University Currents

A Newsletter For and About the University Nuclear Engineering and Science Community

U. S. Department of Energy *Spring 2006*

Dennis Spurgeon Sworn-in as Assistant Secretary for Nuclear Energy

On April 4, 2006, Secretary of Energy Samuel W. Bodman announced the swearing in of Dennis Spurgeon as Assistant Secretary for Nuclear Energy. Assistant Secretary Spurgeon was nominated by President Bush on February 13, 2006, and confirmed by the U.S. Senate on March 27, 2006.

Assistant Secretary Spurgeon

Secretary Bodman stated that, "Dennis's leadership will be a valuable addition to the department as we work together to expand our country's use of nuclear energy as a safe, environmentally friendly power source. President Bush's Advanced Energy Initiative calls for a significant increase in nuclear energy research at the Department of Energy, and Dennis will help lead the development and deployment of these cutting-edge technologies."

In this position, Assistant Secretary Spurgeon is responsible for the Department of Energy's (DOE) nuclear energy enterprise, including nuclear technology research and development, management of the department's nuclear technology infrastructure, and support to nuclear education in the United States.

Mr. Spurgeon also leads the recently announced Global Nuclear Energy Partnership (GNEP), a comprehensive strategy aimed at accelerating the demonstration of a more proliferation-resistant closed fuel cycle and bringing the benefits of nuclear energy to the world in a safer and more secure manner, reducing the possibility that nuclear energy could be used for non-peaceful purposes. GNEP is part of the President's Advanced Energy Initiative.

"I am excited for this opportunity to work with Secretary Bodman and my colleagues to achieve a more secure energy future for Americans," Assistant Secretary Spurgeon said. "I am honored to be part of the department's efforts to ensure that the benefits of nuclear energy are realized here in the U.S. and in the world."

His long and distinguished career includes his most recent post as Executive Vice President and Chief Operating Officer for USEC, Inc. an international supplier of enriched uranium for nuclear plants. Prior to that, he served as Chairman, Chief Executive Officer and principal owner of Swift Group, LLC, an international leader in shipbuilding for commercial and military markets.

He also held executive positions at the former United Nuclear Corporation, where as Chief Operating Officer he managed the manufacturing of reactor cores for the Navy and operation of the department's former N-reactor. Assistant Secretary Spurgeon also worked for the General Atomic Company and served in the U.S. Navy, achieving the rank of Captain.

Assistant Secretary Spurgeon also held posts in the Ford Administration, including an assignment as Assistant Director for Fuel Cycle in the U.S. Energy Research and Development Administration. He also served as a member of the White House task force that developed President Ford's nuclear policy. Earlier in his career, as a U.S. Naval officer, he served as technical assistant to Commissioner Tommy Thompson and later to Dr. Glenn Seaborg, Chairman of the Atomic Energy Commission.

Assistant Secretary Spurgeon graduated with distinction from the U.S. Naval Academy. He holds a Masters of Science in nuclear engineering from the Massachusetts Institute of Technology.

Radiation Studies Key to Nuclear Reactor Life, Recycling Spent Fuel

Two University of Wisconsin-Madison projects to study advanced materials and fuel forms for both current and future nuclear reactors recently received funding of approximately $1 million under the Department of Energy Nuclear Energy Research Initiative (NERI).

The NERI program supports research and development under three Department of Energy nuclear initiatives: Generation IV nuclear energy systems, advanced fuel cycles, and nuclear hydrogen.

In one three-year project, UW-Madison nuclear engineers will study the resistance of oxide, carbide and nitride nuclear fuel "matrix" materials—the vessels that contain nuclear fuel—to radiation damage. A second project will exploit recent advances in computational power and technique to develop computer models of the response of reactor structural materials to long-term radiation exposure.

The projects were among 24 selected for total funding of $12 million; UW-Madison is among five universities to receive funding for multiple projects.

Matrix materials are a key element of future fast-spectrum reactors, which are capable of safely and efficiently recycling spent nuclear fuel. The nuclear fission process produces high-energy "fast" neutrons. Current thermal reactors use a moderator to reduce the neutrons' energy, making them capable of sustaining the nuclear fission reaction using low enriched fuel.

But to recycle and minimize the waste impact of the spent fuel, you need to retain the fast neutrons, says Todd Allen, an assistant professor of engineering physics.

He and James Blanchard, a professor of engineering physics, are studying proposed matrix materials such as zirconium nitride or titanium carbide as a replacement for the current carbon matrix used in gas-cooled reactor fuel. "Replacing a lot of the carbon with zirconium atoms, for example, means you'll slow down neutrons less," says Allen.

While they know that zirconium nitride or titanium carbide do not effectively moderate fission neutrons, what's not clear is how the materials hold up under constant neutron radiation. Allen and Blanchard have constructed a radiation damage test facility on one beam line of the Department of Engineering Physics' ion accelerator. In an experiment that simulates long-term fast neutron exposure, they will bombard their candidate materials with a high-energy neutron beam and study how each one holds up.

"It's all in the context of devising new fuel forms that will allow you to efficiently recycle reactor fuel in a way that minimizes the net waste output from the entire fuel cycle," says Allen. "And the reason for looking at recycle is to limit the number of underground repositories you have to build."

Another project involves applying complex materials modeling to nuclear reactors. In it, Allen and Dane Morgan, an assistant professor of materials science and engineering, will incorporate the properties of iron, chromium and nickel into more complete computer models of radiation damage in steel, a common reactor structural material.

Previously, a lack of computing power limited such models to single pure materials like copper or iron. "People have learned a lot about radiation damage," says Allen. "But you never build anything out of just copper or just iron."

The effort may lead to structural materials that are better able to withstand long-term exposure to radiation—in some cases, nearly 60 years.

Todd Allen

In a reactor, high-energy neutrons can knock the individual atoms in steel out of their normal positions, bumping them elsewhere in the material or wedging them between their normal positions. As a result, vacant spots form in the steel and allow diffusion that can lead to unacceptable changes in shape or the creation of brittle materials. "It all happens because atoms diffuse and form structures that either change the volume or make it brittle," says Allen.

And that means costly reactor components may need to be replaced sooner than desired.

In addition, the researchers have seen evidence that when vacancies are clustered together forming larger voids, the composition of the steel around those voids is different from the composition of the material as a whole. "We'd really like to know how to predict these local composition changes, but to do that requires you to understand how these diffusion events happen, and how they happen as a function of composition," says Allen.

That's where Morgan's computer models will come in handy. Current diffusion data is measured at approximately 1,000° Celsius, but reactors operate at much lower tempera-

Continued on Page 9

Olmec Research at MURR: The Olmec Imbroglio -- A Role for Chemical Analysis by Nuclear Methods

Were the Olmec builders of San Lorenzo, an early city-state in Mesoamerica, representatives of a "mother culture" that gave birth to the splendors of all subsequent pre-Columbian societies? Or were they merely one of many "sister" groups whose religion, art, architecture and social organization combined to lay, in parallel, the foundation for the advanced civilizations that later arose in the region?

Questions about the Olmec have vexed scholars for close to 50 years, sparking sometimes bitter disagreement among archaeologists and others interested in the origins of indigenous culture in the Americas. Settling the question has proven difficult chiefly because the Olmec left no written history.

Scientists have instead had to build their cases by interpreting the data drawn from analyses of artifacts unearthed by archaeological excavations. The great gulf of time separating the Olmec from our own era has further complicated matters.

The most widely recognized symbols of Omlec culture, "Colossal Heads" such as this one above from La Venta, were probably carved to commemorate ruling elites.

Now, thanks to analysis of Olmec pottery by neutron activation analysis conducted at the University of Missouri Research Reactor Center and published in the February 18, 2005 edition of *Science*, empirical measures are, if not opening minds, at least redefining the terms of the debate.

Drs. Jeffrey Blomster from George Washington University, Hector Neff from California State-Long Beach, and Michael D. Glascock from the Archaeometry Lab at the University of Missouri-Research Reactor (MURR) for the first time conclusively pinpointed regional clay sources for hundreds of Olmec-style ceramics unearthed throughout southern Mesoamerica. By tying ceramic artifacts to the clay sources from which they were fashioned, the researchers developed a chemical "fingerprint" for Olmec artifacts. This, in turn, made it possible to track how the artifacts, and the influence they represented, may have spread among early population centers in Mexico and Central America. The key to establishing that the San Lorenzo Olmec actually attained cultural and political primacy was to pin down such patterns of exchange. The establishment of primacy for one location or another may help to settle once and for all the question of who gave birth to one of antiquity's greatest flowerings of civilization.

