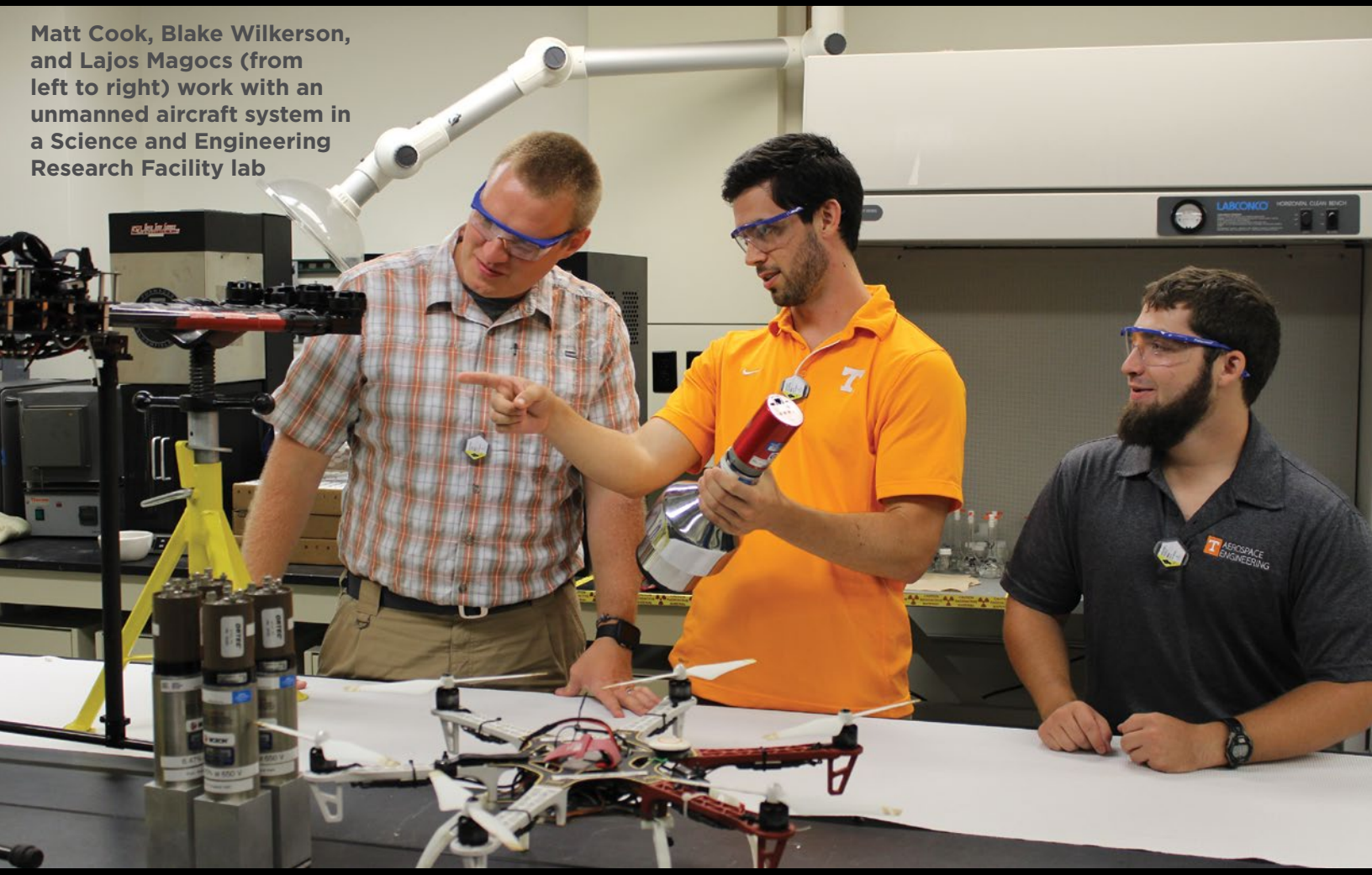
FALL 2016

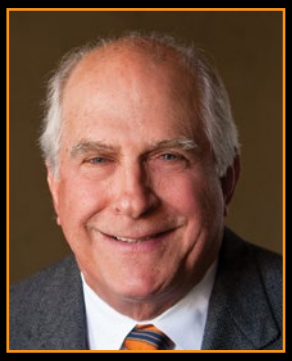
UTNEUPDATE

A Publication from the Department of Nuclear Engineering at the University of Tennessee



Matt Cook, Blake Wilkerson, and Lajos Magocs (from left to right) work with an unmanned aircraft system in a Science and Engineering Research Facility lab

Jacob Shamblin Receives Chancellor's Extraordinary Professional Promise Award



Mr. Wayne Coleman
Alumni Profile

2016 NEUP
Undergrad Scholarships

THE UNIVERSITY OF TENNESSEE KNOXVILLE
DEPARTMENT OF NUCLEAR ENGINEERING

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Department of Nuclear Engineering • Fall 2016
A project of the University of Tennessee College of Engineering Office of Communications and the Department of Nuclear Engineering

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DOP: 10/16

TENNESSEE NUCLEAR ENGINEERING

Department Head's Message from Dr. Wesley Hines

Wow, I can't believe it's fall again and we have a new class of nuclear engineering students on campus. This is one of our largest and most prepared freshman classes with 65 freshmen and an average ACT score of 30. A decade ago those numbers would have been closer to 35 students and an average ACT of 26. The increase in numbers and quality can be attributed to the rise in scholastic performance of our department as a whole. We now have 18 faculty with one faculty search on the way. Our research expenditures have risen each and every year for the last decade and the growth from under $2 million to over $10 million has transformed our department. Our faculty advised 105 PhD students last year making us the university with the largest nuclear engineering PhD population in the country.

Not only is the student body growing in numbers and quality, but they are also getting excellent external recognition. One metric of student quality is the number of Department of Energy (DOE) Nuclear Energy University Program (NEUP) Scholarships and Fellowships awarded. This last year, UTNE once again led the country in undergraduate awards winning 14 of the 57 scholarships. Additionally, three of our BS graduates won NEUP graduate fellowships, with one staying at UT, one going to MIT, and one leaving for UC Berkeley. Having UTNE graduates recruited to the top two engineering colleges in the country that offer nuclear engineering degrees, again validates that we have a high quality undergraduate program. We also had undergraduate students win nine American Nuclear Society scholarships and our graduate students were awarded several prestigious multi-year fellowships from agencies such as the Department of Homeland Security, Nuclear Nonproliferation International Safeguards, and the National Nuclear Security Administration.

Our alumni continue to engage the department and influence our directions and success. Their investments in our department through endowments and gifts continue to propel us forward. They have sponsored student scholarships and fellowships; funded activities such as study abroad, departmental picnics, awards banquets, and student travel to scholarly conferences; and provided the priceless donation of strategic thought and advice.

If you have been to campus recently, you have probably been in awe with the number of construction projects. The university's facilities are also undergoing a transformation with over $1 billion of construction underway. The sciences have two new +$100 million buildings under construction and the detailed design for the College of Engineering's newest building is being put out for bid. This $130 million dollar building will house the Freshman Engage program and the Nuclear Engineering Department. The new nuclear engineering facilities will triple the space currently in Pasqua Engineering Building and will provide us with 23 new laboratories. Several of these laboratories will give us unique state of the art research capabilities.

As we continue our goal of becoming the number one nuclear engineering department in the country, we need your continued support and engagement. Please feel free to reach out, visit us, and strengthen our relationships.

Sincerely,

Dr. Wesley Hines
Charles P. Postelle Distinguished Professor
in Nuclear Engineering and
Department Head of Nuclear Engineering

Faculty News

New Faculty

Dr. Richard Wood

The Department of Nuclear Engineering (NE) recently gained a major boost to its faculty ranks thanks to the addition of a nationally recognized expert.

The NE Department, already the No. 6 public nuclear engineering program in the country, welcomed Richard Wood as a full-time professor in January.

Wood recently retired from Oak Ridge National Laboratory (ORNL), where he held a joint appointment with UT.

In his 30 years at ORNL, Wood established himself as a foremost authority on a number of topics and served as the lead researcher for some national programs. He served as the technical area lead for instrumentation, controls, and human machine interfaces under the US Department of Energy's (DOE) Advanced Small Modular Reactor research and development program. Wood held this national leadership position because of his unique knowledge of nuclear topics and challenges, proven research, and leadership track record.

Wood has spent numerous hours developing an expertise in improving nuclear technology within the constraints that often come with it, including licensing issues and modernizing applications.

He is a leading figure in studies mitigating some of the roadblocks to more widespread adaptation of digital technology and monitoring. Wood's research in those areas has brought him exposure to and interactions with the DOE and the Nuclear Regulatory Commission, a major plus for nuclear engineering at UT.

Wood said that several nuclear plants and research facilities have expressed interest in students learning the techniques, cementing their real-world importance, and he plans to further those relationships.

In addition to his practical knowledge of nuclear science and engineering itself, Wood's longstanding experiences with the DOE will greatly benefit the department in the future.

COE Professors Hayward and Qi Receive DNDO Academic Research Initiative Grant

Dr. Jason Hayward

Dr. Jason Hayward, the UCOR Faculty Fellow in Nuclear Engineering, and Dr. Hairong Qi, an associate professor in the Department of Electrical Engineering and Computer Science, have received a five year, $1.75 million grant from the Department of Homeland Security's Domestic Nuclear Detection Office's (DNDO) Academic Research Initiative.

