THE SOURCE

ALUMNI MAGAZINE • FALL 2017

A graduate student works with researchers to decide if it is safe for Pacific Islanders to return home.
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NUCLEAR ENGINEERING

Inside: We, Robot • Globe Trotting for Peace • Engaging Nuclear Potential

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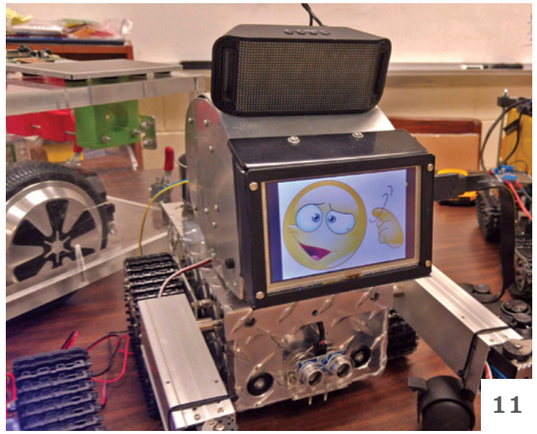

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On the Cover: Adam Stratz, a Department of Homeland Security graduate fellow at UT's Radiochemistry Center of Excellence, climbs a coconut tree to gather fruit for radiological testing.

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A Message from the Department Head

I am excited to share with you the many successes of our Nuclear Engineering Department and give you a glimpse of our future. Each and every day I am delighted to see the progress of our students, staff, faculty, and graduates.

One of the important events of this past year was the naming of our college as the John D. Tickle College of Engineering. Tickle ('65 ISE) is from Bristol, Tennessee, and is chairman of the Strongwell Corporation. He and his wife Ann have been strong UT supporters for many years, naming the John D. Tickle Engineering Building and the John and Ann Tickle Small Animal Hospital. Their latest gift will impact our department through Tickle Professorships and Fellowships and the hiring of professional advisor Amanda Lovelace. Amanda was hired in the summer to provide educational advising to our undergraduate students.

Our undergraduate students continue to impress. This past year they once again showed their strength by winning 13 of the 58 $7,500 competitively awarded Department of Energy Nuclear Energy University Program (NEUP) scholarships—more than triple the next university. This is the sixth year in a row our students have led the nation in the number of NEUP awards received. Our students were also impressive in winning eleven American Nuclear Society scholarships. We truly have the some of the highest quality students in the nation.

Our graduate program continues to grow with our PhD program once again being the largest in the country, surpassing the 110 student mark. This growth continues to be fueled by the research funding secured by our faculty, the competitive fellowships won by our students, and the interdisciplinary program in Energy Sciences with Oak Ridge National Laboratory. Our research expenditures have grown from $2M to over $11M in the past decade. This transformation is due to the support from the campus and college administration and the hard work of our faculty, staff, and students.

One of the most exciting pieces of news is the status of our engineering building. This year our building received full funding from our state. The $129M building will house the Nuclear Engineering Department, Freshmen Engage Program, and new state of the art laboratories. Our department will more than triple its current footprint and has 23 new laboratories programmed. We were to move out of Pasqua Engineering building in the summer, but the move to what was the Earth and Planetary Science Building is now planned for December. We are currently in the detailed design phase and hope to break ground on it next fall. This new facility will provide us with unique research laboratories to continue to solve national needs.

Our alumni continue to engage with our department and influence our directions and success. Their investments in our department through endowments and gifts continue to propel us forward. We continue on our mission to become an exemplary department and need your continued support to share our story. Our image is important to our rankings, our ability to recruit the best and brightest students and faculty, and our ability to secure external funding to solve the nation's scholarly challenges. Please continue to partner with us to meet and surpass our extraordinary goals.

Sincerely,

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

DEPARTMENT ON THE RISE

In the past 24 years, the size and strength of the Department of Nuclear Engineering has expanded on many levels. Here are some of the ways we've grown:*

9.75 faculty members to
18

55 undergraduates to
202

39 full-time grad students to
113

82 full- and part-time graduate students to
137

$1.4 million in sponsored research expenditures to
$11M

**1993–2016*

Check the stats:

1st
Nationally for MS graduates

1st
Nationally for PhD enrollment

2nd
Nationally for total enrollment

3rd
Nationally for PhD graduates

4th
Nationally for federal research expenditures

6th
Nationally amongst public departments of nuclear engineering

New Engineering Complex Update

The UT Board of Trustees and state legislature have approved funding for a new engineering complex, which will house the Department of Nuclear Engineering as well as other research lab spaces and the freshmen programs, earning it the unofficial title of the "Gateway to Engineering."

With approximately $90 million in state funding and a further $39 million in university and donor support, the design phase has begun.

The 228,000-square-foot building will house the department's offices and laboratories as well as meeting rooms, conference rooms, collaboration areas, lounges, break areas, and student study areas, for a combined 38,000 square feet—more than tripling the department's current footprint in the Pasqua Engineering Building.

Nuclear engineering faculty and staff will move in to temporary housing in the Engineering and Science Annex, formerly known as the Earth and Planetary Sciences building, on The Hill at end of fall 2017. It's expected that the new building will break ground in late 2018 with a 30-month build time.

PhD Program Ranked 1st Nationally for Enrollment

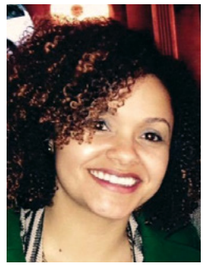
Graduates from the department's PhD program have gone on to work at the following prominent national laboratories, government agencies, and companies, among others:

National Nuclear Security Administration
IAEA International Atomic Energy Agency
U.S. Department of Energy
U.S. Department of Defense
U.S.NRC
CNS consolidated nuclear security, llc — PANTEX PLANT | Y-12 NATIONAL SECURITY COMPLEX
EPRI ELECTRIC POWER RESEARCH INSTITUTE
OAK RIDGE National Laboratory
Pacific Northwest NATIONAL LABORATORY
Los Alamos NATIONAL LABORATORY EST. 1943

Alumni—the Best Ambassadors for our PhD Program

Joseph Bowling (NE MS '04, PhD '12) is a medical physicist on the Gamma Knife team for Fort Sanders Regional Medical Center, where he administers radiation treatments to patients.

"The knowledge I obtained at UT helped me to forge solid relationships with my physician partners and enabled me to better serve our patient population here in Knoxville. So many people you meet in the nuclear and radiological industries have ties to Oak Ridge and the nuclear programs here and having this common history fosters cooperation and collaboration."

