UNIVERSITY CURRENTS

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

U. S. Department of Energy *Summer 2001*

SCSU Students Complete Nuclear Summer At UW-Madison

"It was nice to get hands-on experience with the reactor," says student Alan Seedarsan about one of the courses he took this summer. "Operating a nuclear reactor was not something I actually visualized myself actively doing."

It was an experience he couldn't get at his university, South Carolina State University (SCSU), since its School of Engineering, Technology and Sciences does not offer a nuclear engineering degree. Instead, Seedarsan and classmate Michael Collingwood attended the University of Wisconsin-Madison this summer as part of a unique dual-degree exchange program. A U.S. Department of Energy-funded pilot, it encourages students from SCSU, one of the nation's Historically Black Colleges and Universities, to pursue degrees in nuclear engineering.

When they graduate, the students will receive degrees both in nuclear engineering from UW-Madison and in their chosen field at SCSU. Seedarsan is studying mechanical engineering technology, while Collingwood is pursuing a degree in electrical engineering technology and physics.

The program's first participants, the two spent their freshman, sophomore and junior years at SCSU and recently completed two intensive nuclear engineering summer courses at UW-Madison. They returned to SCSU for the fall semester of their senior year and will finish their final spring and summer semesters in Madison.

Their University of Wisconsin-Madison education includes not only a reactor laboratory, but also courses in reactor operations, theory and design; economics and environmental analysis, power plant technology, and materials.

And they hope the additional educational exposure will pay off. "A lot of the mechanical engineering courses at SCSU overlap with the nuclear engineering courses," says Seedarsan. "So if I can do some extra courses and have more doors open to me—all the better for me right now so I can have a wider selection when making my choices."

Collingwood views his nuclear education as part of the bigger picture. "I've been thinking about a career in power engineering, and I'm seeing that this is just one way of generating power," says Collingwood. When he returns to UW-Madison in spring, he also plans to explore courses in power engineering through the Department of Electrical and Computer Engineering.

To complete their dual degrees, both expect to work hard. "It's not a program to be taken lightheartedly," says Seedarsan. "If you want to stay in the program, you need to realize there's a lot of work required."

The SCSU/Wisconsin program is only one of the four partnerships. The others are North Carolina A&T/North Carolina State, New Mexico State/New Mexico and the just announced Tuskegee/Cincinnati award.♦

SCSU Students Alan Seedarsan (left) and Michael Collingwood (right) pose for a photo in front of the University of Wisconsin-Madison College of Engineering's fountain (Engineering Hall in the background).

INEEL Students Supported by DOE Office of Nuclear Energy

The Office of Nuclear Energy, Science and Technology (NE) sponsored ten undergraduate students from a broad array of universities with internship awards at the Idaho National Engineering and Environmental Laboratory (INEEL) this summer and one student spent the summer with DOE-HQ Office of Isotopes for Medicine and Science in Washington D.C. Another thirteen students wre sponsored at Argonne National Laboratory-East and West by NE.

Of the ten INEEL students, seven majoring in nuclear engineering, two in electrical engineering, one in mechanical engineering and one in biomechanical engineering representing nine institutions. Three of these students returned for a second summer. They were:

- Troy Becker, Oregon State University, So. Nuclear Eng.
- Marcus Chisolm, Howard University, Jr. Electrical Eng.
- Hasan Greene, Howard University, Jr. Electrical Eng.
- Paul Humrickhouse, University of Wisconsin, Jr. Nuclear Eng.
- Amanda Maple, Oregon State University, Sr. Nuclear Eng.
- Ryan McClarren, University of Michigan, So. Nuclear Eng.
- Charles Neill, Texas A&M University, Sr. Nuclear Eng.
- Benjamin Parks, Worchester Polytechnical Institute, So. Mechanical Eng.
- William Wieselquist, North Carolina State University, Jr. Nuclear Eng.
- Gloresca Willis, University of Missouri, Rolla, Sr. Nuclear Engineering
- Micah-Paul Young, Syracuse University, Sr., Biomechanical Engineering

The students at the INEEL spent a day touring the site visiting Argonne National Laboratory-West (ANL-W), Experimental Breeder Reactor I, (EBR-l, a National Historic Landmark), the Radioactive Waste Management Complex (RWMC), Test Reactor Area/Advanced Test Reactor (TRA/ATR), and the Idaho Nuclear Technology and Engineering Center (INTEC). Students felt this was a great opportunity to learn what the INEEL is all about.

Two students were asked to extend their 10-week assignment at the INEEL and were funded by the sponsoring organizations. Marcus Chisolm, Howard University who received a summer fellowship last year, transferred from Howard to Idaho State University for the academic year to take courses offered in the NE program. He spent some of his time at the Idaho Acceleration Center on campus and accepted an INEEL fall academic semester fellowship to use a gas chromatograph for headspace analysis for the Explosives Bioremediation project under a different organization.

Gloresca Willis will be graduating with her bachelor's degree in May and is planning to attend graduate school at either Texas A&M University or University of Wisconsin. Her interest is in food irradiation.

On August 9, the students presented their projects to an audience of peers and managers. Bev Cook, Manager, Idaho Operations Office opened the session with remarks of her experiences and the need for engineering majors, especially nuclear engineers, and how necessary it was for the students to learn data codes. James Lake, INEEL Nuclear & Energy Systems Engineering Associate Laboratory Director and last year's President of the American Nuclear Society commented on the quality of the presentations, especially those who were sophomores.

General exit interviews with the students revealed they were satisfied with their assigned projects and impressed with the quality of professionals at the INEEL. Housing the students in one apartment complex was very positive and formed some lasting friendships.♦

Amanda Maple and Ben Parks try their skills at working the manipulator arms at EBR-I, while Gloresca Willis checks Ben's progress.

Students and mentors pose for a final photo of those involved in this summer's undergraduate fellowship program.

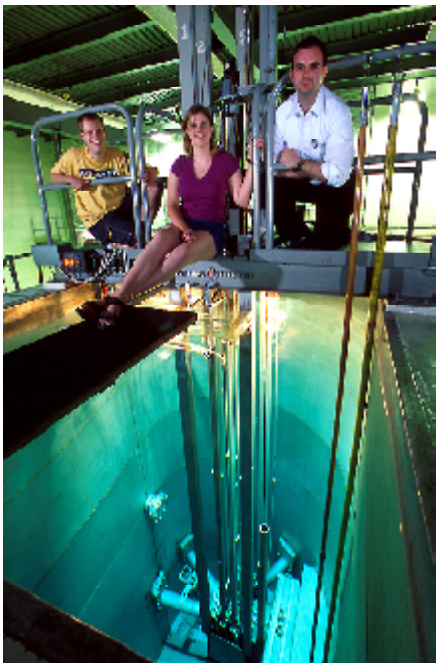
Seated (left to right), Hasan Green, Howard University, Gloresca Willis, Univeristy of Missouri-Rolla, Amanda Maple, Oregon State University and Marcus Chisolm, Howard University. Middle Row (left to right), Tammy Hobbs, Safety Analysis Resources, Paul Humrickhouse, University of Wisconsin, Ryan McClarren, University of Michigan, Charles Neill, Texas A&M University, Troy Becker, Oregon State University, William Wieselquist, North Carolina State University, and Bob Gehrke, Nuclear & Radiological Sciences. Back Row (left to right), Eric Lowen, Nuclear Engineering Design, Gene Hochalter, Safety Analysis Resources, Phil Sharpe, Nuclear Engineering Design, Glen Longhurst, Nuclear Engineering Design, Dick Ambrosek, Nuclear Engineering Design, Richard Schultz, Nuclear Systems Safety, Benjamin Parks, Worchester Polytechnical Institute, Hans Gougar, Nuclear Engineering Design, and Kathy McCarthy, Department Manager, Nuclear Engineering Design.

