Abilene Approval Chart for Curriculum Changes

A = Approve I = Information Item R = Respond In Writing

Degree Plan(s): **<u>Master of Science in Nuclear Science and Engineering</u>**

	Campus-Level Academic Review[1]	Dept./School	College	Dean	TEC	AUAC/Grad	Provost
	Change to a Course Include signatures from all chairs/program directors for cross-listed courses.[1]						
1.	Title (description unchanged)	A	A	A	I	I	I
2.	Description (not affecting content)	A	A	A	I	I	I
3.	Course term(s)	A	I	A	I	I	I
4.	Content (change of course outcomes)	A	A	A	I	I	A
5.	Number of credit hours	A	A	A	A	A	A
6.	Course number within the hundred	A	A	I	I	I	I
7.	Course number beyond the hundred	A	A	A	A	A	A
8.	Prerequisites	A	A	A	I	I	I
9.	Course restriction (e.g., majors only, junior standing)	A	A	A	A	A	A
10.	Level change (U to G *or* G to U)	A	A	A	A	A	A
11.	Cross list course	A	A	A	A	A	A
12.	Department of record	A	A	A	A	A	A
13.	Open or close a course	A	A	A	A	A	A
	Change to a Degree Plan						
14.	Educational Program — Revise	A	A	A	A	A	A
15.	Educational Program — Adopt/revise admission requirements	A	A	A	A	A	A
16.	GPA — Revise program-required GPA	A	A	A	A	A	A
17.	Minor — Revise	A	A	A	A	A	A

	Full Review	Dept./School	College	Dean	TEC	AUAC/Grad	Provost	Campus Faculty	Senior VPAA	President
	Change to Catalog Information (for Campus)									
18.	General requirements for Bachelor’s and Associate Degrees	–	–	–	–	A	A	A	A	I
19.	Policies governing academic probation and suspension	–	–	–	–	A	A	A	A	I
20.	Requirements for graduating with honors	–	–	–	–	A	A	A	A	I
	Change to a Degree Plan									
21.	Educational Program — Add or Discontinue[2] [3]	A	A	A	A	A	A	A	A	I
22.	Educational Program — Discontinue (Provost-proposed)	R	–	R	A	A	A	A	A	I
23.	Minor — Add or Discontinue	A	A	A	A	A	A	–	A	I
24.	Minor — Discontinue (Provost-proposed)	R	–	R	A	A	A	–	A	I
25.	Degree — Add or Discontinue	A	A	A	A	A	A	A	A	I
26.	Degree — Discontinue (Provost-proposed)	R	–	R	A	A	A	A	A	I

	Change to General Education Requirements for Undergraduates (System)	Dept./School	College	Dean	AUAC	Provost	UGEC	University Faculty	Senior VPAA	President
27.	Change course outcomes of an included course	A	A	A	A	A	A	–	A	I
28.	Add or drop a required course from the General Education Requirements	A	–	A	–	A	A	A	A	I
29.	Add or drop a course from a menu within the General Education Requirements	A	–	A	–	A	A	–	A	I
30.	Comprehensive revision of General Education Requirements	–	–	–	–	A	A	A	A	I

Notes

[2] Any change to a cross-listed course requires the signature of both department chairs or program directors overseeing the course to ensure that the courses stay in sync. This includes courses taught at other campuses (e.g. BIBL 101 and BIBO 101).

[3] For undergraduate majors, a minimum of 30 hours is required. These programs must have a minimum of 6 elective hours, unless the requirements of external accrediting bodies make it impossible. Master’s programs must include a minimum of 30 hours, and doctoral programs must include a minimum of 30 hours beyond the master’s.

[4] When a department/school or dean proposes closing a program, approval routing follows the typical process beginning with the department/school. An administrative proposal by the provost or senior vice president for academic affairs would follow the "provost-proposed" routing on the chart.

Updated 8/1/2023

Department/School(s)

Tim Kennedy (Oct 31, 2025 13:56:56 CDT) 10/31/2025

Chair Signature Date

Mark DeHart (Oct 31, 2025 15:01:19 CDT) 10/31/2025

Chair/Program Director Signature Date

College Academic Council(s)

Kathleen Lee (Oct 31, 2025 15:05:54 CDT) 10/31/2025

Chair Signature Date

Chair Signature Date

Dean(s)

10/31/2025

Signature Date

Signature Date

Teacher Education Council

Signature Date

Campus Academic Council:
Abilene Undergraduate or Abilene Graduate

Signature Date

Provost

Signature Date

University General Education Council

Signature Date

University Faculty

Abilene Faculty Senate Chair signature | Date

Dallas Faculty Council Chair signature | Date

Senior Vice President for Academic Affairs

Signature | Date

President

Signature | Date

Abilene New Program Application

Step 1: Campus Coordination Information

1. Program Identification

This document proposes the establishment of a Master of Science in Nuclear Science and Engineering at Abilene Christian University, housed within the Onstead College of Science and Engineering. Developed by Dr. Mark D. DeHart (BS, MS, PhD, Nuclear Engineering, Texas A&M University), whose distinguished career includes 36 years of service within the U.S. Department of Energy system, the program reflects ACU's commitment to advancing graduate education in high-impact scientific fields. Dr DeHart has assembled and used an informal advisory team consisting of faculty, retired faculty and former ACU students with relevant experience to guide program development.

Instruction will be delivered on the Abilene campus with the option for remote participation, and research will be conducted under ACU faculty or approved adjunct supervision - either locally or in collaboration with designated remote research facilities. The proposed launch is planned for Fall 2026, with additional courses introduced over successive semesters to support student progression and program maturation.

2. Program Overview

A. Outlook

The proposed Master of Science program in Nuclear Science and Engineering (NSE) addresses a critical and growing national demand for advanced reactor engineers and health physicists (Nuclear Energy Institute 2024). The U.S. nuclear industry is undergoing a strategic resurgence, with federal and state initiatives aimed at quadrupling nuclear capacity by 2050 (World Nuclear Association 2025, Statista Research Department 2025). Texas, in particular, is positioning itself as a national leader in advanced nuclear deployment, with over $2 billion in public funding proposed to support reactor innovation, including molten salt reactor (MSR) and small modular reactor (SMR) technologies (French American Chamber of Commerce Texas 2025).

Students drawn to this program will include those seeking careers in:

1. Advanced reactor design and operations, especially in support of Texas-based startups such as Natura Resources and Aalo Atomics (Roma and Hughes 2025, Baddour 2024)
2. Radiation protection and environmental monitoring, aligned with IAEA and NRC safety initiatives (Public Utility Commission of Texas 2024)
3. National laboratory research, with internship opportunities at INL, ORNL, LANL, and ANL — all of which support MSR-related work (Baddour 2024)

The job outlook is robust: the U.S. nuclear power market is projected to grow from $13.9 billion in 2025 to $19.6 billion by 2032, with a 5.1% compound annual growth rate (Prescient & Strategic Intelligence 2025). Industry leaders such as Dow Chemical and

Amazon have already committed to deploying advanced reactors in Texas, and the Texas Advanced Nuclear Reactor Working Group has identified workforce development as a top priority (Office of the Texas Governor: Greg Abbott 2024, Hovland 2024).

Abilene Christian University currently does not offer graduate degrees in science or engineering, making this program a strategic expansion into a high-demand academic domain. The NSE programs will serve:

- ACU undergraduates in physics, chemistry, and engineering seeking a direct graduate pathway at ACU,
- External applicants from other institutions drawn by ACU's unique MSR research platform and experimental reactor access,
- Working professionals and early-career engineers seeking specialization in reactor systems or health physics.

This program will attract students who are not currently able to begin graduate work at ACU, for those pursuing careers in nuclear energy, environmental safety, and advanced reactor deployment - fields that require specialized technical training and research engagement. Furthermore, the MSR project under development at ACU provides a unique opportunity for advanced research in these fields.

B. <u>Curriculum Description</u>

The proposed Master of Science in Nuclear Science and Engineering will be a research-intensive graduate program designed to prepare students for careers working with advanced reactor systems, radiation protection, and environmental monitoring, The curriculum will integrate foundational coursework in nuclear physics, reactor theory, radiobiology, instrumentation, and radiation detection with specialized training in reactor design and environmental assessments. Students will complete a thesis under faculty supervision, supported as appropriate by ACU's MSR and associated systems, which will provide a unique platform for hands-on experimentation and applied research.

