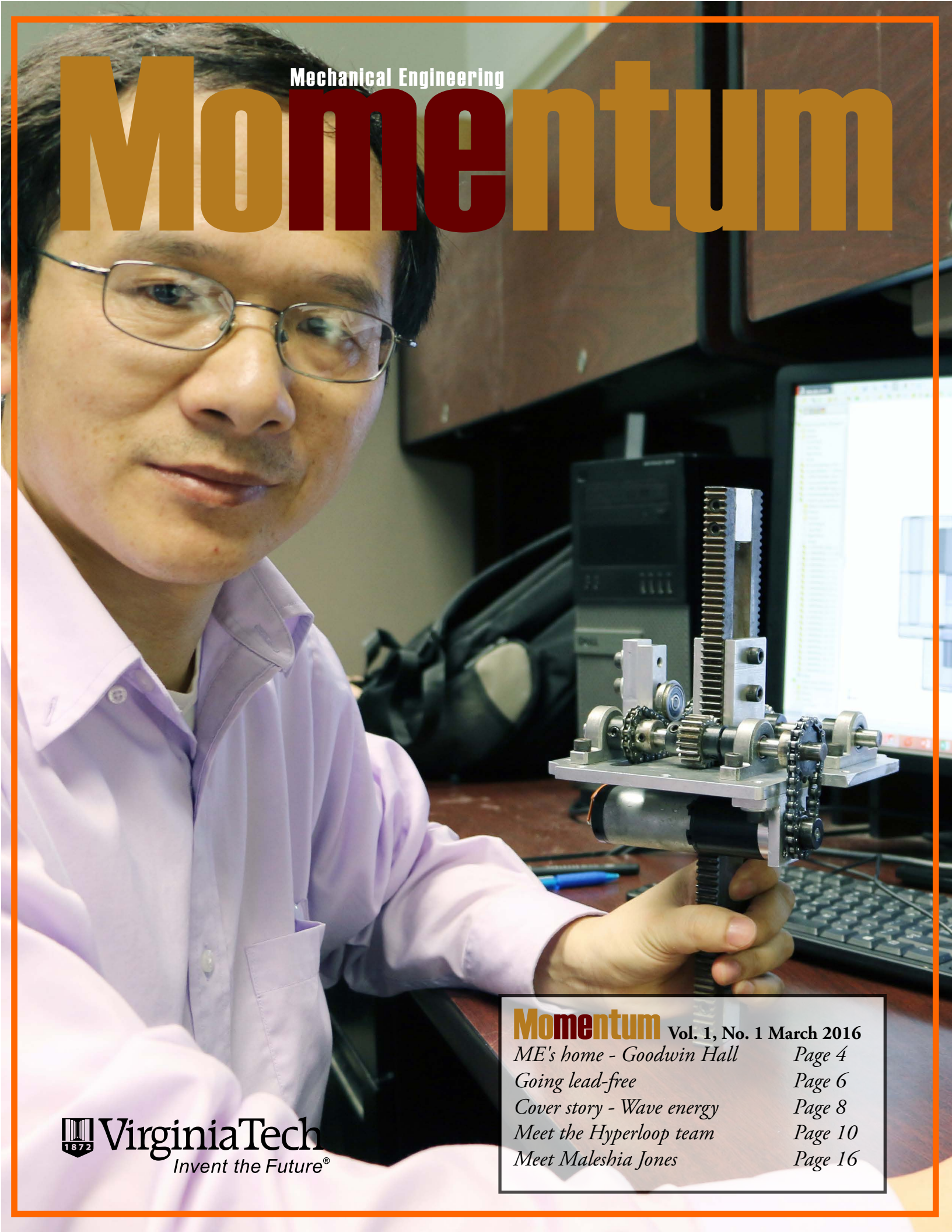
Mechanical Engineering

Momentum



Momentum Vol. 1, No. 1 March 2016

VirginiaTech
Invent the Future®

Momentum: It's what we're about

Azim Eskandarian
ME Department Head

I am very pleased to share with you the inaugural release of our new Mechanical Engineering Magazine, Momentum, with ME embedded in the title, which is truly reflective of our department's current direction.

The activities of our department have soared beyond imagination in recent years after a period of continued growth. In the 2015-16 academic year, since I have been honored to serve the department, we have started a renewed momentum to expand and enhance our research, scholarship, educational and service missions through a set of new initiatives and strategic directions which have been shaped by our outstanding faculty. The Momentum Magazine, along with a new bi-monthly digital ME UPDATE newsletter, a forthcoming Annual Report, and several other on-going media are designed to reflect the results of these new initiatives and highlight the strong research and multitude of discoveries of our faculty. Momentum Magazine is also a new venue to highlight our students, staff, and alumni's activities and achievements.

The accomplishments of our faculty, students, and staff never cease to amaze me; whether it is a new discovery published in one of the best journals in the field, a professional achievement award of our faculty, our students' leadership making its mark in a national competition, or a staff member's self-initiative to enhance diversity in our work environment, our people are continuously striving for excellence in every aspect of scholarship, teaching, and service.

Among many stories in this issue you will find how Professor Shashank Priya and his post-doctoral associate have discovered a new method of making piezoelectric ceramics without lead - one that looks very promising for commercial development and could eventually lead to greatly reducing lead use and waste. Several new publications, books, and presentations are highlighted and Professors Walter O'Brien and Lei Zuo have been selected as Fellows of AIAA and ASME, respectively. Zuo is also highlighted for his new $2 million Dept. of Energy Grant for ocean wave energy research. We get to meet graduate student Maleshia Jones, and join in the excitement of a top five finish for our Hyperloop team against more than 100 worldwide universities team and who move on to compete again this summer at Space-X in California.

Finally you will see the list of seven new faculty hired in 2015 and five more on-going faculty position searches which are being filled successfully this year to complement our department's community of scholars.

Currently with 60 core faculty, 35 affiliate and adjunct faculty, and 18 research faculty and research scientists and associates, we are among the largest and most comprehensive mechanical engineering departments in the nation with a continued plan of growth. We serve about 1200 undergraduate and 350 graduate students, 65 percent of whom are PhD students. We are also annually receiving an ever increasing number of highest quality applicants which is testimony to the quality and demand for our graduate and undergraduate programs.

As you can see from this initial issue, our ME Department is progressing rapidly with a renewed momentum just as the title of this new Magazine implies. I would like to invite you to join us with this momentum and engage with our department, visit our web site often as we have big plans in store for our online presence later this year. Plan a visit in person through the College of Engineering or contact us with any questions you may have about our programs. All of us at the ME department always welcome you and your feedback.

inside

Dr. Azim Eskandarian
Dept. Head, Mechanical Engineering

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Editor, Communications & Outreach

Goodwin

Prof. Shashank Priya and post-doc Deepham Maurya are working to get the lead out, by creating a lead-free crystalline piezoelectric actuator.

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Cover Story

The ocean waves have the potential to create tremendous amounts of energy. A $2M DOE grant will help one Virginia Tech professor harness the power of the ocean.

VHYPER
inventing the future of transportation

#Hyperhokie

20 engineering students went to Texas and took on more than 100 of the world's best universities. This summer they'll head to California to test their creation at a Space-X hyperloop test track.

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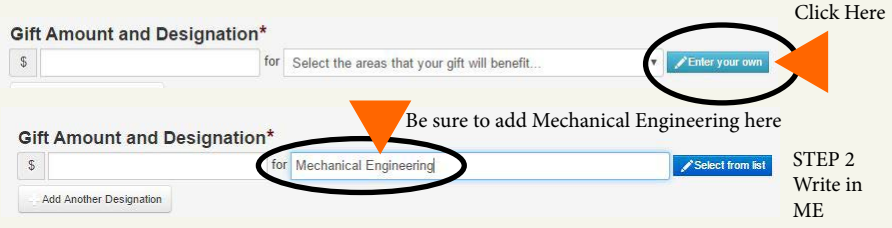
Staying focused

Meet Maleshia Jones, a graduate student from Maryland who has some great advice for young women thinking of engineering careers.

