COVER PAGE

Project Title: Initiatives to Grow New Innovate Talent to Enable Fusion Energy	
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Principal Investigator Information: Dr. Joshua Schlegel	**Recipient Organization:** The Curators of the University of Missouri (Rolla) (Mo. Univ of Sci and Tech) 300 W. 12th Street Rolla, MO 65409-6506 Country: USA **UEI:** Y6MGH342N169

ACCOMPLISHMENTS

This project is organized around the following three objectives:

Objective 1: Student Mentoring

Undergraduate and graduate students (with an emphasis on the Master's level) will participate in two successive summer internships, one at ORNL, and the other at a private fusion company. Several of the private fusion companies have been contacted and have expressed interest in participating. In the intervening year (and beyond), the students will be mentored by ORNL / industry participants, meeting at least once a month to discuss career preparation, course selection, and graduate school selection towards a career in the fusion ecosystem. The students will also have the option to conduct an on-campus RENEW-funded research project related to their internship during the intervening year.

Objective 2: Curriculum Development

Private company and national lab leaders will be surveyed regarding the key knowledge, skills, and experience needed for a career in fusion engineering and technology. Faculty will participate in a 6-10 week summer intensive research experience (internship) at ORNL. ORNL and/or fusion company researchers will deliver 1-2 special topic lectures to university students as an enhancement to existing curricular modules. These lectures, based on the most cutting-edge research results, delivered in plain language, will serve to inspire, and educate students about the latest developments in fusion research. Faculty will lead (with input from national lab and industry partners) in developing curricular modules to be placed into existing curriculum and/or serve as the basis of a special topics course.

Objective 3: Sustainability

A Fusion Innovation Bootcamp (FIB) will be created, offering undergraduate and graduate students the opportunity to collaborate in teams to develop innovative solutions to real-world fusion challenges. Past experience from participating in the Nuclear Innovation Bootcamp will be utilized to ensure the success of FIB, leveraging insights gained to enhance the structure and effectiveness of the bootcamp. This will be patterned after (and use lessons learned from) the Nuclear Innovation Bootcamp that has been operating since 2016. In FY27, as a conclusion to this RENEW project, a fusion engineering and technology workshop will be established for members of the community to share best practices and curricular developments.

Missouri University of Science and Technology (S&T) is an Emerging Research Institution with an existing Nuclear Engineering program. The program currently enrolls over 120 undergraduate students and about 20 graduate students, supported by seven tenure-track faculty. Faculty in the Nuclear Engineering and Radiation Sciences (NERS) department offer courses on fusion fundamentals, plasma physics, radiation protection, radiation shielding, and other fundamental areas of practical interest in the development of nuclear fusion technology. NERS faculty support IGNITE Fusion Energy by developing content modules related to fusion technology and engineering based on existing course resources. These content modules can then be incorporated into existing or new courses offered at other universities. Those faculty will

also be available, as needed, to advise faculty working to incorporate those concepts into their courses.
NERS offers several courses that are relevant to fusion science and engineering. Missouri S&T will leverage the expertise and experience of NERS faculty teaching these courses to develop course modules and/or full courses. Those modules/courses will be based on the content of these and other courses already offered by the department. In the first year, Missouri S&T expects to create several fundamental modules.

Those course modules will be made available to the other participating institutions for review and comment. At this stage, the content and subject matters will be evaluated for relevance to practical application and major gaps will be identified. This component will be led by ORNL with willing private sector partner participation. The education-focused components will be primarily led by UTK due to experience in implementing fusion technology coursework. All participating institutions are encouraged to examine and review the supplied coursework and suggest improvements to the content, implementation strategy, and evaluation process.
The reviewed and collectively improved materials will then be sorted into categories for easy implementation. This will involve combining topics into lectures, modules, or entire courses as is seen most appropriate. Organization will be driven based on the interests of the participating institutions as well as their ability to incorporate the content into their educational programs.

All developed materials, including detailed course modules and full course lecture notes, will be freely shared among the partnering institutions. All institutions are encouraged to use the collaboratively generated content to bring this guided and reviewed fusion technology education to their institutions at the level they deem most appropriate for their resources. This open access approach is designed to foster a uniform standard of education in fusion technology across different programs and to facilitate the easy adoption of these resources by other academic entities. Over time, it is anticipated that these materials and process will also be made available to the broader academic community, thereby extending the impact of our collaborative efforts and supporting the advancement of fusion education.

During this reporting period Missouri S&T has developed two major groups of content. The first is a full course focused on radiation interactions with matter. This course is intended to introduce students in other disciplines to the fundamental physics behind radiation, the importance of shielding, considerations important for high-energy neutrons, etc. The second is a three-week module introducing students to the basics of fusion technologies. These items are currently under review by the Missouri S&T project team and should be available for review by partner institutions in the next few weeks.

In the next phase of the project, several additional modules will be developed for review and distribution. These will include:

- **Module Name:** Heat Transfer Challenges in Fusion reactors
  Description: Key heat transfer mechanisms in magnetic and inertial confinement fusion reactors, energy removal and conversion, key challenges in heat transfer design, current research.
- **Module Name:** Neutron and Radiation Transfer
  Description: Neutron transport equation, particle transport equation, Monte Carlo methods, computational and analytical methods for neutron and gamma attenuation
- **Module Name:** Biological Effects of Radiation
  Description: Effect of radiation on cells, dose and dose rate calculation, international standards, radiation protection guidelines
- **Module Name:** Principles of Radiation Shielding
  Description: Radiation transport, buildup factors, dose estimation, dosimetry, principles of radiation shielding design

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

Project Role	Number of People	Total Person Months Worked
Faculty	1	1
Principal Investigator/Project Director	1	1
Total Responses	**2**	**2**

PARTNERS DETAIL

There are no partners to report.

IMPACT

This project is promoting the professional and technical development of scientists and engineers that will design the next generation of fusion-based technologies.

Engineers and scientists across disciplines will be exposed to concepts central to fusion technology, broadening their skill base and promoting research and innovation in related fields.

The project promotes the field of nuclear fusion to a wider audience and will attract additional skilled graduates to enter the field. This will broaden the pool of qualified scientists and researchers.

IGNITE Fusion Energy promotes innovative new applications for sustainable fusion technologies. This is intended to ensure a stable future energy supply and support plasma-based technologies in a variety of industries that enable a modern technological lifestyle.