The Archaeometry Laboratory at MURR, established in 1988 with support from the National Science Foundation, analyzes close to 5,000 artifacts per year submitted by archaeologists and their students working throughout the world. Dr. Blomster, who was a student at Yale when the initial data for the *Science* article were collected, is one of several current and former graduate students and postdocs who have received support from the Archaeometry Laboratory for archaeological samples submitted from Mesoamerica and other geographic regions. Since 1988, more than 75,000 samples of pottery, obsidian and other archaeological materials have been analyzed by neutron activation analysis at MURR supporting more than 100 graduate students from around the US. As the compositional databases of archaeological materials continue to grow, their importance for addressing questions about the Olmec and other prehistoric civilizations around the world will have even greater impact.

Interdisciplinary collaborations between archaeologists and nuclear scientists of the type mentioned in this example would not be possible without external support. During the past three years, funding to support a post-doctoral student and the construction of two automatic sample changers was made available to the Archaeometry Laboratory at MURR by the MU-Nuclear Science and Engineering Institute which receives its funding from the US DOE.

ORNL Staff Help Start a Science Club

ORNL staff who are members of either the Oak Ridge, Tennessee, Chapter of Women in Nuclear (WIN) and the Oak Ridge/Knoxville section of ANS, have started a Science Club at a local primary school (grades K–2) to encourage interest in science. This science club is an aggressive effort to apply a fun, challenging, hands-on approach to learning science and engineering skills at an early age. Using funds provided by the local ANS chapter, volunteers from WIN are designing a series of take-home lessons and experiments related to a wide range of topics such as optics, geology, biology, and physical science. Each month, the club participant receives a detailed handout and all the materials necessary to perform the set of experiments. The efforts of the volunteers include developing the lessons, testing the experiments, finding the supplies, and preparing the individual kits for the children. A website is being developed to showcase the efforts of the club participants.

The Science Club is a pilot project, and ANS/WIN hopes to bring the program to other schools in the next year. Response to this club thus far has been very positive, with over 33% of the subject school's population participating. Students are required to register and pay a membership fee to offset supply costs. Even so, parents and grandparents in the area have been eager for this opportunity and are more than willing to pay the fee. The current project handed out a basic experiment kit to each child that included a box of basic school supplies and a binder for all their work. It is believed that in other area schools, this basic kit will become more important as a means of encouraging education to lower income areas.

Kingston Elementary Fourth Grade Classroom Nuclear Presentation

On February 22, 2006, Julie Ezold was invited to present nuclear science to Ms. Blount's fourth grade students. The concepts of radiation, (specifically alpha, beta, and gamma), shielding, half-life, fission, and applications of nuclear science were discussed. The students, 27 in all, were inquisitive and enthusiastic throughout the entire one and a half hour presentation.

Different examples of radioactive materials; such as sources, fiestaware dish, and lantern mantle, were measured with the detector, both with and without the shielding materials. The students were able to determine whether a source was a beta or gamma emitter by the type of shielding used. A demonstration of half-life was conducted using M&M candies in which the students tracked and graphed the data. Two different Co-60 sources, one that had been through four half-lives and the other through only one half-life, were measured on the detector and marked on the graph to show the effects of half-life.

Nuclear power was discussed by examining the fission process. In addition to fission, the students also recognized that the steam side of power generation is the same whether it is generated by nuclear, coal, or natural gas. Fuel pellet cards, provided by ANS, were given to the students. These cards helped to visualize the equivalent amounts of uranium, oil, and coal it takes to generate the same amount of energy. Needless to say, the students enjoyed the fuel pellets.

Katherin Goluoglu handing science kits to students

Anderson Area Association for the Education of Young Children

- On February 25, 2006, Katherin Goluoglu and Julie Ezold made a presentation to the Anderson Area Association for the Education of Young Children. The conference title was "Early Childhood Education Conference" and was held at the Roane State Community College, Oak Ridge Campus.

Continued on Page 5

Oregon State University -- Award Recognitions

Andy Klein, former NERHP Department head at Oregon State, is currently serving as Director of Education, Training and Research Partnerships at Idaho National Laboratory

Nuclear Engineering's former department head, Andy Klein, was recently awarded the prestigious Outstanding Engineering Award by Dean David Wormley of Penn State University's College of Engineering. Klein is currently on loan from OSU to the Idaho National Lab where he is the Director of Education, Training, and Research Partnerships.

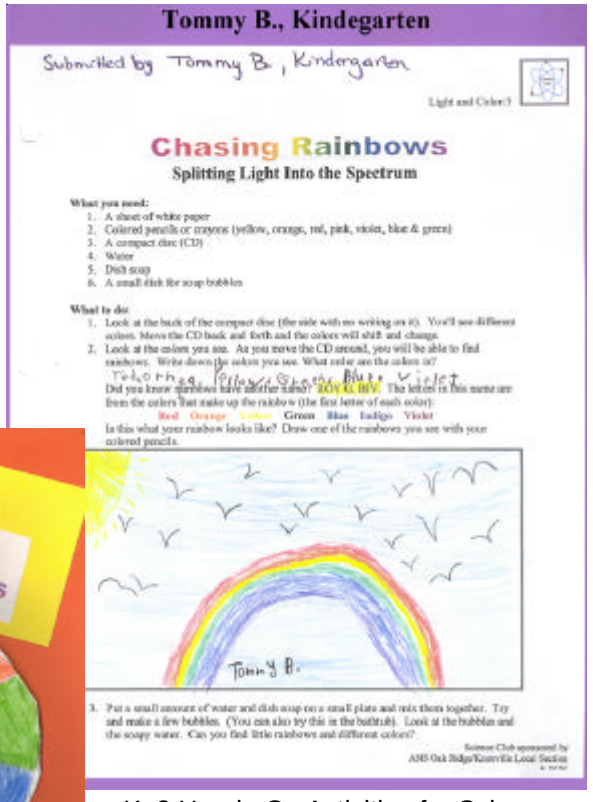
Christopher Francy, OSU NE Student has been selected as a 2006-2007 NANT Scholar. Sixty-nine scholarships at $2,500 each were awarded for the upcoming year.

OSU's Department of Nuclear Engineering & Radiation Health Physics Graduate Program receives top-ten ranking for 2007 by US News & World Report. This is the second year in a row that OSU's NE & RHP Graduate Program has taken top-ten placement as the ninth graduate program in the nation.

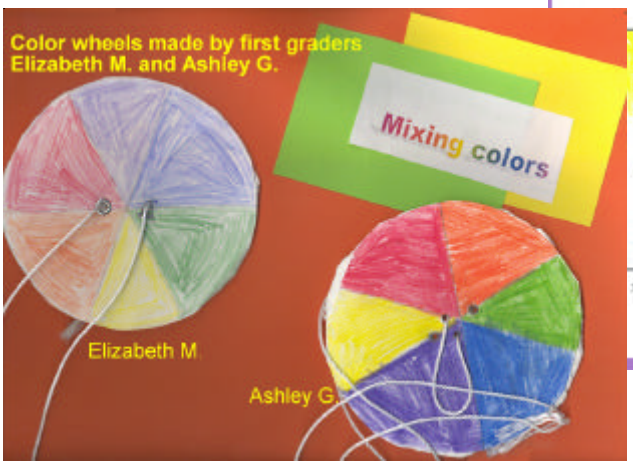
Christopher Francy, NE student at Oregon State University and 2006-07 NANT scholarship awardee

From Page 4
(Science Club)

- Goluoglu and Ezold presented "Science Club: K–2 Hands-On Activities for Science Education."
- There were approximately 30 teachers and after-school care givers.
- Goluoglu gave an overview of the pilot project at Farragut Primary School.
- The two current experiment packs were discussed (Light and Colors and Geology).
- Hand-outs of both experiment packs were provided to the attendees.
- The "Newton Wheel" experiment from the "Light and Color" pack was conducted by all the attendees (hands-on part of the presentation).
- Giveaways included: Yucca Mountain Rocks, bookmarks, and the DVDs of the solar eclipse.