To Give to the Mechanical Engineering Department Click here and follow the steps below:



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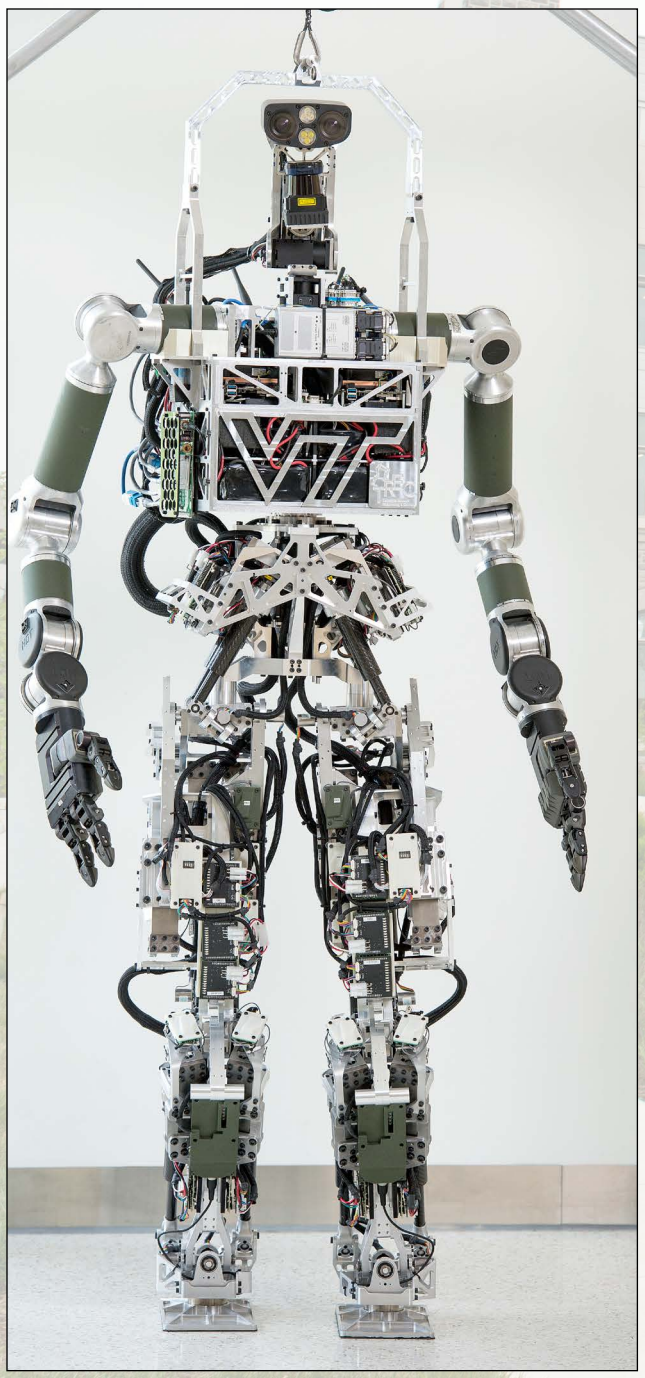
Building on the momentum of engineering success, Goodwin Hall provides space to learn, data to learn from



In 2014 the main office of Mechanical Engineering moved into Goodwin Hall, named for Alice and Bill Goodwin who provided the single largest donation in Virginia Tech history to help fund the $95.2 million, 155,000 square-foot facility.

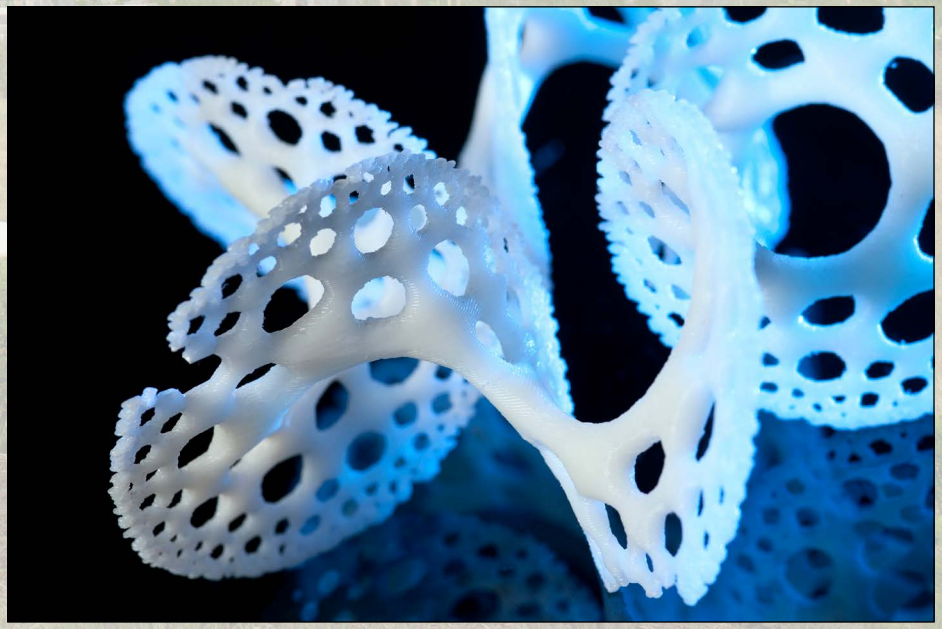
"The mechanical engineering degree I earned from Virginia Tech helped me, and I believe in giving back," said Bill Goodwin, who graduated with a bachelor's degree in 1962, during the building's dedication in 2014.

In addition to ME lab spaces including the Design, Research, and Education for Additive Manufacturing Systems (DREAMS) Laboratory, eight classrooms, more than 150 faculty, staff, and graduate student offices and classrooms, and a 300 seat auditorium, the building also boasts being the most heavily instrumented public building in the world.

A suite of more than 200 accelerometers provide data on the building to include movement related to wind, road vibra-

tions from nearby Prices Fork Road, and foot traffic that allows Goodwin Hall to be its own experiment and laboratory. The Virginia Tech Smart Infrastructure Laboratory (VT-SIL) uses the facility as a test bed for cutting-edge research and education for graduate, undergraduate and K-12 students in areas related to developing advanced smart infrastructure. Collaborators from industry, government and other academic institutions provide a wide-range of expertise including engineers from multiple disciplines such as mechanical, civil, electrical, industrial, and computer science. The Smart Infrastructure Laboratory also works with the geography, and the Schools of education, visual arts, performing arts, and the VT University Libraries.

From April 25-29, the VT-SIL will represent Virginia Tech at Hannover Messe, the world's leading trade fair for industrial technology in Hannover, Germany. While there they will present their work and show how Goodwin Hall will help researchers improve upon and build smarter buildings.



Opposite page: Humanoid robot, ESCHER from Mechanical Engineerings' Terrestrial Robotics Engineering & Controls Laboratory (TREC), which is now located on the second floor of Goodwin Hall.

Above right: Students pass through the lobby under a Rolls-Royce aircraft engine, and 'the pod' a designed conference room for the third and fourth floors that overhangs the lobby.

Right: The Design, Research, and Education for Additive Manufacturing Systems (DREAMS) lab is located in Goodwin Hall's fourth floor. The lab also has 3D Dream Vendor machines in the lobby where 2D CAD designs can be turned into 3D objects.

Dynamic Duo

Team testing material to replace lead-based actuators

For post-doctoral researcher Deepam Maurya, getting the lead out is not a colloquialism for working fast. Working with Shashank Priya, the Robert E. Hord Jr. Professor of Mechanical Engineering and faculty director for materials and sustainable energy at the Institute for Critical Technology and Applied Science (ICTAS), Maurya has been working to find an alternative to lead-based piezoelectric ceramic materials since earning his doctoral degree from Virginia Tech in 2012. Lead zirconate titanate, known as PZT, is one of the world's most often used piezoelectric ceramic materials – and is made up of more than 50 percent lead.

