

UTNEUPDATE

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

New Building Planning Underway



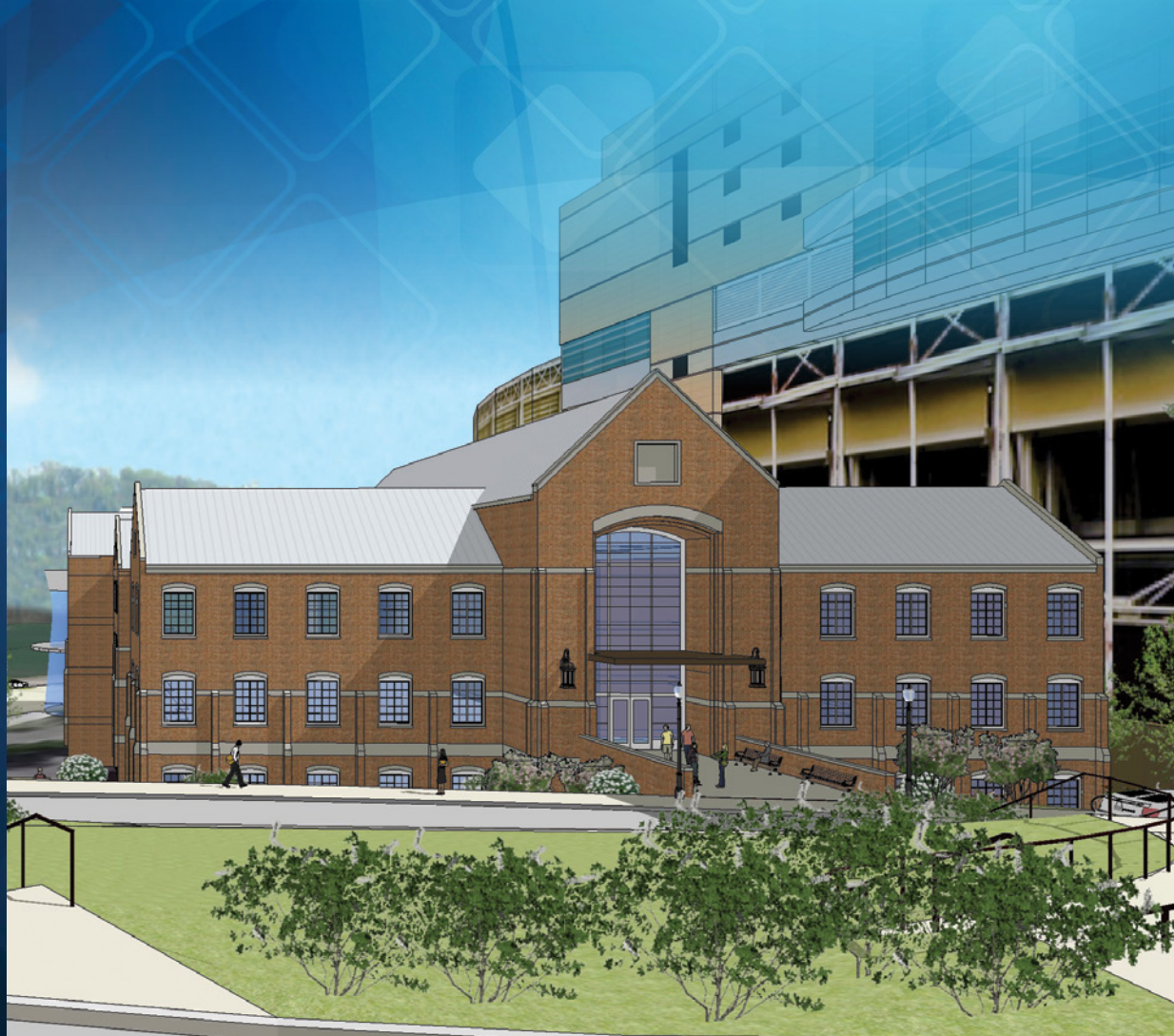
Dr. Jason P. Hayward
Receives NSF CAREER
Award, Named UCOR
Faculty Fellow



Dr. Brian Wirth
Leads \$11.5 Million Dollar
DOE SciDAC Program



Dr. Hash Hashemian
President & CEO,
AMS Corporation
Alumni Profile



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Department of Nuclear Engineering • Fall 2013

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THE UNIVERSITY of TENNESSEE **UT**
KNOXVILLE
Department of Nuclear Engineering
COLLEGE OF ENGINEERING

Department Head's Message from Dr. Wesley Hines

As I reflect on the department's vast changes over the last five or six years, there are almost too many to list, so let me break it down through a systems view, with the system comprised of people, facilities, and activities.

On the very positive side, we have grown our faculty from seven to what will be sixteen total faculty by the end of the year. This will include the addition of three Governor's Chairs with Howard Hall, Brian Wirth, and newly committed Steve Zinkle. We also added two faculty who will go up for tenure this year, and four additional faculty: Jamie Coble, Maik Lang, Eric Lukosi, and Steve Stuknik. This has allowed us to broaden our academic offerings to include courses in nuclear materials and nuclear security. Likewise, our research activities have significantly increased with all faculty highly engaged. With the doubling of our faculty and near tripling of our research expenditures, we have added two staff members to help provide the support that enables us to do our work.

Our student body has also grown. Three years ago, we had more BS graduates than any program in the country and we expect that to occur again this year with a senior class of fifty-five. Two years ago we also began recruiting the best and brightest graduate students from across the country. Dr. Wirth led our formal graduate recruiting program, in which we fly in fifteen to twenty top students each February and let them learn about our research focus areas. They tour our labs, meet our faculty, and get the opportunity to visit many one of a kind facilities at Oak Ridge National Laboratory (ORNL) including the Spallation Neutron Source, High Flux Isotope Reactor, Consortium for Advanced Simulation of Light Water Reactor, hot cell facilities, and the fastest supercomputer in the world, to name a few.

Speaking of our ORNL partners, we now have five UT-based joint faculty and six ORNL-based joint faculty. This arrangement gives our faculty and students access to ORNL's top research facilities and the opportunity to work on solving the nation's most vital energy challenges.

Last year, we were given the opportunity to begin raising private funding to secure a new College of Engineering building that will house the Department of Nuclear Engineering and the Jerry E. Stoneking Freshman Engage Engineering Program. The college is currently planning for the new building. The timeline for completion will not be finalized until possibly later



this year, but it is great to know that a new building is in our future.

Every year, I try to initiate a major improvement to the department. When I took over in January 2012, I immediately began work on transforming our graduate recruiting process. This past year, I developed a study abroad program to give our students training at a world class research facility in Prague and to give our honors students an opportunity for a valuable international experience, which is required to graduate in that program. This coming year I expect to plan for our department's continued growth and new building. It has been a fantastic five years and I look forward to even better times to come.

