

# Research and Development in the FY 2011 and FY 2012 Federal Budgets

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March 21, 2011

for the NAS Mirzayan S&T Policy Fellows

AAAS R&D Budget and Policy Program  
<http://www.aaas.org/spp/rd>

# Federal Policy

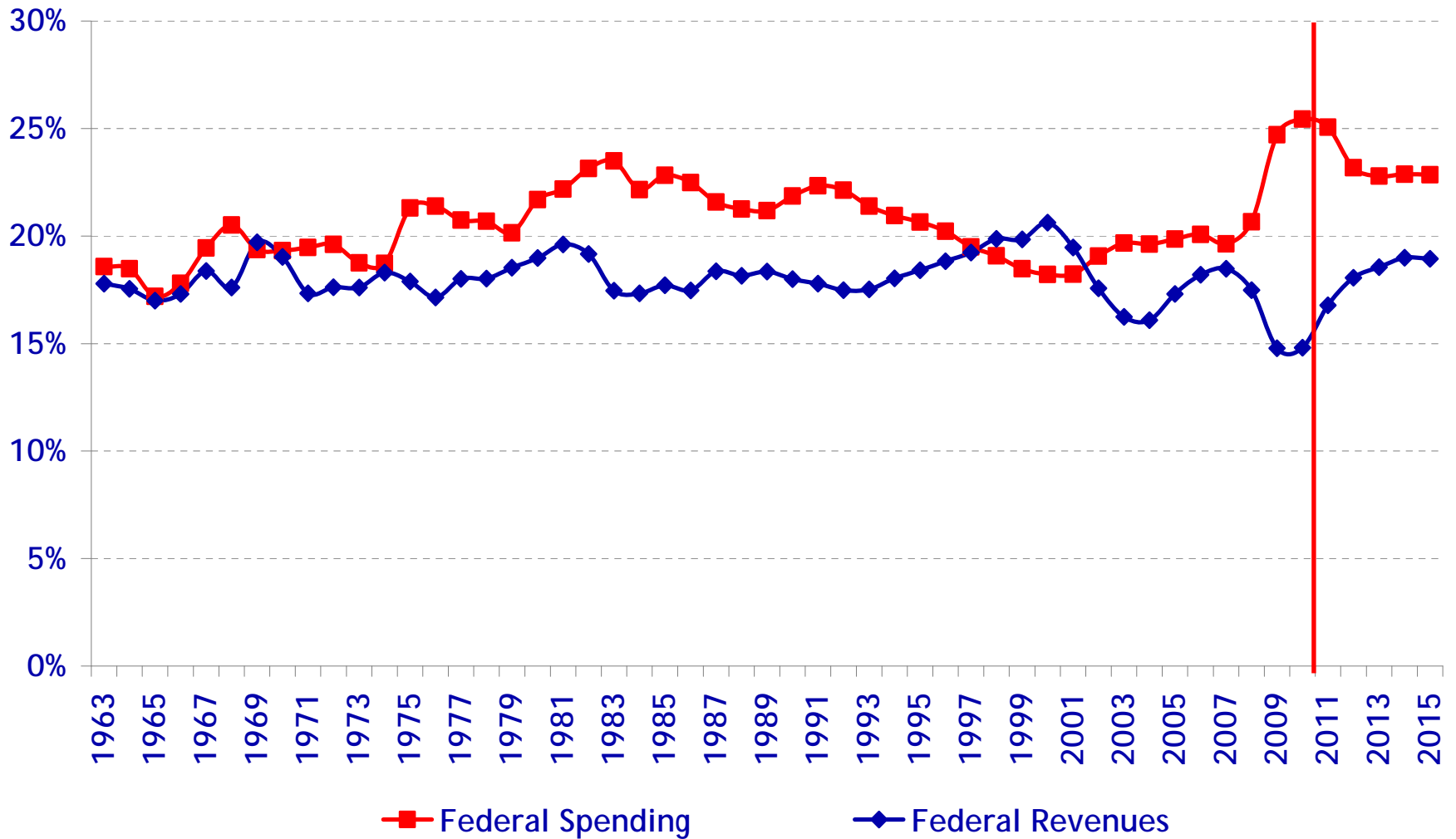
- How does the federal government implement policy?
- The budget is the primary way Congress directs U.S. policy and priorities
  - Almost all policy involves money, directly or indirectly
  - The budget cycle drives decision-making
  - Affects the health of U.S. science and engineering
    - \$147.9b on research and development
    - Over 60% of all university R&D is federally funded
    - Education and workforce training

# The U.S. Federal Budget in FY 2012

- Total Budget: \$3.7t
    - Almost one quarter (23.6%) of the total U.S. economy
  - Total Receipts: \$2.6t
  - Deficit: \$1.1t
    - \$77b borrowed from Social Security and Postal Service
- 
- Moving from Rescue to Rebuilding
    - Tax relief, increased trade, infrastructure investments
  - Putting the Nation on a Sustainable Fiscal Path
    - Spending freeze, entitlement/tax reform, govt reorganization
  - Competing and Winning in the World Economy

# Federal Spending and Revenues

(percent of GDP)



Source: *Budget of the United States Government, FY 2011.*

FY 2010 data are estimates. FY 2011-2015 data are budget projections.

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# Deficit Spending

- The U.S. national debt dates back to our inception
  - Was zero briefly in 1835
  - Tends to expand quickly during wartime
- 33 percent of the FY 2011 budget is funded by loans
  - Government Bonds
  - Auctioned internationally - China (\$799b as of Jan 2010), Japan (\$751b), and UK (\$249b) are major lenders
- Debt limit is raised regularly
  - Currently at \$14.3t (set in February 2010)

# Budget Authority, Obligations and Outlays

- Budget Authority (BA)
  - The legal authority to enter into financial contracts
- Obligations
  - Funds that have been committed to a vendor via financial contract
- Outlays
  - Funds that have been expended in accordance with the financial contract
- Lag from assignment of budget authority to outlays can be 5 years or more, depending on the contract.

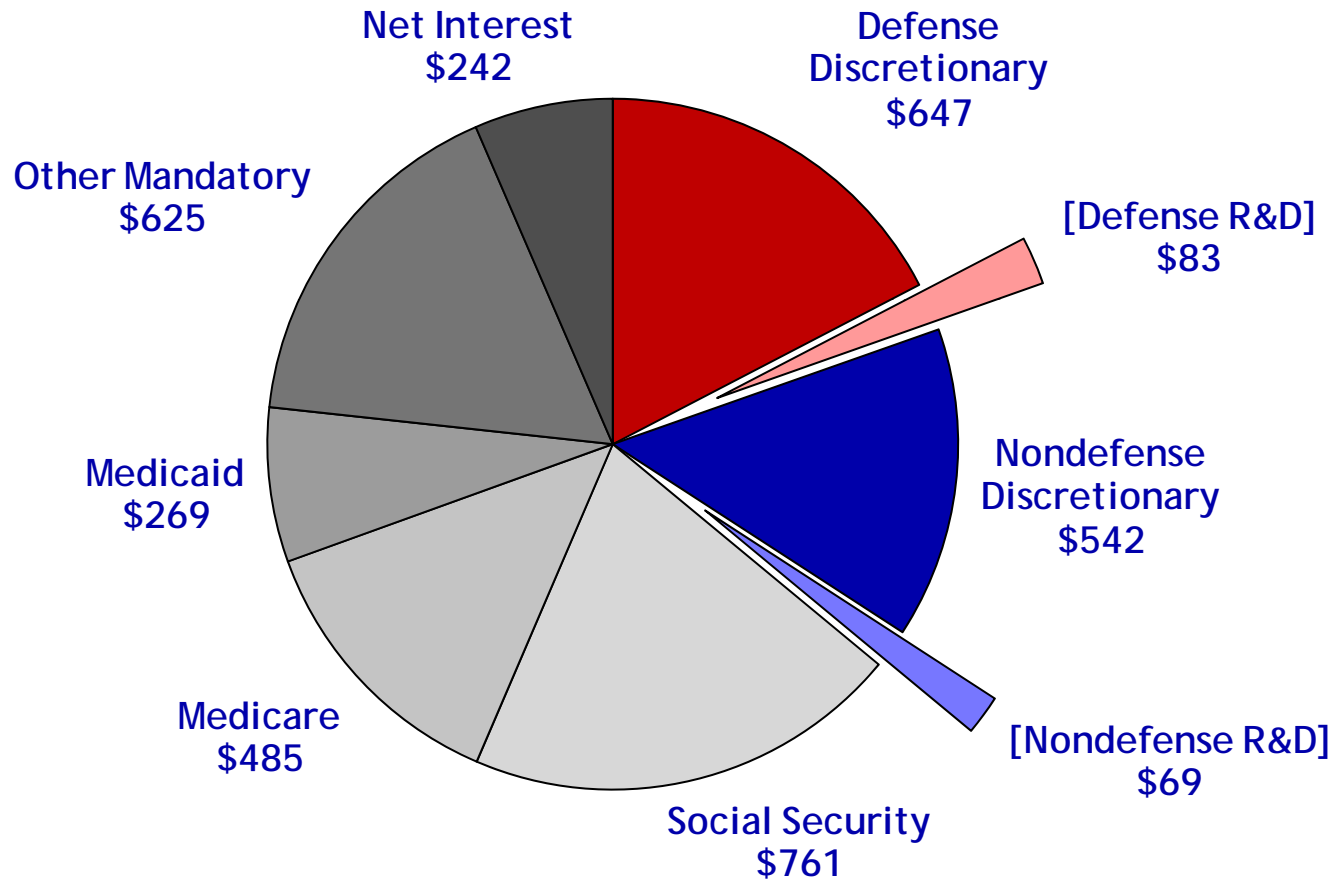
# Discretionary vs Mandatory

- Mandatory Spending (Entitlements)
  - Social Security, Interest on the debt, Medicare, etc.
  - Only adjusted by act of Congress
- Discretionary Spending
  - Military, salaries, construction, domestic programs, R&D, etc.
  - Appropriated to each agency in the annual budget
- FY 2012
  - \$1.3t discretionary outlays (-5.4%)
  - \$456b nonsecurity outlays (-10.1%)

# Composition of the Proposed FY 2012 Budget

## Total Outlays = \$3.7 trillion

outlays in billions of dollars



Source: *Budget of the United States Government FY 2012*.

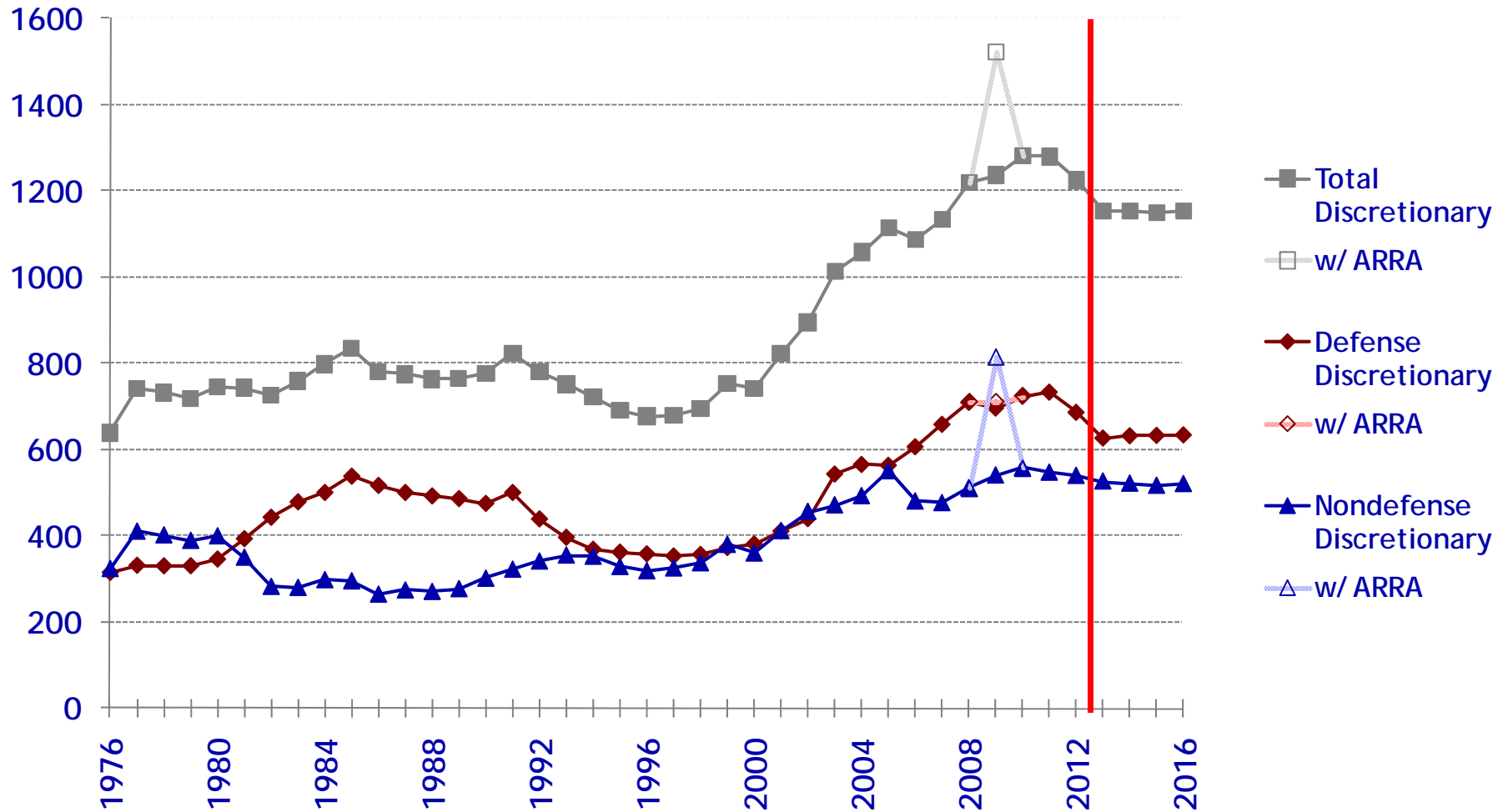
Projected unified deficit is \$1.1 trillion.

