

U.S. Science and Technology Policy and R&D Funding

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September 19, 2008

for the Canadian Embassy

AAAS R&D Budget and Policy Program

<http://www.aaas.org/spp/rd>

● See the “What’s New” section for the latest updates; see the “Seminars and Presentations” section for copies of this presentation.



U.S. federal government and innovation – a long history

- U.S. Constitution (1787) – Article I, Section 8 on patents
- Morrill Act (1863)
- National Bureau of Standards (1901)
- National Research Council, NACA (1916)

Impact of World War II

- Vast expansion of government-funded research
- Growth of contract and grant system (Americans want more government services, don't like "big government")
- Public-private partnerships in support of war effort (synthetic rubber, electronics...)
- Vannevar Bush, *Science: The Endless Frontier*

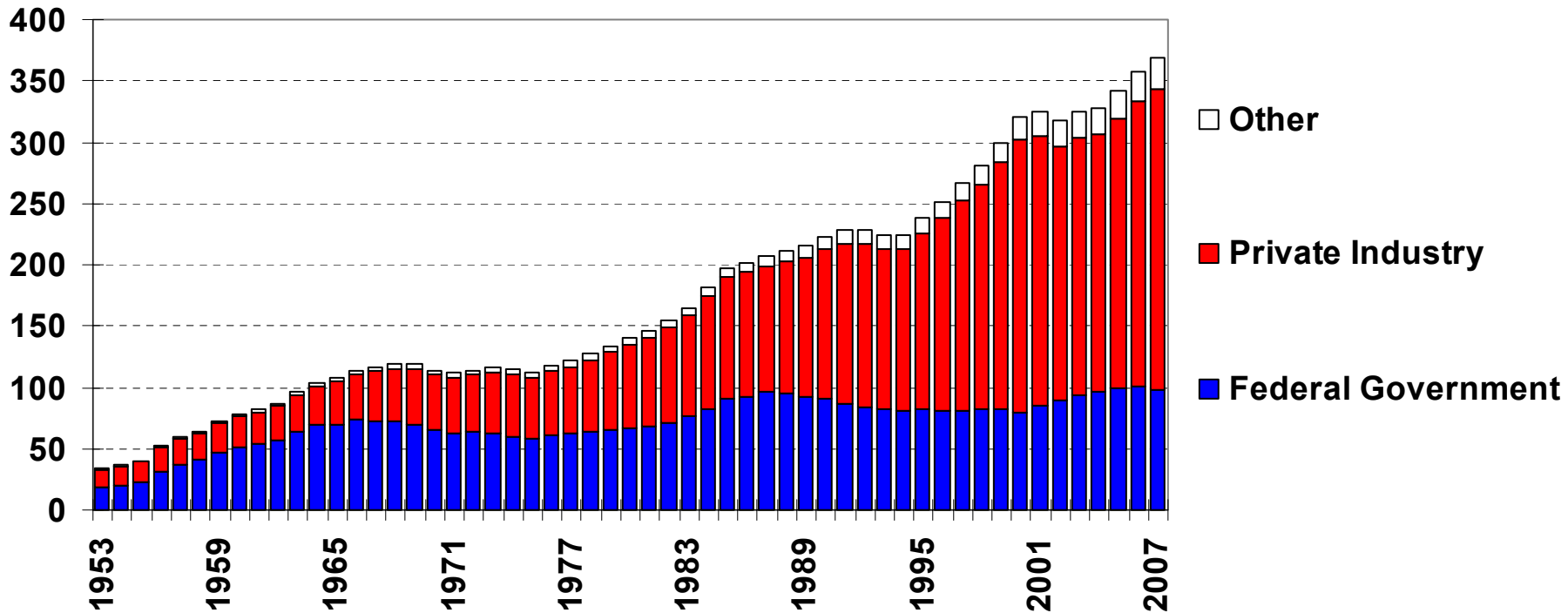


Post-war years to the present

- Growth of both government & private sector R&D, with the majority of federal basic research funding going to universities.
- Up to early '70s, government outpaced industry (space program)
- Since '70s – industrial R&D has grown faster
- Today – U.S. R&D = 1/3 government, 2/3 industry
- Largest shares of government R&D go to defense, health – little directly to innovation

U.S. R&D Funding by Source, 1953-2007

expenditures in billions of constant 2007 dollars



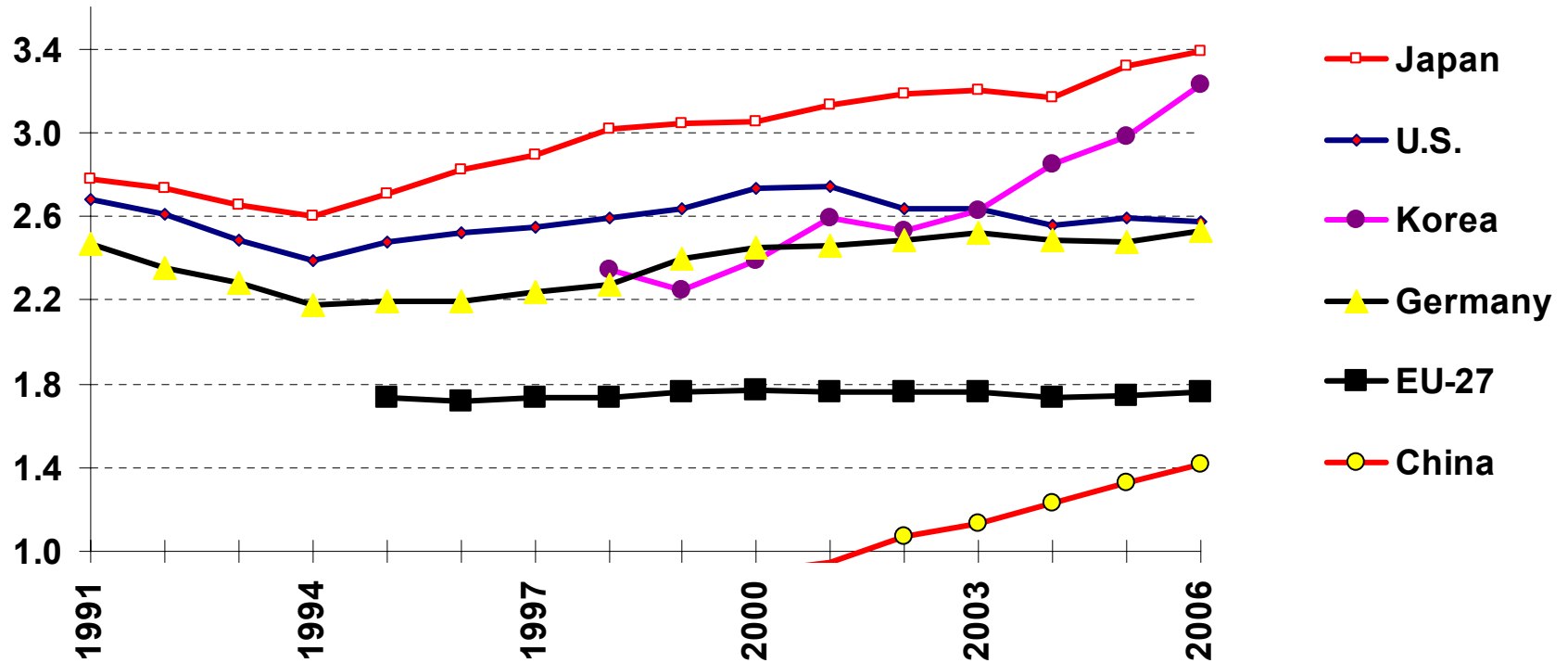
Source: NSF, Division of Science Resources Statistics. (Data for 2007 are preliminary.)
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Current policy concerns

