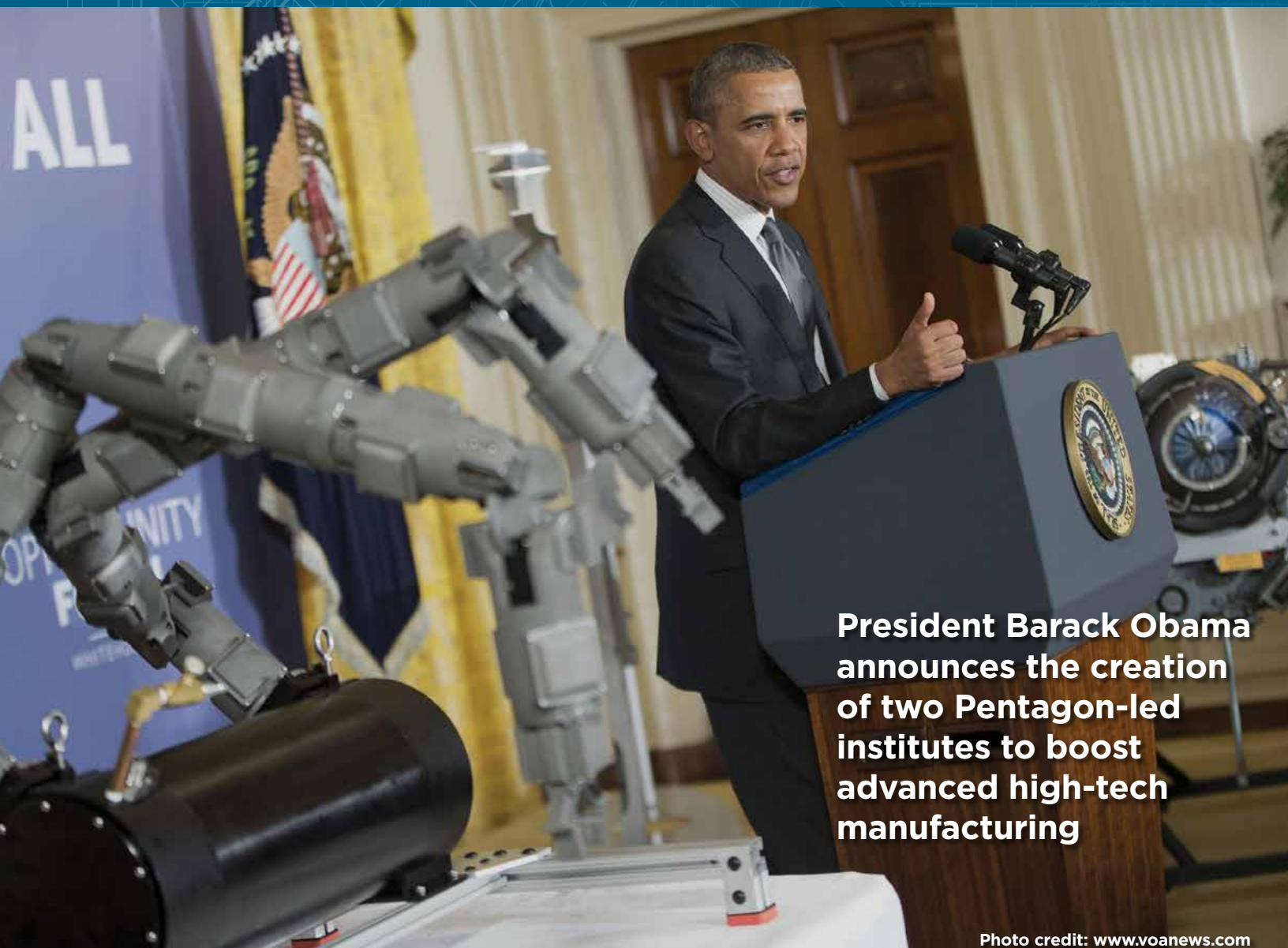




# MABE is Part of \$140 Million Advanced High-Tech Manufacturing Initiative



**President Barack Obama announces the creation of two Pentagon-led institutes to boost advanced high-tech manufacturing**

Photo credit: [www.voanews.com](http://www.voanews.com)

## *Also in this issue...*

*MABE Welcomes Anming Hu to the Faculty, Dr. Kenneth D. Kihm Leads to Success with PhD Students, Dr. James Conwell Visits MABE, Philip Clarke Finds Engineering Program a Perfect Fit.*



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**T**hanks for taking a look at the Spring/Summer Department of Mechanical, Aerospace and Biomedical Engineering (MABE) Alumni Magazine. I hope you enjoy it!



As you probably know by now, the College of Engineering and MABE department are undergoing rapid change, some of which you can read about here. The influx of new talent and focus on innovative research and education is truly transforming the department. One example is the cover story of this issue about our department's multi-million dollar involvement in a new Lightweight and Modern Metals Manufacturing Innovation Institute. The \$140 million Detroit-based institute will help develop advanced manufacturing methods

for more fuel-efficient cars and decreased costs for ships and aircraft. UT's involvement is led by Dr. Suresh Babu, MABE's Governor's Chair for Advanced Manufacturing, who just joined us in July. In addition to Babu, several junior MABE faculty from both UTSI and Knoxville are also part of the effort.

I would also like to invite you to join our Facebook page by clicking the Facebook link at our homepage of [mabe.utk.edu](http://mabe.utk.edu). Here we post pictures of events and additional information. Additionally, I would like to encourage working professionals who use LinkedIn.com to add the group University of Tennessee Mechanical, Aerospace, & Biomedical Engineering Students & Alumni. This is a growing group of students, alumni, and human resource representatives who can help each other with employment opportunities and connections. In the past few years, I have seen a major shift in how employers get connected with potential employees, and LinkedIn connections are becoming increasingly important. I would like to see a robust community of students, employers, and alumni come together and help connect each other with the best opportunities out there. One of the best ways I think alumni can give back is through connections to opportunities, and LinkedIn is a great way to do this.

Finally, some alumni have been sending us old pictures and sharing some stories of their days at UT with me. I think this is absolutely fantastic, and I would love to put some of these on Facebook and in the next newsletter. So, if you have some old photos of your days at UT you do not mind sharing, please scan and send them to us with a brief background caption. We would love to share them.

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.

All the best,

Matthew Mench

# MABE Part of \$140 Million Advanced Manufacturing Initiative



The Department of Mechanical, Aerospace, and Biomedical Engineering (MABE) will be part of a \$140 million national advanced manufacturing initiative recently announced by President Barack Obama.

The announcement fulfills Obama's pledge in his 2013 State of the Union Address to establish new manufacturing innovation institutes from existing resources. The initiative will help the United States (US) manufacturers become more competitive and encourage investment in the US.

The US Department of Defense funded initiative, called the Lightweight and Modern Metals Manufacturing Innovation (LM3I), is being led by Detroit-based EWI, and is a consortium made up of thirty-four companies and nine universities and labs. According to a press release from the White House, "the long-term goal of the LM3I Institute will be to expand the market for and create new consumers of products and systems that utilize new, lightweight high-performing metals and alloys by removing technological barriers to their manufacture. The Institute will achieve this through leadership in pre-competitive advanced research

and partnerships across defense, aerospace, automotive, energy, and consumer products industries."

Dr. Suresh Babu, UT-Oak Ridge National Laboratory (ORNL) Governor's Chair for Advanced Manufacturing and a faculty member in MABE, will help

lead UT's research effort as part of the initiative. The research will be performed by a team of faculty from UT Knoxville and the University of Tennessee Space Institute (UTSI) to develop innovative manufacturing concepts to deploy advanced high strength steels, aluminum, titanium, and magnesium based alloys for a wide range of applications including automotive, aerospace, and defense. Researchers from several departments, the UT/ORNL Joint Institute for Advanced Materials, joint faculty from ORNL, and UTSI will collaborate with small, medium, and large-scale industries within this center.

