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The National Institute for Nano Engineering

Creating the Next Generation of Innovators & Innovations

Government ⇔ University ⇔ Industry

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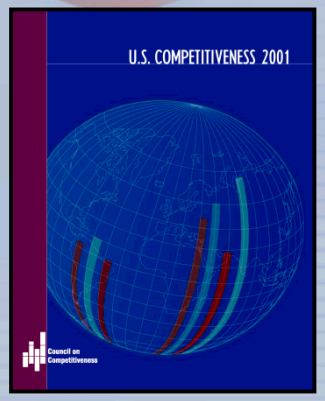
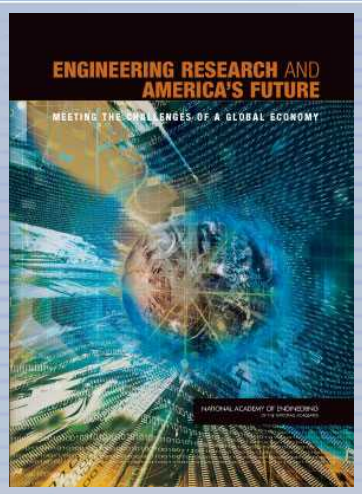
Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy's National Nuclear Security Administration under Contract DE-AC04-94AL85000.

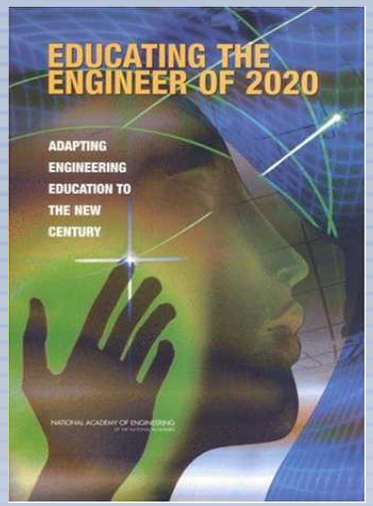
The Future of America's Innovation Engine is in Danger



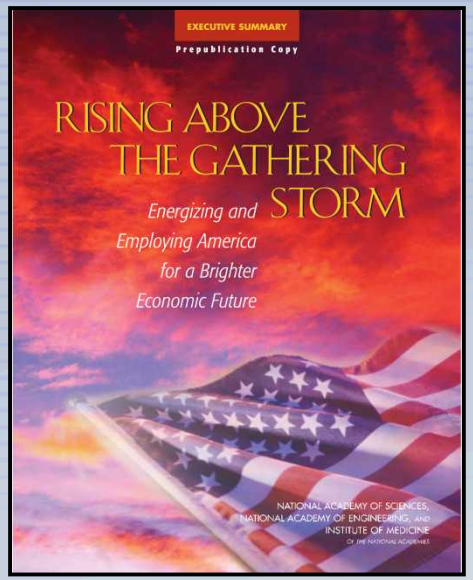
U.S. Competitiveness 2001: Strengths, Vulnerabilities and Long Term Priorities, *Council on Competitiveness*



Engineering Research and America's Future, *National Academies*, 2005 (Duderstadt)



Educating the Engineer of 2020, *National Academies*, 2005 (Clough)

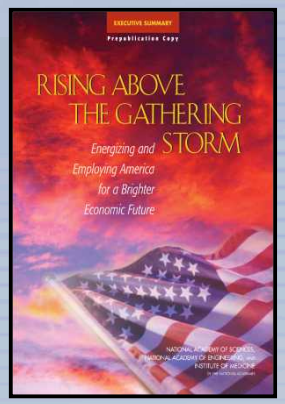


Rising Above The Gathering Storm, *National Academies*, 2005 (Augustine)