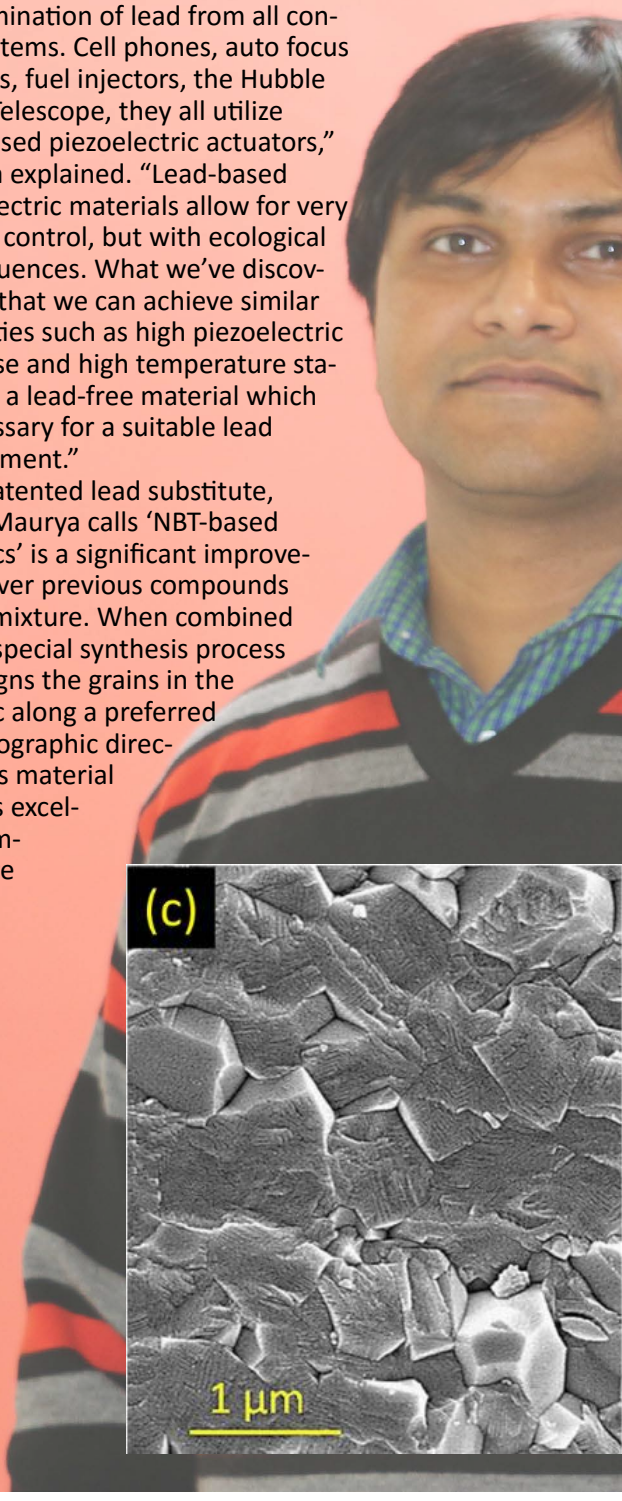
Hoping to find a way to get more lead out of the environment, Maurya has spent the last eight years working to solve the problem of replacing the lead with a suitable piezoelectric material that will meet the working thresholds of PZT. The current lead-heavy composition is used in the automotive, medical, and electrical fields among others to make sensors, filters, actuators and a number of other products.

"People have been working on this topic for more than twenty years," said Maurya of Shahjahanpur, India. "If we can reduce the amount of lead being used in products and disposed of in landfills, we'll be making a positive impact on the ecosystem."

While PZT components are normally very small in dimensions, the numbers of these lead-based products is staggering; and finding a suitable replacement will yield enormous economic and environmental benefits. But finding a suitable replacement for the high properties of lead-based compositions has been a problem.

"The toxicity of lead is a big concern that needs to be addressed as the lead from discarded components can mix with soil and eventually underground water systems," Maurya explained. "In many parts of the world there is a growing demand for the elimination of lead from all consumer items. Cell phones, auto focus cameras, fuel injectors, the Hubble Space Telescope, they all utilize lead-based piezoelectric actuators," Maurya explained. "Lead-based piezoelectric materials allow for very precise control, but with ecological consequences. What we've discovered is that we can achieve similar properties such as high piezoelectric response and high temperature stability in a lead-free material which is necessary for a suitable lead replacement."

The patented lead substitute, which Maurya calls 'NBT-based ceramics' is a significant improvement over previous compounds as the mixture. When combined with a special synthesis process that aligns the grains in the ceramic along a preferred crystallographic direction this material exhibits excellent temperature stability,



Article and Photo, Rosaire Bushey

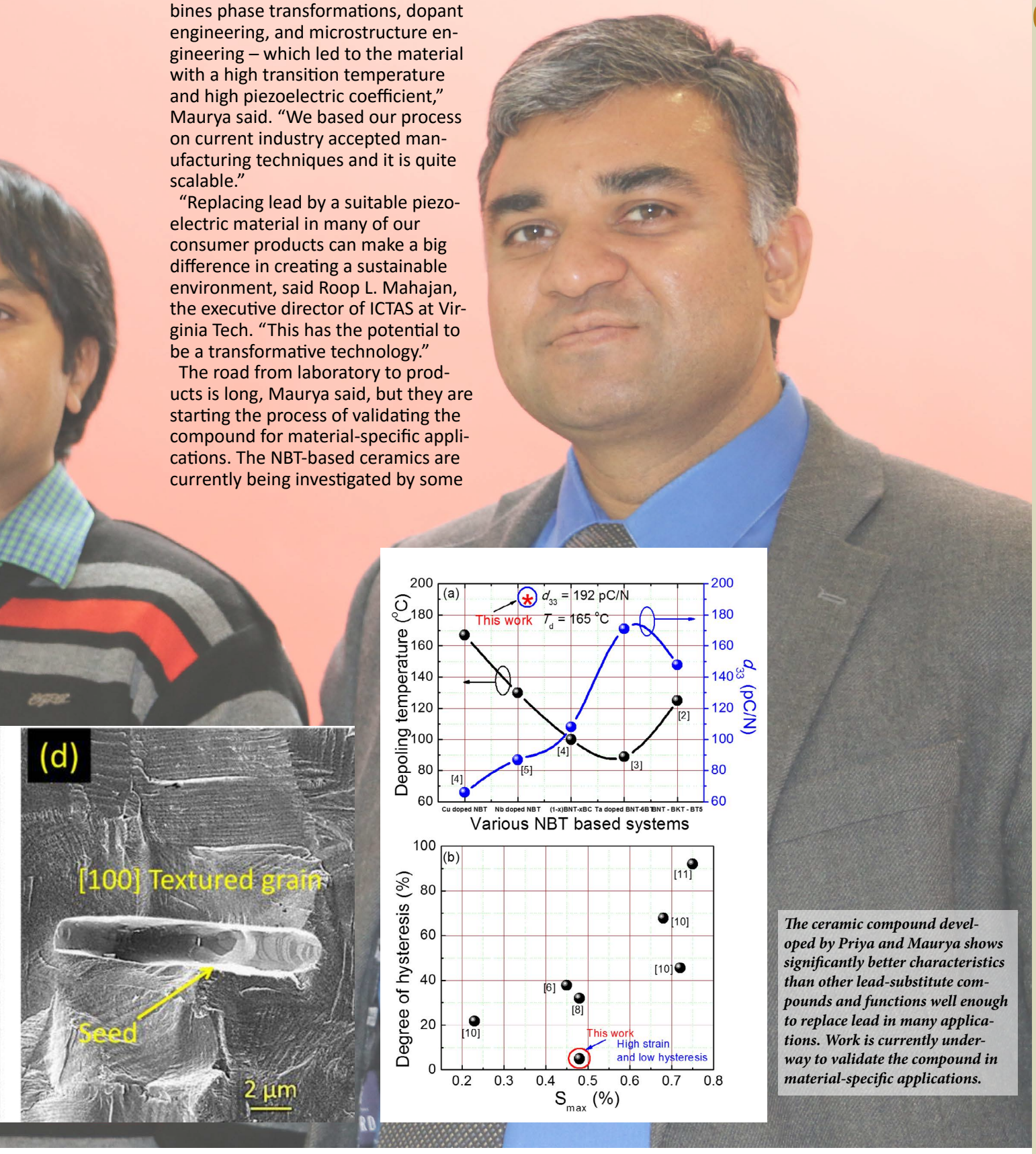
giant electric field induced strain, and ultra-low hysteresis. In short, it achieves the optimum combination of most of the relevant electromechanical parameters necessary to be a viable alternative to traditional PZT.

