

A Review of Year One INIE Activities of the Consortium of BIG-10 URTRs

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INTRODUCTION

The Consortium of Big-10 University Research and Test Reactors has made significant progress in the first year of the U.S. Department of Energy (DOE) Office of Nuclear Energy Science and Technology Innovations in Nuclear Infrastructure and Education (INIE) funding. The Consortium consists of Penn State University (lead institution), Purdue University, the University of Illinois and the University of Wisconsin.

The funding obtained under the DOE INIE grant program is being used to strengthen nuclear engineering education through strategic investments in the Consortium University Research and Training Reactors (URTR) infrastructure. The objectives of our INIE sponsored program presented previously¹ can be summarized as follows: 1) to develop educational programs that utilize Consortium URTR facilities; 2) to develop and design of a 'Virtual' URTR for use in education and research with the intention of constructing a new URTR; 3) to create an educational outreach; and 4) to develop a Mini-Grant program.

ACCOMPLISHMENTS IN YEAR 1

The plan for accomplishing our Consortium's objectives was divided into four major tasks¹. Table 1 summarizes the subtasks to be either completed or started in Year 1.

Subtasks I-1 and I-3 involve efforts to increase the Consortium's URTR utilization. Subtask I-1 focuses on immediate upgrades to improve existing analytical capabilities and reactor research facilities. Accomplishments under Subtask I-1 included purchase of a new ⁶⁰Co irradiator, installation and testing of a slow

neutron chopper, improvement in neutron imaging facility and development of a new neutron activation analysis laboratory at Penn State. Accomplishments at the University of Wisconsin included upgrading the URR coolant system, reactor security systems and laboratories within the reactor containment.

Subtask I-3 focuses on designing, building and testing new techniques and facilities that add capabilities to a member's URTR. The primary activity in Year 1 was planning major long-term improvements. As an example, a conceptual design was created for a new Neutron Beam Hall, and Neutron Beam Ports at the Penn State. This design includes new thermal and cold neutron beams, neutron guides, and associated instrumentation for various neutron beam techniques. At University of Wisconsin the design of the major upgrade of the UWRN visitor center and associated 'hot' radiation laboratories has begun as part of the \$45 million Mechanical Engineering addition.

Task II will provide a major advanced computational environment for the analysis and configuration of URTRs that will be fully open for access and use by the entire URTR and associated reactor communities to assist in the development of a design basis for a next-generation URTR. The University of Illinois acquired relevant computer codes as "building blocks" of a virtual system and the next-generation URTR design, a 3D CAVE-like environment has been built and a virtual control room and shielding experiment developed. Purdue University has developed detailed models of the existing research reactors using Monte Carlo codes (MCNP and COG) and method of characteristics based codes (DRAGON and AGENT for now); a new methodology for tracking neutron trajectories in

time varying geometries (like movement of control rods); and a graphic user interface to support all stages in the calculation procedure for neutron transport in 2D/3D atypical geometries of the research reactors.

Task III focuses on developing innovative education and outreach programs that will seamlessly integrate our URTRs into nuclear science and engineering educational programs. Subtasks III-1 and III-4 were postponed until future years due to funding constraints. Progress Subtask III-2 included completion of a web-based course entitled, "Introduction to Nuclear Engineering" at the University of Wisconsin. At Penn State a new \$200,000 teaching laboratory for student/outreach programs was created with equal Penn State and INIE funding.

Task IV, the establishment of a Consortium Mini-Grant Program, was completed. The Program allows researchers and educators from a wide-range of disciplines access to the URTR facilities by providing small grants. Grants range from \$1,000 to \$25,000 for student support, traveling to the URTR facility, materials and supplies, and staff time at the URTR. The Governance Committee, which recommends the

proposals to be funded, guides the Program. The first awards were made in July 2003. Future, awards will be made semiannually. Details of the Mini-Grant Program are at <http://www.mne.psu.edu/minigrant/>.

CONCLUSION

The Consortium of Big-10 University Research and Test Reactors has made significant progress in the first year of the INIE Program. The accomplishments have been made in a timely manner and are already beginning to yield positive benefits to both Consortium Universities and the communities. During the second year, Ohio State University will be added to the Big-10 Consortium. Ohio State will contribute to all four major tasks and extend the benefits of the Consortium to Ohio and surrounding states.

REFERENCE

1. J. S. Brenizer, et al., "An Update of the Consortium of BIG-10 University Research and Training Reactors INIE Activities," Trans. Am. Nucl. Soc. **88**, 649 (2003).

TABLE 1. Summary and Timetable of Tasks	
PROJECT TASKS	DATE
Task I	
I-1: Design, purchase and implement facility upgrades for consortium URTRs	Years 1- 2
I-3: Design, construct and test long-term innovations and enhancements	Years 1-5
Task II	
II-1: Design and Assemble a Computational Environment for Advanced URTR Analysis	Years 1-3
II-2: Develop I/O Interfaces and Visualization Environment for the Computational Environment	Years 1-3
II-3: Design and Assemble a Computational Environment for In-core, Near-core and Beam-line Analysis	Years 1-5
Task III	
III-1: Organize two capstone design team internships (each year)	Year 1
III-2: Develop web-based introduction to engineering course	Year 1
III-4: Develop middle-school and high-school teacher summer internships	Year 1
Task IV	
Multi-Disciplinary, Multi-University Consortium Mini-Grant Program	Years 1-5