"It is huge. This is indeed recognition of our collaborative relationship with ORNL and it provides us a platform to develop our academic and research portfolio to a greater impact. This also allows for our younger faculty and burgeoning student researchers to be part of a center, which will shape the future of a metals related manufacturing ecosystem. Students will also have opportunities to be embedded within different organizations as they do research and development relevant to the overall missions of the center," Babu said.

Professors Reza Abedi and Feng Zhang will work with Babu and lead

the research efforts at UTSI. Zhang's NanoHelp group will help develop well-controllable and multifunctional materials and components based on lightweight metals, exploring lightweighting solutions for high-efficiency systems of energy, power, and propulsion.

"NanoHELP is honored to be part of this initiative and appreciates the opportunity to contribute to these nationwide innovations in manufacturing and help the US maintain a leading position in these strategic fields," Zhang said.

Abedi's research will perform advanced simulations of microstructure evolution during material manufacturing, correlating them to micro- and macroscopic defects, and investigation of the effect of such defects on material characteristics such as fatigue and fracture response during service life.

"This large-scale research effort leads to highly advanced materials that could drastically boost the efficiency of our transportation system," Abedi said.

Assistant Professor Anming Hu will also be involved with the research at UT Knoxville.

A White House press release stated, "The Institute serves a regional hub, bridging the gap between applied research and product development by bringing together companies, universities and other academic and training institutions, and Federal agencies to co-invest in key technology areas that encourage investment and production in the US. This type of 'teaching factory' provides a unique opportunity for education and training of students and workers at all levels. It also provides shared assets to help companies, most importantly small manufacturers, access the cutting-edge capabilities and equipment to design, test, and pilot new products and manufacturing processes."



## MABE Welcomes Anming Hu to the Faculty

Focusing on Lasers and Nanomanufacturing to Improve the Quality of Life



Dr. Anming Hu

Coming all the way from Waterloo, Canada—a city in southern Ontario—Anming Hu joined the MABE department in the Fall 2013 semester. It's as if Hu could foresee the unusual, frigid temperatures that blanketed the northeast of the United States and Canada this past winter, and decided to move to the southern United States to a city that he describes as “warm, friendly and exciting.” Compared to Waterloo, Hu views Knoxville and the University of Tennessee as an area with great potential for higher academic achievements for his career success.

working under Hu and limited research fund support. By having the freedom to apply for grants, determining the research direction and activities, and recruiting students—with joint efforts of his colleagues and students—Hu developed an energetic research team. Hu said the team was composed of eight research assistants (five PhD and three MS students) and attracted about \$2 million in research grants in the past five years.

Maybe Hu's attraction to country music is what brought him to Knoxville, but most likely

Hu began his studies at Shandong University. After receiving his BS degree, he continued his education at the Institute of Solid State Physics, Chinese Academy of Science where he gained his MS degree. He then furthered his academic progress by obtaining a PhD from the University of Waterloo in 2008. From there, he made a natural progression in becoming a research assistant professor at the University of Waterloo, where he supervised a relatively independent research team that initially developed from one student

he accepted his position as an assistant professor within the department because of his interest in the research and development of additive manufacturing based on laser technology and nanomaterials happening in MABE. He stated this interest also includes laser exfoliation, laser nanosintering, and laser induced front transfer technology for nanodevice fabrication.

Hu's current goal for his new position in MABE is to build a nanomanufacturing lab by integrating nanomaterial synthesis, nanopaste development, and laser processing. To do this, Hu said he needs to obtain external research grants to support his research and lure the most talented students to join his group.

“I am an enthusiastic and accessible person and care about the success of each member in my group. I respect different opinions and build skills for different levels,” he said.

Looking to the future, Hu wants to play a role in probing the nature of ultrafast laser interaction with nanomaterials, specifically at the shortest temporal limit (femtosecond) and the tiniest spatial resolution (a few nanometers).

“I want to be a pioneer in developing the most advanced nanomanufacturing technology for nanodevice fabrications to contribute to a higher life quality and sustainable development in our society,” he said.

In the off chance that you catch Hu outside of his office, classroom or lab, you may find him doing laps in a pool or playing badminton. Welcome to MABE Hu!

—Jenna E. McVey

**Hu's main research interests include: 3D Printing; Femtosecond Induced Additive Manufacturing; Rechargeable Batteries; Water Treatment; Ultrasensitive Substrates for Surface Enhanced Optical Spectroscopy; Femtosecond Laser-Nanosurgery and Cell Transfection.**

## Department Notes



Janet Carnes

Magna Cum Laude with her BS degree in Business Administration-Accounting.

“It depends” is a statement that stuck with Carnes when she heard it in a business management lecture regarding

### Carnes Celebrates 30 Years

On Nov. 28, 2013, Janet Carnes, Accounting Specialist III in MABE, marked thirty years of dedicated service at the University of Tennessee (UT). Carnes began her career at UT in the psychology department, where she worked until she transferred to the MABE department in 2007. While working at UT, Carnes obtained her CPS Certification and graduated

the success and/or failure of different businesses. Carnes explained the statement applies to several areas in her life, including her work.

“Someone will ask me a question and I find that the appropriate answer is ‘it depends.’ We need to think (not just assume) before coming to a decision. Do we need more information? Are we just moving along like always or should there be change? If change, then what, when, where, and how much? It depends,” Carnes said.

Will Carnes be working at UT five years from now? Ten years from now? It depends.

The MABE department congratulates Carnes on her thirty years of service and is thankful for her hard work and dedication to the university and the MABE department.

—Kathy Williams

### MABE Receives \$12,000 Grant from ExxonMobil



Nathan S. Keesecker

During the Fall 2013 semester, MABE received a \$12,000 dollar grant from ExxonMobil. Nathan S. Keesecker, Offsites and Utilities Section Head in ExxonMobil Research and Engineering Company's Projects Department, said ExxonMobil's partnerships with the universities show that it's not satisfied with just hiring talented engineers. For them, it's more about the company wanting to take the university relationships further by nurturing them with financial contributions to improve department programs, and research projects to further energy technologies and student initiatives so students may experience what it takes to succeed and become top engineers, Keesecker said.

Keesecker, alumnus of MABE (BS/ME '96), noted that three of ExxonMobil's core sources of competitive advantage are cutting-edge technology, talented people, and integrity.

“We look to grow our relationships with universities where students exemplify these as core values, and the University of Tennessee's (UT) students do exactly that,” Keesecker said. He said the relationship between ExxonMobil and UT has grown leaps and bounds in recent years, and ExxonMobil looks forward to it growing for many years to come.

Keesecker was attracted to ExxonMobil when he became fascinated with offshore platforms and the level of responsibility ExxonMobil gave to its new employees,

“I love a challenge, and ExxonMobil loves to dish them out on a scale that I couldn't have imagined at the time. It was a perfect match,” he said. His current daily activities include managing a group of thirty-two engineers and contractors who are responsible for the facilities planning and design of the infrastructure portion of ExxonMobil's major Refining and Chemical Projects around the world.

“The challenges are exciting, but they were nothing compared to the support from my other co-workers as we all worked together on a wide variety of technical issues and projects. I wouldn't trade it for anything,” he said. Keesecker noted that his experience in MABE was crucial in showing him how to combine life-long technical learning, social skills, teamwork, and creativity into a skillset that sets the foundation for UT graduates to be successful in many different companies and industries.

Keesecker stated that as an alumnus and someone who loves his job, he is passionate about helping talented Volunteers find an impactful career within ExxonMobil.

“It's a very rewarding part of my job, and nothing makes me more proud than to hear back from appreciative Vols within ExxonMobil, and know that I had a hand in getting them the chance to display their technical talents on a global scale,” Keesecker said.

