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National Nanotechnology Initiative: Driving Innovation & Competitiveness



Ambassador Richard M. Russell
Associate Director
and Deputy Director for Technology
Office of Science and Technology Policy

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Thank you to Senator Bond, University of Missouri Chancellor Deaton and Dean Thompson. It is a pleasure to be here for this event highlighting the opportunities for nanotechnology to researchers at the University of Missouri and for the region's economy.

I am pleased to see representatives here today from the university research community and from small and large businesses representing Missouri's tech industries. Collaboration among these groups is a vital component supporting American innovation and competitiveness.

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Keeping America Competitive

Sustained scientific advancement and innovation depend on:

- Federal investment in cutting-edge, merit-reviewed basic research
- Favorable environment for private sector R&D
- Education system that equips Americans with a strong foundation in technical subjects
- Universities that provide world-class education and research opportunities
- Immigration policies that attract the best and brightest
- Business environment that encourages entrepreneurship and protects intellectual property.

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Maintaining American technological and economic competitiveness involves an “innovation ecosystem” with various components—each of which must be sustained. A critical element is strong Federal investment in R&D, along with policies that encourage private sector research spending.

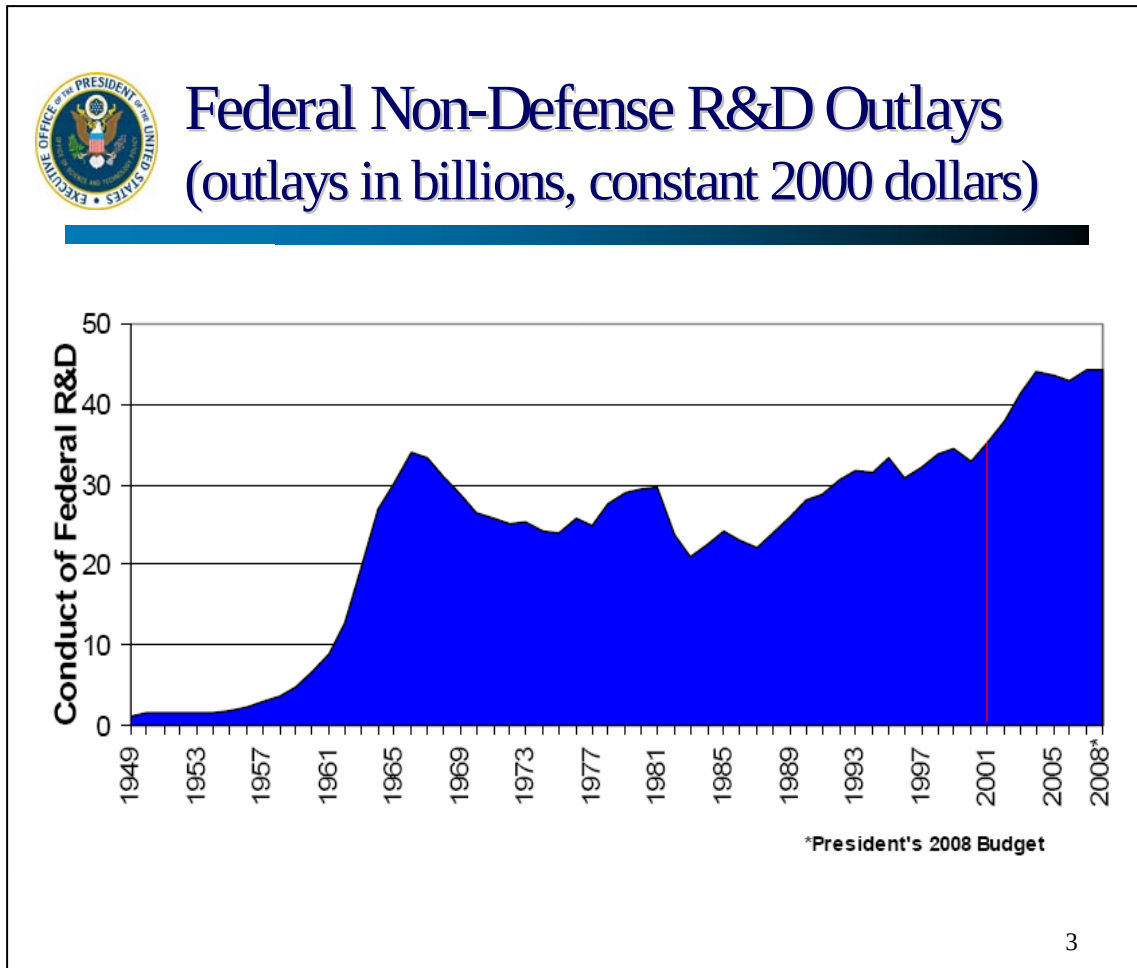
Competitiveness also depends on a K-12 educational system that provides students with math and science fundamentals and universities that are home to world-class learning and research.