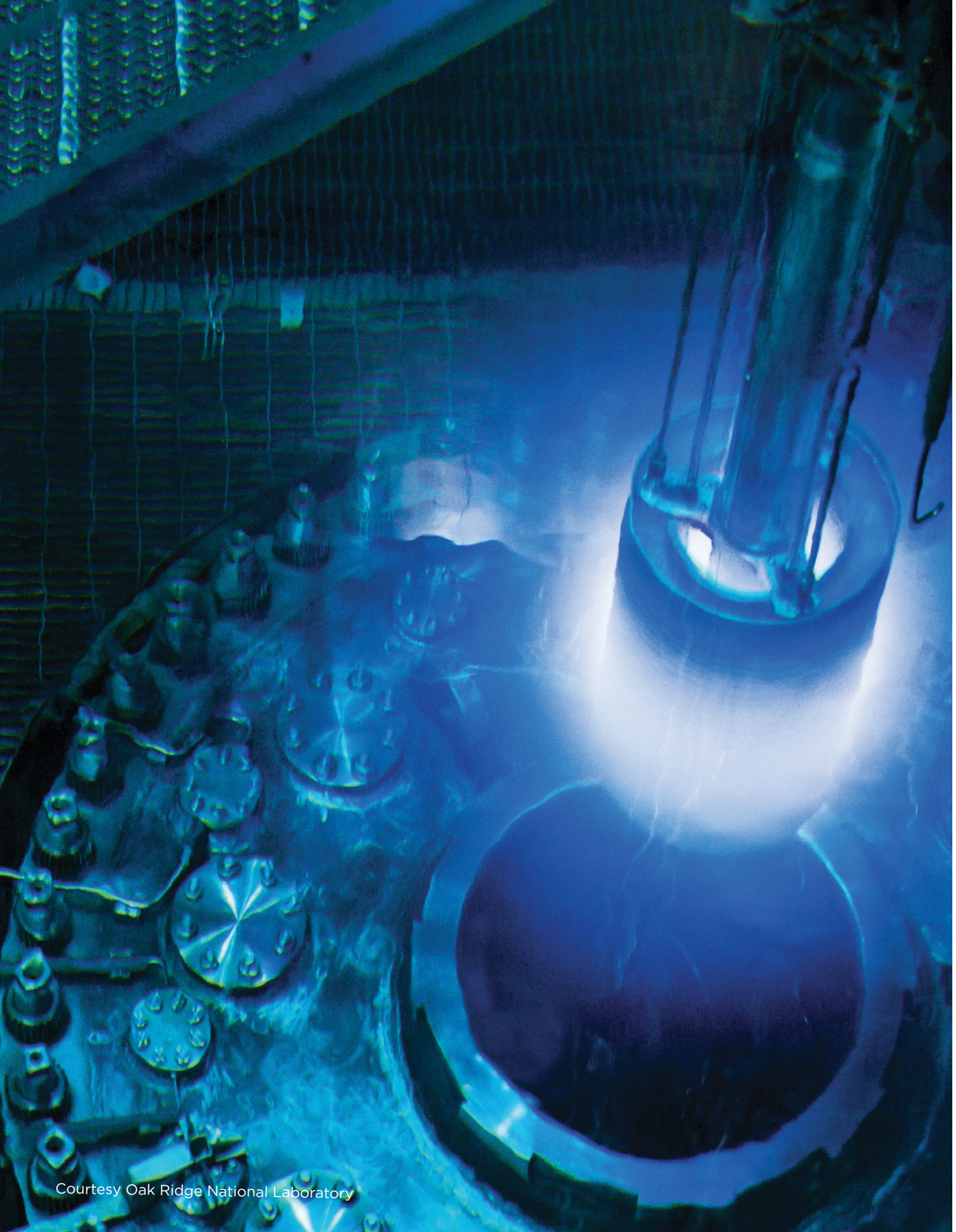


Jamie Porter (PhD NE '12) is a senior radiation engineer in the Space Exploration Sector at Johns Hopkins Applied Physics Laboratory where she contributes to the radiation environment shielding modeling for spacecraft parts and spacecraft charging concerns, among other things.

"I owe my career to the UT Nuclear Engineering Department. Its challenging course work and caring professors prepared me for the amazing opportunity I have today to work and succeed at my dream job!"

Daniel L. Stephens (PhD NE '02) is the director of NNSA programs at the DOE Pacific Northwest National Laboratory.

"UT gave me a diverse range of experiences and exposure to the larger scientific and engineering community that has been invaluable in my professional life. I consider myself lucky to have had the good fortune to have such dedicated advisors, mentors and faculty at UT. That personal investment made all the difference in my personal development. That experience drives me to do the same for the generations coming after me."



Courtesy Oak Ridge National Laboratory

College Rising to the NUCLEAR SECURITY CHALLENGE

One of the highest priorities for both national and international security organizations is facing the threat of a nuclear disaster due to radioactive materials falling into the wrong hands.

The need to anticipate and answer the possible challenges in such scenarios is a key part of some of the research being conducted in the college. In fact, that work has placed UT on the frontline of global security, with the Departments of Nuclear Engineering, Materials Science and Engineering, and Electrical Engineering and Computer Science combining for nearly $10 million in research awards in the area of nuclear security in just the past couple of years.

“We have seen a tremendous amount of growth in research in recent years,” said Wes Hines, department head of nuclear engineering. “In addition to the work itself, we’ve also been able to attract some of the brightest minds in nuclear engineering, both in faculty and in students.

“The support from agencies plays a big part in that.”

UT’s Benefactors

Last year, the DOE announced the National Nuclear Security Administration (NNSA)-backed Nuclear Science and Engineering Nonproliferation Research Consortium, with $4.25 million coming to UT.

Those funds have supported research conducted by Governor’s Chair for Global Nuclear Security Howard Hall, UCOR Fellow and Associate Professor Jason Hayward, and Assistant Professor Eric Lukosi, among others within the college.

Additionally, in 2016 the Domestic Nuclear Detection Office’s (DNDO) Academic Research Initiative (ARI) funded separate projects by Hayward and Lukosi to the tune of $1.75 million each. Both received new ARI grants in 2015 as well, with Hayward as principal investigator and Lukosi as co-principal investigator.

Other currently supported principal or co-principal investigators include Hall and Assistant Professor Maik Lang, Director of the Scintillation Materials Research Center Chuck Melcher and Assistant Professor Mariya Zhuravleva from materials science, and Gonzalez Family Endowed Professor Hairong Qi from electrical engineering and computer science.

All of that contributes to make the college and UT, along with collaborators at ORNL, a key player in the world’s nuclear security.

“The research areas for all of these grants are in the areas of radiation detection materials and systems, and in nuclear chemistry and forensics,” said Hayward. “These areas are critical elements in the safeguarding of nuclear materials and stockpiles.”

A Joint Approach

Hayward pointed out that the complex nature of the problems UT researchers are tackling requires multidisciplinary approaches in engineering.

To that end, the college is putting together a multidisciplinary curriculum in order to train PhD students in these different areas.

For example, Hayward’s last two DNDO grants have funded the initial development of the Radiation Instrumentation Interdisciplinary Graduate Education program.

That’s just the latest growth in an area of increasing expertise for UT.

Four of the 15 joint UT-ORNL Governor’s Chairs do work related in some way to nuclear research, while the nuclear engineering department itself has seen a rapid growth in the number of faculty as well as in the *U.S. News and World Report* rankings, where it has gained standing as one of the top public nuclear engineering departments in the country.

