

***2009 NSF Nanoscale Science and Engineering Grantees Conference,
December 7-9, 2009, The Westin Arlington Gateway, Arlington, VA
Panel: NS&E Centers and Industrial Partnership***

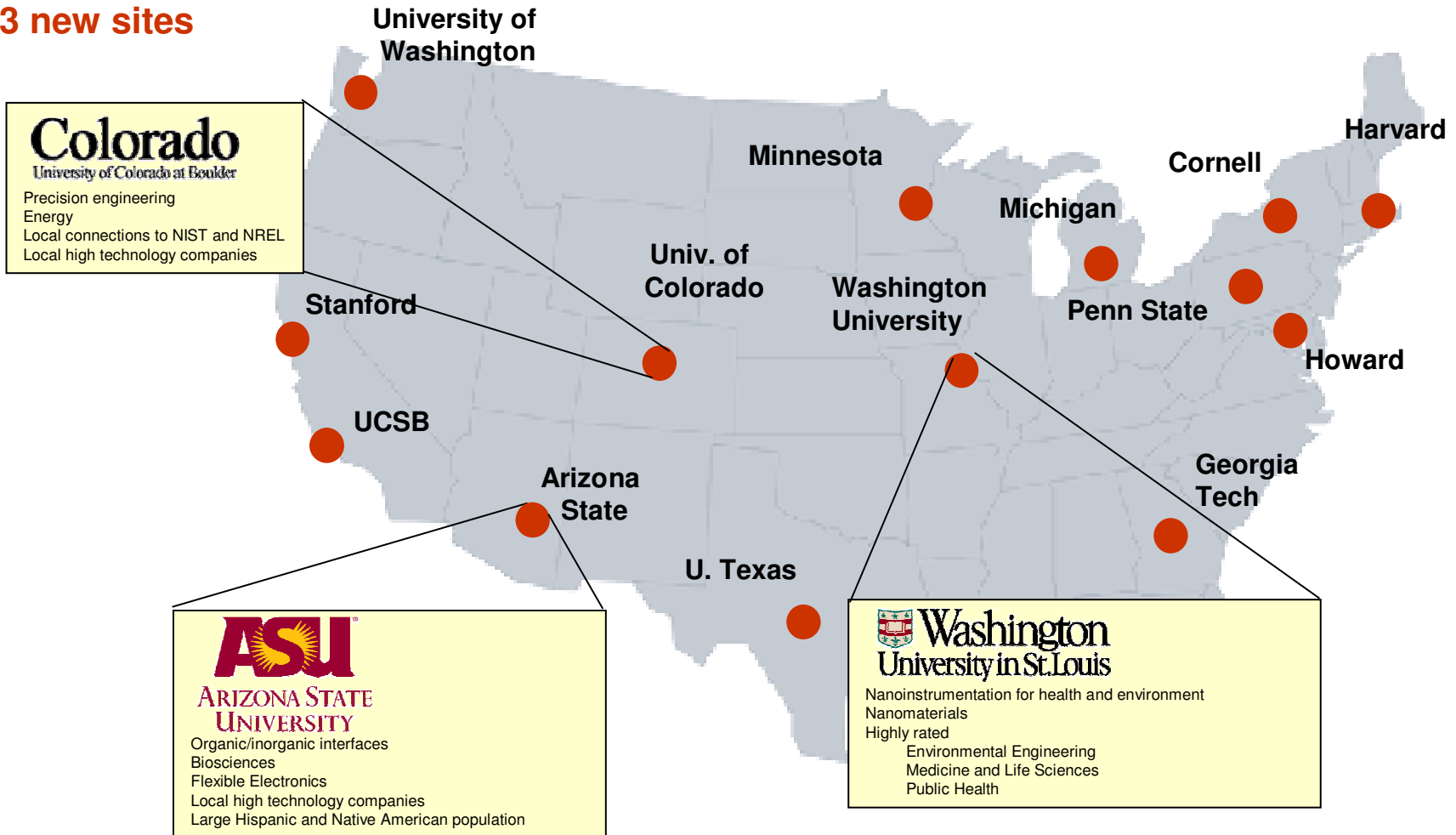
NNIN and Industrial Partnership

Yoshio Nishi

NNIN Stanford Site Director,
Professor, Electrical Engineering
Stanford University