Sincerely,

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

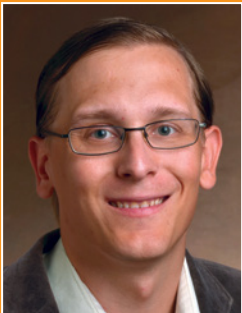
New Faculty



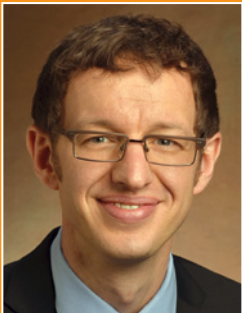
Dr. Ondrej Chvala



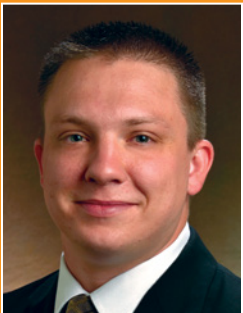
Dr. Jamie Coble



Dr. Niklas Juslin



Dr. Maik Lang



Dr. Eric D. Lukosi



Dr. Jae-Hyeok Shim



Dr. Steven E. Skutnik



Dr. Joseph R. Stainback IV



Dr. Steven Zinkle

Dr. Ondrej Chvala
Research Assistant Professor
PhD: Charles University in Prague, Czech Republic

Research areas: High performance computing applications to nuclear engineering, reactor core physics, molten salt based nuclear systems

Dr. Jamie Coble
Assistant Professor
PhD: University of Tennessee

Research areas: Process monitoring, equipment condition assessment, fault detection, diagnostics, and prognostics

Dr. Niklas Juslin
Research Assistant Professor
PhD: University of Helsinki, Finland

Research areas: Fusion reactor materials, plasma-surface interactions, atomistic simulations

Dr. Maik Lang
Assistant Professor
PhD: University of Heidelberg, Germany

Research areas: Radiation damage and high-pressure studies, materials science

Dr. Eric D. Lukosi
Assistant Professor
PhD: University of Missouri at Columbia

Research areas: Nuclear and radiological engineering, radiation detection, active and passive interrogation techniques, topics of counterterrorism and nonproliferation, nuclear batteries, ion propulsion drives, plasma physics, and fundamental nuclear physical quantities

Dr. Jae-Hyeok Shim
Research Assistant Professor
PhD: Seoul National University, Korea

Research areas: High-temperature energy materials

Dr. Steven E. Skutnik
Assistant Professor
PhD: North Carolina State University, Raleigh

Research Areas: Nuclear fuel cycles, nonproliferation and safeguards, proliferation resistance evaluation, nuclear waste management, and policy issues pertaining to the nuclear fuel cycle

Dr. Joseph R. Stainback IV
Research Associate Professor
PhD: University of Tennessee Institute for Nuclear Security

Dr. Stainback works closely with the Oak Ridge National Laboratory, Oak Ridge Associated Universities, and has a Joint Appointment with the Y-12 National Security Complex

Research areas: Focusing efforts for the University of Tennessee's Institute for Nuclear Security on five principal thematic areas within the nuclear industry, namely policy, law and diplomacy, education and training, science and technology, operational and intelligence capabilities, and real-world missions while taking a systems engineering approach to these matters

Dr. Steven Zinkle
Governor's Chair Professor
PhD: University of Wisconsin, Madison

Research areas: Physical metallurgy of structural materials; the effects of ion and neutron irradiation on the microstructure, physical properties, and mechanical properties of metals and ceramics; transmission electron microscopy; and fusion and space fission reactor materials studies

Faculty News



Dr. Jason P. Hayward

Dr. Jason P. Hayward, an assistant professor in the Department of Nuclear Engineering and UCOR faculty fellow, has received the Early Career Research Program Award (CAREER) from the National Science Foundation.

The CAREER award is the NSF's most prestigious honor for junior faculty who demonstrate outstanding research, excellent education, and the integration of education and research within the context of the mission of their organizations.

Hayward's award includes total funding of \$750,000 over five years to develop the research outlined in his proposal, "Neutron Scattering Instrumentation Research and Development for High Spatial and Temporal Resolution Imaging at Oak Ridge National Laboratory."

Hayward will also perform outreach activities related to his research.

For more information, visit <http://science.energy.gov/early-career>.



Dr. Eric Lukosi

Dr. Eric Lukosi, an assistant professor in nuclear engineering, received a prestigious Ralph E. Powe Junior Faculty Enhancement Award from Oak Ridge Associated University (ORAU) and matching funds from the UT Office of Research. The award is given to thirty young faculty members at ORAU member institutions with the goal of enriching their research and professional growth and spurring new funding opportunities. ORAU provides

innovative scientific and technical solutions for the US Department of Energy (DOE) and other federal agencies to advance national priorities in science, health, education, and national security. A nonprofit corporation and federal contractor, ORAU manages the Oak Ridge Institute for Science and Education for the DOE.



Dr. Howard Hall

Dr. Howard Hall, Governor's Chair in Global Nuclear Security and a professor in the Department of Nuclear Engineering at the University of Tennessee, Knoxville, has been named a Fellow of the American Association for the Advancement of Science (AAAS).

Hall, an internationally respected expert in nuclear security, currently directs a research

group at UT whose interests focus on the application of science, technology, and public policy to international nuclear security needs and challenges. Specific areas of research for the group are nuclear forensics; nuclear chemistry and radiochemistry; and nuclear security policy in the interface between technology, policy, and legal frameworks, including treaty verification and arms control, counterterrorism, and nuclear nonproliferation.

Hall and his group work in collaboration with Oak Ridge National Laboratory, the Y-12 National Security Complex, and Oak Ridge Associated Universities. Hall was a recipient of the Department of Homeland Security/Science & Technology Undersecretary's Award for Science in 2005 and was elected a Fellow of the American Institute of Chemists in 2010. He received his PhD in nuclear chemistry from the University of California, Berkeley.

Hall is also a Senior Fellow in the Howard H. Baker Jr. Center for Public Policy, where he directs the Center's Global Security Program. Since 2011, Hall has also served as Director of the UT Institute for Nuclear Security.

AAAS is an international non-profit organization, founded in 1848, dedicated to advancing science around the world by serving as an educator, leader, spokesperson, and professional association. AAAS works with over 261 affiliated societies and academies of science and serves 10 million individuals. The global organization has offices in Washington, DC, and Cambridge, UK, and award-winning news correspondents reporting from numerous countries.

Each year, the AAAS Council elects members whose efforts on behalf of the advancement of science or its applications are scientifically or socially distinguished as Fellows. In addition to Hall, six other UT faculty members were designated as AAAS Fellows. For more information, visit <http://www.utk.edu/tntoday/2012/11/29/faculty-named-aaas-fellows/>.

Hall was inducted as an AAAS Fellow on Saturday, February 16, 2013, in a ceremony at the Marriott Copley Place in Boston, Massachusetts.

Hall also served on the "Committee on Assuring a Future US-Based Nuclear Chemistry Expertise," under the Board on Chemical Sciences and Technology in the Division on Earth and Life Studies of the National Research Council.

The committee looked at the ability of the United States to meet future nuclear and radiochemistry needs. It found that, while demand for nuclear and radiochemistry experts will not decrease, many of the current experts are approaching retirement age and the number of students opting for careers in these fields has decreased dramatically. The report offers recommendations for actions to avoid a shortage of personnel in the future.

For more information, visit <http://dels.nas.edu/Report/Assuring-Future-Based/13308>.

UT-NE Radiochemistry Center Seeks to Improve Global Security



Dr. Howard Hall



Dr. Arthur Ruggles



Dr. Lawrence Heilbronn



Dr. Joseph R. Stainback IV



Dr. Brian Wirth



Dr. Kurt Sickafus

The current process of analyzing weapons debris to understand the performance or design of the device is often painstakingly slow. New research to be conducted at UT will improve nuclear forensics as well as expand the understanding of the physics of nuclear weapons in the name of global security.

The UT Radiochemistry Center of Excellence is being established through a \$1.2 million grant from the National Nuclear Security Administration (NNSA) for the first year with the potential for a total of \$6 million for five years. The goals of the center are research and education to benefit both UT and NNSA laboratories, such as Los Alamos National Laboratory, Lawrence Livermore National Laboratory, and the nearby Y-12 National Security Complex.

Governor’s Chair for Nuclear Security Howard Hall is the principal investigator for the new center.

The center will have two main research thrusts that seek

to develop new scientific understandings of areas of strategic interest to the NNSA—advanced radiochemical separations and the use of radiochemical probes for understanding complex phenomena like turbulent flow. Smaller efforts on nuclear cross-section studies and nuclear materials will also be supported.

NNSA lab staff will have the opportunity serve as adjunct professors at UT, students will have the opportunity to partner on projects at national labs, and UT will build even closer collaborations with the NNSA labs.

The center’s work in radiochemical separations will seek to accelerate the process of chemically separating isotopes in bomb debris, potentially providing the nation with more information to use during nuclear threats.

