

Some guidelines recommended by the University Archivist,  
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Try to incorporate the following:

1. When did the department begin?
2. What departmental name changes have occurred and when?
3. Did the department grow out of another program (or did the department splinter off from another department or merge with another department)?
4. Who have been the department chairs and when did they serve?
5. Has the department run any degree programs that are not reflected in its name?

*Example 1, Provided by Thomas Elleman.*

## NCSU Nuclear Engineering Department Milestones

- 1950, Dr. Clifford K. Beck was recruited from the Oak Ridge National Laboratory by NCSU Physical Science's Dean, A. C. (Buck) Menius and Engineering Dean Harold Lampe. Dr. Beck arrived with plans to make NCSU the first academic institution to operate a nuclear reactor.
- 1953. The first reactor at an academic institution went critical on September 5, 1953, approximately four years after construction had been started. At the time, Howard Blakeslee, science editor of Associated Press Service, called the reactor the "First Temple of the Atom" because of the public nature of this reactor.

This first university research reactor (R-1), was a 10 kW, homogenous reactor utilizing highly-enriched uranyl sulfate as fuel. It operated briefly until shut down by corrosion problems that contributed to fuel leakage.

- 1954, Utilizing funds from the Atomic Energy Commission supplemented by state resources and funds from Burlington Mills, construction of the Burlington Nuclear Laboratory was initiated. This building was intended to house the nuclear education program and the reactor to follow the R-1 reactor.
- 1955. Dr. Raymond L. Murray, a recognized nuclear scientist and author, was recruited from Oak Ridge National Laboratory to provide leadership to the beginning of a nuclear engineering educational program. Graduate students with

nuclear interests began to pursue thesis research under faculty in Applied Physics or under faculty in Engineering.

Additional faculty participating in the program included Dr. Newton Underwood (an expert in Radiological Safety from UNC) and Dr. Arthur Waltner (an expert in nuclear instrumentation). Permission to offer the B.S., M.S. and Ph.D degrees in Nuclear Engineering was authorized by NCSU.

- 1956. Work was initiated to build a heterogeneous reactor (R-3) utilizing MTR (Materials Test Reactor) plate-type fuel in Burlington Nuclear Laboratories. This reactor operated initially at thermal powers up to 100 kW, later increased to 250 kW.
- In the late 1950's, Dr. Raymond L. Murray became head of the Applied Physics department where he also provided leadership to the beginning of a nuclear engineering educational program. The decision was made to offer the first B.S. degree in Nuclear Engineering in the nation.
- 1957-60 A budget line for the Nuclear Reactor Program was set up by the State of North Carolina to provide basic support for the operation of the nuclear reactor and associated personnel. Personnel from NCSU and other institutions were recruited to become a part of the new Nuclear Reactor program. Key personnel included Bobby Leonard and James Torrence. Harold (Hap) Lammonds was recruited to become department head of Nuclear Engineering.
- 1958-62 "Affiliated Faculty" from other programs were formally identified to serve as the core for the developing nuclear educational program. These included Alonzo Coots (Chemistry), Necati Ozisik (Mechanical Engineering), James Ferrell (Chemical Engineering), Lawrence Bowen (Chemistry), Newton Underwood (Physics), Arthur Waltner (Physics), Edward Manning (Electrical Engineering), and Wesley Doggett (Physics).
- 1959 Clifford Beck departed the program to accept a position with the newly created Nuclear Regulatory Commission in Washington. Raymond Murray and Professor Harold Lammonds assumed supervision of the nuclear program.
- 1952-62 North Carolina State University offered international training courses under the auspices of the Atoms for Peace program that brought internationally trained scientists to the campus to learn about nuclear energy. In the same interval, two pioneering textbooks by Raymond Murray reached the market (Introduction to Nuclear Engineering and Nuclear Reactor Physics) that become leading texts for the nuclear field. These actions, along with the operation of the first university reactor, caused North Carolina State to be recognized as a center for nuclear education.

