As another academic year draws to a close, one of the most satisfying moments for me was to hear the celebratory roar of 332 ME graduates at Spring commencement, making the total ME graduates at approximately 380 for the year. From all indications this number is going to be higher in the coming years. I am pleased to report that with the increasing demand for VTME degrees, the department hired 6 new teaching and research faculty, including a new Department Head, a Professor of Practice to work with senior design teams, and a Laboratory Technician to keep our undergraduate teaching labs up to date and functioning. I would like to welcome all of them to the ME department. The department also has an ongoing search for an additional undergraduate/graduate advisor.

This issue features some of the capstone senior design and service learning projects undertaken by ME as well as other college of engineering students. In an increasingly interconnected world, what better way for students to learn and to showcase their talents, than by impacting global society through industrial and humanitarian projects? I am in awe of the dedication and resourcefulness of our students and their advisors. From southwest Virginia to Malawi, Senegal, Nepal, across three continents, our students are exerting their relevance and passion to change the world one step at a time. It is my hope that both, service learning projects and industry supported projects will grow in the capstone senior design portfolio in the years to come.

Lastly, as my interim appointment ends in August, I wish the incoming department head Dr. Azim Eskandarian the very best. I am confident that under his leadership the department will scale to new heights. It was a privilege to serve the department and the college of engineering as the interim head.

Sincerely,
Danesh Tafti
W.S. Cross Professor & Interim Department Head

Mechanical Engineering Senior Design: The Practice of Engineering

by Kevin Kochersberger
The regular beat of a steel blade cutting grass became the sound of success for the silage production senior design team that was tasked to design and build a low-cost silage production system for Senegalese farmers. Demonstrated in Africa at the end of February, this system provided an innovative solution for USAID-funded partners in the Education and Research in Agriculture (ERA) program, showing the world what VT undergraduates can do.

And 40 other projects are creating equally impressive solutions to problems through the ME capstone design course.

Senior design at Virginia Tech has evolved significantly over the years to keep up with a demand for entry-level engineers that can "do design" within the corporate culture. As such, the class has been structured to place students in preliminary and critical design reviews, visit sponsoring companies and spend the last half of spring semester testing and evaluating designed products. An expo at the end of the academic year showcases the students' work with judging provided by faculty and industry sponsors.

The benefit of externally sponsored projects is that they give students a meaningful design experience while solving meaningful problems. With record class sizes being set every year for the last three years and continuing into the future, VT must turn to industry for design project ideas.

Support for industry-sponsored projects is also growing rapidly in the department, with 3,100 sq. ft. of project space available for students beginning next academic year. APPLIED - Advanced Product Prototyping Laboratory In Engineering Design - will serve the senior design class with machine tools and bench space for teams to build their systems. This facility joins the 600 sq. ft. E-Lab (Electronics Lab) which has $30,000 in National Instruments data acquisition equipment available for students to use in prototype testing and evaluation of their products.

Once machines and workbenches are in place, APPLIED will allow students the freedom to explore
From Virginia to Malawi

by Ashley Taylor

For one research team, the mountains of Malawi, Africa, are starting to feel just as comforting as the mountains of Blacksburg, Virginia.

In July 2013, mechanical engineering students Garret Burks and Ashley Taylor traveled to Mzuzu, Malawi, where they would spend five weeks working in hospitals with local physicians and engineers. It was both students’ first time traveling outside of the United States, and though they prepared for the trip to the best of their ability, there were some things they couldn’t prepare for.

“We saw a lot of inoperable equipment in the hospitals that was unable to be repaired due to lack of resources, both human and material,” Burks said. The students were compelled to contribute and were also inspired by the warmth and ingenuity of the local Malawians. Without any formal ‘engineering’ background, the students noted, local innovators had managed to devise creative solutions with local resources. It was a new type of problem solving that focused on out-of-the-box solutions to difficult problems.

Still, there were many challenges to be faced, and Burks and Taylor were compelled to unite VT engineering forces with the local innovators. Through their experiences in Malawi, they knew that community-based efforts and the utilization of local resources would be critical to the success of an engineering effort. The students decided to focus on preventing infant mortality through improved resuscitation equipment, a dire need observed in much of the developing world.