Recent additions to the nuclear engineering department’s repertoire include:

- A trailer-based dual neutron and gamma ray imaging system that can be used as a mobile laboratory
- Thirty-four fully-efficient, n-type, high-purity germanium detectors that represent the gold standard for gamma detection efficiency and energy resolution
- A Varian Linatron M9 upgraded to work at 6 and 9 MV energies for use in cargo scanning

Soldiers take a break during a mission at Camp Stanley, South Korea. The soldiers were participating in an exercise focused on being able to detect, identify, and defend against chemical, biological, radiological and nuclear threats. Courtesy United States Army

BOOTS ON THE GROUND, and in the classroom

by Whitney Heins

"They know what it is like to be out there in the middle of a pitch-black desert on a moonless night and have people shooting at you."

Howard Hall, director for UT's Institute for Nuclear Security and Governor's Chair for Global Nuclear Security, is talking about some of the students he has in his classes. These students are active duty military.

The US Department of Defense pays for their education at UT to gain a graduate degree in nuclear engineering. The program began in 2011 with the US Army sending soldiers assigned into a group called Functional Area 52, which is the Army's nuclear research and operations core. Years later, the US Navy began sending students and, now, the US Air Force is joining in, too.

"This program is really important because it is these students' first foray into the nuclear counter-proliferation world," explained Hall. "Then, they go on to become the connective tissue for the Department of Defense and all agencies that deal with nuclear security and proliferation issues."

The students take classes within the Department of Nuclear Engineering's Nuclear Security Science and Analysis program, learning about subjects such as issues of proliferation, nuclear fuel cycle, nuclear terrorism, and US and international nuclear doctrines. While a few other universities offer similar coursework to military personnel, UT's program is unmatched because of its relationships with federal partners such as Y12 and ORNL. Thus, students get the chance to work on something that is not just educating them, but also having a real impact on what they're going to do in the future.

"These students have active clearances so they can do research at Y12 and ORNL that has real operational use," explained Hall. "This is why we have grown to three branches of the military. We turn out a really good product."

Graduates have gone on to manage threat reduction programs, serve as an advisor in Weapons of Mass Destruction for special operations in the Army, and teach at West Point.

"I think it's cool that we are influencing these guys who then influence the next generation of military personnel," said Hall. "I think this is the sort of thing a land grant university ought to be doing."

Hall says the program has been strengthened because of the caliber of the active duty students and the real-world insights they bring into the classroom. He hopes to see more and more in the future.

"We now just need to add the US Coast Guard and Marines," he laughed. "Then we have them all."

Hall teaches about proliferation detection and resistance inside a laboratory.

WOMEN ENGINEERS *engage with* NUCLEAR POTENTIAL

Assistant Professor Jamie Coble has a front-row seat to see dynamic progress in UT's nuclear engineering scene. While the ratio of female to male nuclear engineering students holds a steady pattern, she detects progress in motivation for women studying in the department.

"What I have noticed increasing, what really excites me, is that those women are more active and engaged, both inside and outside the classroom," Coble said. "About 18 percent of our undergraduate students are women, but 30 percent of our undergraduate researchers are women."

Coble contributes to the growing momentum through her interaction with students, and through maintaining enthusiasm from her own experience. She is a graduate of the UT nuclear engineering department herself, having earned all four of her degrees here. After working as a staff scientist at Pacific Northwest National Laboratory, she returned to UT to educate others about the varied applications of nuclear engineering.

"Many people think of just a few very specific things when they hear 'nuclear engineering,' with power plants and weapons typically at the top of the list," she said. "Nuclear engineering is so much more than that, though—radiation detection and measurement, materials aging and characterization, health physics and cancer treatment, isotope production, deep space exploration, robotics—we have intersections with practically every technical area."

Coble seeks to find the areas of nuclear engineering that will spark excitement in specific students—inspiring the potential for them to make a lasting, positive impact on the world.

"As we do a better job getting this message out, more women will naturally come to nuclear engineering for their studies and their careers," she said.

Coble addresses this message both in the classroom and as a faculty representative on the college's WomEngineers Leadership Council Executive Committee. The committee worked closely with the conference chair, undergraduate Taylor Short, to support the WomEngineers Day conference in the spring.

"Taylor and her team of student volunteers were the real stars of this event," Coble said. "A big part of the success of WomEngineers Day is that it is student led, which means the topics and discussions are really geared to student interests."

It was the second time the event was held, and Coble described an "amazing" energy for the day, beginning with an opening address from Chancellor Beverly Davenport.

"The questions and discussions on everything—from going to graduate school to starting your own business—were interesting and engaging," Coble said. "The real highlight for me was seeing how many attendees stuck around for the entire event, from 8 a.m. to 5:30 p.m. on a Saturday, even competing with the Orange and White game."

Attendees of WomEngineers Day look on and applaud one of the many speakers who helped make the event a success.

A strong showing of non-UT students was evident at WomEngineers Day, including high school students, community college students, and students from neighboring universities.

> **"The varied cross-section of the attendees really shows that the event is filling a need for engineering professional development that can't be captured in the classroom."**
>
> **—Jamie Coble**

She also noted engineering faculty members in attendance, including some department heads.

"This sends a strong message that the entire college supports the goals of WomEngineers Day," she said.

"Several students were also impressed by the TCE Board of Advisors attendees, who were knowledgeable and approachable on a huge variety of topics."

As a follow-up to WomEngineers Day, Coble also attended the August WomEngineers Welcome Dinner, along with representatives of the UT chapter of Women in Nuclear.

"The nuclear engineering department also has an annual welcome picnic in the fall," Coble said. "I hope that we can entice many of the engineering freshmen considering nuclear as a major to join us for that event as well."

GLOBETROTTING *for peace*

by Whitney Heins

Ghana. Indonesia. Morocco. Romania. The United Arab Emirates.

When Joe Stainback adds a country to his passport, it means the world is about to get a bit safer.

Stainback, research professor in UT's Institute for Nuclear Security (INS) and a Baker Research Fellow at UT's Howard H. Baker Jr. Center for Public Policy, travels the globe teaching principles of nuclear security to scholars, nuclear facility operators, and government workers. The countries he visits are interested in starting or expanding their nuclear energy portfolios. In four years, Stainback has visited about a dozen countries multiple times.

This work, funded by various departments of the US government, is a spinoff of INS's nuclear security and science certificate program, in which participants learn everything from how the mind of a spy works to how a nuclear facility is physically protected.

The initiative has become internationally recognized, and now Stainback and his INS colleagues Howard Hall and Natacha Peter-Stein go beyond training and teaching to help countries and organizations develop their own nuclear security curricula.

"Many of these countries have research reactors that can be a nuclear threat because they use weapons-grade uranium," Stainback explained. "Our work serves as an intermediate effort to teach these states the skills they need to protect themselves while they work to convert their reactors, which currently use highly enriched uranium, into reactors that use low-enriched uranium—much safer."

Stainback began the program with Hall after arriving at UT in 2013. He brought with him close to 30 years in the nuclear security field, having begun his work in the Naval Nuclear Propulsion Program during the Cold War era. In his last position before coming to UT, Stainback directed global security initiatives at the B&W Y-12 National Security Complex.