"We used the knowledge of previous studies to develop a theory that combines phase transformations, dopant engineering, and microstructure engineering – which led to the material with a high transition temperature and high piezoelectric coefficient," Maurya said. "We based our process on current industry accepted manufacturing techniques and it is quite scalable."

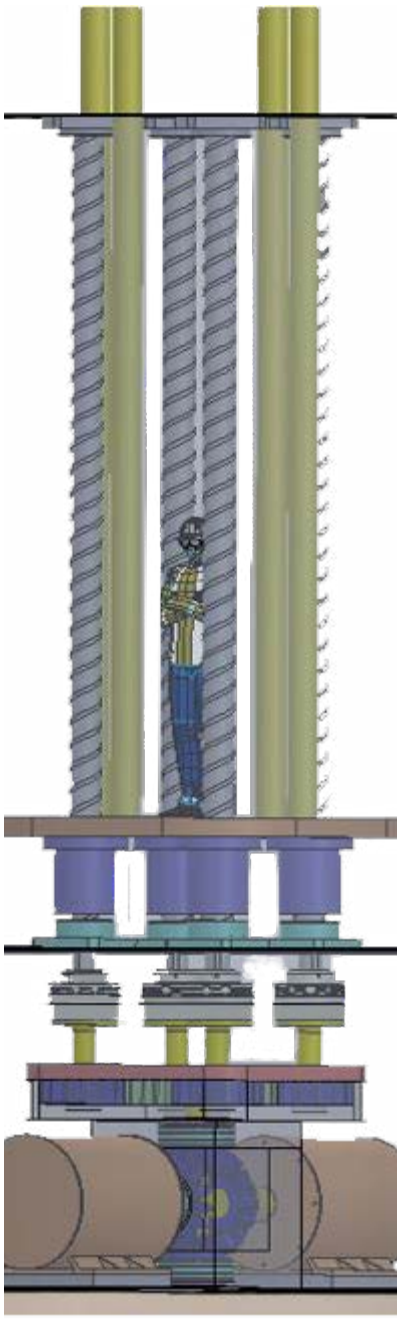
"Replacing lead by a suitable piezoelectric material in many of our consumer products can make a big difference in creating a sustainable environment, said Roop L. Mahajan, the executive director of ICTAS at Virginia Tech. "This has the potential to be a transformative technology."

The road from laboratory to products is long, Maurya said, but they are starting the process of validating the compound for material-specific applications. The NBT-based ceramics are currently being investigated by some of the industrial members of the National Science Foundation Industry and University Cooperative Research Program "Center for Energy Harvesting Materials and Systems."

The pair had a paper published on their work in 2015 that can be found in Scientific Reports.



The ceramic compound developed by Priya and Maurya shows significantly better characteristics than other lead-substitute compounds and functions well enough to replace lead in many applications. Work is currently underway to validate the compound in material-specific applications.



A full scale ocean wave energy harvester would be very large, as shown by this illustration - note the man standing on the mechanism platform.

Making Waves

Ocean wave energy has potential to supply majority of U.S. electric power

For Lei Zuo, associate professor of mechanical engineering, standing on the beach and looking at the ocean shows him more than beautiful scenery, it shows him the potential for abundant cheap, clean energy.

For the United States, where 53 percent of the population live within 50 miles of an ocean coast, energy potential from ocean waves is 64 percent of the electricity generated from all sources in the country in 2010.

That potential has Zuo excited and he's not alone. The U.S. Department of Energy (DOE) recently confirmed a $2 million grant for Zuo to produce a prototype new generation of ocean wave generator.

"The study of ocean wave energy harvesting isn't new – the first patent for a device dates to 1799," according to Zuo, the associate director of the National Science Foundation Industry and University Cooperative Research Program Center for Energy Harvesting Materials and Systems in Virginia Tech's College of Engineering. "Despite this, the field isn't mature either. Wave energy technology is really still in its infancy worldwide, and that opens up an immense area of research which is really exciting to be a part of."

Before arriving in Blacksburg in 2014, Zuo was working on an initial harvesting system as part of the State University of New York at Stony Brook, but his move to Virginia Tech has opened doors to broader research collaboration.

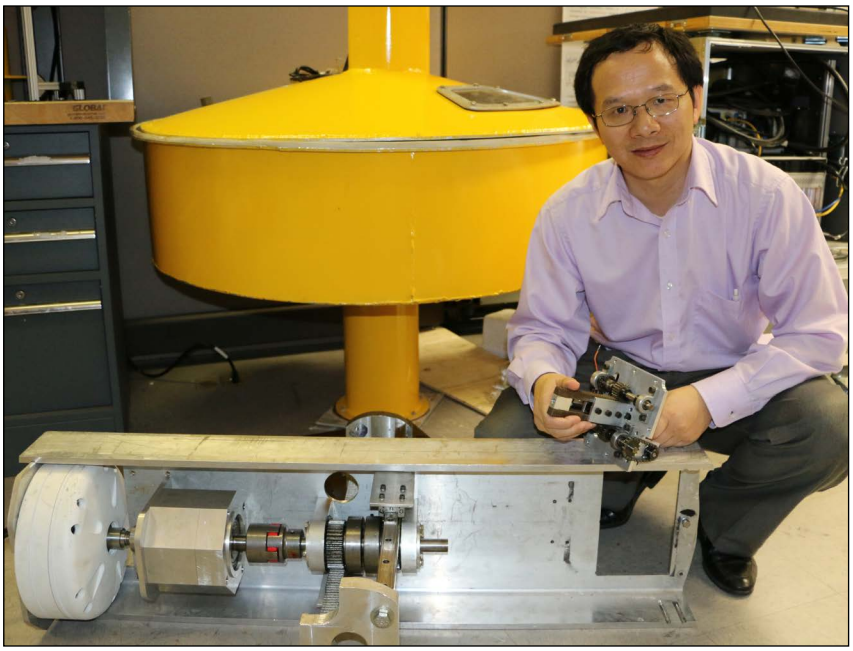
"Virginia Tech is the best in the nation in the fields of energy harvesting and power electronics," he said. The current project with DOE will see Zuo teamed with professors Robert Parker, mechanical engineering and Khai Ngo, Bradley Department of Electrical and Computer Engineering at Virginia Tech; the National Renewable Energy Laboratory in Golden, Colorado; the Resolute Marine Energy company, and THK North America.

The innovation at the heart of Zuo's plan, is the Mechanical Motion Rectifier, a novel power takeoff that uses the up and down and back and forth oscillation of wave energy and turns it into a unidirectional rotation to drive the generator. The design, which also uses a ball screw and highly efficient power electronics, will be placed in a metal or composite housing which is placed in the water in the same was as a buoy. Energy generation begins almost immediately as the waves move the buoy and the components inside.

"The oscillation of ocean waves create a lot of challenges for harvesting energy," Zuo said. "Waves are very irregular and change quickly and frequently, so we needed to come up with a mechanism that would be able to maximize the energy output from the various oscillatory inputs of wave energy."

So far the team has built a small, 1.2 meter proof of concept device using rack pinion, which was tested off the coast of Long Island, New York. In this DOE project, the team will build and test a 500-watt unit using ball screw and Mechanical Motion Rectifier mechanism, and then they will develop and test a 10 kilowatt device which will be housed in a container about 5 meters in diameter. Ultimately, a full-sized wave energy converter can be scaled up to about 25 meters in diameter and able to generate about

Article and Photos, Rosaire Bushey
Illustrations, Xiaofan Li



Left - Lei Zuo holds the first iteration of the mechanism he used to turn wave energy into power. The larger version at his feet will use a multidirectional system that gathers energy as waves move back and forth. The apparatus will be housed in a buoy similar to the yellow one behind him.

Below - Graduate student Xiaofan Li, from Beijing, China, works with Zuo on the ocean wave energy harvesting project. Here he is involved in computer aided design of harvester models which will be built over the next two years.

Bottom - One of Li's creations, the latest model of the mechanism that will convert wave energy into usable power.