The two professors are collaborating on next generation backpacks and algorithms and computer vision technologies to search for radiation and nuclear threats.

The DNDO Academic Research Initiative was established in January 2007 and since its inception, 77 grants have been provided to universities. Currently, the initiative is funding 37 research efforts at 34 universities in areas including materials development and supporting technology, neutron detection, radiation detection techniques, shielded approaches, algorithm/modeling, and nuclear forensics.

For more information, visit ***http://www.dhs.gov/publication/academic-research-initiative***

Hayward is also part of a group of professors from the University of Tennessee, Knoxville, who have been funded to participate as a major partner in a US Department of Energy National Nuclear Security Administration (NNSA)-sponsored consortium entitled "Nuclear Science and Engineering Nonproliferation Research Consortium."

The goal of the consortium, which is led by the University of California-Berkeley, is to create a pipeline of new talent and generate new concepts and technologies in basic and applied nuclear science that can be transferred to the national labs.

Funded at a level of $4.25 million over five years, UT will conduct basic research investigations in the areas of nuclear instrumentation, radiation detection materials, and radiochemistry and forensics. Hayward is the PI, and co-PIs include Dr. Chuck Melcher and Dr. Mariya Zhuravleva from the Department of Materials Science and Engineering (MSE), and Dr. Eric Lukosi and Dr. Howard Hall, also in the NE department. Dr. Kate Jones from the UT Department of Physics is working directly with UC Berkeley in their focus area of nuclear and particle physics.

This work will fund many PhD students working out of the Scintillation Materials Research Center (SMRC) (***http://www.engr.utk.edu/smrc/***), the NE department's nuclear instrumentation laboratories (***rir.utk.edu and http://web.utk.edu/~elukosi/***), and the Institute of Nuclear Security (***http://nuclear.utk.edu***). This research will build collaborations with Oak Ridge National Laboratory (ORNL), Los Alamos National Laboratory (LANL), Lawrence Berkeley Laboratory (LBNL), Lawrence Livermore National Laboratory (LLNL), and Sandia National Laboratories (SNL). Other consortium partners include George Washington University, Michigan State University, Texas A&M University, the University of California-Davis, the University of California-Irvine, and the University of Nevada-Las Vegas. Hayward will serve as a Deputy Executive Director for the $30 million consortium.

Governor's Chair Brian Wirth Presented Richard K. Osborn Lecture

Governor's Chair in Computational Nuclear Engineering, Brian Wirth, presented the Fifth Annual Richard K. Osborn Lecture of the Nuclear Engineering and Radiological Sciences Department at the University of Michigan on Friday, April 1, 2016. The annual lecture is made possible by an endowment by Massachusetts Institute of Technology Professor Sidney Yip, a former student of Professor Osborn. Professor Osborn was a faculty member at the University of Michigan from 1957 to 1986, and during the 1960s Professors Osborn and Yip collaborated extensively together, culminating in the publication of their classic book *The Foundations of Neutron Transport Theory*.

The goal of the lectures is to inspire future generations of students in nuclear theory, simulation, and experiments.

Dr. Brian Wirth

NE Department Assists in Launching the *International Journal of Nuclear Security*

The *International Journal of Nuclear Security*—a peer-reviewed journal that publishes scholarly articles and research related to all aspects of nuclear security—is now available online and free to the public.

The new journal is produced in collaboration by three units at UT: the Department of Nuclear Engineering, the Department of English, and the Institute for Nuclear Security in the Howard H. Baker Jr. Center for Public Policy. The new publication was formally launched at the 2015 International Nuclear Security Education Network in Vienna, Austria, in August.

Howard Hall, UT-ORNL Governor's Chair for Global Nuclear Security and director of the Institute for Nuclear Security, is leading the effort.

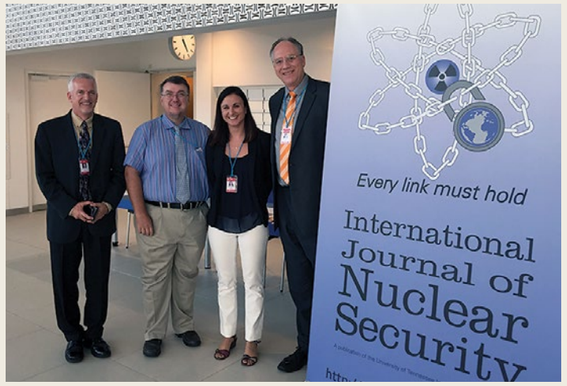
"The journal strengthens UT's ties to even greater international networks of nuclear security experts," Hall said. "We're proud to be a strategic partner in such an innovative campus-wide project in nuclear security."

The journal seeks to promote a much-needed international and interdisciplinary exchange of scholarly work among educators, researchers, policy makers, practitioners, and experts from government and industry, as well as the military and law enforcement communities. All of these entities work together to maintain a world secure from nuclear aggression and illicit use of nuclear materials, while supporting peaceful uses of nuclear technologies.

The Governor's Chair program was created to strengthen the ties between UT and ORNL, as two of the main thrusts of the program are energy science and nuclear security.

Along with Hall, Steve Zinkle, Governor's Chair for Nuclear Materials; Brian Wirth, Governor's Chair for Computational Nuclear Engineering; and William Weber, Governor's Chair for Radiation Effects on Materials, all bring expertise from the nuclear engineering department on those topics, as well as an understanding of the kind of collaboration the journal hopes to forge.

In addition to articles, the journal publishes book reviews; news about conferences, seminars and other events relevant to nuclear security; descriptions of new educational programs or courses in nuclear security, and the work of first-place winners in the international student writing competition.



IJNS board members and editors at the International Nuclear Security Education Network in Vienna, August 10-12, 2015. Left to right are Joseph R. Stainback IV, Howard Hall, Natacha Peter-Stein, and Russel Hirst.

Russel Hirst—who directs the program in technical communication for UT's English department—serves as the journal's managing editor.

"I'm delighted to be part of this new publication, designed to connect and energize conversations among educators and professionals working in the multidimensional fields of nuclear security as well as among laypeople interested in understanding issues of vital importance to their countries and societies," said Hirst. "Although I'm not an expert in the science, technology, or policy connected to nuclear security, I share the motivations of people working in those fields. Like them, I want a world safe from nuclear terror and enriched by peaceful uses of nuclear science and technology."

The *International Journal of Nuclear Security* is published in English and is hosted on the Tennessee Research and Creative Exchange.

For more information, visit ***http://trace.tennessee.edu/ijns/***.

COE Dean Wayne Davis (right) presents the Nathan W. Dougherty Award to Dr. Hash Hashemian (left) at the college's Faculty and Staff Awards Dinner in April.

COE Dean Wayne Davis (right) presents the Dean's Faculty Research Excellence Award to Dr. Steven Skutnik.

Dr. Jason Hayward (left) receives the Professional Promise in Research Award from Dean Wayne Davis.

NE Alumnus, Faculty Honored at College of Engineering's Faculty and Staff Awards Dinner

The College of Engineering honored nuclear engineering alumnus Dr. Hash Hashemian along with other faculty and staff members at the Faculty and Staff Awards Dinner on Thursday, April 21, 2016. The event took place at the Knoxville Museum of Art.

When Hash Hashemian, then a recent nuclear engineering graduate, and then-department head Tom Kerlin co-founded Analysis and Measurement Services (AMS) in 1977, their main goal was to provide the nuclear energy industry with a reliable source of testing and problem solving.

In the years since, AMS has become a globally recognized leader in nuclear energy and safety, establishing a connection in every nuclear plant in the United States as well as in several other countries.

Hashemian has garnered several awards for those efforts, and now his alma mater is recognizing him with the highest honor the College of Engineering (COE) can bestow, the Nathan W. Dougherty award.

The award has been given annually in honor of Dougherty, who served as dean of the college from 1940 to 1956 and was a captain of UT's football and basketball teams as a student athlete in the early 1900s. He was inducted into the College Football Hall of Fame in 1967.

Recognizing Dougherty's success in engineering and education, the award singles out those who have "brought honor and distinction to the college through their achievements or who have made significant contributions to the engineering profession in Tennessee through their professional activities."

For Hashemian, those activities include being named a fellow of the American Nuclear Society, winning the society's Robert L. Long Training Excellence Award, receiving a UT Alumni Professional Achievement Award, and providing financial support to help found the organization Systers: Women in Electrical Engineering and Computer Science, which serves to recruit, mentor, and retain women in those fields at UT.

Additional recognitions for the Department of Nuclear Engineering included the Dean's Faculty Research Excellence Award, given to Dr. Steven Skutnik, an assistant professor; and Dr. Jason Hayward, UCOR Faculty Fellow in Nuclear Engineering received one of the Professional Promise in Research Awards.

NE Faculty Receive Awards at ANS June Meeting

Dr. Brian Wirth, Governor's Chair Professor for Computational Nuclear Engineering, received the Mishima Award at the American Nuclear Society (ANS) meeting in New Orleans in June 2016. Dr. Kurt Terrani, an adjunct assistant professor in nuclear engineering, received the Landis Young Member Engineering Achievement Award.