To stay competitive, we want to train U.S. workers to be the best and at the same time attract and retain—as we have in the past—talented and skilled individuals from around the world.

And finally, in order to convert innovation into competitive products, the business environment should encourage entrepreneurship and protect intellectual property. Policies and investments that support each of these components of the innovation ecosystem, along with a thriving investor community that provides access to capital and is willing to take risks, will enable the U.S. to remain not only competitive, but the world leader in science and technology.

A goal of President Bush is to make sure that the nation remains competitive by ensuring that scientific advancement and innovation can and will take place here in the United States.

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As mentioned, R&D is a critical component of the innovation ecosystem. And as illustrated, R&D spending has increased substantially over the last six years.

Overall, the President's FY 2008 Budget increases the funding for R&D to a new high of \$142.7 billion—56% more than the \$91.3 billion spent in FY 2001.

Analysis of Federal spending for R&D shows that the Administration's commitment to science and technology as a fraction of the budget has been unprecedented since the Apollo program in the 1960's.

A significant portion of the increase in recent years has been in the life sciences with the doubling of the budget of the National Institutes for Health.

One note: During that time, the budgets for physical science research were relatively flat.

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“Tonight I announce an American Competitiveness Initiative, to encourage innovation throughout our economy, and to give our nation's children a firm grounding in math and science.”

-- President George W. Bush (2006 State of the Union Address)

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Even with this growth, there is more that can be done. That is why the President announced the American Competitiveness Initiative in his 2006 State of the Union Address.

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American Competitiveness Initiative

- ✓ **Education** – Improve math and science education.
- ✓ **Immigration** – Enhance our ability to attract and retain high-skilled workers.
- ✓ **Workforce** – Expand community-based job-training grants to build workforce capacity.
- ✓ **Federal Research** – Increase critical basic research in physical sciences.
- ✓ **R&E Tax Credit** – Permanently extend and modernize the R&E tax credit.

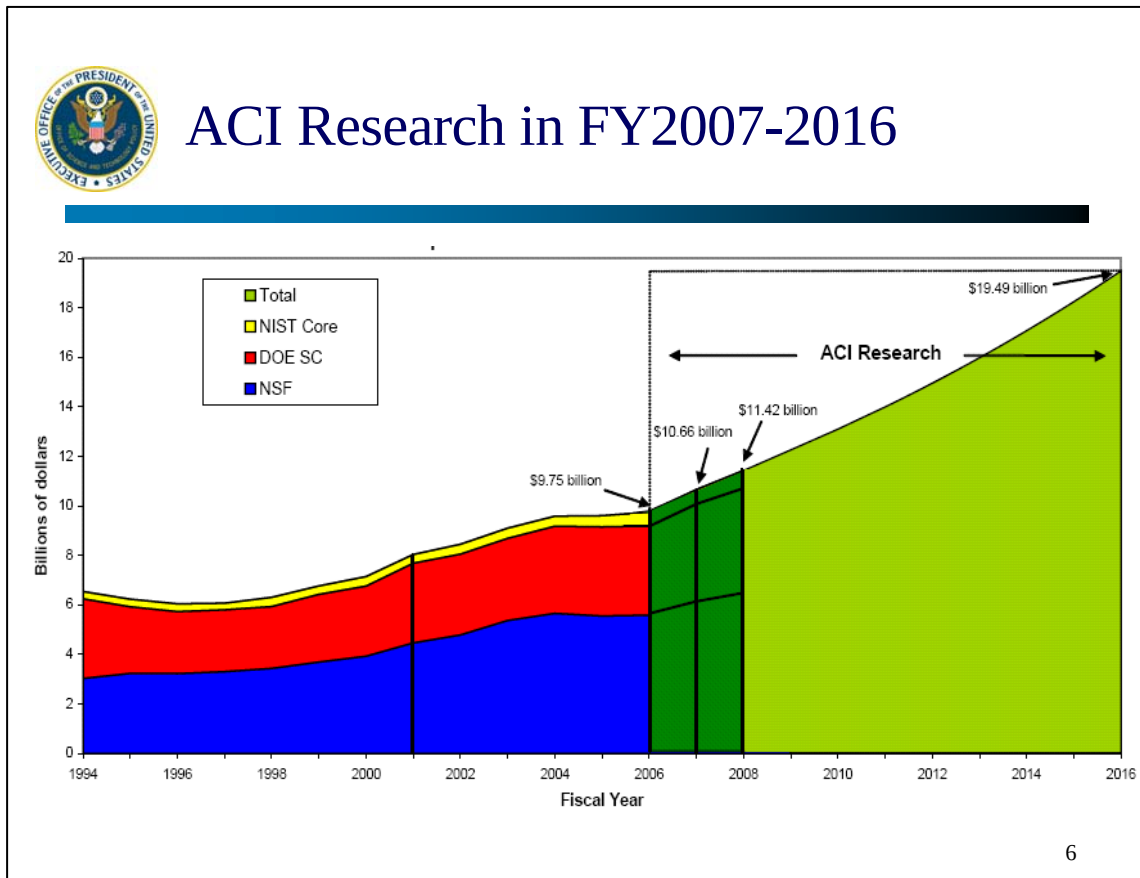
★ **\$136 billion over 10 years**

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The ACI addresses each component of the innovation ecosystem—research, both Federal and private sector; education, and an enhanced skilled workforce through strong training programs and immigration policies.