"In those early years, I was bombarded with making sure we understood the importance of meeting commitments, and of attention to detail and personal integrity," he said. "An outgrowth of that is me giving back. I want to share the fundamentals of what I have learned with others so that they can go on and keep more people safe and secure."

Walk into one of Stainback's classes and you may see an elaborate tabletop exercise complete with multiple teams, timelines, maps, moles, and real-life scenarios. His classes involve case studies with practical takeaways in how to detect and prevent aberrant behavior—his main research focus—along with cultivating a sound nuclear security culture.

"Participants can glean important elements of nuclear security ranging from physical security like guns, alarm systems, and storage systems to the so-called weaker side of security—the human element," Stainback said. "I'm especially passionate about teaching the fallacies of the human variable in nuclear security because they can be the weakest link in an otherwise strong physical security system."

This teaching has translated into solid results. For example, Nigeria is confronted with various insurgencies that could pose a significant threat to the country's research reactor. Stainback's efforts have helped the country safeguard the facility by educating operators and academics through workshops, guest lectures, and UT fellowships. His work in Morocco and Indonesia has helped those two countries establish academic curricula in nuclear security within their universities so their future workforces can take what they've learned into industry.

Stainback and INS continue to expand their outreach and now offer presentations and workshops in such countries as Egypt, Saudi Arabia, South Africa, and Algeria.

More stamps on Stainback's passport means more people around the world can rest easy.

we, ROBOT

by Whitney Heins

Scott Emert demonstrates how robots developed by UT students work to second graders at Middlesettlements Elementary School.

Could it change my cat's litter box? Could it sing happy birthday? Will it do my homework?

These are just some of the requests made by second graders to robots built by UT students in Research Professor Graham Walford's senior design class.

The answer to all of the requests was yes—except Walford frowned at the one about homework.

The questions were asked by Blount County's Middlesettlements Elementary students during a presentation by Walford and lab supervisor Scott Emert. The visit ties into something Walford is very passionate about—opening the doors of science to everyone.

"When you look at engineering sciences there are fewer girls than boys," he explained. "When you look at nuclear engineering, there are even fewer girls. I refuse to believe that this is the way things are. There are biases."

Walford is on a mission to expose young people to what is done in higher education so they can open their eyes to their own possibilities.

"Many children and people will not reach their full capability because of outside limitations," he said. "But imagine. What would this country of 300 million people be like if we all did what we are capable of? It would be much different."

Indeed, the second graders—girls and boys—were dancing around, they were so excited about the robots.

Walford's undergraduate students at UT who built the robots could hardly contain their excitement either, but for a different reason. Their enthusiasm extends from the fact that their work is serving a real purpose—to design devices to measure uranium around a decommissioned weapons processing plant in Ohio.

"I couldn't get them to stop working," he shared. "It was really magnificent."

InSolves, a subcontractor working to clean up the plant, funded the robots and used the students' designs to inform alternatives to their own. The final result was six robots that included cameras to spot objects and LiDAR to measure those object volumes.

"We were able to exchange ideas with InSolves and keep students from getting baked into a certain design," said Walford. "Focusing on a real problem allowed them to use their imaginations."

The students have contributed to six technical and research papers and have presented at several conferences this year.

Walford is very proud of his design class, but he wants to see one change in the future—more girls. Less than a quarter of the students were female.

This is why he is determined to do more visits like the one he did at Middlesettlements Elementary to students young and old because, he says—

"We can always stretch our minds. And, we can always encourage other folks to think, 'hey, I can do this.'"

It is with sadness that we share the news that Graham Walford passed away on August 26, just two months after this article was written. He was an energetic educator on a mission to pass on his knowledge to the younger generation.

Graham volunteered his time and expertise to assist the department and the local community through outreach activities. He worked relentlessly with our design teams and the feedback from those young men and women was uplifting. Seniors who took his class had so many great things to say about him and they knew how much he cared about their education experience and career path. Graham's enthusiasm was contagious and his kindness was everlasting.
—Department of Nuclear Engineering staff.

home STUDY

A UT student's work on a research team helps Pacific Islanders make informed decisions about returning home decades after nuclear tests.

For two decades after World War II, the Bikini, Enewetak, Kwajalein, Majuro, and Rongelap Atolls were ground zero for the US nuclear weapons program.

From 1946 to 1958, the US conducted 67 tests in the area. That period includes the most powerful nuclear test explosion ever conducted by the US, at more than 1,000 times the force of the bomb dropped on Hiroshima.

A team from Lawrence Livermore National Laboratory is studying radiation levels in the Marshall Islands and selected PhD student Adam Stratz to help them out this summer.

Stratz is a Department of Homeland Security nuclear forensics graduate fellow at UT's Radiochemistry Center of Excellence. His expertise earned him a spot as the only student to participate in a radiation survey of some of the most notable nuclear test sites in US history.

Before the program commenced, the native people were removed to other islands, away from the blasts and the radiation. High radiation levels in the Marshall Islands prevented their return for years.

Stratz and the Lawrence Livermore team collected and tested radiation levels in items ranging from coconuts and fruit to fish and giant clams.

"This was a once-in-a-lifetime opportunity to come in and test and monitor animal and plant life as well as soil and water at these atolls," Stratz said.

When the data are analyzed, the results will help determine whether the few remaining people who once lived on the impacted islands will be allowed to return.

Stratz poses in front of a welcome sign on Rongelap Atoll. The atoll is part of the Marshall Islands where nuclear tests occurred in the 1940s, 50s, and 60s.

Stratz works to husk young coconuts in order to test the fruit for radioactivity.

Fruits and vegetables gathered in the islands are bagged for shipping to a lab where they will be tested for radioactivity.

Fruits like the Pandanus fruit are harvested from the trees on the islands and labeled to be tested for radioactivity.

Twin blast craters from the Cactus (left) and Lacrosse nuclear weapon tests on Enewetak Atoll. The Cactus crater was filled with debris and capped with concrete.

FACULTY NEWS

Assistant Professor **Jamie Coble** was recently honored by ANS for her work with nuclear instrumentation and controls. ANS noted that her work with monitoring and diagnosing equipment related to nuclear energy made her a "perfect fit" for the HFICD Ted Quinn Early Career Award, named in honor of an expert in nuclear instrumentation.

Research done by the Institute for Nuclear Security (INS), led by Governor's Chair for Global Nuclear Security **Howard Hall**, was featured at the UT Day on the Hill, held in February 2017 in Nashville. The theme for the event was UT's role in various aspects of national security. The INS team has developed mobile radiation technology that helps guard against radioactive threats. Hall, Research Assistant Professor John Auxier, and Matt Cook, a post-doctoral researcher with INS, exhibited an unmanned aerial vehicle used for research on advanced radioactive materials search development.

Jason Hayward, associate professor and UCOR Fellow, spoke about nuclear security at the Spring 2017 UT MicNite event. His humorous and informative presentation addressed the challenges of radiation detection in various situations, and the research underway via his Rad IDEAS group. MicNite is a twice-a-year Pecha-Kucha-style event hosted by the UT Office of the Provost. View the video at **tiny.utk.edu/hayward-mic-night**.