NNIN Sites

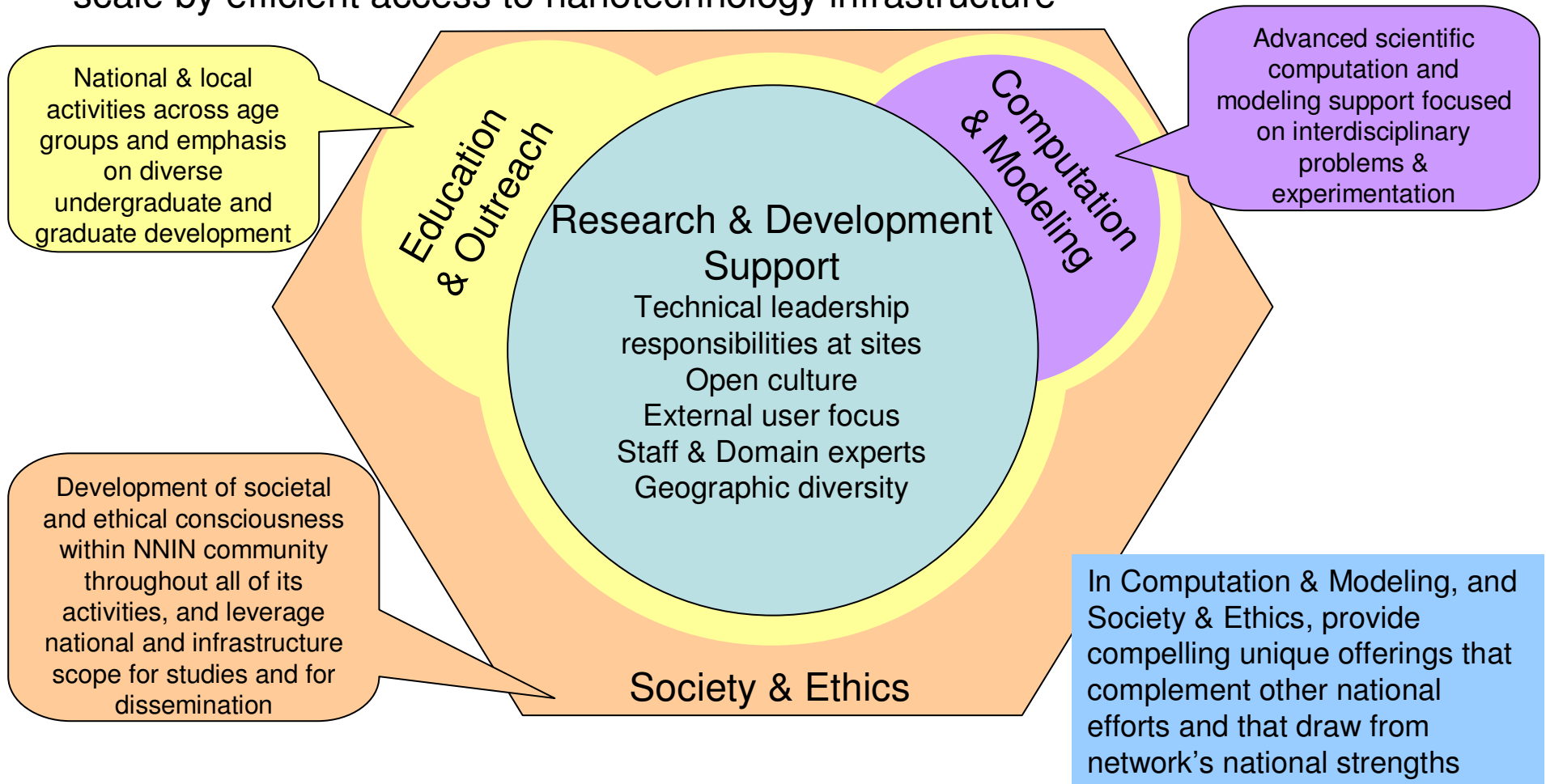
11 existing sites
3 new sites



NNIN Mission

NNIN Research Infrastructure Mission:

Enable rapid advancements in science, engineering and technology at the nano-scale by efficient access to nanotechnology infrastructure



NNIN Goals

- Advance national research and development in nanotechnology through **effective user support** to academia, industry, and others via world-leading user open R&D resource
- Develop and conduct **effective education and outreach programs** across age groups: focus on development of a diverse undergraduate and graduate student population
- **Build social and ethical consciousness** within NNIN-centered nanotechnology community throughout all of its activities, and leverage national and infrastructure strengths for related studies and for knowledge dissemination

Resources
/Effort

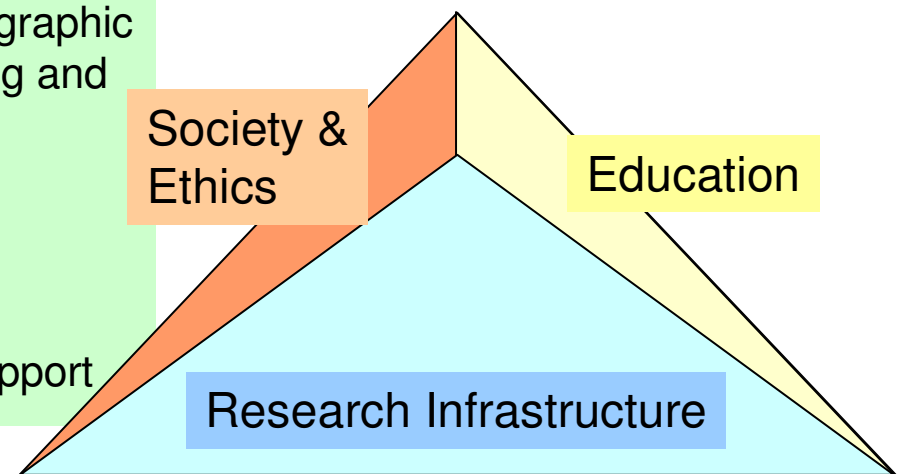
~80%

~12-15%

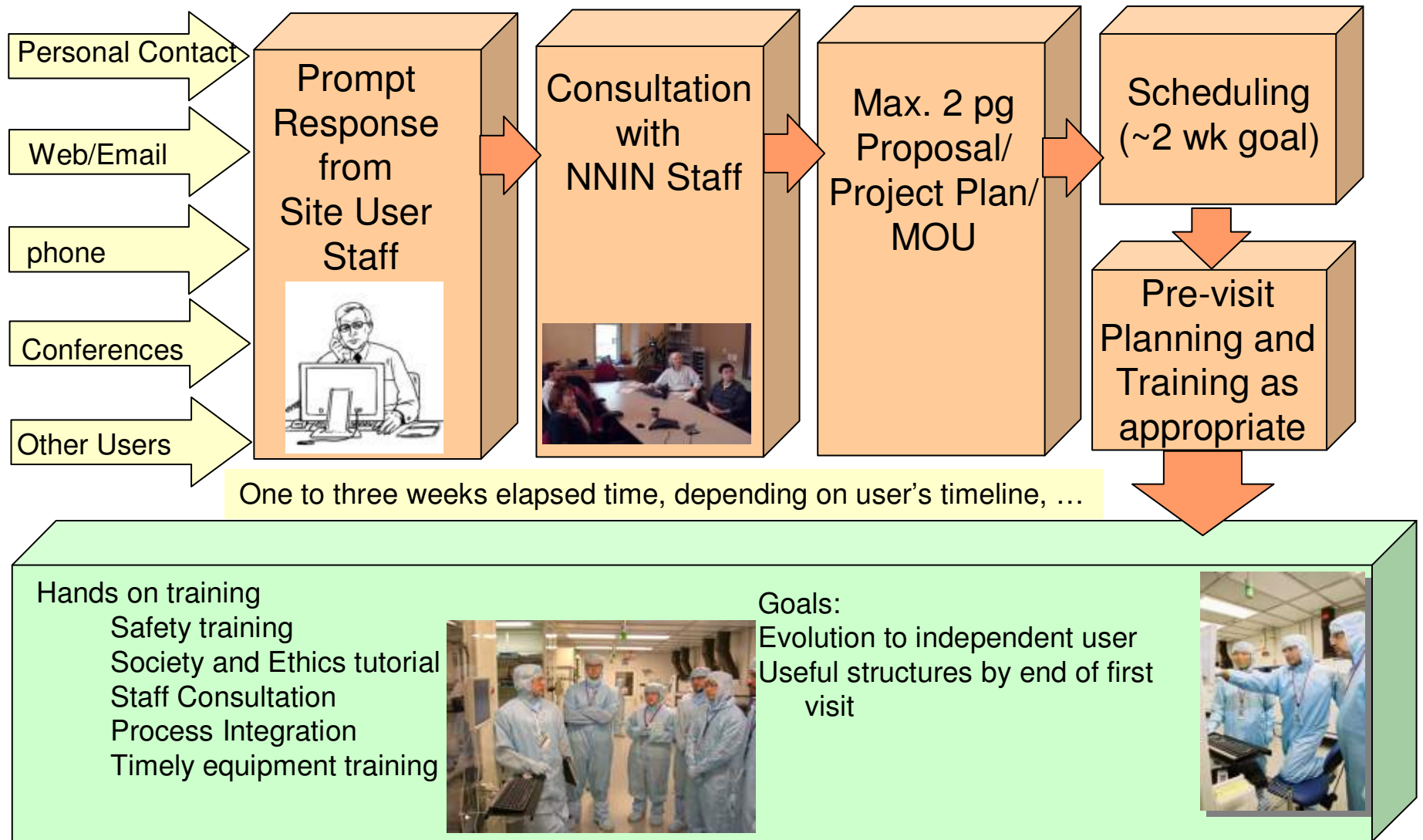
~3-5%

Synergies made possible by Technical and Geographic Diversity, Critical Mass and Cooperative Learning and Action

- Synergies within Education program
- Synergies between Education and SE
- Synergies between SE and Research Support
- Synergies between Education and Research Support