To fund the research, education, and tax incentives, over ten years, the ACI proposes spending \$136 billion to enhancing U.S. competitiveness, including \$50 billion for Federal research.

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Specifically, the ACI doubles funding for the National Science Foundation (NSF), the Department of Energy (DOE) Office of Science, and the National Institute of Standards and Technology (NIST).

The President's budget request for the ACI for 2008 is on track to double the spending in physical sciences research.

The House and Senate Appropriations Committees have fully funded ACI in FY2008. Thanks to Senator Bond and his colleagues for their support for these appropriations.

In Missouri, NSF currently funds 498 projects totaling \$234 million.

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 Executive Office of the President Office of Management and Budget	 Executive Office of the President Office of Science and Technology Policy
August 14, 2007 MEMORANDUM FOR THE HEADS OF EXECUTIVE DEPARTMENTS AND AGENCIES FROM: JOHN H. MARBURGER, III  DIRECTOR, OFFICE OF SCIENCE AND TECHNOLOGY POLICY STEPHEN S. MCMILLIN  ACTING DIRECTOR, OFFICE OF MANAGEMENT AND BUDGET SUBJECT: FY 2009 Administration Research and Development Budget Priorities	
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How are these R&D funds prioritized?

Each year the Directors of OSTP and OMB send a memo to the heads of the agencies outlining the Administration's R&D priorities.

The memo provides guidance and direction to the agencies, which take the priorities into consideration and are expected to provide for their implementation as they plan their budgets for the coming year.

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FY 2009 R&D Budget Priorities

- American Competitiveness Initiative
- Homeland security & national defense
- Energy and climate change technology
- Advanced networking & IT
- National Nanotechnology Initiative
- Complex biological systems
- Environment
- Next Generation Air Transportation Systems
- Federal scientific collections
- Science of Science Policy

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The FY 2009 memo calls out the ACI and a number of other research areas as priorities.

I encourage you to read the entire memo to get further detail on each of the priority areas. You can find it on the OSTP website.

The priorities reflect both needs (R&D “pull”) and opportunities (R&D “push”)

One area which is supported by ACI and called out in the memo this year, as it has been in the past, is the National Nanotechnology Initiative.

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21st Century Nanotechnology Research & Development Act of 2003



One Hundred Eighth Congress
of the
United States of America

AT THE FIRST SESSION

*Began and held at the City of Washington on Tuesday,
the seventh day of January, two thousand and three*

An Act

To authorize appropriations for nanoscience, nanotechnology, and nanotechnology research, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. SHORT TITLE.

This Act may be cited as the "21st Century Nanotechnology Research and Development Act".

SEC. 2. NATIONAL NANOTECHNOLOGY PROGRAM.

(a) NATIONAL NANOTECHNOLOGY PROGRAM.—The President shall implement a National Nanotechnology Program. Through appropriate agencies, councils, and the National Nanotechnology Coordination Office established in section 3, the Program shall—

- (1) establish the goals, priorities, and metrics for evaluation for Federal nanotechnology research, development, and other activities;
- (2) invest in Federal research and development programs in nanotechnology and related sciences to achieve those goals; and
- (3) provide for interagency coordination of Federal nanotechnology research, development, and other activities undertaken pursuant to the Program.

(b) PROGRAM ACTIVITIES.—The activities of the Program shall include—

- (1) developing a fundamental understanding of matter that enables control and manipulation at the nanoscale;
- (2) providing grants to individual investigators and interdisciplinary teams of investigators;
- (3) establishing a network of advanced technology user facilities and centers;
- (4) establishing, on a merit-reviewed and competitive basis, interdisciplinary nanotechnology research centers, which shall—

- (A) interact and collaborate to foster the exchange of technical information and best practices;
- (B) involve academic institutions or national laboratories and other partners, which may include States and industry.