- Despite large industry investments in R&D, U.S. policymakers are concerned about the state of U.S. innovation and competitiveness.
- U.S. R&D/GDP ratio and other indicators are steady or declining, while other nations are growing (esp. Asian nations)

Total National R&D as % of GDP, 1991-2006



Source: National Science Foundation, National Patterns of R&D Resources and OECD, Main Science and Technology Indicators. Data not available for all nations for all years. AUGUST '08 © 2008 AAAS

U.S. Science and Technology Policy

- The federal government has a fragmented, decentralized policymaking system, especially in S&T policy.
- Not only are there divisions between Congress and the executive branch, but fragmented policymaking structures within each branch.

Executive Branch

- The Office of Science and Technology Policy (OSTP) coordinates S&T policy, but it is a small (\$5 mil. / year) office with no budget power and no authority over federal agencies. Its role is mostly advisory. OSTP is led by the President's science advisor, currently John Marburger.
- Budget power rests with the Office of Management and Budget (OMB) and R&D funding agencies.
- There are multiple external advisory commissions, such as the President's Council of Advisers on Science and Technology (PCAST), the National Science Board (NSB), the President's Council on Bioethics.
- OSTP works with OMB in establishing interagency R&D priorities, and runs various National Science and Technology Council (NSTC) committees to coordinate interagency programs and cross-cutting issues (peer review system, science and math education, etc.).
- There are three formal NSTC interagency initiatives with coordinating offices: nanotechnology, IT R&D, and climate change science.

FEDERAL R&D FOR NATIONAL MISSIONS

- In our mission-oriented system, each department funds only the R&D necessary to carry out its mission, and integrates R&D programs with other programs.
- “Innovation” or “funding basic research for future economic competitiveness” is not an explicit mission, though it is often stated as the primary rationale for federal support of research.
- Only NSF and DOE’s Office of Science have a science mission.
- Only NIST in Commerce has an “economic development” mission.
- The relative importance of missions varies over time, and thus R&D for various missions changes according to changing national needs.

THEMES IN THE BUDGET: INNOVATION AND COMPETITIVENESS

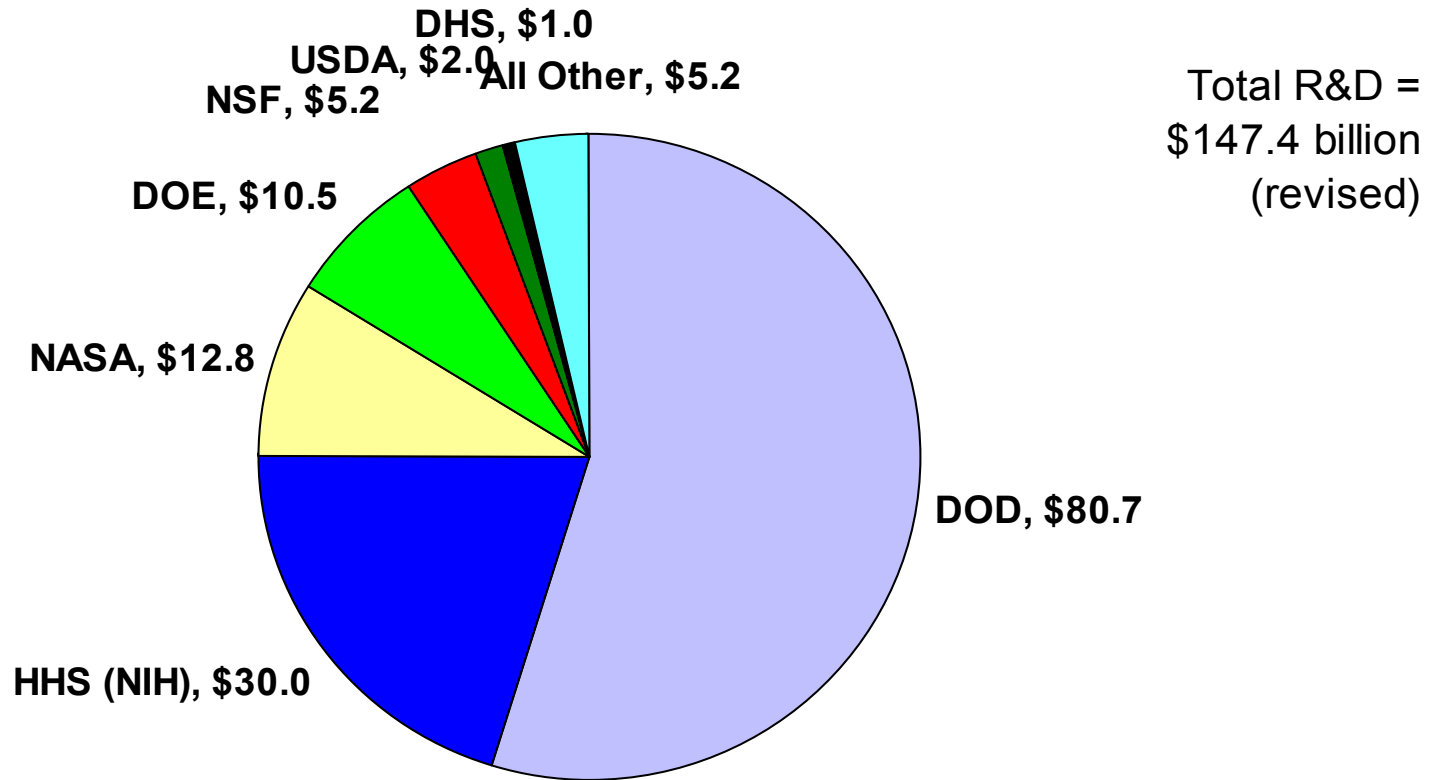
- In response to the “Gathering Storm” report and others, President Bush announced the American Competitiveness Initiative (ACI) in his 2006 State of the Union address.
- There are also several congressional responses, culminating in the America COMPETES Act of August 2007.
- For R&D investments, the theme is boosting federal support for basic research in the physical sciences (broadly defined).
- The plan: Doubling the budgets of NSF, DOE Office of Science, and the NIST laboratories over 7 to 10 years. But 2007 and 2008 appropriations leave the plan off track.

