

National Laboratory Centered Innovation Institutes as Vehicles for Creating the Next Generation of Innovation Leaders

Global leadership in key emerging science and technology areas is central to the economic prosperity of developed nations and their people. A necessary element in achieving and maintaining such technology leadership is the development of new innovation leaders capable of combining in-depth understanding of key emerging technologies with a complementary understanding of the business, legal, and social issues involved in turning knowledge into economic value. For more than a decade researchers at Sandia National Laboratories (Sandia) have explored two different approaches for harnessing the tremendous assets available at a national lab to help create the next generation of innovation leaders in the key areas of micro and nano technologies. This was done through the MESA Institute and the National Institute for Nano-Engineering (NINE) programs in which over 400 university students have participated to date. Learning from these activities can help to guide effective use of the assets of national laboratories in developing new innovation leaders for the nation.

Students participating in MESA and NINE had the opportunity to come to Sandia for extended periods ranging from a few months to more than a year to work with Sandia researchers on large scale, leading edge multi-disciplinary research projects focused on developing micro and nano technology based solutions to important national problems in such areas as energy, advanced electronics, advanced materials and sensors. As part of these projects, students (primarily graduate students) and their faculty advisors were provided access to Sandia's world class micro and nano technology research facilities under the guidance of Sandia's top researchers. This work capitalized on DOE's extensive investment (approximately \$750 million) in micro/nano R&D equipment and facilities at Sandia together with facilities at our participating university partner's sites.

The MESA Institute brought nearly 200 students from 34 U.S. universities to Sandia between 2001 and 2005 to work on microsystems-related projects. Its approach was simple; to provide organization and matching funding to Sandia researchers to help them bring in university students and faculty to participate in existing research projects. Its goals were to establish collaborations with leading university researchers and their students, learn from their ideas, enable cost-effective student participation, and establish a pipeline of top students trained in leading edge microsystems work. While at Sandia the students were provided opportunities to learn from other students, were exposed to many different projects and technologies, and were provided opportunities to learn about entrepreneurship.

The National Institute for Nano-Engineering (NINE) was designed more ambitiously as a government/university/industry collaboration. Since NINE's beginning in 2006 it has brought nearly 250 students from 28 U.S. universities to Sandia to work on NINE-funded projects. The students work on large scale, multi-year, multi-disciplinary, pre-competitive nanotechnology research projects selected as high value by U.S. industry leaders and carried out using the expertise and world class facilities at Sandia in collaboration with top research universities across the nation. These projects were primarily funded by Sandia and DOE to develop nano-enabled solutions to important national problems while also laying the foundation for U.S. commercial leadership and job creation in the important emerging area of micro-nanotechnology. As a key element of its mission, NINE also provides students training in a broad range of innovation-relevant topics including business, legal, communication, and social issues involved in bringing a new technology to market through training by world-leading experts, real world experiences of entrepreneurs, and broad exposure to other students and their work. Approximately 10% of NINE students' time at Sandia is devoted to this innovation training.

The operational experience provided by the MESA Institute and NINE has provided broadly valuable lessons in how to cost-effectively use the assets and on-going work of national laboratories to help create the next generation of innovators for the nation. These included a focus on large scale, multi-year projects that include faculty advisors, regular periods of work at Sandia, a focus on pre-competitive research, avoiding entanglement in intellectual property issues, industry input in the selection of high value projects, the use of mission-driven projects with existing funding to provide high value opportunities for student research that lowers total project cost, and providing broad innovation training critical to success in converting knowledge to economic value.

Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.