This program represents a new academic direction for Abilene Christian University. While it will build upon ACU's undergraduate programs in physics, chemistry, and engineering, it will introduce a distinct graduate-level framework focused on nuclear applications and technologies and skillsets necessary to support industrial and research needs. The interdisciplinary nature of the curriculum will also support future integration with graduate coursework in mathematics, physics, chemistry and computer science as those programs evolve.

To deliver the program, ACU will offer 15 planned graduate-level courses, along with a weekly one-hour seminar, research credit hours, and a flexible special topics course to accommodate emerging subjects and visiting expertise. Courses will be introduced in phases, with five new courses offered each semester: Fall 2026, Spring 2027, and Fall 2027; Fall 2027 and following will offer the five courses from Fall 2026 and five additional courses for second year master's students. Hence, master's-level coursework will be completed over three semesters, with graduation dependent on the completion of research requirements. Students may graduate as early as three semesters, depending on the pace and scope of their thesis or project work. Summers will be reserved for research or to participate in internship opportunities.

C. Resource Estimates

To support the launch of the NSE graduate program, it is anticipated that startup costs for minimum essential laboratory equipment will be staged over the first three semesters. These costs are estimated at approximately $30,000 in Fall 2026, $40,000 in Spring 2027, and $25,000 in Fall 2027, reflecting the core laboratory equipment and materials required for core lab-based courses. An additional $15,000/year budget is expected for supplies and maintenance. No facility renovations are expected at this time, although final lab space assignments remain to be determined; all experimental courses are expected to share a single laboratory room, with no more than two lab courses offered in any given semester. To deliver up to five graduate courses in each of the two semesters of the first year, a minimum of two new faculty hires will be required, with two additional hires planned for the second year as the curriculum grows. The program will pursue institutional accreditation through the Southern Association of Colleges and Schools Commission on Colleges (SACSCOC), consistent with ACU's existing academic standards.

References

Baddour, Dylan. 2024. Companies are coming to Texas to develop a new generation of nuclear reactors. https://www.texastribune.org/2025/02/24/texas-nuclear-power-advanced-reactor-abilene/.

French American Chamber of Commerce Texas. 2025. Nuclear Energy in Texas: A Strategic Opportunity for Reliability, Security and Growth. https://facctexas.com/nuclear-energy-in-texas-a-strategic-opportunity-for-reliability-security-and-growth/.

Hovland, Addie. 2024. "Research Highlights the Paths for Growth of Nuclear Power in Texas." Texas Scoreboard: Real News for Real Texans. https://texasscorecard.com/state/research-highlights-the-paths-for-growth-of-nuclear-power-in-texas/.

Nuclear Energy Institute. 2024. U.S. Nuclear Generating Statistics. https://www.nei.org/resources/statistics/us-nuclear-generating-statistics.

Office of the Texas Governor: Greg Abbott. 2024. "Governor Abbott, PUCT Release Texas Advanced Nuclear Reactor Working Group Report." https://gov.texas.gov/news/post/governor-abbott-puct-release-texas-advanced-nuclear-reactor-working-group-report.

Prescient & Strategic Intelligence. 2025. "U.S. Nuclear Power Market Size & Share Analysis - Trends, Drivers, Competitive Landscape, and Forecasts (2025 - 2032)." U.S. Nuclear Power Market. https://www.psmarketresearch.com/market-analysis/us-nuclear-power-market.

Public Utility Commission of Texas, Texas Advanced Nuclear Reactor Working Group. 2024. Report: Deploying a World-Renowned Advanced Nuclear Industry in Texas. https://www.puc.texas.gov/industry/nuclear/.

Roma, Amy, and Cameron Hughes. 2025. "Texas-sized nuclear plans grow with news from Natura and Last Energy." American Nuclear Society. https://www.ans.org/news/2025-02-28/article-6805/texassized-nuclear-plans-grow-with-news-from-natura-and-last-energy/.

Statista Research Department. 2025. "Nuclear energy in the U.S. - statistics & facts." Statista. https://www.statista.com/topics/3736/nuclear-power-in-the-us/.

World Nuclear Association. 2025. "Country Profiles: Nuclear Power in the USA." World Nuclear Association. https://www.world-nuclear.org/information-library/country-profiles/countries-t-z/usa-nuclear-power.

Stop here and submit to the dean for discussion. The dean may ask for some clarification or revision. If the dean agrees, the dean should send the proposal to the vice provost. Continue with Step 2 after the vice provost approves the proposal to advance. Adjust responses in the Step 1 section as requested by the vice provost.

This proposal
- ☑ should
- ☐ should not

advance for further consideration.

Dean [signature] Date 08/12/2025

Comments:

This proposal
- ☑ should
- ☐ should not

advance for further consideration.

Wes Crawford (Aug 28, 2025 10:18:38 CDT)

Vice Provost Date 08/28/2025

The three programs to use for benchmarking are:

Other comments:

Step 2: Full Proposal Information

3. Program Information

   A. Program description

   The Nuclear Science and Engineering program is designed to develop technically rigorous, ethically grounded professionals for careers in reactor technology, system design and nuclear research. The program emphasizes foundational depth in reactor theory, thermal hydraulics, radiation transport, and radiation detection and measurement, complemented by elective offerings in quantum mechanics, nuclear chemistry, nuclear materials, computational modeling, and machine learning applications for nuclear systems. The program pairs core coursework with reactor-centered laboratory experiences and targeted electives to prepare graduates for doctoral study, industry R&D, and operational roles supporting advanced reactor deployment.

   <u>The Master of Science (M.S.) in Nuclear Science and Engineering</u>

   The program's structure fosters both independent research and practical application, ensuring students graduate with not only a deep theoretical understanding but also hands-on experience in cutting-edge nuclear applications. This approach allows students to develop critical skills in experiment and/or model design, data analysis, and technical communication, equipping them for leadership roles in academia, industry, or government laboratories. Potential collaboration with external partners will further enrich research, providing real-world context and opportunities to contribute to the advancement of nuclear technology.

   B. Program mission statement

   To prepare graduate students for impactful careers in nuclear reactor design by equipping them with deep scientific knowledge, cutting-edge research experience, and specialized technical skills. The program emphasizes integrity, leadership, and service, modeled through rigorous academic standards and Christian values, while promoting innovation, interdisciplinary collaboration, and professional excellence within the evolving field of nuclear science and engineering.

   C. Student learning outcomes

   Graduates of the Master of Science in Nuclear Science and Engineering program will be able to:

   1) Apply Core Nuclear Principles

2) Design and Evaluate Nuclear Systems

3) Utilize Computational and Modeling Tools.

4) Demonstrate Effective Technical Communication

5) Conduct Independent Research

D. Admission requirements.

Applicants to the Master of Science in Nuclear Science and Engineering must meet the following criteria:

- Hold a bachelor's degree in physics, chemistry, engineering, or a closely related technical discipline from an accredited institution.

- Demonstrate a minimum undergraduate GPA of 3.0 on a 4.0 scale, or an equivalent academic performance from institutions using alternative grading systems.

- Have completed foundational coursework in mathematics, physics and chemistry (MATH 185 (Calculus I), MATH 186 (Calculus II), MATH 286 (Calculus III), MATH 361 (Ordinary Differential Equations), CHEM 133 (General Chemistry I), PHYS 220 (Engineering Physics I), PHYS 222 (Engineering Physics II), or equivalent). Familiarity with engineering principles is highly desired, i.e., ENGR 223 (Statics and Mechanics of Materials), MECH 222 (Engineering Mechanics: Dynamics), MECH 281 (Engineering Thermodynamics) or equivalent; admission may require additional coursework program to satisfy minimal requirements.

- Submit a statement of purpose outlining academic interests, career goals, and alignment with the NSE program's research focus.

- Provide two letters of recommendation from academic or professional sources familiar with the applicant's qualifications.

- Submit GRE scores for U.S. institutions and for TOEFL or IELTS scores for non-U.S. institutions, consistent with ACU graduate admissions standards.

E. The proposed graduate program in Nuclear Science and Engineering at ACU has been developed with attention to national trends, institutional positioning, and emerging industry needs. Drawing from market analysis reports, clear opportunities for growth have been identified in areas where traditional programs have yet to evolve.