THE 2009 BUDGET FOR R&D

- The ACI continues for a third year, with large increases for NSF, DOE Science, and the NIST labs to catch up to a 10-year doubling track.
- Again, there would be large increases for DOD weapons and NASA spacecraft development, but also increases for most R&D programs.
- The NIH budget would be flat, agricultural and environmental R&D agencies would decline.

Total R&D by Agency: FY 2009 Proposed

Budget Authority in billions of dollars



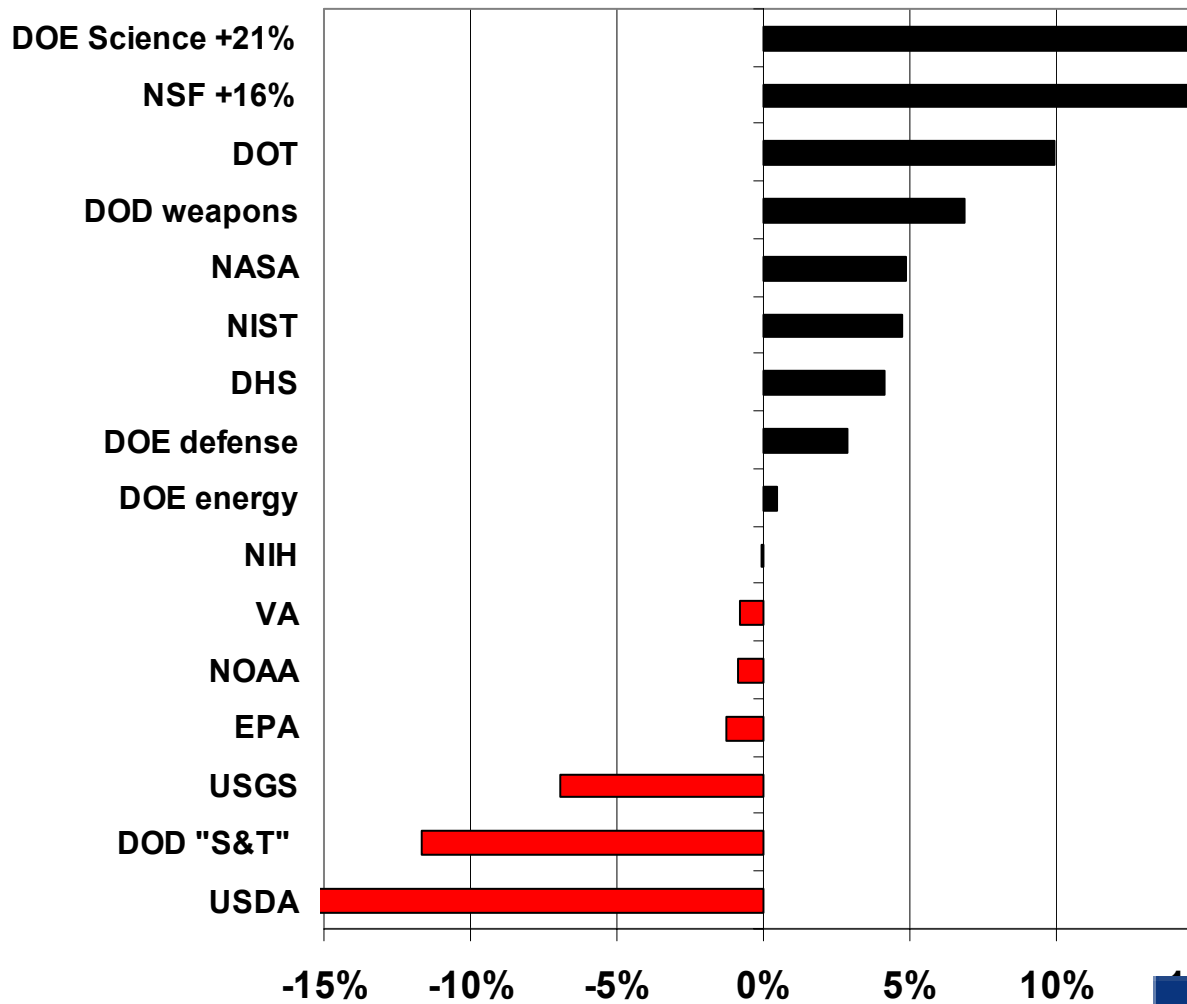
Source: AAAS, based on OMB R&D Budget Data and agency estimates for FY 2009.

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FY 2009 R&D Request

Percent Change from FY 2008



Source: AAAS, based on OMB R&D data and agency estimates for FY 2009.
 DOD "S&T" = DOD R&D in "6.1" through "6.3" categories plus medical research.
 DOD weapons = DOD R&D in "6.4" and higher categories.
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CONGRESS

- The House and Senate have different structures for policymaking.
- Authorizing committees have policymaking power: for example, the House Science and Technology Committee, and the Senate Commerce, Science, and Transportation Committee. But S&T policymaking is scattered: NIH, for example, falls under different committees' jurisdiction, as does most of DOE.
- The House and Senate Appropriations Committees have budget power: R&D is funded in 10 of the 12 annual appropriations bills.
- Long-term policymaking is difficult because R&D programs are funded through annual appropriations; even ITER and the Space Station are funded one year at a time.