Wirth also presented a plenary lecture entitled "Recent Advances in Modeling Nuclear Fuel Performance" at the opening plenary session of the embedded topical meeting, "Nuclear Fuels and Structural Materials."

Dr. Brian Wirth

Dr. Kurt Terrani

NUCLEAR ENGINEERING

Staff Profile: Ami McBride

Ami McBride earned the title of Outstanding Staff Member for 2016 in the Department of Nuclear Engineering (NE). She has been the department's business manager for just over two years, and enjoys juggling the variety of activities that come her way.

"Every day is different," said McBride. "On any given day, I am problem solving; educating students, staff, and faculty on policies; preparing and distributing reports; collaborating with staff, faculty, other departments, and the college to get things processed within deadlines; instilling a continuous improvement culture; and managing the administration of 150 accounts."

Her favorite aspect of it all is the people she gets to work with in NE.

"We have a great staff and faculty," she said. "It takes all of us working together to make everything work. We work hard, but we do our best to have fun at the same time."

Dr. Wes Hines, NE department head, cited McBride's leadership in helping the department grow in recent years.

"Two years ago, our department was going through severe growing pains," said Hines. "Over the five years prior, we had doubled our faculty, tripled our student body, and quadrupled our research expenditures. The transformation caused an exponential increase in staff workload. Ami came in and transformed our department from one just trying to survive the massive growing pains and added compliance requirements, to one that was proactively and strategically organized to provide the best service to our faculty, staff, and students."

McBride has enjoyed her 28 year career in accounting, having started in the profession while in high school. She obtained her MBA from Lake Superior State University in 2000, and was vice president for finance at Baker College of Cadillac, Michigan, for nine years before coming to UT.

"I have worked in multiple industries: construction, manufacturing (printing, automotive, and defense), and education," she said. "I like education best because we impact so many lives, and we get to see it first-hand every day."

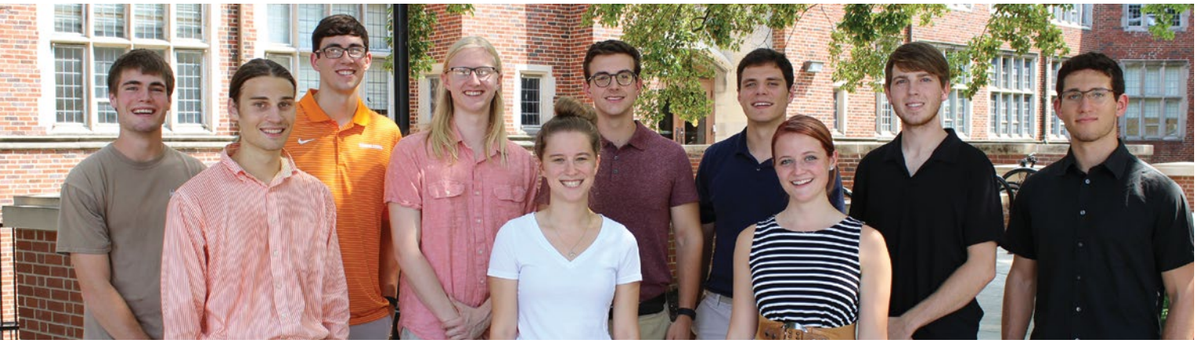
McBride's husband Chad, and their 11-year-old son Caden moved to East Tennessee after vacationing here. The southern climate gives them more opportunity to enjoy outdoor pastimes.

"We love the weather much better than Michigan's," said McBride. "My husband and I each have our own motorcycle, and Caden often comes with us when we ride."

Ami McBride

Student News

2016 NEUP Undergraduate Scholarship Recipients



From left: Micah Troyer, Eric Nelius, Peyton Lara, Austin Stanford, Sarah Creasman, Matthew Herald, Gavin Ridley, Hadyn Daugherty, Roman Sherrod, Matthew Young. Not pictured: Madeleine Burrell, Tyler Camarena, Travis Greene, and Kalie Knecht.

2016 ANS Scholarship Recipients

From left: Gordon Peterson, Eric Nelius, Jessica Bishop, Gavin Ridley, Hadyn Daugherty, Austin Mullen, and Travis Laboissiere-Hickman. Not pictured: Scott Richards, Kalie Knecht.

2016 NEUP Graduate Fellowship Recipients

Jason Rizk

Travis Laboissiere-Hickman

Not pictured: Dane deWet and Peter Doyle.

Dr. Ondřej Chvála, at far right, oversees UT nuclear engineering students as they perform measurements at experimental stations at the VR-1 reactor at the Czech Technical University in Prague.

Nuclear Engineering Students Train in Czech Republic

Twelve undergraduate students from the Department of Nuclear Engineering (NE) participated in a study-abroad Experimental Reactor Physics Laboratory class (NE427) during the summer mini-term. Dr. Ondřej Chvála, a research assistant professor in NE, led the class.

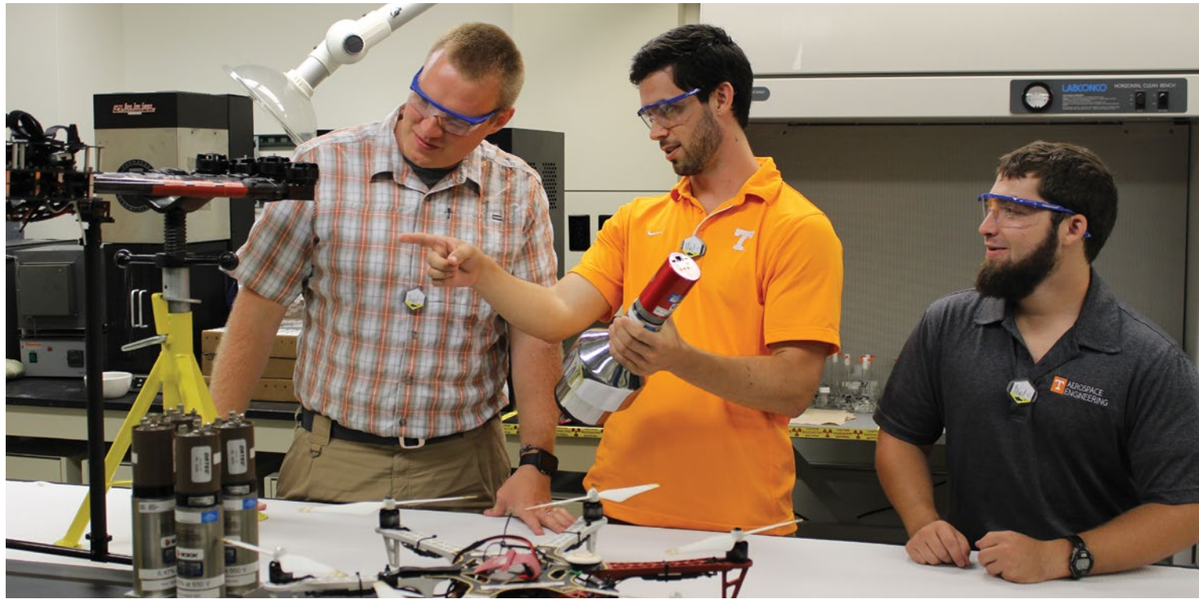
Students spent the first week visiting several sites in the Czech Republic and Vienna, Austria.

The students spent the first week visiting several sites in the Czech Republic, including a uranium mine and a yellow cake chemical factory, Temelín nuclear power plant, a research institute in Řež near Prague, and the Prague Castle. The group also visited sites in Vienna, including the Belvedere palace, the United Nations, the International Atomic Energy Agency, the Comprehensive Test Ban Treaty Organization, and St. Stephen's Cathedral.

During the second week, students worked with a nuclear reactor VR-1 at the Czech Technical University in Prague, performing reactor physics related measurements and working out lab reports.

The annual class is open to undergraduate and graduate students interested in nuclear reactor dynamics and hands on experimental work. Held in 2016 for the fourth time, this class has led to mutual student exchanges and research collaborations between UT and the Czech Technical University.

Research Update



Matt Cook, Blake Wilkerson, and Lajos Magocs (from left to right) work with an unmanned aircraft system in a Science and Engineering Research Facility lab.

NE Researchers Develop New Algorithm for Unmanned Aircraft-based Radiation Detectors

Researchers in the Department of Nuclear Engineering at the University of Tennessee have developed a way to improve the methods used to locate missing radiation sources. The team was led by Howard Hall, Governor's Chair Professor for Global Nuclear Security, and included John Auxier, research assistant professor in nuclear engineering; Lieutenant Colonel Samuel Willmon, US Army; Matthew Cook, postdoctoral research associate; and undergraduate and graduate researchers Blake Wilkerson, James Ghawaly, Lajos Magocs, Emilee Fenske, and Hannah Hale with assistance from Jung Choi, a cadet at the United States Military Academy at West Point.

Industrial and medical radiation sources are common in society and while the majority of them are relatively harmless, they should be located as quickly as possible if lost or stolen. The current methods of locating a missing source involve deploying a large number of personnel equipped with hand-held or vehicle based radiation detectors. Searches such as this may take a large amount of time given that these hand-held units are limited to moving at the speed of someone walking or a ground vehicle driving. An additional challenge is introduced in that an adversary may be continuously moving away from where the source was stolen which results in a rapidly increasing search area. Incorporation of an unmanned aircraft system (UAS) provides the capability for personnel to execute a search over a larger area in a more effective manner.

