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Formidable NINE coalition merges industry, university, national lab goals

By Neal Singer

Leaders of Sandia's fledgling National Institute for Nanotechnology Education (NINE) live a more complicated life than researchers who only must convince a single agency to fund research.

At a first technical workshop held at the Albuquerque Marriott not long ago, Sandia management and researchers worked for several days with 60 national lab, industrial, and academic management partners to agree on common nano-technology topics all could support with funds, equipment, or experience.

As Regan Stinnett (1817), NINE program manager, summarized, NINE's target is to increase "the involvement of DOE labs with universities and industry to jointly help develop the next generation of US global innovators." The developed program must "not only be credible and effective but also replicatable so that it can be used by other DOE labs," he said.

The goal is to produce a self-motivated, innovative, entrepreneurially oriented student with the technical training and economic skills to follow his or her ideas to fruition and make them practical, marketable, and valuable to the nation.

Sandia VP Rick Stulen (1000), who originated the project, opened the meeting with a hope and a warning.

"DOE has a tremendous desire for us to make something happen in improving the focus of US science education," he said. "The personal leadership each of us brings is what will help keep this project going. We must continue to push the pace of developments and ensure we connect R&D activities to real competitiveness issues. If the speed with which we advance this project turns sluggish, the enterprise will fade away."

Representatives from environments that would seem to have the right stuff included Corning, Exxon Mobil, Goodyear, IBM, Intel, Lockheed Martin, and Monsanto. Universities represented include Harvard University, Harvey Mudd College, Massachusetts Institute of

Technology, Notre Dame University, Rice University, Rensselaer Polytechnic Institute, University of California, Davis, University of Florida, University of Illinois, University of New Mexico, University of Wisconsin, University of Texas at Austin, as well as New Mexico Highlands University and Purdue University. Also present were representatives from the Semiconductor Research Corporation and the National Science Foundation.

The formidable coalition must mesh different goals to be successful.

University professors are interested in educating students, winning grants, and publishing their research. National lab researchers are interested, among other things, in developing capabilities of value to their national security missions. Business representatives need projects they can endorse to their bosses with the statement, "This will make us money."

The challenge for NINE administrators is to harness the energies of these divergent participants so that they pull in a single direction.

The project is presently funded with $7.5 million per year from Sandia's Laboratory Directed Research and Development program, the National Nanotechnology Enterprise Development Center (NNEDC), and program management monies. An immediate goal is NINE's selection as a DOE Discovery Science and Engineering Innovation Institute under the American Competes Act.

The Act was sparked by the warnings from Norm Augustine and others in the Rising above the Gathering Storm report sponsored jointly by the National Academy of Science and the National Academy of Engineering. The report argued that new

action was needed to attract American students to enter science and engineering and equip them as technical innovators to compete successfully on a global scale.

Rick's motivation in forming NINE was sparked by Sandia Labs Director Tom Hunter's feeling that the Labs should be part of the solution to the perceived problem.

"NINE is a way for us to anticipate and create the future, rather than just react to it," says Regan.

The somewhat radical educational approach of NINE offers smart students educational experiences similar, in a way, to the hands-on, apprenticeship model of the 19th century rather than the classroom-structured learning of the 20th century.

In NINE, students learn their scientific "trade" by working with university, national lab, and business mentors on large, multidisciplinary projects of high value to the nation. The university provides pedagogical expertise and basic understanding of their fields, the national lab provides multidisciplinary technical experience and mentoring plus access to state-of-art-facilities, and businesses provide economic and market insight so that inventions followed a path that might eventually lead to products that change how people live — the introduction of something new, the definition of innovation.

The hope is that original output from these students — who have been following their own research interests and ideas with unprecedented leverage from NINE — will make money for industry, help national defense, originate innovative technical discoveries and papers, start new businesses, and receive research grant monies, not necessarily in that order.

To industry reps who wondered why they should help fund the Sandia-led NINE program rather than others already in existence, UNM management professor and microelectromechanical systems consultant Steve Walsh responded, "Other programs are completely different. They give money to university centers. They don't access the tremendous leverage provided by the involvement of the expertise and facilities of DOE's national labs or the synergies resulting from the partnerships being built here.

"Look at who we have here," he said, gesturing at the workshop participants.

NINE workshop attendees agree to focus on four areas of study
NINE director Duane Dimos (1800) heads the project and is involved with high-level DOE interactions.

Justine Johannes (1810), senior manager for NINE, led discussions at a recent workshop that narrowed down a wide field of possible nanotechnology areas of study to the four ultimately accepted as being of mutual interest:

- Atomic layer control, nanopatterning, and scalable directed self assembly for IT, photonics, and large-area nanomanufacturing
- Nanoengineered chemical processing
- Synthesis and modeling of active nanocomposites and smart materials
- Nanoenabled, low-cost, self-powering sensors for extreme environments

Sandians in key nanotech areas with NINE students

Randy Schunk (1516), modeling and simulation: Amit Kumar, University of Illinois; Babatunde (Tunde) Oguntade, University of Texas at Austin

Mary Crawford (1123), solid state lighting: Frank Mont, Dept. of Electrical, Computer, and Systems Engineering, Rensselaer Polytechnic Institute (graduate student)

Kate Bogart (1126), proximity-field nanopatterning (PnP) Lithography: Dan Shir, Dept. of Materials Science and Engineering, University of Illinois, Urbana-Champaign; Bayo Falase, Dept.of Chemical and Nuclear Engineering, University of New Mexico; Mehmet Su, Dept. of Computer Engineering, University of New Mexico

Alec Talin (8756), nanoelectronics: Tania Henry, Yale; Aaron Katzenmeyer, UC Davis, both majoring in Electrical Engineering.

Brian Swartzentruber (1132), nanoscale characterization: Tania Henry, Yale.

Jim Miller (1815), nano-enabled chemical processing (unavailable).

Tim Boyle (1815), nanosynthesis: Norma Wells University of New Mexico, Chemical and Nuclear Engineering, UNM; Ray Scheffler, Materials Science and Engineering, University of Florida; Sungjin Park, Mechanical Engineering, University of Texas at Austin; Jason Burbey Materials Engineering, Purdue University