SOME EXAMPLES OF RECENT S&T POLICY

- Ban on federal funding for ESC research (2001): presidential executive order.
- America COMPETES Act (2007): multi-year congressional debates to create a comprehensive S&T authorization bill from multiple committees with R&D funding and SMET education components, based on Gathering Storm report and other recommendations.
- Vision for Space Exploration (2004): Presidential initiative, executed by NASA and later authorized by Congress.
- Decline in federal funding for research (2004 -): sum of annual budget decisions in appropriations bills within a budget framework of rising budget deficits.
- Nanotechnology initiative (2000 -): Championed by VP Gore, institutionalized as a multi-agency initiative with coordinating office in 2001, authorized by Congress in 2003 to include an advisory panel and regular external reviews, fine tuned since then with a greater emphasis on ESH, and funded in annual appropriations.

ALLOCATING FEDERAL R&D

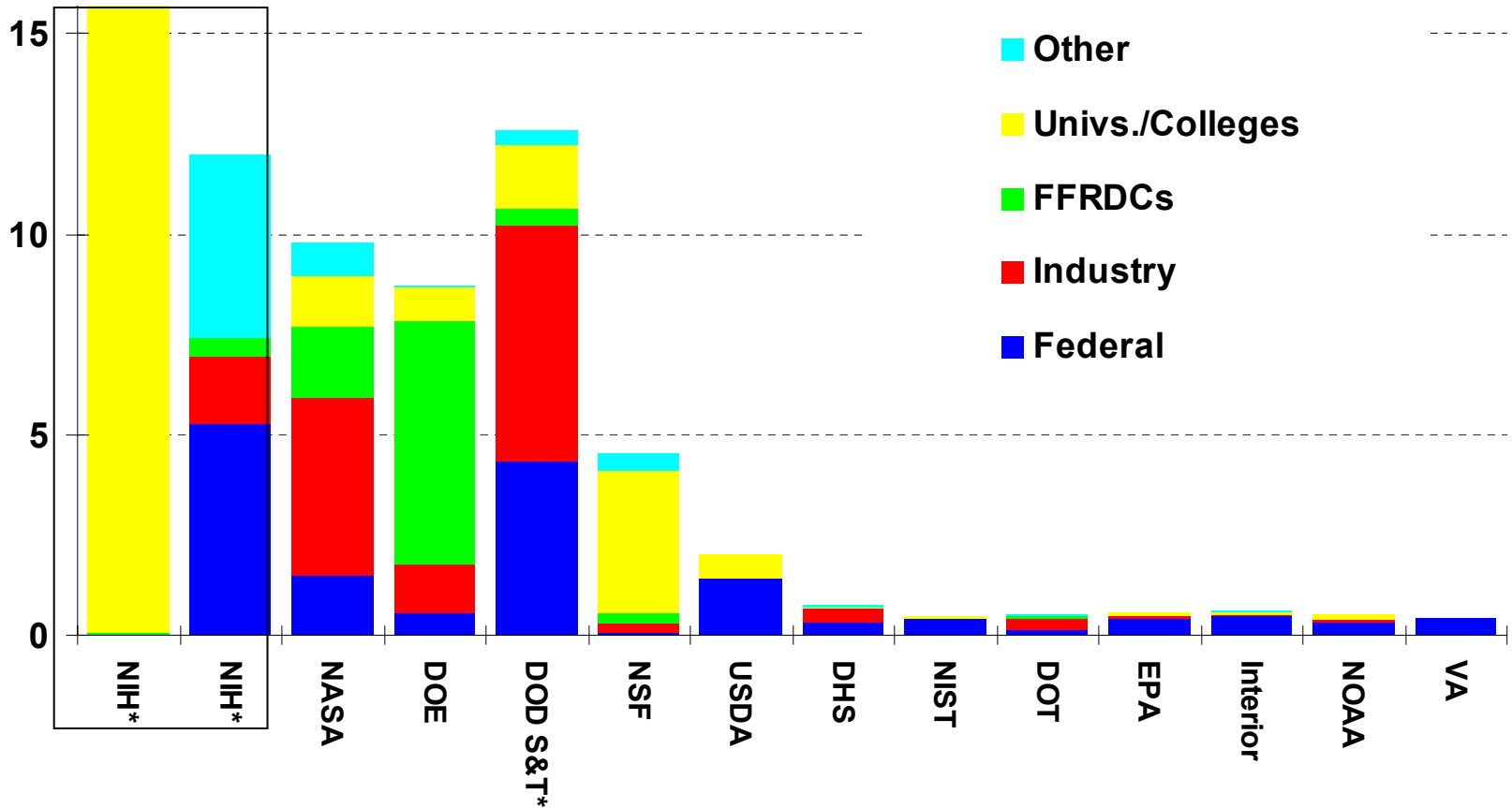
There are numerous ways of allocating federal R&D investments; each agency is different.

- Because of mission requirements, some agencies invest heavily in “D” (DOD), others almost exclusively in “R” (NSF), and others a mix (NASA). Some agencies rely heavily on intramural performers; others are almost exclusively extramural.
- Investigator-initiated, peer-reviewed competitively awarded research grants are a way to allocate funds for scientific excellence.
- Congressional earmarks are another way to allocate funds, for geographic and political considerations.
- Most agencies use a mix, including program managers, formula funds, sheltered competitions, internal allocations with limited external review, etc.

Federal R&D by Performer at Selected Agencies

billions of FY 2007 obligations (preliminary)

* NIH R&D - \$27.8 billion.
Shown as two bars.