While incorporating a radiation detector into an airframe provides the ability to make measurements over a wide area in a more rapid fashion, it does not necessarily provide the most effective solution. Research has been performed to develop an algorithm that uses Bayesian statistical theory to improve how the aerial radiation detector is employed. This algorithm incorporates an inferred background radiation signature to increase the signal to noise ratio of any measurements. The algorithm also provides the means to incorporate other intelligence sources to direct the UAS to the area of the search space where the probability of the source being is highest. As the search progresses the algorithm constantly updates the probability space for placing the UAS in a position where the probability of detecting the source is highest.

To facilitate this research the Department of Nuclear Engineering has partnered with the Law Enforcement Innovation Center's National Forensic Academy and the UT Institute of Agriculture Forest Resources Research and Education Center to develop a permanent test site located in Oak Ridge, Tennessee, for field-testing of this and any other potential UAS based technology.

The overall goal of this research was not to develop a better airframe or a better detector but to develop a more efficient method of incorporating these two disparate technologies to perform a search for missing radiological material. This combination coupled with an algorithm that combines data from many different sources results in a new and improved method of locating missing and sometimes dangerous radiation sources over a wide area.

Nuclear engineering faculty tour the Tore Supra, a tokamak facility for fusion research, at the Cadarache nuclear research center.

David Donovan and Jamie Coble pose with nuclear engineering faculty in front of a completed steam generator at the Areva Large Component Manufacturing Facility in Châlon.

Nuclear Engineering Faculty Tour French Nuclear Facilities

Jamie Coble and David Donovan, assistant professors in nuclear engineering, participated in a tour of French nuclear facilities. The French Section of the American Nuclear Society hosted the event this past July. As part of the tour, they were able to inspect seven nuclear facilities across France.

"This tour offered a remarkable opportunity to compare and contrast the nuclear industry in France and the United States in terms of investment in infrastructure and research as well as public acceptance of nuclear power and the associated waste reprocessing and disposal," Donovan said. "We learned a great deal from both our French hosts as well as the other visiting faculty from universities across the United States."

The objective of the program is to promote and develop exchanges about the status and knowledge of nuclear development and achievements in France and in the US in the different technical fields. To facilitate this exchange of knowledge, the professors were invited to tour the Cadarache research center, a mixed oxide (MOX) fuel fabrication plant, a light water reactor (LWR) components fabrication workshop, a deep underground research laboratory for waste disposal, and the La Hague reprocessing plant.

Coble was particularly interested in investigating the differences in the way each country's nuclear facilities operate.

"The French approach to nuclear power is completely different from what we've done in the US, largely from a public policy perspective," Coble said. "The French nuclear industry has been proactive in engaging and communicating with the public to raise understanding and awareness of nuclear power. I will be incorporating much of these takeaways in my teaching in the future, particularly in the undergraduate courses, to highlight the importance of government support and public opinion in the success of nuclear power."

Donovan's biggest takeaway from the trip involved the infrastructure that France has developed to handle its electricity needs.

"France relies upon nuclear power for the vast majority of their electricity needs and they have developed a remarkably sophisticated and integrated infrastructure that utilizes sites around the country to handle nearly every step of the nuclear fuel cycle from cradle to grave," said Donovan. "The tour gave us a firsthand look at a variety of facilities for advanced nuclear research, large scale manufacturing, power generation, waste reprocessing, and investigation into final geological disposal. It was a fascinating experience to see how these pieces of the industry connect to each other, while also learning more about how the French nuclear industry fits within the larger political and environmental conversations taking place throughout France."

The tour consisted of 12 professors from across the United States. The goal of the French Section of the American Nuclear Society is to strengthen the links between American and French nuclear communities.

"The Nuclear Tour de France provided an excellent opportunity to meet other nuclear engineering faculty from across the US and to network with nuclear researchers and practitioners in France," Coble said.

Research Success Story: Fuel Pellet Modeling

A team led by researchers at the University of Tennessee recently completed a study using 3-D modeling to evaluate the impact of manufacturing defects in fuel pellets on the likelihood of nuclear fuel rod failure. The research was led by Nathan Capps, a recent PhD graduate, and included Brian Wirth, Governor's Chair of computational nuclear engineering, and Pacific Northwest National Laboratory researchers, Robert Montgomery and Dion Sunderland.

The team was able to predict the performance impact of defects in the fuel pellets using the BISON performance code.

"The purpose of BISON is to improve upon existing fuel performance codes," Capps said. "Current state of the art codes are 2-D finite element codes using smeared meshes, and BISON is pushing beyond such limitations and improving the fidelity of 3-D models containing discrete radial cracks in the fuel pellet, as well as missing pellet surface defects. The 3-D capability of BISON allows for a better understanding of pellet geometric effects on cladding stresses and cladding failure criteria."

The study was able to show that a recent fuel failure at a commercial power reactor was caused by a manufacturing defect in the fuel pellet using BISON fuel performance modeling.

"Our modeling effort did conclusively indicate that a pellet defect was the cause, and in this particular case, the failed fuel rods were examined by radiography following removal from the nuclear reactor," Wirth said. "These radiographs clearly revealed the presence of a missing pellet from the fuel chip."

Wirth believes the addition of three-dimensional fuel performance tools will improve reactor uptime and increase the amount of power on the electrical grid.

"The nuclear industry does not have three-dimensional predictive fuel performance simulation tools that can accurately predict the safety margins of plant operation to avoid fuel failures," Wirth said. "It is important to stress that such fuel failures are not a safety concern, but they do impact plant operation, often requiring an unplanned plant shutdown to non-power operating status to replace the defective fuel assembly. A majority of the pellet cladding integration (PCI) related fuel failures occur during an increase in the overall power generation of the reactor, such as returning to full power after a shutdown. Without reliable models to predict the safety margins, the nuclear utility has taken a very conservative approach to increase the power levels much more slowly than might be possible. This limits the availability of carbon-free nuclear power on the electrical grid."

Capps' research revolves around PCI and limiting PCI related failures in light water reactors.

"My current research goal for pellet cladding interaction is to develop the capability for a core wide PCI analysis, which determines the limiting fuel assembly and limiting fuel rod, and to develop protocols to mitigate PCI related failures," Capps said.

The study was done in conjunction with the Consortium for the Advanced Simulation of LWRs (CASL) where Wirth is a focus area lead for fuels, materials, and chemistry. The goal of CASL is to provide leading edge modeling and simulation capability to improve the performance of currently operating light water reactors.

The long term goal of the research is to both maximize power generation and minimize the potential for fuel failures.

"If a rod were to fail, then the reactor must be shut down and the failed assembly must be removed costing the plant millions of dollars," Capps said.

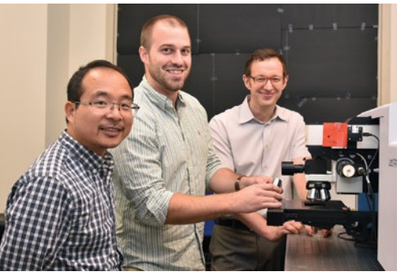
Capps recently completed his PhD at the university, but will continue to work with CASL in his new role.

"Nathan went to work for Anatech Corporation in San Diego, California following completion of his PhD," Wirth said. "This company is one of the industrial partners that CASL works with in the nuclear industry, as we continue to develop modeling capability to improve predictions of nuclear reactor operation and performance."

Wirth views this as the ultimate graduate student success story for him as not only did he get to work with Capps as a graduate student, but he also will continue to work with him as part of CASL.

Nathan Capps

UT, ORNL Scientists Gain New Insights into Atomic Disordering of Complex Metal Oxides



Haidong Zhou, Jacob Shamblin, and Maik Lang (from left to right) prepare samples before being transported to the Spallation Neutron Source at Oak Ridge National Laboratories.

Maik Lang, Jacob Shamblin, and Haidong Zhou (from left to right) discuss the use of lab equipment in a Science and Engineering Research Facility lab.

Dr. Maik Lang, assistant professor of nuclear engineering, Dr. Haidong Zhou, assistant professor of physics, and Jacob Shamblin, a graduate research assistant in nuclear engineering and physics, studied an important class of complex metal oxides. The three researchers looked at materials which are used in a wide range of applications including fast ion conductors in solid oxide fuel cells, host materials for nuclear waste containment, and thermal barrier coatings for gas turbine jet engines.

"The complex oxides we analyzed in this study—pyrochlore and spinel—have been investigated for decades by different researchers," said Lang. "When subjected to extreme environments such as high temperatures or high-energy radiation, many of these compounds partially lose their long-range crystal structure, and the multiple cations were thought to randomly exchange crystal sites."

The results of the study revealed that the cations and oxygens in the materials are not randomly arranged at the atomic level but only appear so when sampling over longer scales. Lang said that the heterogeneous disorder was unexpected but seems to be a general phenomenon for many other materials functioning in harsh conditions.

The new insight is fundamental to controlling oxygen mobility and phonon transport in complex oxides which is critical for technological applications. By gaining a better understanding of such materials, the team could help improve and control performance across a range of technologies—containment and immobilization of nuclear waste being a prime example. The study led by UT and Oak Ridge National Laboratory could soon aid in the development of materials with energy-related applications.