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# Trends in Discretionary Spending

budget authority in billions of constant FY 2011 dollars



Source: *Budget of the United States Government, FY 2012.*

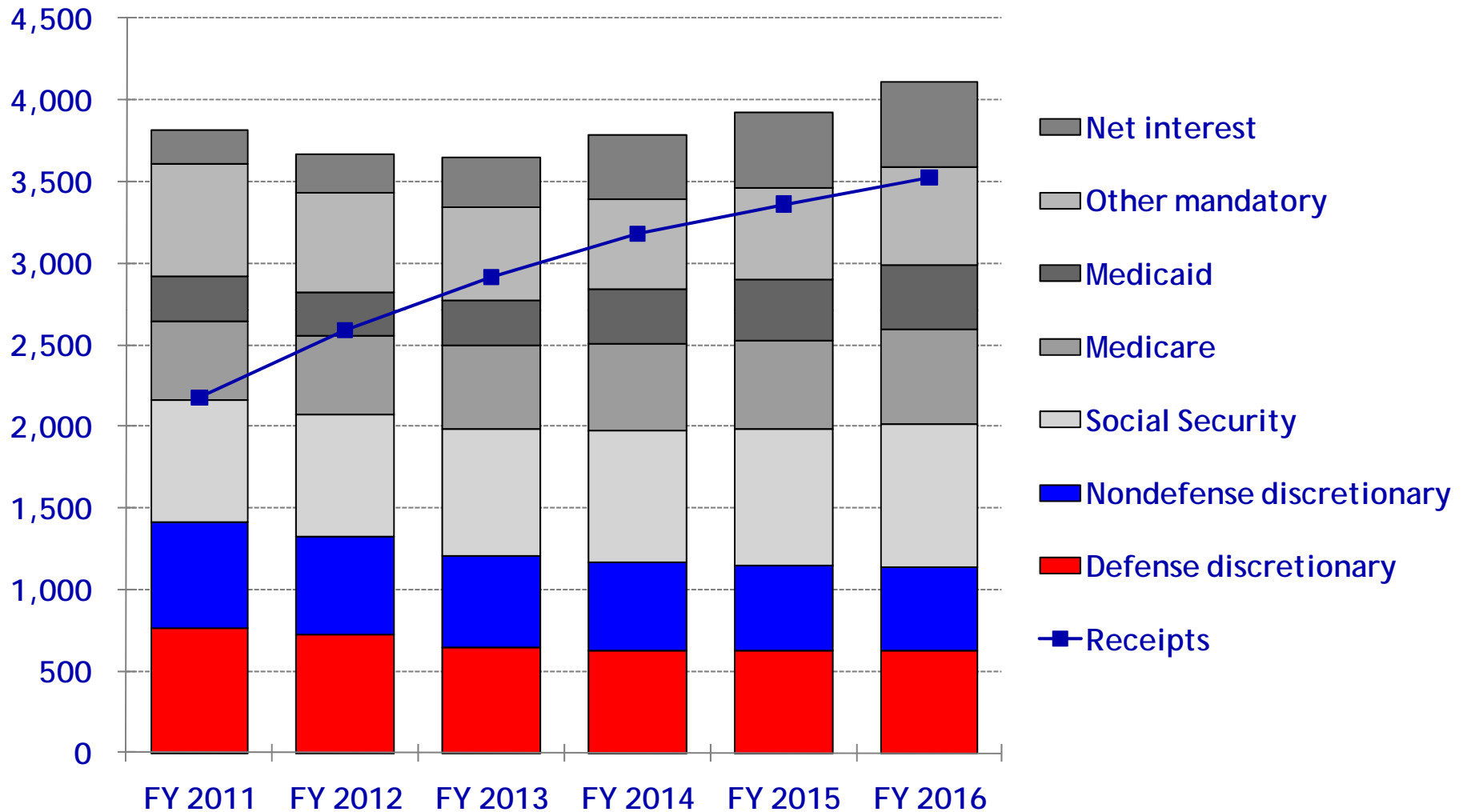
FY 2011-2016 data are budget projections.

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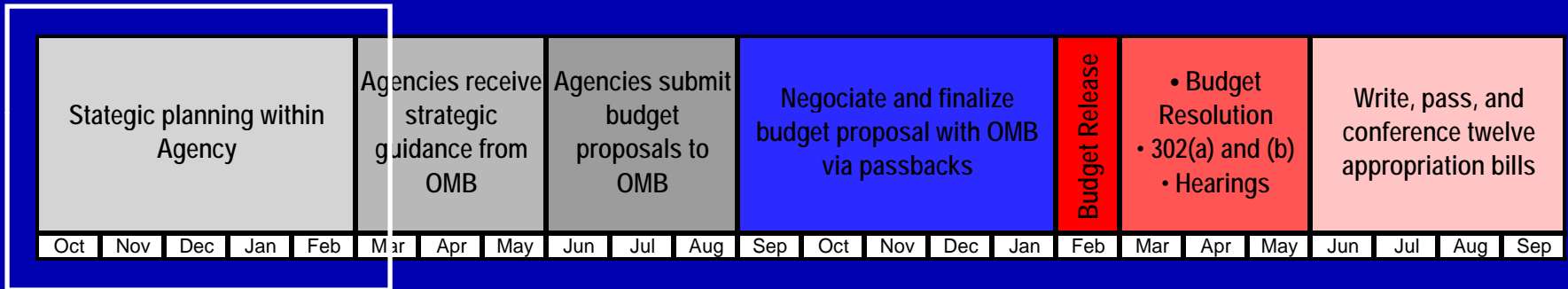


# FY 2012 Budget Projections

outlays in billions of constant FY 2011 dollars

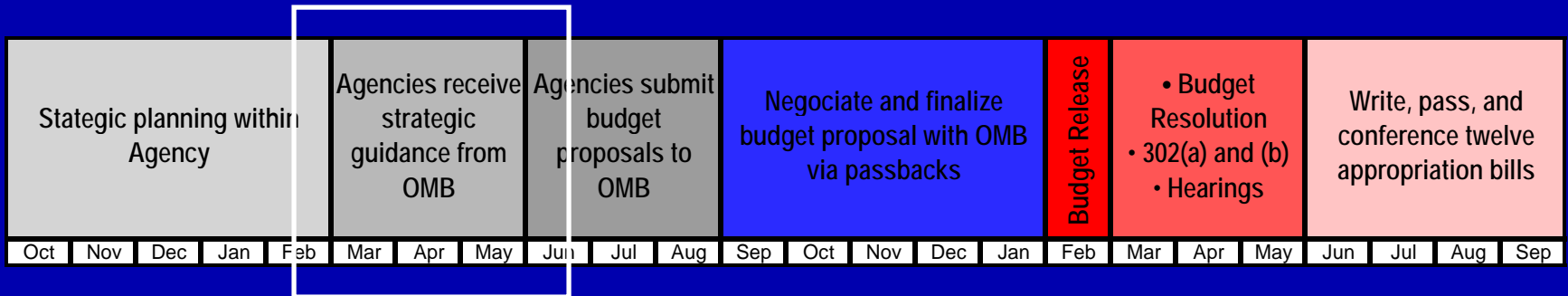


# The Federal Budget Cycle



- Discussions within agencies among upper management about possible priorities and initiatives

# The Federal Budget Cycle

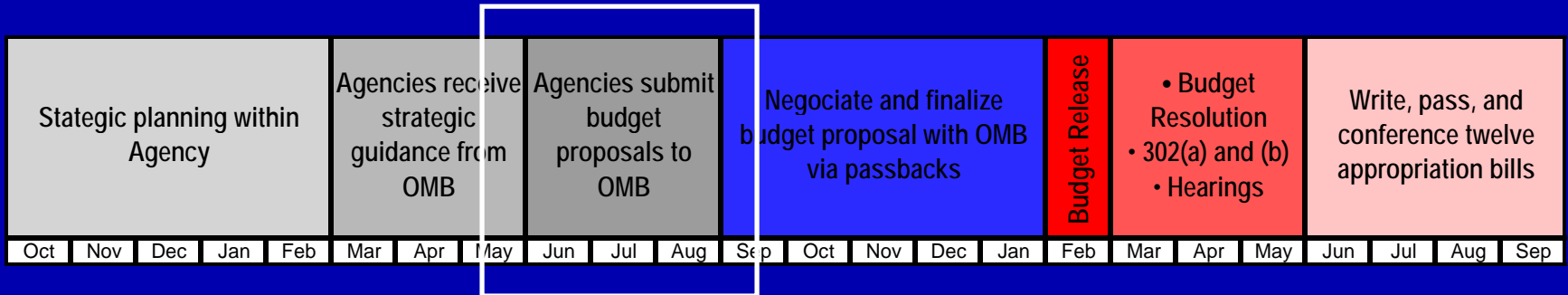


- Joint memorandum from Office of Management and Budget (OMB) and the Office of Science and Technology Policy (OSTP) lays out Presidential priorities and provides broad guidance

## FY 2012 R&D Challenges

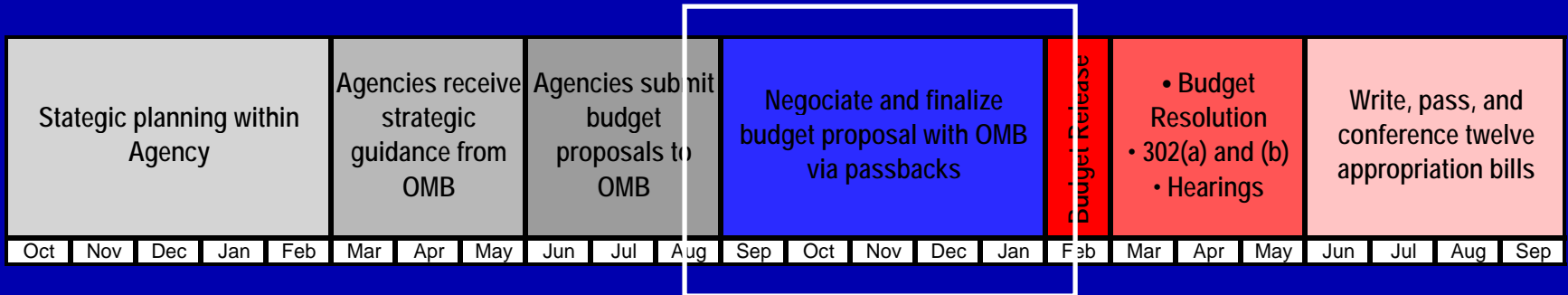
- Promoting sustainable economic growth and job creation
- Defeating the most dangerous diseases and achieving better health outcomes for all while reducing health care costs
- Moving toward a clean energy future to reduce dependence on energy imports while curbing greenhouse gas emissions
- Understanding, adapting to, and mitigating the impacts of global climate change
- Managing the competing demands on land, fresh water, and the oceans for the production of food, fiber, biofuels, and ecosystem services based on sustainability and biodiversity
- Developing the technologies to protect our troops, citizens, and national interests

# The Federal Budget Cycle



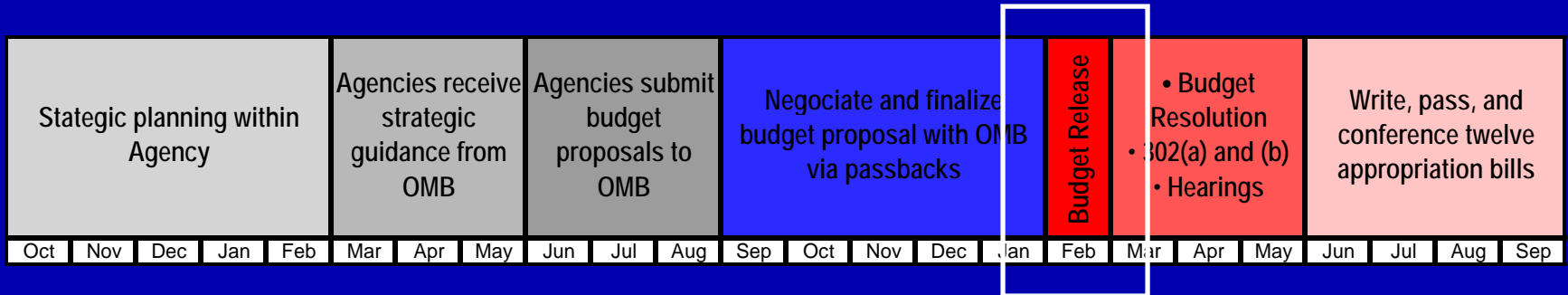
- Agencies deliver budget justifications to OMB