Three ME alumni (Jamie Cabaleiro, Megan Cash, and Lisa Gonzalez) also joined the efforts, and together a senior design team was formed to create an infant resuscitator that could operate without electricity and be manufactured from local resources. The resulting device, Global Assisted Infant Resuscitation, or Global AIR for short, provides suction, positive pressure ventilation, and continuous positive airway pressure for newborn infants. The device was intentionally designed to be fabricated from local materials, such as PVC buckets and pipes, with a long-term goal of employing a sustainable business model that will function within the private sector businesses of Malawi.
Though the project is several steps away from private-sector implementation, progress continues to forge ahead through new teams members. Philip Repisky, a ME senior, joined the team in 2014 and hit the ground running by building an improved prototype of the device. During the summer of 2014, Repisky and Taylor revisited Malawi to demonstrate the second prototype of Global AIR at eight collaborating hospitals and Mzuzu University. Design feedback was solicited from over 60 Malawian medical personnel, including clinicians and maintenance managers. Taylor continues to work on this research as part of her graduate work in the ME department; current work is focused on implementing the design changes recommended by the Malawian collaborators, as well as developing strategies to work with local communities to implement the device, when the time comes. Taylor hopes to return to Malawi in late 2015 to work with collaborators to further improve the design.

"Global AIR opens up the world of design for engineering that is all too often forgotten... By focusing on the real issues facing today’s world, meaningful engineering can be accomplished, even by college students," Repisky said. "This project, in my opinion, exemplifies the heartbeat of engineering- that nothing is impossible," Taylor added. "I have seen only a small slice of the world, but I’ve seen enough to know that there are some big problems that need our help solving. The VT engineering program gives us the resources and then beckons us to go out and solve problems. Slowly, I think, together we can make the world a better place."

Service Without Borders
by Abigail Smith

In the spring semester of 2015, three undergraduate students formed a new student organization on campus entitled Service Without Borders (SWB). The goal of this group is to act as an interdisciplinary student organization that will partner with faculty mentors to take the university’s motto, Ut Prosim (That I May Serve), global. Currently, SWB has two proposed projects. The first project is a design team which has been working with a local Blacksburg nonprofit, The Tshampa Foundation, to improve the quality of life for a village in the Mustang Region of Nepal. The potential projects include a water distribution system, irrigation system and/or renovating a community center into a multifunctional and educational space. Other projects such as rebuilding local schools and doing assessments on earthquake resistant construction methods are being discussed. Since the recent earthquakes, project travel has been postponed and the project scope will be reevaluated. The second project works locally in Southwest Virginia. This team is currently finishing a project with the government of Craig County where a conceptual design and cost analysis were completed for the extension of a greenway and the construction of a bridge near New Castle, VA. The students are learning how to survey, read and interpret topographical maps, while taking geographical, political and social constraints into consideration to help formulate designs. Smaller projects, such as trail maintenance, after-school tutoring or STEM related activities with a local elementary school and work
with Habitat for Humanity are also a part of the local project within SWB.

Through the generous support of multiple engineering departments, including the support of Dr. Danesh Tafti of Mechanical Engineering, as well as the Institute for Critical Technology and Applied Science (ICTAS), the Nepal team will be able to complete an assessment trip to gather information that is essential in formulating design plans before they implement their project(s). The collaboration from across the University, with support from departments such as the Biological Systems Engineering Department and the College of Natural Resources and Environment, as well as the Engineering Dean's office is accelerating the development of this organization.

If you are interested in learning more information about Service Without Borders, please contact Abigail Smith, at abigail8@vt.edu.

New Faces in ME

Alan Asbeck
Assistant Professor

Dr. Alan Asbeck is currently a Research Scientist at Harvard University and the Wyss Institute for Biologically Inspired Engineering. In 2002, he received a Bachelor's degree in Electrical Engineering from the Massachusetts Institute of Technology. The following year he was awarded an M.Eng. in Electrical Engineering and a B.S. in Physics, also from MIT. In 2010, he received his Ph.D. in Electrical Engineering from Stanford University, where he was funded by an NSF Graduate Research Fellowship. His Ph.D. research focused on biologically inspired climbing robots and microspine arrays. After graduation, Alan worked as a postdoctoral researcher in the Stanford Artificial Intelligence Lab where he designed a series of low-cost robotic arms. He has been developing soft exosuits with the Harvard Biodesign Lab since 2012, where he was initially a postdoctoral fellow. His current research interests include designing improved wearable robots, developing human-compatible control systems, and understanding the underlying biomechanics of movement. He is very excited about joining the faculty at Virginia Tech and hopes to pursue many collaborative projects with everyone.