Students will also collaborate with the UT Medical Center to use PET scan technology to better understand how metals interact during a nuclear

detonation. Currently, the NNSA uses high fidelity computational simulations; however new experimental ways to validate these simulations are needed. Tapping into radiochemistry and nuclear medicine techniques, the center will develop capabilities to experimentally assess the performance of these turbulent flow computer models.

Another key benefit of the center is to help provide new students in radiochemistry, a critical field that has been shrinking in academia for years, as noted in a recent report from the National Academy of Sciences.

The center will be housed within the UT Institute for Nuclear Security, which is part of the Howard H. Baker Jr. Center. Faculty involved include Hall; nuclear engineering faculty Arthur Ruggles, Lawrence Heilbronn, Joseph Stainback, and Governor’s Chair for Computational Nuclear Engineering Brian Wirth; Pete Counce in chemical engineering; and Kurt Sickafus, professor and head of the Department of Materials Science and Engineering.



Dr. Belle Upadhyaya

Faculty Research Highlights

Dr. Belle Upadhyaya, a professor in the nuclear engineering department, was inducted as a Fellow in the International Society of Automation (ISA) in September 2012 at the 50th Annual ISA Honors & Awards Gala held in Orlando, Florida. Upadhyaya was recognized for research and development on nuclear power plant sensing and control systems leading to enhanced, fault tolerant power reactor operation methods.



Hayward Named UCOR Faculty Fellow



UCOR Fellow Dr. Jason Hayward (far left) is joined by (left to right) COE Dean Dr. Wayne T. Davis; UCOR President and Project Manager Leo Sain; Professor and Head of the Nuclear Engineering Department Dr. Wesley Hines; and UT Knoxville Chancellor Dr. Jimmy G. Cheek at a luncheon following the announcement of the UCOR fellowship.

UCOR (URS/CH2M Oak Ridge LLC), a Department of Energy (DOE) contractor in Oak Ridge, Tennessee, recently established the UCOR faculty fellowship in the University of Tennessee, Knoxville, College of Engineering (COE). The company donated \$250,000 toward the fellowship, and the first recipient is Dr. Jason Hayward, an assistant professor in the COE’s Department of Nuclear Engineering (NE). Hayward, who was named a COE Research Fellow in 2011, is a top recipient of external research awards in the department.

Since arriving in 2008, Hayward has been awarded more than \$7 million in research funding. With these funds, his group has focused on research in areas of detector science and development of gamma ray and neutron imaging for applications in nuclear security, neutron scattering science, and medical imaging.

“We view this as the beginning of an important partnership,” said NE department head Dr. Wes Hines. “UCOR is a crucial leader in the Oak Ridge technology community, and we are especially pleased that this faculty fellow position allows us to have an even greater involvement.”

Hayward holds a joint faculty position with Oak Ridge National Laboratory. He received his PhD in nuclear engineering and radiological sciences at the University of Michigan.

Leo Sain, UCOR’s president and project manager, announced the fellowship on Friday, June 29, 2012, at the East Tennessee Economic Council meeting in Oak Ridge. Sain said UCOR established the fellowship because it is committed to doing its part to ensure continued excellence in education in the nuclear field.

The UCOR Faculty Fellow position is part of the Chancellor’s Faculty Challenge, a financial incentive plan

inaugurated by Chancellor Jimmy G. Cheek to provide annual stipends from the chancellor’s office while the endowment builds to its full level.

“We would usually have to wait a year or two before income was generated before we could make the faculty award,” said COE Dean Wayne T. Davis. “Now, because of UCOR’s generosity and the excellent timing of this challenge, we were able to make an immediate impact.”

Hayward and Hines visited UCOR on July 22, 2013. The two faculty members received a very informative site tour of the K-25 building from Jimmy Massey with explanations of the company’s cleanup means and methods. K-25 is a former uranium enrichment facility of the Manhattan Project that used the gaseous diffusion method.

UCOR is a partnership between URS, a worldwide leader in environmental work, and CH2M HILL, the United States’ largest environmental company. UCOR is committed to the long-term success of cleanup operations at the DOE Oak Ridge Reservation and performs work at other nearby sites. For more information about UCOR, visit www.ucor.com.



Dr. Jason Hayward and Mr. Jimmy Massey at the former site of the K-25 building.

NE Governor's Chair to Lead National Team to Study Materials Performance in Nuclear Fusion Reactors



Governor's Chair Brian Wirth

A team of researchers at UT Knoxville and Oak Ridge National Laboratory led by Brian Wirth, UT-ORNL Governor's Chair for Computational Nuclear Engineering, in collaboration with seven other institutions, is trying to solve the challenge of bringing fusion energy to the commercial energy market.

The Scientific Discovery through Advanced Computing (SciDAC) project will receive \$2.3 million from the Department of Energy for the first year with plans for a total of \$11.5 million over five years. ORNL and UT will receive \$850,000 for the first year with plans for a total of \$4.1 million over five years.

Nuclear fusion promises an almost limitless supply of clean and safe energy, because the process to create the

energy is different. In nuclear fission, an atom is split into two smaller atoms that remain radioactive for hundreds to many thousands of years. In fusion, two or more smaller atoms are fused into a larger atom that is not radioactive.

The researchers will examine how the surfaces of materials that comprise the reactor respond when being bombarded by energetic neutrons and ions. Using high-performance computers such as ORNL's Jaguar and UT's Kraken, the researchers will try to accurately predict materials' performance and evaluate materials systems and component design for the fusion reactor environment. The team will then be positioned to use their computational tools to evaluate new materials and component designs to enable fusion energy.

The research group is trying to identify and model numerous microscale defect and impurity interaction processes that occur over rapid time scales that can span less than a nanosecond. They will then try to integrate these into a model that can predict the material response over the years and decades for which a fusion reactor needs to operate.

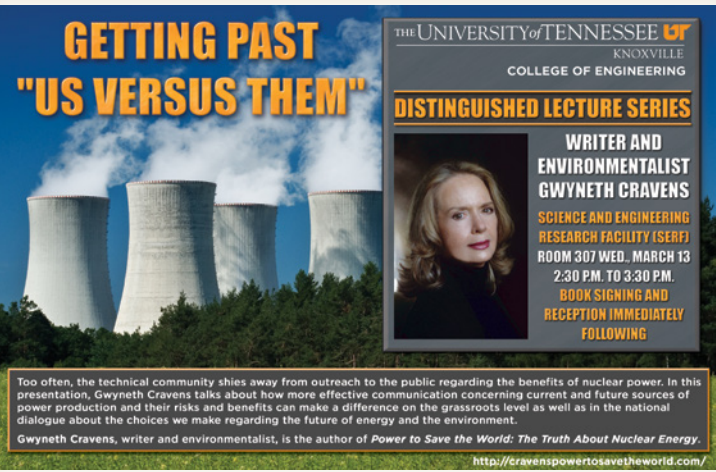
The Department of Energy's Office of Fusion Energy Sciences and Office of Advanced Scientific Computing Research are jointly funding this SciDAC project. Collaborating institutions include Argonne National Laboratory; Los Alamos National Laboratory; Pacific Northwest National Laboratory; University of California, San Diego; University of Illinois at Urbana-Champaign; University of Massachusetts, Amherst; and General Atomics.

Distinguished Colloquium Speaker: Gwyneth Cravens

Writer and environmentalist Gwyneth Cravens presented a distinguished lecture titled "Getting Past 'Us Versus Them'" on Wednesday, March 13, in the auditorium of the Science and Engineering Research Facility. Her talk encouraged outreach to the public regarding the benefits of nuclear power, promoting the idea that more effective communication



Gwyneth Cravens



concerning current and future sources of power production and their risks and benefits can make a difference on the grassroots level as well as in the national dialogue about the choices we make regarding the future of energy and the environment. Cravens is the author of *Power to Save the World: The Truth About Nuclear Energy* and five novels. She has contributed articles on science and other topics to *The New Yorker*, *The New York Times*, *Harper's*, *The Washington Post*, *Discover*, *Huffington Post*, *The Brookings Institution Review*, and other publications. She worked as an editor at *The New Yorker* and as an associate editor at *Harper's*, and for several years wrote a literary column for *The Nation*.