# The Federal Budget Cycle



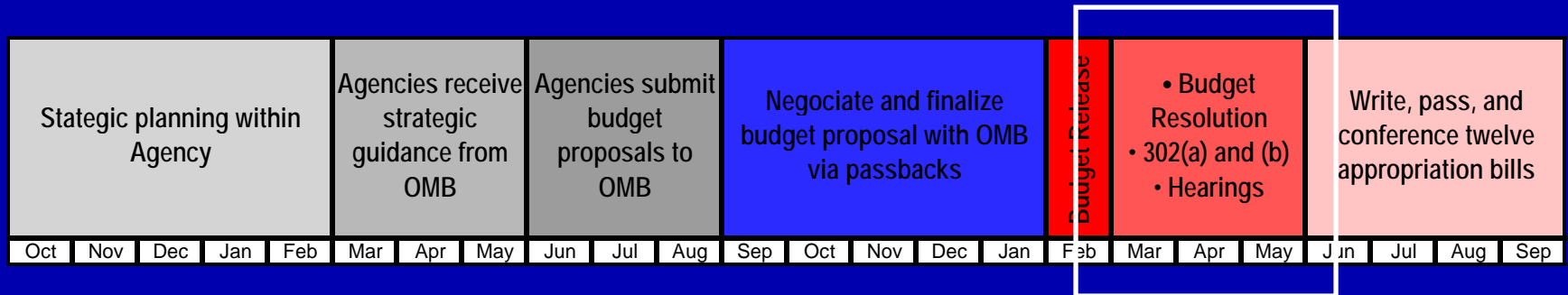
- Agencies negotiate with OMB over their budget proposals with OSTP serving an advisory role
- Budget proposals are finalized in January

# The Federal Budget Cycle



- President presents the proposed budget to Congress on the first Monday of February

# The Federal Budget Cycle



- Congress holds hearings on agency budgets and initiatives
- Authorizing committees create authorizations for agencies
- Congress approves budget resolution, the big-picture spending plan
- Appropriations committees receive 302(a) allocations and determine 302(b) allocations for each appropriations bill
- Determine need to allow for reconciliation bill

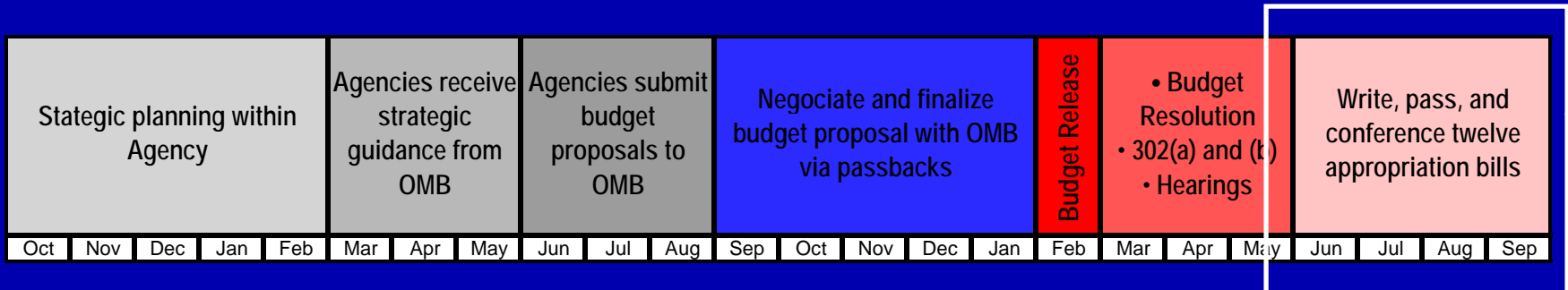
# Reconciliation Bill

- A special bill which modifies tax law or mandatory programs to reconcile with the budget resolution
- Reconciliation is optional, and not always necessary
- Reconciliation bills have special procedural rules
  - Can not filibuster, so the Senate only needs 51 votes to pass a reconciliation bill
- In FY 2010, both health care and education were subject to reconciliation
- No traditional budget resolution for FY 2011

# Authorizations vs. Appropriations

- Authorization
  - Authorization bills guide policy within the agencies including establishing and modifying programs.
  - Usually include authorization of appropriations provisions, establishing funding ceilings for programs.
  - Under the jurisdiction of the topical legislative committees such as Science and Technology and Armed Services.
- Appropriations
  - Under the jurisdiction of the Appropriations Committee
  - Appropriators do not have to follow authorized program funding levels

# The Federal Budget Cycle



- Appropriation committees write and approve appropriations bills
- Bills have to pass the full chamber by majority vote
- The different versions passed by both chambers are conferenced
- Each chamber then has to agree to the conference report before President can sign
- The fiscal year ends on Sept 30, any unfunded agency must shutdown unless a continuing resolution (CR) is passed
- Omnibus bill is created to pass remaining appropriations bills

# Appropriations Subcommittees

- The 12 subcommittees are generally separated by related topical area and agency, but there are a number of exceptions
  - Forest Service is part of USDA, but appropriated in Interior bill
- Subcommittees cannot negotiate between each other after 302(b)s are set
  - Therefore, NIH funding is not directly negotiated with other science agencies
- FY 2011
  - Biggest - Defense (>\$500b)
  - Smallest - Legislative (<\$5b)

# Earmarks

- Funds for a specific project or tax/fee exemptions directed to specific performers
  - Hard Earmarks - Contained in legislative text
  - Soft Earmarks - Contained in Congressional committee report
    - Not binding, but customarily acted upon
    - Most earmarks are soft earmarks
- 9,192 for \$11.1b in FY 2010

Due to budgetary constraints, the Committee is unable to recommend full funding to complete the construction of all ongoing projects. The following table summarizes the Committee's recommendations for Agricultural Research Service, Buildings and Facilities:

AGRICULTURAL RESEARCH SERVICE BUILDINGS AND FACILITIES (In thousands of dollars)	
	Committee recommendation
Agricultural Research Center; Beltsville, MD .....	3,000
Agricultural Research Center; Logan, UT .....	6,000
Agricultural Research Center; Pullman, WA .....	5,000
Animal Bioscience Facility; Bozeman, MT .....	3,000
Appalachian Fruit Laboratory; Kearneysville, WV .....	1,500
ARS Biotechnology Lab. Lorman, MS .....	2,000
ARS Research and Development Center; Auburn, AL .....	6,000
ARS Waste Management Research Facility; Bowling Green, KY .....	5,000
Dairy Forage Agricultural Research Center; Prairie du Sac, WI .....	1,000
National Cold Water Marine Aquaculture Center; Orono, ME .....	1,500
Pacific Basin Agricultural Research Center; Hilo, HI .....	5,000
Sugarcane Research Laboratory; Houma, LA .....	1,000
Systems Biology Research Facility; Lincoln, NE .....	4,000
<b>Total</b> .....	<b>44,000</b>

# The Federal Budget Cycle

<b>FY 2010</b>	----- Spend Fiscal Year Budget -----																							
<b>FY 2011</b>	Budget Release		Budget Resolution 302(a) and (b) Hearings			Write, pass, and conference twelve appropriation bills			----- Spend Fiscal Year Budget -----															
<b>FY 2012</b>	Planning within Agency		Agencies receive strategic guidance from OMB			Agencies submit budget proposals to OMB			Negotiate and finalize budget proposal with OMB via passbacks				Budget Release	• Budget Resolution • 302(a) and (b) • Hearings			Write, pass, and conference twelve appropriation bills							
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep			

- Agencies are working on 3 budgets at any given time

# Supplemental Appropriations

- Throughout the year, as necessary, Congress can introduce a supplemental appropriation bill
  - Usually for natural disasters or emergencies
- Examples
  - February 2009 - The American Recovery and Reinvestment Act (ARRA) - \$787b for economic recovery
  - June 2009 - \$106b for war operations and flu preparations
  - August 2009 - \$2b to extend “cash for clunkers” program
  - July 2010 - \$59b for war operations, FEMA, and Haiti aid

# Federal R&D in Context

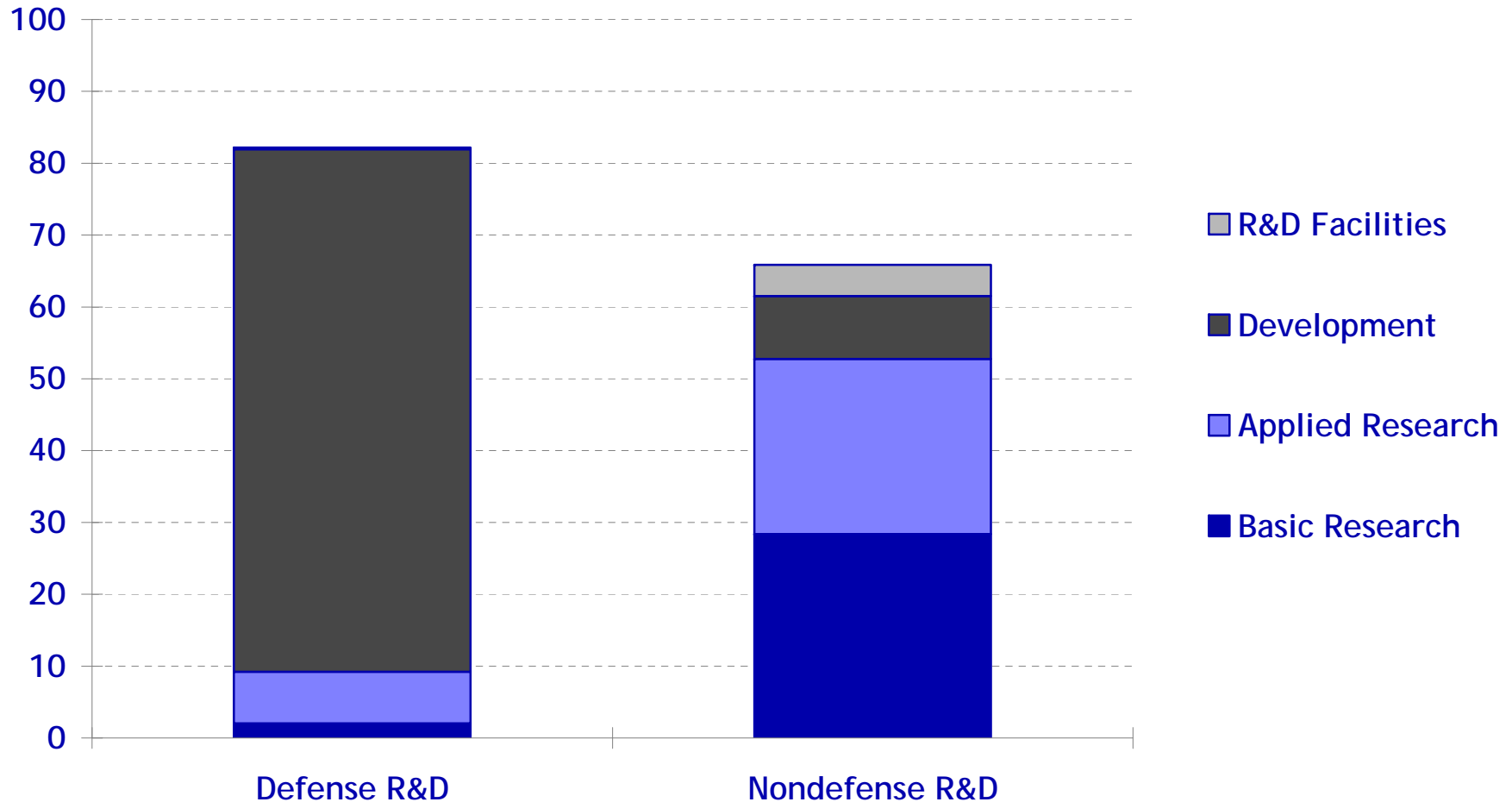
- The federal R&D investment is spread across over two dozen departments and agencies
  - Only two manage more than 10% of the investment
    - Department of Defense (51.8%)
    - Department of Health and Human Services (21.9%)
- The federal R&D investment is also spread across 11 of the 12 appropriations subcommittees.
- Role of federal R&D
  - Supports federal missions
  - Drives U.S. innovation

# Character of R&D

- The Innovation Lifecycle
  - Basic Research
    - Study toward knowledge or understanding of fundamental properties and phenomena without a specific need in mind.
  - Applied Research
    - Study toward knowledge or understanding necessary to satisfy a specific need.
  - Development
    - The application of knowledge or understanding toward the production of materials, devices, systems, or methods.
- Facilities and Equipment (R&D Plant)

# Character of R&D, FY 2011

budget authority in billions of dollars



Source: OMB R&D data, agency budget justifications, and agency budget documents.