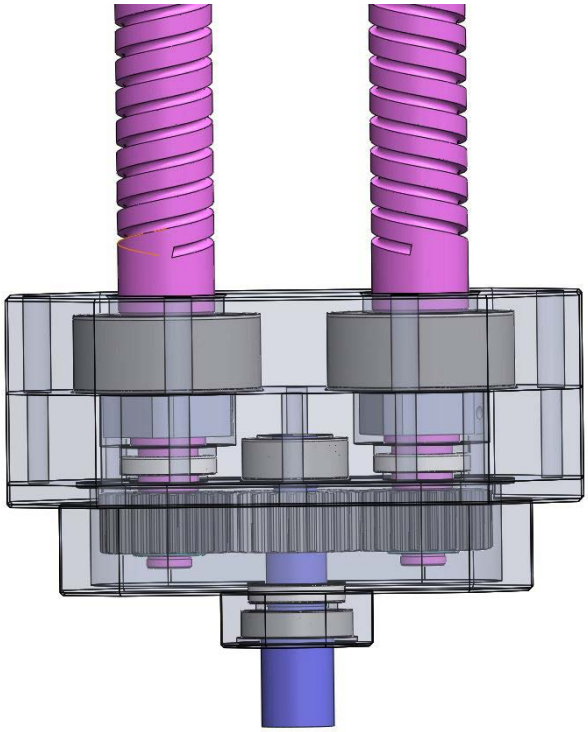
half a megawatt of power.

"Our expectation is that by summer we'll have tested the components of the smaller device in lab, and we will then put the 500W wave energy converter in the water off Hampton Roads by November," Zuo said. "The data we collect there will help us make improvements to the larger unit which will be tested, probably in Hawaii at the Navy's Wave Energy Test Site, in 2017."

Beyond building the generators, Zuo's team, as part of the DOE grant, must achieve minimum gains of 50 percent in reliability and 25 percent in power output, lowering the cost per unit of energy. The baseline for these figures comes partially from data obtained by previous ocean wave energy projects.

"Reliability is a challenge, but we think our mechanism will be both reliable and efficient," Zuo said.

With a more reliable energy harvester, Zuo believes there will come a time in the near future will people will appreciate the value of investing in the harvesting of ocean wave energy. "If you look at other clean energy options, you can get about 1.5 kilowatts of power out of a square meter of sun shine. With a square meter of wind, you get about 1 kilowatts of power. With a meter of ocean wave front, you can get between 10 and 100 kilowatts of power and that's an exciting possibility for us as we continue to mature the technology."



Student team takes on the world...

#HyperHokie

Article and Photo, Rosaire Bushey
Video, Alex Parish

Follow the Team on Facebook and Twitter

The Hyperloop at Virginia Tech team, Vhyper, scored big in Texas with a fourth place finish and a Technical Excellence Award against more than 120 teams representing many of the top universities in the world. The Hyperloop competition pitted teams designing systems for the hyperloop transportation system, a project initiated by SpaceX and Tesla founder Elon Musk.

The hyperloop is a high speed transportation system using a near-vacuum tube to propel a passenger-carrying pod at speeds potentially in excess of 700 miles per hour. The Virginia Tech team's design incorporates magnets not only to levitate the pod, but also to provide braking power. The team will be one of more than 20 that move on to build a prototype to be tested at a 1.5 kilometer test track facility in California this summer.

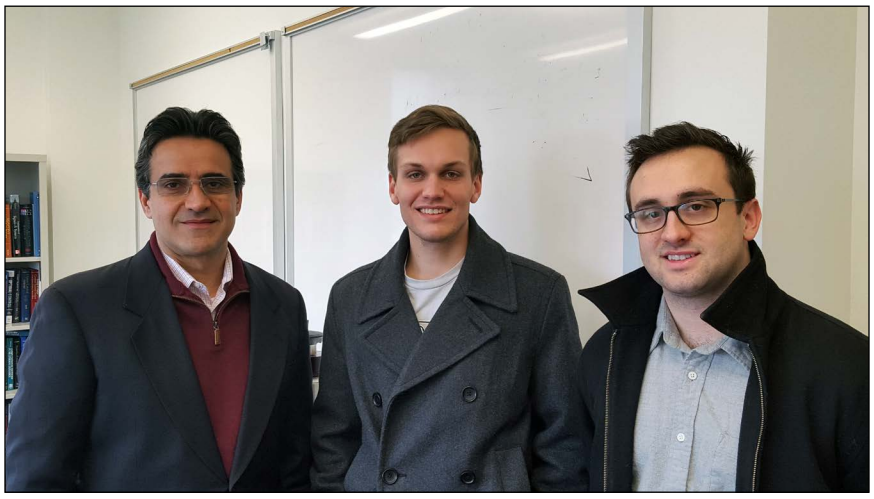
In addition to their finish, and invitation to test their design, the team also secured a cash prize from SpaceX, and the students' presentations helped earn the team sponsorships from Cooley, ANSYS, and Performance Associates.

The Vhyper team brings together students from mechanical, aerospace, and electrical engineering, and biomedical engineering and mechanics. The team is advised by Pat Artis, professor of practice with BEAM, and Dewey Spangler, Ware Lab manager. Supporting the team in their initial design were sponsors including Proctor and Gamble, Performance Associates, The Rogers Company, ANSYS, SolidWorks, and the Ware Lab.

"One of our biggest strengths is that we've proven the concepts of operation, and that wouldn't have been possible without the funds, tools, and software provided to us," said Daniel Kimminau, team lead. "We intentionally started small," Kimminau explained, "to ensure everyone is making decisions and designing with a knowledge of the bigger picture, which allows us to be very dynamic in our design."

Kimminau said the team is very proud to have been awarded the Technical Excellence Award. "The award was given to teams who went into incredible detail, analysis, and specifications, so while the top five are the best designs, this award represents a best execution of the design process."

After the awards were announced, Musk took the stage and spoke to the more than 1,000 students present and he outlined the next step of the competition, implying it will be fun and nerve wracking at the same time. "The basic idea is to get the highest possible speed in 1.5 kilometers – and stop before the end. The idea is to accelerate – we'll have a big screen

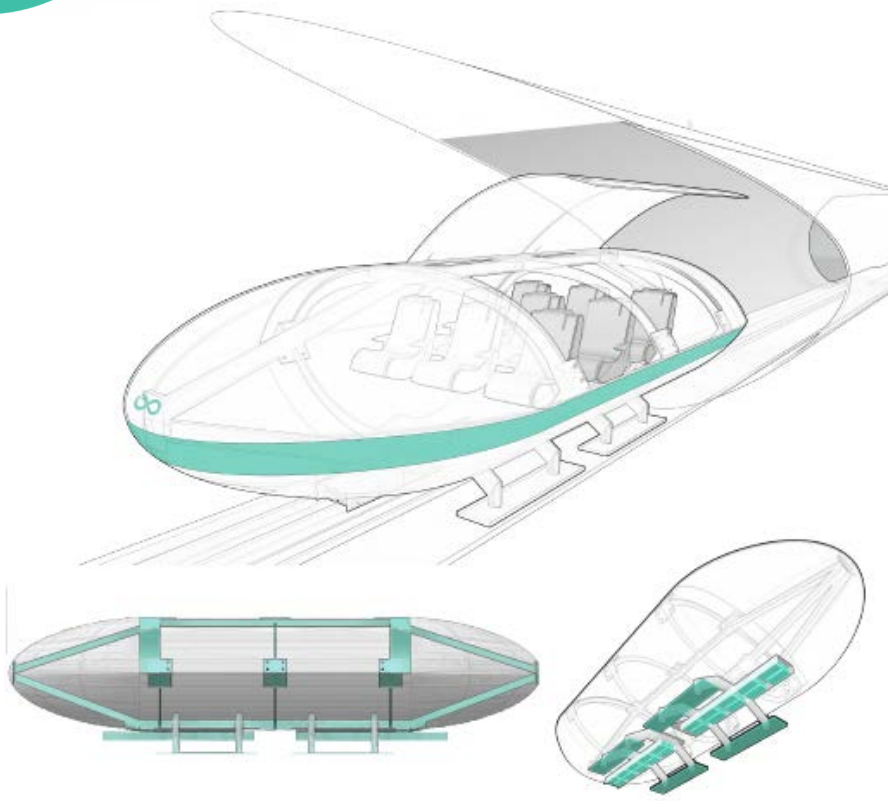


Azim Eskandarian, head of the Department of Mechanical Engineering, with Hyperloop team lead Daniel Kimminau, ME, and Nathan Roberson, an ESM student with BEAM. The ME department presented the team with $8,000 toward the design and build of their pod which will compete in California this summer.

showing the speed of the pod and there will be a big crowd in [Los Angeles] with a lot of people watching - so people will see the speed get to some crazy number and watch it brake. There will be a lot of tension … will it [stop] in time?"