—Jenna E. McVey

### Babu Elected AAAS Fellow

Dr. Suresh Babu, University of Tennessee (UT)-ORNL Governor's Chair in Advanced Manufacturing, was among the three hundred thirty-eight newly elected fellows of the American



Association for the Advancement of Science (AAAS) for the year 2013. Fellows are recognized for meritorious efforts to advance science and its applications, and being elected as a fellow of AAAS is an honor bestowed upon members by their peers. Babu was elected a fellow for his contributions to science and technology and was honored in the section of Industrial Science and Technology. He was cited for “distinguished contributions to computational materials sciences, nonequilibrium phase transformations and application of in situ neutron and synchrotron diffraction tools and other advanced characterization methods.”

This past February, Babu was recognized for his contributions at the 2014 AAAS Annual Meeting in Chicago, where he received a certificate, and a blue and gold rosette as a symbol of his distinguished accomplishments.

Babu is a professor in the MABE department and has a joint appointment in the Department of Materials Science and Engineering at UT.

—Kathy Williams



## MABE Students Win Exhibit Awards at Engineers Day

On Oct. 24, 2013, The College of Engineering held its annual Engineers Day. The event gave university students and faculty the opportunity to interact with hundreds of potential engineering students from high schools across the region. Almost one thousand students from forty-two different high schools (and some homeschooled) attended the event and had the chance to explore and learn about various aspects of engineering through discussions, project demonstrations and exhibits

prepared by UT engineering student organizations and societies. Awards were presented to the top exhibits, with MABE students and societies winning three awards. MABE award winners were:

**Class I Exhibit:** Second Place Award—Pi Tau Sigma: International Mechanical Engineering Honors Society—Engineering For a Better World (Students: Matt Hinricher and Ben Walden)

**Class I Exhibit:** Third Place Award—Society of Automotive Engineers—Creating Sustainability in the Future

of Transportation (Students: Steven Bohling, Paige Black, Keith Havens, Matt Summers and Eric Bridges)

**Class II Exhibit:** Second Place Award—Department of Mechanical, Aerospace, and Biomedical Engineering—Wind Tunnel Lab Tour

Engineers Day has been a tradition of the College of Engineering for more than one hundred years. The next Engineers Day is Oct. 23, 2014. For more information, visit [www.engr.utk.edu/ed/index.html](http://www.engr.utk.edu/ed/index.html).

—Kathy Williams



Alan Pezeshki

## Pezeshki Wins Best Presentation Award

Alan Pezeshki, a graduate student in the Electrochemical Energy Conversion and

Storage Laboratory (EESCL) in the MABE department, won the Best Presentation Award in the Secondary Battery and Material Science section at the 2013 International Forum on Environment and Energy Science. Pezeshki presented his work on electrode degradation in vanadium redox flow batteries. The invitation-only forum is sponsored by Tokyo Institute of Technology's Academy for Co-creative Education of Environment

and Energy Science (ACEEES) and brings together students from Asia, North America, and Europe to present their research on topics relating to environment and energy. Pezeshki continues a proud tradition of students from the EESCL winning an award, with this year marking the third in a row that a student from Dr. Matthew M. Mench's group has won a Best Presentation Award at the Forum.

## Student Organizations News

### SAE

SAE's Baja competition is the 22-25th of May

### Pi Tau Sigma

Pi Tau Sigma won Second place of the Class I exhibits at UT's Fall 2013 Engineers Day last semester

### BMES

**BMEidea Design Team:** In an inaugural effort at UT, a BME design team has been formed and is well underway in preparation for the BMEidea design competition. The multi-faceted team consists of eight undergraduate students (five juniors, three seniors) and two graduate students from BME, as well as a graduate student from the Graduate School of Medicine (GSM) at UT. Good luck to the team in their first efforts with BMEidea!

Team members: Juniors—Willy Yingha, Austin Bow, Cameron Pilkey, Robby Phillips, Jonathan Dreitlein.

**Seniors—**Mehdi (Alex) Zare, Tony Nguyen, David Jacobs. **Graduate—**Guru Venkatesan, Trey Fisher, Graham Taylor. **Faculty Advisor:** Dr. Xiaopeng Zhao. **Departmental support:** Dr. Matthew M. Mench.

For upcoming BMES Spring 2014 activities: see [web.utk.edu/~bmes](http://web.utk.edu/~bmes) for more info.

### ASME

The design team of the American Society of Mechanical Engineer (ASME) student chapter at University of Tennessee is developing a robot to compete against other universities in the Student Professional and Development Conference (SPDC), which will be held at Clemson University this year. The objective of the competition is to simulate the deployment of an unmanned air vehicle to combat a forest fire. The UAV must take off from a starting position while carrying a payload, and will navigate obstacles, change elevation, and drop the payload on a target. Scoring is primarily based on speed, successful

navigation of obstacles, accuracy of the payload drop, and most importantly, UAV and payload weight. They plan to construct a large multi-rotor drone capable of carrying a large payload, while navigating obstacles quickly and reliably.

### ASME Design Team

**Yasser Ashraf Gandomi**  
ASME President

**Stephanie Pollock**  
ASME Vice-President

**Rachel Harmon**  
ASME Secretary

**Turner Williamson**  
Undergraduate Student

**Seth King**  
Undergraduate Student

**Treavor Johnson**  
Undergraduate Student

**Chris LaBorde**  
Undergraduate Student

**Dr. Eric Wade**  
ASME Advisor

## Reinbolt Selected as a Member in the New OpenSim Fellows Program



Dr. Jeffrey A. Reinbolt

On Jan. 3, 2014, an inaugural group of twenty OpenSim Fellows were chosen by the OpenSim team at Stanford University, with input from the Scientific Advisory Board of the National Center for Simulation in Rehabilitation Research (NCSRR). Dr. Jeffrey Reinbolt was selected as one of the OpenSims Fellows.

"This honor, from the NCSRR, recognized my strong commitment to the OpenSim community and my background in biomechanical modeling and simulation," Reinbolt said. The first group of OpenSim Fellows includes a broad range of expertise from distinguished researchers who are located around the world.

The OpenSim Fellows Program is a new initiative from the OpenSim project and the National Institutes of Health (NIH), NCSRR. The goal of this program is to cultivate and engage a community of OpenSim experts who will collectively advance

OpenSim is a set of tools that enable users to develop models of musculoskeletal structures, build and refine simulations that utilize these models, and analyze the results of these simulations to gain insight into muscle function and other aspects of the musculoskeletal system. Reinbolt said the models built using OpenSim range in complexity from simple models used for educational purposes to subject specific models of humans with movement disorders. OpenSim has also been used to model animals, robots, and orthotics.

Reinbolt helped create the OpenSim software system as part of the OpenSim Project Team. First, he was a Distinguished Postdoctoral Fellow (2006-2008) and later he served the team as an Engineering Research Associate (2008-2009) at Stanford University. Currently, there are eleven OpenSim team members at Stanford University, but throughout the past ten years there have been thirty-eight members of the project team who played a vital role in development of the OpenSim Software package.

To date, more than fourteen thousand unique users have downloaded the software, Reinbolt said.

"OpenSim is used in hundreds of biomechanics laboratories around the world to study movement and the program has a community of software developers who continually contribute new features," Reinbolt added. OpenSim caters to a variety of users from students who use it as a learning tool in biomedical engineering programs to researchers who perform cutting edge research in movement science, rehabilitation, and design orthotics.

Congratulations Dr. Jeffrey Reinbolt on all your hard work!

For more information about OpenSim, visit <http://opensim.stanford.edu/support/fellows.html>.