UW-Madison's nuclear reactor going strong after 40 years

During the 40 years that UW-Madison's nuclear reactor has operated, not much has happened. And that's as it should be, says Dick Cashwell, the reactor's director for all but a few years of its existence. "In reactor operations, doing great things means nobody notices you," he says.

But that's not to say there's no story to tell.

After World War II, researchers shifted their focus from developing nuclear weapons to designing better, more efficient nuclear power plants to generate electricity. "Many, many reactors were built in the early days, but a lot more were planned, and it was expected that many, many more were going to be needed," says Emeritus Professor Max Carbon.



Graduate students Andy Smolinski and Elizabeth Young with Associate Reactor Director Robert Agasie .

Carbon was the first chair of UW-Madison's nuclear engineering department, hired in 1958 after an interdisciplinary group of engineering faculty recognized the trend and began planning to construct the college's own reactor.

A few years later, the General Electric Company built the teaching-and-research pool reactor. It achieved initial criticality at 10 kilowatts, its original steady-state power level, in early 1961. At the time, only five or so such university facilities, including those at North Carolina State and Penn State, existed in the United States, says Carbon, who also was the reactor's first director.

A 1964 upgrade brought the reactor's power level to 250 kilowatts and another in 1967 raised it to 1 megawatt, where it is today. That power level makes the reactor, one of seven like it, ideal not only for education, but also research, says Cashwell.

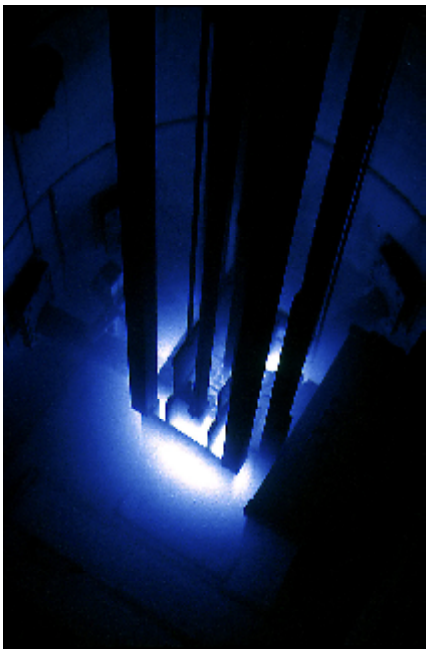
And throughout the years, reactor staff have helped scientists study just about anything that comes to mind. "We probably have irradiated more cow manure than any reactor in the world," says Cashwell. UW-Madison's dairy science department and the U.S. Department of Agriculture initiated those studies to determine how quickly various food travels through the bovine system. They've also tested both United States- and oviet-retrieved moon rocks, soil from former landfills, fish samples, fluid from the joints of people who have artificial joint replacements, and artifacts and pottery from all over the world. Staff even tested storage lengths of rhinoceros sperm for artificial insemination during an experiment to preserve the endangered animal. "Whatever people show up with and need analysis done on, we end up doing it," says Cashwell.

For this reactor, the work, although serious business, is a little like moonlighting. Education takes up the lion's share of its- and Cashwell's- time. He teaches Principles and Practice of Nuclear Reactor Operations (NEEP 234) a course that familiarizes students with operating such a complex machine in a regulatory network. "It is essentially an operator-training course, but we try to include parallels between what we do and what would be done in a power reactor," he says. After they've taken the Nuclear Regulatory Commission's licensing exam, Cashwell hires NEEP 234 "graduates" as student reactor operators.

He also teaches a capstone-style nuclear reactor laboratory class (NEEP 428), which every nuclear engineering bachelor's student must take. In the course, students experimentally verify that they can actually measure all the reactor characteristics they learned in their theory courses. In both courses- and anywhere else- Cashwell imparts a bit of his philosophy: Do it right because it's the right thing to do.

The Department of Energy's reactor-sharing program provides small grants for students and teachers from other educational institutions to use the reactor. Sometimes they just visit for demonstrations; one UW-Platteville class came for a complete lab course, and for years, a Milton College (Wisconsin) chemistry class spent several weeks learning about neutron-activation analysis. The reactor-sharing program also permits nonsponsored research. "This semester we did some samples for an elementary school in Idaho," says Cashwell. Eric Loewen, a former PhD student who volunteers at the school, initiated the project. One class grew plants on various vermiculites, while the other hunted for rock samples to analyze. "One of the teachers wrote me a letter and said that most of the kids were really anxious to get their analyses back because most of them were prospecting for gold," chuckles Cashwell about the rock project. "That may not be good science, but it's good education."Kids also get a reactor education through its outreach efforts. "We have always had an open-door policy toward tours," says Cashwell. Members of the college's American Nuclear Society student section lead tours and conduct demonstrations for local Boy Scouts seeking to earn their merit badges in atomic energy. And reactor staff have hosted several elementary and high school classes- even children from a day care center ("they seemed to like it," Cashwell reflects). Teachers attend reactor "classes," too. Last fall, about 120 high school science teachers attended three educational sessions at the reactor.

Cashwell, who retired this summer, says all of these students mark the brightest spots in his career. "A lot of them are even friends after this long of time," he says. "To me, that's the most worthwhile part of it." *(Photography/UW-Madision Engineering External Relations by Bruce Fritz)*♦



A look inside the reactor at the University of Wisconsin-Madision

U.S. Department of Energy continues to SUPPORT EDUCATOR WORKSHOPS

The American Nuclear Society continues to increase the number of educator workshops with help from the Office of Nuclear Energy, Science and Technology. In 2001 (through July 31), university groups at Air Force Institute of Technology, North Carolina State University, University of Illinois at Urbana-Champaign, University of Missouri-Columbia have each conducted teacher workshops as part of the ANS/DOE Grant activities. These have served 79 teachers (each with the potential of impacting 60-125 students per year).