To assess the program's competitiveness, four benchmark institutions were selected using selected commonalities to provide a basis for comparison:

- Texas A&M University
- University of Tennessee at Knoxville
- Massachusetts Institute of Technology (MIT)
- University of Texas at Austin

These benchmark programs reflect a blend of regional relevance, national prominence, and modern curricula. Texas A&M University houses one of the largest nuclear engineering departments in the country, with strong ties to national laboratories, the Department of Energy, and industry partners. Its program emphasizes reactor design, fuel cycle analysis, and health physics, and consistently ranks among the top producers of nuclear engineering graduates. Texas A&M operates a 1 MW_{th} TRIGA Mark I research reactor at its Nuclear Science Center, used for irradiation, isotope production, and reactor physics experiments. In addition, the university is refurbishing its 5 W_{th} AGN-201M training reactor, which has been inactive since 2013, but work is underway to reassemble and return the reactor to operations to support undergraduate and graduate instruction in reactor operations and neutron interactions. The University of Tennessee at Knoxville has demonstrated substantial growth in graduate degrees awarded, driven by its close collaboration with neighboring Oak Ridge National Laboratory. Although UTK does not operate its own reactor, students and faculty regularly engage in research at ORNL's High Flux Isotope Reactor, one of the nation's leading neutron sources, supporting applied nuclear systems, radiological science, and advanced reactor development. MIT's program is internationally recognized for its leadership in advanced reactor design, fusion energy research, and nuclear policy. It offers access to experimental facilities such as the MIT Research Reactor and interdisciplinary collaboration across engineering, physics, and public policy. The University of Texas at Austin offers a graduate-only program with strong regional alignment and advanced research in reactor operations and radiation detection, supported by its Nuclear and Radiation Engineering Program and TRIGA reactor facility. Its program size and research scope provide a useful aspirational benchmark for ACU's development plan.

ACU's Master's curriculum stands out for its focused structure, technical depth, and hands-on integration. With an initial emphasis on reactor design and analysis, the program guides students through a carefully sequenced set of courses in reactor physics, thermal fluids for nuclear systems, and nuclear instrumentation and control. These topics are reinforced through laboratory experiences that build practical skills combined with technical communication.

Elective offerings allow students to explore advanced topics in quantum mechanics, nuclear materials, and nuclear chemistry at a depth not commonly found in comparable programs. Lab work in instrumentation and control introduces students to detectors and control systems, laying the groundwork for future studies in AI-driven reactor diagnostics and autonomous control. The nuclear chemistry lab provides hands-on experience with the chemical and operational complexities of molten salt reactor systems, offering a rare opportunity to engage with the challenges of next-generation reactor technologies.

Clearly, a defining feature of the program is its alignment with ACU's Molten Salt Research Reactor (MSRR), which will offer future opportunities for direct engagement with advanced reactor systems. Access to a functioning MSR is a powerful differentiator, positioning ACU as a national leader in experiential nuclear engineering education. A radiation protection and health physics concentration is planned for future implementation once the program is fully established, further expanding its reach and relevance.

The market analysis shows growing demand for skills like systems engineering and radiation safety. These areas align with the program's reactor-focused coursework. While project management is not a formal part of the curriculum, the program's structure encourages collaborative problem-solving and technical leadership, which support those competencies. With nuclear engineering jobs expected to grow 13-14% nationally and median salaries over $160,000, the program is well aligned with both student goals and workforce needs.

F. Graduates of the program will be qualified for a diverse range of professional roles in nuclear energy, national security, health physics, and advanced reactor development, including:

- Nuclear Engineer
- Reactor Physicist
- Nuclear Safety Analyst
- Nuclear Licensing Engineer
- Fuel Cycle Analyst
- Molten Salt Reactor Researcher
- Computational Modeling Specialist
- Reactor Operator
- Experiment Designer
- Advanced Reactor Design Engineer
- Space Nuclear Systems Engineer

When the program expands to support radiation protection and health physics, additional roles will be possible, including:

- Radiation Protection Engineer
- Health Physicist
- Radiological Safety Officer
- Regulatory Compliance Officer
- Environmental Radiation Analyst

It's important to note that the current number of employers in Texas specifically seeking nuclear engineers with advanced degrees is limited, which may influence salary expectations. According to the U.S. Bureau of Labor Statistics, the median annual wage for nuclear engineers across all education levels was $127,520 in 2024. Data from the Texas Workforce Commission for SOC 17-2161, Nuclear Engineers, indicates an entry-level wage of $98,000 per year, a mean wage of $107,000 per year, and an experienced wage of $111,000 per year. The mean and experienced wages are likely more representative of a graduate with an advanced degree in nuclear engineering, although the Texas Workforce Commission does not provide specific wage data for advanced degrees in this field. As the nuclear industry in Texas expands, particularly with the development of advanced reactors, the demand for and compensation of engineers with specialized graduate training is expected to increase.

G. SOC code.
17-2161, Nuclear Engineers

4. Rationale and Need for Program

A. Mission fit

This program reflects ACU's commitment to educating students for Christian service and leadership throughout the world. As a graduate program rooted in a Christ-centered academic environment, it will prepare students to address global challenges in energy production, environmental stewardship, and public safety with both technical expertise and ethical perspectives. The curriculum is designed to foster advanced competencies in reactor physics, radiation transport and experimental research, while encouraging students to approach their work through the lens of a Christian outlook - guided by principles of stewardship, honesty, and service.

The program is well-aligned with ACU's 2022-2027 Strategic Plan and complements the university's recent designation as a Carnegie R2 research institution. It contributes to ACU's expanding research enterprise by leveraging the MSRR program and supporting the continued development of the Science and Engineering Research Center (SERC). In reinforcing ACU's academic brand as a world-class, faith-based national university, the NSE program serves as a strategic anchor within the university's effort to develop market-driven centers of academic excellence. Nuclear engineering represents a nationally important discipline with strong workforce demand, and the program supports ACU's objective to expand graduate education to comprise 40% of total tuition revenue. It will attract students and faculty who value the integration of scientific research and application with a distinctly Christian mission. The inclusion of scientific computing and simulation-driven design aligns with ACU's commitment to evidence-based methods of instruction and the development of high-impact learning experiences

B. Prospective student interest

There is robust and growing student demand for programs in nuclear science and engineering, both nationally and in Texas. National enrollment data from the Oak Ridge Institute for Science and Education (ORISE) shows that undergraduate and graduate enrollments in nuclear engineering programs have remained steady or increased over the past decade, reflecting sustained interest in careers related to clean energy, advanced reactor technology, and radiological applications. This trend is driven by the global focus on decarbonization, energy security, and the expansion of nuclear medicine, all of which require a new generation of highly trained nuclear professionals (Oak Ridge Institute for Science and Education, 2023). Lightcast data from 2025 confirms this trend, showing that while master's completions in nuclear engineering declined slightly by 5% nationally between 2019 and 2023, the number of institutions offering the program grew by 8%, indicating institutional confidence in long-term demand (Lightcast, 2025). In Texas, student interest is further amplified by the state's investment in advanced nuclear infrastructure, such as the development of small modular reactors and the growing presence of companies and national laboratories engaged in nuclear research and innovation. Regional workforce projections by the Texas Workforce Commission indicate continued demand for engineers specializing in nuclear technology (Texas Workforce Commission, 2025). Texas A&M remains the only institution in the state with a department of nuclear engineering, with both undergraduate and graduate programs, and its national ranking and enrollment trends potentially position ACU to fill a critical gap in regional graduate education.

Students and interns at ACU demonstrate strong and sustained engagement in nuclear science through hands-on participation in the Nuclear Energy eXperimental Testing Laboratory (NEXT Lab) (Abilene Christian University, 2020). From designing and assembling molten salt reactor prototypes to developing control systems and computational models, students are deeply involved in every phase of research and development. This practical experience not only builds technical expertise but also develops a sense of purpose and innovation among students, many of whom describe their work at NEXT Lab as a defining factor in their academic and career paths (Abilene Independent School District, 2024).

Additionally, the increasing number of applications to nuclear-focused graduate programs, requests for research opportunities, and participation in student-led nuclear engineering societies at ACU and peer institutions further demonstrate the appeal of this discipline. National job growth projections for nuclear engineers are especially strong, with Lightcast forecasting a 29.8% increase in demand between 2022 and 2032 and median earnings of $164,100 annually, highlighting the economic sustainability and appeal of the field. As the energy sector continues to evolve, the prospect of making a tangible impact on the future of clean energy and global safety remains a powerful motivator for students pursuing advanced studies in nuclear science and engineering.