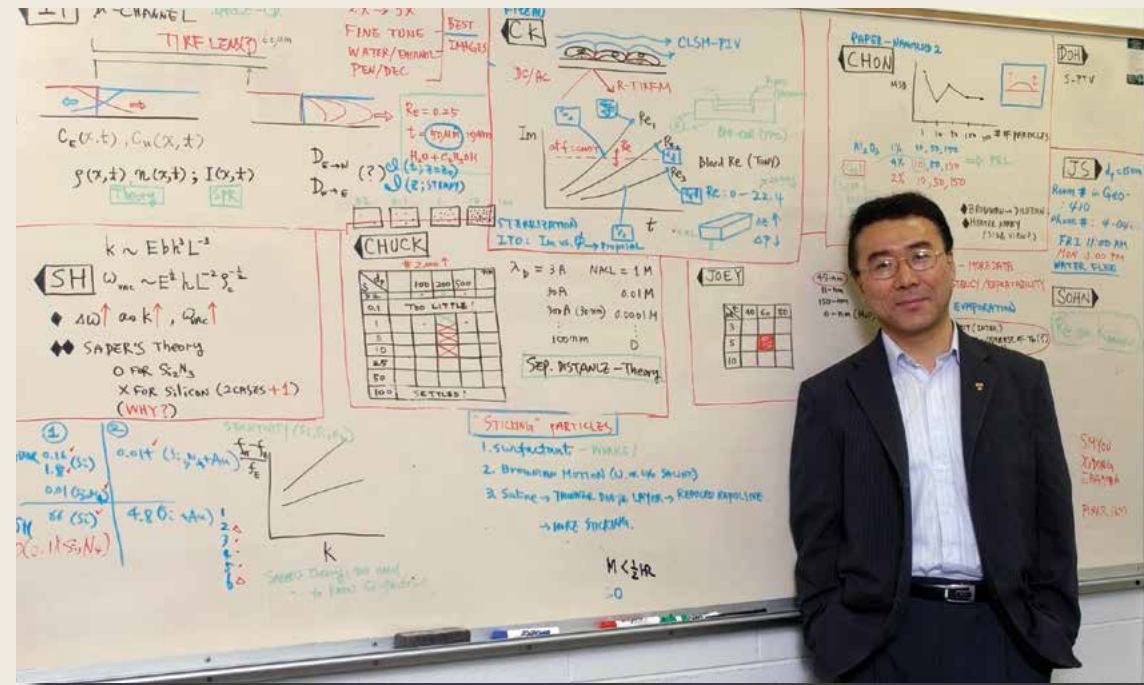
the field of neuromusculoskeletal modeling and simulation. The OpenSim Fellows will conduct transformative biomechanics research and lead the charge in its translation to medicine, robotics, graphics, and other areas that enhance human health. The OpenSim Fellows will help grow and sustain the modeling and simulation community by 1) training the next generation of researchers; 2) encouraging interdisciplinary collaboration; 3) sharing models, data, and software; 4) advocating for model validation and 5) demonstrating simulation best practices.

OpenSim is a freely available, user extensible software system that allows users to develop models of musculoskeletal structures and create dynamic simulations of movement. It started from an initiative by the NIH to launch a set of National Centers for Biomedical Computation, and the first version of OpenSim was released on Aug. 9, 2007. Specifically,

—Jenna E. McVey



# Dr. Kihm's Philosophical Nature Leads to Success with PhD Students



Dr. Kenneth D. Kihm

The past five years have been lucrative for Dr. Kenneth D. Kihm, Magnavox Professor in MABE, as he managed to graduate four PhD students who then effectively landed jobs as assistant professors in a relatively short amount of time. Kihm's former students and the universities they teach at are:

- **Dr. Charles Margraves**, University of Tennessee-Chattanooga, Mechanical Engineering Department.
- **Dr. Seonghwan "Sam" Kim**, University of Calgary, Canada, Mechanical Engineering Department.
- **Dr. Joey B. Tipton Jr.**, University of Evanston, Evanston, IN, Mechanical Engineering Department.
- **Dr. Chang Kyoung Choi**, Michigan Technological University, Houghton, MI, Mechanical Engineering and Engineering Mechanics Department.

It may have been the words of Leonardo da Vinci that inspired Kihm to formulate ideas on how to successfully mentor his students who, Kihm stated, spend a few

"golden years" of their lives under his supervision. A favorite quote of Kihm's is one by da Vinci, who stated, "It is true that nature begins by reasoning and ends by experience. Nevertheless, we must begin with experiments and try through it to discover the reason." Most likely though, Kihm's success rate stems from a few of his own philosophies that he instills in his students for them to use as guidelines.

The first philosophy is about requiring his students to obtain a demanding research topic.

"I carefully think about the scope and future demand of dissertation topics for their successful placements. I have tried hard to receive timely funding for the relevant topics; however, if it is unsuccessful, I take every effort to facilitate bridge funding sources for their start-up," Kihm said. The second is that his students need to recognize the significance of publishing papers and journals.

"I emphasize the importance of the number of quality publications since nothing is more impressive than a good

list of publications as a new PhD graduate," Kihm said.

The third philosophy is to master the skill of presenting his or her research.

"I often quote that the future fate of their years of research efforts can be determined by the last forty-five minute presentation during a job interview. Regularly, I urge them to analyze their video rehearsals, which I believe is the best way to improve one's presentation skills," he said. And lastly, Kihm stated that it is important to keep up the hard-working spirit.

"I ask them to invest a few years, sacrificing many nights and weekends instead of naively expecting that a graduate student can treat research like a 9 a.m. to 5 p.m. job. I often remind them that the number of hours they spend can hardly be defeated by anything else in achieving quality research and rewards," he said. Ultimately, Kihm's philosophies are intended to guide graduate students to become young academic leaders for the future of both the country and the world.

Kihm has strived to uphold these philosophies throughout his twenty-five years of teaching at both Texas A&M University (1988-2004) and the University of Tennessee (2004-present).

"The best reward of my career as an educator has been enjoying watching my former students' growth and success as independently recognized scholars and engineers," he said.

MABE looks forward to the continued accomplishments of Kihm and his graduate students.

—Jenna E. McVey

# UTSI Professor Looks Forward to Developing Future Biomedical Engineers



Dr. Jackie Johnson

When the Institute of Biomedical Engineering (iBME) started in 2013, the goal for the institute was to offer a multidisciplinary curriculum and real-world medical experiences to engineering students. Dr. Jackie Johnson, professor at the University of Tennessee Space Institute (UTSI) and involved with iBME, is focused on making that goal a reality.

Johnson joined the UTSI faculty in the fall of 2007 and is currently working with four students and a research assistant. She is excited about the future of iBME and is currently working with her research team on the synthesis and

characterization of nanoparticles for medical applications. The nanoparticles may be stand-alone nanoparticles or those precipitated in a glass matrix.

Johnson's future research plans include collaborating with other universities to research solutions to medical problems.

"My plans are focused on developing an enhanced magnetic nanoparticle to improve contrast for magnetic resonance imaging with

Vanderbilt University and an up-converting luminescent nanoparticle for visualizing tumor margins in the operating room with Northwestern University and the University of Illinois at Urbana Champagne," Johnson said. Johnson and her research team are also working on image plates for dental applications and non-destructive evaluation.

Johnson has had great success with her research throughout the years and has made a lasting impact in the medical field. In the early days of nanoscience, when only Paul Alivisatos of Berkley had made Cadmium sulfide and Cadmium

selenide nanoparticles, Johnson was asked by Argonne National Laboratory to make stand-alone selenium nanoparticles. By using the reverse micelle method, she successfully created the stand-alone nanoparticles. Johnson also predicted and proved that ZBLAN glass ceramics was a high-resolution image plate, which set the tone for image plates in mammography, dentistry, and non-destructive evaluation and led to the startup company, GCaDD. For her impressive research and work, Johnson received an R&D100 award.

Johnson feels privileged to work at UTSI and is grateful for the support she receives in her research.

"I am very excited about being a part of iBME with across campus teaching, collaboration with the medical school and opportunity to be part of a large team. My research fits really well into the biomedical engineering program at the University of Tennessee. I look forward to developing future biomedical engineers, which *CNN Money* says will have the biggest growth in jobs over the next ten years," Johnson said.