Pinhas Ben-Tzvi
Dr. Pinhas Ben-Tzvi is an Associate Professor of Mechanical and Aerospace Engineering and the founding Director of the Robotics and Mechatronics Laboratory at the George Washington University. He received his B.S. degree (Summa Cum Laude) in Mechanical Engineering from the Technion - Israel Institute of Technology in 2000 and M.S. and Ph.D. degrees in Mechanical Engineering from the University of Toronto, in 2004 and 2008, respectively. Before joining the University of Toronto in 2002, he was an R&D engineer at General Electric Medical Systems Company developing medical diagnostic robotic and mechatronic systems. Dr. Ben-Tzvi's current research interests are in robotics and autonomous systems, dynamic systems and control, mechatronics, human-robot interactions, mechanism design and system integration, and novel sensors and actuators. Examples of his research application areas include autonomous field robots for search & rescue and hazardous environment sensing and monitoring, bio-inspired flexible robots for agile maneuvering of legged robots, autonomous UAV launch and recovery from naval vessels, upper-extremity robotic exoskeletons for teleoperation and rehabilitation, and novel sensors and actuators for biomedicine. He has authored and co-authored more than 70 peer-reviewed journal articles and refereed papers in conference proceedings and holds several patents. He is the recipient of the GW SEAS Outstanding Young Researcher Award and the Outstanding Young Teacher Award, and other honors and awards. Dr. Ben-Tzvi is a senior member of IEEE and a member of ASME.

Dr. Jiangtao Cheng received his Ph.D. degree in Physics from Purdue University in 2002. He also has a M.S. degree in Computer Science from Purdue University and a B.S. degree in Applied Physics from Peking University at Beijing. Prior to joining the University of North Texas in 2011 as Associate Professor, Dr. Cheng was a research associate at the Pennsylvania State University and a research scientist at Teledyne Scientific Company (formerly Rockwell Science Center). He has served as the principal investigator of several research projects funded by DOE, NASA, DARPA and NSF respectively with a total funding exceeding $3.2 million. He has authored/ co-authored about 50 papers in journals and conferences. Dr. Cheng has won numerous awards in his career including three times Best Paper Awards in international conferences and 2013 Outstanding Overseas Young Scholar Award from China NSF. In 2010, Dr. Cheng's project "Optofluidic Solar Concentrators" was announced by the U.S. Department of Energy as one of the "six transformational energy research and development projects that could revolutionize how the country uses, stores, and produces energy". Dr. Cheng has extensive experience in thermal-fluid sciences, renewable energy, micro/nano-fluidics, optofluidics, multiphase fluid flow, nano-fabrications and CFD numerical simulation. Dr. Cheng will be joining the department at the rank of Associate Professor.
Weiwei Deng
Associate Professor

Dr. Weiwei Deng earned his Ph.D. in Mechanical Engineering from Yale University in 2008, and received his BS/MS from Tsinghua University. He has been an Assistant Professor of Mechanical Engineering at the University of Central Florida (UCF) since 2010. Dr. Deng’s research area is in the study of electric stress on disturbing, reshaping, and manipulating liquid jets, droplets, and films, and the exploitation of these principles in printing and deposition of advanced materials. His current projects include printing ceramic sensors for harsh environments, and nano-manufacturing of polymer solar cells via electrospray deposition, drying route for biodegradable micro/nano particles for drug delivery, as well as processing complex liquid suspension for manufacturing lithium ion batteries. Dr. Deng has published 25 archival journal papers in high impact journals and 1 book chapter with 530 Google citations to his credit with a H-index of 10. He has obtained over $1.46 million in total funding, all as PI, with a personal share of $1.06 million. He is the recipient of a NSF CAREER award “Scalable Electrospray Processing of High-Efficiency Perovskite Solar Cells” starting August 2015. Dr. Deng will be joining the department at the rank of tenured Associate Professor.

Horatio Cowan
Lab Technician

Horatio Cowan is the new Lab Technician for the Mechanical Engineering department. He has been putting together a new workspace for capstone design students called the APPLIED lab. He is also helping to develop some new lab experiments for the undergraduate lab courses. He graduated from the University of Maine class of 2013 with a bachelor's degree in mechanical engineering and a minor in math. While at the University of Maine, he worked in the mechatronics lab developing new lab experiments for the mechanical engineering department’s control systems class. Having lived in Rockland, Maine most of his life, he has spent a great deal of his time restoring and sailing classic wooden yachts. After graduating from college he lived aboard one of these boats and sailed from Maine to the Caribbean and back. He is now a licensed boat captain and ham radio technician. Horatio enjoys spending time in the shop and sees engineering as an art where form meets function. He is very excited to join the Virginia Tech team and looks forward to working together on many interesting projects.
Dr. Azim Eskandarian is currently a Professor of Engineering and Applied Science at The George Washington University (GW) and a Fellow of ASME. He has been the founding director of the Center for Intelligent Systems Research since 1996 and the director of the “Transportation Safety and Security” University Area/Program of Excellence since 2002. He was also the co-founder of the National Crash Analysis Center in 1992 and its director from 1998 to 2002 and since May 2013. He has 30 years of academic and engineering experience in dynamics and control, intelligent systems, and applied mechanics, with applications in intelligent vehicles, vehicle dynamics and control, automotive and transportation safety, and robotics. Prior to joining GW in 1993, he was an assistant professor at Pennsylvania State University (1989-92) and earlier worked as an engineer/project manager in industry (1983-89.)

