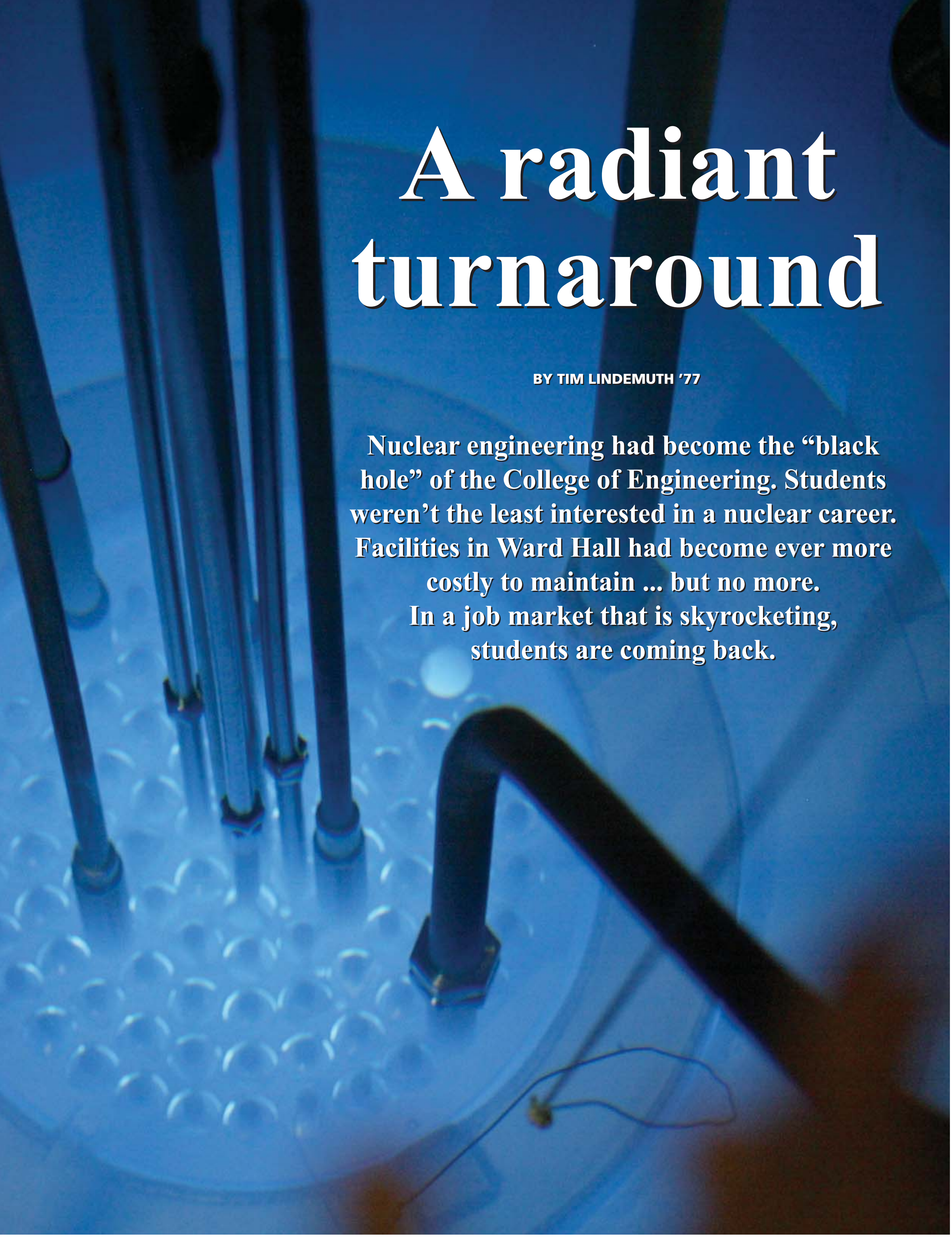

A radiant turnaround

BY TIM LINDEMUTH '77

Nuclear engineering had become the "black hole" of the College of Engineering. Students weren't the least interested in a nuclear career. Facilities in Ward Hall had become ever more costly to maintain ... but no more. In a job market that is skyrocketing, students are coming back.

During the late 1990s, things became so bleak for K-State's nuclear engineering department that less than 20 students declared it as an undergraduate major (in 1963 there were 142 students). The nuclear reactor in Ward Hall siphoned scarce operating dollars out of the College of Engineering. Darkness filled once-busy nuclear engineering laboratories, while obsolete teaching equipment gathered dust in vacant classrooms converted into storage rooms.