—Kathy Williams

## Dr. Kenneth Kihm's Research and Activities with his former students

**Former student:** Dr. Charles Margraves

**Past Research:** Near-field Nanoparticle Tracking to Examine Intracellular Vesicle Trafficking

**Present Activities:** Cultivating ideas to write a research proposal together in the area of nanoparticle tracking.

**Former student:** Dr. Seonghwan "Sam" Kim

**Past Research:** Atomic Force Microscopy (AFM) Cantilevers as Microscale Thermofluidic and Biophysical Sensors

**Present Activities:** Preparing a book chapter on "Near-field nanoscale thermometry" for a book to be published by Royal Society of Chemistry.

**Former student:** Dr. Joey B. Tipton Jr.

**Past Research:** Role of Free-Electrons on Evaporative Transfer of Liquid Metal

**Present Activities:** Continually working together and recently submitted a co-authored manuscript for ASME Journal of Heat Transfer.

**Former student:** Dr. Chang Kyoung Choi

**Past Research:** Development of an Integrated Opto-Electric Biosensor To Dynamically Examine Cytometric Proliferation & Cytotoxicity

**Present Activities:** Working together for ASME K-22 Heat Transfer Visualization committee co-organizing conference sessions and co-editing ASME Journal of Heat Transfer.



## Patent Filed for MABE Research Team Involving Custom Thermocouple Design



Alex Hashemian with Dr. Majid Keyhani and Dr. Jay Frankel

Have you ever watched a space shuttle—on TV or in a movie—barreling toward the Earth and held your breath until the moment the shuttle safely entered the Earth’s atmosphere without catching on fire or exploding? Have you ever thought about why space shuttles normally don’t burst into flames during the hypersonic speeds and extremely hot temperatures? Leave it to engineers, like those in MABE, who are working on thermal protection of hypersonic flight vehicles and developing products to accurately measure high heating rate temperatures, to keep pilots and shuttle equipment safe.

About four years ago, NASA funded Dr. Jay Frankel and Dr. Majid Keyhani

to work on thermal protection systems of flight vehicles subjected to severe aerodynamic heating. They had to figure out how to accurately measure high heating rate temperatures using thermocouples installed in their test samples. Thermocouples are used in many applications to measure temperature where rapid heating occurs.

“It is well known that measured data is attenuated and delayed so you really do not know the actual temperature,” Keyhani said. “Attenuation and time delay can cause significant error.”

Alex Hashemian, MABE graduate student, began working on the

research project more than three years ago, first as an undergraduate research assistant in 2011 and now, as a graduate student. The research team’s solution to the challenge of measuring temperature accurately is a custom thermocouple design, which is composed of two leads of different diameters that act to thermally balance the thermocouple, and a test procedure that is used to measure thermal response characteristics of the installed thermocouple.

“Using the response characteristics of the installed thermocouple, we can then remove the attenuation and the time delay from the measured temperature data,” Keyhani said.

As of now, there are no restrictions on the medium of the installed thermocouple probe.

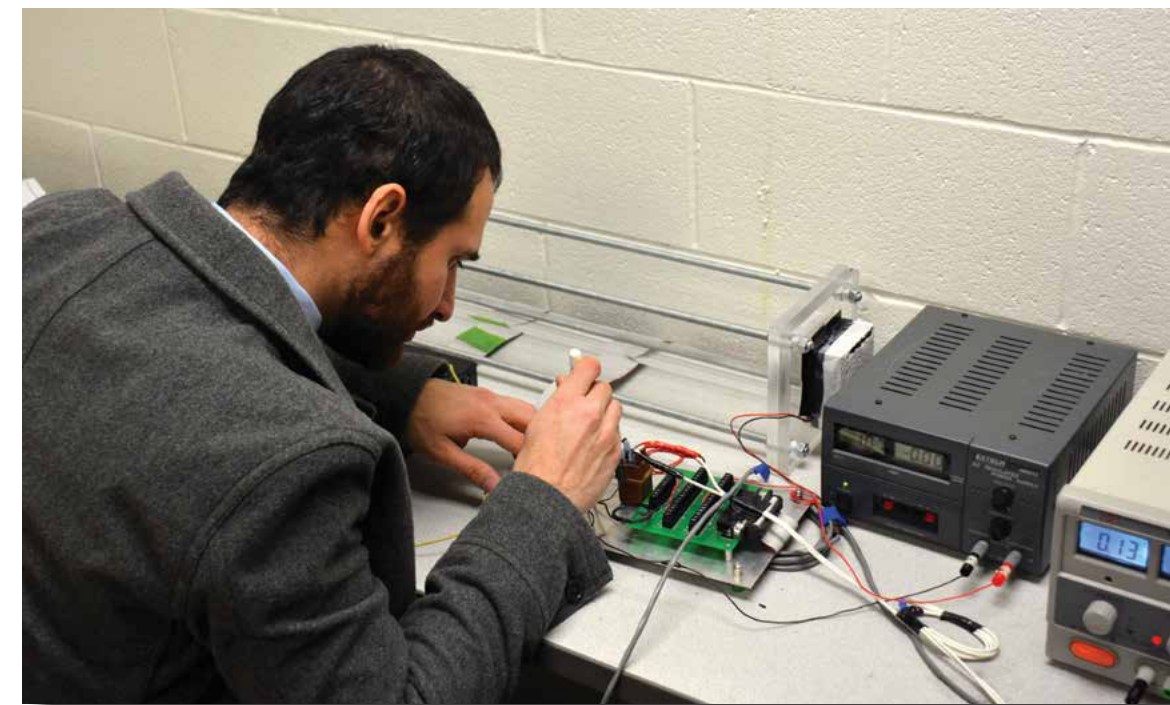
“It just happens that for our research, the thermocouples were installed in a solid,” Keyhani said. “However, it can be installed in a fluid stream. The measured response time of an in-situ thermocouple probe in a fluid stream is really giving us the value of the convection heat transfer coefficient for the probe.” Keyhani noted that they know heat transfer coefficient correlates very well with velocity.

“Alex has collected benchmark data that shows excellent correlation between the measured time constant and fluid velocity. I may add, though, that there are accuracy issues about measuring low velocities. So, our invention can be used as a dual-purpose probe, temperature and low velocity, when installed in a fluid stream,” Keyhani said.

Due to the research team’s successful data collection, in late November 2013, the UT Research Foundation filed for a provisional patent for intellectual property (IP) disclosed by Hashemian, Keyhani, and Frankel. The title of the disclosure is “Balanced-Leads Thermocouple Designed for In-Situ Response Characterization and Low Fluid Velocity Measurements.”

One might say that Hashemian is following in the footsteps of his father. He stated that his research is directly related to the work his father, Dr. H. M. Hashemian, has done for the nuclear energy industry at AMS Corp., a business Dr. Hashemian co-founded in 1977 with UT nuclear engineering professor, Dr. T. W. Kerlin.

“I’m very pleased with what my research has evolved into. It was a long campaign of work and experimentation that concludes with this patent. My research



MABE graduate student Alex Hashemian

project has utilized much of my father’s knowledge of in-situ sensor characterization. I’m proud to have improved upon his work, and apply it toward the development of this invention,” Hashemian said.

Keyhani stated that the invention responds to a growing need in the science and engineering industries as a new means to measure transient temperatures more accurately, especially for rapid transients.

“The product of this patent will be important in almost all applications involving transient temperature measurements such as materials research, process control, and a variety of aerospace and avionics applications,” he said. He noted that thermocouple manufacturers often report measured response times for their thermocouple probes by subjecting them to a step temperature change by sudden insertion in hot water or air flowing at certain velocity.

“This response information is only useful when the customer intends to use the probe under the exact test conditions performed by the manufacturers. Therefore, we must measure the response characteristics of a thermocouple probe after installation,” Keyhani said. The

knowledge of the thermal response time of the installed thermocouple is necessary to correct the measured data for the inherent time delay and attenuation of the measured signal, he said.