In addition, the University of Missouri-Rolla conducted two, week-long Nuclear Engineering Summer Camps for high school juniors and seniors. More than 60 high school students attended. These sessions provided an excellent opportunity to provide information about nuclear science and technology and develop enthusiasm for nuclear engineering among students who are in the process of making college and career decisions.

ANS now has commitments from several universities for additional workshops and events promoting interest in nuclear careers during 2001. University of Missouri-Rolla will conduct a multi-day teacher workshop. Massachusetts Institute of Technology will conduct a special expo to acquaint engineering students with opportunities in the nuclear field.

University of Wisconsin-Madison has scheduled three, six-hour teacher workshops this fall. One of those is being developed as an opportunity for each high school teacher who participates to bring several top-level students to participate in the full-day workshop. During the sessions, students and teachers will be encouraged to develop projects which provide ongoing contact with the nuclear engineering department.

Non-university groups (ANS local sections, ANS organization members, and the ANS headquarters) conducted additional workshops which served more than 360 teachers during the first six months of the year.

ANS is eager to provide assistance to additional Nuclear Engineering Departments as they develop plans for teacher workshops during 2001 or 2002. For a listing of workshops and exhibits, go to the ANS web site www.ans.org\PI.

A Work Force Task Group was established in 2001 by ANS to determine how ANS will be most effective in the efforts to build a sound nuclear work force. With ANS' commitment as well as funding from the DOE grant, nuclear career information is being created and distributed to middle schools, high schools and college-freshmen. A special brochure and poster are scheduled to be distributed in September.. Copies of the information will be distributed to all ANS Student Sections, ANS Local Sections, NEDHO members and others. Contact the Outreach Department at ANS for information <outreach@ans.org>.♦

Pam Close, AP Biology Teacher at Hickman H.S., Columbia, MO

Session on curriculum integration of ANS supplied GM survey meters.

ANS Supports People with Disabilities

Purdue University Student Scott Krepel has more to worry about in class then just learing diffusion theory or how to calculate to Nusselt Number, he has to worry about "hearing" the teacher. Scott was born deaf. He requires the assistance of a sign language interpreter during every class so that he can participate. However, outside class he interacts with his classmates without an interpreter, "…relying on pencils and a lot of note pads".

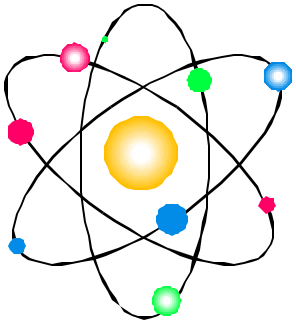
When Scott decided he wanted to attend "2001: a nuclear odyssey" and present a paper, he was unsure of the reception he would receive. By law, ANS was required to supply interpreting services, but that did not mean the conference staff would be helpful. He soon found his fears to be unfounded. Scott has this to say of the staff, "It is very refreshing to have people who are so willing to help out when they had no real previous experience with this kind of thing."

The conference arranged for a group of five interpreters to assist Scott throughout the conference. This included assisting him to co-present a paper entitled "*BWR Blowdown Experiment*" with Natalie Yonker. ANS headquarters was also very willing to provide these services, knowing how important it would be for Scott to "hear" the other student participants in order for him to fully participate in the conference.

In the end, Scott was very pleased with the conference. He interviewed with the Tennessee Valley Authority for possible full time employment. Scott and Natalie also won the best presentation award for the paper they co-presented in Reactor Engineering Session I. There is a lot to be said for the tenacity of a young man who can conquer the rigors of Nuclear Engineering while lacking the ability to hear! Good luck Scott!!♦

Purdue Nuclear Engineering Program Grows

Ranks 7th in Nation



An increase in the number of incoming freshman nuclear engineering students could reflect a renewed interest in the pursuit of nuclear-engineering careers.

This year, Purdue will welcome a freshman class of 37 nuclear engineering students – an increase of 22 from last year. Arden Bement Jr., head of the department of nuclear engineering, said the increase is due to renewed concerns in energy production and to a growing interest in global warming concerns, as nuclear power generation is an emission-free energy source.

Bement said nuclear engineers are being highly sought by companies and federal agencies, who are often required to fiercely compete with other companies in order to recruit knowledgeable graduates. This has secured a 100 percent job placement for students since 1992 and a considerable median annual earning, which according to the Department of Labor is $71,310.

"(Job placement) is off the chart," said Bement. "We just don't have enough graduates to satisfy the job market. Students often receive from 50 to 100 offers from companies."

Bement said this spring the department of nuclear engineering granted only three bachelor degrees at commencement, but only one went out to the job market. He said the other two graduates are hoping to continue their studies until the master's or doctoral level because they might want to get involved later in research.

Bement said that nuclear engineering has many different areas students can focus upon other than nuclear power production. He said the field has been broadening and offers employment opportunities for graduates beyond power generation. Nuclear engineers are specializing in fields such as radiation science, medical radiation, fission nuclear propulsions and plasma propulsion among others.

President Bush's national energy plan said Bement, will speed re-licensing of reactors and licensing of new plants. He said nuclear engineers would be needed to replace retiring engineers at existing plants.

"It's going to stimulate interest in nuclear engineering," said Bement. Funding for nuclear research is also increasing."♦

Students Supported by FY 2001 AAA Funds

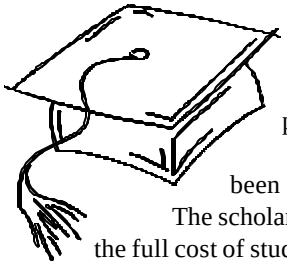
The AAA Program supports students through the AAA University Fellowship Program, the UNLV AAA University Participation Program, research contracts with several universities, and internship programs at national laboratories. This year, at least 65 students have been, are, or will be supported by FY01 funding (includes both AAA and APT funding). In addition, students are working on AAA-related research with support from other DOE programs (special student programs, other research projects, etc.)

Most interns conduct research during the summer, however, several students who are supported during other portions of the year, and Ph.D. students are at the laboratories year-round. Eighteen high school, undergraduate, and graduate students are supported directly by the FY01 AAA funding: sixteen at LANL and two at ANL-West.

Ten students were selected this spring for the first AAA Fellowships (the AAA UFP is administered by the Amarillo National Research Center, a consortium of Texas Universities). They will be attending graduate school this fall at the University of Illinois-Urbana/Champaign, the Massachusetts Institute of Technology, the University of Texas-Arlington, the University of California-Berkeley, the University of Massachusetts-Lowell, the University of Texas-Austin, the Ohio State University, Texas A&M University, and the Chemical Engineering and Nuclear Engineering Departments of the University of Michigan. These students will work on a variety of topics as they conduct research for their Masters theses and degrees. Topics that have already been identified include chemical separation processes and modeling, fuel development and fabrication, in-beam experiments at LANSCE, lead-bismuth loop experiments at LANL, and evaluation of technology readiness levels for ATW systems.