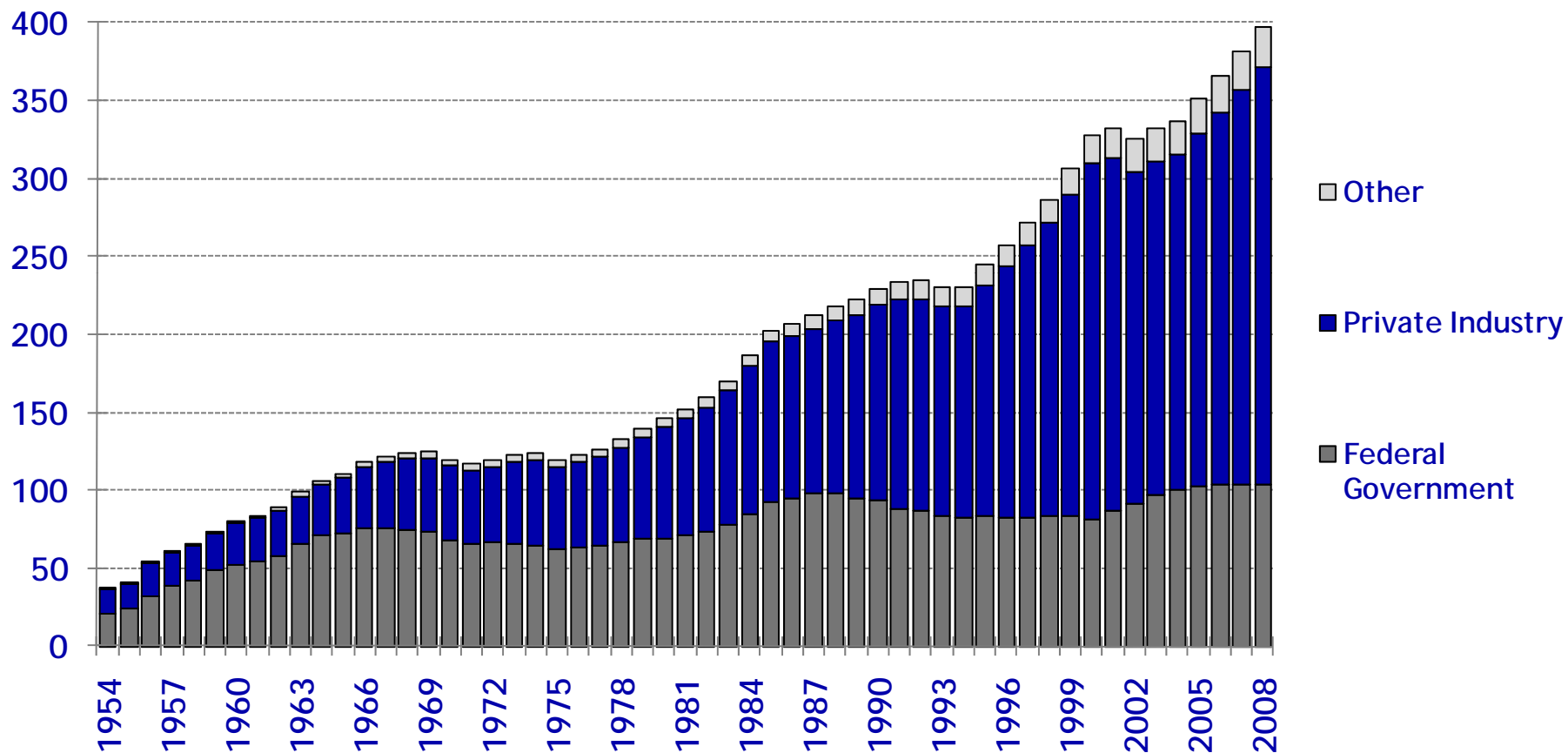
Defense R&D = DOD + DOE defense.

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# Federal R&D Funding by Source

outlays in billions of constant 2008 dollars



Source: NSF, Division of Science Resources Statistics,  
National Patterns of R&D Resources (NSF 08-318)

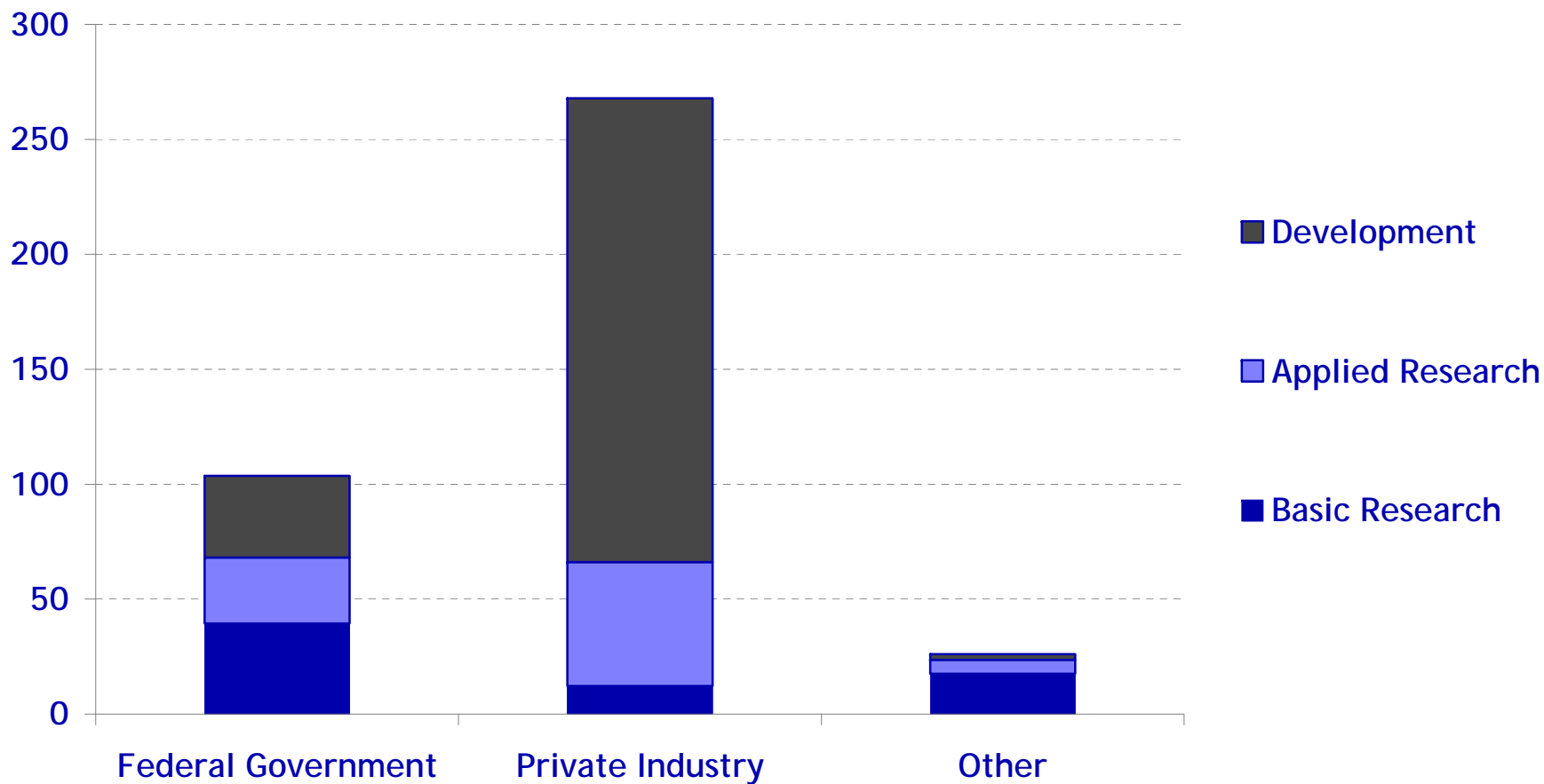
2008 figures are preliminary.

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# Character of R&D, 2008

outlays in billions of dollars



Source: NSF, Division of Science Resources Statistics,  
National Patterns of R&D Resources (NSF 08-318)

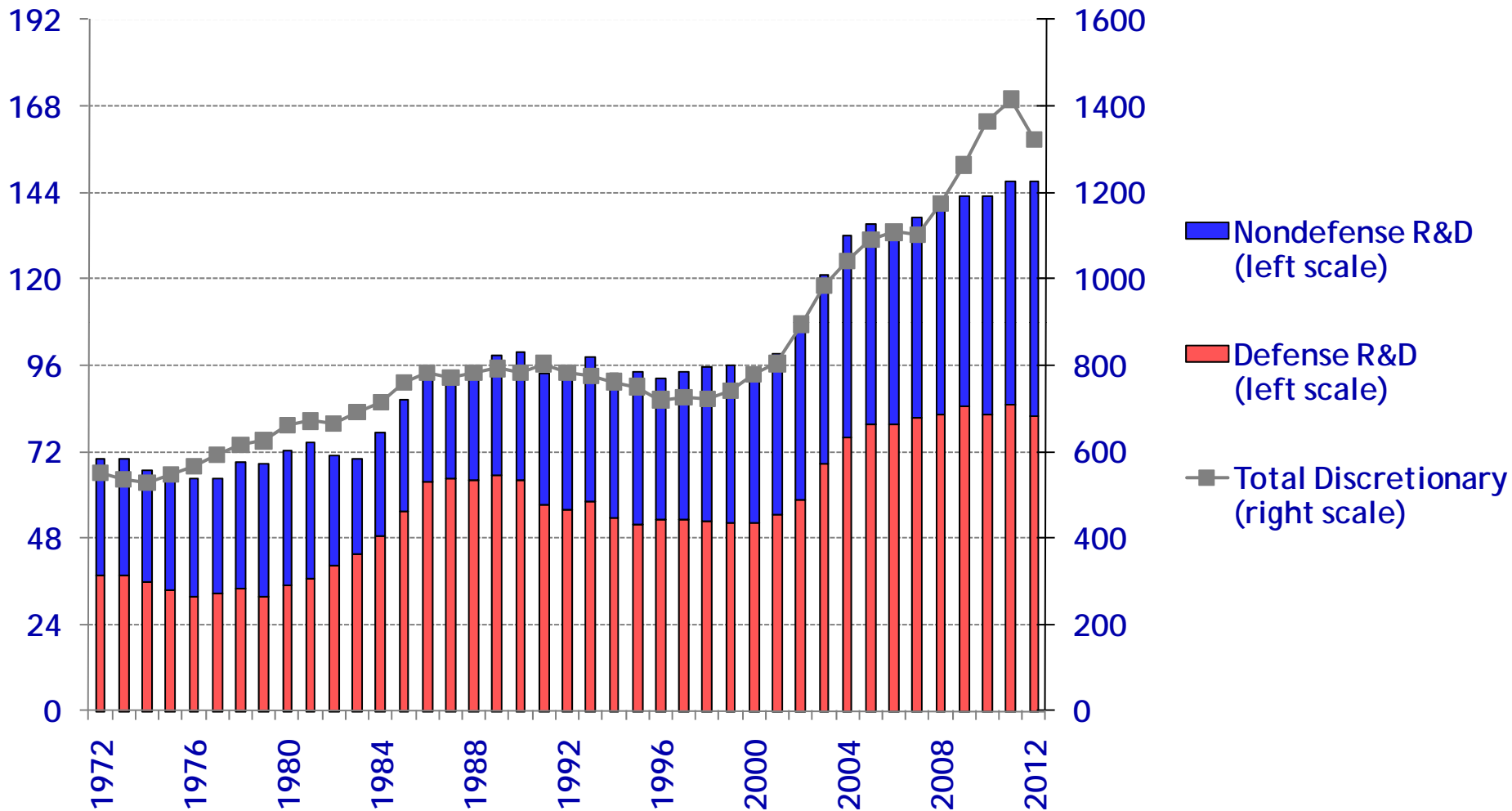
Figures are preliminary.

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# Trends in R&D and Discretionary Spending

outlays in billions of constant FY 2011 dollars



Source: *Budget of the United States Government, FY 2012*.  
 R&D totals do not include construction of facilities and equipment.  
 FY 2011-2012 data are budget projections.  
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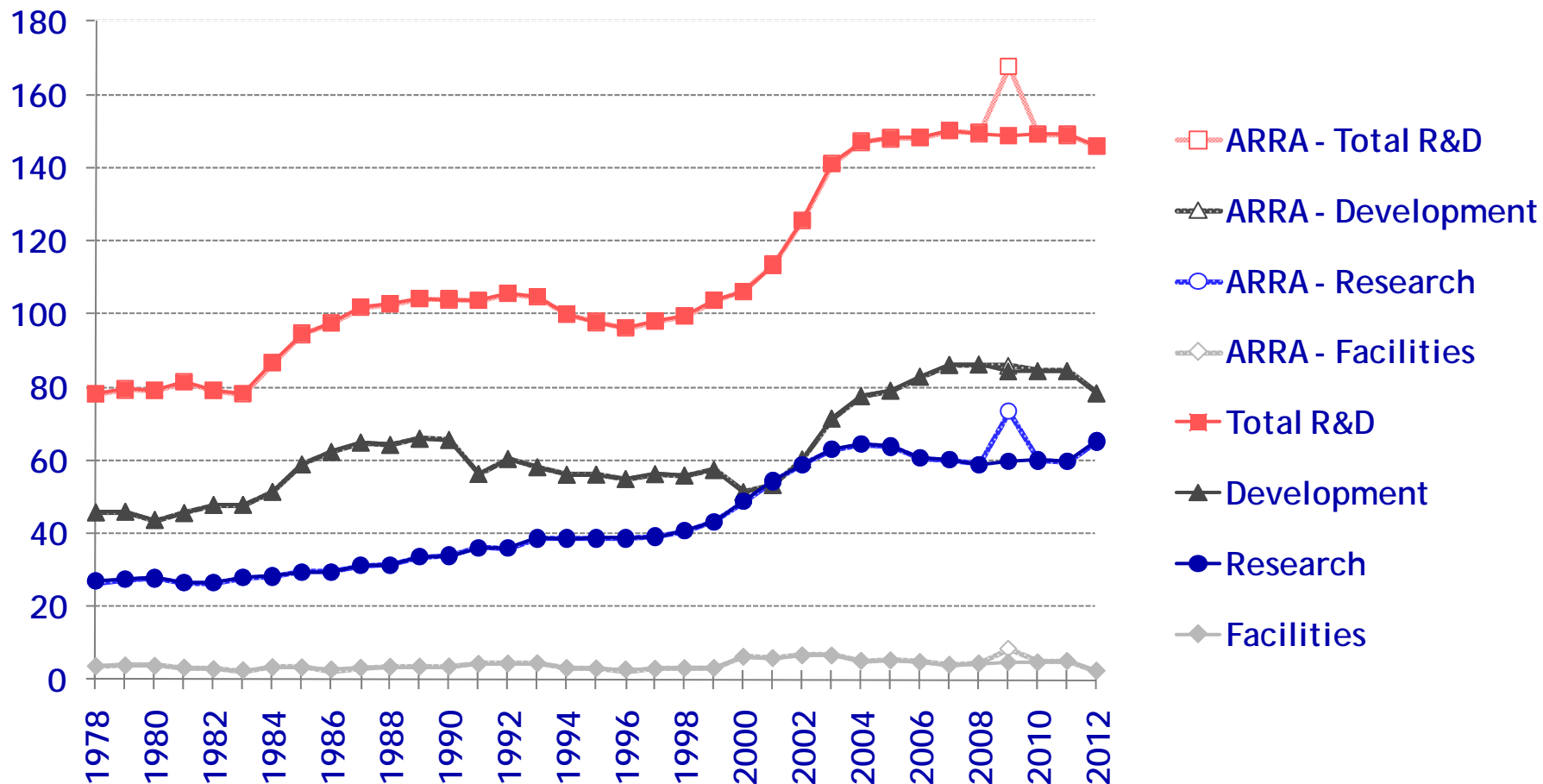