"This ability to accommodate atomic disorder in their structure accounts for the tendency of some compositions to resist becoming fully amorphous under irradiation," Lang said. "Predicting transport of radionuclides, such as plutonium, is important for their safe use as nuclear waste forms and requires a detailed knowledge of how the atomic structure responds to self-irradiation."

The results of the study were featured in *Nature Materials* in February 2016. The research was supported as part of the Materials Science of Actinides, an Energy Frontier Research Center funded by the US Department of Energy, Office of Science, Basic Energy Sciences under Award #DESC0001089.

NE Department Participates in IRP Project for DOE

Dr. Belle Upadhyaya

The Department of Nuclear Engineering is participating in an Integrated Research Project (IRP) led by the Georgia Institute of Technology for the US Department of Energy. The goal of the IRP is to perform collaborative research to create a conceptual design for an integral light water reactor. Recently, a team at UT led by Belle Upadhyaya, professor emeritus of nuclear engineering, completed research on the instrumentation and control challenges of the project.

"The study showed that the integral reactor can be operated at steady state and in a stable load-following mode," Upadhyaya said. "Important technical gaps in plant instrumentation were identified and approaches for some of the process and neutron flux measurements were resolved."

Results of the study have a wide range of effects on future research and development for the IRP.

"The results of this R&D project are applicable to a large class of integral reactors, including small modular reactors (SMRs)," said Upadhyaya. "Some of the technology gaps identified during the project will be considered for future work and for proposal applications for continued research funding."

The university's efforts are led by Upadhyaya who is managing the technical tasks and project deliverables of the IRP. The Department of Nuclear Engineering provides the needed infrastructure of students and facilities to carry out the research tasks of the IRP.

"A typical Integrated Research Project brings together expertise of several organizations—universities, national laboratories, and industry," said Upadhyaya. "This collaboration involves a large number of graduate and undergraduate students in nuclear engineering and other disciplines, thus facilitating education and training needs of future engineering personnel."

The long-term goal of the project is to continue research and development toward the commercialization of the overall design of an inherently safe light water reactor.

Facilities Update

Progress Continues on New Engineering Complex

As the College of Engineering and the Department of Nuclear Engineering (NE) continue to work with UT administrators and the officials with the State of Tennessee to finalize financing and plans for a new engineering complex, progress has been made in the last year.

Associate Dean for Research and Technology Bill Dunne confirmed that a Request for Proposals (RFP) was sent out in September of this year and said that the design team for the building should be confirmed by early fall. Programming for the building has also been completed.

Current plans are for the building to house the freshman engineering programs, the NE department, undergraduate design and project space, and flexible research laboratories. The building will be sited in the area where Pasqua, Berry, and Estabrook Halls are located, but the exact configuration has yet to be determined.

"We're also finalizing our plans for moving the NE labs and administrative and faculty offices," said Dunne. "It looks as though we will be able to move most of the laboratories into the Science and Engineering Research Facilities (SERF) until the new building is completed, and we are reviewing options for office space that will hopefully keep the NE department close to the other engineering buildings. Several new facilities are being completed on campus right now and subsequent moves should open up some space on the Hill."

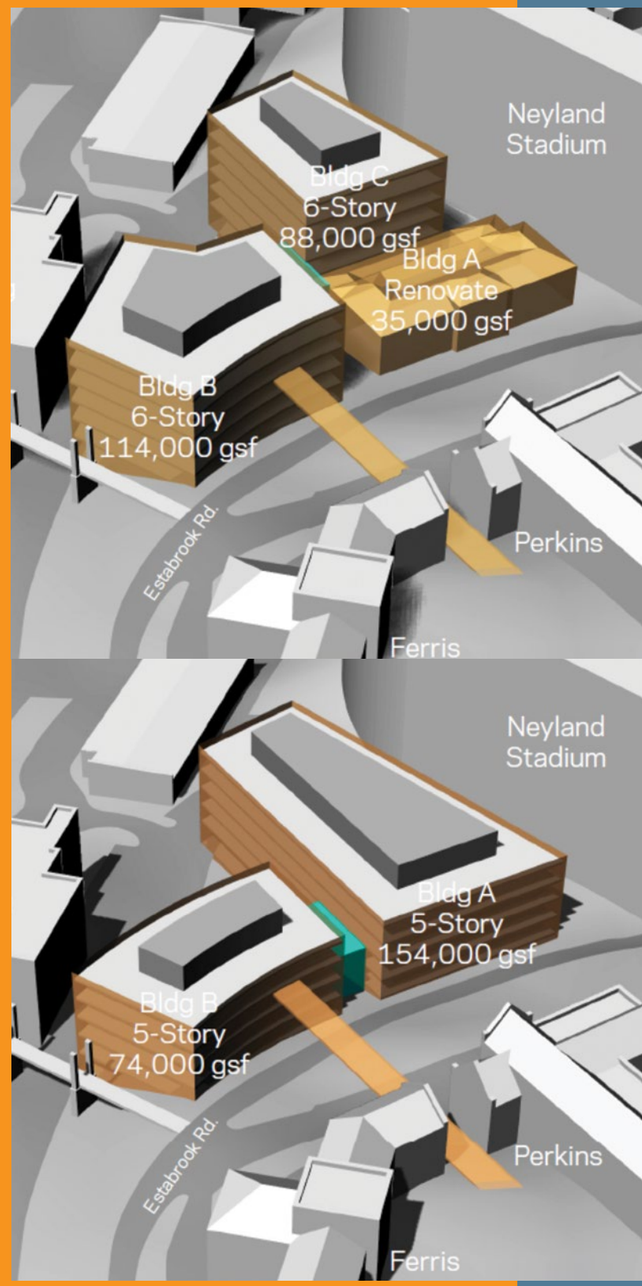
SERF will have a number of available laboratory spaces with the opening of the Joint Institute for Advanced Materials (JIAM). Several of the Department of Materials Science and Engineering (MSE) faculty have already moved their laboratories from SERF to the JIAM building.

The engineering occupants of Estabrook have also been relocated, with the Jerry E. Stoneking Engage Program administrators, faculty, and teaching spaces now in Perkins Hall. The Engineering Diversity Programs Office and the Engineering Advising Office also relocated to Perkins.

The NE department is currently making plans for the move and both faculty and staff are excited about the prospect of moving into a new building custom-designed for their needs.

"Two years ago, we completed the programming phase of the new engineering complex," said Dr. Wes Hines, professor and head of the NE department. "Our space will be about three times the current space in Pasqua, from 13K to 38K. The college secured $10 million in private funding and we are anticipating that the new building will be an impressive facility that will serve several key needs for the department, college, and the university. For the NE department, the space will have 32 faculty offices, several meeting rooms, conference rooms, collaboration areas, lounges, break areas, student study areas, and 23 state-of-the-art laboratories."

Dunne anticipates if State funding is approved, construction of the building would begin in the fall of 2017.



An example of the building options for the new engineering complex that will house the Department of Nuclear Engineering.

Jacob Shamblin Wins the 2016 Chancellor Extraordinary Professional Promise Award

Jacob Shambliin

Jacob Shamblin enjoyed many visits to the UT campus while growing up in Knoxville, so he knew he wanted to study here. He saw a variety of possibilities in the nuclear field, and he decided to explore those paths towards his PhD in the Department of Nuclear Engineering (NE).

"I think when most people think about nuclear engineering, they only think of nuclear power," said Shamblin. "But it is actually much broader than that. We have students in the department that focus on radiation protection for astronauts in space. Others are involved with nuclear security research, and we even have students researching the medicinal uses for radiation. The versatility of the degree really appealed to me."

His choices have paid off, from his undergraduate years to the recent completion of his doctorate. In 2016, his research in nuclear engineering earned him notice from an academic journal and a Chancellor's Extraordinary Professional Promise Award.

"One of my research projects revealed an unusual disordering mechanism in ceramics that are potential nuclear waste forms, which was published in the journal *Nature Materials*," said Shamblin.

He also won the NE department's 2016 PhD Graduate Research Excellence Award, and the Best Poster Award in 2015 at the Ninth International Symposium on Swift Heavy Ions in Matter, held in Darmstadt, Germany.

Most of Shamblin's research involves the study of the "local structure" of complex oxides. Extreme environments, such as high temperatures or high doses of radiation, partially degrade the crystal structure of these oxides in which atoms were previously thought to randomly switch places with one another. His research group was able to show that these atoms only appear to be randomly arranged. They are actually locally ordered when looked at on sub-nanometer length scales.

Shamblin's studies have benefited from campus-wide connections.

"I've collaborated with students and professors from materials science and engineering, chemical and bimolecular engineering, and even physics," he said.

Another big factor for Shamblin in choosing to come to UT was the opportunity to collaborate with scientists at Oak Ridge National Laboratory (ORNL).

"It makes UT really hard to beat for someone who wants to work in science and engineering," he said. "Most of my research projects have involved using the neutron scattering beam lines at ORNL. For example, some projects have investigated magnetic ordering at temperatures approaching absolute zero, while others have focused on determining crystal structures but almost all of them have utilized neutron scattering at state-of-the-art facilities."

Dr. Maik Lang, an assistant professor in NE, has been a big help in shaping Shamblin's approach to his work.

"He has been instrumental to my research and introduced me to many experimental techniques that I will use the rest of my career," he said. "Rather than forcing me to focus on a single topic, he allowed me to perform research in many different areas."

