The background of the entire page is a light blue color. It features silhouettes of several people walking in a city. Some are carrying backpacks and talking on mobile phones. Above the silhouettes, there are three yellow Wi-Fi signal symbols. In the center, there is a large yellow text block for the main article title, and below it, a white text block for the subtitle. At the bottom, there is a yellow horizontal bar containing the magazine title and issue information, and a white area with two article teasers.

Handheld Radiation Detectors

Purdue trio equips
cell phones with
Geiger counters

PURDUE **NUCLEAR**

ENGINEERING **IMPACT**

Summer 2008

Quest for Fusion

A researcher's
multifaceted hunt

Musical Engineer

How one nuke's love of the
arts enhances her studies



On my mind

Nuclear engineers may not leap to mind when you think of the subject of entrepreneurship (the overall theme for this edition of *Purdue Nuclear Engineering Impact*), but I suspect you'd find that the same "can-do" spirit we're trying to instill in our students can translate into startup success should our grads choose that route. And by bringing some of the best nuclear minds to campus, both in the form of distinguished speakers and our stellar faculty, I know we're giving those students a good head start.

There is at least one entrepreneur among us, so you'll enjoy learning about the research efforts of Jere Jenkins, director of Purdue's radiation lab, and his colleagues from the School of Physics. This innovative trio is helping revolutionize how we think about homeland security. They're equipping the everyday cell phone, which you'd likely find pressed next to the ear of every other student walking on campus, with radiation detectors. This is far more than a percolating good idea; it's a proven technology now simply looking for the right sponsor.

And we're not done with the big ideas. Jeffrey Brooks, a research professor profiled in our "Up Close: Faculty" story, is working on the forefront of fusion. Peter Lyons, the commissioner of the Nuclear Regulatory Commission (NRC) who spoke on campus last spring, provides his insight on the NRC's role in the nuclear renaissance. And we've got young faculty such as Igor Jovanovic and Jean Paul Allain, both profiled in "Research News," who are working on theories now that could be world-changers in 10-years' time.

But the students are why our school exists. Professor Tatjana Jevremovic put up her own money, subsequently matched by the Women In Engineering Program, to encourage undergraduate research on a college-wide basis. You can read both about "Dr. J's Award" and get a sense of just how well-rounded our students are with the artistic example of Abbey Donahue in our "Up Close: Students" feature.

I am once again proud to present you with this collection of nuclear success stories from our school at Purdue. If there's anything in particular that catches your eye, please drop us a line and share your thoughts.

Vincent Bralts
Interim Head, School of Nuclear Engineering

How We Doing?

This is our sixth *Nuclear Engineering Impact*. We'd love to hear your thoughts on our efforts. E-mail peimpact@purdue.edu.





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Speakers, Funding, and Impressive Student Numbers

Purdue's School of Nuclear Engineering continues to play a pivotal role in the renewed use of nuclear power.

NE class of 2008 ▶



Vincent Walter

While it may not be the nucleus of the nuclear renaissance, the School of Nuclear Engineering is certainly making the West Lafayette campus a hotspot for surfacing energy topics. Controversies aside, our school has played host to world-renowned visiting speakers, benefitted from funding on several research fronts, and continues to groom students for a role in the nuclear power resurgence. When it comes to energy and power solutions, if it's happening anywhere at Purdue, it's certainly happening within our relatively small school.

Beginning with a visit by Peter Lyons (see his "In My View" article on page 8), the Nuclear Regulatory Commissioner who provided the keynote for Purdue's Student Pugwash Midwest Conference around the spring equinox, our school hosted several speakers on campus who make up a virtual "who's who" of the nuclear power industry. Paul Lisowski, the deputy assistant energy secretary from the U.S. Department of Energy, spoke later in March about a Global Nuclear Partnership that "supports a safe, secure expansion of nuclear power internationally and domestically."

Victor Chrijapin, a project director for nuclear construction for URS-Washington Division's power business unit based in Princeton, New Jersey, responsible for construction planning in preparation for the nuclear renaissance, discussed the resurrection of the U.S. commercial nuclear industry in April. And Larry Hochreiter (BSNE '63, MSNE '67, PhD '71), a professor of nuclear and mechanical engineering at Penn State, spoke to students at the end of the spring semester about the technical challenges of his career, which began at Westinghouse.