- 1962-64, The shielding of the R-3 reactor was extended to allow operation at higher power levels and this improved reactor began operation in 1963, operating at a steady-state power level of 250kW. This reactor became an integral part of the nuclear engineering instructional program and also began to provide some services in radioisotope production and neutron activation analysis.
- 1963 Raymond Murray resigned his position as head of Applied Physics to become Department Head of Nuclear Engineering. Simultaneous with this decision, the Nuclear Engineering Department was transferred from Applied Physics into the School of Engineering, then headed by Dr. Ralph E. Fadum, Dean.
- 1961-64, New faculty were hired to staff the new nuclear engineering department and to fill positions vacated by the departures of Harold Lammonds, Newton Underwood, and Clifford Beck. In the mid-60's, the department faculty consisted of Dr. Raymond L. Murray (Department Head), Dr. Albert Carnesale (later to become Dean of the Kennedy School at Harvard and Chancellor of UCLA), Dr. Kuruvilla Verghese, (a new Ph.D. graduate from Iowa State University), Dr. Martin Welt (an NCSU Ph.D. graduate designated as head of the Nuclear Reactor Program), Dr. Raymond L. Saxe, (a U.K.-educated electrical engineer and professor at Queen Mary College), Dr. Thomas Elleman, (a physical chemist and materials scientist from Battelle Memorial Institute), and the previously designated Affiliated Faculty. Several years later they were joined by Dr. Charles Siewert, a Ph.D. graduate of the University of Michigan and an expert in radiation transport theory. The department offered B.S., M.S. and Ph.D. degrees in nuclear engineering but the field was so new that the only faculty members holding a degree in nuclear engineering were Drs. Welt, Siewert, and Carnesale.
- 1960-1979, Because nuclear engineering was regarded as a promising new field, extremely well-qualified undergraduate and graduate students entered the program. By the mid-1960's, funded research had increased substantially and approximately forty graduate students were enrolled. The resources of Burlington Nuclear Laboratory were becoming considerably strained by the rapid growth and department faculty were primarily housed in various engineering buildings surrounding Burlington Reactor Building.
- Through the late sixties and early seventies, graduate enrollments continued to increase. The Air Force and Army began to send qualified students to the program to obtain M.S. degrees and later staff the nuclear programs in their own organizations. In the 70's, the NESEP program (Naval Enlisted Special Education Program) brought a number of well qualified enlisted men into the nuclear program to earn undergraduate degrees and a number of foreign countries contributed students to earn BS, MS or PhD degrees and then return to their respective countries.

- It became apparent in the mid-1960's that new facilities were needed and a high College of Engineering priority was given to the construction of Burlington Engineering Laboratories, a four-story building located adjacent to Burlington Reactor Building. The building was to be shared by Nuclear Engineering and Materials Engineering, and these two departments occupied the building in early 1972.
- In the late 1960's, an NSF Faculty Improvement program provided seed money for new faculty and Dr. Robin Gardner, with expertise in radioisotopes applications, Dr. Joseph Beeler, a research scientist in the field of computer calculations of radiation damage, and Dr. Lloyd Zumwalt, a well-recognized nuclear materials scientist, joined the program
- Internal discussions within Nuclear Engineering focused upon whether it would be better to further upgrade the R-3 reactor for both teaching and research or to shut down the reactor completely and replace it with an entirely new reactor. Dr. Martin Welt championed the latter point of view and this position was adopted by the department. The new Burlington Engineering Laboratories building was designed to accommodate a new building that bridged the old Burlington Reactor building and Burlington Engineering Laboratories. This new building housed a 1 MW pool nuclear reactor manufactured by AMF and known as a "Pulstar" reactor, named for its ability to safely become supercritical and produce very short pulses of radiation. This reactor was particularly well suited for duplicating the fuel performance of power reactors. This reactor was one of only two Pulstar reactors ever built.
- 1968 Dr. Welt departed the program before the operation of the new reactor to head a new irradiation company and he was replaced by James R. Bohannon, a former director of the AFIT reactor of the U. S. Air Force at Wright Patterson field. Professor Bohannon oversaw the construction of the new reactor as well as much of the new Burlington Engineering Laboratories. He later served as head of the Reactor Program and played a major role in making the reactor available for research and teaching.
- As one of the leading nuclear educational programs in the country, graduates of the NCSU program during the 1960's through 1980's were employed in important positions throughout the nuclear industry. Nuclear trained personnel departing the Naval Nuclear Reactor program begin to enter NCSU for graduate degrees.
- By the late 1970's, the department has essentially stabilized in size. However, national events in the late 70's and 80's lower the country's expectations for nuclear power. The Three Mile Island nuclear accident in 1979 raises concerns over nuclear safety and the cessation of new reactor construction tightened the nuclear job market. The graduate program became increasingly composed of international graduate students and undergraduate enrollments shrank. Nuclear

programs across the country were closed or merged with other engineering departments.