K–2 Hands-On Activities for Science Education



University of Michigan ANS Student Chapter Makes a Difference

The University of Michigan Student Chapter of the American Nuclear Society (UM-ANS) has had a very active and productive year. The UM-ANS won both a national award (the 2005 ANS Samuel Glasstone Award) and a Michigan Engineering award (the 2006 Elaine Harden Award), for their service, outreach, professional development, and social activities, some of which are described below.

Outreach

Saline Middle School Classroom Visits – A UM-ANS graduate member visited Saline Middle School to teach four science classes about basic quantum theory, radioactive decay, nuclear power plants, nuclear proliferation, and medical applications of nuclear sciences.

UM-ANS Member Teaching Middle School Science Class

Southeast Michigan Science Fair Judging – UM-ANS member served as volunteer judges for the annual Southeast Michigan Science Fair.

Detroit Area Pre-College Engineering Program (DAPCEP) – UM-ANS members served as instructors and teaching assistants for DAPCEP, a program which exposes eighth- and ninth-graders to engineering fields, including nuclear engineering topics such as isotopes and radiation, detectors, fission and power plants, plasmas and fusion, nuclear waste, and spent fuel casks.

Professional Development

D.C. Cook Nuclear Power Plant Tour – UM-ANS members visited the D.C. Cook Nuclear Power Plant in Bridgman, Michigan during an all-day field trip. Areas toured included: the Energy Information Center, the Training Center, and the Control Room Simulator.

DAPCEP Students with UM-ANS Members at the Ann Arbor Hands-On Museum

Michigan Section ANS Student Presentations – Six UM-ANS members presented results of their research at the annual student presentation meeting of the Michigan ANS Section.

University, College and Department Involvement

Welcome Days – UM-ANS prepare exhibit tables to distribute information about ANS and the NERS Department at Welcome Days for new undergraduate and graduate students.

Tech Day – Tech Day is one of the College of Engineering's largest annual recruitment programs. Approximately 1000 high school students and their parents visit campus, tour the various engineering departments, and meet representatives from student societies during this one-day event. UM-ANS prepares an exhibit booth to share information about the department and nuclear engineering in general.

NERS Industry Forum and Career Fair – UM-ANS members participated in the annual Career Fair and Industry Forum which included recruiters from: Los Alamos National Laboratory, Idaho National Laboratory, Oak Ridge National Laboratory, Lawrence Livermore National Laboratory, Knolls Atomic Power Laboratory, Sandia National Laboratories, Argonne National Laboratory, Westinghouse, Framatome NAP, Duke Power, American Electric Power, Eli Lilly, DTE Energy, Aerotek Energy Services, U.S. Navy, Dow Chemical, Dominion, Nuclear Management Company, and General Electric.

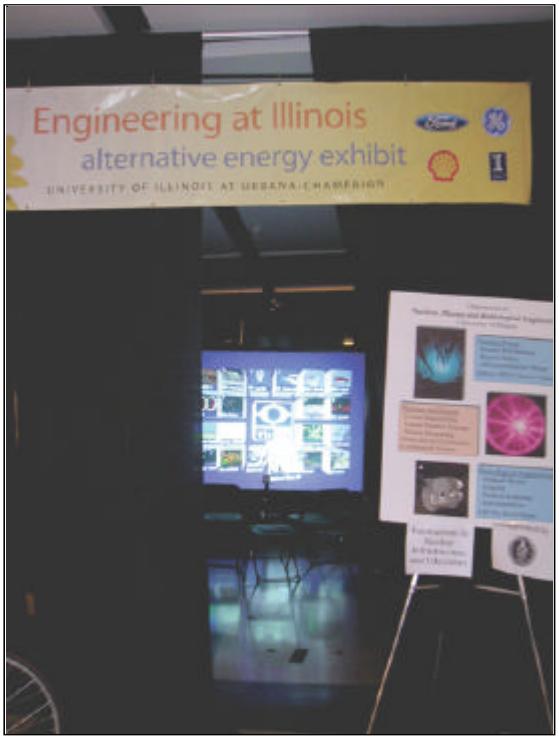
UM-ANS Members at the Annual NERS Career Fair

Social

The UM-ANS also brings members together for fun events. Some of the fun events that are sponsored by the student society include: spring and fall picnics, pizza parties, holiday lunch, ice cream social, ice skating, bowling, reflecting pool races, and intramural sports.

VisBox Shows Virtual Nuclear Reactor at Chicago Museum of Science and Industry

The University of Illinois' Nuclear, Plasma & Radiological Department went a step further in its public outreach efforts this past spring when the "Virtual Reality show" was taken on the road to the Chicago Museum of Science and Industry.

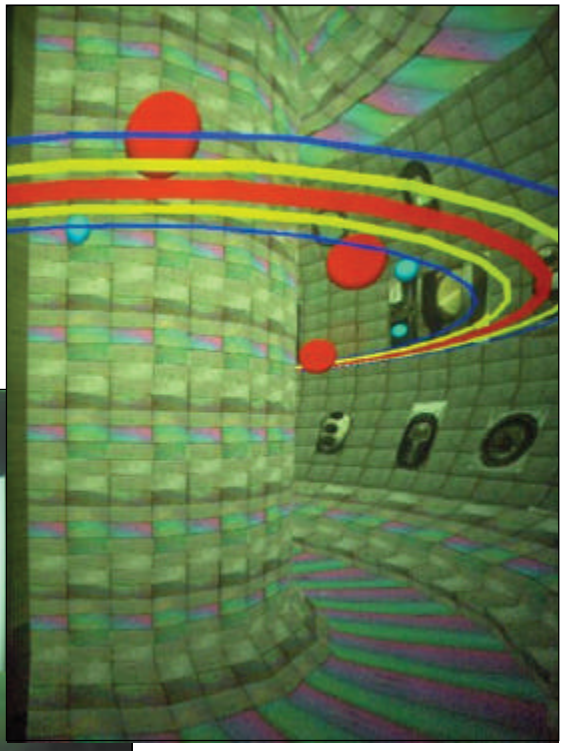


VisBox set-up at the Chicago Museum of Science & Industry

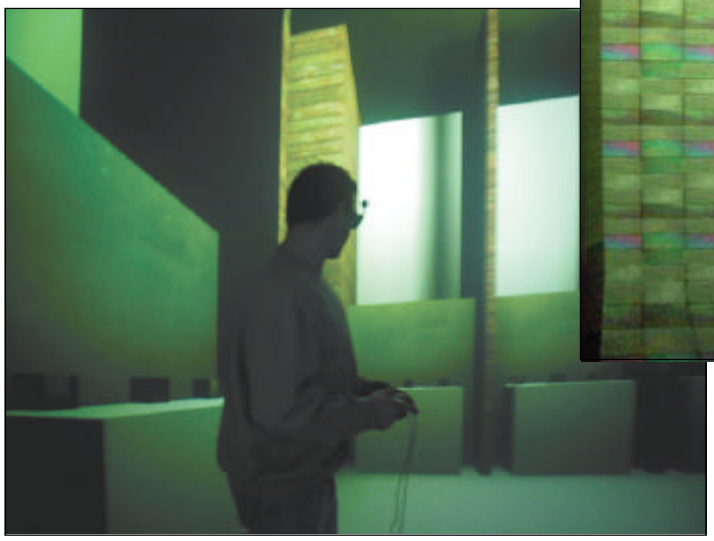
The VisBox, a state-of-the-art 3D visualization system that can be used for training and managing nuclear reactors, was part of the "Best of Engineering at Illinois" showcase at the museum March 31 and April 1 and 2. Several viable forms of alternative energy and related technologies from the UIUC College of Engineering were exhibited in conjunction with the Chicago Public School's Annual Science Fair celebration at the museum.

Much like a walk-in video game, the portable virtual reality (VisBox) unit had entertainment value for the estimated 5,000 high school students who visited the museum exhibit. More importantly it gave the students a chance to learn about nuclear power. "Having a strong nuclear engineering program and the virtual-reality technology available to demonstrate these tools reinforces the university's leadership position in this critical industry," said Rizwan Uddin, NPRE professor and virtual reactor and visualization research program coordinator.

NPRE's latest use of the VisBox builds on earlier efforts to bring the technology to the attention of industry and the public. In spring 2005 the department co-sponsored, with EPRI, a UIUC workshop, "Visualization to Support Human Decision-Making: Technology Demonstrations and Application Discussions." Last summer, 15 to 20 local high school students worked on several projects related to the virtual reactor program. The Department of Energy provided funding for the high schoolers under the INIE-Big10-minigrant program. The high school students used the VisBox to create a virtual representation of the local University High School, as well as designed and developed virtual experiments involving (virtual) radiation.



