT Visitor's Center to celebrate Dennis Higdon's retirement. Dennis worked as an Electronic Specialist in the MABE department for 37 years.



Former department head, Dr. Mancil Milligan and Dennis



MABE Staff



Dr. Roger Parsons and Dr. Rao Arimilli



Dr. Mark Barker, Dr. Libby Barker, Dr. Larry Sharpe, and Dr. Matthew Mench



Dennis opening his gifts



Dennis and Dr. Majid Keyhani



Dennis talking with Dr. Hans DeSmidt



Dr. Toby Boulet and Dr. Gary Smith



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10

Photo Gallery

- (1) L to R- Austin Brown, Elizabeth Dickson, Alex Adams, Dr. Bill Miller, Jordon Jefferson, and Chris Robert after presenting their Capstone Project at The Children's Museum of Oak Ridge
- (2) General Motors presenting a check for \$20,000 to the EcoCAR 3 team
- (3) Dr. Matthew Mench and Electro-Mechanical Corporation's Russell Leonard
- (4) Dr. Jonathan Jones from Marshall Space Flight Center speaking to MABE students
- (5) Aerospace engineering student Joshua Dobbs being inducted into UT's Phi Eta Sigma National Honor Society
- (6) MABE faculty and staff "minions" competing in the COE Halloween Competition
- (7) Dr. Matthew Mench and Lady Vols coach Holly Warwick
- (8) Dr. Masood Parang accepting a check from ExxonMobil's Nathan Keesecker
- (9) MABE being well represented at the BMES 2014 conference in San Antonio
- (10) Research Assistant Professor Libby Barker coaching a First Lego League Team

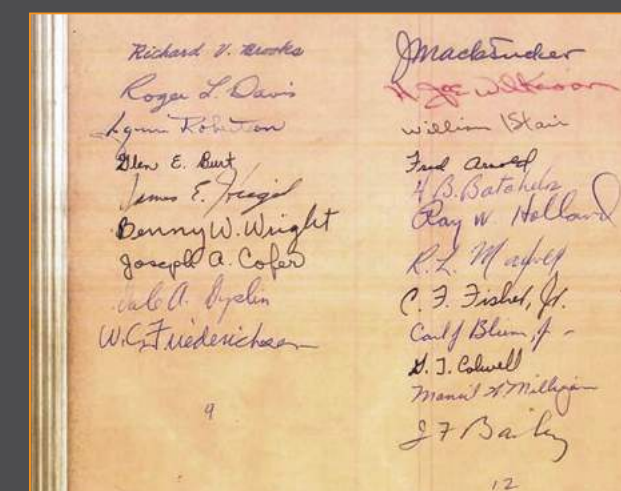


Mechanical Engineering Senior Field Trip Spring 1959 -From the Collection of Jim Corum

- | | | |
|---|---|--|
| <p>Front Row (l. to r.)
 Charles Lasseter, Instructor
 Joe Bain
 Tom Colwell
 Larry and Barry Carpenter
 Jim Rhodes</p> <p>2nd Row
 Joel Fitts
 Charles Egbert
 Kin Wai Yeung
 Sam Bettis
 Vivian Heflin
 ?
 Boyd Sliger
 Lynn York
 R. H. Jackson
 L. E. Wright
 Joe Clendennon
 ?</p> <p>3rd Row
 John Winniger
 Albert Spaller
 Bill Fleenor
 Charles Stump
 George Richie
 ?
 Don Cannon
 Charles Vitelli
 Jack Harrell
 Jack Anderson</p> | <p>Steve Cates
 Allen Jeffries
 Blain Roberts</p> <p>4th Row
 Nelson Harrison
 ?
 Syd Jammes
 Richard Reynolds
 ?
 Bill Payne
 Clyde Norman
 Marion Graybeal
 Lamarr Wigginton
 Roy Huddleston
 Bill Murphy</p> <p>5th Row
 Melvin Mengle
 ?
 ?
 Bill Carden
 Gene Sanders
 J. C. Loope
 Tommy Larkin
 ?
 Phil Buckner
 ?
 ?
 Jim Corum
 Dual South</p> | <p>6th Row
 Felix Reese
 James Petty
 Don Pratt
 Ben Batchlor, Professor
 David Hunt
 Joel O'Brain</p> <p>James Watkins
 George Bishop
 Ron Dommer
 Bill Hurt
 Mike Shepherd
 John Pelton
 Fred Johnson</p> |
|---|---|--|

From the collection of Larry Lacey

"Members and faculty signatures from the class of 1963"



Attention Alumni! We Want Your Old Photos

The MABE department is collecting old photos that relate to the UT mechanical, aerospace, and biomedical engineering department. If you have any photos that are dated between the early 1900s and the 1980s, we would love for you to share them with us. The photos can be of your research, labs, you and your friends in MABE, projects, etc. Please send a digital copy to williamk@utk.edu. We look forward to rediscovering our past!

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 Kathy WilliamsEditor
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 Amanda Andrews.....Contributor
 David Goddard.....Contributor

Dean's Office865-974-5321
 Office of Engineering Development.....865-974-2779
 UT Alumni Association.....865-974-3011
 Check out the MABE website:.....mabe.utk.edu

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