The program is expected to draw students from several sources:

- ACU Undergraduates: A significant number of ACU undergraduates in Physics, Chemistry, and Engineering are expected to seek a direct graduate pathway at ACU.
- External Applicants: The program is expected to attract external applicants from other institutions, drawn by ACU's MSRR and experimental reactor access.
- Working Professionals: The program is designed to attract working professionals and early-career engineers seeking specialization in reactor systems or health physics.

To attract these students, ACU should focus its recruitment efforts on highlighting the unique research opportunities associated with the MSRR, promoting the program's interdisciplinary nature and its integration of Christian values, targeting undergraduate programs at other universities with strong science and engineering departments (as described below) and by reaching out to professionals in the nuclear industry through conferences, professional organizations, and online channels. Given that the average number of master's completions per program in the US is 9 and the median is 5.5, ACU should anticipate modest cohort sizes initially, with an estimated enrollment of on the order of 10 students and 2-3 annual Master’s degree completions at maturity.

ACU will undoubtedly compete with established universities offering graduate programs in nuclear engineering, particularly those with robust research programs and strong industry connections. Within Texas, this includes Texas A&M University and the University of Texas. Prominent nuclear engineering programs also exist at other southern institutions, such as Georgia Tech, North Carolina State University, the University of Florida, the University of New Mexico, and the University of Tennessee. Several institutions evaluated by Lightcast, such as Tennessee, Wisconsin-Madison, MIT, Purdue, and Rensselaer, have shown significant growth in completions, suggesting rising interest and potential shifts in program design that ACU should capitalize upon. In addition, the unique availability of MSR-based research opportunities at ACU is expected to attract students completing undergraduate degrees not only at these institutions but also from across the nation and internationally. The combination of cutting-edge research, a faith-based environment, and a focus on ethical leadership will provide a compelling draw for students seeking to make a significant impact in the field.

5. Curriculum

   A. Degree plan: Master of Science, Nuclear Science and Engineering

   Minimum GPA Requirement: Students must maintain a cumulative GPA of 3.0 or higher across all graduate coursework to remain in good academic standing and qualify for degree conferral.

   Graduate Seminar Participation: Continuous enrollment in NSE 600 is required during each fall and spring semester. Students must attend a minimum of 80% of scheduled seminars and submit reflective summaries for selected sessions.

   Thesis Proposal Approval: M.S. students enrolling in NSE 699 will typically use the first semester to define their research or topic, conduct preliminary background work, and draft a formal proposal. This proposal must outline the scope, methodology, anticipated outcomes, and relevance to nuclear science and engineering. By the end of the first semester of NSE 699, students are expected to submit the proposal for review and approval by their faculty advisor and the program director. Approval is required before students may proceed to the execution phase in the second semester.

   Written Thesis Requirement: Students must prepare a written thesis that presents original research. The thesis must conform to ACU's institutional formatting, submission, and archival requirements and receive approval from the student's research committee prior to scheduling the final presentation.

   Final Presentation Requirement: All students must deliver a final oral presentation of their thesis work to a faculty committee. Presentations will be evaluated for technical clarity, depth of analysis, and professional communication.

Safety Training: Students must complete institutional training modules in radiation safety and laboratory conduct before participating in any experimental activities involving radioactive materials or radiation protection systems.

Time to Degree: Students are expected to complete all degree requirements within six years of initial enrollment in the program. Extensions require formal petition and approval by the program director.

Core NSE Coursework Requirements

NSE 600 - NS&E Graduate Seminar (Credit Hours: 1) (Required each fall and spring enrolled; a maximum of 3 hours will apply to the degree requirements)
NSE 601 - Introduction to Nuclear Engineering (Credit Hours: 3)
NSE 602 - Nuclear Reactor Theory (Credit Hours: 3)
NSE 603 - Reactor Thermal Hydraulics (Credit Hours: 3)
NSE 604 - Reactor Design (Credit Hours: 3)
NSE 699 - Graduate Project or Research Hours (6 Credit Hours (minimum))
Total: 21 Credit Hours over three semesters.

Select 9 hours not taken above from NSE 500-599 (cross-listed courses taught by other departments), 620-698.

Total: 30 Credit Hours

Other Graduation Requirements
Minimum grade for NSE courses: C (courses may be retaken once; only last grade is considered)
Minimum GPA for graduation: 3.00

B. Course coordination

No courses are planned outside of NSE for the M.S. degree. At present, no applicable graduate courses exist.

C. Courses

Course ID	**Rotation/ Frequency**	**Required?**	**Current Faculty Credentialed***
NSE 525 (MATH 325) Linear Algebra	Spring, Annually	Menu	Jordan Broussard, John Ehrke, David Hendricks, Hana Jang, Alexander Karabegov, Traci Yandell
NSE 541 (MATH 341) Numerical Methods	Fall, Even Years	Menu	Jordan Broussard, David Hendricks Michael Daugherity, Hana Jang
NSE 543 (PHYS 453) Machine Learning	Spring, Even Years	Menu	Mike Daugherity, John Homer, James Prather
NSE 562 Nuclear Chemistry	Spring, Even Years	Menu	Ken Czerwinski, James Johnstone, Kim Pamplin
NSE 591 Quantum Mechanics	Spring, Annually	Menu	Mike Daugherity, Jim Drachenberg, Tim Head, Larry Isenhower
NSE 600 NSE Graduate Seminar	Fall/Spring, Annually	Yes	N/A†
NSE 601 Introduction to Nuclear Engineering	Fall, Annually	Yes	Mark DeHart, Tim Head, Rusty Towell
NSE 602 Nuclear Reactor Theory	Spring, Annually	Yes	Mark DeHart, Rusty Towell

NSE 603 Reactor Thermal Hydraulics	Fall, Annually	Yes	Robert Brown
NSE 604 Reactor Design	Fall, Annually	Yes	Mark DeHart, Tim Head, Rusty Towell
NSE 620 Nuclear Materials	Fall, Annually	Menu	Tim Head
NSE 621 Radiation Detection and Measurement	Spring, Annually	Yes	Jim Drachenberg, Tim Head, Larry Isenhower
NSE 622 Radiation Transport and Shielding Design	Fall, Annually	Menu	Mark DeHart, Tim Head
NSE 640 Special Topics in Nuclear Science and Engineering	As Scheduled	Menu	Mike Daugherity, Mark DeHart, Jim Drachenberg, Tim Head, Larry Isenhower, Lester Towell, Rusty Towell, Robert Brown
NSE 650 Object-Oriented Programming and Scientific Computing for Nuclear Science and Engineering	Fall, Annually	Menu	Mike Daugherity, Jim Drachenberg
NSE 699 Graduate Project or Research Hours	Fall/Spring, Annually	Yes	Faculty Advisor

*Listed alphabetically

†Seminar features internal and external guest speakers and graduate student presentations on project work; no formal credentialing is required. The program chair or a designated faculty member will schedule speakers.

D. New courses

All courses planned for this program listed below are new, graduate-level courses specifically developed for the Master's Degree in Nuclear Science and Engineering program. While these courses are currently unique to the NS&E program, they may be applicable to future graduate programs in related STEM fields. The planned course approval timeline is provided in the table below.

Course	First Semester to Offer	Planned Submission Date (may be submitted earlier)
NSE 600	Fall 2026	Oct. 17, 2025
NSE 601	Fall 2026	Oct. 17, 2025
NSE 602	Spring 2027	Dec. 12, 2025
NSE 603	Fall 2026	Oct. 17, 2025
NSE 604	Fall 2027	Mar. 20, 2026
NSE 620	Fall 2027	Mar. 20, 2026
NSE 621	Spring 2027	Dec. 12, 2025
NSE 622	Fall 2027	Mar. 20, 2026
NSE 640	TBD	Dec. 12, 2025
NSE 650	Fall 2026	Oct. 17, 2025
NSE 699	Fall 2026	Oct. 17, 2025

1. NSE 600: Nuclear Science and Engineering Graduate Seminar
Proposed Subject Code and Course Number: NSE 600
Course Title: Nuclear Science and Engineering Graduate Seminar
Course Description: This course is common in most graduate curricula and is designed for students to present and discuss current research topics in nuclear engineering. It will serve as a platform for students to develop their presentation skills, engage in critical discussions, and stay updated on advancements within the field. The seminar will also feature presentations by faculty members or guest speakers, to provide diverse perspectives and expertise. Grading: S/U

2. **NSE 601: Introduction to Nuclear Engineering**
Proposed Subject Code and Course Number: NSE 601
Course Title: Introduction to Nuclear Engineering
Course Description: Covers the foundational principles of nuclear science and engineering, spanning nuclear physics, radiation interactions, reactor systems, and radiation protection. Begins with atomic and nuclear structure, binding energy, and radioactive decay modes. Examines neutron interactions with matter, cross sections, and fission chain reactions, followed by an overview of reactor types, their operation, and thermal-hydraulic considerations. Explores neutron moderation, the fundamentals of diffusion theory, and steady-state reactor behavior.

