

## COVER PAGE

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## ACCOMPLISHMENTS

- **What are the major goals and objectives of this project?**

The major goals of the project involve (1) establishing a student mentoring program to engage undergraduate and graduate students through consecutive summer internships at ORNL and private fusion companies where they will gain hands-on experience with cutting-edge research and commercial applications of fusion technology, (2) developing a series of new courses and special-topics modules to be implemented at participating universities and shared publicly with the broader academic community, and (3) promoting the sustainability of the project through an entrepreneurship and innovation-focused bootcamp designed for sustained training and participation of students in fusion engineering.

### **Student Mentorship Program:**

Personnel involved in the student mentorship program include faculty at participating universities, ORNL research staff, and staff from private fusion companies. These individuals provide academic, technical, and research mentorship as well as career guidance and professional development during the summer and during the academic semesters. For this budget reporting period, 1 slot was allocated to Southern Adventist University for an undergraduate student to travel to Oak Ridge National Laboratory (ORNL) in order to participate in fusion-engineering research for a 10-week period. Additionally, this project allocated funds for the student to attend a scientific or fusion-engineering related conference in order to present their research to the wider academic community.

### **Curriculum Development:**

The curriculum development effort involves faculty at participating universities, ORNL research staff, and staff from private fusion companies. Through interactions between the faculty and ORNL staff, topics of immediate and future relevance to the fusion-engineering community at large are incorporated into new and existing courses for undergraduate and graduate students. Private fusion companies provide content and curriculum review along with ideas regarding topics of immediate usefulness to future fusion energy engineers. Southern Adventist University is incorporating 2-week fusion-engineering modules into 4 existing engineering courses. Additionally, SAU is assisting in the review of other fusion engineering curriculum.

### **Sustainability and Fusion Innovation Bootcamp:**

The Fusion Innovation Bootcamp involves faculty from participating universities, ORNL research staff, staff from participating fusion engineering companies, and invited guest lecturers. This bootcamp will be a 2-week intensive experience for students, guest lecturers, and mentors to explore a wide variety of fusion engineering topics and to ignite future interest among students and provide a workforce pipeline of highly qualified engineering talent.

- **What was accomplished towards these goals?**

For this budget reporting period, 1 student intern slot was allocated to Southern Adventist University. This student spent the summer at ORNL conducting research on sticking coefficients of molecular hydrogen in cryogenic pumping systems. Since the summer internship, the additional objective of providing a conference attendance and research presentation opportunity for the student have been met. The student and one of the supporting faculty from SAU traveled to the Southeastern Section of the American Physical Society where the student presented results from their summer research.

The SAU PI had the opportunity to attend the UTK Fusion Summer School in June of 2025 and observe classroom and laboratory teaching by UTK Nuclear Engineering faculty. Additionally, the SAU PI had the opportunity to interact with ORNL staff researchers onsite during a research presentation poster session in August 2025. The SAU faculty involved in this project spent the majority of the time of the budgetary period recruiting students for the summer internship and developing curriculum to be incorporated into existing courses. The specific objective for this budgetary period was for the SAU PI to include new fusion engineering content in 4 engineering courses. The SAU faculty made substantial progress on draft versions of this fusion engineering curriculum.

- **What do you plan to do during the next reporting period to accomplish the goals and objectives?**

During the next reporting period, SAU faculty will continue (1) recruiting talented students showing interest in fusion engineering for summer internships opportunities, (2) developing fusion engineering and technology curriculum for additional engineering courses, (3) assisting with and engaging in the Fusion Innovation Bootcamp scheduled for summer 2026, (4) attending conferences with student interns to provide opportunities for them to present their research findings, grow professionally, expand their networks, and gain further insights from the larger fusion research community, and (5) participating in a summer 2026 research intensive onsite at ORNL for further inclusion of technical material into undergraduate engineering courses.

- **What opportunities for training and professional development were provided for participants?**

First and foremost, this project is intended as an opportunity for training and professional development of engineering and science students at all participating universities and ideally, through the curriculum development portion of the project, students at universities beyond just those represented in this project. One SAU student had the opportunity to receive one-on-one research mentorship with an ORNL research staff member over the summer and has since had the opportunity to present their research on campus and at the Southeastern Section of the American Physical Society's 92nd annual conference. This student has also had the opportunity to work one-on-one with faculty mentors since returning to campus for the academic semester.