The top five places in the competition went to: 1. Massachusetts Institute of Technology; 2. Delft University of Technology (Netherlands); 3. University of Wisconsin, Madison; 4. Virginia Tech; and 5. University of California, Irvine. Others who have been invited to this summer's competition include: Carnegie Mellon University, Drexel University, Purdue University, Texas A&M, University of Maryland and Rutgers, University of California Santa Barbara, and UC Berkeley.

Follow the Vhyper team on Facebook at VTHyperloop; on Twitter @ hyperloopvt; and on Instagram at hyperloopatvt.



A full scale concept for a hyperloop pod. The Vhyper team will construct a pod about 12 feet long for this summer's competition at a Space-X facility in California.

VIDEO

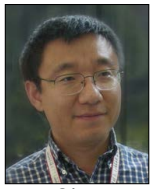
Meet some of the team - Future meet the team videos and profiles will be featured on the Vhyper team's social media sites and on ME social media. Follow the team using the links on page 8. If you can't play the video, click here: https://vimeo.com/157433258


Battaglia


Tian


Zheng


Davalos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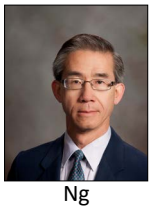

Ng

books

Francine Battaglia, was recognized at the recent Virginia Tech Authors Recognition event honoring university authors' academic contributions and displaying books published in 2015.

Battaglia co-authored a book with Ulrike Passe, professor of architecture at Iowa State University, called Designing Spaces for Natural Ventilation. The book is the first of its kind to bridge architecture and engineering into a cohesive set of guidelines.

Battaglia also recently became the Technical Program Chair for the 2016 ASME International Mechanical Engineering Congress and Exposition (IMECE) which will hold its conference in Phoenix, AZ Nov. 13-16. She is also a founding member, and vice president-treasurer of the American Society of Thermal and Fluids Engineers - a group established in July 2014 to promote the science and applications of thermal and fluids engineering and related disciplines.

Alireza Haghighat published a book, Monte Carlo Methods for Particle Transport, which explains the fundamental concepts, issues, and limitations of the Monte Carlo method and includes illustrative examples, mathematical derivations, computer algorithms, and homework problems. The book aims to provide nuclear engineers and scientists with a practical guide to the application of the Monte Carlo method.

speakers

Zhiting Tian spoke at the American Physical Society's March 18 meeting on, "Thermal and Electronic Transport in Inorganic and Organic Thermoelectric Materials."

Chris Williams was an invited speaker at the Johns Hopkins University Department of Civil Engineering Feb. 11. He spoke on Additive Manufacturing of Multifunctional Products via Tailored Materials and Topologies.

Xiaoyu 'Rayne' Zheng was an invited speaker by the Academy of Science to speak at the Defense Materials, Manufacturing and Infrastructure Standing Committee workshop Feb. 10 and 11 in Washington, D.C. He spoke on Scalable Metamaterials as part of a session on Ultra-Strong Molecules.

publications

Amrinder Nain had an invited review published in F1000 Research, Capturing Relevant Extracellular Matrices for Investigating Cell Migration.

Rafael Davalos, an ME affiliate, was recently published in Biophysical Journal for Electroporation of Brain Endothelial Cells on Chip Toward Permeabilizing the Blood-Brain-Barrier.

Weiwei Deng co-authored a paper published in Applied Physics Letters, Pinhole Formation From Liquid Metal Microdroplets Impact on Solid Surfaces.

Rui Qiao was recently published in the Journal of Physical Chemistry Letters with, Importance of Ion Packing on the Dynamics of Ionic Liquids During Micropore Charging.

boards and more

Corina Sandu represented the Design Engineering Division at the American Society of Mechanical Engineers training meeting for technical leaders Feb. 6. Sandu, an ASME Fellow, serves as the Technical Committee's Executive within the DED Executive Committee. She will become vice-chair and treasurer in July and committee chair in July 2017.

Rob Parker has been selected to the editorial board of the Journal of Sound and Vibration, the most prominent journal in the field of vibration. The board is responsible for governance of the journal and membership is based on long-term, high-impact contributions to vibration research.

Pinhas Ben-Tzvi has been invited to serve as associate editor of the IEEE Robotics and Automation Society's conference editorial board for the 2016 Institute of Electrical and Electronics Engineers (IEEE) International Conference on Robotics and Automation, May 16-21 in Stockholm, Sweden.

Ranga Pitchumani is the conference chair for the Optical Society of America's "Optics for Solar Energy" Congress which will be held in Leipzig, Germany from Nov. 14-17.

Wing Ng was selected as a February Virginia Tech Scholar of the Week by the Office of the Vice President for Research and Innovation.

Zuo selected as ASME Fellow

The American Society of Mechanical Engineers (ASME) has named Lei Zuo, an associate professor of mechanical engineering and director of the Energy Harvesting and Mechatronics Research Lab in Virginia Tech's College of Engineering, as a Fellow of the ASME.

Fellowship is the highest elected grade of the society's membership and can be conferred on people with at least 10 years of active engineering practice who have made significant contributions to the profession.

Zuo has won a 2015 R&D 100 Award for his innovation on ocean wave energy harvesting and a 2011 R&D 100 Award for his research on energy-harvesting shock absorbers. R&D recognizes the top 100 most significant technology innovations of the year around the world. Since 2014 he has received the ASME Thar Energy Design Award for pioneering research on energy harvesting, the Society of Automotive Engineers Ralph R. Teetor Educational Award, a P3 Award from the U.S. Environmental Protection Agency, the ASME Best Paper Award on Structures and Structural Dynamics, and the Winner of the Best Technology Development of Energy Harvesting from Harvesting and Storage USA Conferences.

Zuo joined Virginia Tech in 2014 after six years at the State University of New York at Stony Brook, and four years as a senior research scientist at Abbott Laboratories in Chicago. He has authored more than 130 research papers, over 40 of which have appeared in journals, and holds five U.S. patents. Zuo has received over $8M research grant ($7M as the PI) from institutions including the National Science Foundation, Department of Energy, Department of Transportation, Environmental Protection Agency, Office of Naval Research, state agencies, and industry.

He received his doctoral degree in mechanical engineering in 2005 and two master's degrees in mechanical and electrical engineering in 2002 from the Massachusetts Institute of Technology. He earned a bachelor's degree from Tsinghua University, Beijing, China in 1997.

O'Brien AIAA Fellow

Walter O'Brien, the J. Bernard Jones Professor of Engineering in Mechanical Engineering, was recently selected as a Fellow of the American Institute of Aeronautics and Astronautics (AIAA), the world's largest aerospace professional society.

The AIAA, which selected only 24 members worldwide as Fellows this year, chooses about 1 in 1,000 members as Fellows.

"It's a major honor, and I'm very grateful to my colleagues and the AIAA," O'Brien said.

Since graduating from Virginia Tech in 1960 with a BS in Mechanical Engineering, O'Brien says that the fundamentals of the engineering sciences are the same, the field continues to expand, and evolve. "What has changed is our ability to apply our engineering knowledge much more rapidly, and with higher fidelity. We have advanced electronics for controls, and instant communications; that level of innovation continues to make the field stimulating and exciting."

O'Brien earned MS and Doctoral degrees in Mechanical Engineering from Purdue University in 1961 and from Virginia Tech in 1968, respectively. He is listed on six patents and currently conducts research investigating turbine engine inlet flows with flow distortions, two phase flows in turbomachines, ion methods for active flow control, and advanced instrumentation for turbomachinery clearance, pressure and temperature measurements. Over his career he has supervised the graduate work of 125 students and published more than 150 technical papers and journal articles in the field of propulsion.