Something had to be done to stop the hemorrhaging in Ward Hall, and hard choices had to be made. Either kill the program and shut down the reactor as many universities nationwide were doing, or find the resources to rebuild the program. The fate of K-State's nuclear engineering rested with four key players — the provost, dean, department head and a longtime professor.

Today there's a renaissance in nuclear engineering at K-State with a threefold enrollment increase since 2002. Research funding has gone from $100,000 to $4.5 million with the recruitment of two eminent scholars. Events in the U.S. nuclear industry also are adding trump cards into K-State's hand.

"The United States presently has 103 operating nuclear power plants with decades of operating life still ahead," said Mo Hosni, head of the department of mechanical and nuclear engineering. "The U.S. Navy operates an additional 119 nuclear reactors for propulsion of its vessels."

The initial waves of college graduates in the 1960s who work in these industries are retiring, but fewer than 30 universities today are graduating nuclear engineers.

"More than half of the entire nuclear workforce is over 50 and must be replaced in the next 15 years," Hosni said. "Employers are resorting to calling retired employees back to work for the lack of trained engineers."

With all the nuclear cutbacks at other schools, K-State is positioned to capitalize on these industry demands, said Terry King, dean of engineering.

K-State bucks national trend and saves its nuclear reactor

In 1996, the College of Engineering merged the nuclear and mechanical engineering departments and changed the nuclear engineering major to an option for students as an initial step to salvage the program.

"Following the merger, however, most of our nuclear engineering leadership was lost to retirement," Hosni said. "Enrollment and research support continued to fall to all-time lows by 2002."

The nuclear engineering faculty, which once numbered seven in 1963, numbered one — Ken Shultis, nuclear program director who joined the faculty in 1969. Hosni said attempts to hire and keep two more nuclear faculty failed in 2000 when the newcomers were lured away by high salaries at a national laboratory and a government agency.

Larry R. Foulke, immediate past national president of the American Nuclear Society and a 1960 K-State graduate, explained what he saw happening nationwide in nuclear education.

"Nuclear engineering was the sexiest program around in the 1950s. We attracted the best students, and there was a demand for graduates to work at the nuclear power plants that were being built," Foulke said.

In 1958, K-State was the third U.S. university to create a nuclear engineering program behind the Massachusetts Institute of Technology and the University of Michigan. K-State's program has the distinction of being the first to gain accreditation in 1964.

Then, public opinion for the industry soured, Foulke said. It wasn't cool to major in nuclear engineering.