SAU faculty have had the opportunity to interact with ORNL staff and other participating university faculty on a one-on-one basis and, as a result, have grown substantially in their knowledge of current, cutting-edge developments in the field of fusion energy engineering. Additionally, the SAU PI had the opportunity to attend the Fusion Summer School program at UTK during June 2025 and not only observe educational methods utilized by UTK faculty for teaching fusion energy engineering content but also observe student interactions with these faculty in typical classroom and laboratory settings. These interactions have proved especially helpful during the curriculum development process at SAU and have also guided the PI's professional growth as an engineering educator.

- **How have the results been disseminated to communities of interest? In particular, provide details for any dissemination not reported in the research product section of this report.**

Key findings and results from the student summer internship have been presented by the student during a poster session held onsite at ORNL following the end of the summer internship program. This poster session brought together all of the summer interns, visiting faculty, and a wide variety of ORNL research staff. In addition to this poster session, the student has presented their research findings at the Southeastern Section of the American Physical Society's 92nd annual conference in October 2025.

Preliminary curriculum development results have been shared among participating universities, ORNL research staff, and fusion engineering industry organizations. Once this curriculum has been finalized, it will be publicly distributed on select websites for the wider academic and industrial communities.

## PRODUCTS

The products shown below include only Publications with a 'Published' status and Intellectual Properties with a 'Granted' status. Products with other statuses are not included in this report. The Revision Type indicates whether a product is New (newly added), Updated (existing product modified), or No Change (existing product reported without modifications) during the current budget period. Note that 'Updated' statuses may appear more frequently as products progress through the publishing process. All products listed have been reported for the current project period of this award.

### PUBLICATIONS

There are no publications to report.

### INTELLECTUAL PROPERTIES

There are no intellectual properties to report.

## PARTICIPANTS AND OTHER COLLABORATING ORGANIZATIONS

The table below only contains participants who have identified an affiliation with the Awardee Institution. Participants from any associated subawards may not be included in this count.

### PARTICIPANTS DETAIL

<b>Project Role</b>	<b>Number of People</b>	<b>Total Person Months Worked</b>
Co-Investigator	1	1
Principal Investigator/Project Director	1	1
Undergraduate Student	1	3
<b>Total Responses</b>	<b>3</b>	<b>5</b>

### PARTNERS DETAIL

There are no partners to report.

## IMPACT

- **What was the impact on the development of the principal discipline(s) of the project?**

### **Student Intern Research Work:**

It is anticipated that the research work performed by student interns in collaboration with ORNL research staff and with fusion energy engineering industry partners will contribute to the knowledge base necessary for future fusion energy developments. Additionally, with students being exposed to such focused research knowledge early on, they will likely be well positioned to contribute substantially more toward future research developments should they take a fusion energy engineering research career (which is anticipated to be the case for a substantial number of interns).

### **Curriculum Development:**

As faculty and research partners are developing curriculum to introduce both foundational and cutting-edge knowledge necessary for fusion energy engineering to undergraduate and graduate students, the review process involving multiple partners from academia, research labs, and engineering industry is creating carefully curated educational content that will impact the future trends of engineering education. With this content being openly accessible to the engineering academic community, the developments will improve the educational experience for a wide array of future engineering students.

- **What was the impact on other disciplines?**

In addition to impacting the field of fusion energy engineering, it is likely that the results from this project will make an impact on the field of materials science and engineering. The student intern's research work is broadly applicable within materials science and other areas of engineering as well. Additionally, the educational materials being developed will contribute to the educational experience such fields as heat transfer and cryogenic systems.

- **What was the impact on physical, institutional, and information resources that form infrastructure?**

No impact on physical, institutional, or information resources that form infrastructure will occur.

- **What was the impact on technology transfer?**

No impact on technology transfer is expected to occur.

- **What was the impact on society beyond science and technology?**

As students continue to graduate and become practitioners in the field of fusion energy engineering, they will contribute to the dream of realizing practical, unlimited fusion energy to positively contribute to the energy needs and demands of a growing, healthy society and economy. These students will have the knowledge to contribute to public policy needs and decision-making regarding fusion energy systems and how to operate them in a safe and sustainable manner.

- **What was the impact on the development of human resources?**

The project will make a long-lasting impact on the teaching and professional development of student interns and engineering students at SAU and participating universities. Through regular contact and interaction with field-defining researchers at ORNL and participating industry companies and through mentorship from faculty, students have the opportunity to develop knowledge and skills that will contribute to the fields of engineering, technology, and science for years to come. The curriculum developed will prove to be a tremendous aid to future engineering educators as they strive to keep their students informed of cutting-edge knowledge, standards, and practices in the larger fusion engineering community. Additionally, the knowledge transfer between researchers and faculty will contribute to the further development of leading researchers in fusion engineering.

- **What percentage of the award's budget was spent in foreign country(ies)?**

No portion of the award's budget was spent in foreign countries.