Includes time-dependent reactor behavior, basic reactor kinetics, principles of radiation shielding, biological effects of ionizing radiation, and the framework for reactor licensing and safety.

3. **NSE 602: Nuclear Reactor Theory**
   Proposed Subject Code and Course Number: NSE 602
   Course Title: Nuclear Reactor Theory
   Course Description: Covers the theoretical and computational foundations of neutron behavior in nuclear systems. Begins with steady-state and time-dependent multigroup diffusion theory, including neutron balance equations, boundary conditions, criticality criteria, and reactor kinetics. Develops the linear Boltzmann transport equation in both integral and integro-differential forms, with detailed attention to scattering theory, angular flux, and multigroup approximations. Introduces Monte Carlo methods for particle transport and continuous-energy analysis, emphasizing stochastic treatment of neutron interactions, eigenvalue estimation, and tallies. Incorporates numerical methods for deterministic and probabilistic transport solvers, with focus on discretization strategies, convergence behavior, and benchmark modeling. Extends to multiphysics coupling concepts, including the integration of neutronics with thermal-hydraulics and fuel depletion. Presents contemporary approaches to reactor simulation frameworks, operator splitting, and feedback modeling in heterogeneous core environments.

4. **NSE 603: Reactor Thermal Hydraulics**
   Proposed Subject Code and Course Number: NSE 603
   Course Title: Reactor Thermal Hydraulics
   Course Description: Covers the thermofluid behavior of nuclear reactor systems, emphasizing heat generation, transport, and removal mechanisms across multiple reactor types. Examines conduction through fuel and structural materials, convective heat transfer to coolant, and system-level thermal performance. Introduces conservation equations for mass, momentum, and energy, with applications to single-phase and two-phase flow regimes, including boiling heat transfer and flow instabilities. Explores pressure drop, critical heat flux, flow regime transitions, and thermal limits in reactor channels. Incorporates modeling of primary coolant loops, heat exchangers, and accident scenarios such as loss-of-coolant and reactivity transients. Includes comparative analysis of water-cooled, gas-cooled, and molten salt reactors, highlighting the unique thermal-hydraulic phenomena associated with each design, including fluid properties, heat exchange strategies, and control implications.

6. **NSE 604: Reactor Design**
   Proposed Subject Code and Course Number: NSE 604
   Course Title: Reactor Design

Course Description: Provides graduate students with a comprehensive foundation in nuclear reactor core design, culminating in a team-based design project. The first half of the course focuses on core design fundamentals, including reactivity control, fuel management, power distribution, and spectrum shaping, with emphasis on coupling neutronics with thermal-hydraulic feedback. Topics will also include Doppler broadening, moderator temperature effects, void reactivity, and safety margins.

7. **NSE 620: Nuclear Materials**
   Proposed Subject Code and Course Number: NSE 620
   Course Title: Nuclear Materials
   Course Description: Covers the physical, chemical, and mechanical behavior of materials used in nuclear energy systems. Examines the microstructural and thermodynamic foundations of metals, alloys, ceramics, and composites employed in reactor cores and support structures. Includes detailed coverage of radiation-induced phenomena such as defect formation, swelling, embrittlement, and phase instability. Explores corrosion mechanisms, thermal aging effects, and irradiation-enhanced deformation. Addresses fuel cladding integrity, moderator degradation, and material selection strategies for fission and fusion environments. Discusses creep, fatigue, and fracture behavior under extreme conditions of temperature, stress, and irradiation. Highlights real-world applications for PWRs, BWRs, fast reactors, and advanced concepts such as high-temperature gas-cooled and molten salt reactors, with attention to material performance across reactor lifecycles.

8. **NSE 621: Radiation Detection and Measurement**
   Proposed Subject Code and Course Number: NSE 621
   Course Title: Radiation Detection and Measurement
   Course Description: Covers the physical principles and instrumentation used in the detection and measurement of ionizing radiation. Examines interaction mechanisms for alpha particles, beta particles, gamma rays, neutrons, and charged particles, with emphasis on energy deposition, detector response, and signal generation. Introduces gas-filled detectors, scintillation systems, semiconductor spectrometers, and specialized configurations for neutron and photon detection. Explores pulse processing, counting statistics, energy resolution, and calibration techniques. Includes spectral analysis, dosimetry methods, and shielding considerations for laboratory and field environments.

   The course includes a laboratory component in which students will gain hands-on experience operating and calibrating a range of radiation detection systems, including gamma spectroscopy setups, neutron detectors, and survey instruments. Experiments will explore detector response to different radiation types, energy calibration, counting statistics, and the effects of shielding and geometry on measurements. Using sealed gamma sources and a licensed neutron source, students will collect and analyze spectra, compare detector efficiencies, and apply measurement techniques to realistic scenarios, building both technical skill and practical understanding of radiation detection in research and applied settings.

9. **NSE 622: Radiation Transport and Shielding Design**
   Proposed Subject Code and Course Number: NSE 622
   Course Title: Radiation Transport and Shielding Design
   Course Description: Covers advanced topics in radiation transport and shielding, extending the neutron and photon transport theory developed in NSE 602 to include charged particle transport. Addresses primary and secondary sources such as alpha and beta emitters, recoil nuclei, photoneutrons, and bremsstrahlung. Examines attenuation mechanisms, energy loss processes, and dose deposition for neutrons, photons, and charged particles across shielding materials. Includes analytical and numerical methods for shielding design, point-kernel techniques, buildup factors, and Monte Carlo-based transport modeling. Explores shielding optimization strategies for complex geometries and mixed radiation fields. Applications span nuclear facility design, space systems, medical accelerators, and radiological protection in occupational environments.

10. **NSE 640: Topics in Nuclear Science and Engineering**
    Proposed Subject Code and Course Number: NSE 640
    Course Title: Topics in Nuclear Science and Engineering
    Course Description: This course will offer focused study of advanced or emerging topics in nuclear science and engineering. Subjects will vary each term and may include areas such as advanced reactor designs, novel fuels, digital instrumentation, or data-driven modeling. Instruction will blend lectures and project-based learning, and may include external experts from national labs, regulatory agencies, or industry. The course is designed to integrate new developments and specialized interests into the curriculum.

11. **NSE 650: Object-Oriented Programming and Scientific Computing for Nuclear Science and Engineering**
    Proposed Subject Code and Course Number: NSE 650
    Course Title: Object-Oriented Programming and Scientific Computing for Nuclear Science and Engineering
    Course Description: This course introduces graduate students to object-oriented programming and scientific computing techniques relevant to nuclear science and engineering, with no prior coding experience required. Students will learn core programming concepts—including classes, objects, inheritance, encapsulation, functions, loops, conditionals, and file handling—and will develop modular, reusable computational tools

using programming libraries that support numerical analysis, data visualization, and data processing. Projects and examples are designed to reinforce foundational concepts such as radioactive decay modeling, unit conversions, basic reactor parameters, and nuclear data visualization, all within an object-oriented framework. Emphasis is placed on creating reproducible workflows, automating calculations, and designing clear, maintainable code tailored to nuclear applications. The course will also introduce appropriate open-source software packages and best practices for nuclear data processing and visualization, equipping students with adaptable skills suited for evolving computational tools in the field.