On the Funding Front

Several researchers brought in various awards from national and international agencies, including the U.S. Department of Energy (Ahmed Hassanein), the Department of Energy's Office of Science (Jean Paul Allain), and the Defense Advanced Research Projects Agency (Igor Jovanovic). For stories about the potential impact these researchers are making, read the "Up Close: Faculty" (page 3) feature on Jeffrey Brooks, who is collaborating with Hassanein,

and "Research News" (page 10) on Allain and Jovanovic, both recently named "Young Scholars."

Student Success

According to the Oak Ridge Institute for Science and Education, last year Purdue graduated nearly 10 percent of all the nuclear engineering students earning bachelor degrees in the country (39 out of 413) and a little more than 10 percent of all the graduate students earning doctorates (9 out of 89).

Purdue's School of Nuclear Engineering has almost tripled over the past seven years, with 135 undergraduates in the program this past fall compared to 45 in 2000, says Erica Timmerman of the school's student services department. In fall 2007, the school had 46 sophomores, its largest class of sophomores ever. Forty sophomores are expected to enter into the school next fall.

With graduates receiving offers of more than \$60,000 per year due to high employer demand, the futures of nuclear youngsters look bright indeed. ■ **Clyde Hughes and William Meiners**



Facing Plasma's Challenge

One nuclear engineer's efforts to find important solutions

Deep in the French countryside northeast of idyllic Marseilles, an international team of scientists are cooking up something big. Construction will begin in 2009 in Cadarache on the 15-story, \$15 billion ITER, the International Thermonuclear Experimental Reactor. ITER, which means "the way" in Latin, promises to demonstrate the scientific and technological feasibility of fusion energy for peaceful purposes. "This is the most complex technology made by man," says Purdue's Jeffrey Brooks, a research professor in the School of Nuclear Engineering, "and it's also one of the most important."

Brooks is into important projects. Not content merely to go about replicating the energy of stars to help solve the global energy crisis, Brooks is also involved in numerous other areas. He works on national defense projects; he consults on fluid dynamics models to numerically simulate blood flow in the heart and coronary arteries to predict where life-threatening clots will form; and he creates software to simulate complex physical processes such as those used by the semi-conductor industry, which uses plasmas in microchip production. "I try to identify what I think are the key questions," says Brooks, who admits that his hunger for challenge seems to stem from the simple fact that he "gets bored easily."

Brooks' job on the ITER project is anything but boring. He must figure out the right recipe for the material inside the fusion reactor. "Designing the plasma-facing surfaces of the reactor remains one of the biggest challenges in developing reliable nuclear fusion," says Brooks. The plasma is confined by magnetic fields, but it interacts with the surfaces it touches. Such contact can be harmful both to the walls, which are subject to erosion from intense local heating, and to the plasma, which is easily contaminated and cooled—"put out"—by impurities. The trick for Brooks as the chair of the Department of Energy's Plasma-Facing Component Systems Group will be to determine the best design for a surface material that can stand up to these forces and protect the plasma so it can one day be harnessed to produce energy.

A new proposal is in the works for Brooks and his friend and colleague Ahmed Hassanein, a professor of nuclear engineering, whom he met at the Argonne National Laboratory.



Vincent Walter

NE professors and colleagues Ahmed Hassanein and Jeffrey Brooks on the horizon of fusion research.

Together they hope to work out mathematical models on super computers that will help focus ITER research. An ITER experiment will cost about \$1 million per "plasma shot." In a shot, the plasma is turned on for 400-1,000 seconds. By applying data gleaned from computer simulations, Brooks and Hassanein have an opportunity to "optimize the shot," that is, guide the parameters of the experiment to maximize the experiment time and cost.

And timing is everything. ITER is slated to be up and running by 2016, a very tight window by all accounts. Finely tuned experimentation will help push the theoretical goal towards the technological realization.