Assistant Professor and Pietro F. Pasqua Fellow **Maik Lang** has been named a 2017 Joint Directed Research and Development (JDRD) awardee for his proposal entitled "Unrevealing short-range order in SiO2 glass under extreme conditions using the ORNL Integrated Computational Environmental-Modeling & Analysis for Neutrons (ICE-MAN)."

The JDRD program provides faculty members an opportunity to work collaboratively with researchers at ORNL on a variety of research areas including advanced manufacturing, big data management, and climate change and adaptation.

Lang was also recently awarded an $800,000, three-year grant from the DOE's Nuclear Energy University Program to explore the thermodynamics of crystallization and phase separation in melt-derived nuclear waste forms. The UT-led project is in collaboration with researchers from the Pacific Northwest National Laboratory, University of California, Davis, and the Queen Mary University of London.

Assistant Professor **Steven Skutnik** lent support in May 2017 to the Tennessee Valley Authority to the construction of a small modular reactor (SMR) on TVA land in Oak Ridge. He joined the range of voices offering comments to U.S. Nuclear Regulatory Commission staff during a public meeting. Skutnik stressed the importance of focusing on hydrology, geology, and seismology in judging the adequacy of possible SMR sites. He also stressed the importance nuclear power as a clean, carbon-free energy source in helping to meet future electrical needs.

Brian Wirth, the Governor's Chair for Computational Nuclear Engineering, was officially inducted as a new fellow of the American Association for the Advancement of Science in February at the association's meeting in Boston. He was named a 2016 AAAS Fellow in the physics section with a citation for "advancing knowledge of radiation damage mechanisms and fuel performance in fission and fusion energy via multiscale modeling using high performance computing validated by experiments."

Wirth's 2013 paper, entitled "Interatomic potentials for simulation of He bubble formation in W," was recognized in January for being one of the most highly cited papers in Elsevier's *Journal of Nuclear Materials* during 2014, 2015, and through June 2016.

Steven Zinkle, the Governor's Chair for Nuclear Materials, was selected to receive the 2017 Institute of Metals Lecture and Robert Franklin Mehl Award. The lecture and award was conveyed in March in connection with the 146th Annual Meeting of the Minerals, Metals, and Materials Society (TMS) in San Diego, California. The award recognizes an outstanding scientific leader by inviting him/her to present a lecture at the society's annual meeting on a technical subject of particular interest to members in the materials science and application of metals program areas. The award is considered a TMS pinnacle award. The honoree's lecture will be published in *Metallurgical and Materials Transaction A*.

Zinkle also received the 2016 Leadership Award from Fusion Power Associates (FPA) at its annual meeting in Washington, DC, in December. The awards recognize persons who have shown outstanding leadership qualities in accelerating the development of fusion as a commercial power source. Zinkle is cited for "the leadership [he has] provided over many years on the important issues associated with materials for future fusion power plants," and noting especially his "many scientific contributions to the physical metallurgy of structural materials, the effects of neutron irradiation on materials, and participation in, and leadership of, many fusion community workshops and program reviews."

End of An Era

Chancellor's Professor **Lawrence Townsend**, whose expertise in teaching a generation of students netted him a number of national honors, retired from UT in July after a 22-year stint at the department.

"I take great pride in the work we have done in the department and in its growing reputation," said Townsend. "My time at UT has been a wonderful experience, and I wish colleagues and students nothing but the most continued success moving forward."

"Of my three 'careers' with the US Navy, NASA, and UT, my time at UT has been the most rewarding and fulfilling."
—Lawrence Townsend

Townsend, a Chancellor's Professor and the Robert M. Condra Professor of Nuclear Engineering, came to UT after 14 years at NASA's Langley Research Center.

He received the Exceptional Scientific Achievement Medal from NASA in 1993, along with many other agency awards during his time there.

"Dr. Townsend has provided an exceptional education for countless students over the years," said Department Head Wes Hines. "His research has helped us grow as a department, and we will always be grateful for his contributions."

During his time at UT, he was elected a Fellow of the American Nuclear Society in 2005, a Fellow of the Health Physics Society in 2006, and received the American Nuclear Society's Professional Achievement Award in 2013 for research activities in radiation protection and particle transport methods related to space radiation. He is also an associate fellow of the American Institute of Aeronautics and Astronautics.

He has received eight UT-specific awards, including being named nuclear engineering's professor of the year four times.

Wood Named Fellow by American Nuclear Society

Professor **Richard Wood** has been selected as a 2017 fellow of the American Nuclear Society (ANS), one of the highest honors a nuclear engineer can achieve.

Given in response for what the group called his "significant contributions to nuclear engineering," Wood's award was presented during the ANS annual conference in San Francisco in June.

"We are extremely happy for Richard and for this recognition of his years of innovative work," said Wes Hines, head of the department. "His selection is validation of the contributions he has made to the field, to our department, and to our university."

As part of his recognition, ANS pointed out that Wood alone is responsible for having developed or revised one-third of the Nuclear Regulatory Commission's Instrumentation & Controls regulatory guides.

The society also noted Wood's expertise in international reviews of nuclear safety as a major reason for his induction.

"Being inducted into ANS as a fellow is very gratifying, both personally and professionally," said Wood. "It's a great reflection on the work we do here and with ORNL and demonstrates a recognition by the nuclear power community of the significance of our research."

Wood is the fifth faculty member in the department to be named an ANS fellow, along with Hines, Lawrence, Townsend, Upadhyaya, and Zinkle. Several part-time faculty members also hold the distinction.

ANS was founded in 1954 as a nonprofit entity to promote nuclear science and technology. It now includes 11,000 members representing 1,600 universities, research centers, and businesses.

American Nuclear Society

Department Sweeps NRC Grants

The department has been awarded, for the first time ever, all three types of institutional grants offered from the US Nuclear Regulatory Commission (US NRC). The funds, totaling more than $1 million, will be used to recruit and retain top faculty and both graduate and undergraduate students.

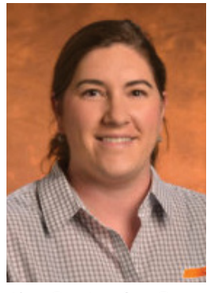
A **$450,000 Faculty Development Grant** will provide support toward a new assistant professorship, joining eight other faculty members supported by the US NRC's Nuclear Education Grant Program. They will play key roles in supporting design, construction, operation, and regulation of nuclear facilities and the safe handling of nuclear materials for years to come.

A **$200,000 Scholarship Grant** will help the department award the equivalent of at least 35 scholarship units, targeted to increase the program's excellence and improve student retention and success. These will help reward high-performing students, some with strong financial needs.

A **$400,000 Fellowship Grant** will allow the department to award the equivalent of seven one-year fellowships, maintaining a flow of opportunities and educational excellence for graduate students.