Source: AAAS, based on NSF, Federal Funds for Research and Development, Fiscal Years 2005, 2006, and 2007, 2008. R&D includes research, development, and R&D facilities. * - DOD R&D in "6.1" through "6.3" categories.
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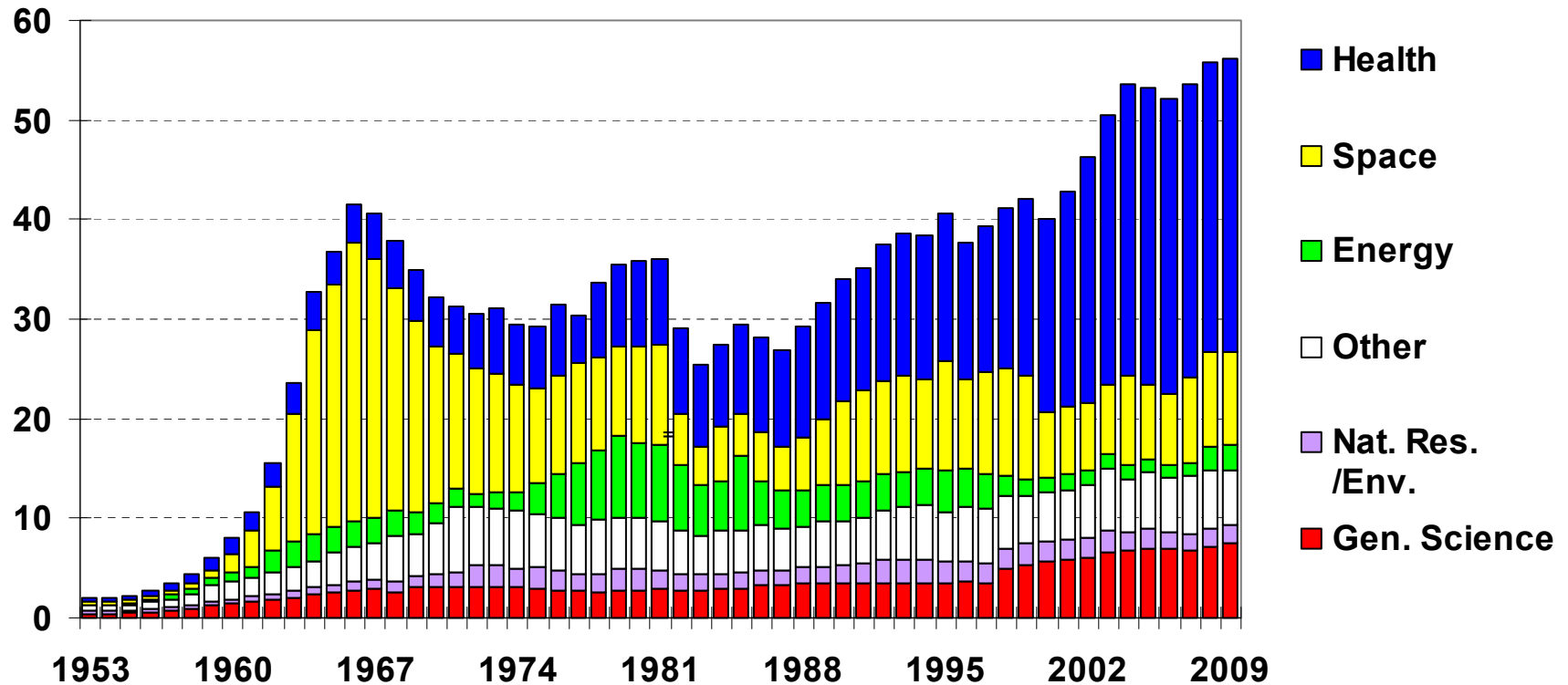
BUDGET MAKES POLICY

In the absence of explicit priorities and policies, scattered agency budget decisions make a *de facto* U.S. S&T policy :

- Over time, R&D investments change to reflect changes in national goals.
- Until recently, there was increasing funding for the biomedical sciences, stagnant funding for most other disciplines.
- Because the university-oriented NIH and NSF budgets have done well, there have been dramatic increases in support of university R&D.
- Over time, industry has come to play a greater role in U.S. R&D; industry spending determines the R&D intensity of the U.S. economy but the federal government remains the most important for RESEARCH. (There are very few policy tools for the federal government to affect industry spending.)

Trends in Nondefense R&D by Function, FY 1953-2009

outlays for the conduct of R&D, billions of constant FY 2008 dollars



Source: AAAS, based on OMB Historical Tables in *Budget of the United States Government FY 2009*. Constant dollar conversions based on GDP deflators. FY 2009 is the President's request.

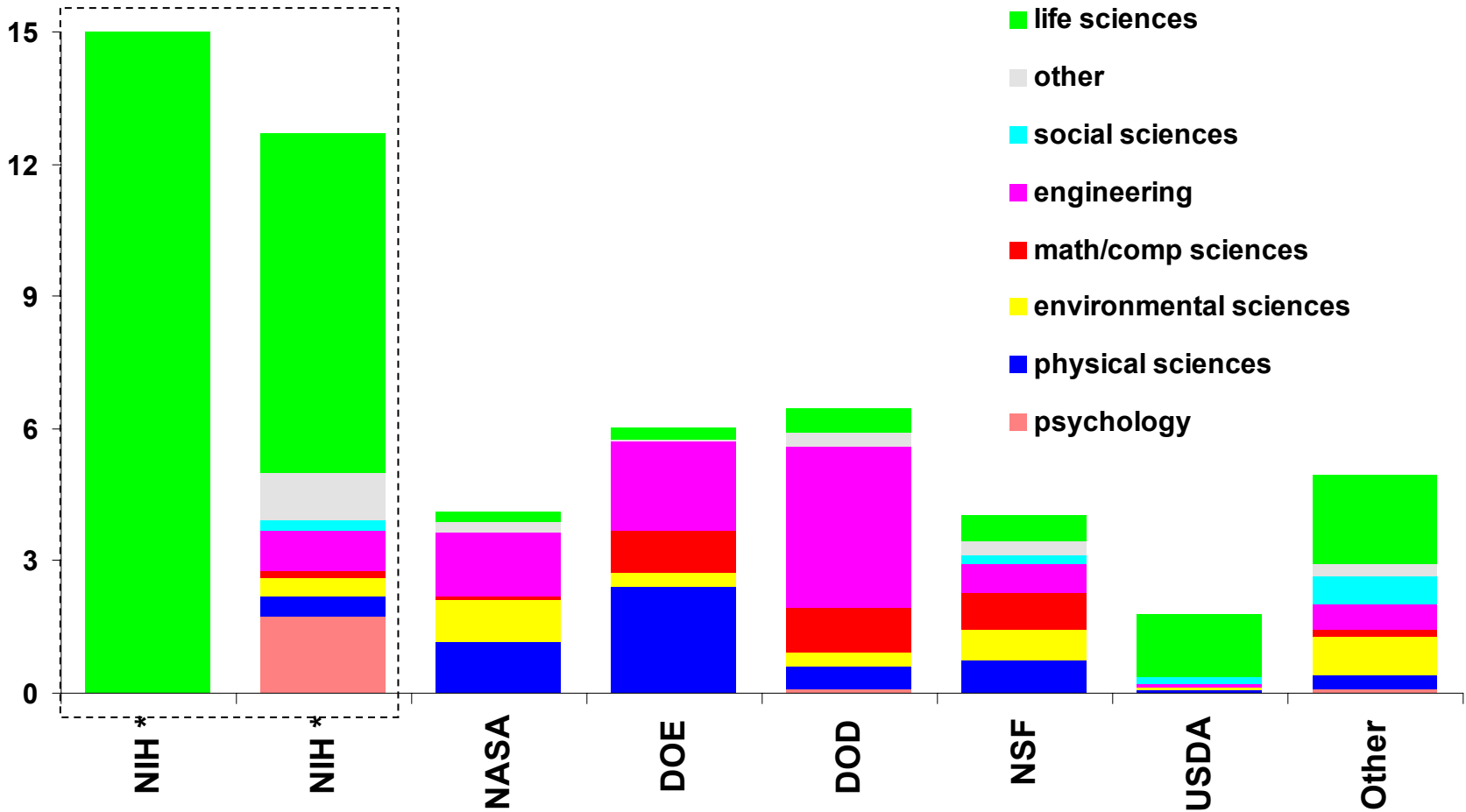
Note: Some Energy programs shifted to General Science beginning in FY 1998.