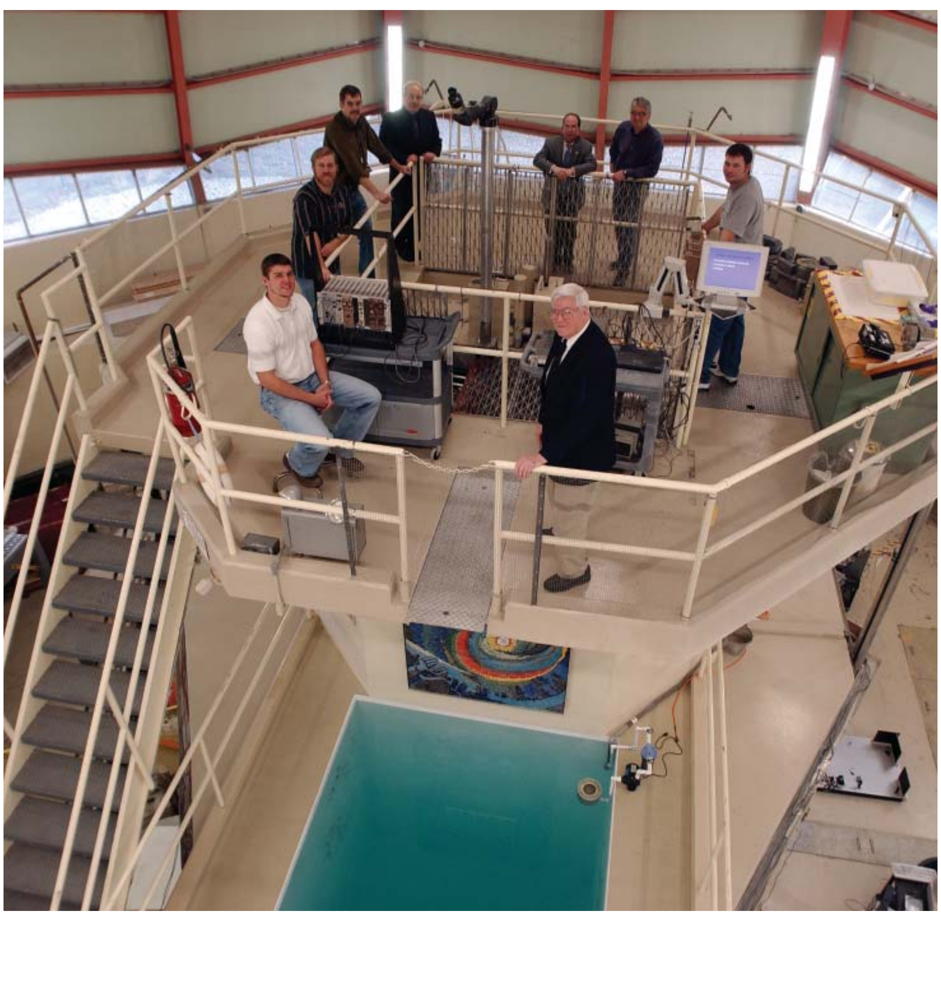

PHOTO BY DAN DONNERT '84, K-STATE PHOTOGRAPHIC SERVICES

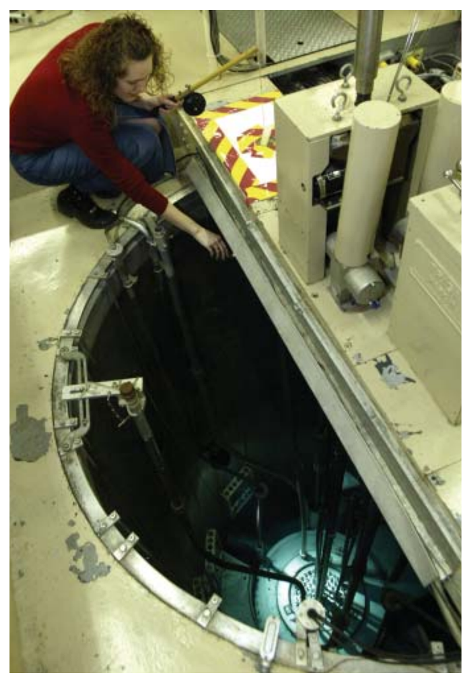

PHOTO COURTESY OF NUCLEAR ENGINEERING STAFF

OPPOSITE: THE REACTOR'S NUCLEAR CORE EMITS BLUE LIGHT. LEFT: THE NUCLEAR ENGINEERING FACULTY, THE REACTOR STAFF AND STUDENT ASSISTANTS POSE ATOP THE REACTOR'S WORK AREA IN WARD HALL. ABOVE: THE REACTOR CORE IS SUBMERGED IN A TANK OF PURIFIED WATER. OF THE 64 RESEARCH REACTORS THAT EXISTED IN THE UNITED STATES IN 1980, ONLY 24 REMAIN TODAY.