The promise of fusion energy is tantalizing to scientists like Brooks. "If fusion works, the impact will be fantastic," he says. "The fuel mostly comes from water, the fuel is essentially free, and the possibility exists for an unlimited source of energy. It would be an extremely important addition to the world's energy portfolio."

He also points out that a fusion reaction is inherently safe; it cannot meltdown. Further, very little long-term nuclear waste is produced, and no carbon dioxide or greenhouse gases are released during the reaction. Clean, safe, limitless energy will not come easily, though. "Fusion presents some of the most technologically advanced challenges," Brooks says, "but it promises the highest payoff." And that's just the kind of job Brooks likes best. ■ **Gina Vozenilek**

Phoning Homeland Security

By William Meiners with Emil Venere

A Purdue inspired, upstart technology could transform millions of cell phones into handheld radiation detectors.



While researchers within Purdue's School of Nuclear Engineering often find themselves working on the cutting edge of the highly regulated nuclear industry, it's not often that they test the waters of entrepreneurship. But that's all changing for Jere Jenkins and two of his colleagues as they search for the perfect sponsorship match for an already proven technology that could put radiation detectors in the palms of the public's hands. Millions of them.

Jenkins, the director of Purdue's radiation labs, brought his radiation expertise to a collaborative effort with Andrew Longman, a consulting instrumentation scientist, and Ephraim Fischbach, a professor of physics. The trio also attracted the attention of the state of Indiana in their quest to develop a system that would use a network of cell phones to detect and track radiation to help prevent terrorist attacks with radiological "dirty bombs" and nuclear weapons. Such a system could blanket the nation with millions of cell phones equipped with radiation sensors able to detect even light residues of radioactive material. Because cell phones already contain global positioning locators, the network of phones would serve as a tracking system.

"It's the ubiquitous nature of cell phones and other portable electronic devices that give this system its power," Fischbach says. "It's meant to be small, cheap, and eventually built into laptops, personal digital assistants, and cell phones."

And what's even more encouraging for the researchers—the technology already works. "The proof of concept was already a success," Jenkins says. With funding from Purdue's Joint Transportation Research Program and representatives from the Indiana Department of Transportation on hand, the researchers tested the system last November using off-the-shelf technology and cellular data air time provided by AT&T. The demonstration showed that the small-scale system is capable of detecting a weak radiation source 15 feet from the sensors. "We set up a test source on campus, and people randomly walked around carrying these detectors," Jenkins says. "The test was extremely safe, because we used a very weak, sealed radiation source, and we went through all the necessary approval processes required for radiological safety. This was a source much weaker than you would see with a radiological dirty bomb."

[continued on next page](#)

Passive Detection

The likely targets of a potential terrorist attack would be big cities with concentrated populations, and a system like this would make it very difficult for someone to go undetected with a radiological dirty bomb in such an area,” says Longman, the Purdue alumnus who originated the idea. “The more people are walking around with cell phones and PDAs, the easier it would be to detect and catch the perpetrator. We are asking the public to push for this.”

While the mind might race to images of thousands of business-clad New York City vigilantes combing Manhattan with their detecting cell phones held aloft, the researchers have a more passive technology in mind. The equipped phones would simply translate whatever radiation levels are picked up. “The sensors don’t really perform the detection task individually,” Fischbach explains. “The collective action of the sensors, combined with the software analysis, detects the source. The system would transmit signals to a data center, and the data center would transmit information to authorities without alerting the person carrying the phone. Say a car is transporting radioactive material for a bomb, and that car is driving down Meridian Street in Indianapolis or Fifth Avenue in New York. As the car passes people, their cell phones individually would send signals to a command center, allowing authorities to track the source.”

In addition to detecting radiological dirty bombs designed to scatter hazardous radioactive materials over an area, the system also could be used to detect nuclear weapons, which create a nuclear chain reaction that

causes a powerful explosion. The system also could be used to detect spills of radioactive materials.

“It’s very difficult to completely shield a weapon’s radioactive material without making the device too heavy to transport,” Jenkins says.

The system could be trained to ignore known radiation sources, such as hospitals, and radiation from certain common items, such as bananas, which contain a radioactive isotope of potassium.