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Federal Research by Discipline at Selected Agencies, FY 2007 (preliminary obligations in billions of dollars)

* NIH research - \$27.7 billion.
Shown as two bars.

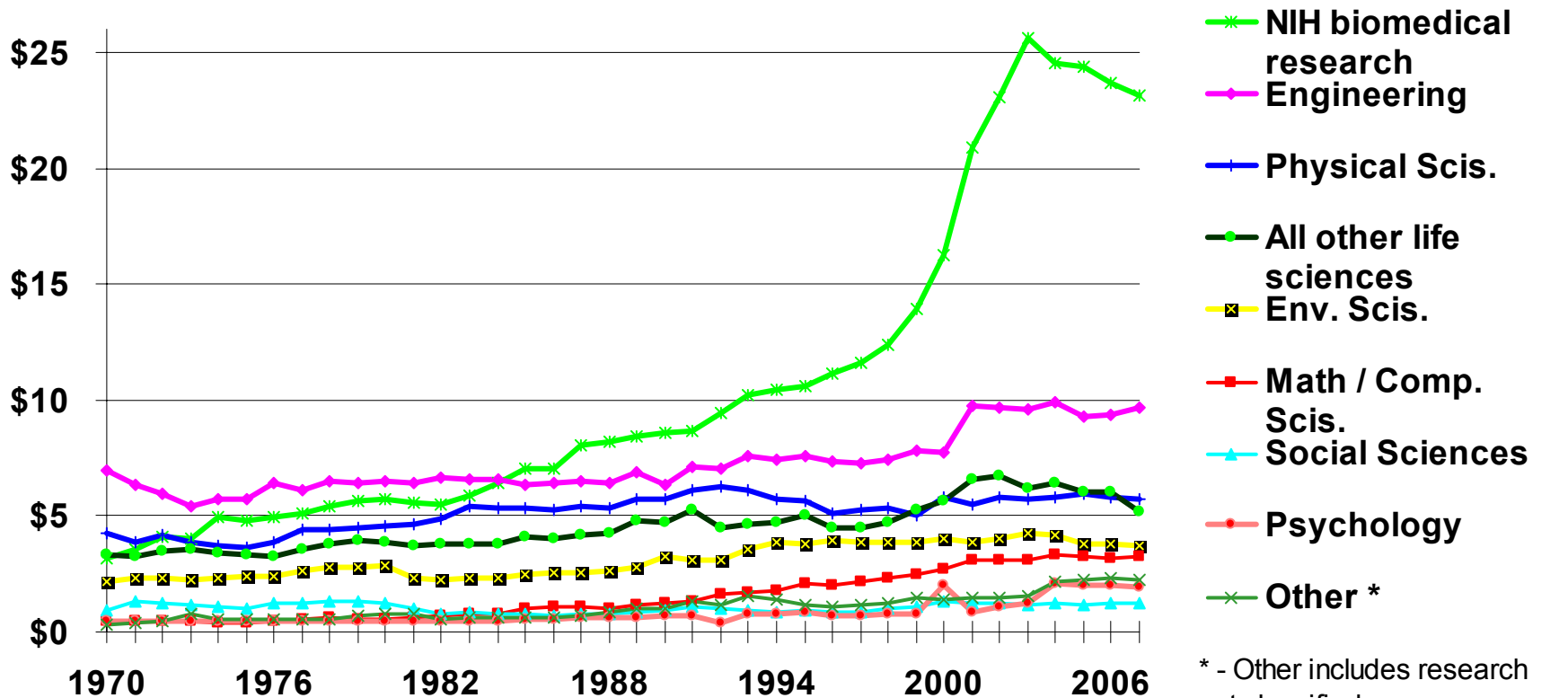


Source: National Science Foundation, *Federal Funds for Research and Development Fiscal Years 2005, 2006 and 2007, 2008*. Development and R&D facilities excluded. FY 2007 data are preliminary.
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Trends in Federal Research by Discipline, FY 1970-2007

obligations in billions of constant FY 2008 dollars



* - Other includes research not classified (includes basic research and applied research; excludes development and R&D facilities)