COE Faculty Teams Receive NEUP Awards



Dr. Wesley Hines



Dr. Belle Upadhyaya

The University of Tennessee was selected to collaborate with Georgia Tech and eleven other institutions on a \$5.9 million Nuclear Energy University Programs (NEUP) Integrated Research Programs (IRP) Award project to develop a novel concept of a high-power light water reactor (LWR) with inherent safety features that will advance its safety level beyond that of advanced passive systems. The UT group is led by Dr. Wesley Hines, Charles P. Postelle Distinguished Professor in Nuclear Engineering and the head of the UT Department of Nuclear Engineering, and Dr. Belle Upadhyaya, a professor in the nuclear engineering department.

A second proposal submitted by a research group led by Dr. Kurt Sickafus, Alvin and Sally

Beaman Professor and head of the UT Department of Materials Science and Engineering, to the 2012 NEUP IRP Awards was selected for a \$3.5 million award for a nuclear innovation project. The US Department of Energy (DOE) provided a total of \$13 million in funding for the three university-led research teams.

Researchers on the UT-led project will develop a fuel concept based on an advanced ceramic coating for Zr-alloy cladding. Collaborating institutions on the UT team include Pennsylvania State University; University of Colorado, Boulder; University of Michigan; Westinghouse Electric Company; Los Alamos National Laboratory; University of Manchester; University of Oxford; University of Sheffield; and University of Huddersfield.

The NEUP programs support multifaceted projects to develop breakthroughs for the US nuclear energy industry. Universities lead the three-year projects, working in collaboration with the nuclear industry, national laboratories, and international partners.

For more information on the specific awards, visit www.neup.gov.

UT Nuclear Engineering Rankings Go Up

The Department of Nuclear Engineering's (NE) graduate program at the University of Tennessee now ranks fifth among nuclear engineering programs at all public universities and sixth in the nation, according to the *U.S. News and World Report* graduate rankings released recently.

The NE department has grown graduate enrollment by more than forty-five percent in just four years, due in part to new interest in nuclear power as a global energy option.

The national ratings surveyed more than 1,250 public and private university graduate programs.

"We are very happy that our hard work and dedication is being noticed by others," said Dr. Wesley Hines, the Charles P. Postelle Distinguished Professor in Nuclear Engineering and NE department head. "We have invested heavily in new faculty, doubling our size in the last six years; we have also begun recruiting graduate students nationally, flying top students in for a recruiting weekend each February; and the college has received a commitment for significant private funding to initiate the planning for a new engineering complex that will house the department and other engineering programs. These

investments in faculty, students, and facilities have already shown results in increased research and improved scholarly quality, and we expect these performance improvements to continue."



Nuclear engineering students Hannah Hale and Tom Wulz with Dr. Eric Lukosi.

Student Research Highlight: David Dixon



David Dixon, a PhD student studying with Dr. Ivan Maldonado, gained notice for his ingenuity in a series of projects while working at Los Alamos National Laboratory (LANL).

Dixon was a member of the flow-rate technical group and nodal analysis team, along with teams from several other national laboratories, in the cleanup response to the 2010 Deepwater Horizon oil spill.

Later, during the 2011 Fukushima nuclear tragedy in Japan, Dixon represented LANL in Washington, DC,

as a nuclear-engineering expert and advisor to the US government. He led a team of engineers looking into the feasibility of using water-jet cutting technology to help cut through thick, reinforced concrete structures. Dixon and team set up the water-jet experiment and showed evidence of its effectiveness.

Dixon received recognition for his work on these projects through two Secretary's Achievement Awards from the US Secretary of Energy, Dr. Steven Chu, presented in October of 2011. Only one other participant received two awards in this ceremony.

In November of 2012, Dixon was quoted in a LANL press release to the national science press in regards to his work on a new type of nuclear reactor that could be used on space flights. Dixon and colleagues demonstrated the first use of a heat pipe to cool a small nuclear reactor and power a Stirling engine at the Nevada National Security Site's Device Assembly Facility near Las Vegas.

"Perhaps one of the more important aspects of this experiment is that it was taken from concept to completion in six months for less than a million dollars," said Dixon. "We wanted to show that with a tightly-knit and focused team, it is possible to successfully perform practical reactor testing."

Titled "Demonstration Using Flattop Fissions (DUFF)," the experiment produced twenty-four watts of electricity. The research team included engineers from Los Alamos, the NASA Glenn Research Center, and National Security Technologies LLC (NSTec).

"It was an exercise in engineering, taking existing technology—and in many cases, existing equipment—in a configuration that had not been operated before," said Dixon.

Though a "relatively simple experiment," as Dixon describes it, it is being recognized with an R&D100 Award in the Kilopower (Energy Technology) category in the September 2013 issue of *R&D Magazine*.

"It did not surprise me at all that David Dixon was involved in this rather unique experiment that involved quite a bit of engineering creativity," said Maldonado, who attended the demonstration. "This unprecedented experiment was a great success in that it proved a relatively simple concept that could potentially be used to generate long-term electricity for deep space and long-term NASA applications."

Outstanding PhD Student: Joshua Cates

When Joshua Cates expressed an interest in nuclear physics to his high-school physics teacher, the teacher told him of the growing demand for nuclear engineers and encouraged him to apply to UT's nuclear engineering program.

Cates, a native of Johnson City, Tennessee, followed through on the encouragement, earned both his BS and MS degrees, and is currently a PhD candidate with a healthy list of awards and accolades.

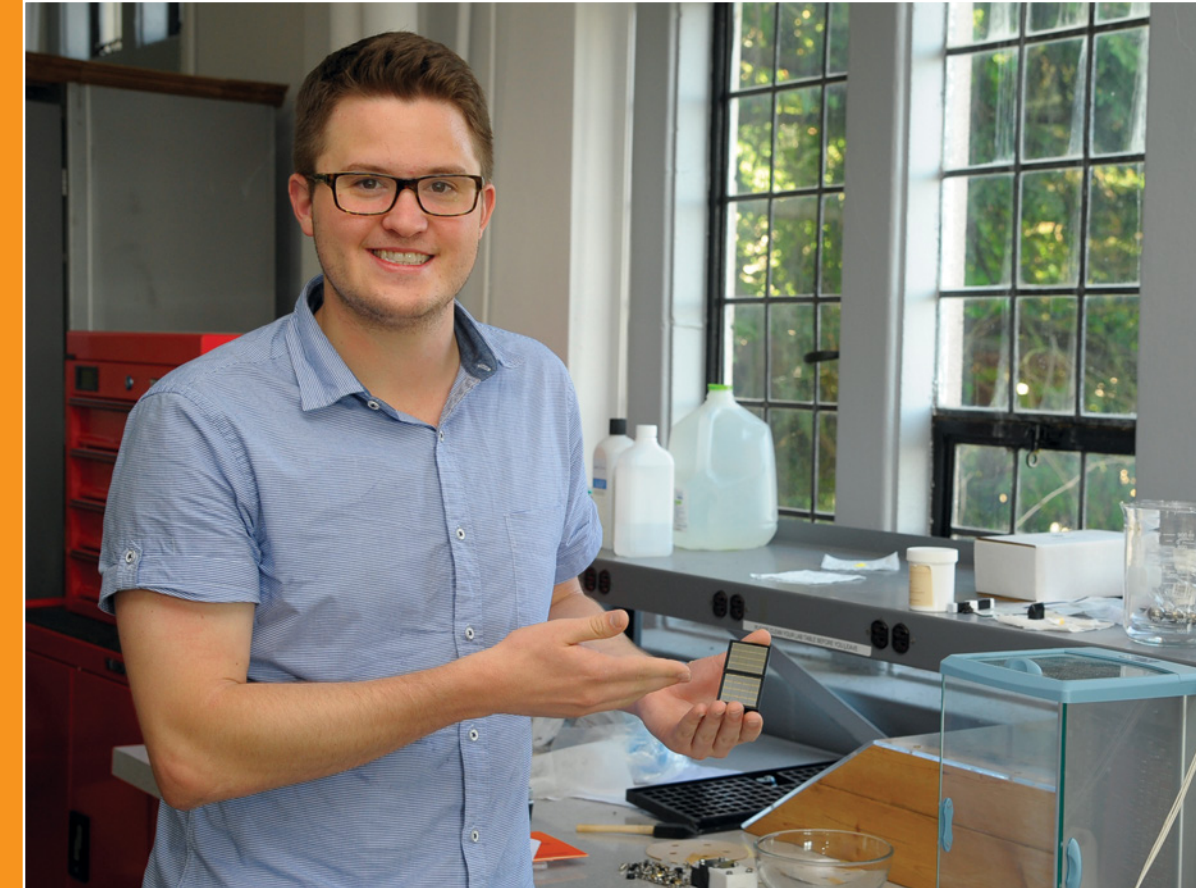
"As an undergraduate, I won an intern research contest at Oak Ridge National Laboratory (ORNL) in 2008," said Cates, who worked as a research assistant within the Safeguards Group and the Nuclear Materials Detection and Characterization Group at ORNL. "This year, the Institute of Electrical and Electronics Engineers (IEEE) Nuclear and Plasma Science Society (NPSS) recognized my contributions to the fields of nuclear and plasma sciences with a Graduate Scholarship Award."