# The FY 2012 Federal R&D Investment

- Total R&D: \$147.9b, +0.5% from FY 2010
  - Basic Research: \$32.9b, +11.9%
  - Applied Research: \$33.2b, +11.4%
  - Development: \$79.4b, -4.7%
  - Equipment and Facilities: \$2.4b, -47.8%
- \$81.2b for defense R&D, -3.9%
- \$66.8b for non-defense R&D, +6.5%
- -2.2% in constant dollars from FY 2010 (Non-defense: +3.7%)
- -0.8% in constant dollars since FY 2004 (Non-defense: +1.0%)
  - Peak in FY 2007

# Trends in Federal R&D

in billions of constant FY 2011 dollars



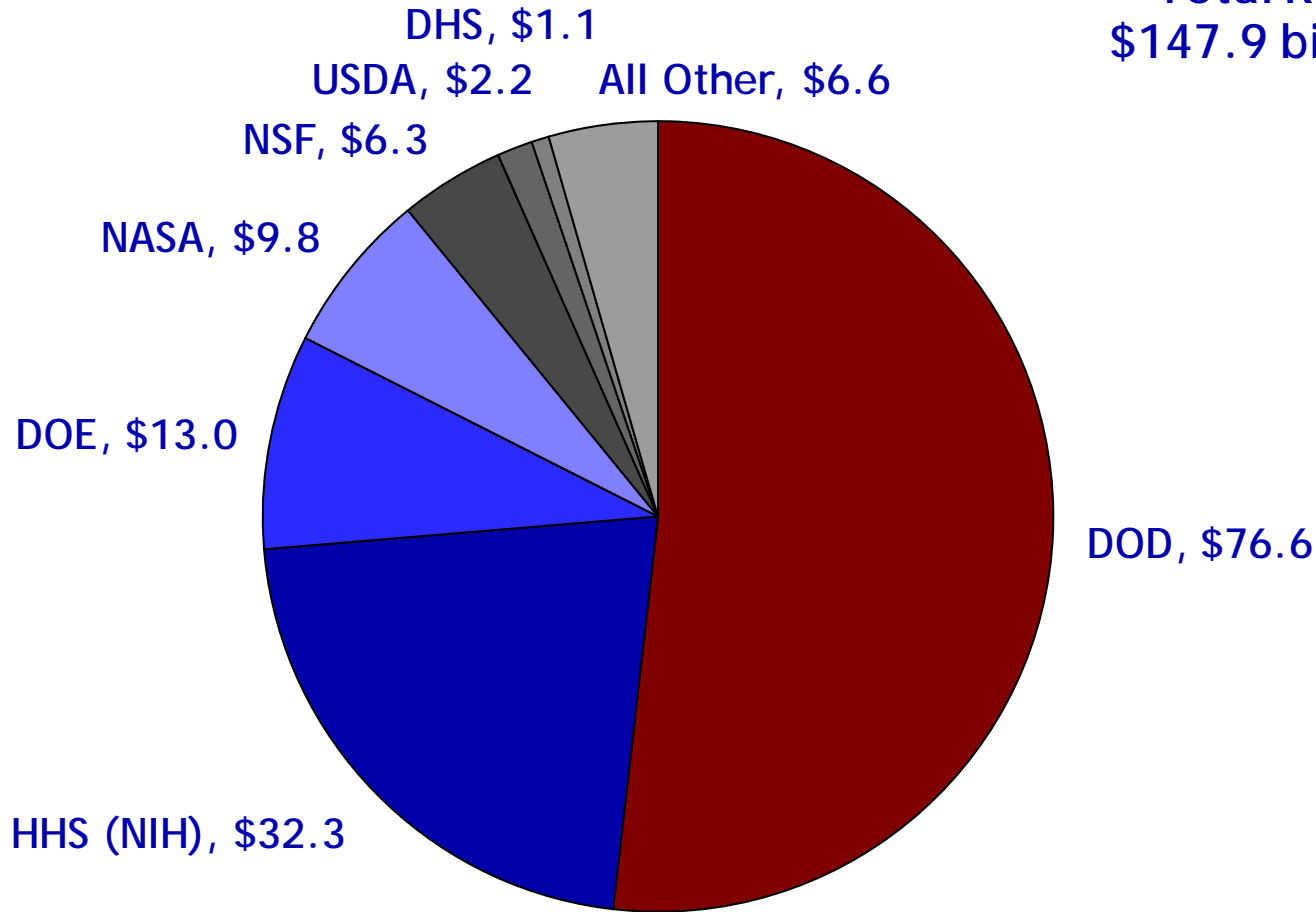
Source: OMB R&D data, AAAS analyses of R&D in annual AAAS R&D reports.  
 FY 2011 and FY 2012 figures are latest AAAS estimates.  
 R&D includes conduct of R&D and R&D facilities.  
 1976-1994 figures are NSF data on obligations in the Federal Funds survey.  
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# Total R&D by Agency, FY 2012

budget authority in billions of dollars

Total R&D =  
\$147.9 billion



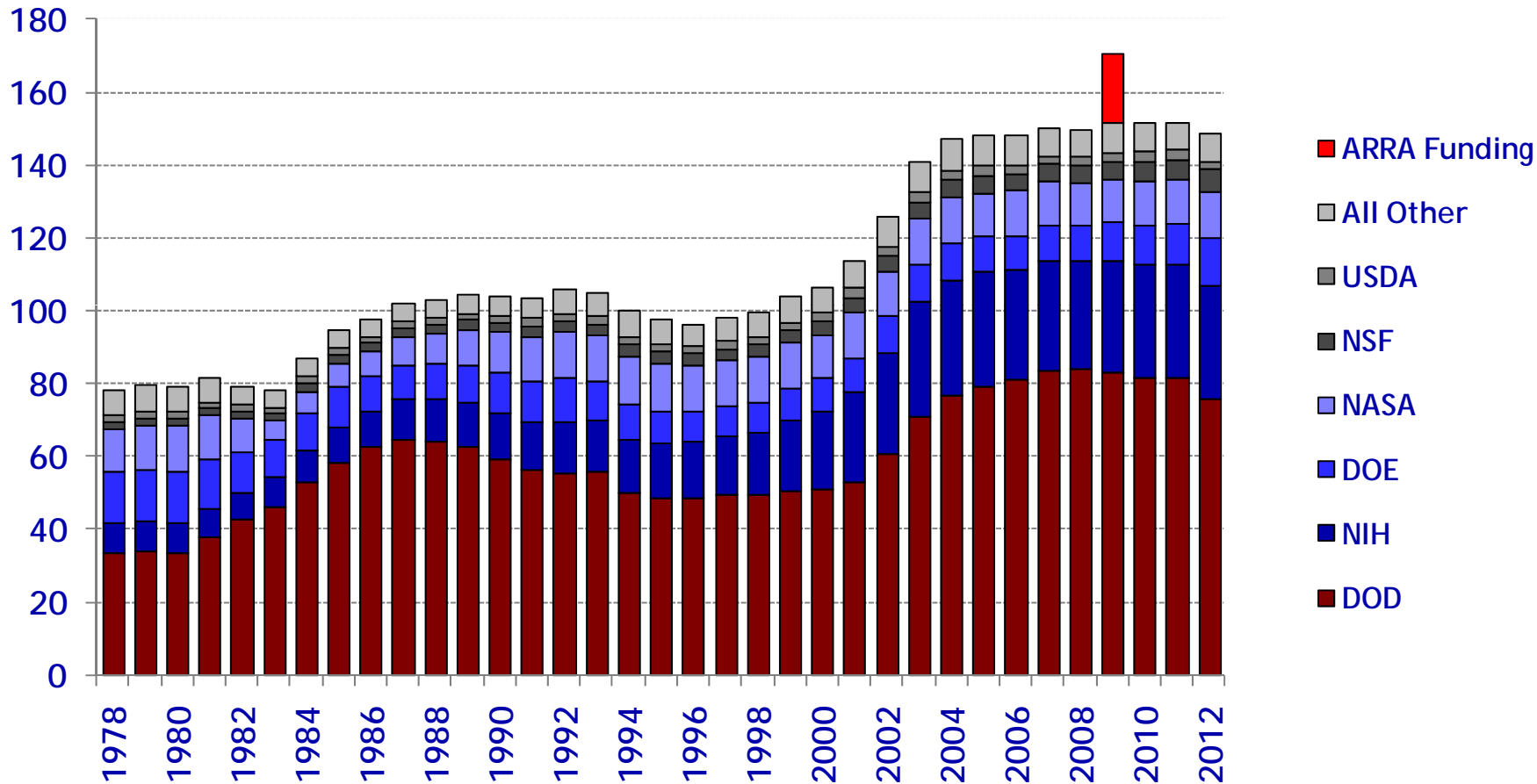
Source: OMB R&D data, agency budget justifications, and other agency documents.  
R&D includes conduct of R&D and R&D facilities.

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# Trends in R&D by Agency

in billions of constant FY 2011 dollars



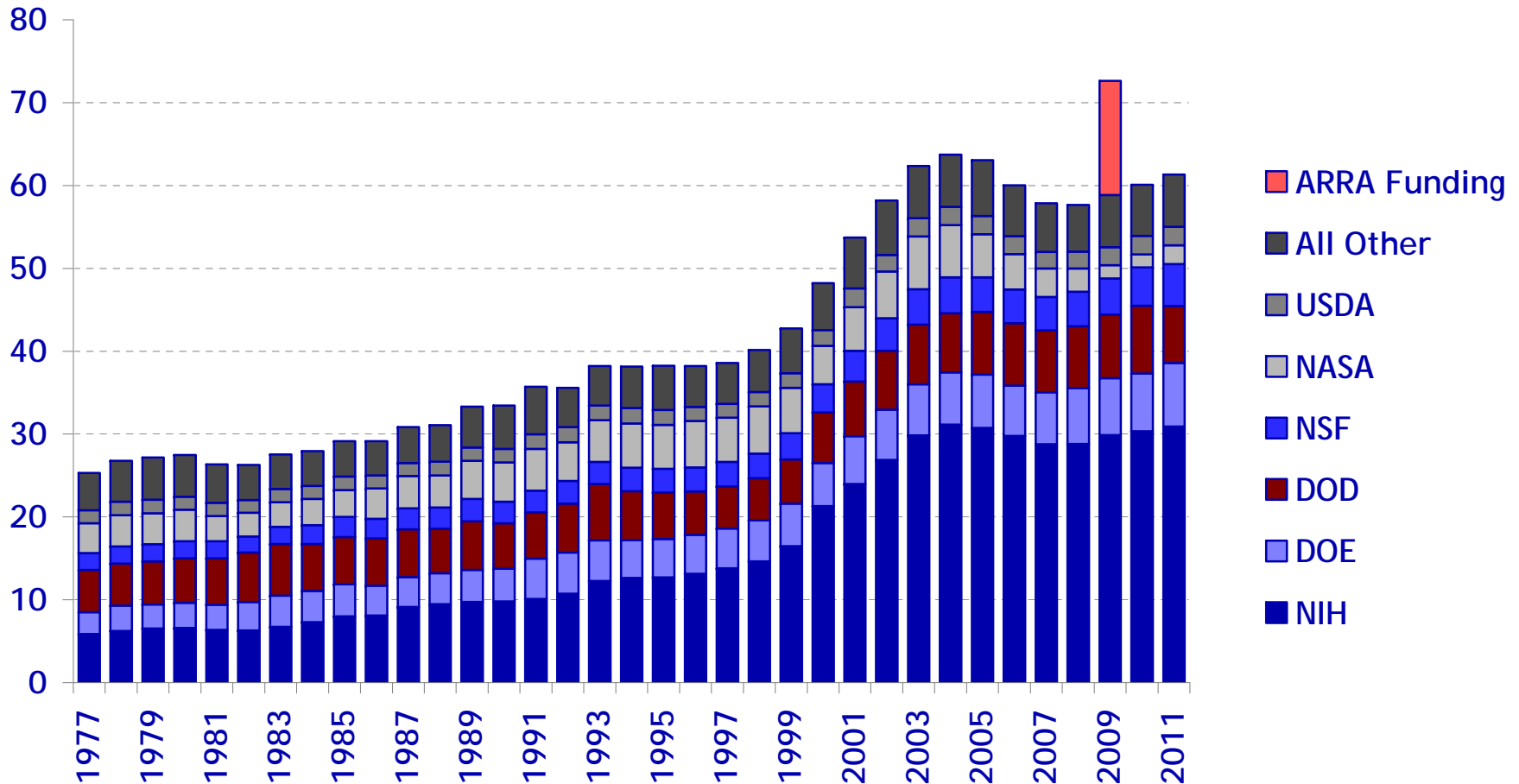
Source: AAAS Report: Research & Development series.  
 FY 2011 and FY 2012 figures are latest estimates.  
 1976-1994 figures are NSF data on obligations in the Federal Funds survey.