ME brings on 7 new faculty in 2015

Azim Eskandarian
Dept. Head - Professor

PhD: The George Washington University
Previously: Professor of Engineering and Applied Science at GW; an ASME Fellow, he was founding Director of the Center for Intelligent Systems Research, and co-founder of the National Crash Analysis Center.
Research Area: Dynamics and control, intelligent systems, applied mechanics, intelligent vehicles, vehicle dynamics and control, transportation safety, and robotics.

Pinhas Ben-Tzvi
Associate Professor

PhD: University of Toronto
Previously: Director, Robotics and Mechatronics Laboratory, The George Washington University.
Research Area: Robotics and autonomous systems, dynamic systems and control, mechatronics, human-robot interactions, mechanism design and system integration. His work includes autonomous field robots for search and rescue, hazardous environment sensing and monitoring.

Jiangtao Cheng
Associate Professor

PhD: Purdue University
Previous Positions: Associate Professor, University of North Texas; Research Associate at Pennsylvania State University; and Research Scientist with Teledyne Scientific Company.
Research Area: Optofluidic Solar Concentrators - hailed as one of "six transformational energy research projects" by the DOE. He receives over $3.2M in funding from DARPA, NASA, DOE and NSF.

Weiwei Deng
Associate Professor

PhD: Yale University
Previous Positions: Assistant Professor, University of Central Florida.
Research Area: Experimental fluid dynamics of liquid subjects such as droplets, jets, and films; manufacturing of thin-film solar cells, nanoparticles of cancer drugs, and printed electronics. An NSF CAREER Award in 2015 supports his research on a scalable spray deposition method for highly efficient perovskite solar cells.

Department to hire five faculty in 2016

The department is currently interviewing faculty for five tenure-track positions, which will increase the number of core, adjunct, and affiliate faculty positions to 100. The new faculty will be hired in the following areas.

Combustion - areas include aerospace propulsion, turbomachinery, biofuels, automobile engine systems, and combustion dynamics.

Energy - nuclear engineering

Energy - areas include sustainable/renewable/alternate energy, microbial fuel cells, thermo-magnetics energy harvesting, and energy systems integration.

Advanced manufacturing/materials - areas include advanced manufacturing, materials processing (metals, ceramics, and composites), hybrid manufacturing processes, and novel optical, acoustic and thermal metamaterials.

Bio-inspired science and engineering - areas include bio-inspired locomotion, bio-inspired integrated sensors, actuators, and control systems, and bio-inspired materials and devices.

Alan Asbeck
Assistant Professor

PhD: Stanford University
Previous Positions: Research Scientist, Harvard and the Wyss Institute for Biologically-Inspired Engineering.
Research Area: Asbeck developed soft, textile-based exosuits to assist the body in walking. He is interested in creating human-assistance devices that work effectively with the body. His goal is to help people regain lost capabilities, or enable them to perform feats not previously possible.

Ziaoya 'Rayne' Zheng
Assistant Professor

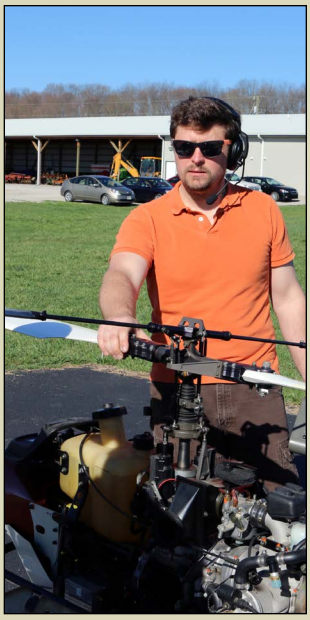
PhD: Boston University
Previous Positions: Lawrence Livermore National Laboratory
Research Area: Zheng developed the "Ultralight, Ultrastiff Metamaterials" in polymer, metal, and ceramic while leading an LLNL and MIT team. His work involves advanced additive manufacturing and design tools to design, analyze,and fabricate 3D architected metamaterials possessing capabilities for structural, energy, and biological applications.

Robin Ott
Professor of Practice

BS: Virginia Tech, Mechanical Engineering
Previous Positions: Senior Director of Project Management for bio-technology company Intrexon, where she introduced manufacturing principles into a highly specialized DNA production facility. She has worked as a design engineer on a Countermeasure System for U.S. Navy MHC-51 Coastal Minehunter ships; and with Shingijutsu Global Consulting experts while with Kollmorgen.

engines and motion

Clockwise from top left: Drew Morgan, a lab technician in the Unmanned Systems Lab; a Chevy Camaro is in its Ware Lab bay and undergoing a transformation into EcoCAR3 - with the help of an 8-cylinder Silverado engine; The Bolt Mk II Electric motorcycle ended its career in February with a first place finish in an eMotoRacing AHRMA event - the Mk III is currently being designed with anticipated speeds in excess of 200mph; an RMAX aircraft hovers March 17 at Kentland Farms.



Video, Rosaire Bushey

VIDEO

Mechanical Engineer undergraduates take part in a number of Senior Design Challenges. In this video, a team works on a water pump which will be constructed in Malawi to help a village easily gather clean water.

There is no sound with this video.

https://vimeo.com/159103816

Focused on what matters

As part of the Design, Research, and Education for Additive Manufacturing Systems (DREAMS) lab with Associate Professor Christopher Williams, the Pete White Chair for Innovation in Engineering Education, Maleshia Jones is the first in her family to earn a 4-year degree. She's done it with a network of support, encouraging mentors, and focus.

Among the students who will graduate from Virginia Tech this spring is Maleshia Jones, who will earn her master's degree in mechanical engineering after presenting her thesis on using additive manufacturing technologies to explore the effect of surface texturing on friction response and adhesion performance. She is a member of the Design, Research, and Education for Additive Manufacturing Systems (DREAMS) Lab with Christopher Williams, associate professor and the Pete White Chair for Innovation in Engineering Education.

Before graduation, Jones, an active member of the Black Graduate Student Organization, will help host the 18th annual Ebony Affair April 2 at the Inn at Virginia Tech. The event celebrates Black excellence and recognizes key members within the university community who have made tremendous contributions that reflect the theme, "Black Excellence: THEN.NOW. NEXT." The Department of Mechanical Engineering is supporting the event as a Gold Sponsor.

"The motto of the BGSO is 'Lifting as We Climb' and I think that speaks volumes to all of us – not only African Americans," Jones said. "We are responsible for each other's well-being and together we can help each other to be successful."

Jones was accepted to Virginia Tech as an undergrad but decided to take advantage of an opportunity to be a Meyerhoff Scholar at the University of Maryland, Baltimore County (UMBC).

Photo/Rosaire Bushey

Future engineers?

Two fifth graders from Christiansburg Elementary School, raise their hands to answer a question posed by Marcus Alston, a senior majoring in Industrial and Systems Engineering from Hampton, Virginia. The students were visiting Virginia Tech as part of the Kindergarten to College Career Awareness program with the school's guidance counselor Ms Sandy Kay. As part of their visit, the class was taking a tour of the Ware Laboratory and learning about the Formula SAE car and student team. The Formula team's advisor is Associate Professor Robert West of Mechanical Engineering.

"Of all the things that stood out ... the correspondence I had with Cathy Hill. She was very warm and friendly ... it was like I was already linked to the university."

Maleshia Jones

The Meyerhoff Scholars Program has been recognized by the National Science Foundation as a national model for increasing diversity in future leaders in science, engineering and related fields. While at UMBC, the idea of attending Virginia Tech was reintroduced.