Cates received the award at the Nuclear Engineering Awards Banquet on April 24, 2013. That same month, the university chancellor cited him for "extraordinary professional promise" and he earned the nuclear engineering department's PhD Graduate Research Excellence Award.

"As a young researcher, it's pretty difficult to not be able to find a subject of research within the umbrella of nuclear engineering that interests you," said Cates. "Specifically, I enjoy nuclear-engineering research topics because they fuse hard science with real-life applications that are beneficial to the public as a whole."

Cates studies under Dr. Jason Hayward, assistant professor and UCOR Faculty Fellow in nuclear engineering, who nominated him for the IEEE award.

"I've been in the nuclear engineering department since I was an undergraduate, so all of the faculty members have had a direct impact on me in one way or another," said Cates. "However, my major professor, Jason Hayward, has had the largest influence on my transition



from a student to a successful researcher. His constant availability for insightful discourse and the mentoring he has provided me really benefited me in my PhD research."

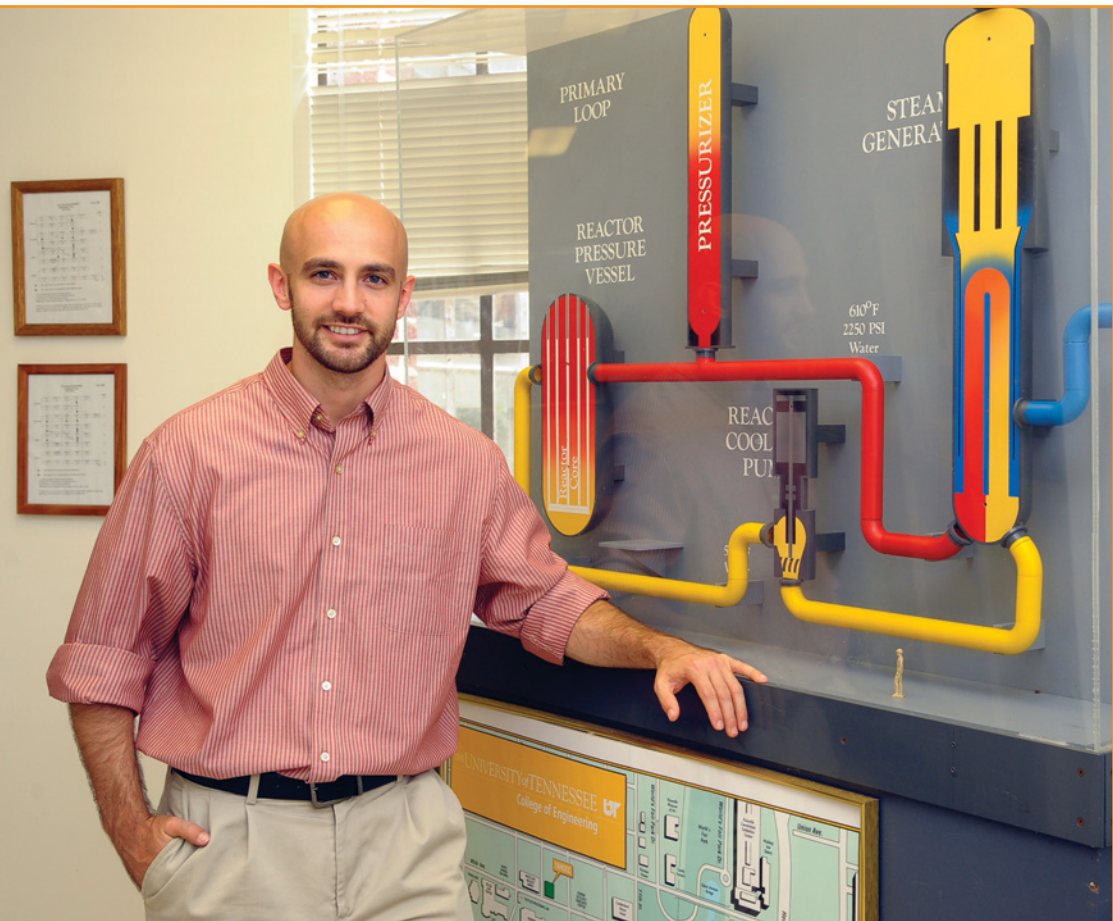
This mentoring and Cates' enthusiasm for his subject have fueled his successful UT career, and he maintains his drive through his PhD research.

"My favorite project would be the one I am on now, and is covered in my dissertation work," said Cates. "It involves fundamental improvements on the performance of imaging systems for increased sensitivity in detecting, imaging, and interdicting shielded, special nuclear material. The project combines a number of techniques and technologies from the nuclear security and molecular imaging communities, and my work on it has developed my understanding of imaging sciences across a number of fields and applications."

Even outside of his own research path, Cates sees a world of opportunity and potential progress in his field.

"My favorite thing about nuclear engineering is how diverse its research scope is," said Cates. "If you talk to a number of graduate students in nuclear engineering, you'll find that each of their research topics are not only different, but very different. The unique challenges that nuclear engineers tackle are multidisciplinary in nature and span a wide spectrum of applications in energy, nuclear security, space, medical, and materials research."

Outstanding MS Student: Cole Gentry



Before enrolling at the University of Tennessee, Cole Gentry's main interest was in astrophysics. But he also looked forward to a career that offered more hands-on experiences.

"Nuclear engineering provided somewhat of a mix of the two desires," said Gentry. "It has provided study opportunities to take advanced math and physics classes, while still maintaining a high degree of practicality."

The path seems to have suited him well. Gentry began earning academic accolades in his time as an undergraduate. He received Outstanding Undergraduate awards for 2003-2004, 2004-2005, and 2005-2006, and then topped those off by receiving the Top Collegiate Scholar Award for 2008 and graduating Summa Cum Laude.

"My favorite experiences have always come from taking classes (i.e. physics, math, computer science) that help to expand my understanding of physics related problems and how they are addressed," said Gentry. "After completing these classes, I always feel like my eyes have been opened to new challenges and opportunities which drive me to continue to learn more."

After graduation, Gentry spent two years working with the Tennessee Valley Authority (TVA). Dr. H. Lee Dodds, then the head of the Department of Nuclear

Engineering, inspired and helped Gentry to return to graduate school at UT. As a master's degree student, he landed a US Department of Energy (DOE) Innovations in Fuel Cycle Research Award for Universities with Less Than \$630 Million in 2009 Research and Development Expenditures.