Dr. Eskandarian has been instrumental in the establishment of a new and unique graduate program of study in Automotive Safety and Intelligent Transportation Systems (ITS) at GW. He has published 146 refereed (journal and conference) articles, three edited volumes, one book, and one edited reference handbook, and delivered 76 abstracts in presentations, seminars, and invited talks. He has directed/co-directed 12 post-docs, 18 doctoral dissertations, 18 master theses, and 36 student projects, and served as reader/examiner of 47 additional theses and dissertations. He was recognized among the highest cited authors of IEEE Transactions on ITS during 2000-2009 and co-author of one of the top ten selected papers in the same period. One of his co-authored articles won an ASME IMECE student paper award in 2012. His research has been covered in several media. His sponsored research has reached $27.3M ($11.5M as PI and $15.8M as Co-PI/Key Investigator.) He also contributed significantly to additional fund raising (as a team member) for $42M for a university building ($26M) and research for others ($16M). He is an associate editor and a board member of five journals, and was recently invited to serve as associate editor of ASME Journal of Dynamic Systems, Measurement, and Control. He has been elected twice to the Board of Governors of the IEEE ITS Society and is also active in ASME Dynamic Systems and Control Division. He has served by invitation on several government, DOT, NSF, and NAS committees and panels. He received his B.S. (with awards), M.S., and D.Sc. degrees in Mechanical Engineering from GWU, Virginia Polytechnic Institute and State University, and GWU in 1982, 1983, and 1991, respectively.
Robin Ott

Associate Professor of Practice

In 1995 Robin received a Bachelor's degree in Mechanical Engineering at Virginia Tech and has since gained 20 years industry experience. Early job experience included working as a design engineer for a Naval Sea Systems Command contractor where she designed a Countermeasure Washdown System for the MHC-51 Coastal Minehunter ships. She also spent time as an Application Engineer at Parametric Technology Corporation, the creators of 3D CAD software PRO-Engineer. In 1999 she joined Kollmorgen, a Danaher Motion company based in Radford, where she held multiple roles of increasing responsibility during her nine years there. While at Kollmorgen Robin worked with Shingijutsu Global Consulting experts from Japan and earned black belts in the DBS kaizen areas of Standard Work and 5S and traveled globally to qualify suppliers in Asia and Europe. Most recently Robin worked as Senior Director of Project Management for a small bio-tech company, Intrexon, located in the VT Corporate Research Center and had the opportunity to introduce manufacturing principles into a highly specialized DNA production facility. Robin lives in Salem with her husband and two children and is thrilled to be joining the faculty at her Alma Mater.

Xiaoyu Zheng

Assistant Professor

Dr. Xiaoyu "Rayne" Zheng has been on the Member of Technical Staff and Principle Investigator at DOE Lawrence Livermore National Laboratory, Livermore, California. He has been the principle investigator on advanced additive manufacturing and hierarchical architected material projects. The aim of Zheng's research is to advance the next generation of additive manufacturing technologies and design tools to enable the design, analysis, and fabrication of multi-scale, three-dimensional materials and systems that possess extraordinary and unique capabilities for structural, energy and biological applications. Zheng received his Ph. D in Mechanical Engineering with the Best Dissertation Award from Boston University in 2011. After graduation, he joined the Materials Engineering Division at Lawrence Livermore National Laboratory, working on the advanced additive manufacturing initiatives and micro-architected materials. There, he led the LLNL and MIT team and developed the "Ultralight, Ultrastiff Metamaterials" in polymer, metal and ceramic, which was published on the June 20 2014 issue of Science and featured on Highlights of the issue. He has published over 40 journal articles, proceeding papers and book chapters. Zheng is the recipient of 2013 Directorate Award for Publication Excellence at LLNL, Best Poster Award at 2012 Materials Research Society Spring Meeting, Best Paper Award at 2010 IEEE Sensor Conference, 2008 Outstanding Graduate Teaching Award at Boston University, and the President Award at Boston University in 2007.
Awards Recognition

Faculty Awards

Prof. Pablo Tarazaga's proposal "Adaptive Structural Vibrations for Multifaceted Motivity" was selected for the 2015 Air Force Young Investigators Research Program.