“The radiological dirty bomb or a suitcase nuclear weapon is going to give off higher levels of radiation than those background sources,” Fischbach says. “The system would be sensitive enough to detect these tiny levels of radiation, but it would be smart enough to discern which sources pose potential threats and which are harmless.”

Startup Success: Enablers and Blockers

The university is intent on backing the researchers (the Purdue Research Foundation owns patents associated with the technology licensed through the Office of Technology Commercialization), but there have been naysayers. While some may cry that this technology is the ultimate arrival of a governmental “Big Brother,” Jenkins and Fischbach simply believe that 100 million or so people, each equipped with a detector that may cost \$100 to install, could be sold on the idea of its good citizenship.

The team is working with Karen White, senior technology manager at the Purdue Research Foundation, to commercialize the cell phone sensors. The professionals in the foundation’s Office of Technology

Commercialization work with Purdue faculty, staff, and student entrepreneurs to provide the resources needed to better understand the processes of patents, copyrights, trademarks, and tangible research property to help develop and deliver an actual product or service.

For Fischbach and friends, they’re simply looking for a matchmaker. And whether it’s a federal department powerhouse, a national lab, or a forward-thinking industrial partner, the ultimate sponsor will be critical in building the robust technology needed to maximize the effectiveness of the Purdue brainchild.

Jenkins says the larger funding source would help with the scale-up phase. “If we can show that we have a large-scalable and workable concept, I think these phones could be on the market in three to five years.”

The big payoff, says Jenkins, beyond the potential moneymaker of a technology-inspired idea, is the added layer of defense across an enormous area of the country. And as we look to avoid the worst-case scenarios, this is one idea that could be worth phoning home about. ■

NE's Jere Jenkins (left), alongside Ephraim Fischbach, displays the cell phone/radiation detector prototype.

“ If we can show that we have a large-
scalable and workable concept, I
think these phones could be on
the market in three to five years. ”

—**Jere Jenkins**, director of
Purdue's radiation labs



The NRC in a “Nuclear Renaissance”

A regulator’s take on the future*



Commissioner Peter Lyons of the Nuclear Regulatory Commission.

As concerns about future energy needs for the world and the environment become increasingly important, the attention of energy producers has again turned to nuclear energy to play a larger part in the generation portfolio. The role the regulator plays in this initiative comes from the strategic goals of the Nuclear Regulation Committee (NRC):

Safety: Ensure adequate protection of public health and safety and the environment.

Security: Ensure adequate protection in the secure use and management of radioactive materials.

The foundation of a favorable outlook for increased safe and secure utilization of nuclear energy is based on demonstrating continued safe operations of existing nuclear generating capacity and keeping the public informed and involved in the process of developing new nuclear capacity. Public openness is essential to regulatory strength. There must be opportunities for public comment, and those comments should be addressed

openly. There must also be opportunities for public hearings in licensing new reactors and amending the licenses for existing reactors. All of this openness will, of course, be balanced with the need to maintain security. The communications challenge for the NRC is to relate “risk” concepts in an understandable way to the public.

The concept of risk, such as the health effects of radiation exposure, reactor safety, and environmental issues, and the fact that each “type” of risk has its own methods of analysis and its own metrics, complicates the challenge for the NRC to communicate with both its internal and external stakeholders. But the NRC must also communicate how its requirements adequately manage the risk to acceptable levels and how the NRC ensures that licensees are meeting those requirements.

To aid in this challenge, the nuclear industry must continue to operate the more than 400 reactors worldwide in a safe and secure manner, and the regulators around the world must be seen as strong, consistent, and credible by both external and internal stakeholders. International cooperation and effective communication can make this happen.

The NRC has been engaged with regulators from around the world for some time and has been working with developing countries with no or newly developed regulatory agencies to assist them in becoming independent safety and security regulators in their own countries. The NRC has also continued its cooperation with the well-established regulators from around the world and has shared information to continuously improve the NRC’s abili-

ties to ensure the continued safe and secure operation of the world’s nuclear fleet. One example of this cooperation is the bi-lateral and multi-lateral agreements between the Institute for Radiological Protection and Nuclear Safety (IRSN) and the U.S. NRC to perform research in severe accident analysis and high-burnup fuels. The NRC is also a partner in the Multinational Design Evaluation Program (MDEP).