Outside of his doctoral work, Shamblin spends family time with his wife, Aimee, and sons Kayden and Liam. When time permits, he enjoys playing golf, basketball, or football.

With his PhD completed, Shamblin is keeping his momentum going with an appointment as a postdoctoral research associate in the UT physics department, which he started in August 2016. He plans to use the next year to finish up several projects that he is working on, then continue to explore research opportunities in nuclear engineering.

Outstanding Student Ambassador and Courage to Climb Recipient, Greg Meinweiser

Greg Meinweiser, from Millington, Tennessee, is the first student honored as Outstanding Student Ambassador, a new departmental award launched in 2016 by the Department of Nuclear Engineering (NE). The distinction recognized Meinweiser's approach in going above and beyond the norm to help with department outreach, tours, hospitality, and public education about the nuclear sciences and their benefit to human kind. He was also commended for helping newer students become familiar with lab locations, faculty and their areas of study, and student group events and meeting information.

Meinweiser finished his MS degree in spring 2016, along with completing the Graduate Certificate Program in Reliability and Maintainability Engineering, and now works in the Nuclear Safety Analysis and Design group at Dominion in Richmond, Virginia. He still carries with him the Volunteer spirit that earned him accolades at UT.

"My favorite experiences with the nuclear engineering department were all of the outreach events with faculty and student volunteers," he said. "I was always at the front of the line to volunteer. I had a passion for telling new/prospective students and the public how nuclear science and power could, and does, benefit the human race."

Meinweiser contributed to the department and college through community service and outreach activities, especially with middle and high school students, through his involvement with the STEMpunk Reverse Science Fair, High School Introduction to Engineering Systems for Twelfth Graders (HITES12) Program, Tennessee Teachers Energy Camp, Science Expo, and Nuclear Science Week.

"My favorite times were seeing the wonder in the faces of middle and high school kids when they were able to actually see radiation in our demonstrations of cloud chambers at different events," said Meinweiser.

He served as a College of Engineering Professional Practice Ambassador, a Department of Nuclear Engineering Ambassador, and an officer of both the American Nuclear Society (ANS) and Women in Nuclear (WiN) university chapters. In 2015, he took on the role of President of the ANS at UT. He is now involved with the Virginia Section of ANS and was a guest lecturer at their Science Teacher Workshop in summer 2016.

While at UT, Meinweiser's enthusiasm and activities inspired the UT Division of Student Life to choose him as the winner of the October 2015 Courage to Climb Award. His nominator for the award said, "Greg displays a true volunteer spirit; he fully involves himself in campus activities and outreach programs while maintaining a high standard for his coursework."

Meinweiser credits the group effort of faculty and staff in the College of Engineering with helping him achieve this standard of involvement.

"I feel the faculty as a whole had a very positive impact on my academic career and life, and I'll be forever thankful," he said. "In particular, there were two folks who especially went out of their way to help and guide me through grad school, professional engagements, and even some of life in general. One was Suzanne Sawicki from the Engineering Professional Practice office. I am sure I would not be where I am today without her guidance and mentorship in the professional engineering realm."

Greg Meinweiser

Meinweiser also appreciates his NE department mentor, Dr. Jamie Coble, as an instructor, advisor, and inspiration. "She gracefully answered any questions I ever had about the academic field, our projects, and lessons to be learned. She also challenged me to be a better worker, student, and citizen in the nuclear field."

His senior design project, working with Dr. Laurence Miller and Dr. Belle Upadhyaya, helped Meinweiser hone his project-management skills. His work on this project carried over into new applications in his graduate research at UT. He worked with TerraPower on a new plant design called the Traveling Wave Reactor. The new design could help mediate the issue of waste storage in a safe and secure manner.

Meinweiser enjoys backpacking and hiking when he gets out of the lab, and also sings and plays guitar and piano in his church's band.

"I've recently picked up some ballroom dance, and plan to eventually return to doing some theatre and acting—something I did growing up," he said.

His interest in nuclear engineering began in high school when a substitute teacher introduced his class to the field of nuclear science.

"This word of mouth during high school was really the only way I could have heard anything about the field without stumbling upon random articles on the Internet," said Meinweiser. "This actually was the reason that I went back and taught as a guest lecturer in the chemistry classes at my high school back in May of 2016. I wanted to share some of what I had experienced and give the students an introduction into something they wouldn't have otherwise heard about. One student actually decided that she wanted to study nuclear engineering after hearing a few of my presentations and discussions. I was really excited to hear that!"

Outstanding Undergraduate Student Research: Austin Saint-Vincent

Austin Saint-Vincent

Austin Saint-Vincent was awarded the 2016 Outstanding Undergraduate Research Award at the nuclear engineering annual awards banquet in April. He was recognized for his work as part of the lifetime prognostics group led by Dr. Jamie Coble, assistant professor of nuclear engineering, and Dr. Wesley Hines, nuclear engineering department head.

"The prognostics group gathers data from industry related equipment/systems (motors, bearings, pumps, flow loops, etc.) and attempts to identify trends and modes of failure in those components," Saint-Vincent said.

As part of the prognostics group, he led the motor accelerated degradation research laboratory. The laboratory is designed to test the remaining useful life of an induction motor.

"The goal is to develop predictive technology that industry can employ to increase the longevity and decrease superfluous expenditure in the maintenance of their equipment/system components," said Saint-Vincent.

As part of the study, a private company allowed the university to use their testing equipment. Saint-Vincent was integral in the coordination of the equipment.

"Austin worked closely with a private company who loaned us their testing equipment for a brief period; because of his efforts, we were able to maximize our usage of the test equipment and collect very interesting and useful data that has guided the experiment moving forward," Coble said.

Before enrolling at the University of Tennessee, Saint-Vincent enlisted in the United States Navy where he served in the Reactor Controls division of the Nuclear Navy. Hines believes this experience made him a perfect choice to join their research group.

"With his Nuclear Navy training, he was uniquely qualified to safely manage the experiments in which electrical failures were expected and did occur," Hines said. "Having a student who came from an organization with a mature safety culture was a definite plus."

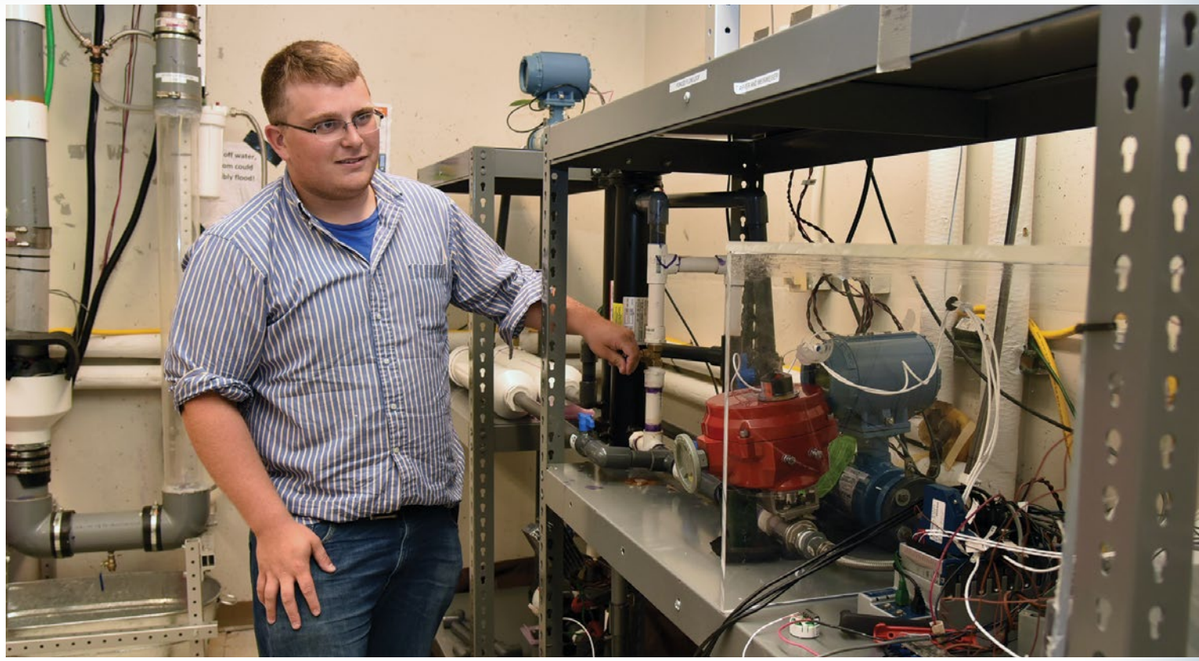
Saint-Vincent is currently looking for his next project as part of the nuclear engineering department and looks forward to sitting down and discussing opportunities with the nuclear engineering faculty. His goal is to find a long-term research project in the coming school year.

"This summer was an experiment working for another organization at UT, however, the slate will be blank for the new school year so I will be sitting down again with the NE department to figure out what to engage in next," he said.

While he is currently planning on continuing his education, Saint-Vincent is always on the lookout for his future as well.

"My highest priority is finding a fulfilling job at some point in the near future," Saint-Vincent said.

Outstanding Master's Student Research: Ryan Tarver



Ryan Tarver, 2016 Outstanding MS Research Student in the Department of Nuclear Engineering, looks over lab equipment used in his research project at UT's Science and Engineering Research Facility.