A little history about the National Nanotechnology Initiative:

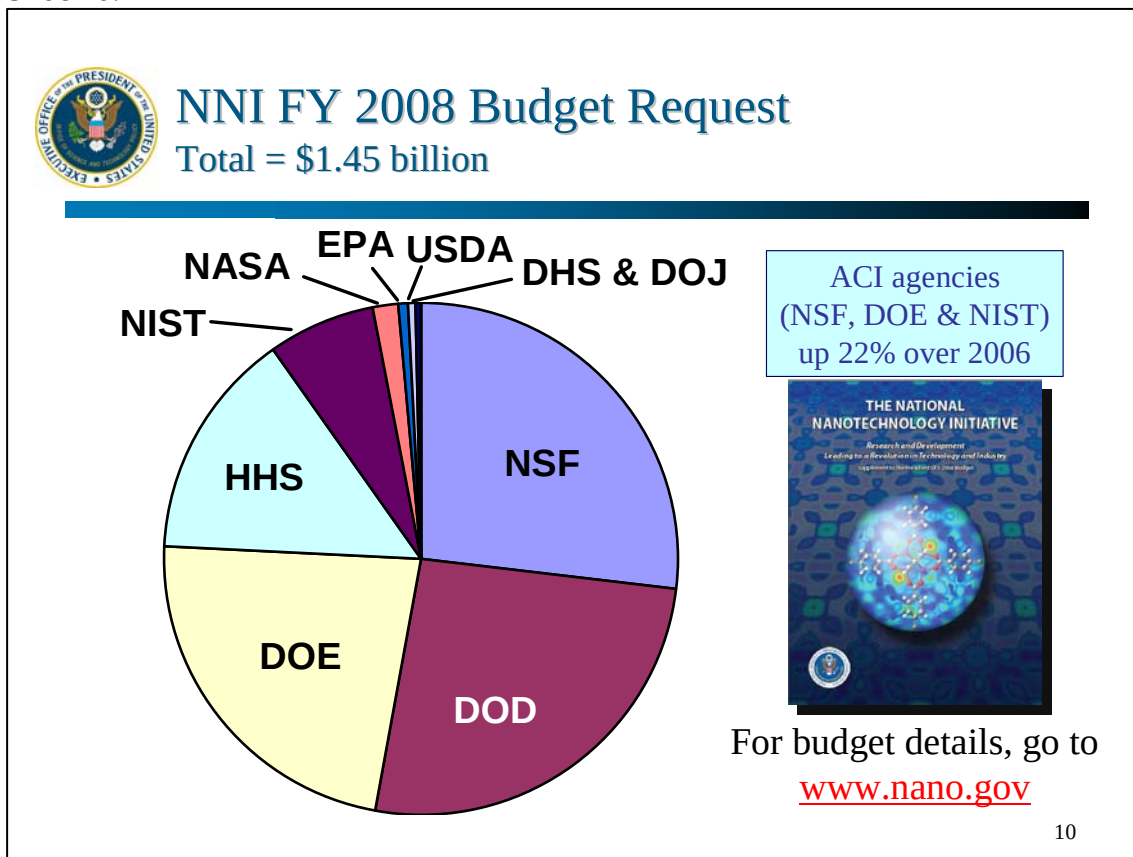
The interagency program was launched in FY 2001.

In 2003, Congress passed and President Bush signed the 21st Century Nanotechnology Research and Development Act, which:

1. Put into law the existing multi-agency, multidisciplinary R&D program. The program is run under the auspices of the National Science and Technology Council (NSTC).
2. Established the National Nanotechnology Coordination Office.
3. Provided for sound management through coordinated interagency planning and periodic external review.

Today, the NNI involves 26 agencies—13 of which have budgets for nanotechnology R&D totaling nearly \$1.5 billion in planned spending in 2008.

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This chart shows the distribution of nanotech R&D funding across the government.

The ACI agencies (NSF, DOE & NIST) account for over half (56%) of the federal nano spending and these three agencies are up 22% since the ACI was launched two years ago.

HHS includes NIH and NIOSH (National Institute for Occupational Health & Safety)

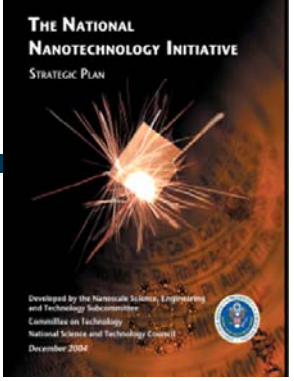
Agencies like DOD do not have an R&D budget specifically for nanotechnology research, but rather are investing in nanotechnology to address the agency's needs and mission.

Note that among the smaller research agencies— EPA plans to spend more than twice as much on nanotechnology R&D in 2008 as it did in 2006 (\$10.2M vs. \$4.5M). The agency is taking steps to better understand how nanomaterials interact in various environments in order to support sound regulatory decision making.

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NNI Goals



- ***Sustain world class R&D***
- *Facilitate technology transfer*
- *Develop infrastructure: education; workforce preparation; facilities & instrumentation*
- *Support responsible development of nanotechnology*

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The NNI issued at Strategic Plan in 2004 that identifies 4 high-level goals.

The first is to ***sustain world class R&D.***

- The NNI has funded thousands of grants to individual investigators.
- Today, NSF is funding 81 grants in Missouri totaling \$26 million.
- Washington University (in St. Louis) is the lead for one of the National Cancer Institute's Centers for Cancer Nanotechnology Excellence.
- Nationwide, the NNI has promoted multidisciplinary research at the interface of traditional disciplines.