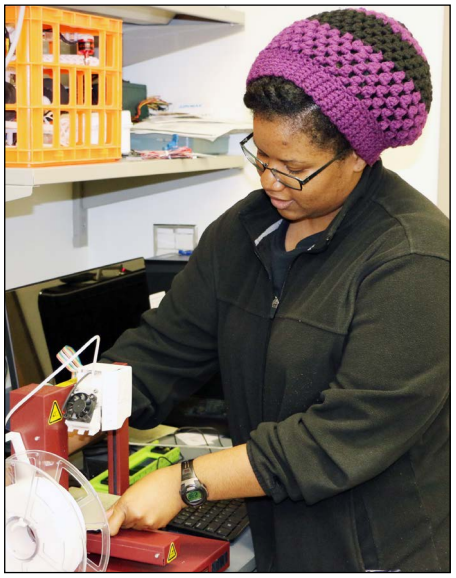
"The Meyerhoff Scholars Program is a very prestigious opportunity I didn't want to turn down," Jones said. "As I was nearing graduation at UMBC, my academic advisor recommended I look at Virginia Tech for graduate school, based on the type of work I had done previously and on what I wanted to do with mechanical engineering design"

A visit to the Blacksburg campus confirmed her choice, but what really sealed the deal for Jones was the reception she received before ever traveling down I-81. "Of the things that stood out the most was the correspondence I had with Cathy Hill (the ME graduate admissions liaison), she was very warm and friendly and timely with her correspondence – from the first time it was like I was already linked into the university. At recruitment weekend, I felt welcomed and supported and was impressed by the opportunities to explore various aspects of mechanical engineering."

Having grown up in the Hyattsville area within Prince Georges County, Maryland, Jones admits Virginia Tech was different than what she was used to, but confides, it was the change she needed.

"I wanted to challenge myself; see myself grow; I didn't need the additional distractions of a big metropolitan area. I was fortunate to have grown up in a diverse area with people from all backgrounds and the Meyerhoff Scholars Program helped nurture my open-minded perspective. Even in my undergraduate program there were times where I was the only African-American or woman in a class, but I don't focus on that as part of my journey. I see people for who they are, and instead of focusing on the idea of being the only woman or only African-American, I choose to focus on transitioning to graduate school and a new set of standards for work and utilizing resources."

For Jones, earning her masters may not be the end of her time in a classroom. "A doctorate is a possibility, but for now I think I'll be better served getting some real industry experience. I want to use this time to hone in on my passion and use the time to craft a project for an eventual PhD program. It will be interdisciplinary and not solely focused on design, but on how the social side of a problem influences the engineering side."



As Jones prepares for life as an engineer, she offers some advice to young women and minorities who are considering careers in science and engineering.

"Never discount what you're interested in. If you're passionate about a dream that's unusual or different from what your family is used to, don't be afraid. Build a support network – have people behind you to encourage and inspire and to help give you confidence in yourself – these people can be family or guidance counselors who take the time to have a candid conversation. Having those mentors makes a huge difference.

"I was fortunate to have high school counselors and mentors, like Dr. Marisha Saunders-Wright and Mrs. Allison Galloway at Eleanor Roosevelt High School, who saw my interest in engineering and pointed me toward programs to develop those interests and who nominated me for the Meyerhoff Scholarship," she said. "She said, 'Girl, you better apply!' If not for her and others like her, I don't know what my trajectory would have been."

Finally, Jones, who joined the National Society of Black Engineers at the end of high school added, "Get involved. Make sure you're involved in academic clubs, activities and organizations that help you to become well-rounded and not narrow-minded in your thinking. Put yourself in places and situations that will allow you to learn and grow from others."

Cathy Hill

Graduate Program Coordinator

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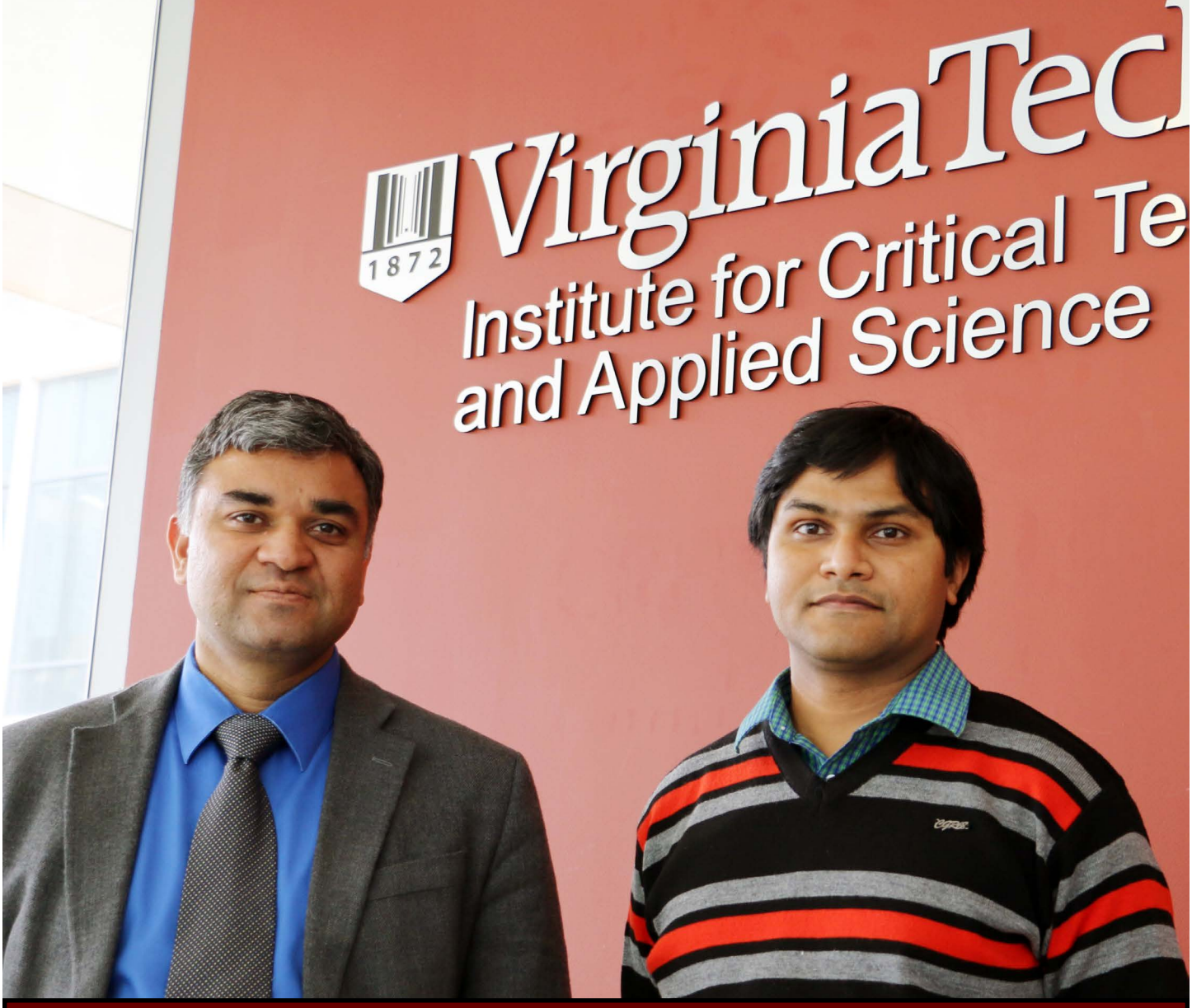

The future is HERE

The magic word is: Lead-free.

Ancient alchemists dreamed of turning lead into gold. Today, Virginia Tech's Robert E. Hord Jr. Professor of Mechanical Engineering, Shashank Priya (left), and post-doctoral researcher Deepam Maurya (right) are working to make lead disappear.

Developing environmentally responsible material to replace lead components in many consumer products is one way Virginia Tech research is reaching beyond borders to transform our global future.

Robert E. "Bobby" Hord Jr. (mechanical engineering '49), for whom the professorship held by Priya is named, accomplished much, lived modestly, and invested wisely during his 90 years. After his lifetime, Hord's $17 million estate gift, the largest bequest ever realized by the university, endowed a lasting legacy of scholarship and professorship support.

The power of Hord's visionary generosity, and that of many Virginia Tech alumni and friends, is helping transform the future, today.

Join them!

Read more about Deepham Maurya's story on page 4

Visit http://bit.ly/vt-hordbeq for more about Bobby Hord's gift.

Learn how you can help transform the future with a bequest through your will or with any gift for the Department of Mechanical Engineering. Contact:

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