- The department was further challenged by the requirement to decontaminate and remove the decommissioned R-3 reactor. This process occupied several years and was completed in the early 1980's under the supervision of Dr. Robert Cockrell, NRP Director, and Mr. Robert Cross, the Reactor Program Health Physicist.
- An additional challenge was posed by the discovery that the new Pulstar reactor pool was leaking. The presence of high radiation fields within the reactor pool complicated both the discovery of a minor leak location and the underwater repair but this was successfully accomplished in the mid-1990's and the reactor continued to operate at its designed power of 1 Mw.
- The department leadership changed in the 70's and 80's. Raymond Murray elected to retire in 1972 and was replaced as department head by Thomas Elleman who continues through 1979 when he departed the university to become a vice president at Carolina Power & Light Co. Dr. Raymond Saxe provided interim leadership for a year and Dr. Paul Turinsky arrives in 1980 from Westinghouse to serve as department head through 1991 and later from 1998 through 2006.
- The challenges faced by Dr. Turinsky and the department faculty from the period of the early 80's through the beginning of this century were considerable. Approximately 55 departments of nuclear engineering existed at the beginning of this period and the job market could not sustain this many programs. A strong high school recruiting program was developed by NCSU to counter decreasing undergraduate enrollments. Strong efforts were made to develop good working relationships with nearby nuclear industries. Graduate enrollments were increasingly comprised of students from developing countries. The traditional fission base of nuclear engineering was broadened to include education in fusion technology and nuclear materials. Research programs in fusion, plasma technology, radiation effects, reactor core management, reactor thermal-hydraulics and radiation applications were conducted.
- A number of additional developments in the 1980's and 90's help to strengthened the nuclear program:
  - The nuclear reactor began to be used by nuclear utilities to train their reactor operations personnel.
  - The service activities of the reactor increased, providing radiation services, radiation damage studies, and neutron activation analyses.
  - The research productivity of the faculty continued to increase, with corresponding increases in funded research. By 2000, funded research totaled over \$1M annually.
  - The nuclear industry began to recognize that they would be unable to find nuclear trained employees if they did not support the nationally decreasing

number of nuclear academic programs so they substantially increased their financial support of the NCSU program.

- Younger faculty with newer skills began to replace older retiring faculty at about the time that the employment market began to strengthen through retirements in the nuclear industry.
- A Center for Engineering Applications of Radioisotopes was created by Dr.'s Gardner and Verghese within the nuclear department. A Electric Power Research Center was created in cooperation with Electrical Engineering.
- The department initiated a faculty-supported summer workshop for high school students that proved to be a valuable recruiting tool for attracting new students into the undergraduate program. A separate workshop for high school science teachers was also conducted.
- An undergraduate degree program for nuclear industry employees of Progress Energy was provided through distance learning courses at nuclear plants.
- A radiological engineering option was added to the graduate curriculum.

Dr. Turinsky stepped down as department head in the early 1990's and was replaced by Dr. Donald Dudziak, an educator and research scientist from Los Alamos National Laboratory. Dr. Turinsky returned as department head in 1999 following Dr. Dudziak's retirement and continued to provide strong leadership for the department through 2006.

- As of 2005, the NCSU Department of Nuclear Engineering is ranked repeatedly as one of the top ten departments in the country by the U.S. News & Report engineering department evaluations—the most recent ranking in 2005 being No. 6 for the graduate program. The department benefited from both strong leadership and strong administrative support from the College of Engineering through the lean years. The future of nuclear energy began brightening at the turn of the century with selected utilities beginning to make commitments to new nuclear power plants.
- Since 200, the following significant events have taken place, solidifying the department's position as the best nuclear engineering program in the southeast and positioned to move to the elite class nationwide:

-Significant renovations of Burlington Engineering Laboratory (\$1.5M), including the “observation room”, classrooms, laboratories and graduate student offices was accomplished through the generosity of Progress Energy and Duke Power, with financial assistance of the university provided in the form of matching funds. This was accomplished within the context of Materials Engineering and Science moving out of Burlington, and Operations Research and Biomedical Engineering moving into Burlington. Nuclear Engineering acquired new space and relocated from some space occupied in South Burlington (old wing) to North Burlington.

-Major development research facilities for the PULSTAR reactor were begun after many years of no support to accomplish this. A \$12M grant through the Department of Energy Innovations in Nuclear Infrastructure and Education (INIE) was received. This provided approximately \$8M to upgrade experimental facilities of the PULSTAR reactor. In addition, a \$1M NSF grant provided support development of the ultra cold neutron source and another \$1M NSF grant provided to develop a national users' positron facility.