Ryan Tarver's interest in nuclear engineering was sparked by growing up just down the road from Oak Ridge, Tennessee, with its rich history of nuclear research.

"I've always been fascinated by nuclear sciences and wanted to become engaged in this field," said Tarver. He chose the University of Tennessee for its reputation as a nuclear engineering university.

His engagement has earned him notice as the Outstanding Masters Degree Student for 2016 in the Department of Nuclear Engineering (NE). He also received the Uhrig Scholarship and a Thomas and Patricia Shannon Fellowship during his time as a graduate student.

"My favorite thing about the College of Engineering, and especially nuclear engineering, is the vast amount of opportunities here at UT," said Tarver. "I have had the pleasure of working in some very interesting places and on very involved projects thanks to my nuclear engineering studies."

His research has focused on nuclear instrumentation and controls.

"I was involved with research that was funded by TerraPower, a nuclear reactor design company started by Bill Gates," said Tarver. "The goal of this research was to implement flow measurement techniques that could be applied inside pool-type reactors which cannot employ traditional flow measurement techniques."

For this project, Tarver focused on construing a scaled test bed, to evaluate calorimetric flow characterization methods.

"In this work, I developed dynamic physical models as well as implemented neural networks to create inferential flow models that successfully measured flow compared to our test standard," he said.

His research projects have benefited his career opportunities, as well.

"My work on the TerraPower project helped me get my first post-degree job at Y-12 as a metrology engineer," said Tarver.

His major professors, Dr. Jamie Coble and Dr. Wes Hines, were very influential in helping Tarver move forward in his research and academic career.

"They encouraged me to stay for graduate school after my undergraduate degree, which has paid off very well for me," he said. "Overall, I am extremely grateful for all the support they have given me."

Outside of work and research, Tarver spends time with his wife, Emly, and their two boys, three-year-old Kason and one-year-old Grayson. While working at Y-12, he continues to build his competitive skills.

"For now, I am focusing on my early career development," said Tarver. "In fact, I just completed a summer course in LabVIEW programming."

Outstanding Graduate Teaching Assistant: Mitchell Laubach

Mitchell Laubach

Mitchell Laubach was named the Outstanding Graduate Teaching Assistant for 2016 in the Department of Nuclear Engineering. As a teaching assistant, Laubach has worked under Jason Hayward, associate professor of nuclear engineering, and Eric Lukosi, assistant professor of nuclear engineering.

While working for Lukosi, Laubach was in charge of four other graduate teaching assistants where he organized lab training for each week, supervised all laboratory sections, and coordinated the grading of assignments as well as taught the graduate section of the lab. Lukosi felt he was very effective in his duties.

"He went above and beyond what previous GTAs have done, spending time optimizing the Blackboard site, creating spreadsheets for students to use to make some tasks easier that did not detract from learning, and was overall a positive influence in student learning," Lukosi said. "Every student I talked to was very positive about his presence in the lab."

Laubach would also take the time to look over the course work from the perspective of the students for Lukosi.

"During the course, Mitchell took the time to proofread my laboratory assignments and find potential pitfalls for students," Lukosi said. "His continued effort throughout the semester in enhancing the laboratory exercises greatly benefited the course."

Hayward also spoke highly of Laubach's ability to connect with students.

"He knows the instrumentation and software very well, and he is approachable, so his teaching and feedback has always greatly benefited the students," Hayward said.

While working for Hayward, Laubach supervised a lab for undergraduate students, teaching them how to use radiation instrumentation to measure radiation sources. In doing so, Laubach was always willing to go above and beyond.

"When Mitchell worked for me as a teaching assistant, he was still an undergraduate student, so he took on the grading responsibility for students just one year younger than him," Hayward said. "This required a lot of maturity, which he had. He also asked if he could help me grade quizzes for the class, even though this wasn't part of his responsibility. He was also quick to volunteer for other tasks, such as proctoring an exam."

Laubach believes many of the amazing professors in nuclear engineering influenced him, but credits Lukosi and Hayward as having the most influence on his own style as a teaching assistant.

"I've always been amazed at the wonderful cast of professors we have in the nuclear engineering department and would feel it would be an injustice to choose just one, but if I had to choose I would have to say Dr. Hayward and Dr. Lukosi because I've been a TA under both of them," Laubach said. "They are excellent teachers because of how much they care and how hard they work to ensure their students have the optimal learning experience."

Laubach's favorite thing about being a teaching assistant was not necessarily a single moment, but many moments when he felt he was making a difference.

"My favorite moments were those when I could tell I was making a difference in a student's understanding of the material; the 'watching the light bulb come on' moments," he said.

He plans to pursue his current research on neutron detection for now, but could see himself moving into a role in academia.

"In the near term, I want to pursue my own research but I really do enjoy teaching so I'm sure I will consider coming back to academia in the future," Laubach said of his future plans.

Endowments Continue the Legacies of NE Professors Miller and Upadhyaya

The Department of Nuclear Engineering (NE) had two longtime professors move to emeritus status recently when Dr. Lawrence "Larry" Miller retired in June of 2015 and Dr. Belle Upadhyaya retired on December 30, 2015. Both professors and their wives have set up endowment funds in their names to benefit the Department of Nuclear Engineering.

Miller joined the NE department in 1976 and continues working at UT with a post-retirement agreement that includes teaching, research, and service responsibilities. Miller was a COE Research Fellow in 2009 and received the UT Nuclear Engineering Professor of the Year Award in 2004. His most notable achievement was serving as a mentor for more than 100 graduate students, including 83 master's students and 20 PhD students. He is also included, along with four other COE faculty colleagues, in a Department of Energy integrated research project on advanced, accident-tolerant, ceramic coatings with funding of $3,500,000 through the end of 2016. Miller chaired the UT Radiation Safety Committee for 18 years.

Miller and his wife, Carol, have established the Laurence Miller Family Student Award Endowment to be conferred via an undergraduate student design competition in the NE department. The award will be granted to the student competition winner, regardless of academic performance. As the fund grows, additional distributions can help to develop other graduate or undergraduate student awards in the department.

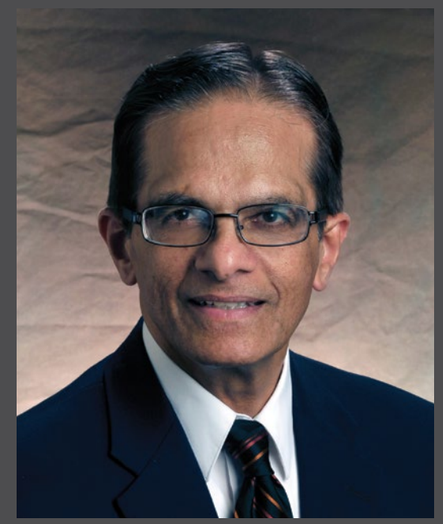
Upadhyaya has been a professor in the NE department for over 40 years, and his list of honors and awards includes the university's Alexander Prize in 2015; COE Research Fellow Awards in 2004, 2007, and 2014; the college's Moses E. and Mayme Brooks Distinguished Professor Award; the American Society of Engineering Education's (ASEE) Glen Murphy Award in 2007; and the Chancellor's Award for Research and Creative Achievement.

Upadhyaya and his wife, Dr. Nirmala Upadhyaya, who is a physician at the University of Tennessee Medical Center, established the Upadhyaya Family Endowed Engineering Scholarship in 2015. The scholarship is available to juniors and seniors in the Department of Nuclear Engineering who have demonstrated successful academic performance.

"These professors have been leaders in the classroom and the research labs," said Dr. Wes Hines, professor and head of the NE department. "They are proving to be leaders again with these generous gifts. We invite their former students and colleagues to honor their service and their achievements with gifts to these worthy endowments."

For more information about a gift to the College of Engineering or the Department of Nuclear Engineering, please contact the Engineering Development Office at (865) 974-2779 or e-mail the office at ***engrdev@utk.edu.***

Dr. Lawrence Miller



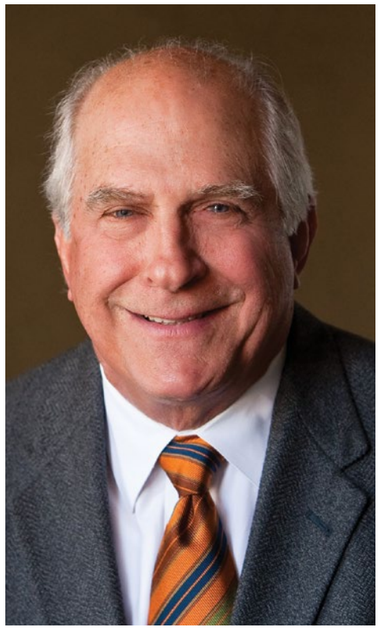
Dr. Belle Upadhyaya

Alumni Profile: Dr. Wayne Coleman

Wayne Coleman (*BS/NE '63, MS/NE '65, PhD/NE '69*) considers himself fortunate to have associated with some of the "great figures" in the Department of Nuclear Engineering, in the football program, and at the University of Tennessee.

Coleman was born and raised in Miami, Florida. Jim Powell, his high school head football coach at Miami Edison High, had been an All-American end at UT in 1948. Although Coleman was small by SEC standards (even in those days), Powell persuaded the then UT Athletic director, General Bob Neyland, to give Coleman a full football scholarship at UT. He had the good fortune to start every game in his last three years of eligibility.