PHOTO BY DREW ROSE, KANSAS STATE COLLEGIAN

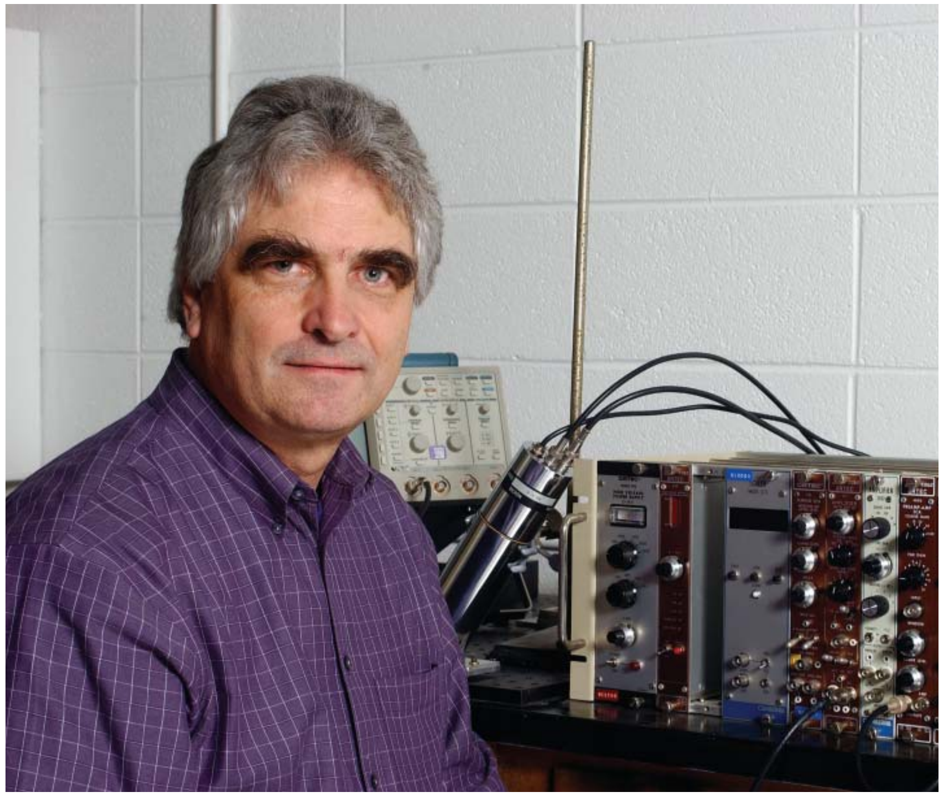

PHOTO BY DAN DONNERT '84, K-STATE PHOTOGRAPHIC SERVICES

PROFESSOR BILL DUNN IS PERFECTING AN IMAGER THAT WILL OFFER A NEW WAY TO STUDY STRESS AND STRAIN IN METALS AT THE MICROSCOPIC LEVEL NEVER BEFORE ATTAINABLE. EVENTUALLY, THE PROCESS WILL BE USED TO LOCATE CRACKS IN THE SUBLAYERS OF AIRPLANE WING METAL WITHOUT DISASSEMBLING THE WING.

"The Three Mile Island power plant scare in 1979 and the Soviet Union's catastrophe at Chernobyl in 1986 created much negative publicity," Foulke said.

The cost to build nuclear power plants ran into the billions of dollars, scaring away investors, while anti-nuclear activists caused construction delays of up to 12 years. In reality, nuclear energy is one of the most highly regulated, inspected, monitored and upgraded industries in the United States.

"Still, there hasn't been a new nuclear power plant ordered in the United States in 25 years," Foulke said.

A perception existed among students that nuclear engineers weren't needed, yet the opposite was true.

Half of the 48 universities with nuclear engineering programs in the early 1970s had closed their departments by 2001, Foulke said. Universities also shut down their research nuclear reactors, including the University of Kansas. Where there had been 65 research reactors in 1980, only 24 remained in 2004. One of those was K-State's TRIGA® reactor, and it was being considered for closure.

"We hired a consultant from Cornell University to advise us on what it would cost to shut down our reactor. We also wanted to know what it would take to rebuild the program," King said.

Consultant Kenan Ünlü said the reactor's shutdown and site cleanup would cost K-State $5 million. He also declared the reactor to be in excellent condition with a value of $25 million if constructed today. Extensively upgraded since it was built in 1962, the reactor originally cost $650,000. The K-Staters realized the reactor was a campus gem to be saved.

It's cool to major in nuclear engineering again

Out of high-level meetings involving King, Hosni, Shultis and former Provost James Coffman '60, '62, '69 came a long-range plan to allocate new funding for the department. This enabled the department to try again at attracting two top faculty, reequip the labs and classrooms, and communicate the professional opportunities to potential students.

"We found that we weren't doing enough to tell our story, so we've put a lot of effort into communicating to students that the nuclear industry needs graduates," said Hosni, adding that starting salaries are as high as $50,000 to $60,000.

Industry leaders say they need 550 newly trained nuclear engineers annually, but U.S. schools are graduating approximately 350 each year. K-State's nuclear engineering students, which number more than 60, are in high demand.

These jobs go beyond the typical nuclear power plant operations to include biomedical fields and research activities using radio isotopes.

Several K-State students now train to be nuclear reactor operators and obtain their federal licenses from the Nuclear Regulatory Commission (NRC) before they graduate, Shultis said. They also work side by side with faculty and technicians on teams doing graduate research.

"Once they are licensed, we put them to work at the reactor," he said. "The hands-on experience makes graduates ready for the industry."

One of those students, Clell Solomon, senior from Wichita, Kan., recalled his three-hour written test and the walk-through in the reactor control room with an NRC examiner.

"You show that you know everything about the reactor and the control console. What it does, how to control and monitor it," he said.

