University – Industry – State Partnerships

Building the Arkansas Innovation Economy

The U.S. National Academy of Sciences
in cooperation with
The University of Arkansas at Little Rock

Clinton Presidential Center
Little Rock, Arkansas

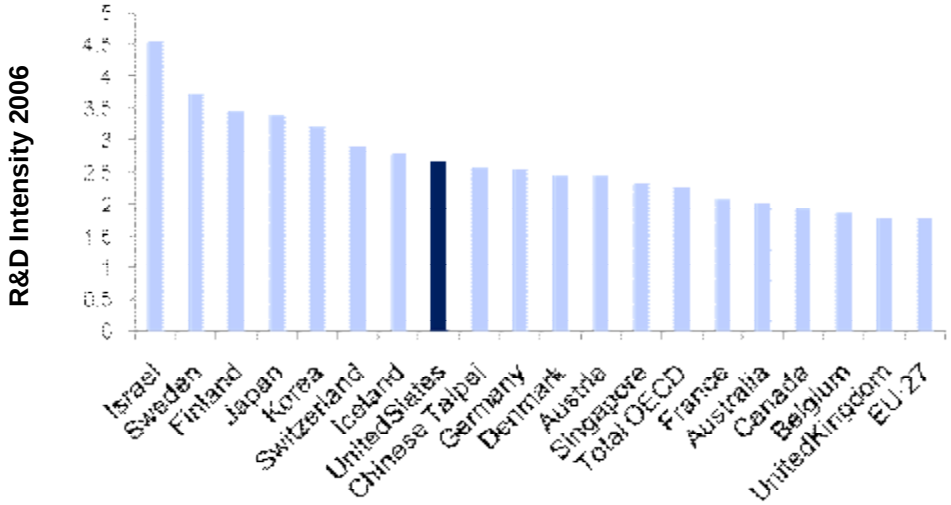
March 8-9, 2010

Marc G. Stanley, Acting Deputy Director
National Institute of Standards and Technology

Problem: There are disturbing trends in R&D Investment

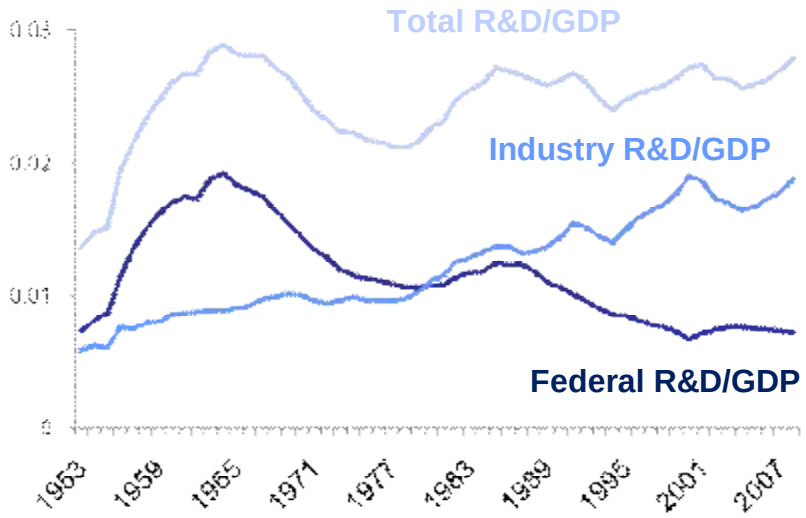
R&D intensity is lagging and ...