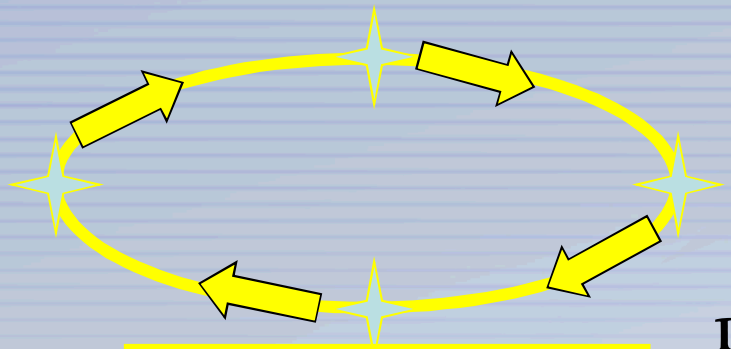
- Global competition for talent – need for highly qualified personnel
- Significant reductions in U.S. industrial R&D
- The rest of the world is closing the technology gap, rapidly
- Fewer U.S. students choosing careers in Engineering and the Physical Sciences, fewer foreign students staying

The U.S. is developing an aggressive plan

America COMPETES Act
President Signs 8/9/07



Rising Above the Gathering Storm December 2005



Next Generation Of Innovators

Discovery Science and Engineering Innovation Institutes

Bring together …

'Innovation is the only competitive advantage in the global economy'

Sandia National Labs began to respond to these challenges more than a year ago

Accelerating Engineering Innovation Summit, Sandia National Labs
Albuquerque, May 31st - June 2nd, 2006

Participants

Corning	Harvard	Harvey-Mudd
Exxon-Mobil	U Florida	RPI
Goodyear	U Michigan	MIT
Hewlett Packard	U Wisconsin	Notre Dame
IBM	U Illinois	Yale
Intel	UC Davis	U New Mexico
Lockheed Martin	UC Santa Barba	U Texas Austin
Microsoft	Rose-Hulman	Oak Ridge NL
Monsanto	Los Alamos NL	DOE

A few key issues were identified:

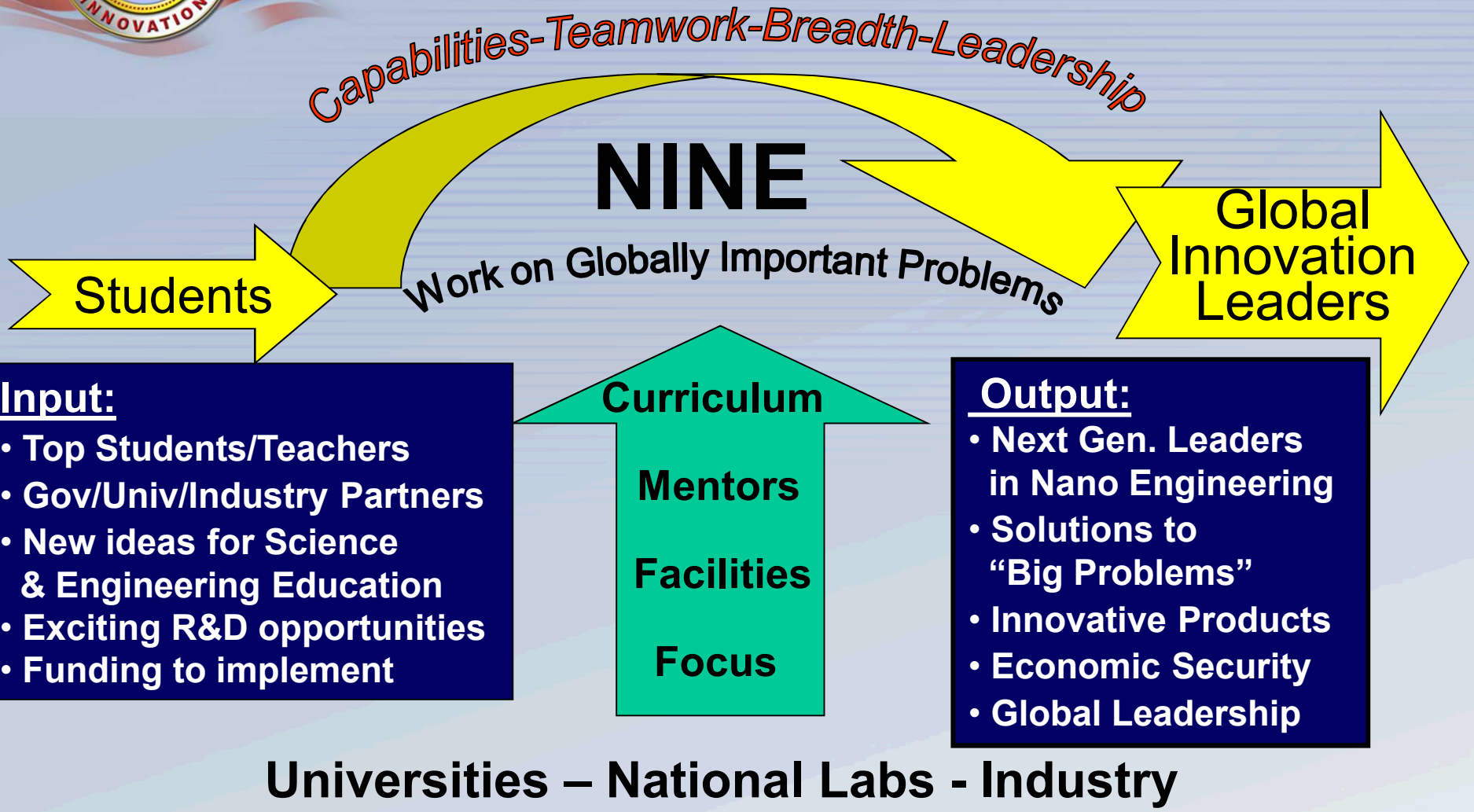
1) **Partnerships will be the key to future breakthroughs**
   - Engineers need to know how to partner effectively
   - Partnering among universities, labs and companies must be simpler
2) **Engineers and scientists need broader experience**
   - Multi-disciplinary education is important, but the challenges are great
3) **A concerted effort is needed to attract, inspire & retain top students**
   - Bright minds want important problems and capabilities to solve them