As a result, the U.S. leads in the number of nanotechnology articles in high impact journals, including Science and Nature. And according to the US Patent & Trademark Office, U.S. inventors/assignees lead in the number of:

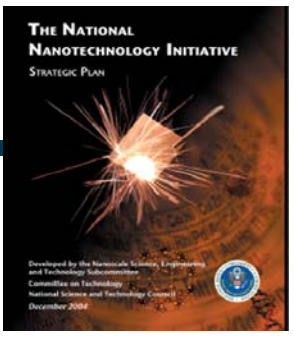
✓ U.S. patents

- ✓ Patents published globally
- ✓ Inventions with patent publications in 3 or more countries (i.e., inventions that are believed to be worth protecting in the biggest markets—US, Europe, and Japan).

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NNI Goals



- ***Sustain world class R&D***
- ***Facilitate technology transfer***
- *Develop infrastructure: education; workforce preparation; facilities & instrumentation*
- *Support responsible development of nanotechnology*

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The second NNI goal is to:

Facilitate technology transfer-- That is, to promote the commercialization of the results of the NNI funded research.

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NNI activities supporting tech transfer

- Agency-specific programs support application and use of nanotechnology (DOD, NASA, NIH, etc.)
- SBIR/STTR grants (nearly \$200 million in 2004-2006)
- Industry liaison groups to exchange information on NNI research activities and industry needs
- Standards development (NNCO Director C.Teague chairs the ANSI Technical Advisory Group to the International Standards Organization)

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The NNI is taking a number of approaches toward accomplishing its tech transfer goal.

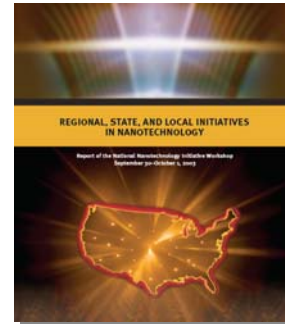
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- Standards development (NNCO Director Clayton Teague chairs the ANSI Technical Advisory Group to the International Standards Organization)

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NNI activities supporting TT (cont.)

- Regional, State, and Local Initiatives in Nanotechnology Workshops
- NNI-funded multi-disciplinary research centers include industry partners
- Broad availability of NNI user facilities



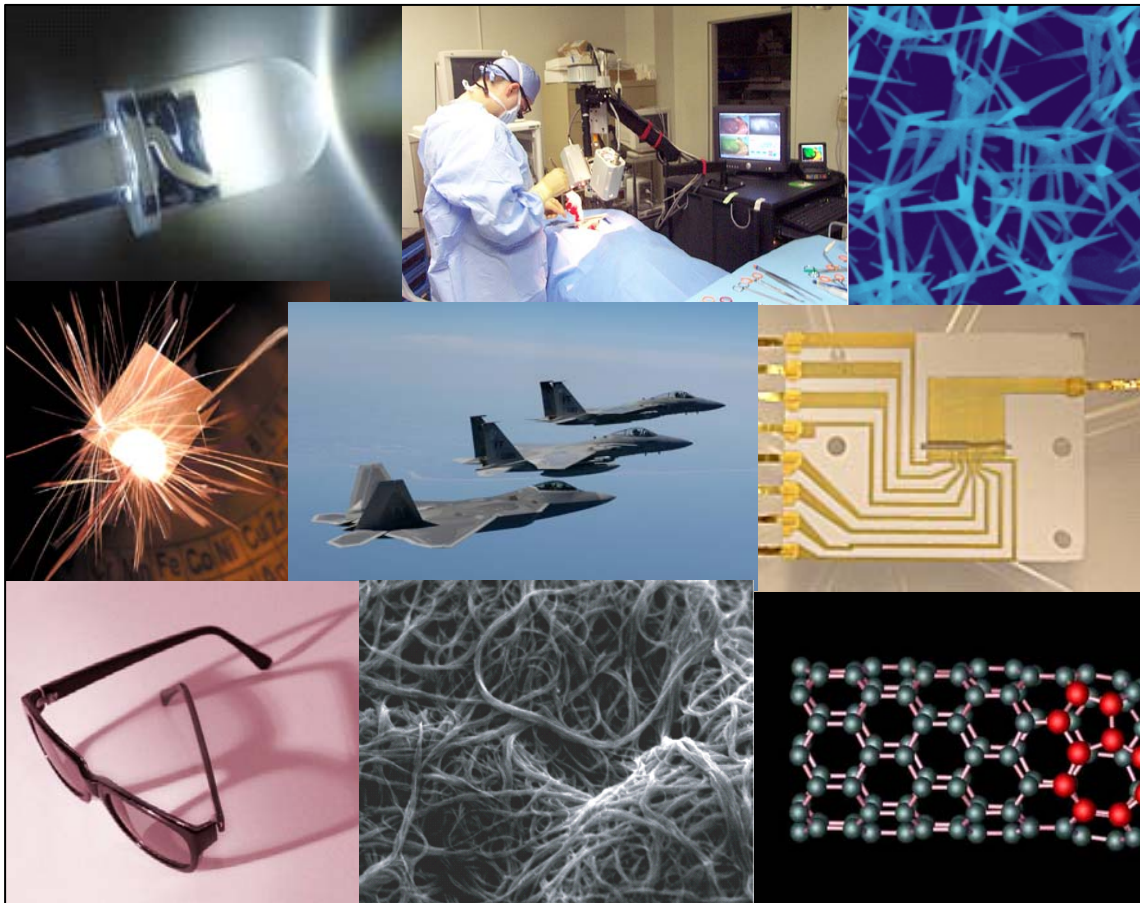
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Technology transfer of NNI research results is also facilitated by workshops (two have been held to bring together representatives from State and regional nanotechnology initiatives to learn best practices and exchange information).