Hashemian stated it has been a pleasure working with Keyhani and Frankel.

“I’ve learned to be a good analyst from Frankel’s careful analysis of data, and from Keyhani, my mentor, I’ve learned to be a careful experimentalist. He has taught me the importance of developing physical insight, a skill I intend to apply in my future work as an engineer,” Hashemian said. The biggest accomplishment for Keyhani was that he trained an undergraduate mechanical engineering student to become a MS degree-seeking student, a great researcher, and a co-inventor on a patent. Speaking on behalf of Frankel, Keyhani stated, “We are educators and researchers. On both fronts, we have succeeded with Alex.”

MABE congratulates this hard-working team on an invention that brings the science and engineering world one step closer to accurately measuring transient temperatures.

—Jenna E. McVey



## Conwell Visits MABE to Speak to Students and Faculty and to Reminisce

Dr. James Conwell spoke to students about his work around the world as a mechanical engineer since graduating from the MABE department more than thirty years ago.



Dr. James Conwell

About thirty-five years ago, Dr. James C. Conwell, a budding mechanical engineering student, was attending class in 416 Dougherty Engineering building (DO 416). Little did he know, his life would blossom in two ways—personally and professionally—from DO 416.

Fast-forward to Sept. 12, 2013, Dr. Conwell is standing at the front of DO 416, not as a student, but as an outstanding global leader and educator in the mechanical engineering industry. Hundreds of eyes from students and faculty are staring back at Conwell, as they patiently wait to hear what he has to say. One pair of eyes, he is very familiar with. These eyes belong to his wife, who he met in DO 416 back when they were mechanical engineering students. Angela Conwell said the reason they first met in DO 416 was

because “he came and sat next to me, and we started talking!”

MABE students and faculty had a great opportunity of meeting with and listening to Conwell speak about the Rose-Hulman Institute of Technology, his experiences of working around the world as a mechanical engineer with companies such as BMW and Rolls Royce, and his advice for current and soon-to-be graduating engineering students. Conwell was recently named president of Rose-Hulman. Before Rose-Hulman, Conwell served as Vice President of Jacobs Engineering Group, one of the world’s largest and most diverse providers of engineering and technical services to primary markets such as automotive, mining, oil/gas, and pharmaceuticals. He received his Bachelor and Master of Science degrees in mechanical

engineering from the University of Tennessee, then became a senior engineer for Proctor & Gamble manufacturing in 1983, and earned a doctorate degree in mechanical engineering at Vanderbilt University. His background also includes teaching courses at Vanderbilt University, Louisiana State University and Grove City College. Conwell was asked what team he rooted for more often—UT or Vanderbilt University? “It would have to be UT,” he said.

After giving his presentations, touring different engineering buildings and the campus, and talking with many of the students, Conwell said, “Some of the buildings are the same, and a lot are different. Also, the students seem the same—a lot of them are still from the state of Tennessee.”

One thing Conwell misses most about his days at UT is the people. “I miss the people who really influenced my life—people who really made a difference, such as professors: Dr. Jeffrey W. Hodgson, and Dr. Robert L. Maxwell. I wish I had a chance to say thank you,” Conwell said.

After a long, full day of presentations and meetings with various individuals, including faculty and students, Conwell said, “This is a really neat place—UT.”

—Jenna E. McVey



Dr. Matthew M. Mench, Angela Conwell and Dr. James Conwell

## Alumni Spotlight: Larry Lacey Receives Lifetime Achievement Award



Larry Lacey

In 2001, MABE alumnus Larry Lacey retired from Abbott Laboratories, a leading global health care company, where he was known as the “Legend” by co-workers. He received a Lifetime Achievement Award in Engineering from Abbott Laboratories due to his knowledge, professionalism, and many accomplishments while at the company.

Born and raised in Kingsport, Tennessee, Lacey decided in seventh grade he wanted to become an engineer; mainly because he liked to build things, but also because his dad, a chemical process operator, worked with engineers at Tennessee Eastman Company.

In 1963, Lacey received his BS in mechanical engineering from the University of Tennessee (UT). While a student in MABE, he was a member of Tau Beta Pi and PI Tau Sigma, a co-op student, and received the student machine design award. Lacey described the time he found out he

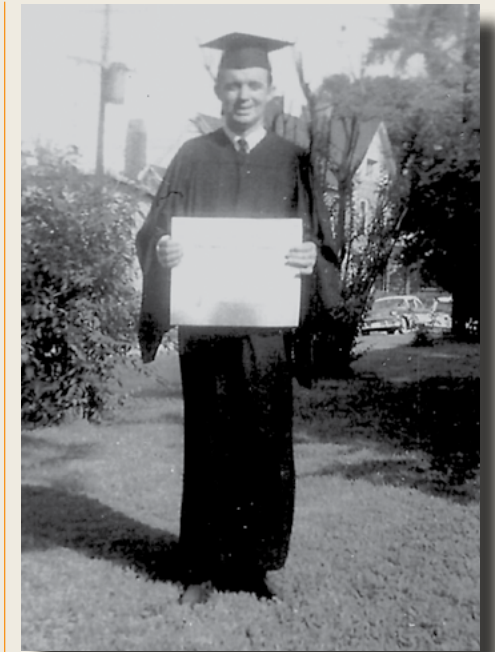
was accepted into the co-op program as “a great moment.”

“I realized that having the co-op meant I would be able to get my engineering degree,” Lacey said. Lacey selected to co-op at Tennessee Eastman Company, where he worked in various engineering positions for seven years. While working at Tennessee Eastman Company, he realized that having a job is just the beginning of new learning experiences.

“In my initial meeting with my first boss, he told me that my engineering diploma and twenty-five cents might buy me a cup of coffee. I fully understood what he was telling me. The door had been opened for the learning experience,” Lacey said. Lacey stresses to other engineers to “Learn! Learn! Learn! Learn from experienced engineers. Learn from other engineering fields. Learn from your mistakes and other engineers mistakes.”

Lacey began working at Abbott Laboratories in 1975 and held many positions, including Plant Engineer, Senior Plant Engineer, Plant Engineering Manager and Engineering Section Manager. These positions had him working at plant locations in North Carolina, Texas, and Illinois. Lacey’s largest accomplishment was having the position of Engineering Manager, where he was responsible for the construction, start-up, and validation of a large volume parental flexible container manufacturing facility, which is the largest IV plant in the world. He was also responsible for staffing a one hundred and sixty man engineering organization.

“I view my engineering career as a great adventure. I would like to do it all over again, but you only get to go around once,” Lacey said.



Lacey when he graduated from MABE in 1963

Lacey is grateful for the education he received at UT and feels it was excellent preparation for him becoming a top engineer. In 2005, he bequeathed a sizeable estate to the MABE department to fund scholarships for students from rural areas. He is now the second top living donor to the department.

“I was given a great education and as a result had a wonderful career. It’s great to be able to give something back,” said Lacey.

Enjoying retirement, Lacey is busy ranching, writing, doing engineering consulting work and is still learning. He recently wrote a pamphlet, *So You Want to be an Engineer—A Practical Guide*, that he hopes to have published soon.

—Kathy Williams

If you would like to donate to the MABE department, please go online to <http://mabe.utk.edu/> and click on the Give to MABE link at the bottom of the page.



## Engineering Program is a Perfect Fit for Bahamian Student



Philip Clarke

Philip Clarke, Bahamas native, is taking many steps to fulfill his dream of becoming an engineer and in the process is receiving national publicity in the Bahamas.

At a young age, Clarke spent hours on end watching the Discovery Channel and National Geographic and was inspired to become a scholar like the ones he grew up watching. The desire to be a scholar, along with his determination, set the foundation for Clarke's academic success.

