

# Research and Development in the Federal Budget

Patrick Clemins

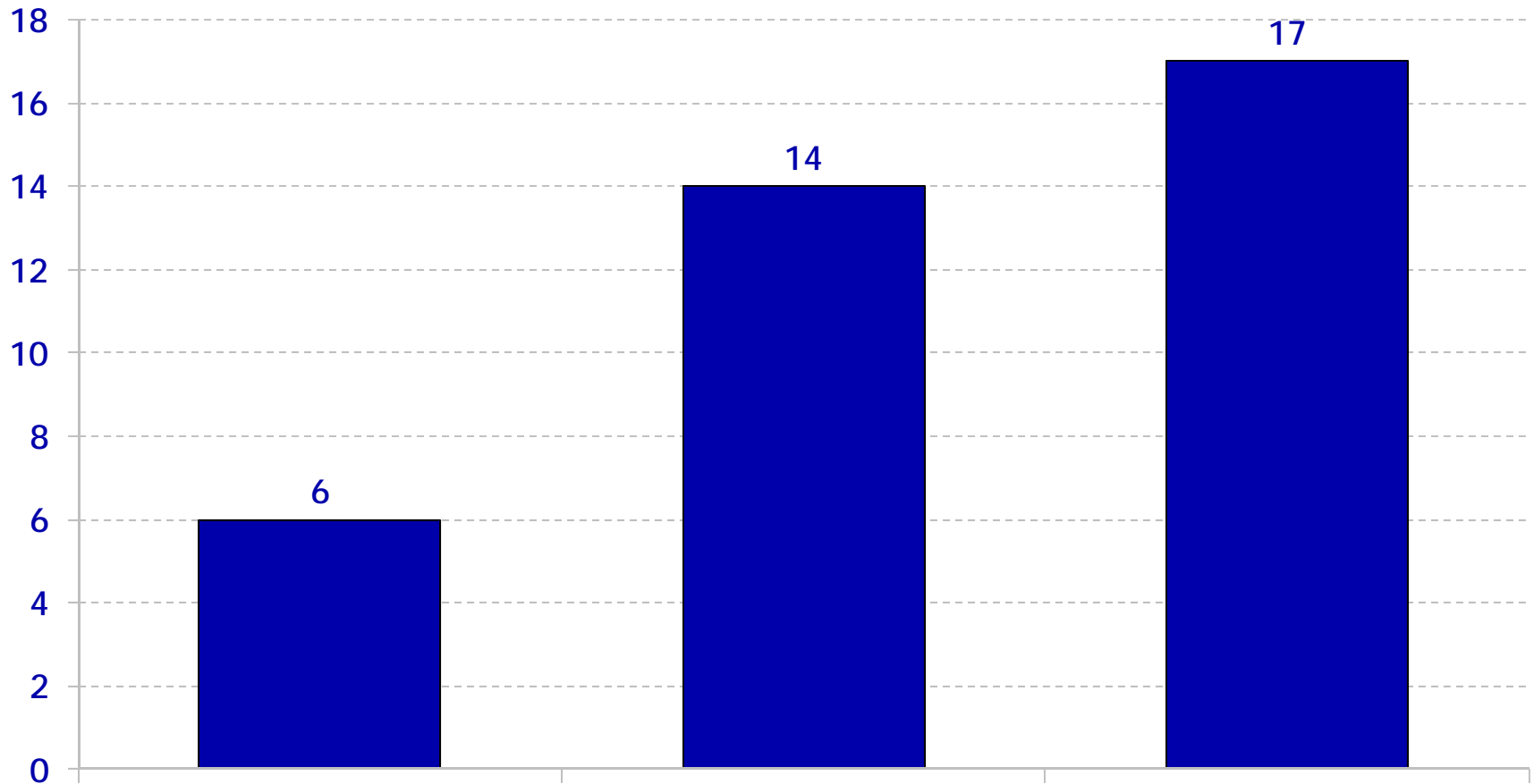
June 12, 2011

for the ASME Board Meeting

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

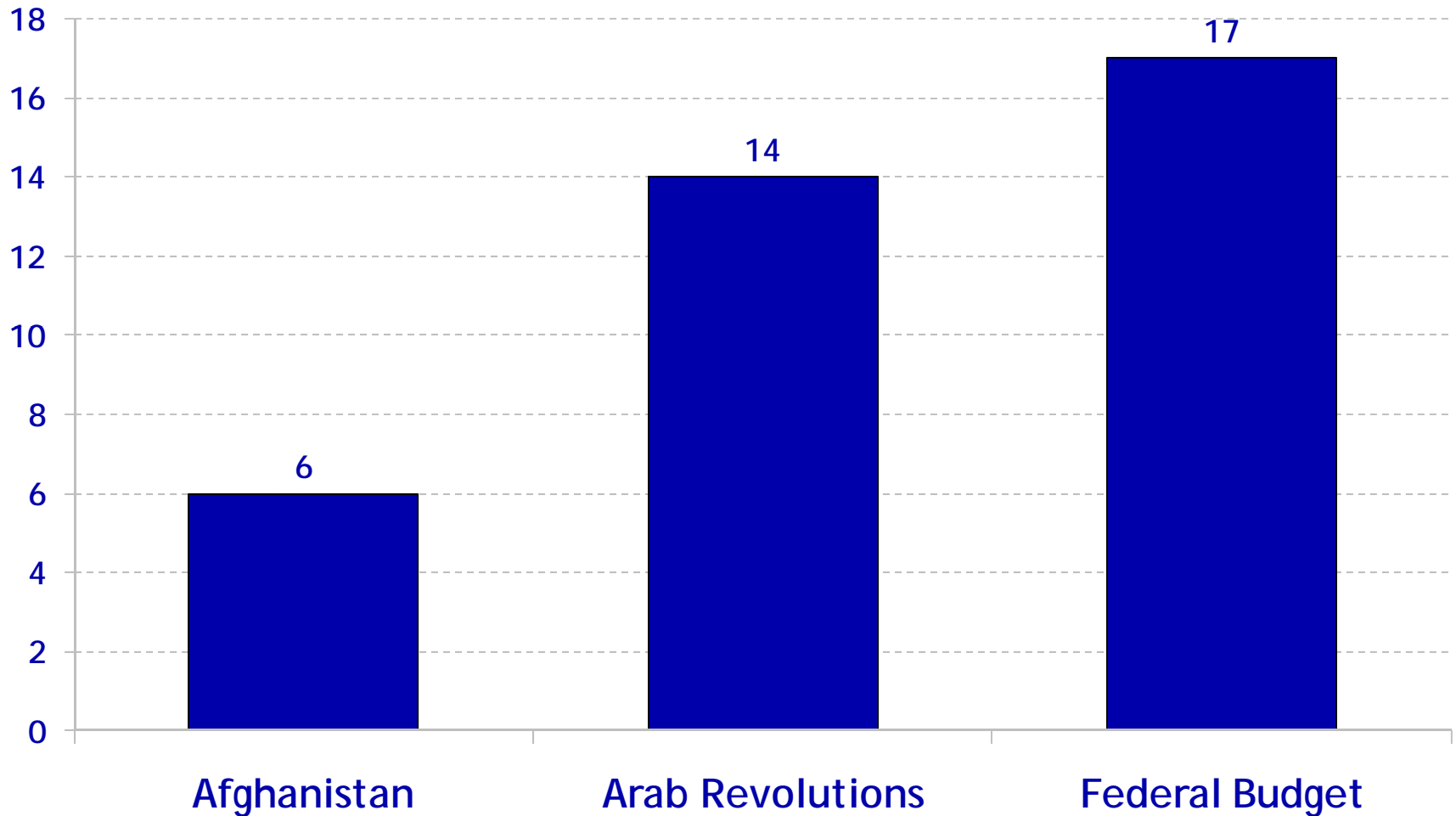
# Most Popular News Headline Topics

appearances at the top of a front page column - 4/7/11 through 5/4/11



# Most Popular News Headline Topics

appearances at the top of a front page column - 4/7/11 through 5/4/11



# The Celebrity Budget

- With fame, comes scrutiny
  - Programmatic Oversight
    - Effectiveness
    - Funding policy and mechanisms
    - Duplication across agencies
  - Role and Size of Government
    - Applied research funding
    - Appropriate topics of research
    - Research capacity