Model of a tokomak fusion reactor



Model of a room with shielding. The model was built by high school students.

Happenings at North Carolina State's Nuclear Engineering Department

Increasing Graduating Classes At NC State University

NC State's Nuclear Engineering department has seen an increase not only in enrollment but also in graduating classes. On Saturday, May 13, 171 family, friends, faculty and staff members congratulated 18 undergraduate and 6 graduate students graduating with a Bachelor of Science, Master of Science, Master in Nuclear Engineering or doctoral degree. Job prospects are great for these students, ranging from employment with major vendors (GE and Areva) to utilities (Progress Energy and Duke Energy) to government agencies (Department of Defense).

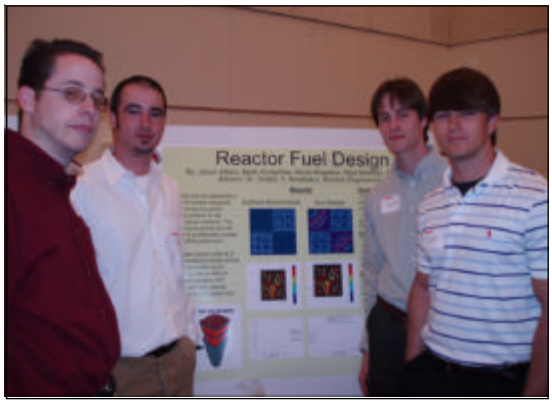

From Page 11
(WNSA on OSU)

NC State's Nuclear Engineering 2006 Graduating Class

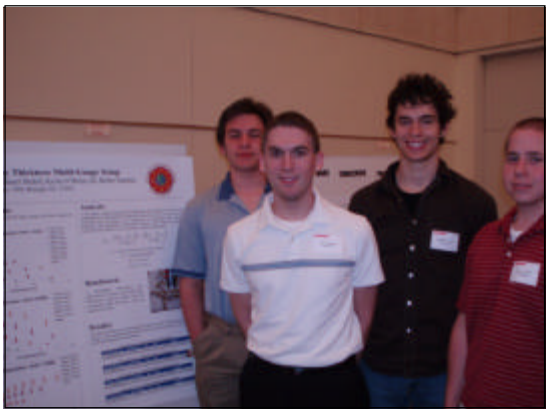
NC State's Nuclear Engineering Department Makes Presence Felt at the 15th Annual Undergraduate Research Symposium

The Undergraduate Research Symposium highlights some of the finest work and thinking at NC State University. The objectives of the Symposium is to demonstrate the importance of research in the undergraduate experience, to recognize the contributions made by undergraduates to research, and to stimulate research involvement by young people. Research topics from NC State's Nuclear Engineering students included:

- Enhancement of Thermal Flux at Beam Tubes and Thermal Column for NCSU PULSTAR
  - Student Authors: Jennifer Bowie, Gene Bennett, Ralph Williams, Chris Hardiman, Daniel Long and Burnie Brinn.
  - Research Mentors: Drs. Bourham, Doster and Turinsky
- Optimization of an Aluminum Alloy Thickness Multi-Gauge Setup
  - Students: Brandon Clark, Andrew Mallner, Daniel Bedell, Francisco Robles and Kevin O'Brien
  - Mentor: Dr. Gardner
- MOX Fuel Assembly Design



MOX Fuel Assembly Group Photo



Aluminum Alloy Group Photo

Thermal Flux Group Photo

Continued on Page 9

From Page 8
(Happenings)

- Students: Eric Moss, Jason Elkins, Mark Humphrey, Kevin Kingston and Neal Mahedy
- Mentor: Dr. Anistratov

• A Transportation Cask for High Burnup Spent Nuclear Fuel

- Students: Paul Swaney, Devon Bell, Wesley Broome, Justin Ogburn, Alan Rominger and Tyler Schweitzer
- Mentor: Dr. Yim

Nuclear Engineering Students Continue To Take On-Campus Leadership Roles

The Engineers' Council is the representative assembly for the engineering undergraduate student body at North Carolina State University. The Council meets regularly and addresses issues of concern to engineering students and to appropriate funds to Engineering organizations. The Council is also involved in the organization of events and activities for engineering students, including the Engineering Career Fair and E-Week. Of particular note, the career fair saw 180 companies and over 2000 student participants. At the helm during this accomplishment was Tyler Schweitzer, graduating nuclear engineering senior. The chair-elect, for 2006-07, is another nuclear engineering student, Casey Fields.

North Carolina State's Nuclear Engineering Alumnae in the News

Director of National Intelligence, John D. Negroponte, presented the first DNI Fellows Awards to nine renowned members of the Intelligence Community. These awards recognize and rewards outstanding technical achievement within the Intelligence Community.

"These distinguished experts are the best of the best professionals in whom we have enormous trust and confidence," said Director John D. Negroponte. "As globalization spreads technology to the far corners of the globe, the Intelligence Community's S&T leaders must devise ways to maintain our competitive advantage."

A $200,000 research grant is awarded to each Fellow to perform government intelligence technology research. Grants may be applied to fund current or future research initiatives and may be used to support research assistants within their organization, contract to external research groups, or to inaugurate new research programs.

Dr. Dwight Williams

Dr. Dwight Williams received his bachelor of science in 1992, and his masters of nuclear engineering in 1994 from North Carolina State University. He earned Ph.D. in nuclear engineering from Maryland.

The National Society of Professional Engineering first African-American National Young Engineer of the Year was recently awarded to him as well. Dr. Williams serves as the Principal Nuclear Physicist in the Defense Intelligence Agency's Science and Technology Brain Trust within the Directorate for Measurements and Signatures Intelligence (MASINT) and Technical Collection.

Continued from Page 2
(Radiation Studies)

tures. Researchers can only speculate that the diffusion and composition-changes occur in the same manner at lower temperatures. Add radiation and the diffusion mechanisms become more complex. Morgan's models enable the researchers to calculate diffusion parameters in complex materials under radiation.

Coupled with accelerated *ex situ* reactor experiments, which are fast to perform but are not strictly representative of the multi-year damage that occurs in a nuclear system, the duo's more accurate models can help researchers predict how materials such as steel might behave over a reactor's lifetime. "And if you really start to understand the fundamental mechanisms of radiation damage, you gain the ability to predict how changes to the material could improve its properties," says Allen. "If you understand things on a fundamental basis, it's easier to translate your accelerated experiment into the performance of the real system."

Effect of the Western Nuclear Science

The Western Nuclear Science Alliance (WNSA), with Oregon State University (OSU) as the lead institution, has been in existence for 3 ½ years. The consortium is funded under DOE's Innovations in Nuclear Infrastructure and Education (INIE) program. Members of WNSA include Idaho State University, Oregon State University, Reed College, University of California Berkeley, University of California Davis, University of California Irvine, University of Nevada Las Vegas, University of Utah, Washington State University; INL, LANL, LLNL, PNNL; Energy Northwest, Entergy, and Exelon. Total funding for the first four years is $5.25 million.

Major WNSA accomplishments at OSU center around education, research, and infrastructure improvements. New programs instituted with WNSA funding include distance education, radiochemistry education and research, neutron radiography, laboratory equipment upgrade, and increased graduate and minority student support.

Distance Education

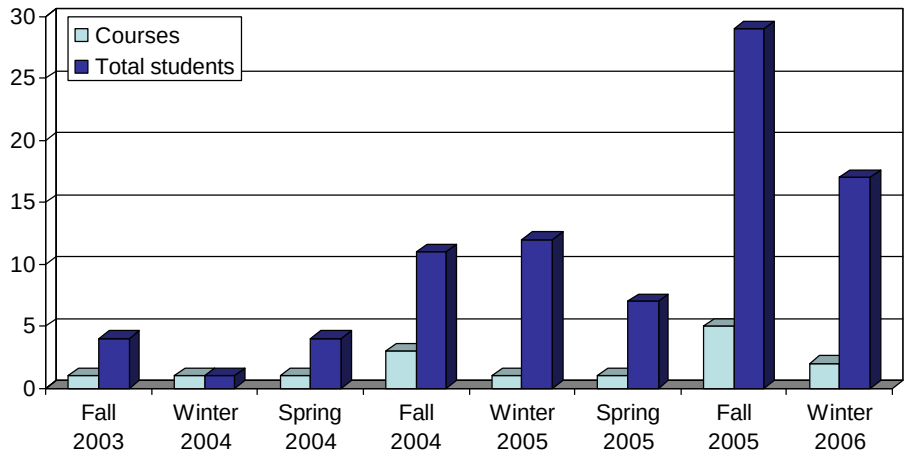
The objective of the OSU distance education program is to offer off-campus Radiation Health Physics (RHP) graduate courses and degrees *concurrent* with on-site courses. The program began in Fall 2003 with a goal of having the bulk of the RHP graduate courses available to off-campus students within about three years. By the end of Summer 2006 all the RHP graduate courses will have been offered at least once, including two RHP laboratory courses (Advanced Instrumentation and Radiochemistry) which will be offered as one-week intensive on-site courses.