STAFF NEWS

NE has New Professional Advisor, Amanda Lovelace



Amanda Lovelace joined the nuclear engineering team as a student advisor in spring 2017. She assists undergraduates in co-creating academic plans and identifying experience-learning activities such as internships and cooperative opportunities, research, study-abroad for-credit, or service-learning trips.

She serves as the liaison to the Center for Career Development, the Office of Professional Practice, the Office of Undergraduate Research, and other on-campus departments to best meet the interests of the students.

Lovelace is originally from Lynchburg, Virginia, but has lived in Knoxville for the past several years. Her husband graduated from UT's Department of Nuclear Engineering in 2008 and they have both established careers in the area.

"My husband, Tyler, and I have been together for sixteen years and have two wonderful and spunky daughters: Abigail, 5, and Merida, 2," she said. "We also have an Irish wolfhound/Labrador-mixed dog named Neyland."

Outside of the world of student advising, she enjoys spending time with family and friends.

"We're typically outside reveling in the beautiful sights of East Tennessee," Lovelace said. "Whether it's at a backyard barbeque or on a trail in the Great Smoky Mountains, we prefer to be outside together making memories."

Ashly Pearson Wins Outstanding Staff Award

Ashly Pearson earned the 2017 departmental Outstanding Staff Award. A strong number of nominations were received, with staff members who go above and beyond for the department, but her name came up repeatedly.

Pearson is an electronics and communications specialist for the department.

"My primary duties are all things technical-support related," she said. "If I can't take care of the issue, I find out who can and work with them till the issue is resolved. My other duties include asset management, procurement card purchasing, overseeing of departmental websites, and other various needs of the department."

She is noted for her ability to help out with this variety of needs, and always being ready to step up to the plate. Comments from faculty and staff colleagues were enthusiastic:

- "She takes on additional duties to help out the faculty and staff."
- "She will explain why something can't be done and help to figure out a way to make the situation work. She always has a can-do attitude."
- "She looks ahead and plans for the future."

Pearson first came to Knoxville to attend UT, and graduated in 2011 with a BA in communication studies and minors in computer science, information studies and technology, and communication and information.

"After college, I worked at TVA as a contractor doing desktop support till the position in NE opened up and I took it," she said. She has been a staff member at UT for four years. Outside of her engineering duties, Pearson enjoys cycling, reading, learning new things, and video games.

STUDENT NEWS

Wouter de Wet Earns Research Excellence Award

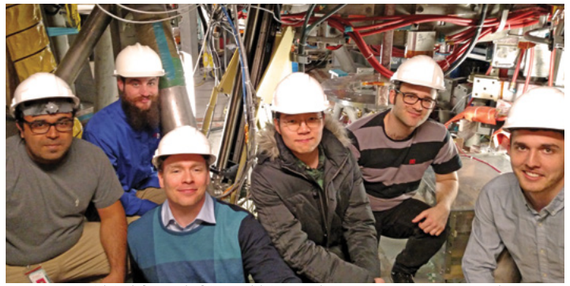
Wouter de Wet received the department's PhD Graduate Research Excellence Award for 2017. He is set to complete his doctorate in December.

"I was very honored to hear that I had been selected to receive the award this year," said de Wet. "Receiving it has really helped motivate me to build upon the momentum we have gained over the last few years by pursuing a career in research."

De Wet graduated with his bachelor's degree in 2014. Immediately after, he was the most junior of 16 people selected to attend the 2014 NASA Space Radiation Summer School at Brookhaven National Laboratory. He completed his master's degree in 2015. Along the way, he coauthored five published, refereed journal articles (one as lead author) and has coauthored three others (one as lead author) currently under review by prestigious journals. He has presented two invited papers, one at a national American Nuclear Society conference, and the other at the Mars Space Radiation Modeling workshop at Southwest Research Institute in Boulder, Colorado. He has also presented and/or coauthored 11 additional conference presentations.

Said de Wet, "I am very grateful for all of the unwavering support I have received over the years from not only my mentor, Lawrence Townsend, but all of the faculty and staff in the nuclear engineering department."

Grad Students Soak in Spring Break Fusion



Donovan (third from left) and his students tour Princeton Plasma Physics Laboratory.

What do nuclear engineering grad students do during their spring break? They jump in a UT van and take a road trip to New Jersey to see one of the country's biggest fusion experiments.

Graduate students Anurag Maan, Jonah Duran, Seung-Sup Lee, Joe Kelsey, and Shawn Zamperini traveled with Assistant Professor David Donovan to the Princeton Plasma Physics Laboratory (PPPL) to tour the NSTX-U fusion and LTX-Beta experiments, and the university's new Andlinger Center for Energy and the Environment.

"I had been planning to travel to PPPL to meet with our research collaborators and plan experiments," Donovan said. "Several of the students had contributed to this collaboration, so I decided to take our whole group."

The Nuclear Fusion Technology program at UT has enjoyed a growing interaction with experimental fusion facilities like PPPL, including ORNL and San Diego's General Atomics. Maan performs surface chemistry analysis of lithium coatings used in the LTX-Beta research and other UT students are researching fusion technology that directly applies to the NSTX-U, an experimental magnetic confinement fusion device.

"PPPL offers excellent opportunities for post-graduate research positions when the students graduate," said Donovan, who has introduced several new courses relating to fusion technology, plasma physics, and plasma diagnostics.

"Many of the subjects I discuss in my classes are part of the research performed at PPPL," he said. "It is a very impressive sight and it is important for students to see these incredible feats of science and engineering to understand how their studies and research fit into the larger national fusion energy research effort."

The team had planned for two days of tours, but Princeton's "Spring Break" weather involved a serious snowstorm that closed most of the university on the second day.

"Luckily, we were able to fit most of the tours into the first day," Donovan said. "We couldn't leave town early, but we had a good time visiting the campus and walking around in a foot of snow."

Record Number of UT Students Honored by American Nuclear Society

The American Nuclear Society bestowed 11 scholarships on UT nuclear engineering students at its annual meeting in San Francisco on June 11.

That number, a record for the department, is the latest sign of recognition of UT as a national leader in nuclear engineering education.

“This is a tremendous accomplishment for our students and a reflection of the strengthening of our program over the last decade,” said Wes Hines, head of the department. “Being able to have some of the top students in the country—as acknowledged by these selections—is a key to that growth.”

The impressive student total includes two Blount County residents: Gavin Ridley, a graduate of Seymour High School, and Mullin Green, a Maryville High School graduate.

Ridley won the Rudolf Stamm’ler Undergraduate Reactor Physics Scholarship, named for a pioneer in nuclear physics who developed a number of concepts still in use today, while Green received the Sophomore Undergraduate Scholarship.

Other undergraduate winners are:

- Christopher Haseler, of Fairfax, Virginia
- Kalie Knecht, of Charleston, West Virginia
- Austin Saint-Vincent, of Vero Beach, Florida
- Andrew Volkovitskiy, of Louisville, Kentucky

Graduate students winners are:

- Jessica Bishop, of Fredericksburg, Virginia
- Rachel Gaudet, of Clarksville, Tennessee
- Austin Mullen, of West Chester, Ohio
- John Wagner (hometown withheld)
- Fan Zhang, of Shanxi, China

Nuclear Engineering Students Trained in Prague, Czech Republic

Twelve undergraduate nuclear engineering students participated in the study abroad Experimental Reactor Physics Laboratory class (NE427) during the 2017 summer mini-term. The class was led by Ondřej Chvála, research assistant professor, at the Czech Technical University (CTU) in Prague, Czech Republic.