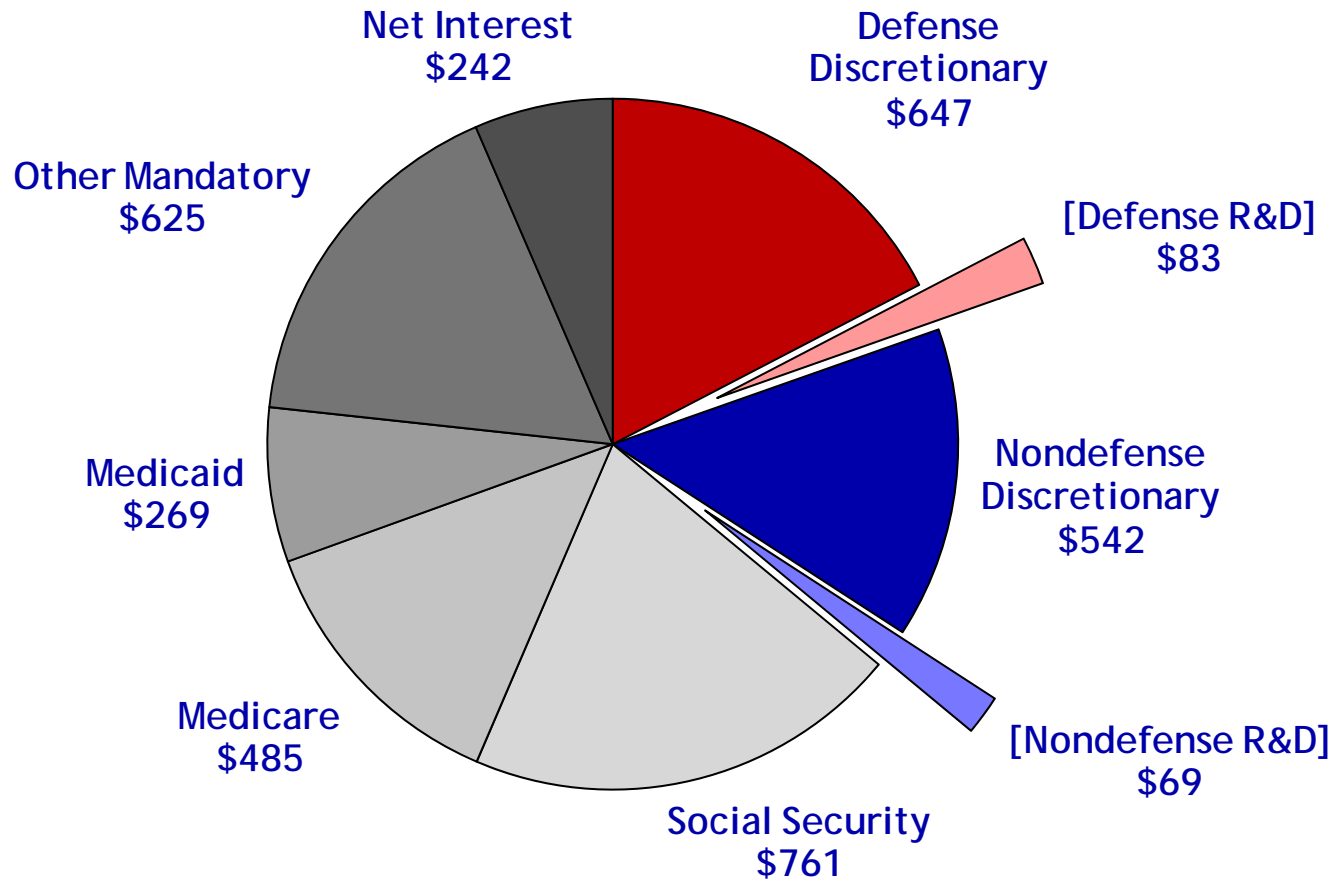
# The U.S. Federal Budget in FY 2012

- 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

# 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*.

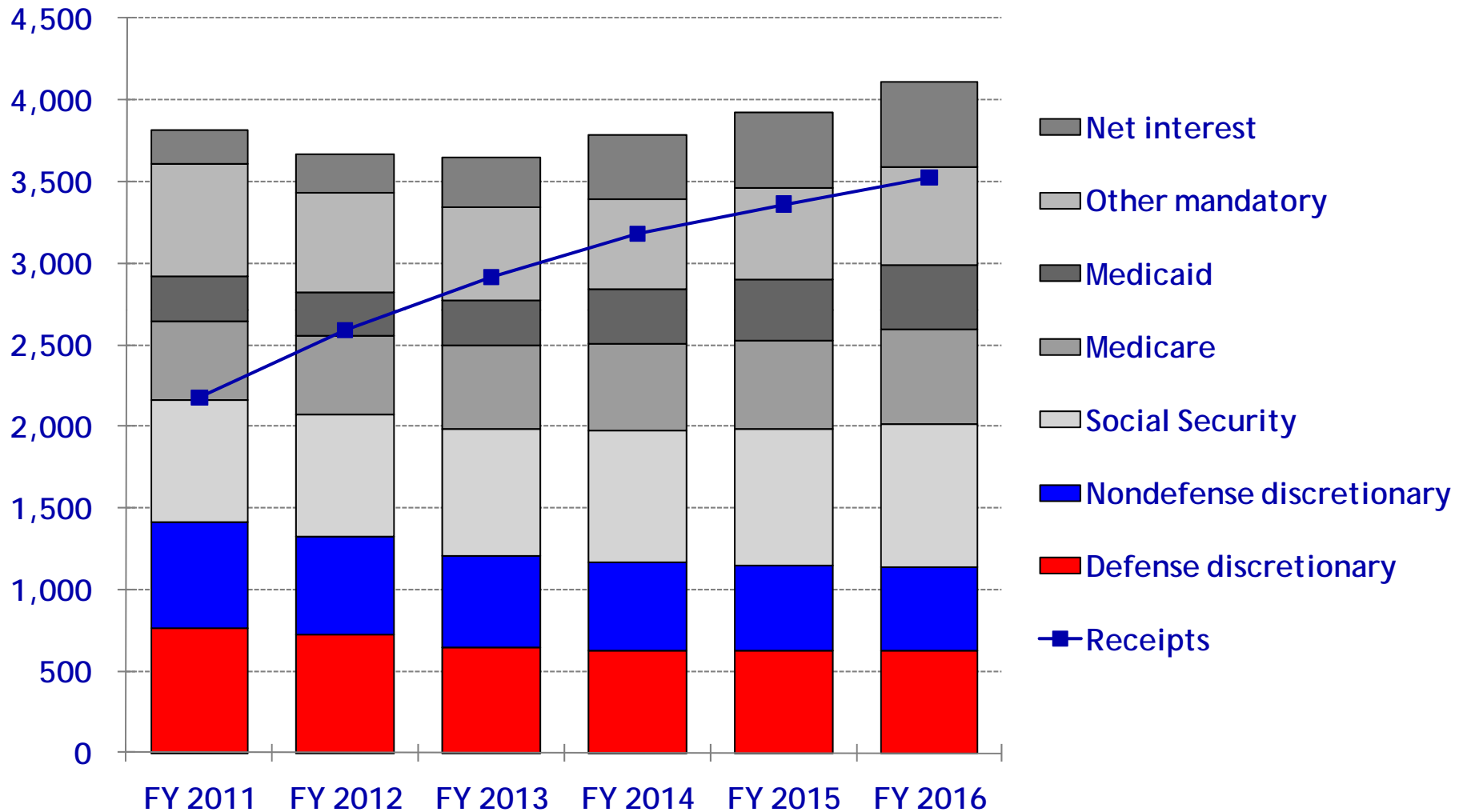
Projected unified deficit is \$1.1 trillion.