Students at UNLV are employed in research projects and as support to the project administrators in the Harry Reid Center for Environmental Studies (some of this support to administrators is technical in nature, however). The first four approved research projects include twelve undergraduate, Masters, and Ph.D. students. For additional information contact Dr. Denis E. Beller, AAA University Programs, (702) 895-2023, beller@lanl.gov . The AAA Project conducts research through universities, which currently include the University of California-Berkeley, the University of Michigan, and the University of Texas-Austin. Research projects there employ undergraduate and graduate students. Several students are working on AAA research, and they and others will begin research projects this summer. Approximately twelve students are receiving (or will beginning this fall) support from AAA university collaborations.♦

University of Illinois Grad Recipient of Gates Cambridge Scholar



A May 2001 graduate from the Department of Nuclear, Plasma, and Radiological Engineering at the University of Illinois will be continuing his studies this fall at Cambridge University in Cambridge, England, as a recipient of a prestigious, merit-based scholarship.

Michael Geline, of Glenview, Illinois, is among the inaugural group of more than 150 students worldwide who have been named Gates Cambridge Scholars.

The scholarship, funded by a $210 million endowment to Cambridge from the Bill and Melinda Gates Foundation in Seattle, covers the full cost of studies at Cambridge, as well as some travel and living expenses. The awardsare for one to three years of study, and in some cases, may be extended to fourth year. Once the program is fully established, the goal is to have at least 225 Gates Scholars at Cambridge at any one time. About half of those students will be from the U.S.

The scholarship program is administered by the Gates Cambridge Trust. According to Gordon Johnson, the president of Cambridge's Wolfson College, the trust "seeks American students who, through graduate study at Cambridge and perhaps additional graduate study in the U.S., are likely to make a significant contribution to their discipline by research, by teaching, or by using their learning creatively in their chosen professions. The trust expects that Gates Cambridge Scholars "will deploy their education for the benefit of others, finding solutions for problems facing the societies of the world."

The University of Illinois has a very strong presence at Cambridge," said Julia Goldberg of the University of Illinois's Office of Scholarships for International Study. "Since 1993-94, we've had at least one student at Cambridge every year." Goldberg said the Gates scholarship is very competitive.

Geline, who received bachelor's degree in nuclear engineering, with mathematics minor in May 2001, will study math at the university's Churchill College in preparation for career as a research scientist in the nuclear industry. An inductee in the Golden Key National Honor Society, Geline an active member of the American Nuclear Society, participated in the James Scholar honors program, and served as a math tutor in the University of Illinois's residence halls. He spent two summers doing research at the U.S. Department of Energy's Knolls Atomic Power Laboratory and Oak Ridge National Laboratory. This summer [2001] he did research in algebra and numbers theory for the National Security Agency in Washington, D.C.♦

AAA Fellowship Program

The AAA fellowship program was initiated in 2001 by the U.S. Department of Energy, Los Alamos National Laboratory (LANL), and Argonne National Laboratory in partnership with other National Laboratories. The Advanced Accelerator Applications project will require a large cadre of educated scientists and trained technicians. The DOE established the AAA/University Fellowship Program to provide financial support to science and engineering students as they pursue master's degrees in support of the Advanced Accelerator Applications program.

The 10 AAA fellows will receive up to $42,500 in benefits as they pursue master's degrees and conduct research in areas of interest to the Advanced Accelerator Applications program. Among the AAA projects is Accelerator-driven Transmutation of Waste (ATW). The AAA Project and ATW studies involve four major technologies for treatment of civilian spent nuclear fuel: accelerators, separations and waste forms, transmuters, and spallation target development. The Amarillo National Research Center manages the AAA university fellowship program. For more information about the AAA-UFP, see www.studentpipeline.org/aaa or call the ANRC at (806) 376-5533.♦

AAA Fellows pose with Dr. John Herczeg for a photo in front of the White House.

Resurgence of Nuclear and Radiation Engineering at The University of Texas at Austin

Since 1997 there has been a major concerted effort to reinvigorate undergraduate and graduate interest in Nuclear and Radiation Engineering. A broad approach was undertaken that included the following: a restructuring of the nuclear option within the Mechanical Engineering Department, the introduction of a one hour course in Concepts of Nuclear and Radiation Engineering, offering a summer course in instrumentation, teaching traditional mechanical engineering courses to show faculty presence, placing summer intern students at DOE national laboratories, power plants and other nuclear related industries, promoting a strong web-based graduate distance learning program, introducing a nuclear and radiation engineering option within the Physics Department, and promoting the program to the NAVY ROTC. All these efforts with continuous advertising have attracted many more students, including domestic ones, into the undergraduate and graduate programs. All classes are regularly filled and in the 2000 spring semester some sixty undergraduate students were enrolled in various nuclear courses. This has led to more students choosing the undergraduate nuclear option and applying to the graduate program. The Nuclear Engineering Teaching Lab that houses the 1 MW TRIGA reactor has been judiciously used for a series of experiments for the introduction class, instrumentation class and for tours for other classes. The reactor has had a major influence on the recruitment program. Efforts are continuing to increase enrollments even more.♦

New Neutron Scattering Facilities at The University of Michigan

Installation of new neutron diffraction instrumentation is currently underway at the Phoenix Memorial Laboratory. This investment will restore neutron beam research to the portfolio of research capabilities at the University of Michigan. The instrument, a neutron powder New Neutron Scattering Facilities at the University of Michigan . The instrument, a neutron powder diffractometer, will use the beam from the 8" diameter Beamport-J at the 2 MW Ford Nuclear Reactor.

Neutron powder diffraction is employed for the study of materials in a way that is analogous to the use of X-Rays. In a diffraction experiment, the angular position of the diffraction lines is determined by the crystal symmetry and lattice spacings, the intensity of the diffraction peaks is fixed by the location and species of the atoms within the crystal unit-cell. The special utility of neutron diffraction arises from the unique properties of neutron - atom interactions. Using neutron diffraction methods, it is often possible to distinguish light elements in the presence of heavy ones. The fact that isotopes of the same element have different neutron scattering properties means that isotope substitution can be employed to obtain additional information on the specimen chemistry and structure.

Extremely powerful methods for computer comparison of calculated and measured neutron diffraction patterns (Rietveld refinement) have been developed. Detailed analysis of a neutron diffraction pattern allows the experimenter to accurately determine the species and location of atoms within the crystal unit-cell: thermal vibration amplitudes, internal stresses, vacancy concentrations, impurity atom locations, impurity concentrations and phase fractions in multi-phase systems can also be determined. Neutron diffraction experiments provide information that is critical for materials characterization and that is difficult or impossible to obtain by other means; a unique capability that appeals to a broad community of researchers and has found a ready net of potential instrument users at the University of Michigan.