-The NCSU NE department was teamed as a member of the Battelle Energy Alliance, along with four other nuclear engineering programs, to successfully bid to operate the new Idaho National Laboratory. This alliance holds the promise of funding an Academic Center for Excellence in Advanced Modeling and Simulation at NC State, along with several jointly funded NC State-INL faculty positions.

-In fall 2005 the undergraduate enrollment was 135 (bottomed out five years earlier at 39) exceeding the target of 120 students. Similarly, the graduate enrollment was 51 (bottomed out five years earlier at 31) closely matching the target of 50 students, with about 80% of new graduate students from the USA. This student growth was accomplished through the hiring of a full-time Director of Outreach Programs for the department.

-Drs. Dmitriy Anistatov and Ayman Hawari joined the department following the retirements of Drs. Thomas Elleman and Kuruvilla Verghese.

- A disappointment is that the coordinated NC A&T BS/NC State MNE degree program funded by DOE was unsuccessful in increasing underrepresented group enrollment in nuclear engineering.
- The faculty who started the nuclear engineering program in the late 1950's have now retired but newer, younger faculty are continuing the tradition of a quality education that has marked the NCSU nuclear engineering program throughout its fifty year history. Through 2005, \_\_\_ B. S. degrees have been awarded, \_\_\_ M.S. degrees and \_\_\_ Ph.D. degrees. Research funding has continued to increase with awards increasing from \$1.2M in 2001-02 to \$2.8M in 2004-05, and currently stands at \$3.2M only half a fiscal year into 2005-06..

*Example 2, Provided by Larry Monteith.*

## **Memories about important events in the Department of Electrical Engineering.**

- 1) Irwin Holmes- the first African American to graduate (1960) from NC State. An honor student in EE
- 2) First African Americans admitted into graduate program in 1952. Had graduated from NCA@TinEE.
- 3) (1950's- 1990's) Popularity of Bill Stevenson's book in Power Engineering adopted by EE programs throughout US.
- 4) First PhD to a female ( 1970's)- Alice Cline- faculty at Carnegie Mellon and now at USC
- 5) One of the early PhD's ( 1950's) - John Mayo- recognized for his contributions to the development of digital communications- Medal of Technology and member of the Academy of Engineering-President of Bell Labs.
- 6) Bob Lade (1962?)- Participated in development of Center of Excellence proposal to NSF that resulted in grant for the purpose of enhancing graduate education at NC State. Subsequently, Cy Mathews John Hauser and Mike Littlejohn were hired and developed the area of solid state electronics and materials.
- 7) In the 60's the departmental faculty identified 4 areas of emphasis and hired Ben O'Neal and Til Glisson in Communications, John Staudhammer and Jim Gault in digital systems, John Grainger in Electric Power Systems, Larry Monteith in Solid State Electronics and Materials. and Fred Tischer, Don Rhodes and Bud Flood in Microwaves.
- 8) (1970) John Staudhammer and colleagues develop computer graphic system. Nick England, Turner Whited, and Mary Whitten (Nick's wife).
- 9) (1970's) Al Goetz develops computer controlled generator and distribution power system to simulate real time power system behavior.
- 10) (1970's) Department of Computer Science cooperates in establishing master's

degree program in Computer Studies since NC State could not duplicate graduate programs existing at UNC Chapel Hill. Wushou Chou was recruited as the first director.

- 11) (1970's) EE and Computer Science receive a gift of a DEC 11780 to support research and instruction in computer systems. Due to the TUCC there had been a prohibition to stand alone mini or microcomputers purchased with departmental funds for concerns about the impact on the financial status of the TUCC operation.
- 12) (1970's) Nino Masnari is hired as Department Head. He was the director of a research lab at the University of Michigan.
- 13) Ben O'Neal receives a large communications systems University-Industry Partnership NSF grant with the emphasis on sharing research activities and providing opportunities for graduate students to interact with industry personnel. Often cited for success.
- 14) (1970's) Ben O'Neal cited by IEE(?) for pioneering work in digital communications research.
- 15) (1980's) NSF Engineering Research Center headed by Nino Masnari. Over 10 years, received \$60 million plus. Cited by industry as one of the successful centers. Significant number of graduate students and sought by industry. Faculty received a number of awards for their accomplishments, especially Jim Wortman and John Hauser.