12. **NSE 699: Graduate Project or Research Hours**
Proposed Subject Code and Course Number: NSE 699
Course Title: Graduate Project or Research Hours
Course Description: Graduate research hours provide students with supervised opportunities to conduct original inquiry in nuclear science and engineering. These hours support the development of a research topic or engineering project that demonstrates mastery of advanced concepts, methodology, and scholarly communication. Students work under the guidance of a faculty advisor to formulate research/project topic, perform work, analyze data, and present findings in written and oral formats. May be repeated for credit. Grading: S/U

All NSE courses are numbered using the following numbering system:

- Cross-listed Electives (NSE 5xx).
- Core Requirements (NSE 600–619) – these courses are required for all M.S. students.
- Reactor and Materials Electives (NSE 620–639) – these courses focus on reactor systems, design, and material.
- Computational Electives (NSE 641-659) – these courses focus on computational aspects of the program.
- Health Physics and Safety (NSE 660–679) – reserved for future.
- Other special course numbers – NSE 640 and NSE 699.

6. Assessment Plan
    A. Curriculum map: Master of Science in Nuclear Science and Engineering. In this table, letters I, R and A indicate whether the course addresses the program outcome at an introductory, reinforcing, or advanced level, respectively.

Program Outcome à Course â	(1) Apply core nuclear science to real-world systems	(2) Design and Evaluate Nuclear Systems	(3) Utilize Computational and Modeling Tools	(4) Demonstrate Effective Technical Communication	(5) Conduct Independent Research
NSE 600 Graduate Seminar			I	I	I
NSE 601 Introduction to Nuclear Engineering	I				
NSE 602 Nuclear Reactor Theory	R	I	R		
NSE 603 Reactor Thermal Hydraulics	R		A		
NSE 604 Reactor Design	A	A	A	R	R
NSE 699 Graduate Project or Research Hours				A	A

B. Outcome assessment measures

Because initial cohort sizes are expected to be small (approximately 4–5 students), outcome percentages will be highly sensitive to the performance of individual students. For example, a single student not meeting a target could reduce the measured success rate by 20–25 percentage points. While the program's aspirational goal is to achieve 80–85% success on all measures, the acceptance criterion is set at 75% during the early years to account for this statistical variability until enrollment reaches a level that supports more stable percentage-based assessments.

Outcome 1: Apply Core Nuclear Principles

<u>Measure 1: Core Principles Application Exam</u>

Description: Cumulative written exam assessing reactor physics, neutron transport, and radiation interactions, requiring both conceptual explanations and quantitative problem solving.

Location: NSE 602 - Nuclear Reactor Theory (final exam).

Target: At least 75% of students score ≥ 75% on the exam.

Timeline: Spring semester, first year

<u>Measure 2: Core Parameter Analysis in Reactor Design</u>

Description: Evaluation of the section of the NSE 604 team project focused on calculating and justifying key core parameters (e.g., reactivity coefficients, fuel arrangement, or power distribution) using fundamental nuclear principles.

Location: NSE 604 - Reactor Design (design project).

Target: At least 75% of student teams achieve ≥ B based on correct application of nuclear engineering concepts and calculations in team project

Timeline: Fall semester, second year

Outcome 2: Design and Evaluate Nuclear Systems

<u>Measure 1: Thermal-Hydraulic Analysis Skills</u>

Description: Performance on designated thermal-hydraulic homework assignments in NSE 603, explicitly labeled in the syllabus as "Core Analysis Assignments." These assignments require students to calculate heat transfer rates, temperature distributions, fluid flow characteristics, pressure drops, reactor core cooling flow, and natural circulation conditions.

Location: NSE 603 – Reactor Thermal Hydraulics (Core Analysis Assignments)

Target: At least 75% of students achieve ≥ 75% averaged across these assignments.

Timeline: Fall semester, first year

Measure 2: Reactor Design Final Exam

Description: Final exam evaluating students' ability to apply reactor core design principles, including reactivity control, spatial power distributions, and the effect thermal-hydraulic conditions on reactivity feedback.

Location: NSE 604 – Reactor Design (final exam).

Target: At least 75% of students earn a grade of B or higher on the exam.

Timeline: Fall semester, second year

Outcome 3: Utilize Computational and Modeling Tools

Measure 1: Python Numerical Simulation

Description: Students use Python to implement a simple numerical solver (e.g., finite difference with iterative updates for a 1D two-group diffusion problem) in a basic geometry, produce fast/thermal flux profiles, and provide a brief interpretation against a provided reference.

Location: NSE 601: Introduction to Nuclear Engineering (computational homework or mini-project).

Target: At least 70% of students achieve ≥ 75% on this exercise.

Timeline: Fall semester, first year.

Measure 2: OpenMC Installation and Test Case Execution

Description: Students download and install OpenMC with required cross-section libraries, then run a provided test case to verify correct setup and basic operation.

Location: NSE 602: Nuclear Reactor Theory (computational assignment).

Target: At least 75% of students successfully complete the installation and test case as verified by submitted outputs.

Timeline: Spring semester, first year.

Outcome 4: Demonstrate Effective Technical Communication

Measure 1: First-Year Research Seminar Presentation

Description: Each first-year graduate student will give a 20-minute seminar presentation in the spring semester on the status of their research, including objectives, progress, and planned next steps.

Location: NSE 600: Graduate Seminar

Target: At least 75% of students meet departmental expectations for clarity, organization, and delivery.

Timeline: Spring semester, first year.

Measure 2: Technical Report and Team Presentation

Description: Technical report and accompanying oral presentation summarizing the results of the team-based reactor core design project, demonstrating clear technical writing, logical organization, and effective oral communication.

Location: NSE 604: Reactor Design (final project deliverables and presentation).

Target: At least 75% of students earn a grade of B or higher on both the report and presentation components.

Timeline: Fall semester, second year.

Outcome 5: Conduct Independent Research

Measure 1: Research Proposal

Description: Preparation and submittal of a research proposal, outlining objectives, methodology, and expected contributions to the field.

Location: NSE 699: Graduate Project or Research Hours

Target: At least 75% of students meet departmental expectations for clarity, feasibility, and scholarly merit.

Timeline: First year

Measure 2: Final Thesis Submission and Defense

Description: Completion of a research thesis evaluated for originality, scientific rigor, and clarity, followed by an oral defense before a faculty committee.

Location: NSE 699: Graduate Project or Research Hours (culminating requirement).

Target: At least 75% of students meet departmental expectation of a successful defense on the first attempt.

Timeline: At program completion.

C. Assessment Memo. Attach a memo or email of feedback from the Assistant Vice President for Academic Affairs indicating how the assessment plan meets university standards.

7. Required Institutional Support

A. Faculty requirements and availability

The program will launch with a clear plan to ensure adequate instructional and advising capacity from day one. At present, most faculty with the expertise to teach graduate NSE courses are currently fully committed to other work. Hence, in the program's early stages, we will leverage existing undergraduate courses in the Onstead College of Science and Engineering to meet instructional needs, offering dual-listed versions of NSE 591 (PHYS 491), NSE 541 (MATH 341), NSE 562 (CHEM 362), NSE 553 (PHYS 453) and NSE 525 (MATH 325).

We plan to add two new full-time faculty members before the launch of the program, focusing on graduate-level teaching and research, and pursuing external funding to support graduate students and their own research programs. If suitable candidates are not secured by that time, qualified adjunct faculty will be engaged to develop and teach courses as needed while recruitment for permanent hires continues. This tactic ensures the program can meet instructional and advising needs at launch while building toward stable, long-term research-focused mode of operation.

B. Impact on existing programs

The NSE graduate program is expected to draw most of its applicants from recent graduates of the Engineering and Physics Department, with potential additional interest from students completing degrees in Mathematics and Chemistry. Because it is a graduate-level program, it will supplement these undergraduate programs rather than compete with them.

In addition, interest in ACU's MSRR is expected to attract nuclear engineering graduates from other institutions who wish to gain hands-on, experiential reactor training not available at their undergraduate institutions. No adverse enrollment effects are anticipated on existing programs within the home department or other departments.

C. Program director

The Program Director is Dr. Mark DeHart, who has already been hired and is leading the program's development. Dr. DeHart holds a Ph.D. in nuclear engineering and brings over three decades of experience spanning national laboratory research and professional leadership in the field. He has published extensively in reactor physics, computational methods, and advanced reactor technologies, and has directed multi-institutional projects funded by federal agencies.

As the program matures, it may ultimately transition into its own department within the OCSE, with Dr. DeHart continuing to provide academic and administrative leadership to ensure its success.