Over the last decade, the development of linear position sensitive detector arrays, bent perfect single crystal silicon monochromators and open neutron beam optics have substantially reduced the construction cost of the neutron powder diffractometer while greatly enhancing its performance. These developments make it possible to build research grade instruments at the low and medium flux reactor laboratory and are incorporated into the design of the Phoenix Powder Diffractometer (PPD).

A schematic diagram of the PPD is shown which illustrates the arrangement of the reactor core, Beamport-J, the monochromator shield and the mechanical elements of the system. Beamport J is particularly well situated for a neutron diffraction instrument: an 8" diameter beam tube that views the core essentially tangentially.

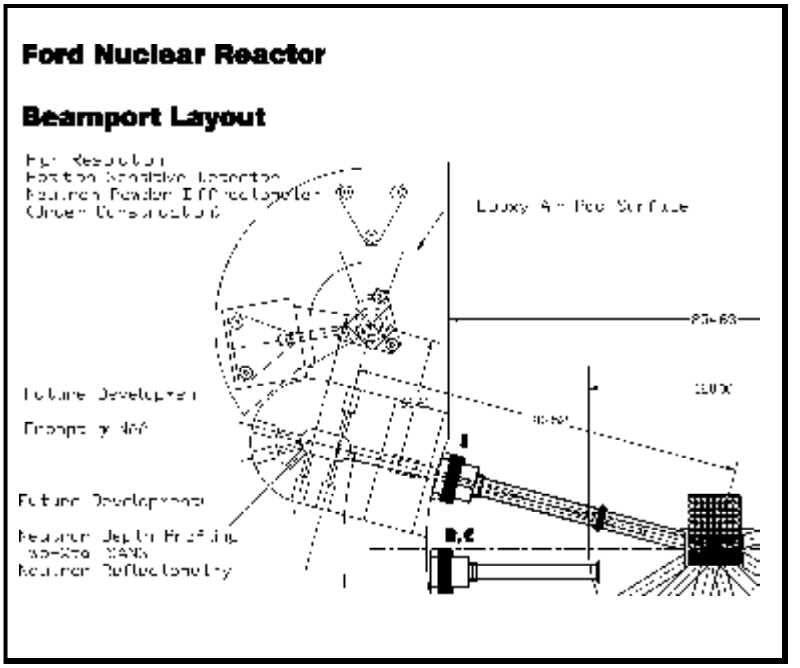
External to the reactor biological shield is the primary monochromator shield. It has been designed to accommodate several instruments. The powder diffractometer has been placed on a 90E take-off port, scattering to the left (when looking upstream). The second monochromator position has been equipped with 30E , 60E and 90E take-off ports for flexibility. A straight-through port can accommodate a third instrument .

The detector for the PPD is a stack of fifteen linear position sensitive proportional counters, each 1" in diameter and with and active length of 24" clamped into a plane array. The detector elements operate by charge-division and can sense the position of a neutron capture event to within about 3 mm along their axis. Each of the detector elements is serviced by an electronics module that provides the analog signal processing, neutron capture position calculation and histogramming.

The diffractometer base consists of two coaxial rotary tables: one for the rotation of the detector arm and the other for orienting the specimen. Placed at a distance of 1.6 m from the sample (for high resolution) or at 0.95 m from the sample (for high intensity), the detector array can simultaneously acquire data from a 20E or 30E span of the diffraction pattern.

We anticipate that it will take of order 12 - 18 hours to collect a diffraction pattern at high resolution with good statistics. Less demanding experiments may be completed in 6 - 8 hours. The instrument will be equipped with facilities for low and high temperature specimen environments and we expect that it will be extensively utilized by groups within the Unviersity of Michigan and researchers from other Universities.

For more information on the PPD, please contact R. Berliner, Department of Nuclear Engineering and Radiological Sciences at 734-647-8117 or berliner@UMich.edu.



Caption: Layout of the Phoenix Powder Diffractometer and Beamport-J of the Ford Nuclear Reactor. The arrangement of the reactor core, D 2 O tank, beamport, monochromator shield and diffractometer is shown. The position sensitive detector, mounted on a 3-element air-pad support is shown at its two extremum angular positions (15 o and 115 o).Only a portion of the reactor pool wall and the outside of the biological shield are shown. The representation of Beamport B and C in this drawing is incomplete.♦

University of Florida Training Reactor Designated a Nuclear Historic Landmark

The Board of Directors of the American Nuclear Society approved the University of Florida Training Reactor (UFTR) for a Nuclear Historic Landmark Award in November 2000. In its initial decade of operation, the UFTR concentrated on student training and research support, especially in radiochemistry where much original research on action chemistry and fission analysis was undertaken. A power upgrade from 10 kW to 100kW was completed before the end of the first decade of operation in 1967. The UFTR has now tailored its reactor operations laboratory to be a stand-alone course taken by many nuclear engineering students planning to work for the utility industry. In a typical year over 2,500 visitors utilize the facility in a substantive manner representing various University of Florida departments and disciplines as well as institutions around Florida and the Southeast. This societal service—ensuring an informed citizenry in matters related to radiation, nuclear power, reactor technology and safety, dose levels, and myriad other areas—has become an integral part of the public education process in addressing nuclear energy issues in Florida, a state with five large power reactors producing about 20 percent of the state's electrical energy each year.

The diversity of the uses for research, education and training of students and faculty clearly demonstrates the vitality of the only Argonaut-type nonpower reactor still operating in the United States.♦

Fiscal Year 2002 NEER & URI Information

The FY-02 solicitations for the NEER & URI programs have been issued via the Industry Interactive Procurement System (IIPS). In order to read the solicitation or apply for either program, you must register at http://e-center.doe.gov. All proposals will be submitted and reviewed electronically. No paper copies are be allowed. Additional information on the E-center will be sent to all the Nuclear Engineering Department heads. The solicitation number for NEER is DE-FG07-02ID14200. The NEER solicitation was posted on September 12th with proposals due November 1, 2001. The solicitation number for URI is DE-FG07-02ID14238. The URI solicitation was posted on September 27th with proposals due November 29th.♦

Reactor at Purdue has Plenty of Power to Surprise

Purdue has 37,871 students, 2,300 faculty, 145 major buildings, 14 schools, two Silver Twins and one nuclear reactor. Behind locked doors in the basement of the Electrical Engineering Building's Duncan Annex is the only nuclear reactor in Indiana and one of 29 on a U.S. university campus. Resembling a deep, circular swimming pool, only eight feet wide, the equipment has been used by nuclear engineering students, and others, since August 1962.

"The instrument and electronics are clearly outdated, but the way the nuclear reaction behaves won't change," said Robert Bean, director of radiation laboratories. "We're not trying to teach students how to run reactors."

Up to 1,000 people a year tour the Purdue facility. No special clothing or safety equipment is needed. Even at full power , the reactor can produce only 1,000 watts, enough to power two household electric irons, or five 200-watt bulbs, or create 1 1/3 horsepower.