Another way in which technology transfer takes place is within the interdisciplinary research centers and user facilities around the country.

In these collaborative environments, researchers from academia and industry can interact, allowing for rapid diffusion of knowledge and increasing the likelihood of innovation.

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NNI-funded research is leading to advanced materials that have applications ranging from consumer products to aviation and electronics.

Examples include:

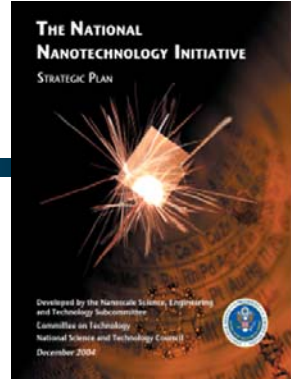
- Nanomaterials that reduce maintenance on Navy ships, saving \$100s of millions
- Coatings that make glasses more scratch resistant and that make windows easier to keep clean
- Nanomaterials that provide improved medical imaging
- Low-power LEDs for more efficient solid-state lighting

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NNI Goals

- *Sustain world class R&D*
- *Facilitate technology transfer*
- *Develop infrastructure: education; workforce preparation; facilities & instrumentation*
- *Support responsible development of nanotechnology*



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The third goal of the NNI is:

Develop infrastructure, including facilities & instrumentation, as well as infrastructure for education and workforce preparation.

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A significant fraction of the funding at DOE is going toward establishing five Nanoscale Science Research Centers.

With these centers, DOE has made the largest investment in infrastructure within the NNI.

Each center is:

- Co-located with large facilities (such as Oak Ridge's Spallation Neutron Source).
- Operated as user facilities that are open to all researchers (at no charge if they agree to make their results public; at cost if the results are to be treated as proprietary).
- Promoting multi-disciplinary research that leverages the broad expertise of the various laboratories.
- Access to advanced facilities and instrumentation is critical to performing much of the cutting-edge nanotechnology research.

For more information about the DOE centers, go to the DOE website.

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NNI Goals



- ***Sustain world class R&D***
- ***Facilitate technology transfer***
- ***Develop infrastructure: education; workforce preparation; facilities & instrumentation***
- ***Support responsible development of nanotechnology***

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The fourth goal of the NNI is:

Support responsible development of nanotechnology

Responsible development means supporting research to understand the potential risks to workers, consumers, and public, and to the environment.