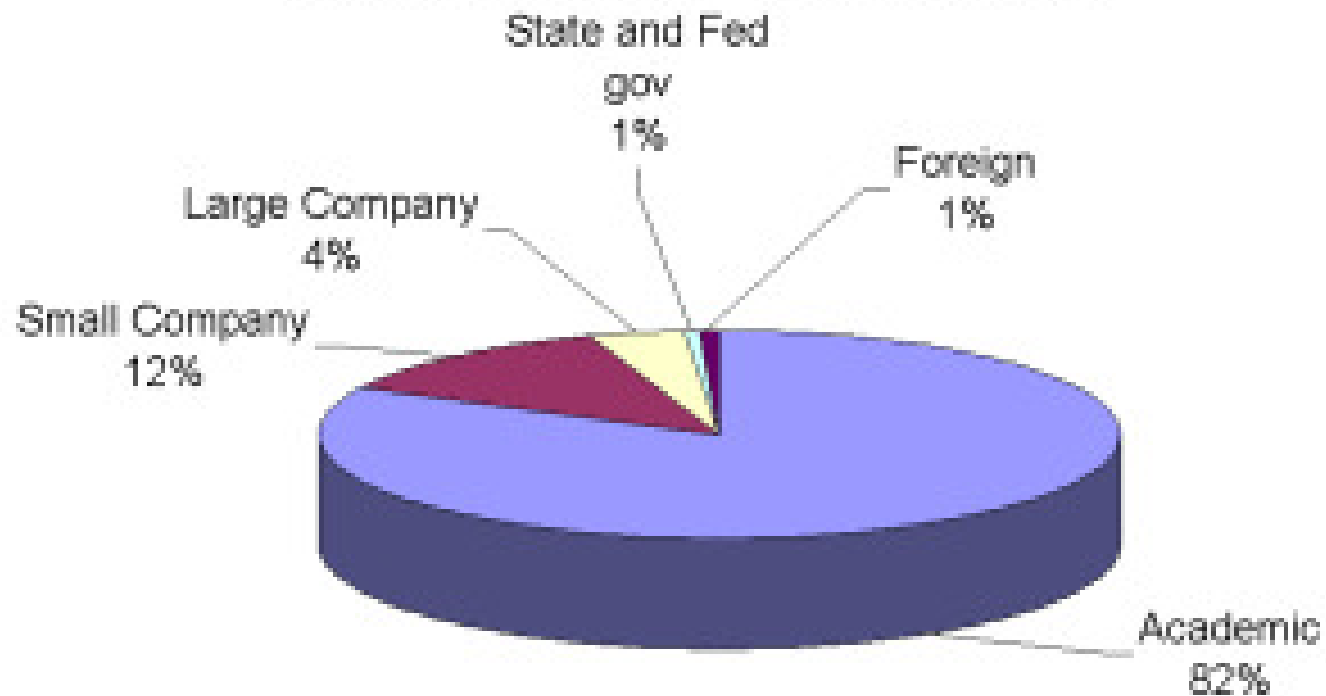
New User Process



>1800 new users trained per year on a large equipment set

NNIN Users

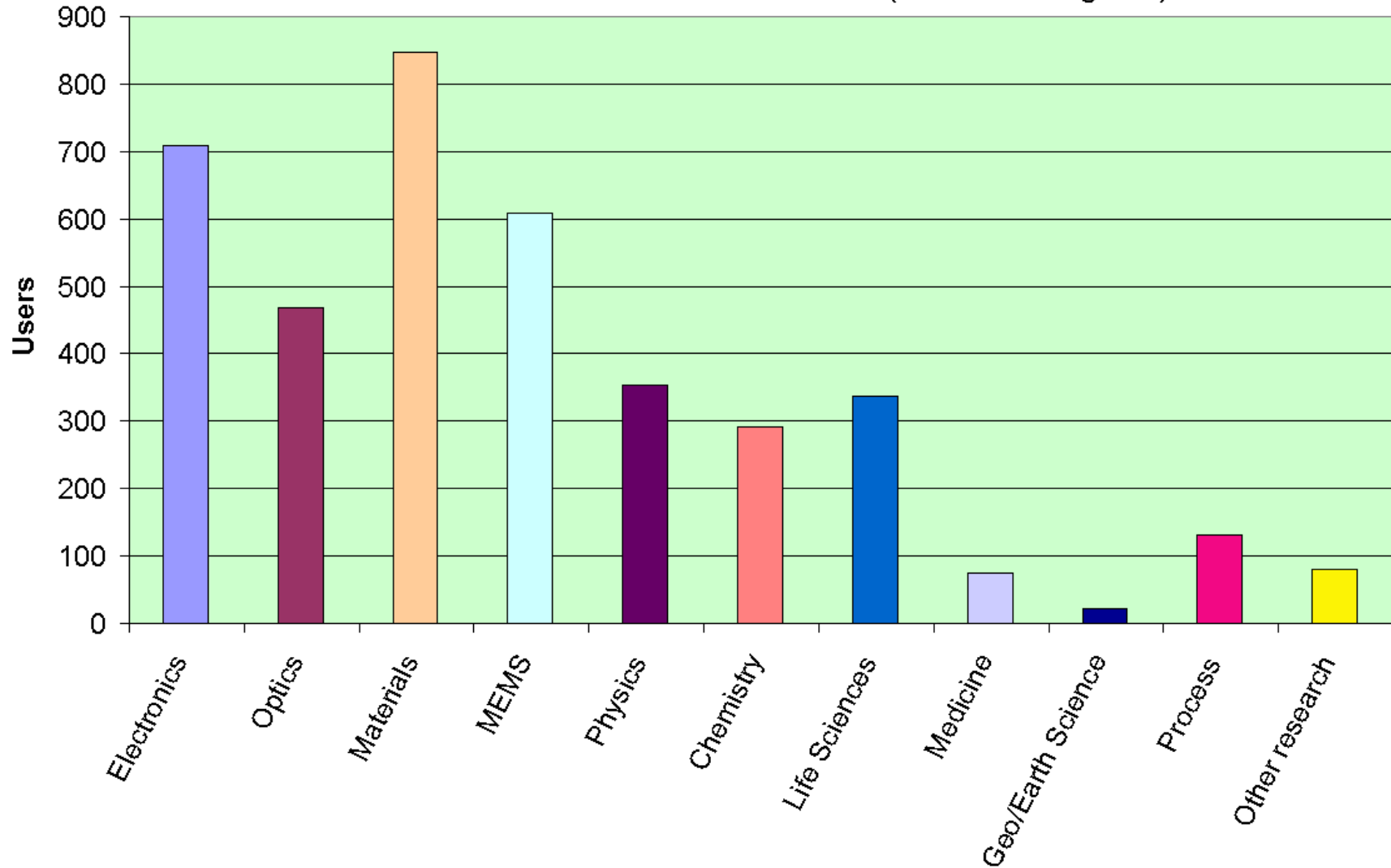
NNIN Total Users --2008 Full Year



5049 total users 12 months

User Interests

Network User Distribution 2009 6 months (March 2009-Aug 2009)

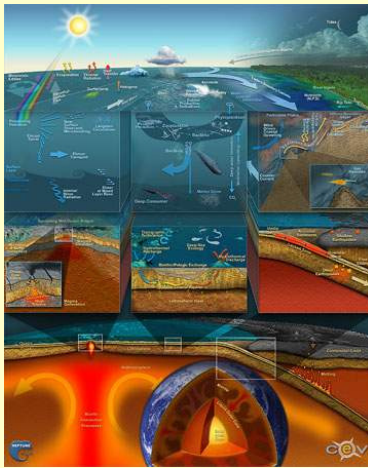


Catalyst for Change: Symposia

Major Symposia on major technical themes that bring together leaders for talks and discussions with users/participants **to define challenges of critical/emerging/changing areas and possible NNIN contributions to them**

2008

**Nanotechnology as an
Enabler for Ocean
Observatories**
Apr. 18-19, 2008
U. of Washington



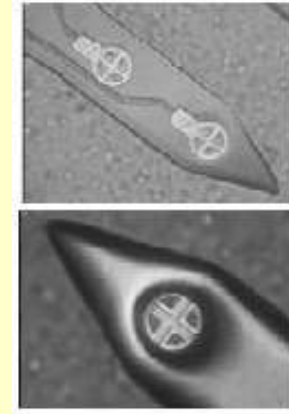
Ocean Sciences
community

**Symposium on Computing
& Complexity**
Oct. 12-14, 2008
Cornell University



EE-CS-Appl Math-
Physics-Neurosciences

**Nanotechnology as
Enabler for
Neuroscience,
Neuroengineering, and
Neural Prosthetic
Systems**
Dec. 11-12, 2008
Stanford University



Neuroscience &
Neurointerface Community

Economic Impact of NNIN

NNIN is a network of accessible nanotechnology user facilities. Its economic impact derives from

- **Facilities and Technology**
 - **Technology developed in NNIN facilities and licensed to existing or start up companies**
 - **Access for start up companies to facilities for R&D**
 - **Access for start up companies to facilities for small scale manufacturing**
 - **Access by established companies to advanced laboratory facilities for “routine” use**
- **Technology Partnerships**
 - **Companies supporting research infrastructure at NNIN**
- **Human Resources**
 - **Graduate students and Postdocs**