Originally the Nuclear Engineering graduate program was going to be offered as well. However, because of lesser interest, limited course rollout, and export control issues, the focus has been limited to the RHP program for which enrollment continues to climb. About 10-12 new degree seeking students are being admitted to this program annually. Twenty-four students are now enrolled via distance as degree seeking RHP students. A significant number of these students are currently working in the health physics and medical communities.

Several factors have been implemented to support the distance education program. To facilitate the off-campus, place-bound student, a Master of Health Physics (non-thesis) degree has been added as a terminal degree. The main OSU Radiation Center classroom has been converted into a distance learning center capable of teleconferencing and remote course delivery. RHP courses are taught live via web streaming and delayed archive. The upgraded classroom and course delivery mode help address WNSA's goals of developing highly skilled nuclear scientists since graduate students who cannot come to campus can take advantage of remote offerings. An overarching precept in the distance education program is to offer a quality education for distance students at the same level as for on-site students.

Radiochemistry Education and Research

Historically OSU has had an emphasis on radiochemistry at the Radiation Center since the 1960s. With retirements that program declined significantly. The INIE award allowed OSU to revive its radiochemistry education and research programs with the hiring of a full-time radiochemist, Dr. Alena Paulenova. In the past three years Dr. Paulenova has developed new radiochemistry courses (lecture/laboratory) to address the critical issue of shortage of trained radiochemists in the national laboratories. The radiochemistry courses integrate all facets of nuclear science, being tailored for students in RHP, Nuclear Engineering, and Pharmacy. This has also led



to a newly created tenure track position in Radiochemistry in the Department of Chemistry.

Radiochemistry research has also increased strongly in the past three years with enrollment growing from zero to six students (four graduate students, two of whom are DOE Graduate Research Awardees, two undergraduates, one of whom is a DOE Undergraduate Research Awardee) and one Post-Doctoral appointment.

Radiochemistry research opportunities at OSU have also increased rapidly. Primary research areas include chemical speciation and separation of actinides, lanthanides, and fission products; interdisciplinary studies (environmental, biomedical, nano- and material science), and speciation and distribution of plutonium and other actinides in UREX separation processes. In particular, studies are ongoing investigating the structural (FT-IR, Raman, NMR) aspects of actinide complexes with organic ligands (kinetics of radiochemical reactions, surface reactivity and AFM/SEM imaging of irradiated surfaces, and radiolabeled nanoparticles for imaging (NIH, pending, OHSU foundation)

Both radiochemistry education and research have been assisted by new laboratory remodeling and equipment purchases, including a new Cobra autogamma counter, Dionex ion-chromatography, automated titrator, autogamma counter, flow-injection analysis valve, ESI-MS, and an HPLC/electronspray/MS/MS system.

There has been Increased radiochemistry research collaboration within OSU (Chemistry, Veterinary Medicine, Chemical Engineering, Oceanography), nationally (Argonne National Laboratory-West, Idaho National Laboratory, Pacific Northwest National Laboratory, University of Nevada Las Vegas, Washington State University), and internationally (JAERI). This has led to funding from DOE NERI (AFCI) and OSU Office of Research with several more proposals, including an INL LDRD pending.

In all, a tremendous revival in a short time with bright prospects for the future.

Neutron Radiography

As with radiochemistry, neutron radiography had flourished in the past, primarily in the early 1980s. Again, due to retirements, this capability was all but lost. A former radiography facility had laid dormant for nearly two decades. The INIE grant changed all that. By October 2004 a new Neutron Radiography Facility had been designed and built in the OSU TRIGA reactor bay with an objective of resurrecting neutron radiography to a state-of-the-art level at OSU. Significant assistance in the design phase was supplied by radiographers from the University of California Davis McClellan Nuclear Radiation Center facility, one of the WNSA members. The new facility has real-time capability with digital image plate technology and a CCD camera / image intensifier real-time imaging system. The facility was declared fully operational in May 2006.

Applications for the Neutron Radiography Facility include neutron tomography, two-phase flow studies, analysis of soil thin sections and hydrogen movement in soils. Three multidisciplinary research proposals are currently in review with a total funding of ~$1.2 million. To date one graduate degree has been completed and two others are in process for work related to the facility.

Laboratory Equipment Upgrade

Before the INIE grant the undergraduate radiation detector and the radiochemistry teaching laboratories at OSU were still operating on equipment purchased primarily in the 1970s. With the INIE grant the radiochemistry laboratory was upgraded to modern standards. The radiation detection laboratory was equipped with new NIM counting electronics to teach nuclear instrumentation and detection methods. Also purchased were three Perkin-Elmer single-sample liquid scintillation counting systems and eight NaI gamma spectrometry systems (germanium spectrometry systems are available for student use in another laboratory). The laboratory can now handle laboratory sections of up to 24 students with modern, functional equipment.

Graduate and Minority Student Support

The INIE grant has been used to meet the objective of enhancing financial opportunities for

Continued on Page 12

Nuclear Infrastructure and Education-Nuclear Energy Research Advisory Committee (INIE-NERAC) Workshop

On May 16–17, 2006, representatives of the Nuclear Energy Research Advisory Committee (NERAC) and participants in the Innovations in Nuclear Infrastructure and Education (INIE) program attended a workshop in Oak Brook, IL. The purpose of the workshop was to assess progress being made by the six INIE consortia toward the goal of improving the infrastructure for nuclear engineering education. The workshop was attended by Bob Long and Jose Cortez from NERAC and 63 university participants representing the 36 institutions involved in the six INIE consortia (Big 10, Midwest, New England, Southeast, Southwest, and West). The workshop began with a general session in which Bob Long, Jose Cortez, and Mike Corradini described a pair of reports prepared for NERAC in 2001 and 2002 that documented the tenuous status of nuclear engineering programs and research reactors at that time and which proposed a series of recommendations to DOE to address the problem. The INIE program, now in its fourth year, is a result of those recommendations, and workshop participants were given the task of assessing progress to date and developing a path forward. Breakout groups in education, infrastructure, and research met separately to identify accomplishments, establish goals, and develop recommendations in their respective areas. The results from each group were presented to all of the attendees. The list of educational enhancements, infrastructure improvements, and research initiatives is impressive; and there was general consensus that INIE is playing a key role in the revitalization of nuclear engineering education and university research and training reactors.

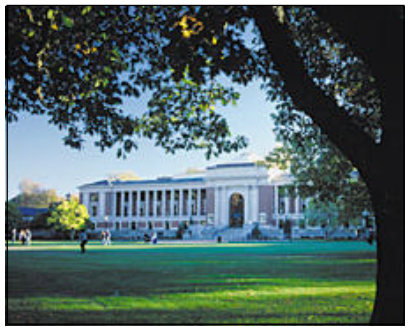
From Page 11
(WNSA on OSU)

underrepresented minority undergraduates (including females) and funding for graduate students. Four year undergraduate scholarships have been awarded to six minority individuals. Graduate assistantships have been provided to 16 individuals, three students being funded for the entire two years of their MS degree program and 13 students partially funded in order to leverage funding from year to year. To date eight MS degrees have been awarded to students funded under the INIE grant.

Synopsis

The WNSA INIE grant has allowed the building of the OSU Neutron Radiography Facility and upgrading of OSU nuclear classrooms and laboratories. These would never have been possible without the INIE grant. The WNSA INIE grant has been used as significant leverage of other funds for equipment purchases, establishment of new faculty positions, and obtaining grants that would not have been possible without the INIE grant.