In addition to exploring the possibilities of the nuclear world, the Hixson, Tennessee, native pursues a wide range of dynamic pastimes. He balances physical activities such as soccer, Brazilian Jiu Jitsu, and marathon and trail running with flute and saxophone playing. Gentry's active lifestyle, like his list of awards, reflects his two-fold passion for absorbing knowledge and putting it into practice through his research.

"So far, the most beneficial project has been my study of using ceramic microencapsulated fuel for transuranic waste recycling in pressurized water reactors (PWRs)," said Gentry. "It was essentially a study to demonstrate the feasibility of using the tristructural isotropic fuel forms to achieve a high burnup of transuranic waste in PWRs. It involved setting up a variety of simulation models and converging onto an assembly and core design that would achieve the desired level of burnup while still maintaining similar operating conditions as typical PWR fuel."

Work on the project gave Gentry new insight and connections for future research.

"It introduced me to a number of different neutronic simulation codes as well as the different approaches one uses to solve these types of problems," said Gentry. "Additionally, it gave me a chance to collaborate with Oak Ridge National Lab (ORNL) staff—leading to additional projects with them—as well as the Innovations in Fuel Cycle Research Award."

Gentry cites Dr. Ivan Maldonado as an influence and a mentor throughout his graduate career.

"He not only provides me direction in my academics and projects, but also has helped me develop as a professional," said Gentry. "Dr. Maldonado maintains an excellent relationship with ORNL, which he uses to provide myself and other students projects and opportunities to work with lab members."

NE Hosts Graduate Recruiting Weekend

The Department of Nuclear Engineering held its second annual recruiting event for graduate student prospects Sunday-Tuesday, February 24-26, 2013.

Visiting students came from universities around the region and country, from as far away as Washington. Five participants were from the University of Tennessee: Peter Collins, Natalie McGirl, Aaron Selby, Ryan Sweet, and Daniel Wentz.

The first evening kicked off with a Sunday evening barbecue hosted by the UT Student Section of the American Nuclear Society (ANS) at the Four Points Cumberland House near campus.

The second day of activities began with a continental breakfast and greeting of participants in the Pasqua Nuclear Engineering Building. Dr. Brian Wirth, Governor's Chair Professor in Nuclear Engineering, gave an overview of the graduate school and procedures in nuclear engineer at UT. Faculty presentations, a tour of Oak Ridge National Laboratory (ORNL), and an overview of the department's joint research activities followed.

Students learned more about the college and department through more faculty presentations and small group



Participants in the 2013 graduate student recruiting event pose with Dr. Wesley Hines, front-row second from right; and Dr. Jason Hayward, front row far right.

meetings during the third day of the recruiting event. During a lunch with local nuclear leaders and alumni, Dr. Wesley Hines, head of the Department of Nuclear Engineering, spoke to the group about the program. The participants viewed a graduate student poster session to close out the visit.

ANS Awards UT Nuclear Engineering Students Scholarships

The American Nuclear Society (ANS) announced their 2013-2014 student scholarship recipients. Undergraduate students in the Department of Nuclear Engineering were very successful this year, receiving eight scholarships ranging from \$1000 to \$5000. Last year, nuclear engineering undergraduates received six student's ANS scholarships. This year's recipients are:



ANS scholarship recipients are, from left: Seth Langford, Cody Wiggins, Hannah Hale, Alyxandria Wszolek, Mikah Rust, and Natalie McGirl. Not pictured are Peter Collins and Victor Lollar.

2013-2014 ANS Scholarships

- Mikah Rust**, Junior
Accelerators Applications Division
Scholarship - \$1,000
- Cody Wiggins**, Senior
William R and Mila Kimel Scholarship
\$2,000
- Natalie McGirl**, Senior
Graduate Scholarship - \$3,000
- Hannah Hale**, Junior
Undergraduate Scholarship - \$2,000
- Alyxandria Wszolek**, Freshman
Sophomore Undergraduate
Scholarship - \$2,000
- Victor Lollar**, Senior
Human Factors and Controls Division
Scholarship - \$2,000
- Seth Langford**, Junior
John and Muriel Landis Scholarship
\$5,000
- Peter Collins**, Senior
Graduate Scholarship - \$3,000

Nuclear Engineering Students Visit the Czech Republic on Study Abroad Tour



The nuclear engineering group poses in front of the United Nations complex in Vienna.



Students at the Temelin Nuclear Power Plant in the Czech Republic.

Dr. Wes Hines, Charles P. Postelle Professor and head of the Department of Nuclear Engineering, led twelve students on a tour of nuclear facilities in Prague, Czech Republic, during a mini-term program abroad in May of 2013. Research Assistant Professor Dr. Ondrej Chvala, who is from Prague, also accompanied the group and proved to be an invaluable tour guide. During their stay, the students participated in a reactor-physics training program for which they received upper-division laboratory credit in the nuclear engineering program.

After settling into accommodations at a recently renovated hotel dating back to the 1820s, the study-abroad class dined with hosts from the Czech Technical University and went over plans for the visit. The next day, they received a first-hand look at a uranium yellow cake processing facility near the village of Dolni Rozinka. The group donned lab coats and hard hats for an extensive tour of the sixty-year-old “Soviet-era” facility.

“The plant looked run-down,” noted John Pevey, a graduate research assistant in nuclear engineering. “But they assured us it was fully operational and produces over 300 tons of uranium a year.”

The next day, the UT students visited two research reactors at



The UT nuclear engineering group in the operating room of the Rez National Lab outside of Prague.



UT nuclear engineering students work in the reactor lab at the Czech Technical University.

the Czech Nuclear Research Institute just outside of Prague, where they toured the facility’s reactors and control rooms, and learned about the important research conducted there.

“We were shown the LVR-15 reactor and the different types of fuel used, as well as the spent fuel pool,” said Danny Tran, a senior in nuclear engineering. “The pool was glowing bright blue!”

The class absorbed Czech culture and history with a visit to the town of Tabor, which featured historic, centuries-old tunnels created to shield the inhabitants during wartime. Later that day, they toured the Temelin Nuclear Power Station.

The group made other cultural-site visits in the city of Prague, such as Prague Castle, Old Town Square, Charles Bridge, and more. They also toured Vienna, Austria, sites such as Belvedere Palace, Stephansdom Cathedral, and

others. The class received an International Atomic Energy Agency (IAEA) Safeguards Tutorial and a United Nations tour while in Vienna.

The students spent the second half of the trip in class time, including hands-on experience with the Czech Technical University’s training reactor.

“The course was set up so that we had a lab in the morning and a lab in the afternoon,” said junior Emily Frame. “I was surprised at how much I learned in one week.”

Hines gave a seminar during the trip at the Czech Technical University of Prague.

“This study abroad program will be a yearly event and should be the highlight of any student’s nuclear-engineering education experience at UT,” said Hines.

NE Students Receive NNIS Fellowships



Benjamin Dabbs



David Vermillion

Two students from the University of Tennessee Department of Nuclear Engineering were awarded highly selective fellowships from the Nuclear Nonproliferation International Safeguards (NNIS) Graduate Fellowships Program in May of 2013.

The recipients were Benjamin Dabbs and David Vermillion, both graduate research assistants working towards their PhD degrees in collaboration with Oak Ridge National Laboratory.

The NNIS program is one of many designed to meet the needs of the National Nuclear Security Administration (NNSA) Office of Nonproliferation and International Security's Next Generation Safeguards Initiative (NGSI) by producing exemplary doctoral graduates who are appropriately trained in specialized research and development activities pertinent to nuclear nonproliferation and global security. This fellowship seeks to build collaborative educational curricula at the nation's leading nuclear educational institutions to provide the study of the technical and policy aspects surrounding modern nuclear security challenges.



UT ANS Chapter Hosts Boy Scout Merit Badge Workshop



The UT student chapter of the American Nuclear Society (ANS) and the UT Department of Nuclear Engineering have hosted "Nuclear Science Merit Badge" workshops for local Boy Scouts of America (BSA) troops every year since the spring semester of 2011. The successful program has enabled more than fifty scouts to earn a difficult and

unique merit badge among the 131 merit badges that BSA currently offers.