Vendors and electric utilities are also engaged in international partnerships. Construction of new nuclear capacity will have to be an international effort, since the resources necessary will have to come from the global economy. The domestic workforce requirements alone are an enormous challenge, particularly since much of the experienced labor that built the last nuclear plants in the United States has reached retirement age.

Therefore, science and technology education must play an important part in any renaissance of nuclear energy. With the closure of almost half of the nuclear engineering departments on college campuses during the 1980s and 90s, much of the important education infrastructure has been lost, and nuclear engineering enrollments in the latter half of the 1990s have declined to less than half of their relatively constant levels at the beginning of that decade. Those enrollments are now returning to their previous levels, thanks in part to the efforts of nuclear engineering departments like Purdue’s, which graduated about 10 percent of the nuclear engineers in the country last year.

continued on next page ►

The NRC has become a partner in this effort with the NRC's Nuclear Education Program. This program will award funds to educational institutions through undergraduate and graduate fellowships, grants to NE departments, and faculty grants. Developing the nuclear professionals of tomorrow will play a key role in expanding the utilization of nuclear energy to meet a significant part of the world's energy needs. The NRC alone has set a goal to see a net increase in staff of 200 new employees per year. With the aging of the present nuclear workforce, more than 200 NRC employees are retiring each year. That means that to meet its hiring goals, the NRC needs to hire some 400 new employees every year, when there are only about 600 nuclear engineering graduates in the U.S. annually!

This is not the only education challenge that must be addressed in a nuclear renaissance. The United States continues to remain in or near the bottom half of Organization for Economic Co-operation and Development nations in the International Mathematics and Science Literacy Rankings. The need to drastically invigorate and improve our primary and secondary education systems cannot be understated. The NRC and others need to work together to communicate the satisfaction and excitement of a technical career.

The nuclear renaissance is not guaranteed. There are many uncertainties, including regulatory issues, power demand, workforce requirements, availability of commodities, and availability of financing. It will be a tremendous effort to meet these challenges. ■ **Peter Lyons, Commissioner, U.S. Nuclear Regulatory Commission**

**This article is based on the NRC Commissioner Peter Lyon's speech, which was delivered to the 2008 Annual Midwest Regional Pugwash Conference at Purdue, March 22, 2008.*

Dr. J's Scholarship

Gift supports undergraduate research for women

It's a faculty first as far as Beth Holloway knows. Many alumni sponsor scholarships for young women pursuing engineering degrees. But for a faculty member to pony up her own money, well, that's practically unheard of, says Holloway, director of Purdue's Women in Engineering Program (WIEP).

The donor in question, Tatjana Jevremovic, an associate professor of nuclear engineering, established Dr. J's Women in Engineering Undergraduate Research Award, matched by the WIEP. Nicknamed Dr. J by the many nuclear undergraduates she's encouraged along a research path, Jevremovic wanted "to popularize a movement" that would encourage both scholarship initiatives along with inspired discovery efforts. And while this Dr. J may never win a slam dunk contest, she is helping good students raise their scholastic goals. "We often have excellent students who make straight As," Jevremovic says. "But I want to expose them to the challenges of research."

Any student, male or female from sophomores to seniors, can apply for the college-wide scholarship. Strong criteria, which include a published paper or one accepted for a journal, ensure that the recipient is dedicated to serious research. Students involved in EPICS (Engineering Projects in Community Service) and SURF (Summer Undergraduate Research Fellowships), however, are not eligible for the award.

For both Holloway and Jevremovic, undergraduate research is important in many ways. Students are able to work closely with a faculty member, get a



Tatjana Jevremovic presents her inaugural Dr. J's Scholarship Award to Heather Murdoch, a senior in materials engineering.

sense of belonging to the research profession, and even add to the body of knowledge in that profession. Early exposure to research also plants the seed of a graduate degree.