NNIN Economic Impact -Leverage

- **NNIN NSF direct funding**
 - \$14 M/yr (2003-2008); \$17.0M/yr (2009-2012)
- **Support of NNIN facilities by University, State, Foundation and International Sources (buildings, equipment, operations)**
 - More than \$550M over 5 years
 - Includes 6 new buildings constructed or under construction
- **Support of NNIN Facilities by Industrial Partnerships**
 - \$12M/year (most recent year) (Cash and equipment)
- **Support of NNIN Facilities by Industrial User fees**
 - \$26M industrial user fees over 5 years
 - ~\$5M per year

NNIN Economic Impact Companies Founded and Supported

- **38 small companies founded** based on technology developed by NNIN faculty in NNIN Facilities
 - ~1000 employees
- **100 small companies whose R&D is PRIMARILY done in NNIN facilities (5 years)**
- **30 companies doing small scale manufacturing in NNIN facilities (prototypes, etc.)**
- **>2300 employees at the 115 small companies that are “significantly dependent” upon NNIN (founded on NNIN technology, or conduct most R&D or Mfg functions in NNIN)**
- **Many more companies use NNIN facilities on a routine basis but would not be considered “dependent”**
- **A total of 358 companies using NNIN facilities in recent 2 years**

NNIN Representation on Major Scientific and Corporate Advisory Boards

- **Sandip Tiwari, Cornell**
 - **Defense Science Research Council, Advanced Design Consulting Anvik**
- **Yoshio Nishi, Stanford**
 - **BeSang Memories, Intermolecular Inc, DSM Semiconductors, Ultratech Inc, Soltaix Inc, Novellus Systems**
- **James Meindl, Ga. Tech**
 - **Sandisk, Zoran and US Venture Partners**
- **Sanjay Banerjee, U. Texas**
 - **DSM Semiconductors, Cambrios, Nanocoolers Inc., BeSang Memories, NanoVance, Organic ID and ITU Ventures; HSMC Foundry**
- **Steve Brueck, New Mexico**
 - **Lightpath Technologies**
- **Khalil Najafi, Michigan**
 - **Evigia, SSYS**
- **Dennis Grimmard ,Michigan**
 - **Moibus Microsystems**

Comments given by NNIN/SNF Users

- 1. By providing research infrastructure to nearby Silicon Valley nanotechnology community as well as to remote users, SNF has contributed to stimulate innovative research in nanoscience and engineering. This has resulted in a number of new finding and new ideas, some of which have created new product prototypes and opened up new markets.**
- 2. SNF capability to accommodate challenges for new nanomaterials has led large corporations to take significantly larger risk than they could do internally, which has promoted new discoveries and break-through ideas beyond their typical time horizon.**
- 3. Small start-up companies have grown to the next level after successfully spinning out from SNF toward higher volume foundries where they manufacture new products.**
- 4. SNF provides a melting pot environment for both industrial and academic researchers/engineers who can interact cross disciplinary manner for Silicon Valley style of new innovations.**
- 5. SNF provides a model for other laboratories in the US and around the world for the shared semiconductor based research and development facility.**

Summary

- **Qualitative:**
 - Fundamental understanding in life sciences & physical sciences enabled by advanced experimental resources to the national community at large
 - Major avenue for affordable development and commercialization for small companies in nascent application areas
- **Quantitative:** Publications (>3000 publications in 2008-09)
 - Economic development (> 275 small companies during 6 mo of 2009; 590 industrial users during 6 mo of 2009)
 - Academic users (~3200 PhD students in 6 mo of 2009, >1200 PhD awards/year)
 - >1800 new users trained
 - Workhorse for educational development (>750 workshop participants, >10,000 visitors to NNIN educational events & >100,000/month reached through *Nanooze*, ...)