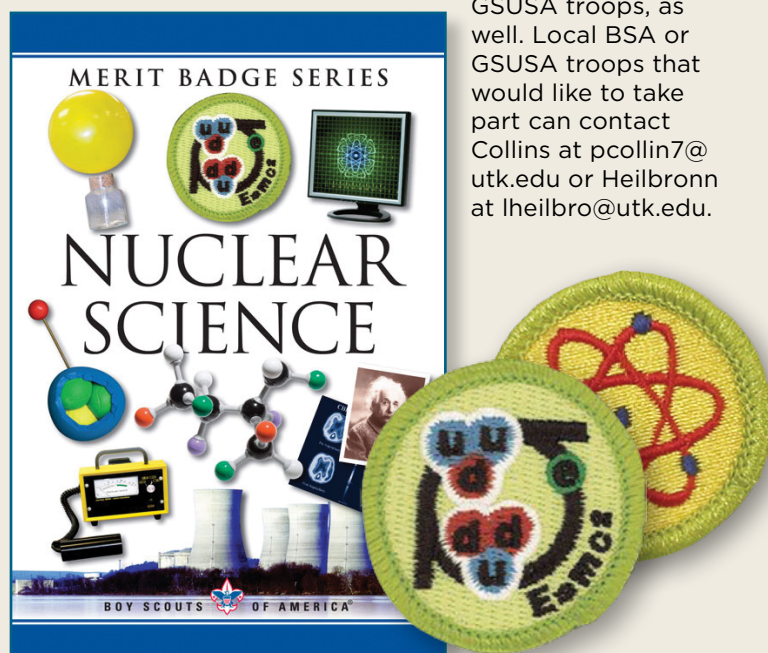
During the one-day workshop, the scouts learn about the basics of nuclear power and nuclear science during two hours of class work, and then spend the rest of the day engaged in hands-on activities. They construct isotope models using marshmallows and toothpicks, learn about what materials make good shielding, learn how radioactivity and distance are related, build miniature cloud chambers and get to see radioactive decay as it happens, go on a hunting expedition to find hidden sources, and see how a nuclear reactor works using the department's PWR simulator.

A lunch of grilled hamburgers, chips, and vegetables is provided for the workshop participants. In 2011 and 2012, the scouts had the chance to eat burgers made from irradiated beef and learn about food irradiation. Before being grilled, they checked the meat with detectors to learn that the beef is not radioactive, and then afterwards discovered that the burgers taste just as good as burgers made from non-irradiated beef.

Price Collins, a UT nuclear engineering graduate student and Eagle Scout, developed the workshop and has organized the volunteers and lessons since 2011. Dr. Lawrence Heilbronn, ANS faculty advisor and Troop 451 Venture Crew advisor, has also helped develop and run the workshops. Many UT nuclear engineering students, some of whom are Eagle Scouts and Girl Scouts of the USA (GSUSA) Gold Award winners, have volunteered their time to help with the workshops.

Plans are to run workshops at least once a year, and organizers hope to include involvement from local

GSUSA troops, as well. Local BSA or GSUSA troops that would like to take part can contact Collins at pcollin7@utk.edu or Heilbronn at lheilbro@utk.edu.



NE Graduate Participates in International NE Symposium



Dr. Jamie Anderson Porter

Dr. Jamie Anderson Porter (BS/NE '08, MS/NE '09, PhD/NE '12), the first female African-American student to graduate from the University of Tennessee with a PhD in nuclear engineering, participated in the "Rising Stars in Nuclear Science and Engineering" Symposium on March 5, 2013, at the Massachusetts

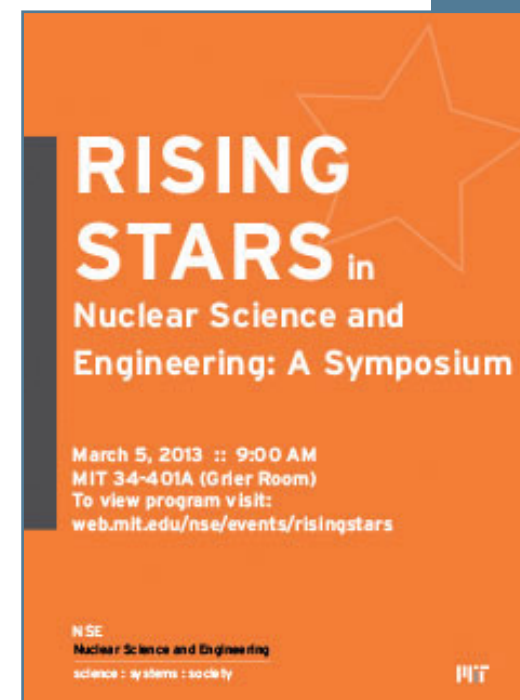
Institute of Technology. The event focused on current research in nuclear science and engineering.

Porter's studies at UT, within the radiological engineering concentration, included measurements and modeling of the effectiveness of shielding materials for use in space environments; Monte Carlo space radiation transport and shielding codes; and methods for estimating environmental levels of radioactivity. As a graduate research assistant, she helped develop improvements for the Cosmic Ray Telescope for the Effects of Radiation (CReTER) instrument on NASA's Lunar Reconnaissance Orbiter (LRO) spacecraft and analyzed data from the LRO mission. She also spent a summer as an intern at

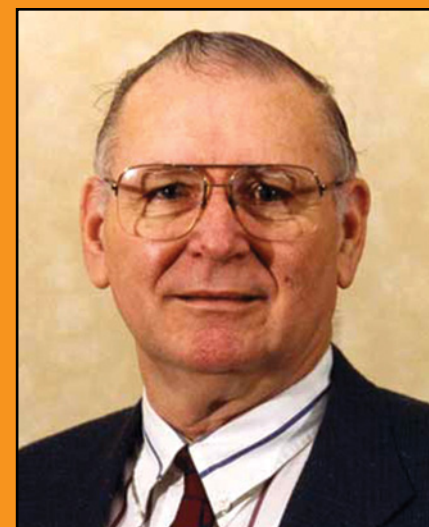
the Tennessee Valley Authority Watts Bar Nuclear Plant in Spring City, Tennessee.

In addition to her experience and coursework, Porter was honored with several awards in her academic career, including the Hall of Fame Award at the 2012 Tennessee Louis Stokes Alliance for Minority Participation (TLSAMP) Banquet.

Porter has presented numerous papers and co-authored journal articles on her research. She will continue her research with nuclear engineering professor Lawrence Townsend on a post-doctorate basis at UT.



Memorial: Dr. Robert Uhrig



Dr. Robert Uhrig

Dr. Robert Eugene Uhrig, a former professor in the UT Department of Nuclear Engineering, died June 12, 2013, in Gainesville, Florida.

From 1986 to 2002, Uhrig held a joint appointment as Distinguished Professor of Engineering in the UT nuclear engineering

department and as a Distinguished Scientist in the Advanced Science and Technology Division at the Oak Ridge National Laboratory under the UT/ORNL Science Alliance Program. He was the Vice President for Advanced Systems and Technology at Florida Power & Light Company (1974-1986), Dean of the College of Engineering (1968-1973), and Chairman

of the Department of Nuclear Engineering Sciences (1960-1968) at the University of Florida.

In 2010, Dr. Uhrig was the first recipient of the Don Miller award from the American Nuclear Society for his advancement in the fields of nuclear instrumentation and control. In 2005, Dr. Uhrig was the recipient of the American Society of Mechanical Engineers' ASME Medal, the organization's highest award. He was elected a Fellow of the American Nuclear Society, the American Association for the Advancement of Science, and the American Society of Mechanical Engineers.