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# Trends in Research by Agency

in billions of constant FY 2010 dollars



Source: AAAS Report: Research & Development series.  
 FY 2010 and FY 2011 figures are latest estimates.  
 Research includes basic research and applied research.  
 1976-1994 figures are NSF data on obligations in the Federal Funds survey.  
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# R&D Investment Priorities

- Jumpstarting Innovation / Scientific Discovery
  - Research Funding: \$66.1b, +11.6% (\$6.9b)
  - \$13.9b combined NSF, DOE SC, NIST, +12.2% (\$1.5b)
- Clean Energy Future / Climate Science
  - DOE Sci and Energy: +\$1.4b (19.7%) to \$8.5b
  - USGCRP: +\$446m (20.4%) to \$2.6b
- Permanent, Expanded and Simplified R&E Tax Credit
- Education
  - \$100m for 100,000 new K-12 STEM teachers
- Infrastructure
  - Wireless Innovation Fund - \$3b

# House CR Proposal for FY 2011

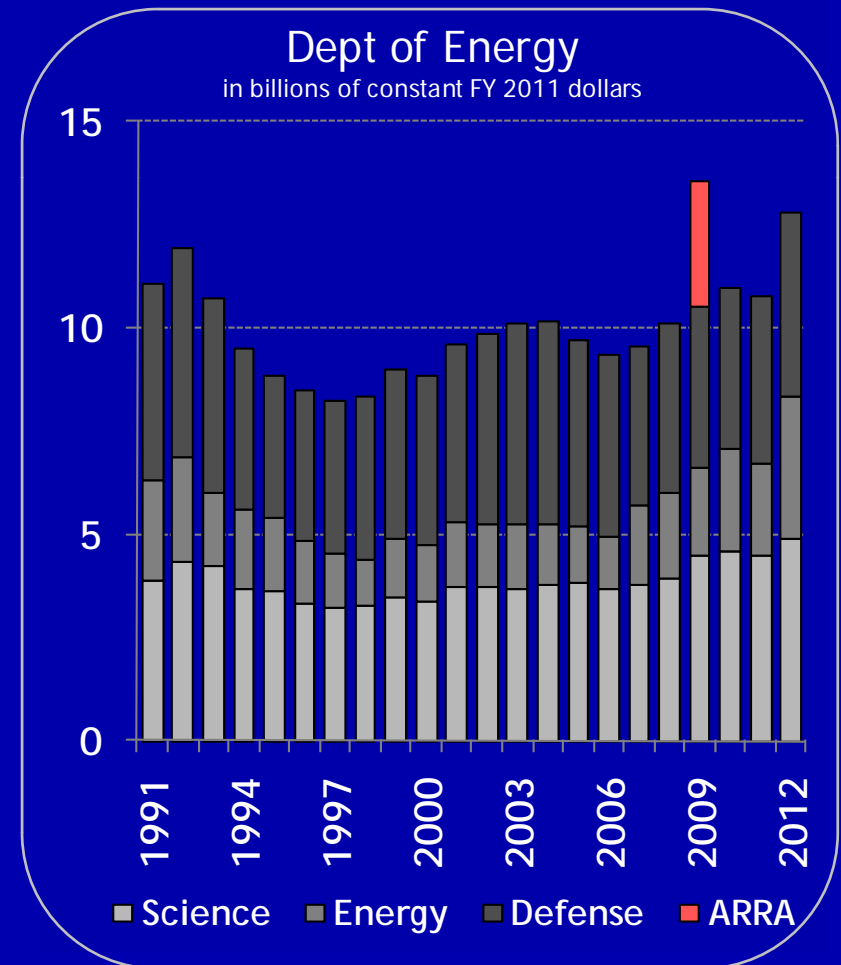
- Total Budget: \$1.029t
  - -\$60.9b from FY 2010 enacted
  - -\$99.6b from FY 2011 request
  - -\$62.4b from FY 2012 request
- Total R&D: \$140.7b
  - -\$6.4b from FY 2010 enacted
- Nondefense R&D: \$59.5b
  - -\$7.3b from FY 2012 request
- R&D totals 10.5% of all cuts in CR (vs. FY 2010)
  - Short of R&D's 12% share of discretionary spending

# Senate CR Proposal for FY 2011

- Total Budget: \$1.079t
  - -\$51b from FY 2011 request
  - +\$51b from FY 2011 House CR proposal
- Total R&D: \$143.4b
  - -\$3.7b from FY 2010 enacted
- Nondefense R&D: \$62.8b
  - +\$162m from FY 2010 enacted

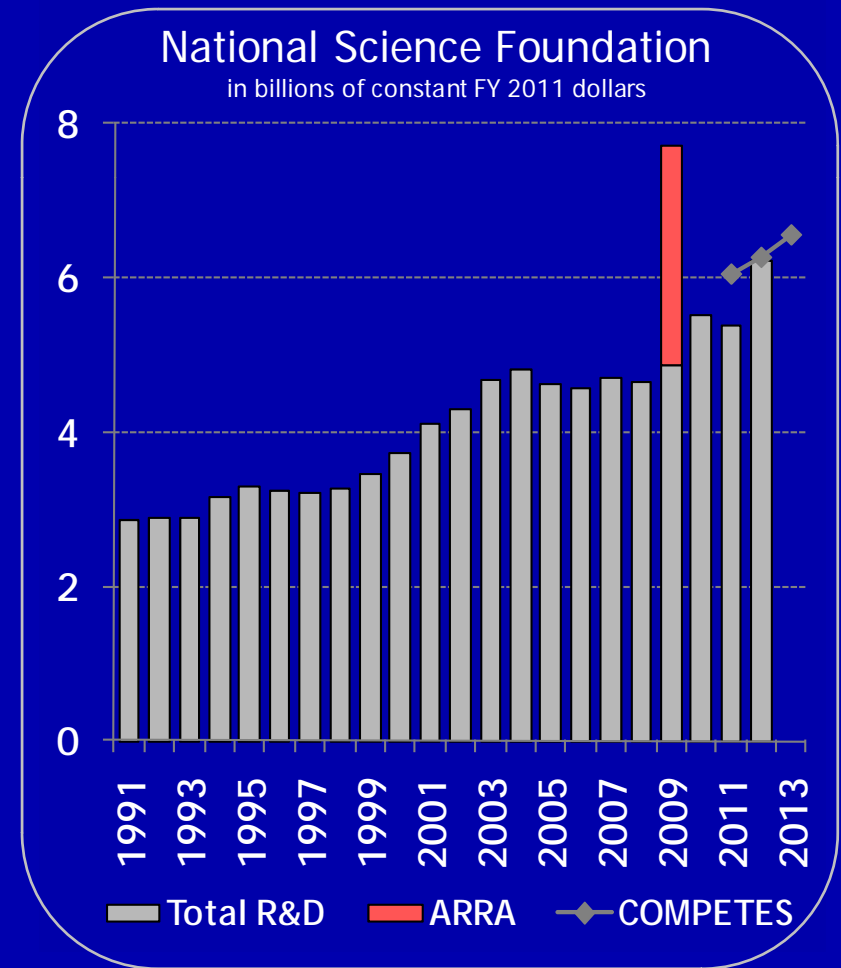
# Department of Energy

- Total R&D
  - FY 11 House CR: \$9.3b, -13.9%
  - FY 11 Senate CR: \$10.1b, -6.5%
  - FY 12 Request: \$13.0b, +19.9%
- Energy R&D
  - FY 11 House CR: \$1.7b, -29.7%
  - FY 11 Senate CR: \$2.1b, -12.8%
  - FY 12 Request: \$3.5b, +43.7%
- Office of Science
  - FY 11 House CR: \$3.6b, -19.6%
  - FY 11 Senate CR: \$4.7b, -3.5%
  - FY 12 Request: \$4.9b, +9.1%
- FY 12 Request
  - ARPA-E: \$550m + \$100m WI<sup>3</sup>
  - Energy Innov Hubs: Doubled to six



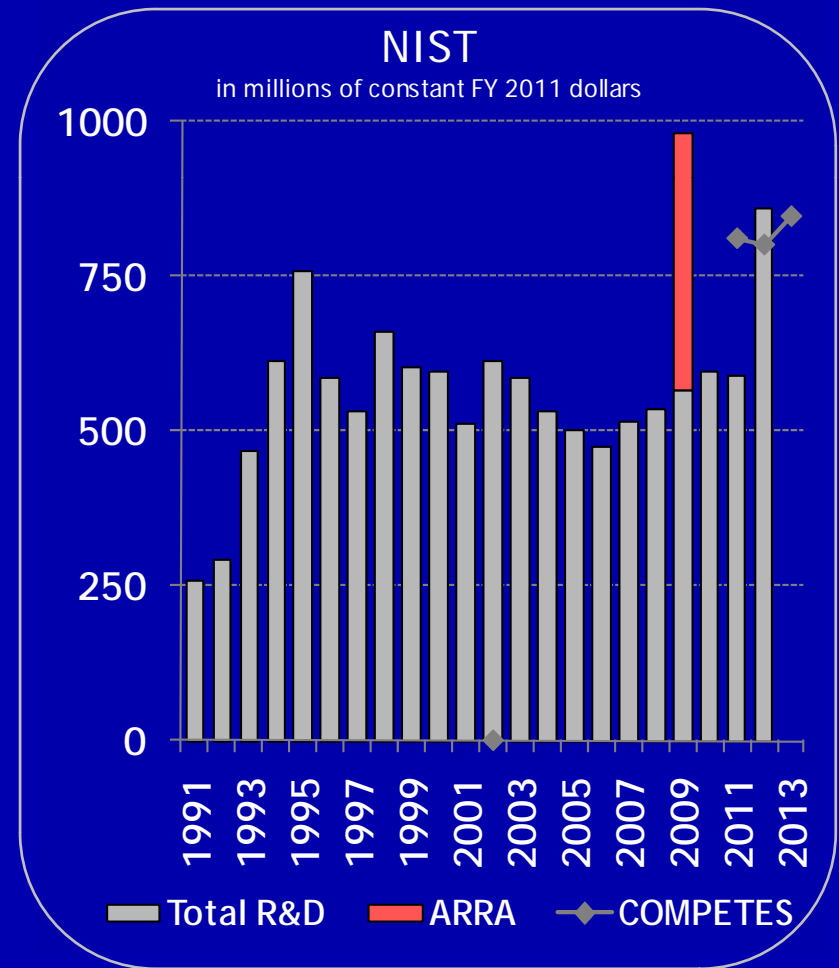
# National Science Foundation

- Total Budget
  - FY 11 House CR: \$6.6b, -5.8%
  - FY 11 Senate CR: \$6.9b, +0.0%
  - FY 12 Request: \$7.8b, +13.0%
- Total R&D
  - FY 11 House CR: \$5.2b, -4.1%
  - FY 11 Senate CR: \$5.4b, -1.7%
  - FY 12 Request: \$6.3b, +16.1%
- Clean Energy: \$576m
- Science, Engineering and Education for Sustainability (SEES)
  - \$998m for climate and energy
- Cyberinfrastructure for 21<sup>st</sup> Century Science and Engineering (CIF21): \$117m



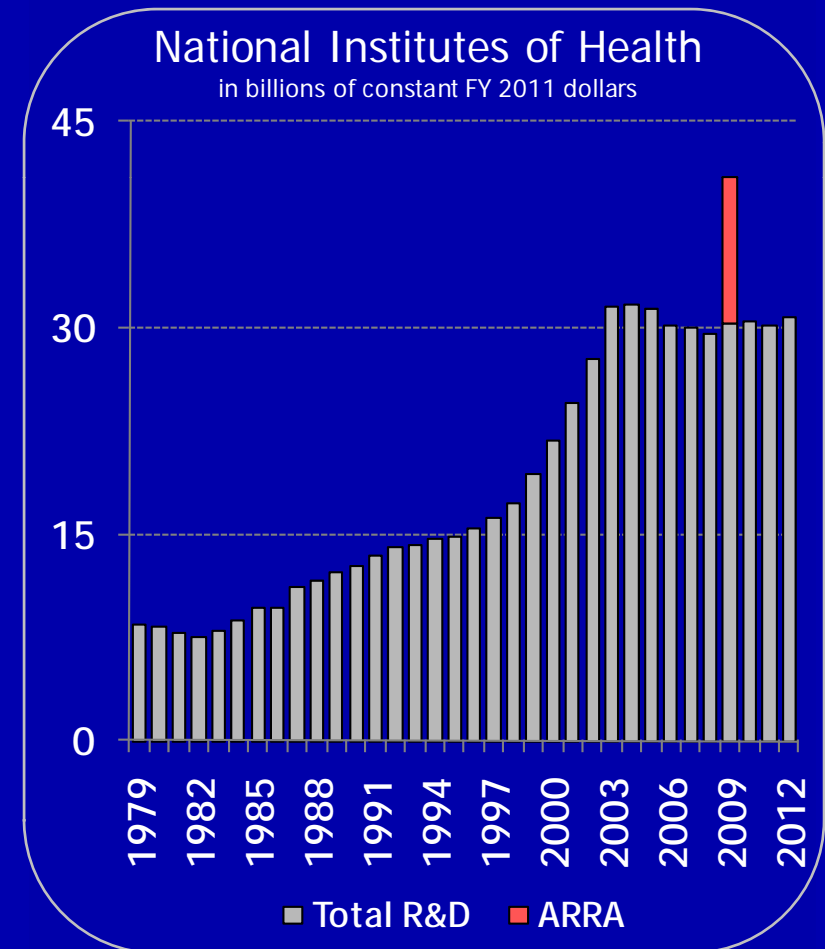
# NIST

- Total R&D
  - FY 11 House CR: \$542m, -7.8%
  - FY 11 Senate CR: \$573m, -2.5%
  - FY 12 Request: \$872m, +48.3%
- NIST Labs Total Budget (STRS)
  - FY 11 House CR: \$470m, -8.8%
  - FY 11 Senate CR: \$505m, -2.0%
  - FY 12 Request: \$679m, +31.8%
- Secure and Robust Cyber Infrastructure: +\$43.4m
- 21<sup>st</sup> Century Manufacturing: Faster, Smarter & Cleaner: +13.3m
- Wireless Innovation Fund: \$100m