Clarke began his journey as an engineering student at Florida International University in Miami, Florida, where he received his BS in mechanical engineering (Cum Laude '11). During his senior year as an undergraduate, Clarke focused on furthering his academic career and knew he wanted to pursue his PhD in engineering. His goal was to attend a university that placed a greater priority in their students' success than the rank of the school. Several people Clarke spoke with suggested the University of Tennessee (UT) was the place he needed to be, and he agreed.

Clarke entered UT's mechanical engineering doctoral program in the fall of 2012 and began his studies at the Knoxville campus. Later he transferred to the UT Space Institute (UTSI) so he could work closely with his advisor, Dr. Reza Abedi. Clarke, under the guidance of Abedi, is working on the development of his PhD thesis on the optimization of lithium ion battery components to reduce capacity fade due to mechanical and electrochemical induced degradation and in turn increase the lifespan of these batteries. He is also assisting in the development of an in-house Finite Element Analysis (FEA) code utilizing Space-time Discontinuous Galerkin Finite Element Methods (SDGFEM).

Abedi describes Clarke as a very self-motivated, friendly student who always seeks innovative solutions in his

research and had a level of maturity that is rare at his age.

"He is a person who is constantly seeking to learn more whether it is in the classroom or during our research meetings," Abedi said.

The quote from Galileo Galilei, "I do not feel obliged to believe that the same God who has endowed us with sense, reason, and intellect has intended us to forgo their use," is what Clarke bases his life on.

"I have a passion in enhancing my mind at every opportunity possible and the opportunity of obtaining my PhD has always been a goal of mine ever since childhood," Clarke said. This passion is not going to end when Clarke receives his PhD, though. He is already making plans to pursue a non-thesis MS degree in mathematics.

"I've come to greatly appreciate the mathematical aspect of engineering and this interest has led me to want to pursue a math degree. I then want to obtain a post-doctoral position where I can transition into a teaching/research position within the engineering department of that or some other university," Clarke said.

After having mixed experiences with professors, Clarke decided he wants to become a caring and dedicated professor because a good professor can be the deciding factor between a student wanting to further his or her academic career or not. "A PhD in mechanical engineering, in my opinion, is a means of living by Galileo's quote and becoming one step close to my desire to teach," Clarke said.

Clarke's success in his academic years has been an inspiration to others in his hometown and as a result, he has been featured in a national Bahamas newspaper story. Clarke hopes the publicity will be a motivational tool for the youth in his country.

He is very thankful for the opportunity to study and do research at UT and is excited for the future.

"This path I chose is by no means an easy one traveled, but I am glad that I chose the UT family to support and guide me along the way. I feel that my time here has been and will continue to be prosperous," Clarke said.

In his free time, Clarke always likes to keep his mind and body active, and he enjoys new experiences. He is studying Mandarin, learning to play guitar for recreation, and increasing his knowledge of computer programming. Although he loves the tropical weather in the Bahamas, Clarke enjoys the experience of different seasons.

"I especially love the colors during fall and the snow in winter; both things I would definitely not be able to experience back home. There is no place like home, but it pays to experience new things; so I've adjusted well and enjoy the difference," Clarke said.

—Kathy Williams

## MABE Students Accepted into Phi Kappa Phi



Yasser Ashraf Gandomi



Alexander (Alex) Hashemian



Andrew Henry



Misagh Mansouri Boroujeni



Graham Taylor

MABE students Yasser Ashraf Gandomi, Alexander Hashemian, Andrew Henry, Misagh Mansouri Boroujeni, and Graham Taylor were recently accepted into Phi Kappa Phi, the nation's oldest, largest, and most selective collegiate honor society for all academic disciplines.

**Yasser Ashraf Gandomi** is a PhD student in mechanical engineering and is a member of the Electrochemical Energy Storage and Conversion Laboratory. Gandomi's advisor is Dr. Matthew M. Mench and his work is primarily focused on developing a model for all-vanadium redox flow batteries. His work also includes designing in-situ diagnostics for all-vanadium redox flow batteries. Gandomi is the student chapter president of ASME (American Society of Mechanical Engineers).

**Alexander (Alex) Hashemian** is a MS student in mechanical engineering and works in the heat transfer research group with Dr. Majid Keyhani, his advisor, and Dr. Jay Frankel. He has been working in this research group since his third year as an undergraduate in the MABE department. Hashemian's work deals with the development of an in-situ thermal characterization method of specialized thermocouples for the purpose of obtaining accurate transient temperature data from the installed sensor as well as low fluid velocity measurements, provided the sensor is in a fluid domain. The results of his research have led to a patent application, which has recently been submitted to the University Research Foundation.

**Andrew Henry** is a MS student in mechanical engineering and worked as an intern for Oak Ridge National Laboratory in the Battery Manufacturing Facility. While working in the lab, Henry worked on using different materials as the anode and cathode of batteries and analyzing the effect moisture has on batteries to increase energy density for electric vehicles.

**Misagh Mansouri Boroujeni** is a PhD student in mechanical engineering and works as a graduate research assistant under the supervision of Dr. Jeffrey Reinbolt. Mansouri's work seeks to develop an integrated research foundation to understand human balance and movement control through a design, control, and simulation environment to uncover the principles that govern the coordination of muscles during normal and abnormal movement. He recently has his work titled "A platform for dynamic simulation and control of movement based on OpenSim and MATLAB" published at in the *Journal of Biomechanics*. Mansouri is a member of the American Society of Mechanical Engineers, the American Society of Biomechanics, and the Biomedical Engineering Society.

**Graham Taylor** is a PhD student in biomedical engineering and works in the Bioinspired Materials and Transduction Laboratory under the guidance of his advisor, Dr. Andrew Sarles. Taylor's research is aimed at developing novel devices and smart materials that utilize active biomolecules including lipids and proteins as the building blocks. Taylor has presented twice at the ASME SMASIS (Smart Materials, Adaptive Structures, and Intelligent Systems 2012-13) conference for separate projects underway in the lab. The current focus of his research is yielding new information regarding membrane interactions of amyloid beta (1-40), a protein found in the bloodstream and in amyloid plaques in Alzheimer's. Taylor's future research goals include advancing bilayer based constructs from the lab to point of care therapies while probing, understanding, and applying biomedical engineering principles to basic sciences of biochemistry and molecular biology.

Congratulations to these students on their acceptance into Phi Kappa Phi!

—Kathy Williams



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## GAME Sparks Interest in Science



The Graduate Association of MABE Engineers (GAME) is sparking interest in science in elementary school students through a recently developed outreach program. This February, four graduate students gave a presentation and provided hands-on demonstrations on non-Newtonian fluids to two fifth grade classes at John Hay Elementary School in Morristown, Tennessee. The demonstrations brought the fifth grade classes an opportunity to learn about oobleck, a shear-

thickening non-Newtonian fluid. The demonstrations were designed around the class curriculum to provide a fun and interesting learning experience that complemented their education.

The classes were given the chance to handle oobleck and gain a concrete understanding of concepts they had learned about in class. The students were asked questions to invite them to think of similar fluids they experienced in their daily lives and to think of unique ways that non-

Newtonian fluids could be used to solve problems.

The demonstrations were well-received by the students and teachers, with some of the fifth graders asking when the UT graduate students would return for another round. Other teachers at John Hay invited the graduate students back to provide similar demonstrations for other classes. GAME is now pursuing other outreach opportunities in the community.



Students discover properties of non-Newtonian fluids by immersing their arms in oobleck as Ph.D. student Akinola Oyedele from the Bredeesen Center looks on.



MABE Ph.D. student and GAME vice president Andrew Kaminsky shows a 5th grade student from John Hay Elementary some aspects of the non-Newtonian behavior of oobleck firsthand.



Discussion of oobleck-on-a-speaker experiment is led by MABE Ph.D. student and GAME member Andy Burch.