Need: Restore international innovation leadership



Source: OECD, Main Science and Technology Indicators

Need: Increase the intensity of federal R&D efforts

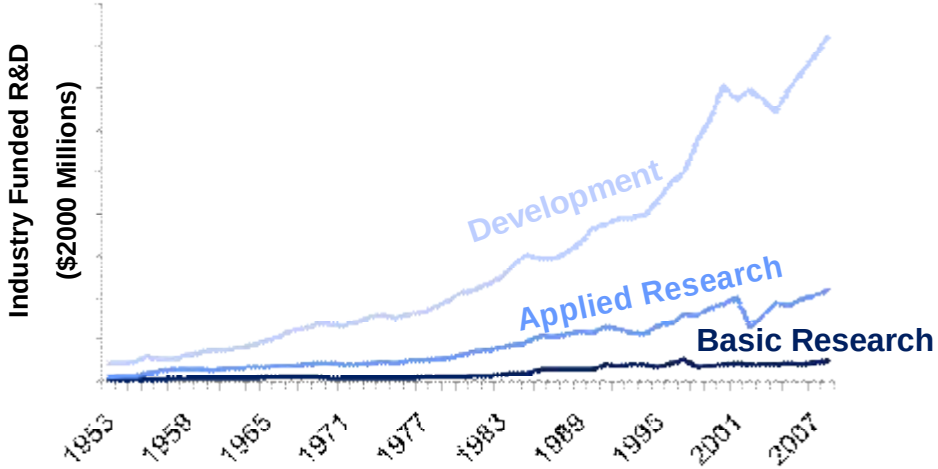


Source: National Science Foundation

Problem: There are disturbing trends in R&D Investment

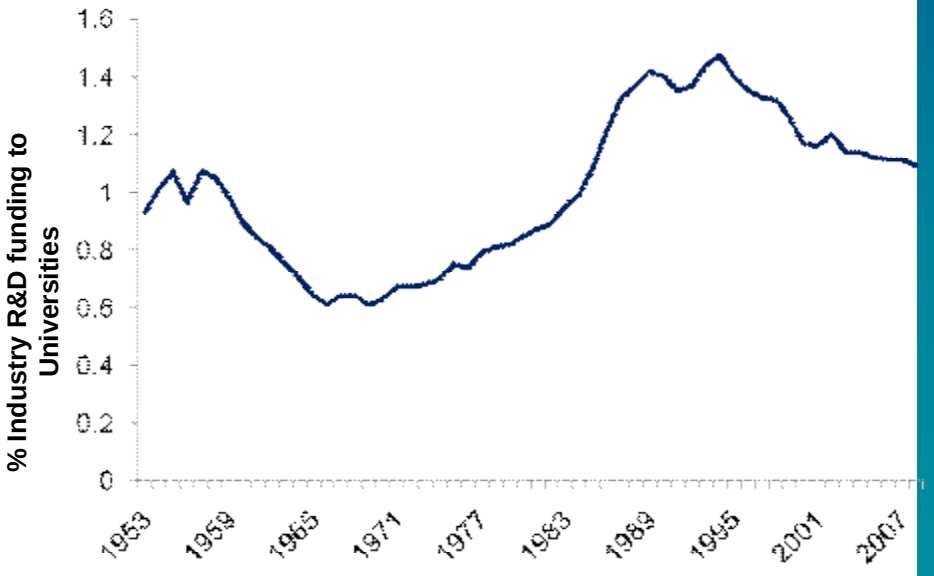
... and R&D Composition is changing

Need: Increase industry focus on breakthrough research



Source: National Science Foundation

Need: Long-range research targeting industry needs

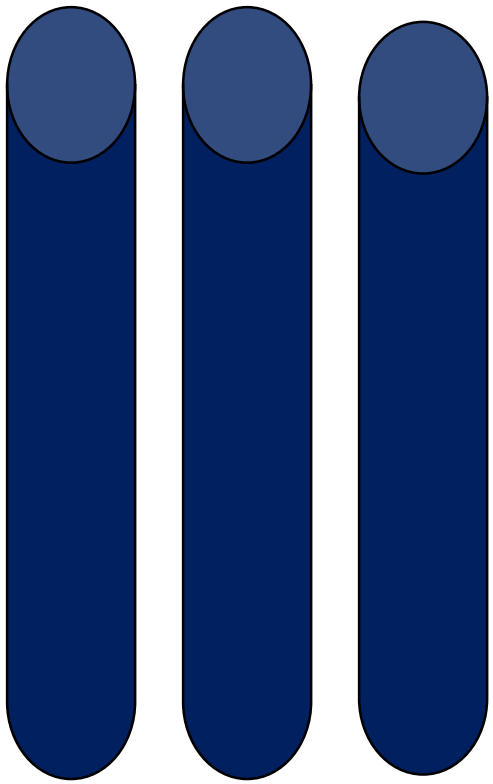


Source: National Science Foundation

Our Approach Must Change

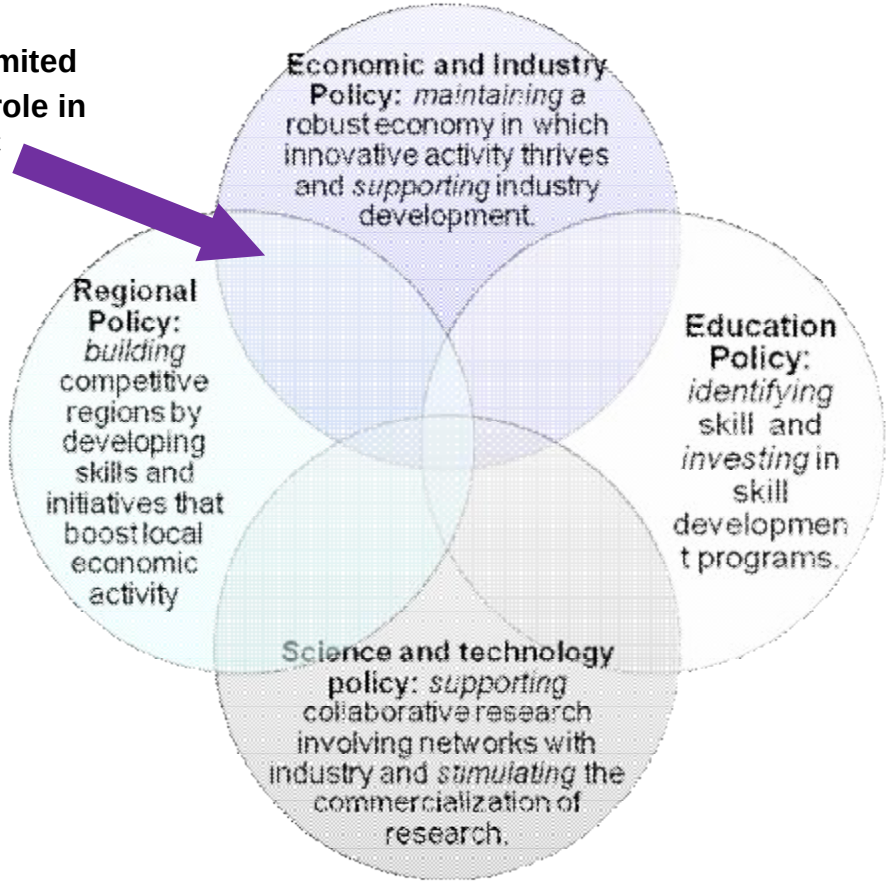
Unprecedented challenges require innovative solutions for creating jobs and promoting regional prosperity.

From Silos …



… to Collaboration.

Vital but limited NIST/MEP role in E-RIC



However, NIST has another pilot cluster initiative that builds upon the scientific base and leverages NIST assets in all 4 key areas ...

The Rapid Innovation and Competitiveness (RIC) Initiative

A new public-private partnership for R&D investment

Goals:

- Increase the Nation's return on its scientific investment
- Collapse the timescale of technological innovation
- Encourage investment in need-driven research
- Stimulate the economy and enhance competitiveness

The Rapid Innovation and Competitiveness (RIC) Initiative

A new public-private partnership for R&D investment

Approach:

- Coordination and Advanced Planning
  - Partners from **industry**, **academia**, and **government** develop a shared vision of an industry sector's research needs via a technology roadmap
- Research and Knowledge Transfer
  - **Industry** and **government** fund goal oriented basic research, measurement science research, and standards development based on the needs and priorities of the roadmap
  - Periodically re-evaluate the impact and priority of that research
  - Sponsor postdoctoral fellowships and personnel exchanges to facilitate tacit knowledge transfer
- Transition scientific findings to commercial products
  - Transcends the Valley of Death
  - Provides a framework that facilitates **regional government** and **venture-capital** support, enabling a clear path to commercialization