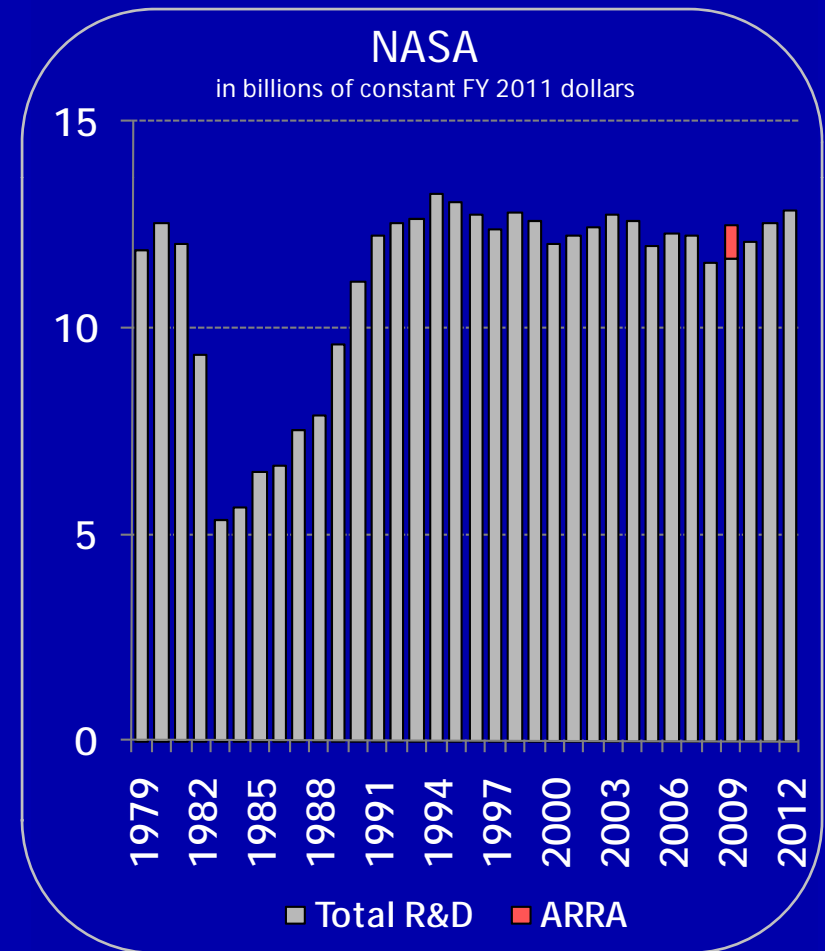
# National Institutes of Health

- Total Budget
  - FY 11 House CR: \$29.5b, -5.2%
  - FY 11 Senate CR: \$31.2b, +0.0%
  - FY 12 Request: \$31.8b, +2.4%
- FY 11 House CR
  - Proposals to limit grant size
- National Center for Advancing Translational Science (NCATS)
- Tech to accelerate discovery
- Comparative effectiveness and personalized medicine
- New Innovator Award and Early Independence Award



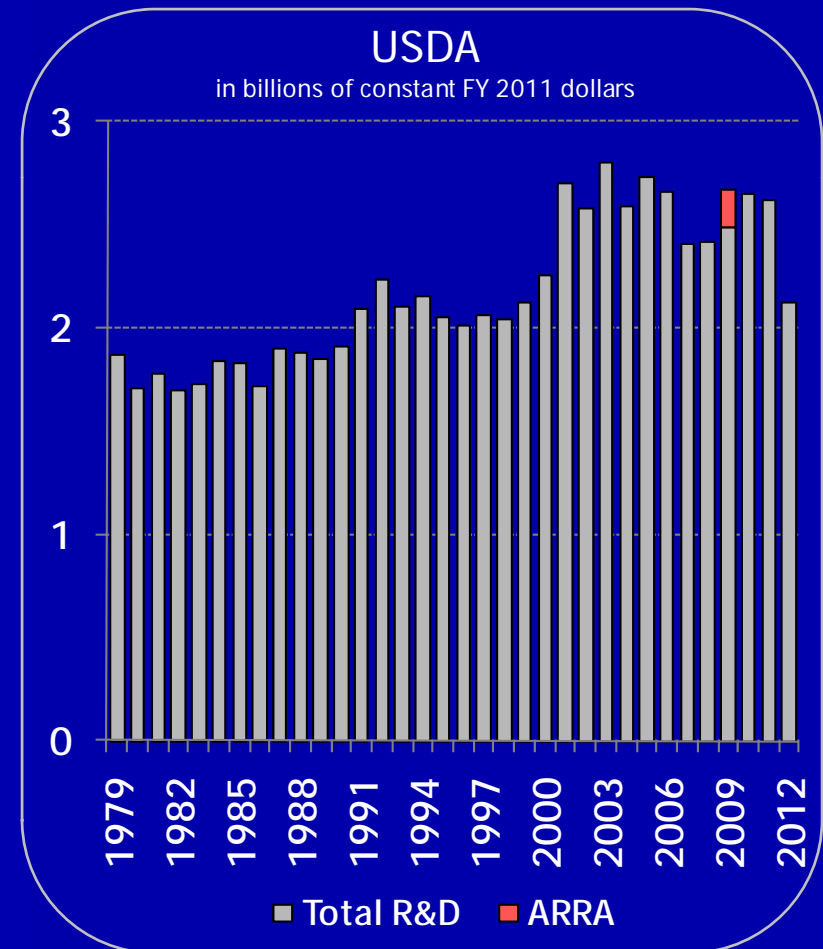
# NASA

- Total R&D
  - FY 11 House CR: \$9.8b, +6.0%
  - FY 11 Senate CR: \$10.0b, +7.7%
  - FY 12 Request: \$9.8b, +6.0%
- Guided by NASA Reauthorization (S.3729) - Oct 11, 2010
  - Transition to research and technology development on ISS; Independent NPO management
  - Commercial cargo and crew services for near-earth orbit
  - New space launch system and multi-purpose crew vehicle
  - Space Research and Technology Program: \$1.0b
  - Deeper and more effective partnerships internationally



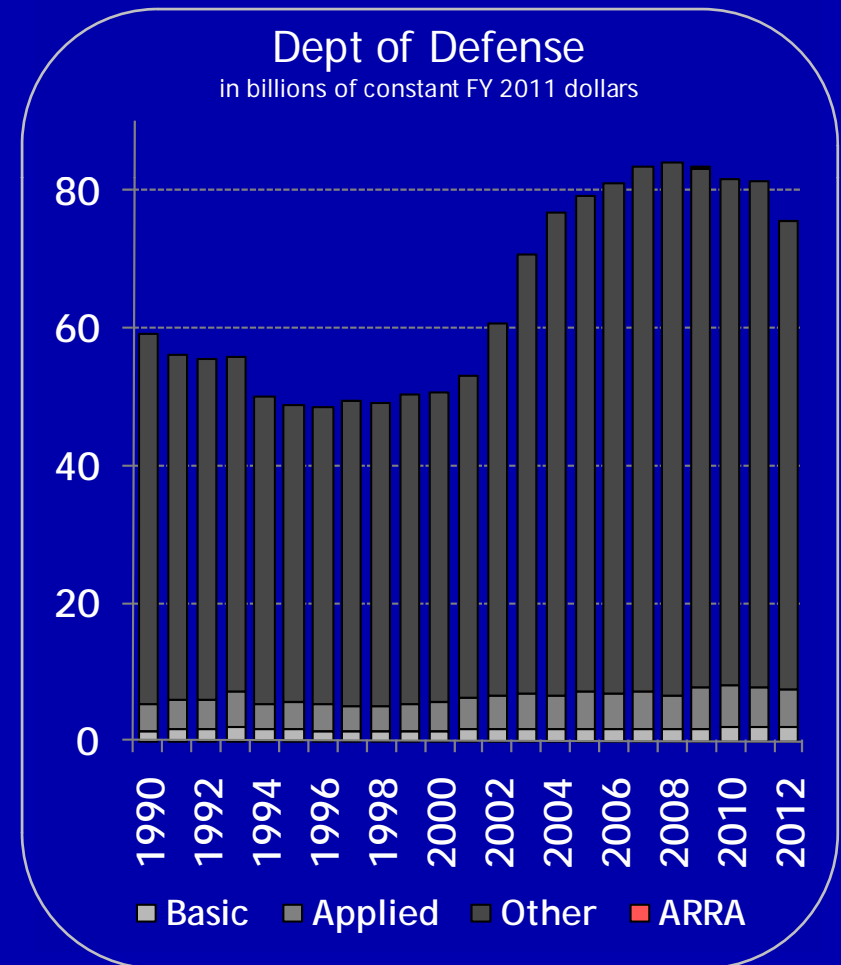
# USDA

- Total R&D
  - FY 11 House CR: \$2.2b, -14.2%
  - FY 11 Senate CR: \$2.6b, -2.4%
  - FY 12 Request: \$2.2b, -17.7%
- ARS (Intramural)
  - Buildings and Facilities: -\$71m and cancels \$224m in unobligated balances
  - Directed Projects: -\$42m
  - +\$59m in program increases
- NIFA (Extramural)
  - R&D: \$741m, -11.8% (-\$99m)
  - AFRI: \$325m, +24.0% (+\$62m)
  - Directed Projects: -\$141m



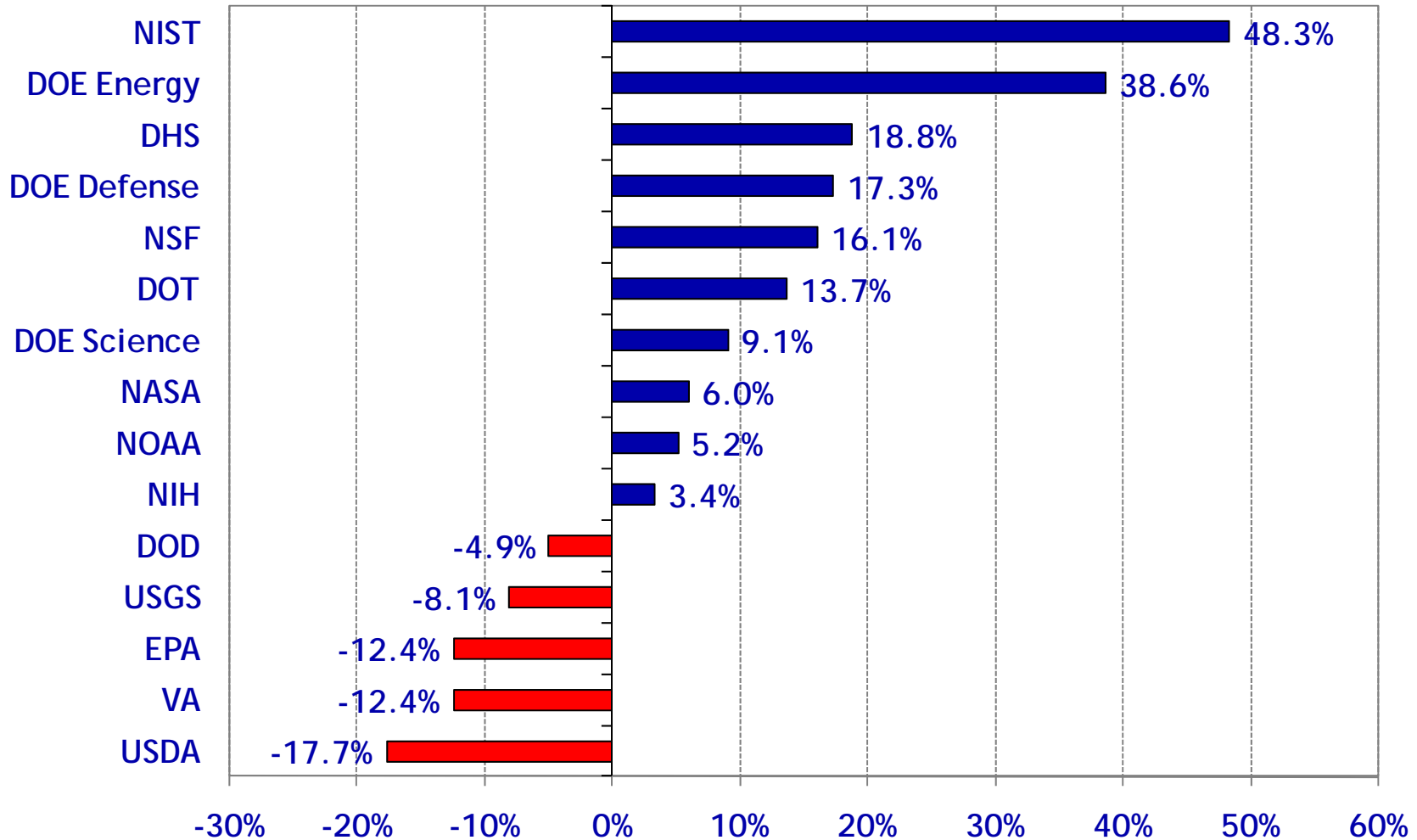
# Department of Defense

- Total R&D
  - FY 11 House CR: \$77.2b, -4.2%
  - FY 11 Senate CR: \$76.7b, -4.8%
  - FY 12 Request: \$76.6b, -4.9%
- Basic Research
  - FY 12 Request: \$2.1b, +14.5%
- Total S&T
  - FY 12 Request: \$12.3b, -7.2%
- Defense Efficiencies Initiative: -\$178b over 5 yrs, \$100b reinvested
- UAVs: \$4.8b, Cyber: \$2.3b, F-35: \$9.7b and restructured



# R&D in the FY 2012 Budget Request

percent change from FY 2010



Source: OMB R&D data, agency budget justifications, and other agency documents.