© 2011 AAAS



# FY 2012 Budget Projections

outlays in billions of constant FY 2011 dollars

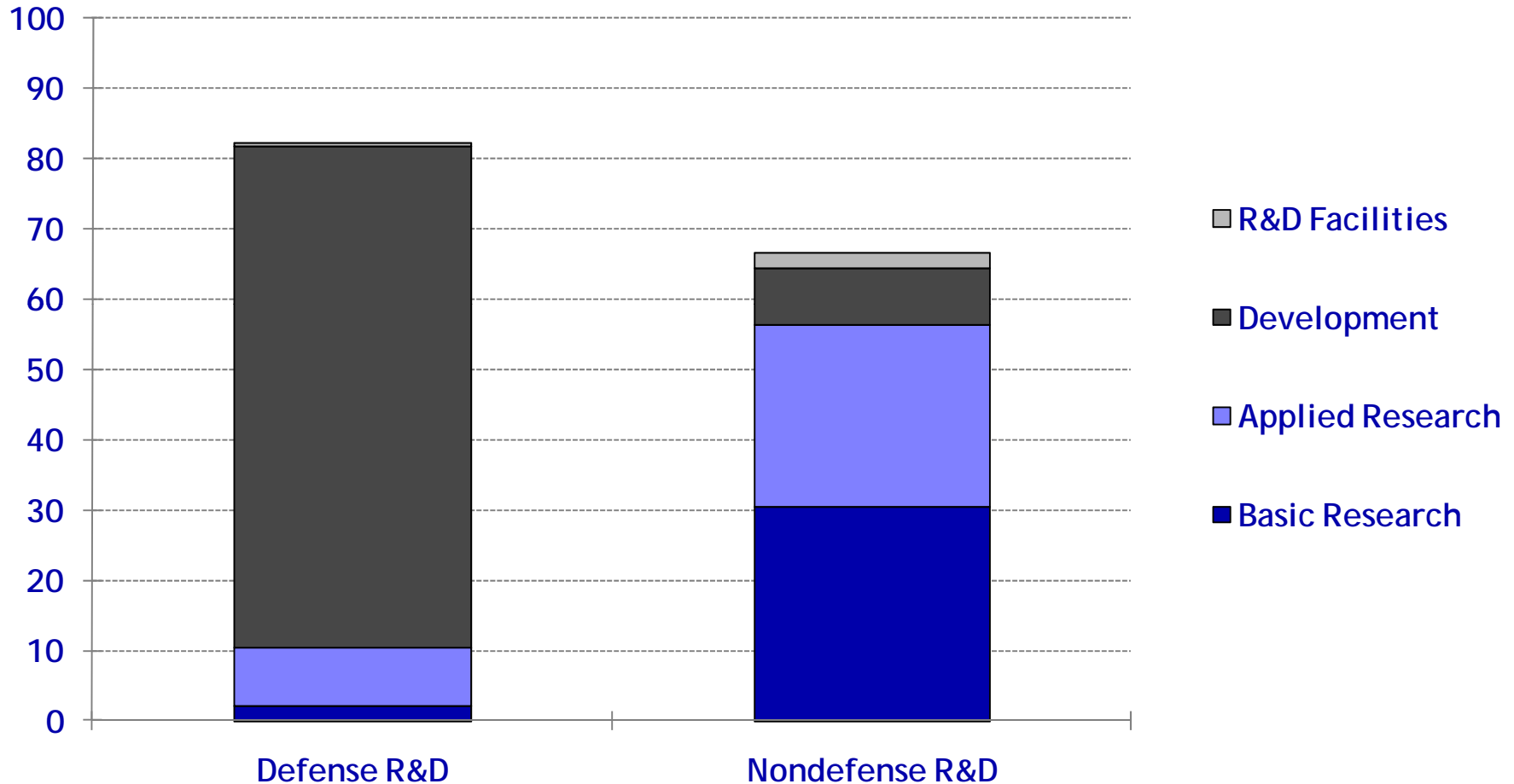


# Federal R&D in Context

- 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, FY 2012