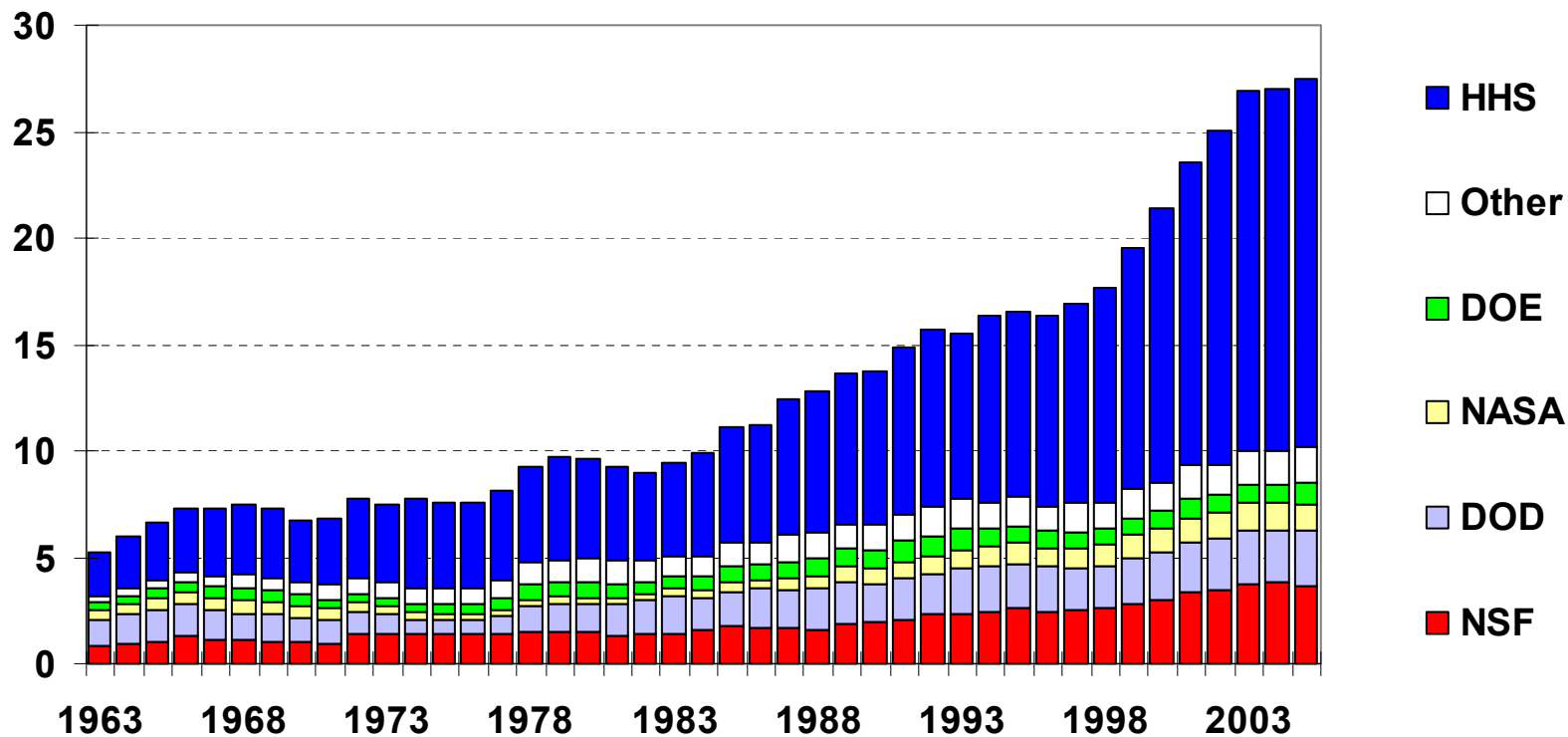
Life sciences - split into NIH support for biomedical research and all other agencies' support for life sciences.

Source: National Science Foundation, *Federal Funds for Research and Development FY 2005, 2006, 2007, 2008*. FY 2006 and 2007 data are preliminary. Constant-dollar conversions based on OMB's GDP deflators. FEB. '08 © 2008 AAAS



Federal R&D Funding to Colleges and Universities FY 1963-2005

Obligations by agency in billions of constant FY 2008 \$



Source: AAAS, based on NSF, *Federal Science and Engineering Support to Universities, Colleges, and Nonprofit Institutions, FY 2005, 2007.*

R&D includes research, development, and R&D facilities support. Constant-dollar conversions based on OMB's GDP deflators.

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A FEW NOTES ON THE PRIVATE SECTOR

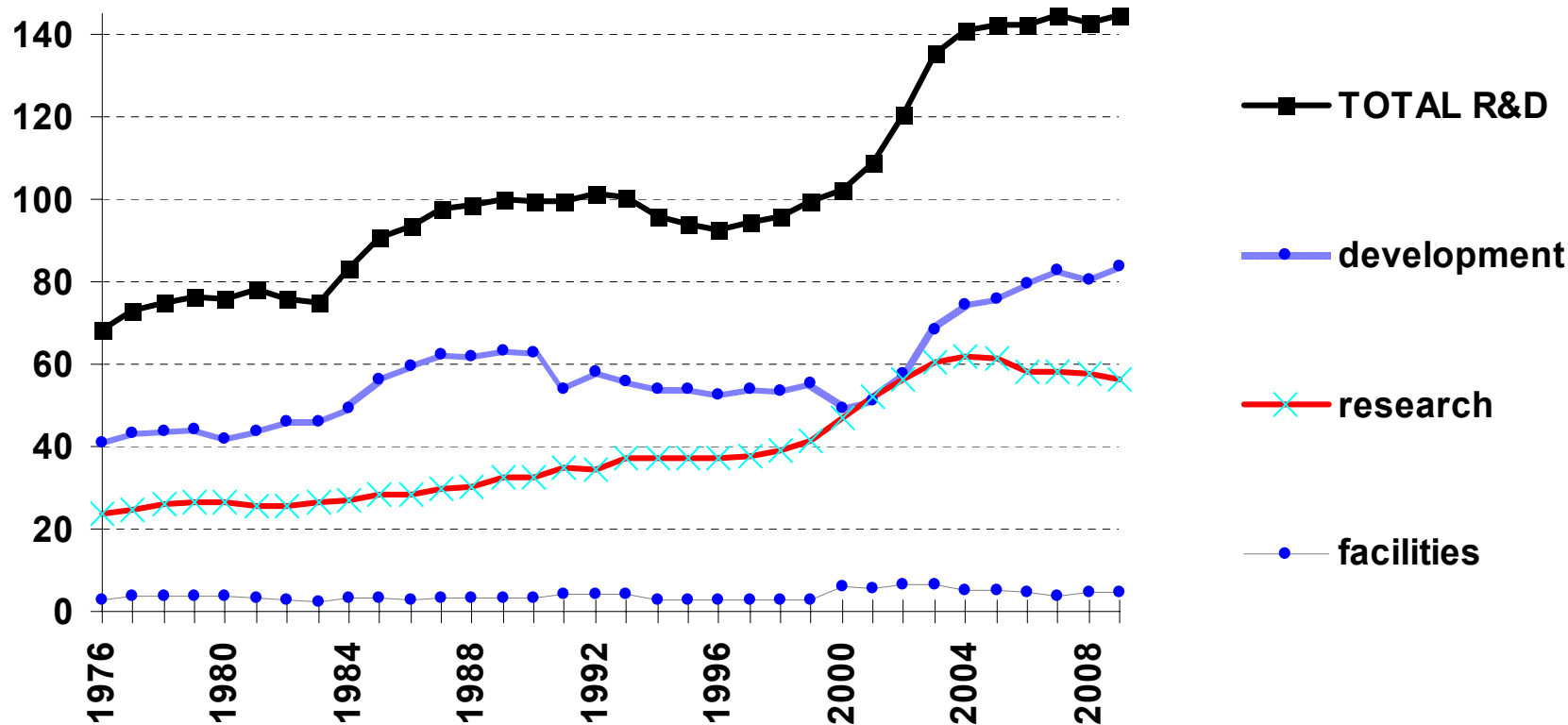
- There was a Research & Experimentation (R&E) Tax Credit, but it expired last December. It may be renewed retroactively next week.
- Direct government support of industry R&D is primarily in the defense, aerospace, and homeland security areas. There is no policy consensus on how the federal government should assist in private-sector innovation.
- There are small programs to encourage commercialization of promising technologies, such as the Technology Innovation Program (TIP) in Commerce. There is a set-aside for SMEs in the Small Business Innovation Research (SBIR) program, requiring a dozen federal agencies to spend 2.5% of their external R&D funds on SMEs.
- Policies such as the Bayh-Dole Act encourage universities and others to commercialize federally supported research findings.