D. Staff requirements

No new staff positions are anticipated in the near term. The program will utilize existing staff within the OCSE and at the NEXT Lab to support instructional, laboratory, and administrative needs at launch. As the program grows and faculty numbers increase, additional staff may be required; however, it is expected that incoming research funding will help offset the cost of any future staff augmentation. The use of current resources will prevent added workload strain on existing staff during the initial years.

E. Library resources

Subscribing to journals from the American Nuclear Society (ANS) is important for staying informed on industry developments and current research. Two journals published by the Society are *Nuclear Science & Engineering* and *Nuclear Technology*. *Nuclear Science & Engineering* is the oldest journal in the field of study. *Nuclear Technology* covers many of the topics in courses being offered or developed and will receive significant use by students in the program.

These two journals published by the ANS can be made available to students for the following costs:

Nuclear Science & Engineering - $4,733 + 7% escalator each year
Nuclear Technology - $5,137 + 7% escalator each year

Additionally, the *ACU Interim Nuclear Engineering Report* recommends that an arrangement be made with the libraries at Texas A&M and the University of Texas where ACU faculty and ACU students taking courses at these institutions could have access to trade magazines. Trade magazines can be very expensive and probably not worth the investment for a program of our current size. In some cases, specific articles of interest can be purchased individually and avoid an annual subscription. Also, students who have student memberships in the American Nuclear Society will have access to *Nuclear News,* or the faculty member can share relevant articles with students.

The ACU Library offers a wide range of resources tailored to science and engineering disciplines. These include comprehensive databases of science and engineering journals and research papers, e-books and reference books. Our electronic resources are accessible 24/7, allowing students and faculty to conduct research and access materials anytime, anywhere. Below is a list of current resources available to support the program:

> **ScienceDirect Freedom Collection** - ScienceDirect is a leading full-text scientific database offering journal articles and book chapters from more than 2,500 peer-reviewed journals and more than 11,000 books. There are currently more than 11 million articles/chapters, a content base that is growing at a rate of almost 0.5 million additions per year. *Progress in Nuclear Energy*, *Nuclear Engineering and Design,* and *Annals of Nuclear Energy* are available through ScienceDirect

> **Wiley Online Library** - Multidisciplinary collection of online resources covering life, health and physical sciences, social science, and the humanities. It delivers seamless integrated access to over 4 million articles from 1500 journals, over 10,000 online books, and hundreds of reference works, laboratory protocols and databases. *International Journal of Energy Research* and *Science and Technology of Nuclear Installations* are part of this platform.

> **Springer Nature E-Journals -** Diverse portfolio of journals in engineering and environmental science, including nuclear energy. *Nuclear Science and Techniques* is included in this platform.

> **IEEE Xplore Digital Library** - The IEEE Xplore Digital Library is the premier database for research in electrical engineering, electronics, computer science and related disciplines. IEEE Xplore includes full-text access to over 180 IEEE peer-reviewed journals and magazines; 1,500 annual conferences; active, archived and redline IEEE standards; as well as IET journals, magazines, and conferences. *IEEE Transactions on Nuclear Science* is available on this platform.

Knovel - Provides full-text reference books, manuals, and reference materials to support science and engineering knowledge and related topics.

EBSCO Science & Technology Collection - Contains over 800 leading full text journals covering topics including aeronautics, astrophysics, chemistry, computer technology, geology, aviation, physics, archaeology, and materials science.

Scifinder Scholar Search - SciFinder is a research discovery tool that allows you to explore the CAS databases that contain literature from many scientific disciplines, including biomedical sciences, chemistry, engineering, materials science, agricultural science, and more! Contains: CAS REGISTRYSM database, more than 16 million single- and multi-step reactions, more than 1 billion predicted property values, and more than 2 million experimental properties.

Proquest SciTech Premium Collection - The SciTech Premium Collection includes the Natural Science Collection and the Technology Collection and provides full-text titles from around the world, including scholarly journals, trade and industry journals, magazines, technical reports, conference proceedings, government publications, and more.

Scopus - large abstract and citation database with more than 75 million records of journal articles, books, and conference papers. Scopus is unique in its features of discovery and analysis of shared authors, keywords, references, and citations.

Subject Librarians are available to assist with research inquiries, citation guidance, and utilizing information research tools.

F. <u>Physical resources</u>

At program launch, office space will be required for two full-time faculty members, with capacity to expand as additional faculty and support staff are added in later years. Classroom needs will begin with a single dedicated space in Year 1, with a second classroom anticipated after the first year as course offerings double. Two laboratory courses are planned; both can be accommodated within the same dedicated laboratory space to optimize utilization and minimize facility impact; logistically it would make most sense to use laboratory space within SERC because of existing radiological controls.

The most significant physical resource cost will be laboratory equipment to support the reactor design and analysis curriculum. Minimum specific equipment requirements and associated costs have been estimated in alignment with course design and are described below. These assessments assume six students in the lab working in groups of two or three. All costs are estimated and are considered ballpark accurate. Adding ^{252}Cf enables labs on neutron moderation, shielding, detection efficiency, and mixed field discrimination.

Survey and Basic Counting

- Three Geiger-Mueller survey meters with pancake probes (beta/gamma surveys, contamination checks). $1,830 each; $5,500 total

Gamma Spectroscopy

- Two spectroscopy systems, each using thallium-activated sodium iodide (NaI(Tl)) scintillation detectors with a multichannel analyzer, high-voltage supply, and acquisition software. $8,000 each; $16,000 total
- Two lead castles/shields for background reduction. $3,000 each; $6,000 total
- Two laptops/PCs for multichannel analyzer control and analysis. $1,000 each; $2,000 total

Neutron Detection

- One moderated ^{3}He or BF_3 proportional counter system with preamp, high-voltage supply, and counting electronics. $15,000
- One portable neutron REM meter (for dose rate monitoring). $8,000
- Polyethylene moderator blocks for experiments. $1,500

Californium-252 Neutron Source

- Sealed ^{252}Cf source (1–5 μg, encapsulated, Type A certified). $20,000 (cost will vary depending on activity and encapsulation)
- Source storage and shielding unit (e.g., a lead/polyethylene combo safe or shielded cabinet) $6,000
- Annual leak testing and license compliance costs. $1,500/year (likely covered under SERC operations)

Electronics and Test Equipment

- One pulse/function generator for electronics calibration. $1,000
- Two digital two-channel oscilloscopes. $750 each; $1,500 total
- Assorted cables, tees, terminators, stands, collimators. $1,500

Sources for Gamma Experiments

- Sealed gamma check source set (^{137}Cs, ^{60}Co, ^{22}Na, ^{133}Ba) with shielded containers (pigs) and lockable cabinet $5,000

Safety and Compliance (likely covered under SERC operations)

- Contamination monitor (pancake GM) $2,500
- Electronic dosimeters or TLD service for all students/faculty $1,500 initial + $500/year
- Radiation area signage, personnel protective equipment (PPE), wipe test kits. $1,000

Estimated Cost Summary

Category	Cost Estimate
Survey meters	$5,500
Gamma spectroscopy (NaI(Tl), shields and computers)	$24,000
Neutron detection ($^{3}He/BF_3$ + REM meter and moderators)	$24,500
^{252}Cf source and storage	$20,000
Electronics and test gear	$4,000
Gamma check sources	$5,000
Safety and compliance gear	$5,000
Total (one time, no SERC contribution)	$88,000
Annual recurring (no SERC contribution)	$2,000
Total (with SERC contributions)	$83,000

Notes:

1. ^{252}Cf half-life is ~2.65 years, so activity (and neutron yield) will drop by ~50% every 2.5 years - budget will need to account for replacement.
2. Licensing for possession and use of ^{252}Cf, plus secure storage and handling protocols likely umbrellaed by SERC.

H. Recruiting

Recruiting for the Master of Science in Nuclear Science and Engineering program may begin following formal approval by ACU, with all materials clearly noting that the program is pending approval by SACSCOC, anticipated by July 2026. Initial outreach will target students with undergraduate backgrounds in nuclear and mechanical engineering, physics, or closely related fields, with emphasis on those interested in reactor design, advanced energy systems, and ethical leadership in nuclear technology. We anticipate strong participate from graduating ACU seniors who are already familiar with the MSRR project and who may have already completed an internship within the NEXT Laboratory. Internal recruiting efforts will include direct engagement with ACU juniors and seniors in related departments, with the goal of attracting top-performing students to the graduate program.