budget authority in billions of dollars



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

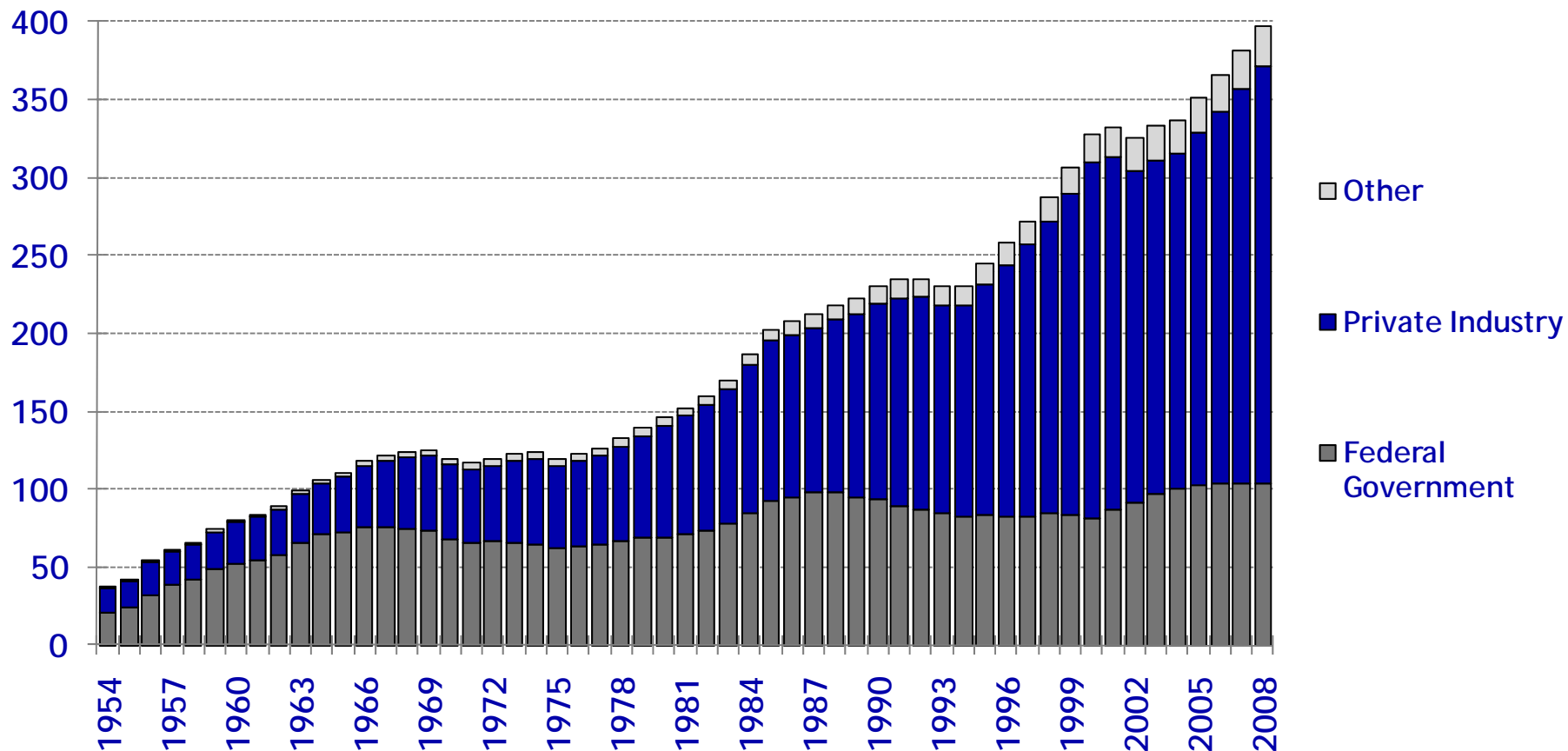
Defense R&D = DOD + DOE defense.