NINE is a Nation-wide Network of Government/University/Industry Partners …

… who are joining together to revolutionize innovation education in the U.S.

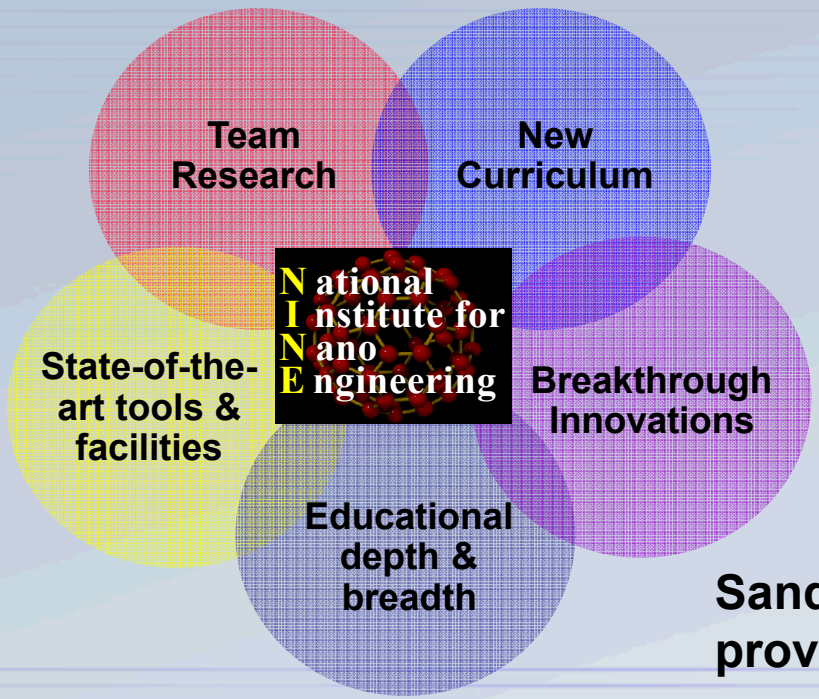
Sandia National Laboratories

The National Institute for Nano Engineering



Universities – National Labs - Industry

NINE is already in operation



NINE Goals:

- **Transform** nano engineering education with curriculum, hands-on learning, exposure to teams, business, innovation, social issues
- **Inspire** a new generation of nano-engineers skilled in working across multiple disciplines using the latest tools/facilities
  - ✓ Graduate focus, undergraduate involvement, outreach to teachers
- **Pilot** government-academic-industry education & innovation hubs
  - ✓ Build off previous experience and successful models (e.g., SRC, Sematech)
- **Capitalize** on existing DOE investments to address problems of national importance

Sandia's facilities, projects and researchers provide the hub for NINE

Sandia National Laboratories

So who and what at Sandia is part of NINE?

- Access to our researchers and facilities through involvement in our projects is Sandia's key contribution
- NINE's work will be supported by DOE and industry funds
- Work is done through Centers -1100, 1400, 1500, 1700, 1800, 8700

People

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NNSA National Nuclear Security Administration

Sandia National Laboratories

NINE seed projects have been started in selected nano-engineering theme areas

~$7.5M seed funding

➢ Nanoelectronics and Quantum Information Processing

- ✓ Nano-electronics and photonics for the 21st Century
- ✓ Atom Chip Device Engineering for Cold Atom Quantum Information Science and Technology
- ✓ Self-assembly to direct manipulation of nanostructures on length scales from atoms to microns

➢ Nanomaterials Processing & Manufacturing

- ✓ Nanocomposite Materials Design: Understanding and Control of Rheology, Assembly & Functionality
- ✓ Phase Imprint Lithography for Large Area 3D Nanostructures
- ✓ Nano-Engineering by Optically Directed Self Assembly
- ✓ Stress-Induced Chemical Detection Using Flexible Nanoporous Metal Organic Frameworks
- ✓ Electrostatic Microvalves Utilizing Conductive Nanoparticles for Improved Speed, Lower Power, and Higher Force Actuation
- ✓ Interfacial Property Control of Elastomeric Nanocomposites

➢ Nano-based Energy Technologies

- ✓ Nanoengineering for Solid State Lighting
- ✓ Developing a Thermal Microscopy Platform for In-Situ Thermal/Thermoelectric Structure-Property Studies of Individual Nanotubes and Nanowires
- ✓ CO2 Reduction Using Biomimetic Photocatalytic Nanodevices
- ✓ Improving Electronic Structure Calculations to predict Nanocatalyst Functions
- ✓ Optimized Nanoporous Materials
- ✓ Fundamentals of Synthetic Conversion of CO_2 to Simple Hydrocarbon Fuels

NINE will focus on "Big Problems" of Global Importance

Sandia National Laboratories

The DOE is in a position to ‘change the game’

… with Discovery Science & Engineering Innovation Institutes (3@$10M/year each)

Unique national facilities

Mission Drivers

- Meeting national security needs
- New solutions for energy needs
- Sustaining the environment
- Economic security

Department of Energy
25,000 scientists and engineers

Sandia National Laboratories

NINE Status and Plans

June 2006 – Accelerating Engineering Innovation Summit

January 2007 - 14 NINE LDRD projects begin

June 2007 – NINE Education Program Workshop

July 2007 – Student Summer Program

August 2007 – America COMPETES Act signed

August 2007 – Official NINE Press Release

Now – working IP agreement, Bylaws, new members, DOE

November 2007 – Industry Needs Workshop

Spring-Summer 2008 – DSEII proposal to DOE

October 2008 – NINE begins operation as a DSEII (!?)

Innovation Institutes will help to Connect and Integrate the Engineering/Science Talent Pipeline

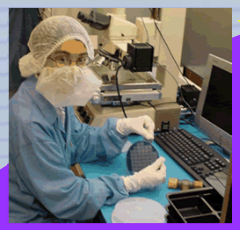
Integrating new & existing outreach efforts into a coherent program

Innovation

Career

Leadership

Graduate fellowships



Mentoring

Specialty classes

Excellence in science & engineering teaching

Interns and teachers programs

Linking science & schools

… helping provide innovators and innovations to ensure future national security and global technology leadership.

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