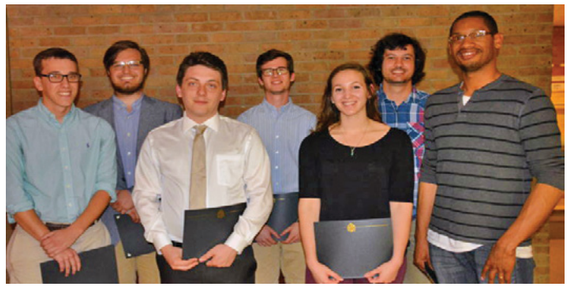
The students spent the first week visiting several sites throughout the Czech Republic—including a uranium mine and a yellow cake chemical factory, Temelín nuclear power plant, research institute in Řež near Prague, and the Prague Castle. In Vienna, Austria, the group visited the Belvedere Palace, the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

During the second week, the students worked with nuclear reactor VR-1 at the university, performing reactor-physics-related measurements and working out respective lab reports. Each student actually operated the reactor on the last day of the labs.

This is the fifth time this study-abroad class was held. It is open to undergraduate and graduate students interested in nuclear reactor dynamics and hands-on experimental work. Contacts with the Czech university have already led to mutual student exchanges and research collaborations with the UT nuclear engineering department.

This year, UT nuclear engineering professor Belle Upadhyaya visited CTU and presented a seminar titled “Integral Reactors: I&C Research, Technical Gaps, and Challenges.” He discussed possibilities of future research collaboration along these topics.

NE Students Win 2017 EURēCA Awards



Nuclear engineering students swept up seven awards in UT's 2017 Exhibition of Undergraduate Research and Creative Achievement (EURēCA) competition. This annual event showcases research by currently enrolled undergraduate students in collaboration with a faculty mentor.

Nuclear engineering students earned first and third places in the design category, first and second places in the research category, and three honorable mentions in research.

The winning design team also won the University Undergraduate Research Gold Award.

Design Category

First Place: “Design of a Subcritical Fast Neutron Source for UTNE”
Team: William Cureton, Zachary Bingham, Duncan Brocklehurst, Daniel Peffley, James Ghawaly, and Colton Oldham
Faculty Mentors: Wes Hines and Ondrej Chvala

Third Place: “Comprehensive Modeling of Holdup Deposits for Internal and External Piping Measurement Systems”
Team: Eleanor Comer, Zane Wallen, Thomas Smith, Cameron Ubben, Stephen Barush, and Cal Fosseen
Faculty Mentor: Graham Walford

Research Category

First Place: “Tungsten Deposition Analysis Using Inductively Coupled Plasma Mass Spectrometry”
Student: Lauren Finney
Faculty Mentor: David Donovan

Second Place: “Trajectory Distortions Associated with Positron Emission Particle Tracking”
Team: Zachary Bingham and Matthew Herald
Faculty Mentor: Arthur Ruggles

Honorable Mentions

“Characterization of Surrogate Alloys for Special Nuclear Material Forensic Applications”
Student: Joshua Gurka
Faculty Mentor: John Auxier

“Structural stability of REE-PO4 (REE=Sm,Tb) under static pressure and swift heavy ion irradiation”
Student: Jacob Cooper
Faculty Mentor: Maik Lang

“Study of temperature effect on cation inversion in MgAl2O4 and NiAl2O4 spinel using neutron total scattering.”
Student: Igor Gussev
Faculty Mentor: Maik Lang

Three Doctoral Students Earn Prestigious Grants

Chris Andrews, Dory Miller, and Adam Stratz were recently selected by the DOE for the National Nuclear Security Administration’s Graduate Fellowship Program, one of the most exclusive paths afforded to budding nuclear engineers. The program seeks to identify and encourage students who are seeking to work in the nuclear energy sector after graduation.

“These selections serve to highlight the great education in nuclear engineering available at UT,” said Department Head Wes Hines. “The strengthening of our program has led to an increase in our reputation in our field. Having three such students chosen for the NNSA fellowship program is confirmation of both our success and that of our students.”

The trio will be given full-time funding while they gain hands-on experience in some of the top labs in the country, gain career development and specialized training, and work with groundbreaking researchers and nuclear security professionals.

Andrews is part of the Rad Ideas Group at UT, while Miller and Stratz take part in UT’s Institute for Nuclear Security.

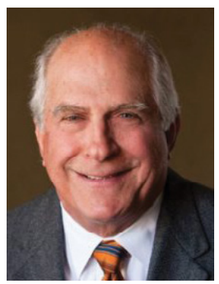
Hines noted that the experience prepares students for a wide array of future endeavors. Recent UT graduates in the program have gone on to work for the NNSA, ORNL, and the US Department of State.

ALUMNI NEWS

Family members of Pietro Pasqua accept the Hall of Fame induction plaque in honor of the founding head of the department.

Department Inducts Hall of Fame Inaugural Class

The inaugural class of the department's Hall of Fame was inducted at the spring 2017 awards banquet. The Hall of Fame recognizes graduates or those with a sustained positive relationship with the department. The 2017 inductees all have made exceptional contributions to the nuclear engineering community through their technical innovations, scholarly activities, and leadership.



Wayne Coleman earned his bachelor's, master's, and PhD degrees in nuclear engineering from UT. His career in the nuclear industry spans almost forty years, including his time with the Army Nuclear Defense Laboratory. Following his military tour, he began work with a small firm of just fifteen people, then called Science Applications, Inc. Over the next 35 years, Coleman served in multiple roles and helped grow the company, now known as Science Applications Internal Corporation, to more than 40,000 employees. He retired as the company's vice president. He has spent many years on the Board of Advisors for the Tickle College of Engineering and has given generous service in multiple capacities to the university.

In 1974, **Hash Hashemian** earned his bachelor's degree in physics from Iran University. His educational and professional career took him to the US where he earned his master's degree in nuclear engineering at UT. Since then, he has demonstrated exceptional leadership and service to the nuclear power industry, specifically as founder and president of Analysis and Measurement Services Corporation, which provides equipment, training, and services for testing the instrumentation and control of nuclear power plants worldwide. He also continued his education, earning three PhDs in electrical, nuclear, and computer engineering from Lamar University; Chalmers University of Technology, Sweden; and the University of Western Ontario, Canada, respectively. Hashemian has presented his academic and professional research at a number of international lectures and has been published in nearly 150 publications.

Pietro Pasqua was the founding head of the department in 1957 and served until 1988. He received his bachelor's degree from the University of Colorado and his master's and PhD degrees from Northwestern University, all three in mechanical engineering. Pasqua is fondly remembered by faculty, staff, and students not only for his scholarly accomplishments and outstanding leadership, but also for his integrity, kindness, and dedication to teaching and learning. He was a genuine inspiration to all that knew him, and he will forever live in the hearts and minds of those he touched.