© 2011 AAAS



# National 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)

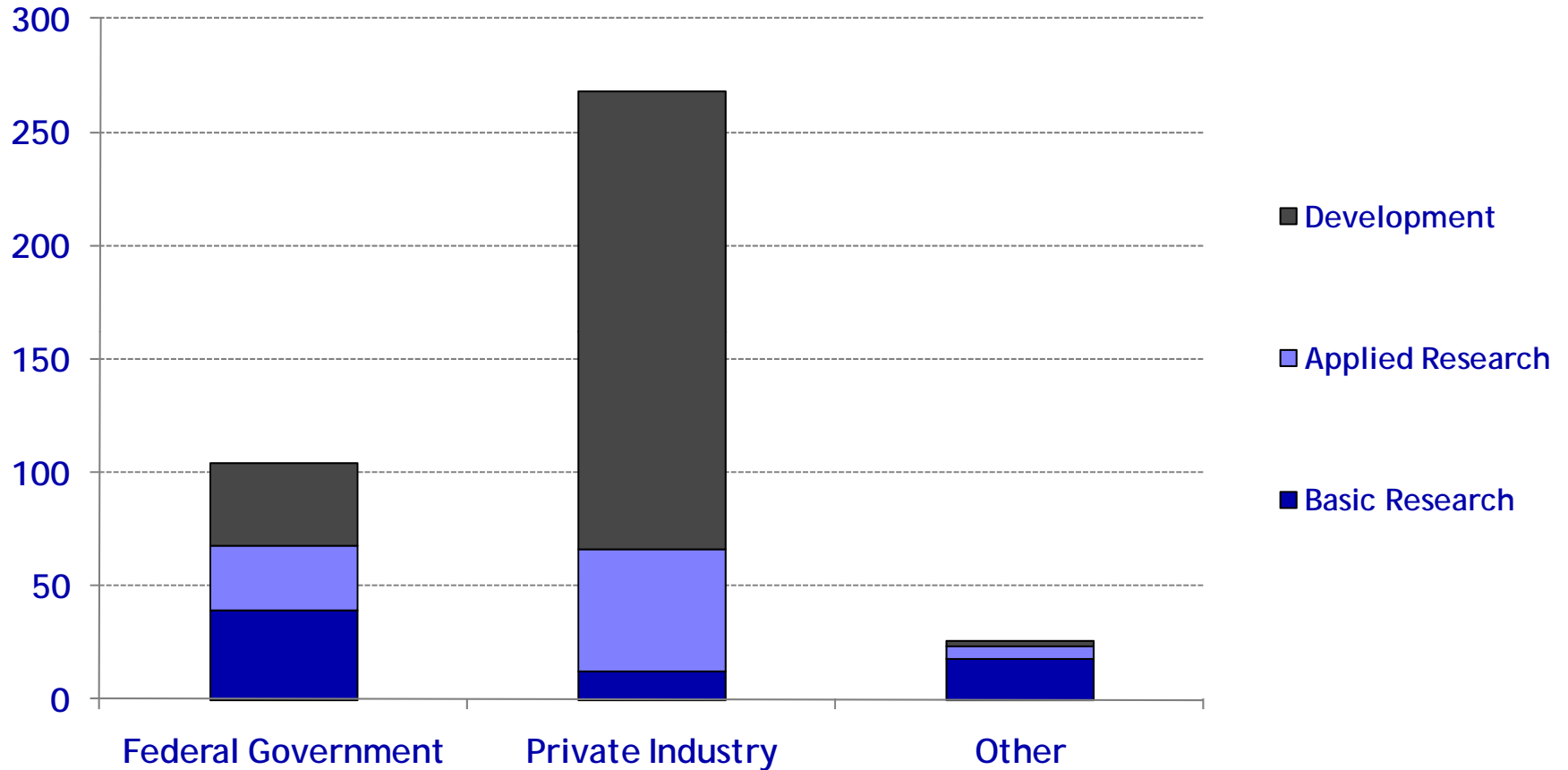
2008 figures are preliminary.