At OSU several important factors have recently coalesced into elevating the status of the Department of Nuclear Engineering and Radiation Health Physics and the Radiation Center within the university, nationally, and internationally. These factors include OSU's internationally recognized $13+ million thermal hydraulics facilities and research program, becoming a lead institution for an INIE grant, being a top ten ranked graduate Nuclear Engineering program, and OSU's selection as a member of the National University Consortium of the newly formed Idaho National Laboratory. These factors have reinforced each other wherein success has bred more success. As a result, the OSU Radiation Center and Department of Nuclear Engineering and Radiation Health Physics are currently being showcased by the OSU administration for a major $10 million building upgrade, establishment of an additional sponsored faculty chair position, a new Medical Physics program, and new faculty positions. The INIE grant has been an important focal point in achieving this status. Morale and enthusiasm of the department's faculty are at an all time high.



Oregon State University

USDOL High Job Growth Training Initiative Grant for RP Technician Education Supporting the Nuclear Utility Industry

In response to the nuclear energy industry's need for well-trained radiation protection technicians, the US Department of Labor (DOL) Employment and Training Administration awarded a $2.3 million grant to the University of Missouri-Columbia (MU) as part of the President's High-Growth Job Training Initiative (HGJTI) for the energy sector (nuclear, coal, oil, and natural gas). National manpower studies of nuclear industry staffing needs have cited that, with an aging existing workforce, a significant shortfall in available personnel to fill radiation protection jobs will occur, starting within the next five years. The DOL grant to MU is designed to specifically address this manpower shortfall.

MU and its curriculum development partner in the DOL grant — the Linn State Technical College's Advanced Technology Center (LSTC/ATC; Mexico, MO) — received the DOL funding to establish the Center of Excellence for Radiation Protection Technology Education and Training. The primary near-term goal of the Center is to develop a standardized, industry driven curriculum for an Associates of Applied Science Degree in Nuclear Technology. The curriculum — which is based on industry standards (INPO ACAD and DOE criteria) and ABET continuous improvement principles — will be disseminated to community colleges throughout the country.

Dr. William Miller (PI of the DOL grant; Professor of MU Nuclear Engineering and Research Associate at the MU Research Reactor Center) is working closely with Drs. David Jonassen and Rose Marra in MU's School of Information Science and Learning Technologies to create a coordinated set of educational materials to enhance student learning. One of the objectives of the curriculum development process is to address the educational needs of diverse learners (e.g, women, minorities, veterans), who are currently underrepresented in RP technician jobs.

The AASNDT curriculum being developed is based on a model degree program implemented by LSTC/ATC. Under funding from a US DOE Innovations in Nuclear Infrastructure grant to the Midwest Nuclear Science and Engineering Consortium, LSTC/ATC developed and implemented their two-year degree in consultation with AmerenUE's Callaway Nuclear Plant and MU's Nuclear Science and Engineering Institute. LSTC/ATC will be graduating its first cohort of RP students in July 2006.

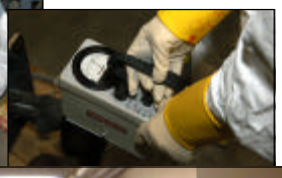
Four community colleges are working with MU and LSTC/ATC to initially receive and test the curriculum prior to national dissemination. These schools and their nuclear utility partners are:

- Central Virginia Community College (AREVA Framatome ANP)
- Hill College (TXU Power / Comanche Peak)
- Miracosta Community College (Southern California Edison / San Onofre)
- Estrella Mountain Community College (Arizona Public Service Company / Palo Verde)

The US Center for Workforce Preparation (*Washington, DC*) is also collaborating in the DOL grant to assist participating schools with local workforce relations and economic development initiatives.

A unique feature of the degree program being constructed is a paid internship at a nuclear utility in order for students to gain invaluable professional

Linn State Technical College Nuclear Technology Students Rebecca Case (left) and Jennifer Swader assess the radiological conditions prior to work on a simulated radioactive piping system. The rest of the class (background) evaluate their performance.



Students prepare for lab. Buddy Fisher (l), Eric Renn, and Nicole Weimer (foreground) are the students. Bruce Meffert, their Instructor, is in the background.

Continued on Page 18

UNLV NE Students Win ME Design Competition

A group of mechanical engineering seniors at the University of Nevada, Las Vegas (UNLV) who have taken a specialization (minor) in nuclear engineering have won the Harriet and Fred Cox Senior Design Award in the Mechanical Engineering Senior Design Competition. At UNLV senior engineering students complete a two-semester design course where they design, construct, and demonstrate the performance of a real system. Last fall ANS member Dr. Denis Beller proposed a project to design a high-power accelerator target for the DOE's AFCI Reactor-Accelerator Coupling Experiments Project, which he conducts through Idaho State University's Idaho Accelerator Center. The RACE Project is a multi-national collaboration involving five U.S. universities and several teams in Europe.

A group of ME seniors, Timothy Beller, Brice Howard, and Ryan LeCounte, who have taken a sequence of nuclear engineering courses that covered topics such as radiation transport calculations, nuclear detection for homeland security, and radioactive waste management, accepted the challenge. The students went through several design iterations including the fabrication of a rapid prototype in nylon, settling on a water-cooled multi-plate tungsten target contained in a solid aluminum housing with a natural uranium neutron generator. They then purchased supplies and fabricated the body and other components at UNLV while the tungsten plates were cut and machined at the Idaho Accelerator Center. The design team then assembled and pressure tested the target in Nevada, followed by thermal and neutron production performance testing with a 22-MeV electron linac at the Idaho Accelerator Center.

On Monday, May 1, the students presented their final report, then on Tuesday they presented a poster at the ANS International High Level Radioactive Waste Meeting in Las Vegas, and on Wednesday they defended their design and hardware in a public senior design competition judged by engineering professionals, including representatives from the Bechtel-SAIC Corp. (Yucca Mountain Project) and the Washington Group. At the awards banquet Friday evening, with about 250 professionals, faculty, and students and their families in attendance, Mr. Fred Cox, Founder and Chairman Emeritus of Emulex Corp., Mrs. Harriet Cox, and H. K. Desai, Pres., CEO, and Chairman of QLogic Corp., presented Mr. Beller, Mr. Howard, and Mr. LeCounte with the first place award for Mechanical Engineering design (Emulex and QLogic are leading suppliers of components to Cisco, Dell, EMC, HP, IBM, NEC, Network Appliance and Sun). Each student received a plaque and they will share the $1000 first place award.

The target has since been shipped to the Idaho Accelerator Center, where it will continue to be used for testing for the RACE Project in an international collaboration with UNLV and with scientists and engineers from the European community.

(L to R) Brice Howard, Fred Cox, Tim Beller, and Ryan LeCounte with the poster from the winning project

Mr. Howard has taken a position with Bigelow Aerospace in Las Vegas (manufacturer of space systems such as commercial space planes and space stations), and Mr. Beller and Mr. LeCounte have applied to enter graduate school at UNLV in the M.S. in Materials and Nuclear Engineering degree program, with entry expected this fall. They will conduct research for the UNLV Transmutation Research Program. On Saturday morning Mr. Daniel Lowe became the first graduate from this new nuclear engineering degree program.

University of Florida -- Nuclear and Radiological Engineering

Nuclear Engineering Meets Growth Challenge

The University of Florida (UF) Nuclear and Radiological Engineering (NRE) is coping with dramatic growth. Since fall 2001, UFNRE's student population has jumped from 74 to 175, of which 72 are graduate students. In addition to a B.S. in nuclear engineering, NRE offers three graduate programs—nuclear engineering, medical physics, and health physics.

Recently, 22 of NRE juniors and seniors were on the Dean's list. For the 2005-2006 academic year, NRE recruited 22 graduate students among more than one hundred applicants. The total research contribution brought into UF by NRE reached ~$4.3 million. The NRE faculty was awarded the highest amount of funding per faculty at the College of Engineering.

In addition, the Florida Institute of Nuclear Detection and Security (FINDS) is growing rapidly, thanks to the faculty. Considering this Institute was started 18 months ago, it has made impressive gains. Nearly 20% of NRE's research funding currently is related to FINDS. Relative to FINDS, Drs. Glenn Sjoden and James Baciak were the very first professors at UF to receive a DHS grant. The project is entitled, "*Synthetically Enhanced Detector Resolution Algorithm (SEDRA).*" This project seeks better clarity in detectors that have characteristically lower resolution.