Prof. Ranga Pitchumani named George R. Goodson Jr. Professor of Mechanical Engineering.

Prof. Bahareh Behkam received a NSF CAREER award for the proposal "A Biomanufactured Platform for Modulating Immune Cell-Bacteria Interactions in the Tumor Microenvironment".

Prof. Jan Helge Bøhn awarded the 2015 Alumni Award for Excellence in International Outreach by the College of Engineering.

Prof. Mark Pierson received the 2015 Deans' Award for Service Excellence from the College of Engineering.

Prof. Celine Hin awarded the College of Engineering Outstanding New Assistant Professor Award.

Prof. Chris Williams named as a College of Engineering Faculty Fellow.

Prof. Lei Zuo selected to receive the 2015 Thar Energy Design Award by the DED.

Prof. Rolf Mueller won the IBM Faculty Award to develop bioinspired computing designs modeled on the mammalian brain.

Faculty Promotions

Prof. Bahareh Behkam was promoted to the rank of Associate Professor.

Prof. Brian Lattimer was promoted to the rank of Professor.

Staff Awards

Melissa Williams completed her Bachelor's of Science in Business Management and Leadership from Bluefield College.
Jackie Woodyard completed her Bachelor's in Interdisciplinary Studies with Business ad Social Cognates from Liberty University.

**Student Awards**

Coleman Knabe, Viktor Orekhov, Michael Hopkins, Prof. Brian Lattimer, and Prof. Dennis Hong were finalist for the IEEE Humanoids 2014 Best Video Award for "Two Configurations of Series Elastic Actuators for Linearly Actuated Humanoid Robots with Large Range of Motion".

Michael Hopkins, Viktor Orekhov, Coleman Knabe, Prof. Brian Lattimer, and Prof. Dennis Hong were finalist for the IEEE Humanoids 2014 Best Video Award for "Humanoid Balancing on Unstable Terrain Using Whole-Body Momentum Control and Series Elastic Actuation".

Joseph Starr and Prof. Brian Lattimer won the 2015 Tibor Z. Harmathy Award for their Fire Technology paper "Evaluation of Navigation Sensors in Fire Smoke Environments".

Formula SAE takes 6th place at the International Michigan Formula SAE event.

HEVT placed 2nd at the EcoCar 3 Year 1 Final Competition.

**Staff's Corner**

Diana Israel

*Program Support Technician, Turbo Group*

Diana Davis Israel is a Program Support Technician for the Turbo and ThermoFluids Group and began working for the department January 2009. She also processes undergraduate scholarships and backs up Beth Howell with pre-award. Diana has been with the university for 10 years, including working for Real Estate Management and Upward Bound/Talent Search. Diana grew up in Blacksburg, where her father was a professor at VT in EE, her brother is a VT ME graduate, and her mother received her PhD from VT. Before coming to Virginia Tech, she worked for the Blacksburg Parks and Recreation Department and graduated from Radford University. Outside of VT, Diana is a mother of four, a cub scout leader, and a landlord for two homes in Pembroke.
Timothy Kessinger
Lab Instrument Maker

Timmy has been employed in the Mechanical Engineering Machine Shop full time since 1988. Since then he has worked on many challenging and interesting projects with both faculty and students. In Timmy's spare time, he enjoys hunting, playing golf and spending time with family and friends.

Sara Vallejo
Program Support Technician, CVeSS

Sara Vallejo came to the Mechanical Engineering Department as a Program Support Technician in February 2015 for the Center for Vehicles Systems & Safety under the direction of Dr. Mehdi Ahmadian. Prior to coming to Mechanical Engineering, Sara was a travel analyst for the University Operating Controller's Office. Before coming to VT, Sara spent 11 years in the automotive dealership industry on the administrative side beginning at Duncan Automotive in 2001. She then accepted a position at the Shelor Motor Mile as a Finance and Accounting Administrative Assistance where she stayed until accepting the position at VT in 2013. In the evenings and weekends, Sara can be found in the bleachers cheering on her 14 year old son, Jared, who plays basketball for Christiansburg as well as AAU travel ball. Sara and her husband Michael, who is a field training officer for the Christiansburg Police Department, are both very active on the CPD Relay for Life Team "Hero's Helping Hero's". She also has a cupcake business on the side, "Heaven Sent Cupcakes", specializing in cupcakes for baby showers, birthdays, weddings, company events, and those wanted cupcakes just for fun! Proceeds from her cupcake sales are donated every quarter to the UVA Children's Hospital NICU.