© 2011 AAAS



# 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)

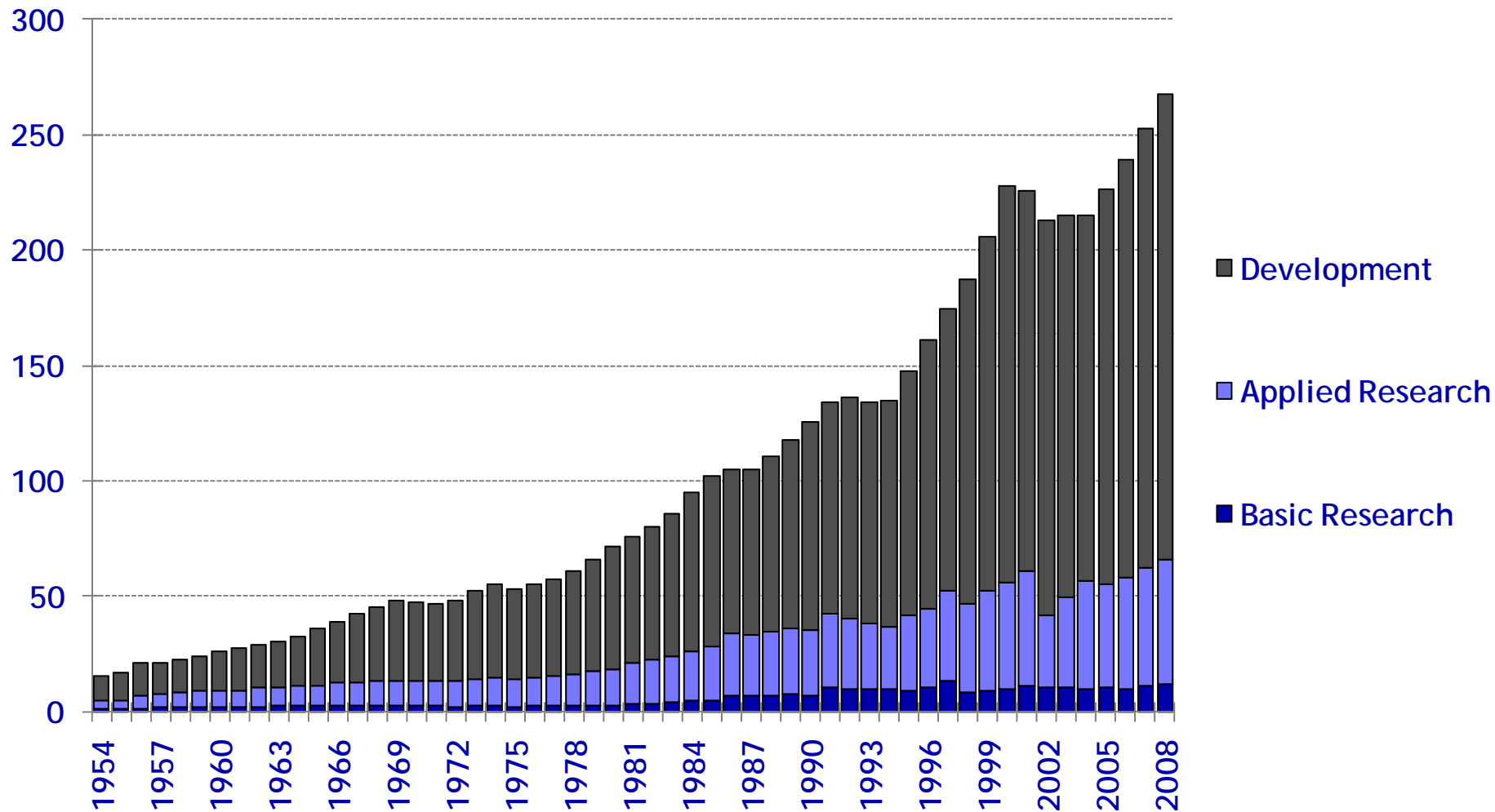
Figures are preliminary.