Ken Piety earned his bachelor's and PhD degrees in nuclear engineering from UT. In the early 1980s, he co-founded Computational Systems, Inc. (CSI), which provides multiple services and products to global industrial manufacturing facilities. At CSI, he provided exceptional leadership as vice president of engineering and technology, serving for more than 25 years in multiple roles through the transition of CSI as it became a subsidiary of Emerson Electric. He provided further exceptional service to Azima DLI for approximately 10 years as vice president of technology. His pioneering work in vibration analysis and other predictive maintenance technologies has resulted in more than 30 patents and crucial innovations in diagnostic and reliability technologies in industrial manufacturing.

Jessie Hill Roberson received her bachelor's degree in nuclear engineering in 1981 from UT. Early in her career she worked at Dupont and Georgia Power and later served as the youngest and first female manager for DOE's Rocky Flats Field Office. She was nominated by President Bill Clinton as a member of the Defense Nuclear Facilities Safety Board (DNFSB) and was later nominated by President George W. Bush as assistant secretary of the DOE. Still later, Roberson was nominated as vice chairman of the DNFSB by President Barack Obama, who has more recently nominated her to serve as commissioner for the Nuclear Regulatory Commission. It is particularly noteworthy that Roberson was nominated by three sitting presidents representing both parties. Roberson's exceptional career has been defined by her dedicated corporate leadership and government service to the nuclear engineering field in waste management, reactor operation, environmental restoration, and project management.

Hashemian Named to Nuclear Advisory Committee

Adjunct Professor Hash Hashemian was recently named to the Department of Commerce Civil Nuclear Trade Advisory Committee.

The committee was established in 2008 to help advise the department on the development and administration of efforts related to making the US nuclear industry more competitive.

"Maintaining US leadership in the nuclear industry is critical to our country's economic vitality and to global efforts to combat climate change," said Secretary of Commerce Penny Pritzker. "[The committee] is a valuable mechanism for private sector representatives to contribute to policy discussions and work with government leaders to create the conditions that will strengthen US competitiveness in this sector."

As president and CEO of Analysis and Measurement Services Corporation, Hashemian heads a globally recognized leader in nuclear energy and safety. In fact, AMS has establishing a connection in every US nuclear plant as well as plants in several other countries.

It is only the most recent honor for Hashemian, who in the past few months has also been named a fellow of the American Nuclear Society and the recipient of the Dougherty Award from the college.

ORNL TAPS ALUM FOR NEW REACTOR DEVELOPMENT

By Jason Ellis, ORNL

The Department of Energy's Office of Nuclear Energy (DOE-NE) has selected Lou Qualls as the national technical director for molten salt reactors (MSRs). In his new role, Qualls—a UT nuclear engineering alum who joined ORNL in 1988—will serve as a liaison among the nuclear industry, the national laboratory system, and DOE in defining the future of MSR technology in the US.

The position was created in response to the private sector's growing interest in MSRs as the next generation of power reactors. A significant number of nuclear plants are expected to close beginning in 2030, with most closed by 2045, as their operating licenses from the Nuclear Regulatory Commission (NRC) expire. Various companies are pursuing new reactor designs to replace this loss of nuclear energy, which represents approximately one-fifth of US-generated electricity and the nation's largest source of carbon-free energy.

"There are about ten US companies developing MSR designs in hopes of seeing their technologies make it onto the grid," Qualls said. "My job is to work with these vendors and DOE to understand how each design could fit into the energy market and to identify hurdles that could prevent these reactors from ever delivering electricity. It's a positive step that shows the level of excitement from industry, DOE, and the national labs."

Bringing ideas to the forefront

Qualls will coordinate with the national technical directors for gas-cooled and sodium-cooled fast reactors to establish research and development priorities for DOE-NE's Office of Advanced Reactor Technologies. He will serve as an advocate for MSRs and aim to ensure the technology is fairly considered along with the other advanced reactor types.

In the first year in the role, Qualls plans to spend much of his time listening—to the companies designing new reactors about the challenges they face; to ORNL and other national labs on the research that could assist in the process, from advanced manufacturing of reactor parts to creating modeling and simulation capabilities for testing and improving MSR designs; and to the NRC on how it can create a path for the licensing of advanced reactors.

"We want to vet the technology and have a healthy conversation with the nuclear community, so they understand how to make their concepts viable," he said. "We also want to identify research that will provide the greatest impact. If the national laboratory system can do research that benefits everyone and has a broad impact, we're doing our jobs."

The stated DOE goal is for at least two advanced reactor designs to reach technical maturity, demonstrate safety and economic benefits, and complete licensing reviews such that construction can go forward. It's an aggressive vision that Qualls believes is possible and necessary.

"If we are going to replace the current fleet of reactors with new technology, we need to begin focused efforts immediately," he said. "The nuclear industry needs to become better at evolving and incorporating new technology and MSRs provide that opportunity."

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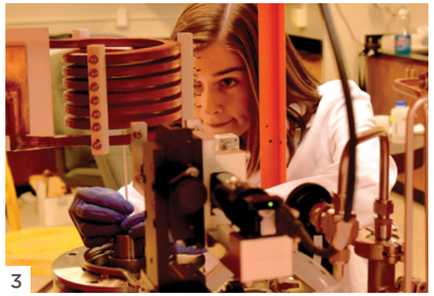

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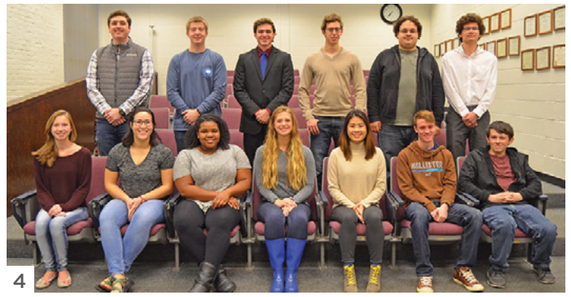

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1. Dory Miller, Rachel Gaudet, and Asia Conley (from left to right) engineering a drone-based system for detection of radioactive sources that have gone out of regulatory control.
2. Michael Moore fabricating a radiation detector in a cleanroom at the Microprocessing Research Facility.
3. Robyn Collette working on radiation scintillation fabrication at the Scintillation Materials Research Center.
4. Thirteen freshmen receive Joint Nuclear Regulatory Commission and Pasqua Scholarships.
5. Adam Stratz measuring the voltage across the top of a gas chromatography instrument.
6. Nuclear Engineering Faculty attend the Tickle College of Engineering Gala.
7. Lawrence Heilbronn and Jason Hayward standing in front of a portal monitor that is waiting for installation as a part of the new engineering complex.
8. HITES12 students visit the Nuclear Engineering department for hands-on activities. Learn more at **tiny.utk.edu/hites12**.

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big orange. big ideas.

Courtesy Tennessee Valley Authority

UT's expertise in nuclear security continues to grow.
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