The reactor causes a nuclear reaction through the use of uranium panels 20 one-thousandths of an inch thick. In 38 years, it has never been refueled. Normally, it is put into operation about once a week.

The 6,400 gallons of water provide cooling and shielding and lower the energy level that comes from nuclear fission. The tank also allows students to clearly see what happens when they lower test materials into the vicinity of the core.

At the time of its construction, "Purdue University Reactor Number 1," or PUR-1, cost less than $150,000 and was one of the least expensive in the country. The equipment was built by the Lockheed-Georgia Co.

Long, stainless-steel control rods stretch from outside the pool itself through the water to the core. The absorb neutrons and control the reaction.

Access to the reactor room is limited, but guided tours are given routinely. Regular classrooms, offices and laboratories in the Electrical Engineering Building are on the floors above the reactor.

Chris Culbertson, a graduate student in nuclear engineering, said his mother was a bit concerned when she learned that he would be working with the reactor. But after taking the tour, those concerns vanished. "She thought it was neat," Culbertson said.♦

2001: a nuclear odyssey -- ANS/HPS Student Conference, Texas A&M University

The annual ANS Student Conference, which was hosted by the students at Texas A&M University, proved to be an overwhelming success. As one attending recruiter commented during the career fair, "We should have brought more of our team, this is amazing…I have never seen this number of nuclear companies recruiting, with this many students, at the same time."

To quote a few of the statistics from the conference: 330 registered student participants; 24 US schools represented; 39 foreign student attendees from 11 countries; 120 registered professional speakers/recruiters; 129 technical paper presentations; 24 exhibitors at the career fair; 48 newly registered ANS student members.

For additional information regarding the ANS / HPS conference, a copy of the student resume book, or a copy of the conference proceedings please contact the conference co-chairs, Shawn Bennett and Donald Todd at: Texas A&M University, Nuclear Engineering Department, 3133 TAMU, College Station, TX, 77843-3133, Phone: (979) 845-4161, Fax: (979) 845-6443, Email: ans@tamu.edu, Web: http://ans.tamu.edu/conference.

Plans are fast underway for the 2002 ANS/ASME Student Conference. This conference will be hosted by Penn State University from April 10-13, 2002. For more information, or to contribute financially, please contact Frank Buschman, Chair, at 814.865.6351 or fxb129@psu.edu.♦

The Center for Advanced Nuclear Energy Systems

The Center for Advanced Nuclear Energy Systems (CANES) was established in the past academic year by the Department of Nuclear Engineering and the MIT Energy Laboratory to create, through research, a better understanding of nuclear energy systems that promise more favorable economics, safety, proliferation resistance and environmental impact. The Center's programs involve development and application of methods for the design, operation, and regulation of current and advanced nuclear reactors and fuel cycles. This requires advances in knowledge about traditional scientific and technical disciplines, modern methods of systems reliability, probabilistic safety analysis and decision analysis, together with human interactions and management science.

Professor Mujid S. Kazimi was appointed as the first director of CANES. Dr. Pavel Hejzlar was appointed as Director for the Center's Advanced Nuclear Power Reactors Program.

In its first year, the center had a research program consisting of four main areas:

***Advanced Power Reactors*:** The most notable projects here are the modular pebble bed reactor and two versions of long-term cores, one is a thermal and cooled by water and the other is fast and can be cooled by either gas or lead-bismuth. In addition, utilizing information from a probabilistic risk perspective in determining safety requirements of the new plants is being investigated.

***Nuclear Fuel Cycle Economics and Environmental Policy*:** The focus of this program is on high burnup UO_2 fuel for light water reactors, and on optimization of designs of advanced fuels and cladding materials, including ThO_2-UO_2. The optimization includes consideration of fuel cycle economics, spent fuel volume and proliferation resistance. This program also includes the transmutation of actinide fuels in reactors and accelerator systems.

***Enhanced Performance of Nuclear Power Plants*:** the focus here is on increasing the reliability and safety of the nuclear plants by utilizing risk information to rationalize the operations of the plants, such as maintenance, as well as the regulation of their operations. Also involved is studying mitigation of materials' degradation and ways to detect signs of aging.

***Nuclear Energy and Sustainability*:** this area involves characterizing the best approach to maximizing the beneficial impact of nuclear plant additions on the air quality and global climate change. This includes the design of advanced power cycle options to achieve high thermal efficiencies and assessment of hydrogen production potential by thermal means from high temperature reactors.

CANES programs include professional and public educational activities, including short courses, electronic offerings and topical publications, for a variety of audiences, including nuclear engineering and energy professional, national and international policy makers and interested members of the public. At present, three short professional courses established earlier by the department faculty are offered through the center:

Nuclear Systems Safety: a two-week course directed by Profs. Todreas and Kazimi

Reactor Technology for Utility Executives: a four week course directed by Prof. Golay and offered jointly with *The National Academy of Nuclear Training.*

Risk-informed Operational Decision Management: a one-week course directed by Prof. Apostolakis. ♦

International Symposium on Nuclear Energy

An "International Symposium on The Role of Nuclear Energy in a Sustainable Environment," was held at MIT, April 19-20 hosted by MIT's recently formed Center for Advanced Nuclear Energy Systems. About 60 participants, including 21 speakers, came from the US, Europe, Asia, and South America, including nuclear industry leaders, policy makers, and members of the academic community. The two day workshop was devoted to four sessions entitled (1) Nuclear Energy and the Environment; (2) Nuclear Energy in a Deregulated Electricity Market; (3) Advanced Nuclear Energy Systems; and (4) Rethinking the Nuclear Fuel Cycle. A poster session was held in which more than 18 students organized posters describing the ongoing research at the Center.

MIT President Charles Vest, who was the opening speaker at the symposium, said "Nuclear energy is an extremely important topic for the future of mankind". Noting the need for a public educational program, he said "The emotion around the decades-old debate about nuclear energy needs to be wrung out in order to put a factual basis on decision-making before we make decisions," emphasizing the need to continue to explain energy options and trade-offs to the public and policy-makers.

Professor Mujid S. Kazimi, noted that the US public attitude about nuclear energy has become more positive in recent years. This is partly due to concerns about greenhouse gas emissions of fossil energy and partly due to significant improvement in reliability and safety of nuclear power. In the last decade, nuclear energy production in the US has increased from 60% to 85% of the capacity in the existing plants. This is equivalent to adding 20 new large nuclear plants. Because of that and of new nuclear plants in other countries, mostly in Japan, Korea, and Taiwan, the global production of nuclear energy has increased in the same period by about 25%.♦

Dallas Hoffer Named Employee of the Quarter

Dallas Hoffer, the Contracting Officer at Idaho Operations Officer, was recently named DOE-ID Employee of the Quarter. He received a monetary award, plaque, and special parking place. Dallas has been instrumental in the NEER, URI, Reactor Sharing and Matching Grants programs. Congratulations, Dallas!♦

Marie Curie Exhibit Comes to Georgia Tech

From January 22nd to March 2, 2001, Georgia Tech hosted an exhibit titled, "The Legacy of Marie Curie: One Hundred Years of Science Innovation." The exhibit covered Marie Curie's legacy, that is, other women scientists and their discoveries, including an historical perspective on the difficulties of women getting an advanced education in the sciences. The exhibit also displayed the many benefits of radioactivity in our daily lives. Interactive displays included the Geiger counter, the nuclear quiz, the X-ray light box, and the science 'Jeopardy' quiz and science station.