Pilot Program with Nanoelectronics Research Initiative (NRI) Initiated in 2007

Pilot Initiative

- NIST sought public-private partnerships to accelerate the support of research and innovation in nanoelectronics
- Competition announced in Federal Register May 4, 2007
- NIST/NRI partnership announced September 13, 2007
  - The NRI is a collaborative effort between industry, government, and academia to support world-class research in nanoelectronics
  - NRI is part of the Semiconductor Research Corporation (SRC), which is part of the Semiconductor Industry Association (SIA)
  - NRI goal: Demonstrate novel yet practical computing devices capable of replacing conventional chip technology by 2020

Partnership Details

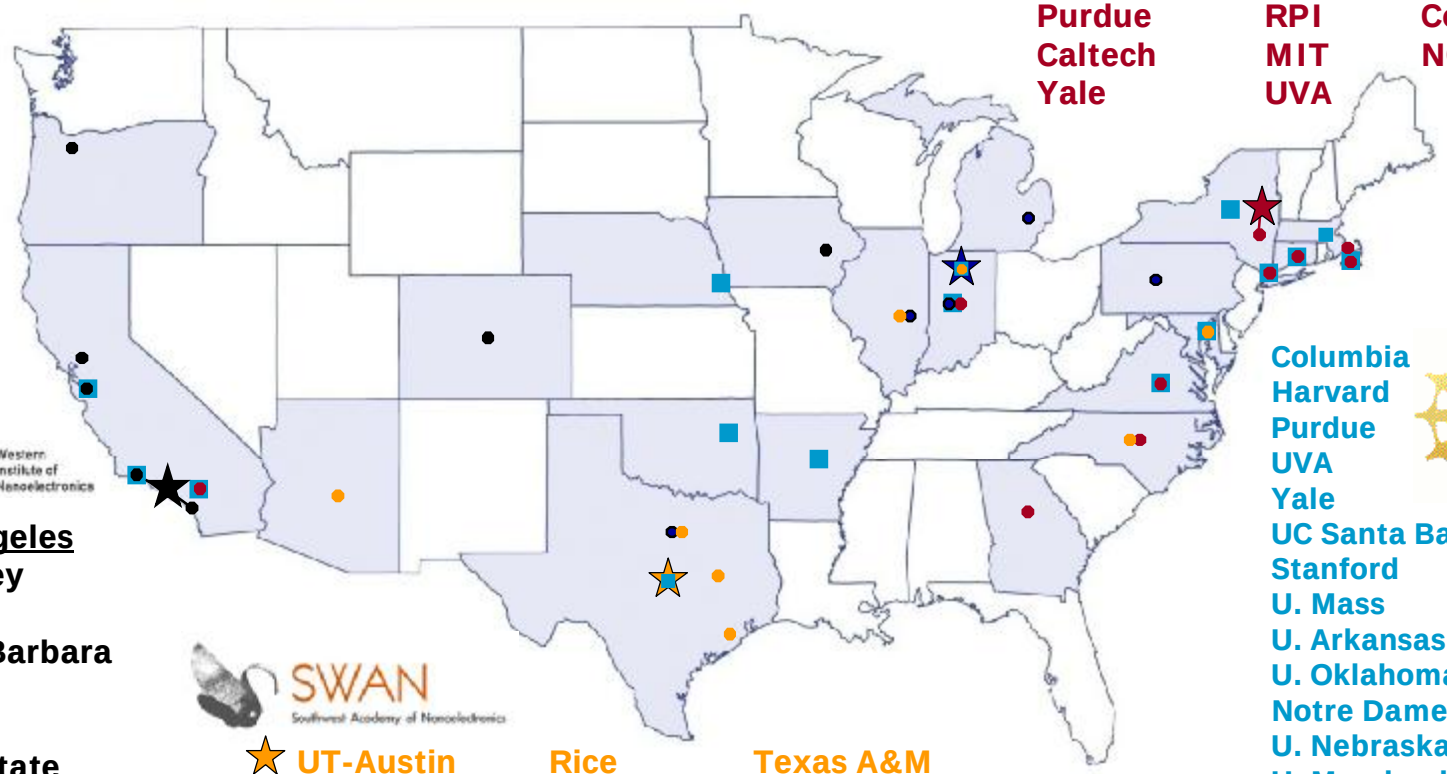
- Cooperative agreement, renewable for up to five years
- NIST provides $2.76 million per year; six NRI partners match with at least 25% each
- Funds combined and competitively awarded for research at U.S. universities to meet industry's long term needs
- Starting FY2009 NIST has an additional $1.5 million for related in-house research