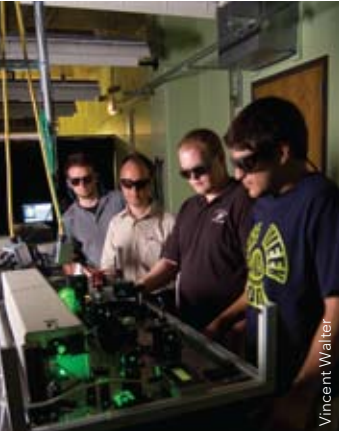
While Dr. J's award had a handful of strong candidates, Heather Murdoch, a senior in materials engineering, met all the criteria to become the inaugural winner. Jevremovic plans to maintain the WIEP connection, increase the dollar value of the scholarship in the future, and hopefully inspire her own colleagues to put some money into the research futures of young students.

"I thought it was a wonderful thing and a testament to how strongly Dr. Jevremovic believes in undergraduate research," Holloway says. "I was more than happy to match her donation with department funds so we could make this happen." ■ **W. M.**



Engineering for the Future

The two most recent recipients of the Purdue Young Scholar Award are seeking to change the world—now and 10 years down the line



Vincent Walter

Igor Jovanovic (second from the back) directs students in the Intense Laser Lab.



Vincent Walter

Jean Paul Allain stands before students in the Surface Analysis Lab.

When Paul Zmola (BSME '44, MSME '47, PhD '50) established the Young Scholar Awards to advance nuclear engineering research at Purdue, his philosophy was simple: "What strikes me as especially important to understand about the potential of nuclear power is that these energy systems are not just technical, they're environmental, political, and perceptual as well."

This year's award recipients, Igor Jovanovic and Jean Paul Allain, both assistant professors of nuclear engineering, are working to realize that goal by employing Zmola's donations into advanced research on

technologies that we're just now beginning to grasp. Both men are interested in emerging uses of radiation that can lead to profound security, environmental, and medical advances.

Jovanovic, who earned his PhD at University of California-Berkeley by way of Zagreb, Croatia, spent more than five years researching ultra-high intensity lasers at the Lawrence Livermore National Lab. Arriving at Purdue in August 2007, he brought that expertise with him and has already made a significant impact. "I've worked to start a new lab here called the Nuclear Engineering Intense

Laser Lab," he says. "Already we've acquired quite a bit of equipment for it, and we employ many students in our research. It's progressing very well so far."

That research involves a number of practical applications. For one, Jovanovic is working with the Department of Homeland Security to develop new methods to detect nuclear material at high-risk entry points like shipping ports. "Because there has been some concern about the potential risk of smuggling bombs through ports, we're developing radiation detection in a non-disruptive fashion, so that we can keep the ports and the country safe without interfering with international trade."

Another area Jovanovic sees as ripe with potential is helping to alleviate the worldwide energy deficit. At Livermore, he'd been involved with research at the laser fusion facility to harness vast amounts of energy from water, rather than relying on fossil fuels. He's continuing that research at Purdue and keeping the Department of Energy within earshot. "In all of this research, the question is 'How can you make radiation interact with matter in a fundamentally different way?'" Once researchers like Jovanovic find a new way, it could open the floodgates for the usable production of fusion power in the future.

Allain arrived with Jovanovic in August 2007 after earning a University of Illinois PhD and spending four years as a staff scientist at the Argonne National Laboratory in Chicago, working on problems from nuclear fusion materials science to nanolithography. Like his colleague, Allain heads up his own lab, the

Radiation Surface and Interface Science Laboratory. He stresses that while the traditional association of nuclear engineering is with the production of power, he's utilizing his research grant to push the level of discourse in novel and emerging areas.

"I'm more interested in high-risk, high pay-off areas," Allain says. "There's a lack of fundamental understanding on the mechanisms of how radiation in the form of ion beams, or other excitation sources, can be used to control patterning and structure at the nanoscale on surfaces. In particular, developing a new class of materials through radiation-induced synthesis and establishing the field of radiation surface and interface science. It's frontier-type work, looking at applications 10 to 15 years down the road."