In addition to his excitement about football, Coleman was also enthusiastic about studying nuclear engineering.



Wayne Coleman

"When I arrived at UT, the race to space was the dominant national interest," Coleman said. "This stimulated my interest in aerospace engineering. Unfortunately, at that juncture, UT had no such curriculum per se. However, luckily for me, UT had a nascent nuclear engineering program, led by founder Dr. Pietro Pasqua. The department was only one year old when I enrolled in nuclear engineering as a freshman. What a blessing the NE department would turn out to be for me!"

Since the NE department was small at the time, there was an uncommon closeness among the NE students, and Coleman has warm recollections of that comradery. However, his deepest and most inspiring memories are of the professors, including Ted Mott, Jim Robinson, and of course Pete Pasqua, the first NE department head.

"Dr. Pasqua was not only a dedicated teacher, he took a personal interest in encouraging the success of his students," Coleman said. "Dr. Pasqua persuaded me to continue nuclear engineering in graduate school at UT. When I told him financial support would be a challenge for me, he somehow managed to identify a modest fellowship that (along with the earnings of my beautiful wife, Barbara) allowed me to earn a master's and eventually a PhD in nuclear engineering."

Coleman also remembers a very special UT educator and administrator, Andrew D. Holt, known affectionately by all as Andy Holt. Holt was the President of UT from 1959 to 1970. He was a captivating orator who had a Will Rogers style, often containing humor and always delivering a moral message.

"When Andy spoke to the students he came across as a sage, a mesmerizing grandfather," Coleman commented. "In my senior year, I was honored to be elected as president of the Student Government and selected as Volunteer of the Year. In those roles, I got to know Andy as few students would. When Barbara and I were married, Andy and his lovely wife, Martha, gave us a small book—a guide to Christian marriage entitled *From This Day Forward*. Three years ago we gave that very book to our grandson and his wife as they married."

As an undergraduate at UT, Coleman had committed to the Advanced Army ROTC program. After receiving his PhD degree, he entered the US Army for a two-year tour of duty. He was assigned to the Army Nuclear Defense Laboratory in Maryland, and for the duration of his tour, he performed nuclear weapons' effects analyses.

In November of 1969, he accepted an offer from what was then called Science Applications, Inc. (aka SAI). This was a fifteen-person firm founded by Dr. J. Robert Beyster and located in La Jolla, California. He was the first person that Beyster hired who came from outside of San Diego. Under the leadership of Beyster, SAI became SAIC, a highly diversified, employee-owned technical services company of over 40,000 employees. Coleman was employed by SAIC for 35 years–one entity, but not one career. For the first five years, he was an analyst and principal investigator, diversifying his experience into various fields of engineering and physics. In the next career phase, he was in management, overseeing multiple projects and managing what was defacto a subsidiary of SAIC. He then transitioned into corporate marketing, his final career segment at SAIC. In this role, he concentrated on growing SAIC by synthesizing teams to secure business in new domains. The teams consisted of both internal and external organizations, with the latter normally being other contractors. Also, he was heavily involved in the recruiting of key individuals and conducting quality assurance assessments with critical customers.

" When I arrived at UT the race to space was the dominant national interest, " Coleman said. "This stimulated my interest in aerospace engineering. Unfortunately, at that juncture, UT had no such curriculum per se. However, luckily for me, UT had a nascent nuclear engineering program, led by founder Dr. Pietro Pasqua. The department was only one year old when I enrolled in nuclear engineering as a freshman. What a blessing the NE department would turn out to be for me!"

"In 35 years, there was never a dull moment," Coleman said. "I retired from SAIC in 2005."

Coleman continues to serve on the Board of Advisors to the UT College of Engineering. In that capacity, he has recently promoted an approach to enhancing UT's performance in the national EcoCar competition, sponsored primarily by the Department of Energy and General Motors. He is also involved in the National Leadership Seminars, sponsored by Hillsdale College, and the endeavors of the Kroc Institute for Peace and Justice and the School for Peace Studies, both at the University of San Diego.

The Colemans live a busy life filled with family and community activities in Solana Beach, California, but they never forget their ties to Big Orange Country.

"I am still married to my best friend, Barbara Ann (Beck) Coleman," Coleman said. "We met in high school and were married 53 years ago when we both received our bachelors degrees. Barbara's was in nursing. What a wonder woman. Barbara managed to teach nursing at UT Hospital–making possible my completion of grad school–and give birth to our three sons in Knoxville while I was working on my MS and PhD degrees at UT. Barbara and I spend a lot of time in joint activities, not the least of which are various ministries within our church. We also engage in regular exercise together. Although she is a University of Miami graduate, Barbara is also a strong UT fan. We usually make it back for at least one football game a season. This year, we attended two games, including the Battle at Bristol where UT played Virginia Tech on September 10th. We have three handsome sons who each have lovely spouses, and we are especially proud, too, of our five grandchildren and one great grandchild. Some of the family joined us at the game in Bristol!"

Wayne (right) and Barbara Coleman (left) at their home in California.

Outstanding Faculty: Dr. Jamie Coble

Dr. Jamie Coble

Dr. Jamie Coble's ties to the East Tennessee region drew her to become an assistant professor in the Department of Nuclear Engineering at the University of Tennessee in 2013. Coble spent her childhood in Johnson City, Tennessee, where her father worked for the Tennessee Valley Authority in hydro-based electricity production. After graduating from Science Hill High School, Coble attended UT for her undergraduate and graduate studies, completing four degrees–a bachelor's degree in nuclear engineering and mathematics in 2005, a master's degree in nuclear engineering in 2006, a master's degree in reliability and maintenance engineering in 2009, and a PhD in nuclear engineering in 2010.

Coble's interest in engineering naturally grew out of her early interests in math and science.

"Growing up, the fathers of several of my close friends were scientists and engineers at local companies, Nuclear Fuels Services and Eastman," Coble said. "I talked with them about their work and responsibilities, and the opportunities were very exciting. I was very lucky to be encouraged by family, teachers, and mentors to continue to pursue interests in math and physical sciences through adolescence and into college."

After completing her PhD, Coble worked at Pacific Northwest National Laboratory (PNNL) in Richland, Washington, working as a staff scientist in the Applied Physics group for two years. Although she enjoyed the challenges and opportunities working at PNNL, Coble missed academia and the Appalachian region. When the opportunity arose to return to UT as an assistant professor, she eagerly pursued it.

"My long-term goal has always been to return to academia. The university environment provides opportunities to do cutting-edge research and to mentor the next generation of scientists and engineers," Coble commented. "I received a fantastic education at UT, and I am very excited to be part of the department on this side of the classroom. The nuclear engineering department has undergone impressive growth over the last several years, in terms of student body, faculty, and research. We have excellent research labs planned for our new building, which will further open new areas of research and expertise for the department."

Coble's research falls under the broad umbrella of instrumentation and controls (I&C), specifically focused on data-driven methods for process monitoring, equipment condition assessment, prognostics, and advanced system control. Coble and her research team collect data on operating components (such as pumps and motors). Measured data are analyzed to detect very early indications of degradation and faults, and to estimate the remaining time that the component can operate before it breaks. This work supports optimized operations and maintenance planning for nuclear power plants to reduce the cost of generating electricity while maintaining the high safety and reliability standards currently enjoyed in the US nuclear fleet.

Coble is part of a multi-institute team that recently received a $1 million grant from the Department of Energy's (DOE) Nuclear Energy Enabling Technology (NEET) program for a research project headed by Pacific Northwest National Laboratory with UT as a collaborating institution.

"This project was awarded through the DOE-NE NEET program to a collaboration between UTK, Pacific Northwest National Laboratory, and Analysis and Measurement Services Corporation (AMS), a local company owned by UT nuclear engineering graduate Dr. Hash Hashemian," Coble commented. "This project is focused on empirical modeling methods for sensor calibration assessment to support reduced sensor calibration requirements in nuclear power plants."

Currently in the US, nuclear plants are required to recalibrate all of their safety-related instrumentation at each refueling outage, every eighteen to twenty-four months. Studies by the Electric Power Research Institute (EPRI) suggest that only 3-5% of the sensors are actually out of calibration when this periodic maintenance occurs. The unnecessary recalibration efforts are expensive, time consuming, and contribute to radiation exposure for plant personnel. Future reactor designs feature longer operating cycles before refueling, from four to forty years, which don't provide the convenient opportunities for calibration assessment required for the current fleet.

Coble's team is developing methods to use the data that are being collected by the plant process monitoring and control sensors to evaluate the calibration of these sensors as the plant is operating. With this analysis, plants can focus recalibration efforts on only those sensors that exhibit calibration problems. Eliminating unnecessary maintenance supports the delivering the Nuclear Promise in the US: safe, reliable, and economic nuclear power generation.

Coble also enjoys her role in teaching future nuclear engineers, and UTNE students are consistently some of the best and brightest in the country.

"We attract some of the best nuclear engineering students at both the undergraduate and graduate level," Coble commented. "With our close proximity to Oak Ridge National Laboratory, TVA, and the Southern Company, we're uniquely positioned to offer students a lot of opportunities for research and industry internships."

THE UNIVERSITY OF TENNESSEE KNOXVILLE

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