Visiting Engineer & Professor Adds to NRE Skills

Dr. Ren-Tai Chaing, recently retired from the General Electric Company, is visiting Nuclear & Radiological Engineering as an adjunct professor teaching two undergraduate courses. Dr. Chaing is the primary developer of a software package for computing the 3D distribution of neutron and gamma fluences in a BWR. He received his Ph.D. in Nuclear Engineering from the University of Illinois at Urbana-Champaign, his M.S. in Nuclear Engineering, and a B.S. in Physics from Universities in Taiwan. He is a fellow of the ANS.

Dr. Ren-Tai Chaing, retired General Electric principle engineer and new adjunct professor of Nuclear Engineering is greeted by Dr. Alireza Haghighat, professor and chairman of University of Florida's NRE department.

IAEA Fellow Visits NRE

Desislava Kirilova is an IAEA fellow visiting NRE from the Institute for Nuclear Research & Energy in Bulgaria.

Miss Desislava Kirilova, from the Bulgarian Nuclear Energy Research Institute, is sponsored by the IAEA to receive training in advanced radiation transport methodology/codes for simulation of power reactors. Miss Kirilova is working with the UF Transport Theory Group (UFTTG) under the supervision of Prof. Haghighat, Director of UFTTG. She will apply the UFTTG methodologies for simulation of Russian VVER designs.

Southern Nuclear Operating Co. Donates to NRE

Southern Nuclear Operating Co. (SNOC) recently came to Gainesville and presented Chairman Dr. Alireza Haghighat with a $10,000 grant to fund two engineering scholarships. Michael Stinson, Vice President of the Farley Nuclear Power Station was joined by Ken Folk, Manager of Reactor Core Analysis, Corporate Office; Mr. Pete Wells, General Manager of the Hatch Nuclear Power Station, Mr. Rob Szollosy, Plant Engineer at Farley Power Station; and, Mr. Ryan Joyce, Core Engineering at Corporate Office.

"NRE appreciates generous contributions and support of Southern Nuclear over the past eight years, and looks to initiate new collaborations addressing the workforce and the research needed for the maintenance of existing plants and the building of new power stations," said Dr. Haghighat.

On hand to accept the grant was the College of Engineering Dean Pramod Khargonekar. "We are exceptionally pleased to continue our long relationship with Southern Nuclear," Dean Khargonekar said, "especially considering the promise of increased nuclear power in the country."

Continued on Page 16

Continued from Page 16
(University of Florida -- NRE)

Mike Stinson reiterated the growth of the energy requirements, "Growth statistics say the southeast portion of our country will be the most heavily populated area in the U.S. over the next 25 years," he said. "And to respond to this growth, SNOC is establishing partnerships with other utilities in building six new nuclear units in strategic locations in the Southeast."

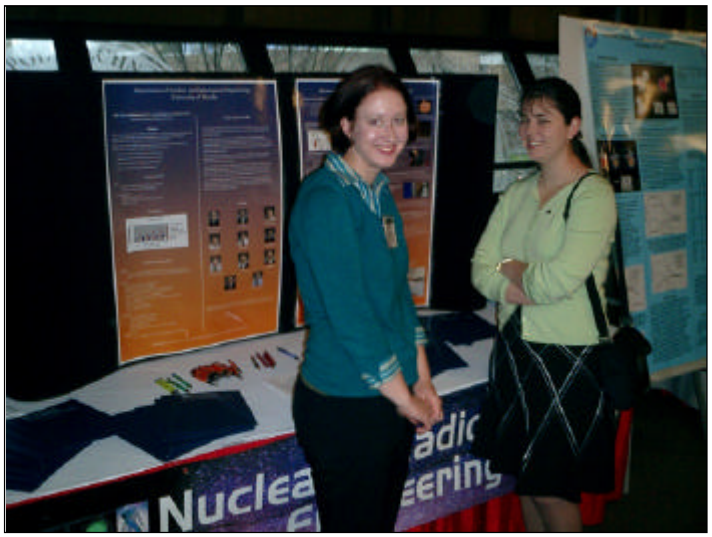
While visiting the department, the group joined Dr. Ed Dugan to view the status of nondestructive testing research for the NASA Space Shuttle using lateral migration radiography. Also, Dr. Haghighat provided an explanatory tour of the Particle Transport Distributed Computing Laboratories and its supercomputing clusters, which are used to perform detailed simulations of nuclear power plants, and medical devices, nuclear security and detection devices.

SNOC's contribution will be matched by funds from the DOE-Match Program to offer two Southern Nuclear Operating Company Elite Nuclear Engineering Scholarships.

Mike Stinson (l), Southern Nuclear Operating Company vice president of Plant Farley, enjoys a moment during the cutting of a cake commemorating a significant SNOC contribution to NRE with department chairman Dr. Alireza Haghighat.

ANS Students Attend Conference

Eight undergraduate and five graduate NRE students attended this year's American Nuclear Society (ANS) national student conference in early April at Rensselaer Polytechnic in Troy, NY. The conference offered a glimpse of the future leaders in academia, government and industry, while featuring presentations from experts.



Colleen Polit (l) and Lauren Nalepa were two students who represented the University of Florida at the Student ANS Conference at Rensselaer Polytechnic Institute in April.

Two awards were bestowed upon Florida nuclear engineering students. Mike Liesenfelt and Brian Triplett won best presentation in the "Reactor Design" technical session for the presentation on a design project entitled "Low Enriched High Flux Isotope Reactor Design." Also, Max Minch and Matt Denman won best poster for their reactor design project.

Progress Energy Florida Donates Funds to Refurbish Lab

Progress Energy Florida, which operates the Crystal River Nuclear Unit on Florida's west coast, has donated $100,000 to Nuclear & Radiological Engineering to help renovate UF's Advanced Radiation Detection Laboratory. The new laboratory is expected to help develop new generation radiation detectors applicable for national security purposes. The laboratory also provides opportunities for UF undergraduate and graduate students to learn about and operate various radiation detectors, detector systems, and their associated electronics. Other nondestructive testing equipment is also available for investigative/educational purposes. Mr. William Habermeyer, President of Progress Energy Florida, came to Gainesville to visit and dedicate the AdRad Lab, together with Dr. Alireza Haghighat. "We are pleased to continue this university-industry association, which promises many important detector developments that can help utilities and our nation as well," Dr. Haghighat said.

A New Medical Physics Graduate Program at Georgia Institute of Technology

An on-campus and distance-learning graduate program in Medical Physics (MP) was created by Georgia Institute of Technology in cooperation with the Emory University School of Medicine in 2004. The program is administrated by Georgia Tech; Emory handles the clinic rotation and teaches 2-3 of the Georgia Tech courses.

Currently, the program offers a Master of Science in Medical Physics (MSMP) degree and a Ph.D. degree as an option under the nuclear and radiological engineering program. The MSMP degree program is intended to prepare the student with a bachelor's degree in science or engineering for productive careers in medical physics. The MSMP has minimum requirement of a total of 30 credit hours for the non-thesis option and 33 credit hours for the thesis option. The doctoral degree requires 42 credit hours of course work beyond the bachelor's degree or 12 credit hours of course work beyond the master's degree.

The clinical rotation and laboratory course offered each summer is designed to familiarize students with the relevant hospital/clinical environment. The course includes clinical experience in nuclear medicine physics, diagnostic imaging physics and nuclear therapy physics.

The MSMP program is also available to the distance-learning (DL) students. The admission criteria and degree requirements for the DL students are the same as those for the on-campus students.

Systems Analysis May Guide Fuel Cycle Decisions

University of Wisconsin-Madison Assistant Professor of Engineering Physics Paul Wilson is working with researchers in the Department of Energy Global Nuclear Energy Partnership (GNEP) to develop systems analysis tools to answer questions of interest.

By minimizing waste, maximizing resources and addressing the risk of proliferation, GNEP aims to improve the use of nuclear energy around the world. In particular, says Wilson, researchers hope the effort will restart a U.S. spent nuclear fuel recycling program with an engineering-scale facility for aqueous separations of spent nuclear fuel, fuels testing in a fast flux reactor, and fast-reactor fuel reprocessing and fabrication.

Paul Wilson

Systems analysis is guiding the decision-making process by allowing researchers to estimate the total system impact of different fuel-cycle decisions over a 100-year period. The holistic approach includes a wide variety of metrics such as the cost of electricity, the amount of spent-fuel repository space that will be necessary, and the amount of separated plutonium that exists at any time in the system.