In addition to applications in nuclear materials science, quantum computing, and nuclear detection, radiation-modified surfaces play an integral role in the biomedical area. "We can actually use radiation to apply special surfaces that would be both biocompatible and exhibit function in ways never thought of before," says Allain. "This technology is especially useful in manufacturing stents at the nanoscale to promote arterial wall growth for patients who've suffered brain aneurysms." These novel materials would also open the door to localized imaging and detection of cancer cells.

"Purdue is a 'let's build something' type of school," Zmola is famous for saying. And Professors Jovanovic and Allain, employing the resources provided by Zmola, are living proof of that ongoing legacy.

■ Patrick Kelly



Artistry and Nuclear Know-How

Music, photography, and mentorship help shape the life of a young nuclear scholar.

One need only stroll through the halls of the Nuclear Engineering Building to see how today's engineering students are shaking off the stereotypical images of the pocket-protected engineers of yesteryear. Take nuclear engineering senior Abbey Donahue for example. A top-notch student well on her way to earning one of the most challenging degrees on campus, Donahue displays an artistic side revealed in her love of photography and music.

Both of Donahue's parents were Boilermakers. So while the pull to Purdue and the School of Nuclear Engineering may have been strong, she had no desire to leave the arts behind. Donahue plays bass in Purdue's orchestra, an instrument she has played since she was 11. But she's also very involved in activities related to her studies. Recently, Donahue was named the new president of Purdue's chapter of the American Nuclear Society (ANS). It comes at a time when she is transitioning between her education and career, all the while handling a schedule chock-full of commitments.

She also participates on the professional practice student council, a way of giving back to the next generation of students who are where she was four years ago. "We set up co-op days where companies come to the Union," she says. "We set up interview spots, call-out meetings, and question and answer sessions. It's great to be in the reverse role—to have gone through it as a freshman myself and now to be the person checking them into the co-op days, showing up as a mentor and answering all their questions."

Next fall Donahue will take on a new role as a resident assistant in Earhart Hall, where she hopes to land a learning community. "My freshman year," she says, "I was in a Women in Engineering learning community."

Support systems like the learning community have helped Donahue excel in the classroom. And while another stereotype of engineers has to do with a male-dominated field, Donahue is aware of the changing times. "It's good to see things leveling out," she says. "I think a lot of engineering fields are experiencing that, especially nuclear."

Donahue says that only two women graduated with NE degrees this past spring. "Now there are five or six girls in any given course," she says, "more than twice the number in my class. It's increasing."

All of Donahue's coursework and involvement with Purdue's many student programs have been balanced with a co-op opportunity every other semester in Richmond and North Anna, Virginia. This summer she's finishing up her last co-op session in the reactor engineering group at the North Anna Power Station. She was also recently awarded the ANS Operations and Power Division Utility Working Conference Internship and will be attending the professional conference in August. "For the internship, I'll be helping with logistics beforehand, participating in technical sessions during the conference, and presenting a poster," she says.

This hands-on experience should serve Donahue well in an industry that is also in transition. One of the biggest challenges facing nuclear power has been its image. "It's about over-riding peoples' misconceptions. [Nuclear energy] is very, very clean, and very, very safe," Donahue says.

As far as her plans for the future, Donahue exudes the excitement of a young woman with a world of opportunities. "I went to the ANS student conference in February. Several speakers from Areva talked about the Young American Engineering Program. If you are hired, you go to their headquarters in France. I've signed up for French next year, and I'm hoping to get an edge in that application process," she says. And while this young engineer could be well positioned in the workplace, the French, no doubt, along with her artistic sensibilities, could help her do it all with that certain *je ne sais quoi*. ■ **Jessica Kohl**





This colorful collage consists of work by MSE Professor R. Edwin García. It is actually two superimposed simulations of the nucleation and growth process of an undercooled Nickel melt. The background shows periodic tapestry of Ni nuclei during the initial stages of the solidification process. The superimposed structure in the center corresponds to a single solidified Ni-dendrite. The coloring embodies the degree of crystallinity and the orientation of each nuclei. Simulations were performed by Michael Waters (BSMSE 2008). García's work is featured in the current issue of *MSE Impact*.