NIST

NRI anoelectronics RESEARCH INITIATIVE

SRC®

4 Centers, 35 Universities, 20 States



Nanoelectronics • Architectures
MIND
MIDWEST INSTITUTE FOR NANOELECTRONICS DISCOVERY

★ **Notre Dame**
Illinois-UC
Michigan
Purdue
Penn State
UT-Dallas

INDEX
INSTITUTE FOR NANOELECTRONICS DISCOVERY AND EXPLORATION

★ **SUNY-Albany**
Purdue
Caltech
Yale
GIT
RPI
MIT
UVA
Harvard
Columbia
NCSU

WIN
Western Institute of Nanoelectronics

★ **UC Los Angeles**
UC Berkeley
UC Irvine
UC Santa Barbara
Stanford
U Denver
Portland State
U Iowa

SWAN
Southwest Academy of Nanoelectronics

★ **UT-Austin**
UT-Dallas
U. Maryland
Rice
ASU
NCSU
Texas A&M
Notre Dame
Illinois UC

NSF
Columbia
Harvard
Purdue
UVA
Yale
UC Santa Barbara
Stanford
U. Mass
U. Arkansas
U. Oklahoma
Notre Dame
U. Nebraska/Lincoln
U. Maryland
Cornell
UT Austin
Caltech

Regional Centers

INDEX: Institute for Nanoelectronics Discovery and Exploration
- Research Focus: Post-CMOS switches
- Regional location: SUNY-Albany
- Other Participants: Caltech; Columbia; GIT, Harvard; MIT; NCSU; Purdue; RPI; UVA; Yale

MIND: Midwest Institute for Nanoelectronics Discovery
- Research Focus: Energy efficient devices
- Regional location: Notre Dame
- Other Participants: Illinois-UC; Penn State; Purdue; Michigan; UT-Dallas

SWAN: South West Academy of Nanoelectronics
- Research Focus: Novel structures and architecture
- Regional location: UT-Austin
- Other Participants: ASU; Illinois UC; NCSU ; Notre Dame; Rice; Texas A&M; UT-Dallas; U. Maryland

WIN: Western Institute of Nanoelectronics
- Research Focus: Spintronics
- Regional location: UC Los Angeles
- Other Participants: UC Berkeley; UC Irvine; UC Santa Barbara; Stanford; U Denver; Portland State; U Iowa

NIST/NRI Funding

AMD freescale semiconductor IBM intel Texas Instruments Micron

ITRS

Strategic Planning and Evaluation

International Technology Roadmap for Semiconductors

POST-CMOS: NRI Defined 13 Research Vectors of primary importance for finding the next switch

$2.75M per year NIST

$5M per year Industry Partners

$15M per year States

>$200M / over 5 years States & Private

University-Based Research

- **INDEX: Institute for Nanoelectronics Discovery and Exploration**
- **MIND: Midwest Institute for Nanoelectronics Discovery**
- **SWAN: South West Academy of Nanoelectronics**
- **WIN: Western Institute of Nanoelectronics**

Research Results

Business Start-up, Development, and Commercialization

Regional Government Contributions:
- Grants
- Tax Incentives

Industry Contributions
- VC Funds
- Direct Investment

RIC Initiative
NIST/NRI Results

NIST/NRI brings together leading principal investigators

- Researchers from over 30 Universities work at regional centers

NIST/NRI Supports Students

- 128 graduate students and 24 post-docs perform work at the four regional centers
  - WIN (38 PhD students, 6 post-docs)
  - INDEX (24 PhD students, 2 post-docs)
  - SWAN (26 PhD students, 11 post-docs)
  - MIND (40 PhD students, 5 post-docs)

NIST/NRI Produces results

- Publications: From 10-1-2007 through 10-1-2009 the centers under the NRI/NIST partnership have generated 239 publications
- Patents: To date 13 patents applications have been filed based on the work of sponsored by the NRI

Industry Support of NIST's Involvement

- "There is tremendous interest in every part of the world to win the nanoelectronics race and reap the economic rewards that will go with it. For America to win, it will take radical collaboration between government, higher education and industry. The best example of this type of collaboration is the important work going on in the Nanoelectronics Research Initiative at more than 30 universities with funding and participation from NIST, IBM, and other major semiconductor and research institutions."