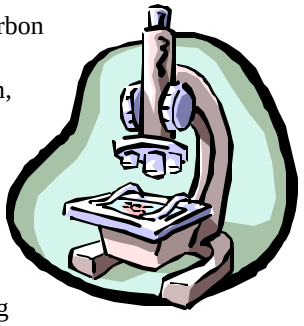
The color coded exhibit panels was divided into five sections. The first section was about Marie Sklodowska Curie, who received the Nobel Prize in Physics in 1903 and the Nobel Prize in Chemistry in 1911. She was the first person to receive the Nobel Prize twice and is the only woman so honored. One of the most important parts of the exhibit was the opportunity to see some of Marie Curie's laboratory equipment. This was the first time these items have been in the United States. In addition, a series of photographs depicting Marie Curie as a young woman, a middle-aged woman, and in her old age, was added to the exhibit by Georgia Tech.

The next section was the 19th century, including Harriet Brooks, Irene Joliot-Curie (the daughter of Marie Curie), the discovery of radioactivity, basic chemistry, the periodic table, and radiation.

Section 3 spanned 1900 to 1945 and included Florence Rena Sabin, Edith Hinkley Quimby, Lise Meitner, radiocarbon dating, eradication of pests, the cathode ray tube, food irradiation, irradiated gemstones, and nuclear power.

Section 4 covered 1945 to 1965, including Marie Coeppert Mayer, Chien-Shlung Wu, Dorothy Crowfood Hodgkin, Mildred Dresselhaus, radioactive tracers, new drugs, protection, and oil and gas exploration.

Section 5 went from 1965 to the present and included Helen Thom Edwards, Rosalind Franklin, Rosalyn Sussman Yalow, the 21st century, nuclear vision in medicine, and exploring the universe. For a complete guide to the exhibit, see the Marie Curie web site at **http://www.me.gatech.edu/me/curie**.



Some members of the organizing committee: (l-r) Richard Meyer, Dean of the Library; Rona Ginsberg, Woodruff School Director of Communications; Ward O. Winer, Woodruff School Chair; Kirk Henderson and Anne Salter, Library Archives; Michele Sutton-Ferenci, graduate student, Steven Girardot, CEISMC, and Gena Poe, graduate student.

In addition to the exhibit, a number of related activities were held: an opening reception, a symposium (see the accompanying article), and seminars on Marie Curie, nuclear engineering and radiation. In addition, graduate students in nuclear engineering, physics, and chemistry hosted approximately 1500 middle and high school aged students through the exhibit and to selected campus facilities. An appreciation reception was held for everyone who helped make the exhibit a success at Georgia Tech after the exhibit had been packed and shipped to the next site.

More than 2000 people attended the exhibit while it was at Georgia Tech. The exhibit was curated at Texas A&M University.

We would like to acknowledge the support of our sponsors at Georgia Tech were The Woodruff School, Georgia Tech Library, CEISMC, College of Science, Neely Reactor Research Center, School of Chemistry and Biochemistry, School of Physics, and the Women in Engineering Program in the College of Engineering. Our corporate and organizational sponsors were the Atlanta Section of the American Nuclear Society, Georgia Power Company, Georgia Space Grant, NAC International, Southern Nuclear Company, and Theragenics.♦

WOMEN IN DISCOVERY SYMPOSIUM

Ms. Susan Quinn, author of *Marie Curie: A Life*; Dr. Ruth Lewin Sime, Biographer and Professor at Sacramento City College; and Dr. Caroline Herzenberg, a physicist at Argonne National Laboratory each spoke at the symposium and then had an opportunity to sign their books at a reception. This event was held in conjunction with the Marie Curie Exhibit at Georgia Tech.

Ms. Quinn spoke about Marie Curie and the Nobel Prize committee. She told how the committee would have awarded the first prize only to Marie's husband, Pierre, if he had not intervened on her behalf. In addition, some members of the Nobel Committee asked her not to accept the second prize because of a scandal they feared would embarrass the king of Sweden.

Dr. Sime spoke about "Politics, Race, and Gender: Lise Meitner and the Discovery of Nuclear Fission." Chemists did the crucial experiments, while the physicists (like Meitner) provided the theoretical explanation for nuclear fission. The historical accounts, she said, emphasize this division between chemists and physicists; when the Nobel prize was awarded it went to Otto Hahn, the chemist. Meitner was not even acknowledged by the committee.

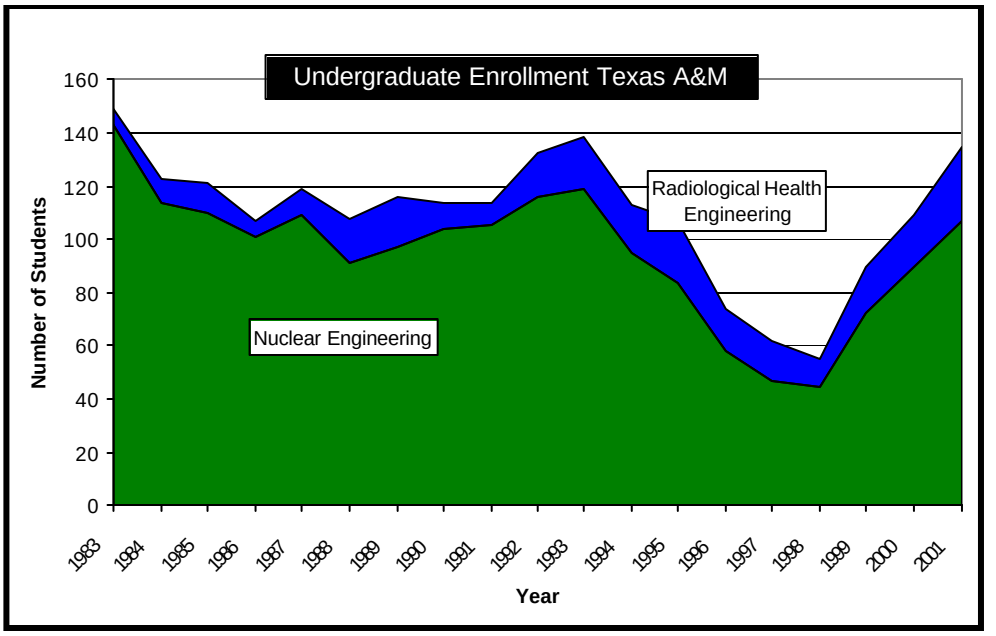
Dr. Caroline Herzenberg's talk was titled "Their Day in the Sun: The Women of the Manhattan Project." Although few historical accounts mention them, she noted there were more than 300 women scientists and technicians who contributed substantially to the technical research programs of the project.♦

REBOUNDING Student Enrollments at Texas A&M

The recent downward spiral in nuclear engineering student enrollments, especially at the undergraduate level, is well known to the university community. But fortunately, some good news is beginning to appear. At Texas A&M University, the undergraduate enrollment has increased by 236% over the past three years, rising from 55 undergraduates in the fall of 1998 to 135 in the fall of 2001. In combination with the 90 students enrolled in the graduate program, the TAMU program now appears to be one of the largest (if not the largest) in the nation.