WHERE IS FEDERAL R&D FUNDING HEADED?

- Congress is way behind schedule in finishing the 12 FY 2009 appropriations bills. After the election? After the inauguration?
- The big budget battle between the President and Congress is over how much to spend on domestic discretionary programs.
- Even at a time when policymakers are concerned about U.S. leadership in science and technology eroding, and when proposed R&D increases are authorized in the America COMPETES Act and other legislation, the problem remains how to find the resources.
- Because many 2009 appropriations bills haven't even been drafted, this fall is still a key time for deciding the fate of R&D funding.

Trends in Federal R&D, FY 1976-2009 *

in billions of constant FY 2008 dollars

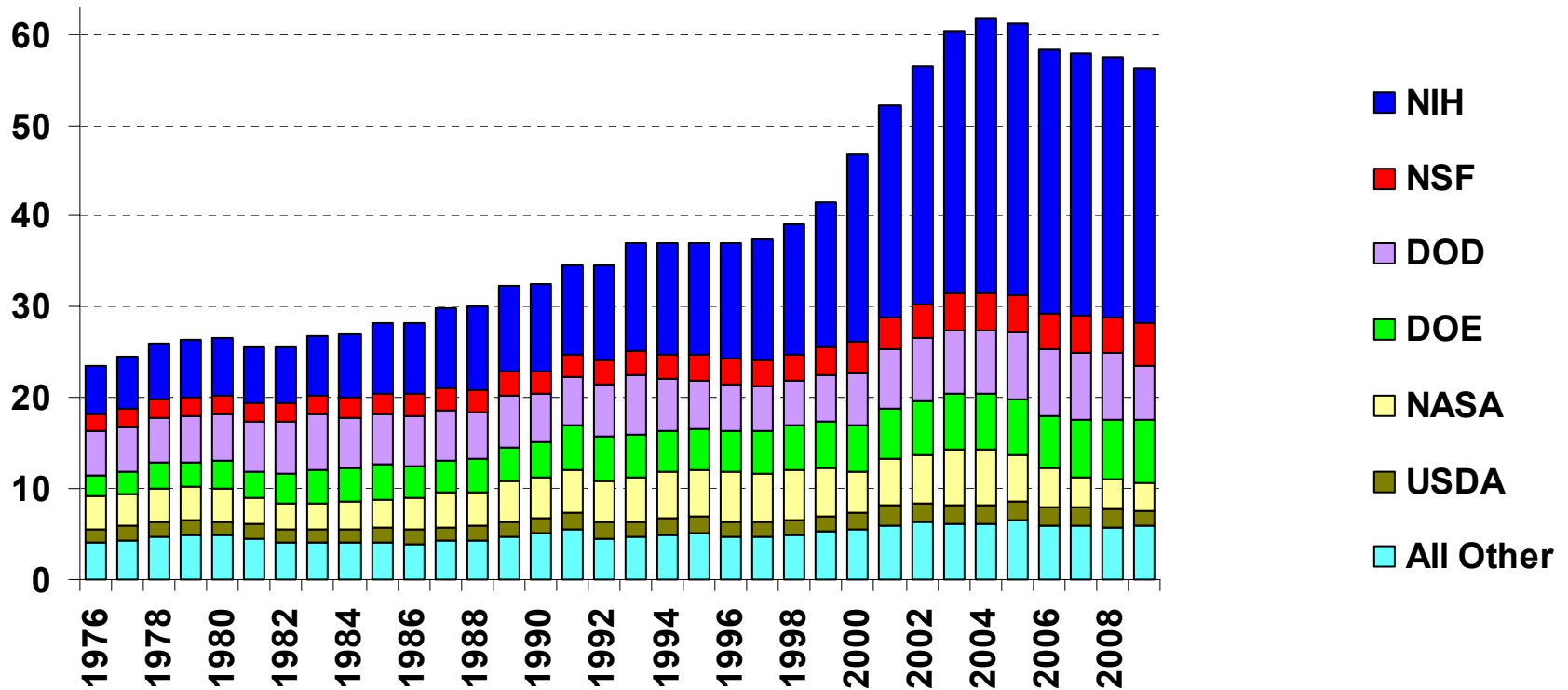


Source: AAAS analyses of R&D in annual AAAS R&D reports. * FY 2009 figures are latest AAAS estimates of FY 2009 request. R&D includes conduct of R&D and R&D facilities. Data to 1984 are obligations from the NSF Federal Funds survey. GDP figures are from OMB, Budget of the U.S. Government FY 2009.
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Trends in Research by Agency, FY 1976-2009 *

in billions of constant FY 2008 dollars



Source: AAAS analyses of R&D in annual AAAS R&D reports.

* FY 2009 figures are latest AAAS estimates of FY 2009 request. Research includes basic research and applied research. 1976-1994 figures are NSF data on obligations in the Federal Funds survey.

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FOR MORE INFORMATION...

The AAAS R&D web site is
www.aaas.org/spp/rd