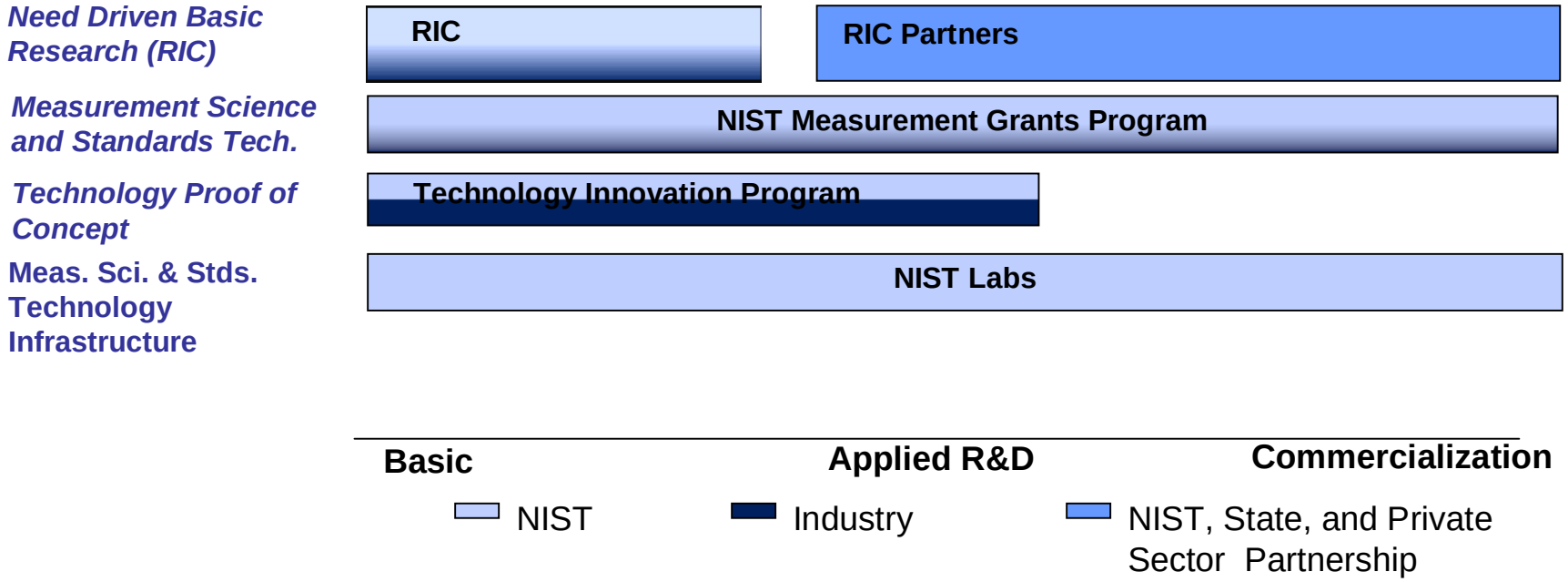
  -- John E. Kelly III, IBM Senior Vice President and Director of Research

- "NRI experiment is working; we learned more about graphene for device applications in the last 2 years than we would normally learn in 5 or 10 years in the business-as-usual research model."

  -- Industry member at INDEX review (9/08)

NIST Toolkit: Impacts across the technology lifecycle

Science and Technology Policy



NIST Toolkit: Impacts across the technology lifecycle (cont.)

Education Policy

Training and technology transfer

Industrial Technology Fellowship Program

Regional Policy

Research Infrastructure

NIST Construction Grants Program

Economic and Industry Policy

Technology transfer and implementation

MEP

Future NIST Support for Regional Innovation

NIST brings substantial Resources and expertise that other states can leverage for their growth.

What about Arkansas?