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## Photo Gallery

- (1) Dr. Matthew M. Mench, Angela Conwell, and Dr. James Conwell.
- (2) Dr. Andy Sarles speaking to students during the Spring Engineering Fundamentals Fair.
- (3) MABE student demonstrating how a robot works during the Spring Engineering Fundamentals Fair.
- (4) MABE students with Dr. Hash Hashemian.
- (5) Dr. Matthew Mench with Dr. Hash Hashemian.
- (6) Dr. Hash Hashemian speaking during the Distinguished Seminar Series.
- (7) (L-R) Dr. Hashemian, Jason Clement, Shiqi Ou, Yasser Ashraf Gandomi, and Jacob Houser.

## A MABE alumnus is part of the cast for NBC's new Weekly Show *American Dream Builders*



Tarrick Love

Tarrick Love, (BS/ME '97) a 1997 mechanical engineering graduate, is one of twelve cast members to enlist in a high-pressure competition designed to push the contestants' creative reach. The show premiered at 8:00 p.m. Eastern on March 23 on NBC.

Love is a licensed general contractor and owner of two residential development companies based in Nashville, Hart-Love Enterprises and Dream Build Nashville. Love began his career as a mechanical engineer and, after being introduced to home building, found his new passion. He credits his UT education with helping realize his dream.

"UT's College of Engineering did a tremendous job preparing me for both my career as a mechanical engineer and my transition to general contractor/home builder," he said. "The technical fundamentals I learned helped me to understand and analyze structural loads on homes. The critical thinking and analytical processes I learned helped sharpen my problem solving skills, which I use daily as a home builder."

Since forming his own companies in 2006, Love has served as a licensed general contractor and developer for more than a hundred new builds, renovations and additions. Love

has been recognized twice by the Historic Homes Commission of Middle Tennessee as winner of the Historic Preservation Award.

"I find homebuilding so satisfying because I am helping make people's visions and dreams of what they want in a home for their families come true," Love said. "I also relish the art of making a project come together from the initial design inception phase to completion."

Each week, Love and the other contestants will tackle two massive home renovation projects, each featuring unique architectural styles that result in major transformations. The winner at the end of the series will receive a grand prize of \$250,000.

"The best thing about being given the opportunity on NBC is the ability to showcase my talents and abilities on a national stage. I am hoping this opportunity will help produce growth in our business and potentially some additional television opportunities," Love said.

Love advises engineering students to know that with their engineering degree, the sky is the limit.

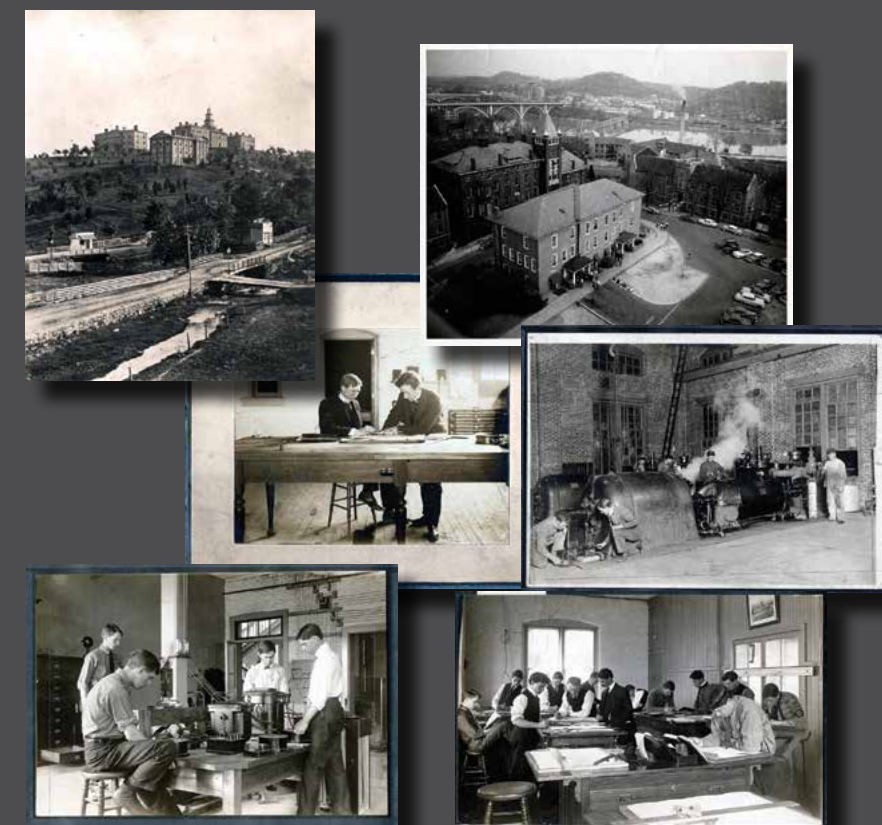
"Never put yourself in a box," he said. "Our engineering degree offers us a solid foundation with a diverse array of skills that can lead to many professional paths."

Former Tennessee Titans running back and landscape architect Eddie George and design expert featured on HGTV's hit series *Designed to Sell* Monica Pedersen have been tapped as judges for the one-hour reality competition series. Interior designer and TV host Nate Berkus will serve as host, judge, and executive producer.

—Whitney Heins

## 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 [jmcvey1@utk.edu](mailto:jmcvey1@utk.edu). We look forward to rediscovering our past!





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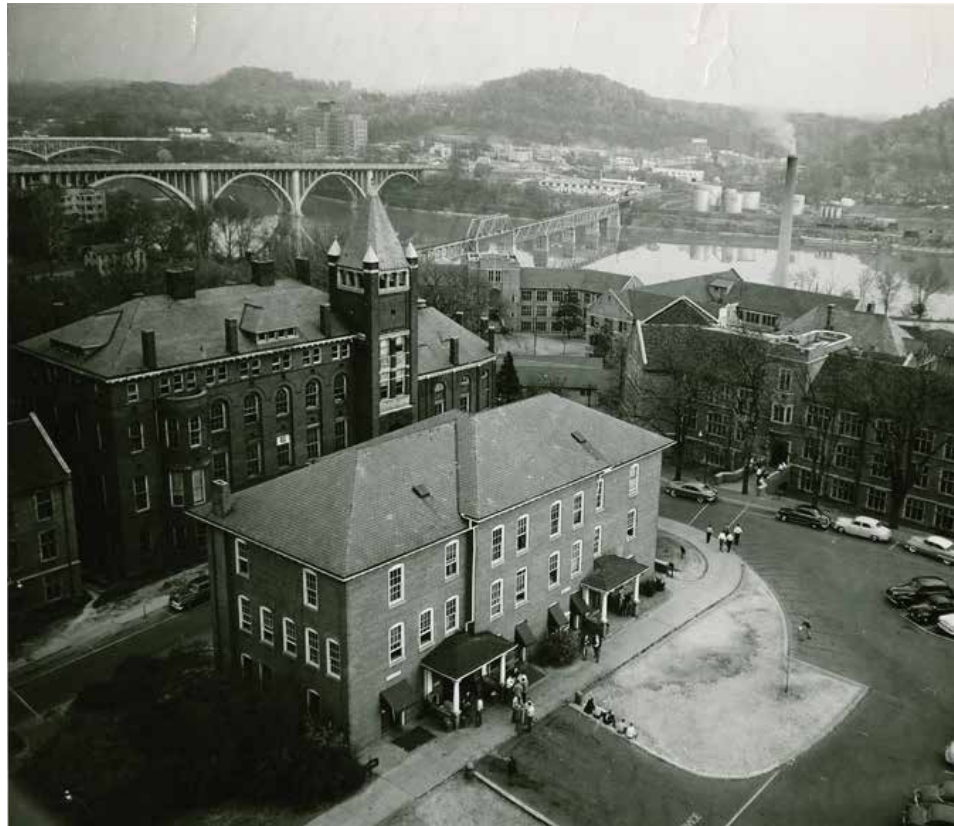
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