A key recruiting milestone will be participation in the 2025 ANS Winter Meeting in Washington, D.C., where ACU will host a booth in partnership with the NEXT Laboratory to highlight activities in nuclear science and engineering and showcase the Molten Salt Research Reactor (MSRR) project. The booth cost of $4,500 includes two paid registrations (valued at approximately $2,400), enabling direct engagement with prospective students, faculty, and industry partners.

Regional recruiting will focus on institutions with existing nuclear engineering programs (e.g., Texas A&M University, Georgia Tech, University of New Mexico, Missouri University of Science and Technology, and Kansas State University), emphasizing ACU's hands-on reactor design curriculum, laboratory integration, and the opportunity for future engagement with the Molten Salt Research Reactor. Outreach will be supported by ongoing NEXT Laboratory initiatives and the MSRR, which help attract applicants who are specifically interested in hands-on reactor design, advanced laboratory work, and the opportunity to engage with the MSRR project.

Estimated recruiting costs include:

ANS Winter Meeting booth and registration: $4,500

Targeted digital advertising and sponsored content: $3,000/year

Travel and registration for additional graduate fairs: $2,500/year

Printed materials and promotional collateral: $1,000/year

Faculty time for outreach and presentations: covered under existing workload

I. Additional cost to deliver program

One-Time Expenses

Category	Description	Estimated Cost
Faculty Office Setup	Initial office space for two new faculty	Included in existing facilities

Classroom Setup	One classroom in Year 1, second in Year 2	Included in existing facilities
Laboratory Equipment	Full setup for NSE 621 lab, including gamma spectroscopy, neutron detection, ^{252}Cf source, electronics, and shielding	~$88,000
Recruiting Booth	ANS Winter Meeting 2025 booth (includes 2 registrations)	$4,500
Printed Materials	Initial promotional brochures	~$1,000
Total		**~$93,000**

Ongoing Annual Expenses

Category	**Description**	**Estimated Annual Cost**
Library Subscriptions	ANS journals (Nuclear Science & Engineering, Nuclear Technology)	$9,870/year
Library Escalation	Estimated 7% annual increase	~$700/year
Recruiting Travel & Ads	Graduate fairs, digital ads, outreach	~$5,500/year
Radiation Safety Compliance	Leak testing, dosimetry, signage, PPE	~$2,000/year
Total		**~$18,000/year**

J. Pro Forma

		FY2027	FY2028	FY2029	FY2030	FY2031
	YR 0	YR 1	YR 2	YR 3	YR 4	YR 5
GROSS MARGIN:						
Tuition		$110,500	$192,270	$236,470	$280,670	$298,350
Fellowships		-110,500	-192,270	-236,470	-280,670	-298,350
Net Tuition Revenue	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
COGS -College/Department Direct	**-$462,500**	**-$675,045**	**-$415,129**	**-$120,610**	**-$74,792**	**$246,314**
Grant Revenue		500,000	1,000,000	2,000,000	3,000,000	4,000,000
IDC Revenue		15,390	15,852	16,327	20,616	21,234
Salaries & Benefits	-337,500	-615,600	-634,068	-653,090	-824,626	-849,365
Funded GA Stipends	0	-75,000	-175,000	-250,000	-325,000	-375,000
Books & Materials	0	-2,210	-3,845	-4,729	-5,613	-5,967
Other OpEx	-25,000	-27,625	-48,068	-59,118	-70,168	-74,588
Start-up Costs	-100,000	-200,000			-100,000	-100,000
Research Expenditures		-300,000	-600,000	-1,200,000	-1,800,000	-2,400,000
Gift/Endowment Support		30,000	30,000	30,000	30,000	30,000
GROSS MARGIN	**-$462,500**	**-$675,045**	**-$415,129**	**-$120,610**	**-$74,792**	**$246,314**
Contribution Margin	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*
ACQUISITION:	**-$10,000**	**-$11,050**	**-$19,227**	**-$23,647**	**-$28,067**	**-$29,835**
CAMPUS:	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
SYSTEM:	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Total ACQ & OH	**-$10,000**	**-$11,050**	**-$19,227**	**-$23,647**	**-$28,067**	**-$29,835**
EBIDA	**-$472,500**	**-$686,095**	**-$434,356**	**-$144,257**	**-$102,859**	**$216,479**
Depreciation						
Interest						
NET OPERATING INCOME (LOSS)	**-$472,500**	**-$686,095**	**-$434,356**	**-$144,257**	**-$102,859**	**$216,479**
Cash Adjustments						
ADJUSTED NET INCOME	**-$472,500**	**-$686,095**	**-$434,356**	**-$144,257**	**-$102,859**	**$216,479**

Cost of Delivery (COD)	FY2026	FY2027	FY2028	FY2029	FY2030	FY2031
MS/PhD Nuclear Director	$250,000	$250,000	$257,500	$265,225	$273,182	$281,377
Fringe	$87,500	$87,500	$90,125	$92,829	$95,614	$98,482
FTE Compensation	**$337,500**	**$337,500**	**$347,625**	**$358,054**	**$368,795**	**$379,859**
Sections	0	0	2	2	4	4
FTE Sections	3	3	3	3	3	3
Adjunct Faculty Support	0	0	0	0	0	0
Adj Pay Rate	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000
Adj Compensation	$0	$0	$0	$0	$0	$0
Fringe	$0	$0	$0	$0	$0	$0
Adj Compensation	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Student Services	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Books & Materials	**$0**	**-$2,210**	**-$3,845**	**-$4,729**	**-$5,613**	**-$5,967**
OpEx	**$0**	**-$27,625**	**-$48,068**	**-$59,118**	**-$70,168**	**-$74,588**
Faculty	0	2	2	2	3	3
Faculty Pay	$100,000	$103,000	$106,090	$109,273	$112,551	$115,927
Total faculty Compensation	$0	$206,000	$212,180	$218,545	$337,653	$347,782
Fringe	$0	$72,100	$74,263	$76,491	$118,178	$121,724
Professor Compensation	**$0**	**$278,100**	**$286,443**	**$295,036**	**$455,831**	**$469,506**

Cost of Acquisition (COA)		FY2027	FY2028	FY2029	FY2030	FY2031
Marketing / Advertising	$0	-$11,050	-$19,227	-$23,647	-$28,067	-$29,835
Student Admissions / Partnerships	$0	$0	$0	$0	$0	$0

References

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Abilene Independent School District. (2024, September 4). ATEMS graduate working at NEXT Lab to help solve real-world issues. https://www.abileneisd.org/article/1746438

Lightcast. (2025, August). Program Overview - Nuclear Engineering form Lightcast Q3 2025 Data Set, prepared for Abilene Christian University.

Oak Ridge Institute for Science and Education. (2023). Nuclear engineering enrollments and degrees survey: 2021–2022 data. U.S. Department of Energy. https://orise.orau.gov/stem/workforce-studies/nuclear-engineering-enrollments.html

Texas Workforce Commission, Labor Market & Career Information Department. (2025). Texas wages and employment projections. TexasWages.com. https://texaswages.com/WDAWages

Approvals

The proposal aligns with institutional policies and processes, and the campus is prepared to support the proposed program as presented.

Wes Crawford (Oct 14, 2025 13:24:06 CDT) 10/14/2025

Vice Provost Date

This proposal connects the program's student learning outcomes, curriculum, and assessment plan completely and has designed a program that institutional systems can support.

Jessica Smith 10/15/2025

Assistant Vice President for Academic Affairs Date

The library has sufficient resources to support the program, or the comments below outline additional acquisitions required and their associated costs.

Mark McCallon 10/15/2025

Associate Dean of the Library Date

Comments, if needed:

We have developed a pro forma budget for the program under consideration.

Steven Rutt 10/23/2025

Chief Revenue Officer Date

This proposal does not require additional review for institutional accreditation purposes, or I have worked with the faculty to gather the information necessary to notify SACSCOC or gain its approval.

Chris Riley 10/23/2025

SACSCOC Liaison Date

Step 3: Curriculum Approval Process

When all signatures are complete, attach an Abilene Approval Chart for Curriculum Changes, conduct the department faculty vote to approve the new program, and continue the approval process as specified by the approval chart.

Updated 8/18/2025