With funding from the Nuclear Energy Research Initiative, Wilson is investigating economically efficient fuel cycles under the constraint of a single spent-fuel repository, including new models for financing and pricing the repository space, and what is an economically favorable fuel cycle.

Optimization methods in systems analysis tools are emerging as an important alternative to complicated feedback mechanisms within the systems analysis models. Wilson also is reviewing and recommending optimization methods for a new systems analysis tool, with funding from the Idaho National Laboratory Laboratory-Directed Research and Development program.

To that end, for the GNEP effort, he is implementing different optimization and decision-making algorithms to find solutions that either optimize one variable, such as economics, or define tradeoffs between variables, under a variety of constraints, including repository space.

Rensselaer Polytechnic Institute

Rensselaer's student section of the American Nuclear Society (ANS) played host to the National Student Conference from March 30th- April 1st. The conference theme was "Nuclear Power: A Look at the Future," and was attended by three hundred and fifty students and professionals from around the country.

This conference was host to a large number of speakers from industry covering topics such as power generation, regulation, nonproliferation, and career paths for nuclear engineers. Guest speakers included the current president of RPI and previous chairman of the Nuclear Regulatory Commission Dr. Shirley Anne Jackson and previous Admiral of the US Nuclear Navy and current CEO of the Nuclear Energy Institute Admiral "Skip" Bowman. Other speakers at the conference included John Gutteridge from the Department of Energy, Dan Pace from First Energy Nuclear Operating Company, Mike Kansler from Entergy, Gregory Jaczko from the Nuclear Regulatory Commission (NRC), and Moustafa Bahran from the International Atomic Energy Agency.

Newly elected RPI Student ANS Chapter President Eric Pace presents Admiral Skip Bowman, CEO of the Nuclear Energy Institute, a token of appreciation for his speech at the recent ANS National Student Conference, held at RPI earlier this Spring.

This year the conference featured two separate panel discussions, addressing the topics of nuclear nonproliferation and the state of new plant startups. Members of the panels include Moustafa Bahran from the International Atomic Energy Agency, Bernie Copsey from Areva, Eugene Grecheck from Dominion Energy, Laura Dudes from the NRC, and Bob Evans from Enercon Services.

* *

Rensselaer is pleased to announce that Dr. Li (Emily) Liu will join the Nuclear Engineering and Engineering Physics Program in July as an Assistant Professor of Nuclear Engineering.

Dr Liu received her B.S. degree in Technical Physics in 1999 at Peking University, and her Ph.D from MIT in 2005. At Rensselaer, Dr. Liu will conduct research in various aspects of neutron scattering, including its use in nanotechnology and polymer science, such as the dynamics of water confined in nanoporous materials, proteins and DNAs. She also will study alternative energy sources, such as nuclear and hydrogen, and will work in the measurements and calculations of inelastic neutron cross sections.

From Page 13
(USDOL)

development perspectives to reinforce their classroom education. Each of the community college's nuclear utility partners, along with Bartlett Nuclear (a major employer of RP technicians for the nuclear industry), has committed funds for student internships as part of the industry matching funds required under the DOL HJGTI program.

With the vital role that RP technicians play in the nuclear power industry, the DOL grant to MU and its partners is creating the educational capacity to produce Associates degreed RP technicians in the United States.

"A pipeline of skilled radiation protection technicians will be crucial to the nuclear energy sector's growth," said Emily Stover DeRocco, assistant secretary of labor for employment and training. "The program the University of Missouri is developing with its private-sector partners will prepare up to 200 workers throughout the country for jobs in this critical field."

Nuclear power to play major role in proposed Energy Initiative at MIT

On May 3, 2006, a thousand members of the MIT community attended a day-long conference entitled, "MIT Energy Forum: Taking on the Challenge," held in conjunction with the release of a report from the MIT Energy Research Council (ERC) that calls for an Institute-wide response to the world's escalating energy crisis. The proposed initiative, which assigns a major role to nuclear and fusion research, will be implemented over the next five years and will include dedicated research space. Professor Mujid Kazimi, Director of the MIT Center for Advanced Nuclear Energy Systems (CANES) and a member of the ERC Council, was one of the nineteen faculty members who discussed MIT's ongoing energy-related programs and research, presenting an overview of recent developments in the nuclear power industry.

Professor Mujid S. Kazimi of nuclear science and engineering gives a presentation during the panel titled 'Improving Today's Energy Systems.'

The Energy Council's report divides its proposed research into three categories:

1. Basic research to underpin the sort of critical breakthroughs that will fundamentally alter energy systems, at large scale, several decades into the future. Examples of this sort of research include: electrochemical energy storage and conversion, nuclear fusion and plasma physics, and renewable energy sources such as wind, solar, geothermal, waves, and biofuels;
2. Research focused on the next several decades that would help evolve today's energy infrastructure towards lower cost, enhanced security, and less environmental impact. Examples include advanced nuclear reactors and fuel cycles that address cost, safety, waste, and nonproliferation objectives;
3. Multidisciplinary research that would yield new policies and technologies to address environmental concerns, climate change, and escalating energy demand, especially in the developing world (e.g., energy-efficient buildings, advanced transportation systems, and "giga-city" design).

"Delivering on the promise of this energy initiative," the report concludes, "will call upon many of the Institute's attributes beyond excellence in research – a creative but grounded approach to complex problems; interdisciplinary research tradition; exceptional faculty, staff, and students; long-established experience with industrial collaboration; international partnerships; convening power for key conversations; and a practiced ability to serve as "honest broker" in framing and analyzing important societal issues with significant scientific and technological content. The energy challenge, while formidable, will yield to dedicated application of such capabilities."

Professor Jeffrey P. Freidberg of nuclear science and engineering described fusion energy for a packed audience in Kresge Auditorium on Wednesday, May 3.

Revised Energy Curriculum is Making the Grade

To increase high school students' awareness of nuclear physics, the Department of Energy has partnered with universities, the private sector, national laboratories, and public high school teachers to revamp a 2-decades-old middle school curriculum, *The Harnessed Atom*, for high school use.

Working with university partners, DOE encourages first-hand understanding of physics and engineering as part of the curriculum though field trips to reactors like Penn State's Breazeale Reactor

John Gutteridge, Director of University Programs in the Office of Nuclear Energy, says that the updated curriculum offers students a better understanding of nuclear engineering and science at a time when many are making important decisions about college.

"Our Nation needs qualified, skilled engineers in order to maintain our scientific and technological leadership. *The Harnessed Atom* was developed, in part, to help students make informed decisions about their career options in nuclear energy."

The Harnessed Atom is a 10-day honors course module that engages talented juniors and seniors in hands-on experiments, interactive learning, and focused reading. The module includes student and teacher texts, equipment for lab experiments, posters, and computer and web resources. University Programs is offering grants to encourage classes to include a field trip to a university research reactor.

Students visit the Breazeale Nuclear Reactor at Penn State

Pittsburgh physics students learned about radiation by building cloud chambers to observe tracks of subatomic particles

In 2005, nine Pittsburgh Public Schools teachers pilot tested the curriculum in their AP classes. This year, the curriculum is being evaluated in an expanded field test in four regions, including E.C. Glass High School in Virginia, Hickman High School in Missouri, and Brookline High School in Massachusetts.

Teachers and students have praised the curriculum for its accuracy and balanced approach, and all pilot test teachers reported that they plan to teach the course again. "This is a gem," said veteran Pittsburgh AP physics teacher Ed Hencke. "There is nothing else like it in our science curriculum."

After taking the course, students' test scores jumped an average of 3 letter grades on the material. "Because of the *Harnessed Atom*," said pilot test teacher Mary Steck, "one of my students will begin Penn State's nuclear engineering program this fall. That's pretty exciting."

Plans are to expand the field test evaluation to additional regions next year in partnership with laboratories and utilities. "We are taking precise steps to ensure that curriculum meets high educational standards before it becomes available to educators nationwide," said Gutteridge.

For Additional Information Please Contact

John Gutteridge or
John J. McClure
NE-40/Germantown Building
U.S. Department of Energy
1000 Independence Avenue, S.W.
Washington, D.C. 20585-1290
john.gutteridge@nuclear.energy.gov
john.mcclure@nuclear.energy.gov