Solomon credits this experience for helping him obtain a summer internship at the Sandia National Laboratories last summer and for the offer to intern at the Los Alamos National Laboratory

PHOTO BY DAN DONNERT '84, K-STATE PHOTOGRAPHIC SERVICES

PROFESSOR DOUGLAS MCGREGOR IS DEVELOPING AND BUILDING A DEVICE THE SIZE OF A SHIRT BUTTON TO DETECT HIDDEN RADIOACTIVE MATERIAL. ONE OF ITS APPLICATIONS WILL BE TO DETER THE IMPORTATION OF A DIRTY NUCLEAR BOMB IN CARGO SHIP CONTAINERS.

PHOTO BY DAN DONNERT '84, K-STATE PHOTOGRAPHIC SERVICES

NUCLEAR ENGINEERING PROFESSOR KEN SHULTIS JOINED THE K-STATE FACULTY IN 1969 AND BECAME A KEY PLAYER IN THE REBUILDING OF THE PROGRAM. ONCE THE ONLY NUCLEAR FACULTY MEMBER IN 2000, HE IS NOW NUCLEAR PROGRAM DIRECTOR OVER A THRIVING AREA WITH MORE THAN 60 STUDENTS AND $4.5 MILLION IN RESEARCH.

this summer.

Comparing his freshman and senior years at K-State, Solomon sees a marked increase in the number of students in his classes and increased student worker activity around the reactor.

"It's wonderful that people are taking more interest in nuclear engineering," he said.

K-State's research aids U.S. search for terrorists' nuclear weapons

The threat of a dirty nuclear bomb smuggled into the United States in a ship cargo container is real. K-State nuclear engineers are playing a central role to help inspectors find and stop the entry of rogue nuclear material.

With work like this, it took only two years for K-State's nuclear program to return to the forefront as the nation's leader in research on neutron imagers and radioactive detection devices.

"We are unique with these studies. Think of it as our niche," Shultis said.

Douglas McGregor and William Dunn joined the department in 2002. McGregor moved his entire nuclear laboratory and team here from the University of Michigan after the school closed its reactor. Dunn, who comes from a commercial background, also moved his company's lab from North Carolina to K-State. Between the two professors and Shultis, they have brought in nearly $4.5 million in new research grants and contracts.

The National Science Foundation awarded $2 million to K-State last fall to develop semiconductor neutron-imaging chips. In collaboration with the University of Tennessee and the Oak Ridge National Laboratory, the imager offers a new way to study stress and strain in metals at the microscopic level never before attainable. For example, Dunn uses a similar imager to look for cracks in sub-layers of metal in airplane wings without disassembling the wing.

In 2003, McGregor received more than $2.5 million from the U.S. Departments of Energy and Defense to further develop and build a device the size of a shirt button to detect hidden radioactive material. McGregor and his team manufacture the device in a Ward Hall lab. From growing pure crystals under bell jars to etching the silicon semiconductor chips, the team of technicians, graduate students and undergraduates turn out the finished product.

Scientists from other institutions also are using K-State's nuclear reactor in their studies. As an example, King pointed to the collaboration of state archeologist Robert J. Hoard of the Kansas State Historical Society and K-State geologist Kirsten Nicolaysen.

Nicolaysen studies trace elements in Stone Age tools made of chert, a rock similar to flint, and compares findings to those in rocks from known sites where prehistoric Plains inhabitants gathered stone to make spear heads, points and knives. The rock undergoes neutron activation in the reactor to analyze the trace chemical composition down to the parts per million and billion.

"The neutron activation is the best way to get the elemental composition," she said. "It's like a fingerprint."

Once these elemental "fingerprints" and the source of the chert deposits are determined, Hoard believes he can conclude something about commerce and migration of early Native Americans from 2,000 to perhaps 12,000 years ago.

"Flint Hills chert was used locally and traded widely to other groups," Hoard said. "It should tell us about migration and hunting excursions and who was trading."

The operational revenues generated from these and other grants have moved the nuclear engineering program from the red to the black.

Shultis, who has given 35 years of his life to nuclear education, is proud of the turnaround.

"I was one of those trained in the first wave of nuclear engineers after the Korean War," Shultis said. "Many of the workers in the industry are like me: soon to retire. The demand for nuclear engineers is skyrocketing."

Of the flurry of new research activity that has returned to Ward Hall, Shultis said it has importance to national security, material science and other areas.

"We're the only university that has the people and the facilities to do what we do." ▼