What are the reasons for this rather remarkable rebound? Dr. Alan Waltar, Head of the Nuclear Engineering Department at Texas A&M, listed below some of the recruiting techniques used at TAMU—in hopes that some of these approaches may benefit others in our collective efforts to enhance student enrollments:

Building the Case: The job market for new graduates has never been better, and the gap between demand and supply is still growing. Most current reactors, which are now operating at near peak capacity, will be licensed for another 20 years of life—but will lack an operating staff (due to retirements) without the influx of new personnel. Renewed interest by the DOE in nuclear technology is sparking interest in a wide variety of nuclear research and development areas. An impressive case for a challenging and rewarding professional career can now be made.



Rallying Industry Support: The importance of developing a strong External Advisory Council cannot be underestimated. Our Department was fortunate to attract top-flight leaders from throughout the national nuclear infrastructure.

Developing "Headliner" Scholarships: The Council should be challenged to help develop a "headliner" scholarship program. The A&M Nuclear Engineering Advisory Council helped develop $10,000 Stinson Scholarships, named for an early alumni of TAMU and a Past President of the American Nuclear Society. These scholarships provide $2500/year for outstanding students. Starting with 9 Stinson Scholarships in 1999, the TAMU total is now up to 15. This has been exceptionally helpful in attracting top quality students!

Promoting Other Scholarships: Take advantage of the new DOE matching program, which at TAMU has underwritten both computer system upgrades and additional scholarships. The combination of Stinson, DOE, ANS, NANT, and department scholarships allowed us to increase the number and dollar value of scholarships

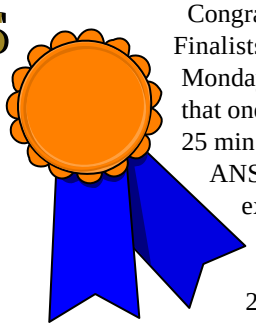
Publicizing Starting Salaries: Graduating A&M nuclear engineering students have, for the past three years, received the highest starting salaries in the entire university (currently over $55,000 on the average—plus signing bonuses in many cases). Once articulated, this word gets around fast!

Recruiting Off-Campus: We at TAMU created a new "now" generation recruiting brochure and subsequently contacted several hundred high schools in the state. Last spring, 13 faculty members and 2 students made 35 high school presentations (servicing over half of the 65 direct invitations). Information packets were then mailed to interested students to help "set the hook."

Emphasizing Retention: Finally, we have found it imperative to "care and feed" the students once within our program. The TAMU faculty highly encourages social functions, including a new mentoring program—where faculty and students at all levels get together for pizza every two to three weeks.

More detail can be found in a full paper (presented at the recent ASEE meeting in Albuquerque) by accessing the TAMU web page -- http://www-nuen.tamu.edu/ .♦

2001 ANS Student Design Contest



Congratulations to UC-Berkeley, Ga. Tech., MIT, and U. of Tennessee for their selection as Finalists in the 2001 ANS Student Design Contest. Final oral presentations are scheduled for Monday afternoon, Nov. 12, at the Reno ANS Meeting. Confirmation via email to Lee Dodds that one or more students from your university will be present to make an oral presentation (20-25 min. plus 5 min. for questions/comments) in front of a second panel judges is required. FYI, ANS will provide $500 to each of the above four universities to help defray student travel expenses to Reno.

Thanks to all who participated in the 2001 Contest. Please encourage your students, both undergraduate and graduate, and your design-oriented faculty to participate in the 2002 contest, which will be announced in January of 2002.♦

A Nuclear Taste for High School Students

The Department of Nuclear Engineering at North Carolina State University hosted twelve students this summer for three weeks, July 8- July 27, participating in the annual Young Investigators Summer Program in Nuclear Technology & Applications. The students are from across the country, six from North Carolina and six out-of-state (1 VA, 2 MD, 1 NY, 1 MO and 1 CA). The program is designed to provide an insight into NCSU Engineering, campus life and nuclear science fundamentals. The program introduces students to nuclear science and its applications through lectures, laboratories, field trips, and participation in research projects. It is sponsored in part by the NC Engineering Foundation with contributions from Progress Energy 'CP&L', Duke Energy and the America Nuclear Society NEED committee.

The program is divided into two phases; (1) lectures, laboratories and tours; and (2) group research projects. The faculty, invited speakers, graduate students and technical staff of the Department of Nuclear Engineering, conduct the lectures and laboratories. The research projects are guided and supervised by faculty members and conducted by graduate students.

The students use the facilities of the Department of Nuclear Engineering, including the 1-MW PULSTAR research reactor, radiation measurements laboratory, a freon-based functional hardware replica of a pressurized water reactor (Scaled PWR Facility) for power-reactor control, an atmospheric plasma device for surface treatment and sterilization, and are given access to the powerful NCSU computing network. Upon completing the program, they are very knowledgeable about energy resources and nuclear reactors, energy and environment, nuclear techniques in industry and medical diagnosis and treatment, food packaging and sterilization using plasma technology, and the future of global energy resources and distribution.

Students this past summer were grouped to conduct three research projects, an air-water two-phase flow project, an external radiation dosimetry project, and an atmospheric plasma treatment of food and cut flowers project. At the conclusion of the program, the students made oral presentation on their measurements and project findings.♦

Mr. Gerald Wicks, Reactor Health Physisit, discussing the External Radiation Dosimetry project with the students.

Dr. J. Michael Doster providing guidlines on the AIR-WATER TWO-PHASE FLOW EXPERIMENT to the project team.

A group picture of the summer program students with Dr. Mohamed Bourham, the program director.

For Additional Information Please Contact:

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Important Dates to Remember

- **November 1, 2001, NEER Proposals Due**
- **November 11-15, 2001**
  ANS 2001 Winter Meeting, Reno, Nevada
- **November 29, 2001 , URI Proposals Due**