Uhrig received a BS degree (with honors) in mechanical engineering from the University of Illinois in 1948, and MS and PhD degrees in theoretical and applied mechanics from Iowa State University in 1950 and 1954 respectively. He was a 1976 graduate of the Advanced Management Program of the Harvard Business School, and was a registered Professional Engineer in Florida and Iowa. He was the author of over 250 technical and professional publications, more than 100 tutorials and seminars, a book, *Random Noise Techniques in Nuclear Reactor Systems*, and co-author (with Dr. Lefteri H. Tsoukalas) of a book entitled *Fuzzy and Neural Approaches in Engineering*.



Alumni Profile: Dr. Hash Hashemian

From Nuclear Research Assistant to Global Industry Leader

Alumnus turned lab endeavor into multimillion-dollar company

In the mid-1970s a UT graduate student with an entrepreneurial mind and vast determination began nuclear engineering research projects in the labs of the Pasqua Engineering Building. Today, that former student, Dr. Hash Hashemian, is the owner and CEO of AMS, a multimillion dollar enterprise in Knoxville that is one of the world's premier nuclear instrumentation and control services companies. The story of his success also highlights the importance of research and discovery as part of the American university experience.

Hashemian chose Knoxville for his graduate degree for simple reasons. The Department of Nuclear Engineering (NE) at UT was academically renowned and well connected to Oak Ridge National Lab (ORNL) and the Tennessee Valley Authority (TVA)—and his aunt was a post-doc at ORNL in biology. Not only does his Iranian culture honor family, being that far from home

it was a decided advantage to have a family member so close. Living with her, riding the bus in the morning, and commuting home with her in the evenings enabled Hashemian to save precious funds those first months until a combination of assistantships and grants made the US more affordable.

Three men at UT were to have a profound influence on Hashemian. Dr. Pete Pasqua, head of the NE department gave Hashemian his first teaching assistantship. Dr. Thomas Kerlin hired him to become his research assistant. And Dr. Fred Peebles, then dean of engineering, allowed tremendous latitude for faculty and students to develop companies from concepts originating in the UT labs.

"Peeble's idea was to let grad students and faculty flourish, with the intent to develop a Tennessee

Technology Corridor in Knoxville," said Hashemian with a smile.

AMS has, indeed, prospered.

The research itself began in the somewhat dingy labs of Pasqua—UT's former coal power plant. In July 1977, Hashemian and Kerlin began the company in office space shared with another spinoff from UT engineering. Their first contract was for \$15,000, but by 1982, AMS had nearly \$500,000 in annual revenue and moved to a larger space in West Knoxville. Hashemian bought out Kerlin in 1985 and continued to expand.

AMS services are comprehensive with core instrumentation that has evolved from those first units produced in the 1970s. Today, these devices help power plants around the world to verify safety functions and sensor reliability while the plant is operating. Hashemian emphasizes this key component, noting that an AMS customer recently published a paper that revealed that AMS technology saves his plant more than \$10 million a year.

While the economic value of AMS technology speaks directly and impressively to their customers' bottom lines, their business philosophy speaks to another important value—service. Quoted in *First Tennessee's Business Review*, Hashemian emphasizes, "The reason for our success—in addition to our very loyal, exceptional workforce—is that we are extremely customer-focused and courteous, available twenty-four hours a day, seven days a week. Customers can call me at home at 4 a.m. and I can dispatch people to their plant within an hour. Bigger companies can't do that. We have an edge in that we are very responsive and prompt."

Those customers are not mere numbers on the AMS fiscal spreadsheet. During a recent economic downturn one customer, near bankruptcy, called Hashemian to tell him to stop all work—there would be no money to pay. Hashemian told them AMS would continue their project, regardless. They had been good customers; he would stand with them through this tough time. AMS has since handled millions of dollars for this company.

It's no wonder that accolades have come his way again and again. Most recently, Hashemian was named the 2013 Tennessee Small Business Person of the Year by the US Small Business Administration (SBA) in Washington, DC. Given every year since 1963, this award specifically recognizes both personal achievement and the role of small business in powering the nation's economic growth. In 2012, AMS was named to *Inc. Magazine's* list of five thousand fastest-growing private companies. The prestigious Tibbetts Awards, recognizing high-tech innovation, was given to him by the SBIR in 2011, along with the Free Enterprise Award from the US Chamber of Commerce and SBA's National Research Award. The chancellor of the University of Tennessee, Knoxville, recognized his many accomplishments by presenting Hashemian with the Alumni Professional Achievement Award in 2012.

"Hash has been a friend and mentor," said Wes Hines, Postelle Professor and head of the NE department, "He provides expertise as well as important international connections. As I look at the story of his success, it illustrates what can grow from research at a university when it is advanced by an astute business mind. Sometimes I hear people question the value of research, thinking it has with little real-world application. From the Pasqua research labs to a world arena, Hash's research with Tom Kerlin took on application that is making a global difference. We are incredibly proud that Hash is a UT graduate and made Knoxville his home."



Dr. H.M. Hashemian with Karen Mills, Administrator of the United States Small Business Administration (SBA). Dr. Hashemian was selected as the 2013 Small Business Person of the Year for Tennessee.

With one hundred employees today, most located at their impressive Knoxville headquarters, AMS is a positive force on East Tennessee's economy. The company's impact is even more powerful when you consider that all one hundred and four operating nuclear power plants in the United States are AMS clients. A world map reveals an equally impressive international clientele served by AMS offices in Spain, Austria, Switzerland, and Korea. Hashemian has additional expansion planned, using this time while the nuclear industry is working itself out of the worldwide economic drop to hire and train next generation leaders for his business.

Behind the remarkable achievements of his company, however, is Hashemian's family. For this Iranian immigrant and United States citizen, his warmest smiles come when he talks about wife Nazy, an artist of some note; his son Alex, now a master's degree candidate in mechanical engineering at UT; and his daughter Nikki, who is pursuing a bachelor's degree in business. Both children also work in the company, offering the distinct possibility that the Hashemian business traditions will continue strong in Knoxville for decades to come.



Dr. Hashemian (center) with his family, wife Nazy (center), daughter Nikki (left) and son Alex (right)

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A Transformed Engineering Program



The University of Tennessee College of Engineering is undergoing an extraordinary transformation. As we celebrate **175 years** of engineering instruction, we are also embarking on the most ambitious expansion in the recent history of our college. Located in Knoxville, Tennessee (and at the University of Tennessee Space Institute (UTSI) in Tullahoma, Tennessee), the college currently serves over 2,600 undergraduate

and 1,000 graduate students and is a part of the state's land-grant research-intensive university with a total enrollment of 27,500. The college's transformation has included:

- **Record-breaking increases** in undergraduate and PhD enrollment of **37%** and **62%**, respectively, in the **last five years**.
- **A 14% increase in freshmen enrollment** for the fall 2013 semester.
- **An increase in state-of-the-art new facilities with over 260,000 square feet of new space** in the Min H. Kao Electrical Engineering and Computer Science Building (2012) and the John D. Tickle Engineering Building (2013), housing the Department of Civil and Environmental Engineering and the Department of Industrial and Systems Engineering.
- **A new Joint Institute for Advanced Materials under construction** (estimated completion in 2015) and planning initiated for a new engineering complex (estimated completion in 2018) to house the Department of Nuclear Engineering and freshman programs.
- **Major investment in funding** for new faculty and staff by the State of Tennessee.
- **U.S. News & World Report ranking** as a public college of engineering now **37th**, an increase of **six places in four years**.



Min H. Kao Electrical Engineering & Computer Science Building



John D. Tickle Engineering Building

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- **3 Assistant Professors, Mechanical, Aerospace & Biomedical Engineering**
- **2 Assistant Professors, Aerospace Engineering***
- **1 Assistant Professor, Industrial & Systems Engineering**
- **1 Assistant Professor, Nuclear Engineering**
- **3 Faculty of Practice, (EECS, CBE, MABE)**
- **2 Assistant Professors, Civil & Environmental Engineering**
- **1 Associate Professor, Chemical & Biomolecular Engineering**
- **Ericsson/Harlan Mills Chair in Software Engineering, Electrical Engineering & Computer Science**
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