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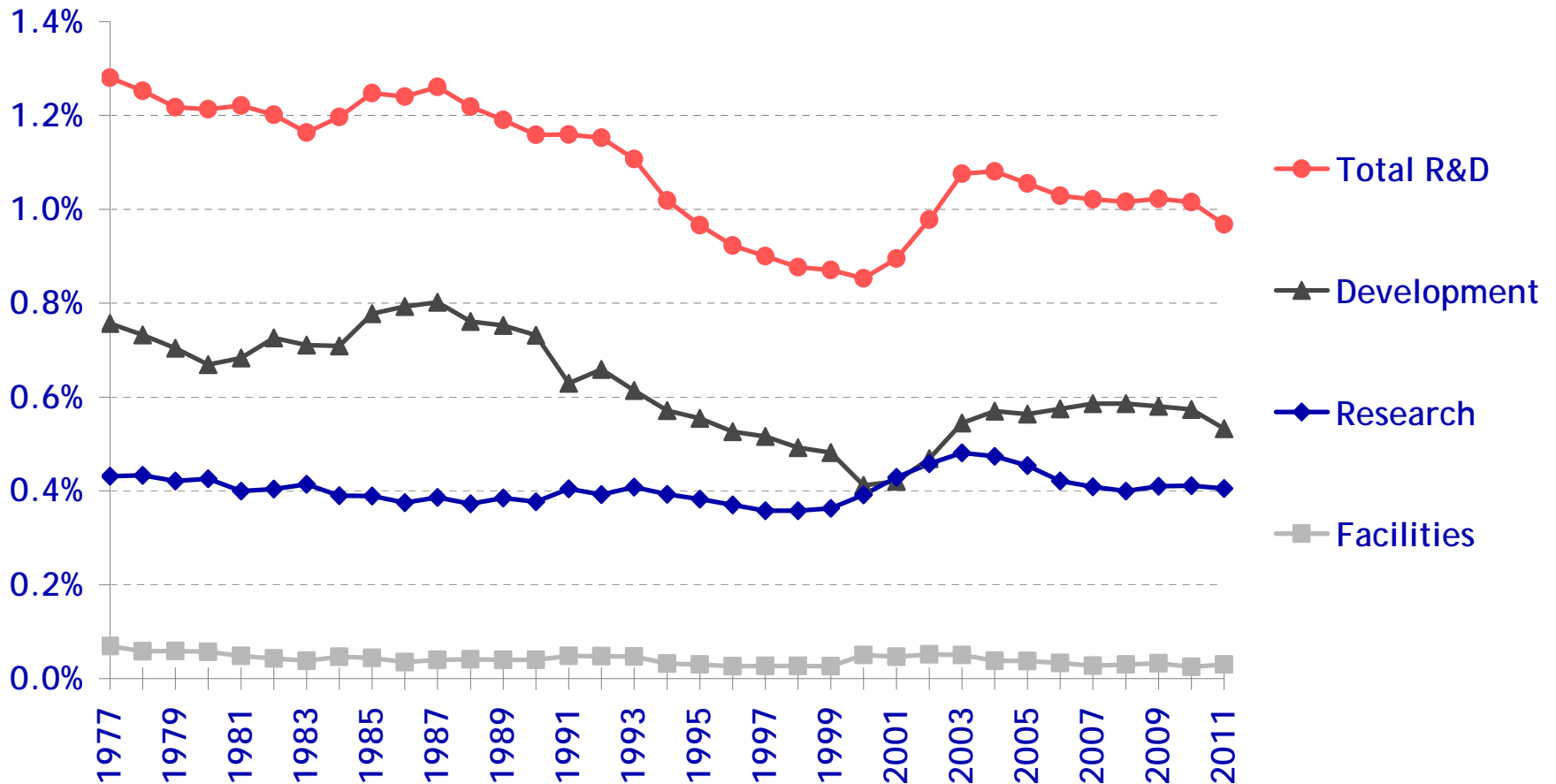


# International R&D Investment

- The United States leads the world in R&D investment
  - \$369b PPP, 35.7% of world R&D investment
- But, others are quickly increasing their investment
  - Over 1997 - 2007,
    - South Korea, +0.99% of GDP to 3.47%
    - China, +0.85% of GDP to 1.49%
    - Taiwan, +0.81% of GDP to 2.63%
    - Japan, +0.57% of GDP to 3.44%
    - United States, +0.10% of GDP to 2.68%
- President Obama set goal of 3.0% of GDP investment in R&D

# Trends in Federal R&D

percent of GDP



Source: AAAS Report: Research and Development series.

FY 2011 figures are latest AAAS estimates of the FY 2011 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 *Budget of the U.S. Government FY 2011*.

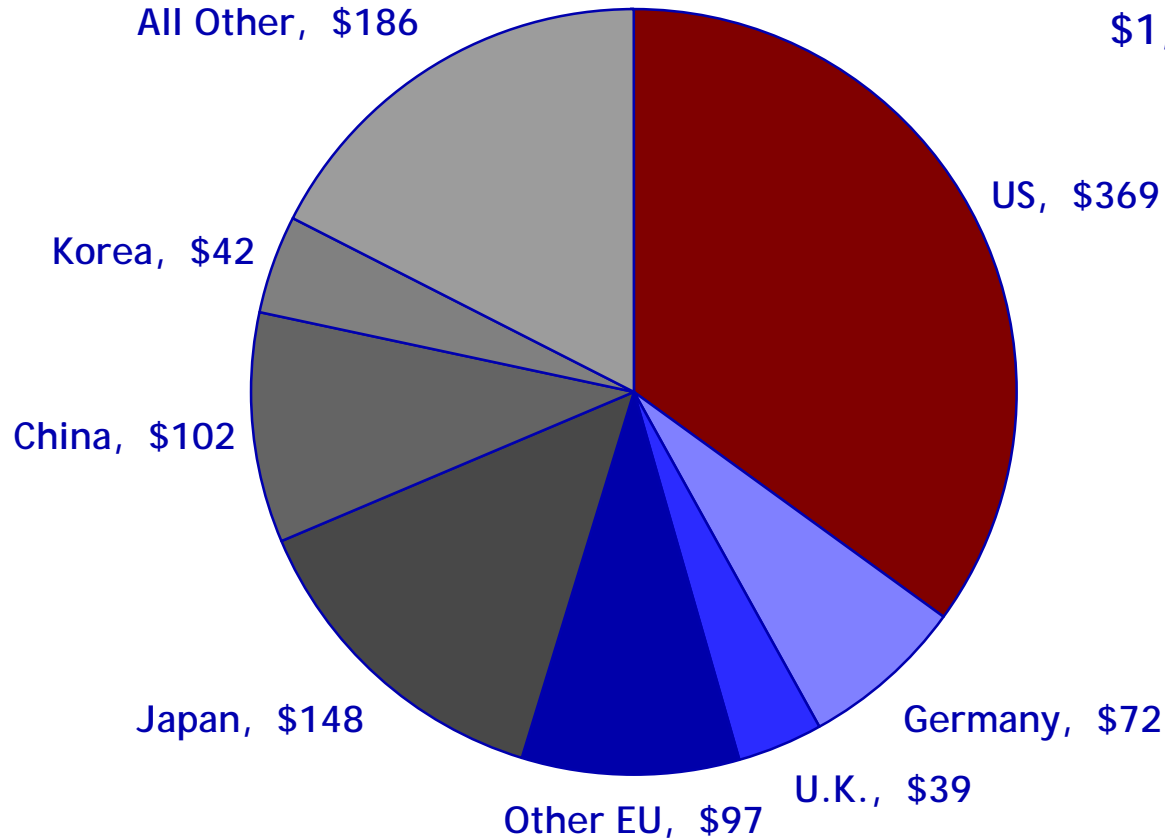
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# Total World R&D, 2007

in billions of PPP \$

Total World R&D =  
\$1,054 billion



Source: OECD, Main Science and Technology Indicators, May 2009.

World = OECD members plus Argentina, China, Israel, Romania,  
Russian Federation, Singapore, Slovenia, South Africa, Taiwan.

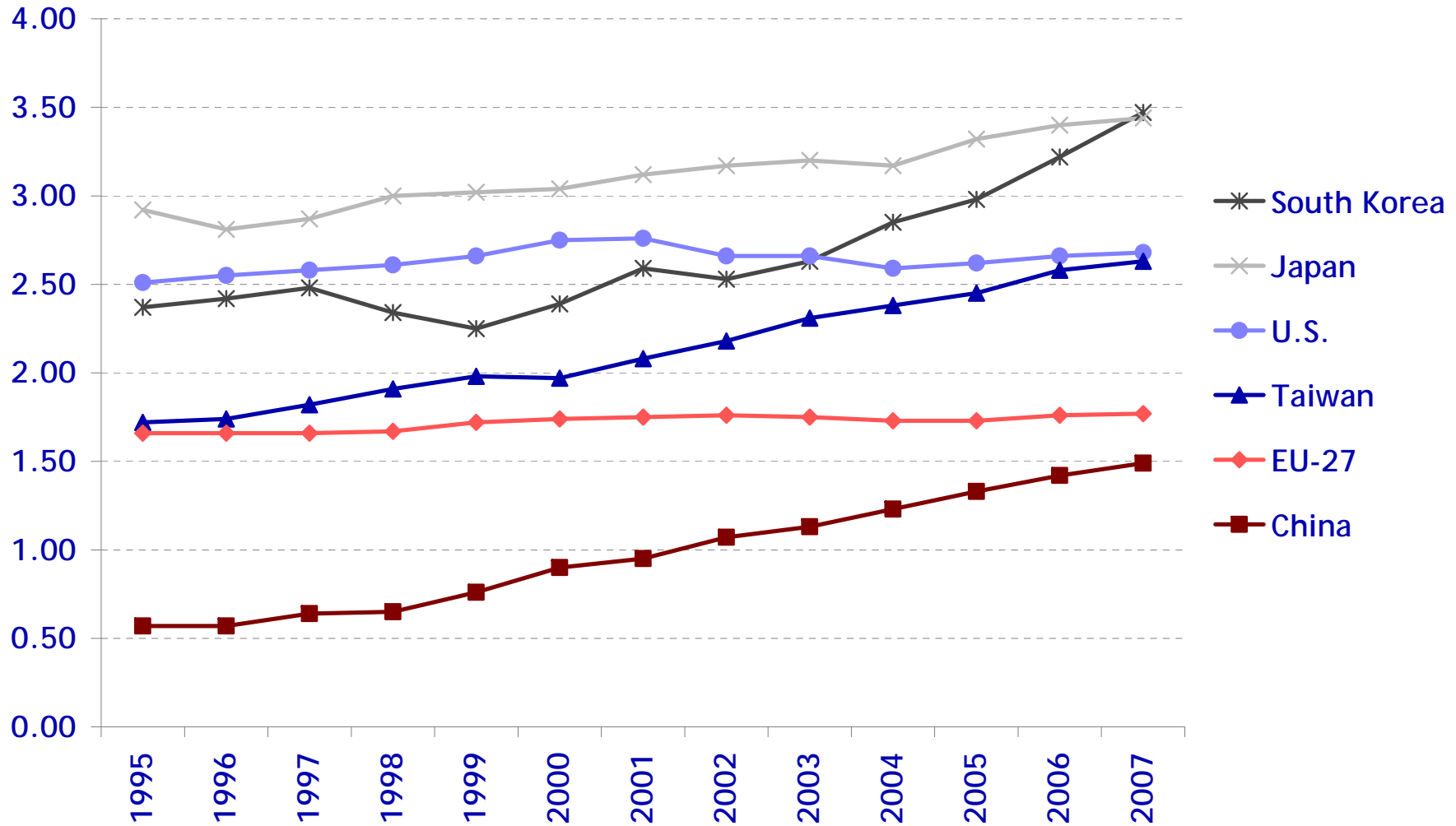
Calculated using purchasing power parities.

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# National R&D Investment

percent of GDP



Source: OECD, Main Science and Technology Indicators, May 2009.

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# Next Steps

- FY 2011
  - Current continuing resolution (CR) expires April 8.
  - FY 2011 funding levels are likely to be between \$1.029 trillion, the total of the House year-long CR (H.R.1), and \$1.079 trillion, the total of the Senate amendment.
- Debt Ceiling Increase
  - Needed by April / early May.
- FY 2012
  - Results of FY 2011 appropriations will be the best insight.

## For More Information...

The AAAS R&D web site is  
<http://www.aaas.org/spp/rd/>

Twitter: @AAAS\_RDBudget

The FY 2012 AAAS Forum on  
Science and Technology Policy  
is May 5-6, 2011  
in Washington, DC

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