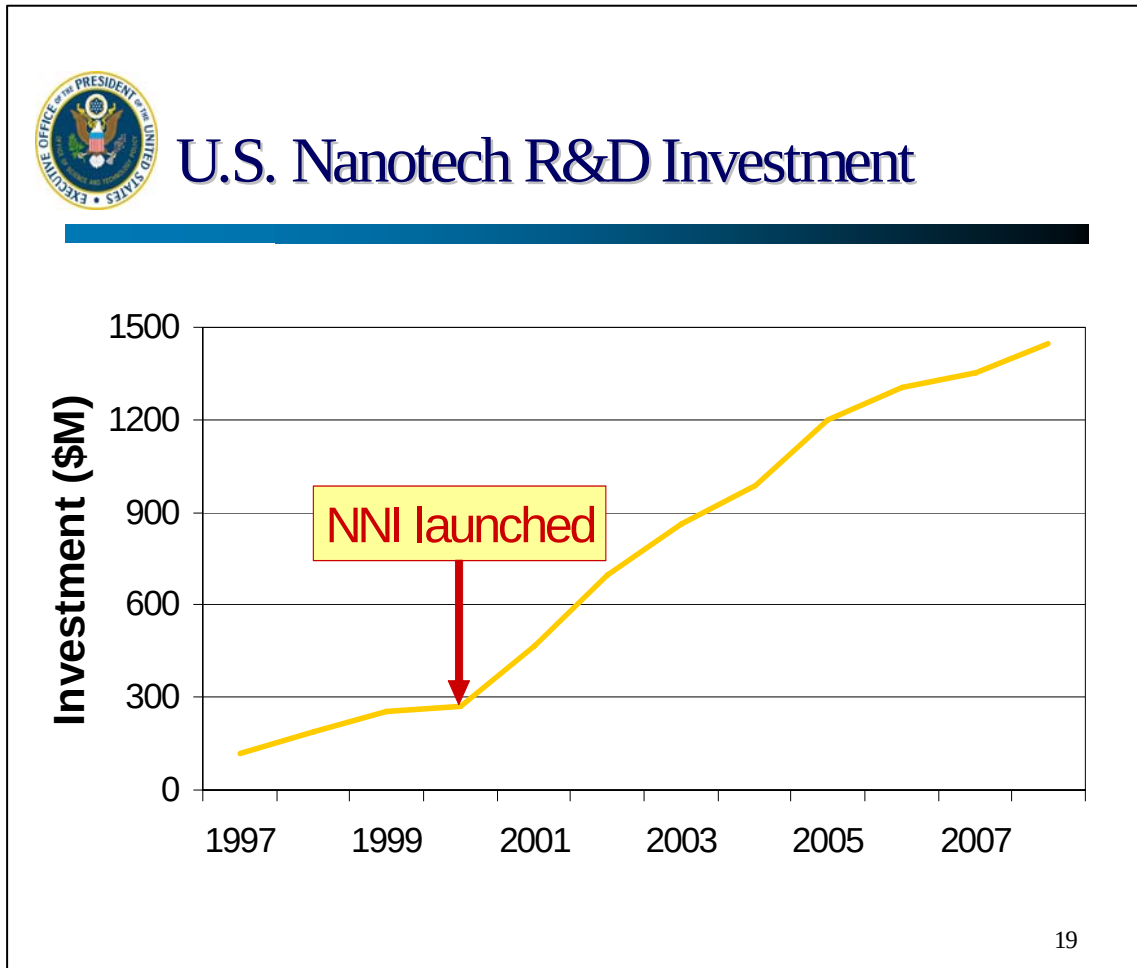
NOTE: This research is important to do in parallel with the development of nanomaterials for commercial use. Nanomaterials can have different biological properties and some may be harmful in certain uses. Understanding these properties will allow for proper handling and use.

The NNI plans to spend \$58.6 million in 2008, up 55% over the amount spent last year (\$37.7 million in 2006).

The NNI recently published a document that identifies the Environmental, Health, and Safety research priorities to support risk assessment and risk management for nanoscale materials. Several NNI agencies are investing in research in these priority areas.

Responsible development also means addressing the societal, ethical, and legal implications that accompany a many new technologies— e.g. misuse for harmful purposes, applications that lead to loss of privacy, or for performance enhancement that are “beyond therapeutic” uses.

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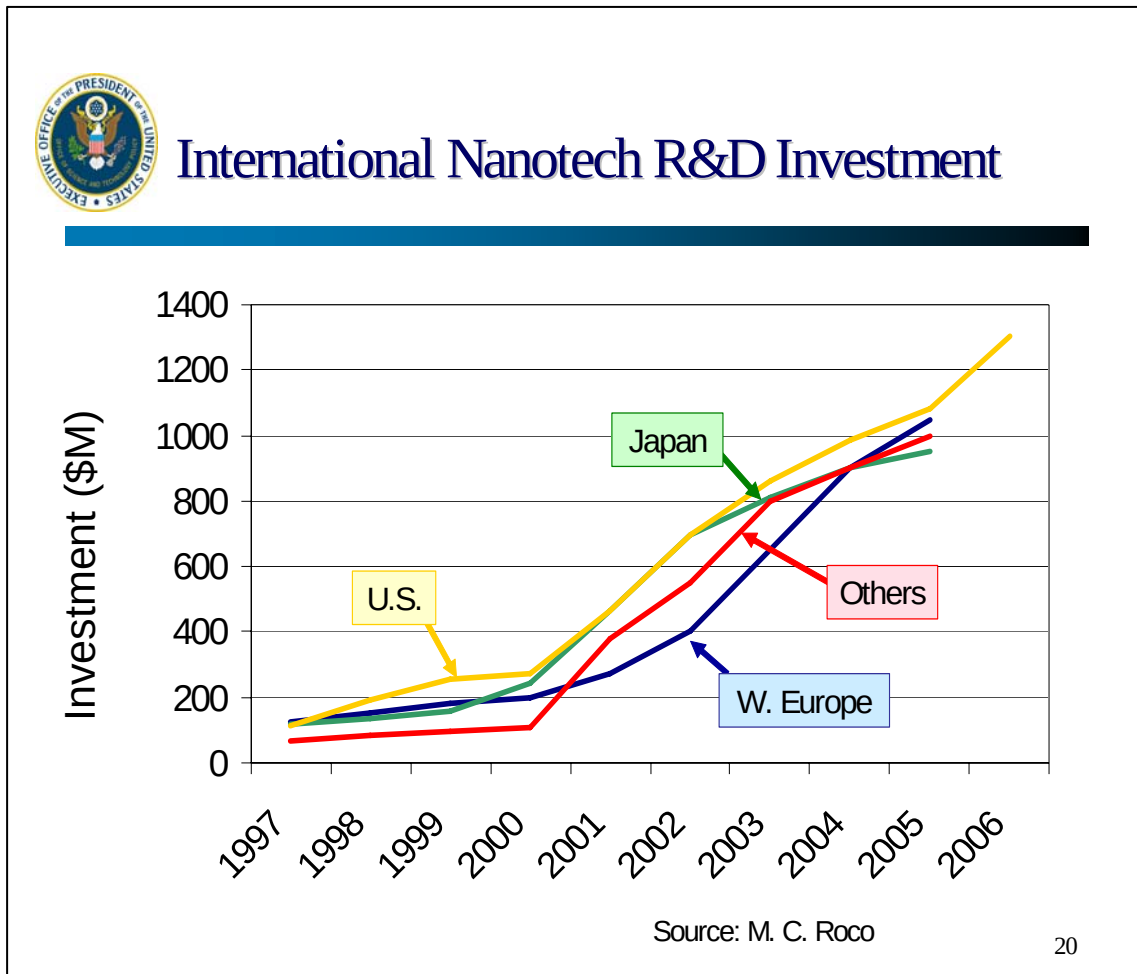


The Administration’s support for nano did not begin with ACI.

Since the NNI was launched in FY 2001, annual spending has more than tripled (from \$465M to nearly \$1.5 billion in FY 2008).

However, the U.S. is not the only nation that is investing in nanotechnology R&D.

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In fact, the U.S. spends roughly one quarter of the amount spent by governments around the world.

In addition to Japan and the Europe (through spending by individual nations and by the EU), many other countries have organized initiatives, including:

- Canada
- Singapore
- Taiwan
- Brazil
- South Africa
- Israel
- South Korea
- Australia
- China
- And others

Russia has recently established a program based closely on the U.S. model. Russia intends to spend \$1.4 billion a year on nanotechnology research.

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The screenshot shows the NCSL website with a header featuring the organization's logo and a search bar. A navigation menu includes links for 'About NCSL', 'State & Federal Issues', 'Legislatures', 'Legislative Staff', 'Meetings', 'Bookstore', and 'Legislators & Staff Only'. The breadcrumb trail reads: 'NCSL Home > State & Federal Issues: Issue Areas > Nanotechnology Related Legislation 2006'. The main heading is 'Nanotechnology 2006 State Legislation', with a sub-header 'Last Update: October 2006'. The text states: 'Nanotechnology is the science of the very small. This growing field is getting attention in a number of states, which are considering legislation to support nanotechnology education and economic development initiatives.' A red box highlights the 'Summary' section, which says: 'Legislation has been introduced or considered in at least twenty-nine states in 2006; enacted or adopted in at least twenty-two states: [Arkansas](#), [California](#), [Colorado](#), [Connecticut](#), [Florida](#), [Georgia](#), [Illinois](#), [Indiana](#), [Louisiana](#), [Maryland](#), [Massachusetts](#), [Minnesota](#), [New York](#), [North Carolina](#), [Ohio](#), [Oklahoma](#), [Pennsylvania](#), [South Carolina](#), [Tennessee](#), [Utah](#), [Virginia](#), and [Washington](#).' Below this, the 'Arizona' section lists two bills: 'H.B. 2623' (Creates 'Innovation Arizona'; includes nanotechnology as an "emerging technology industry"; establishes Innovation Arizona board of directors with eight of the members from the private sector who have experience in any of a number of listed technologies, including nanotechnology.) and 'H.B. 2789' (Creates 'Innovation Arizona'; includes nanotechnology as a "technology field"; establishes Innovation Arizona board of directors with five of the members who have experience in any of a number of listed technologies, including nanotechnology.). The footer of the page includes the text 'For more info: www.ncsl.org' and the page number '21'.

Much work has also been done at the state level. Estimates vary, but between \$200 and \$400 million are being spent annually by the states on nano.

One place for information on state activities is the National Conference of State Legislatures website.

In 2006, that organization identified 29 states in which legislation related to nanotechnology has been introduced or considered.

State spending is targeted at not only supporting nanotechnology research at state universities, but also at supporting tech transfer that creates economic value—new businesses and new jobs.

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“Preparing our nation to compete in the world is a goal that all of us can share. I urge you to support the American Competitiveness Initiative, and together we will show the world what the American people can achieve.”

-- President George W. Bush (2006 State of the Union Address)

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The NNI and ACI are critical elements of the innovation “ecosystem.” The Federal government can help create the environment in which America's can succeed, but it is the hard work and ingenuity of researchers, state and local governments, and members of the private sector that are the engine for American competitiveness.

Thank you.