© 2011 AAAS



# Character of Industrial R&D

outlays in billions of constant 2008 dollars



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

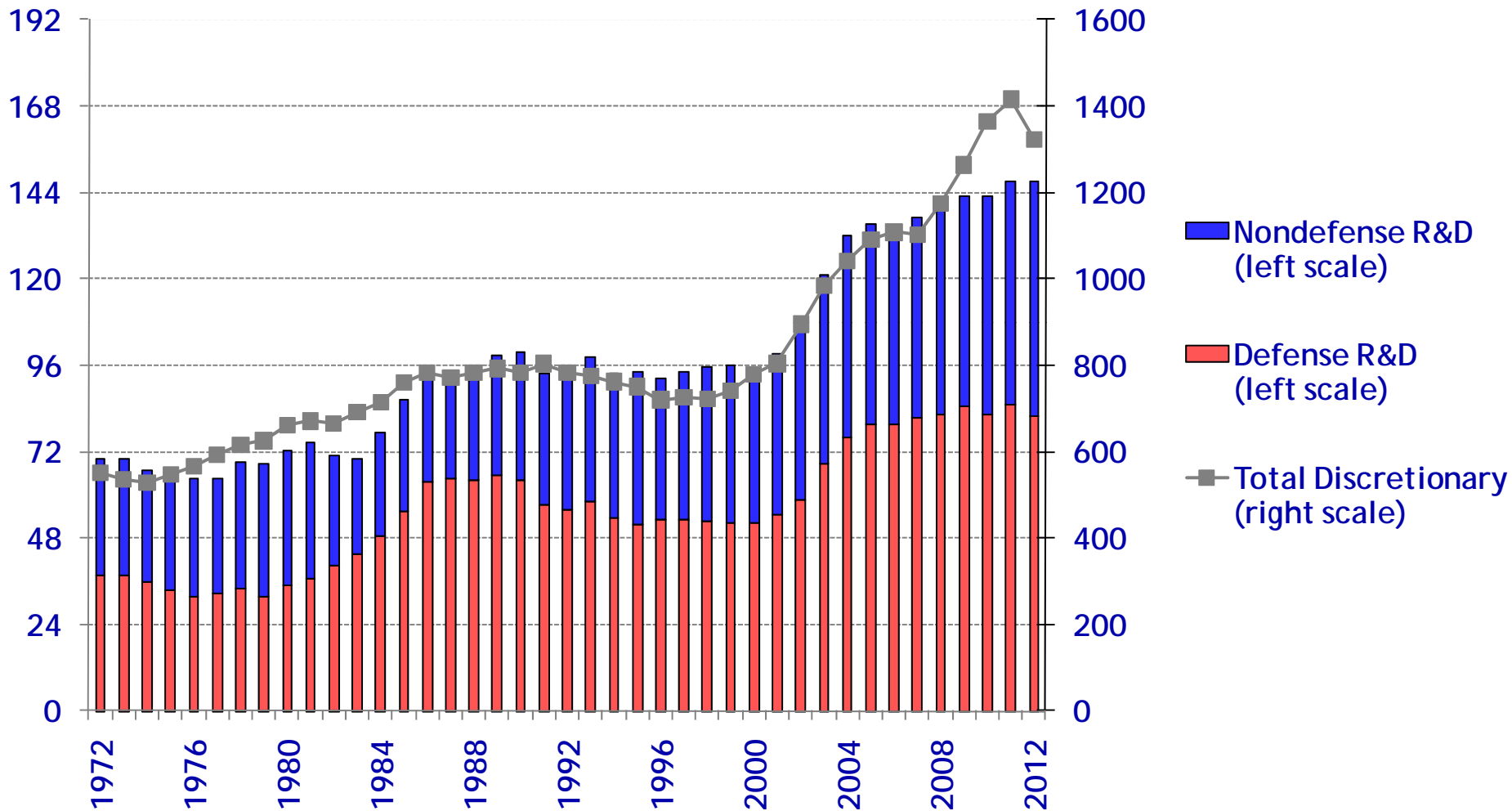
2008 figures are preliminary.

© 2011 AAAS



# 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.  
 © 2011 AAAS



# The FY 2011 Federal R&D Investment

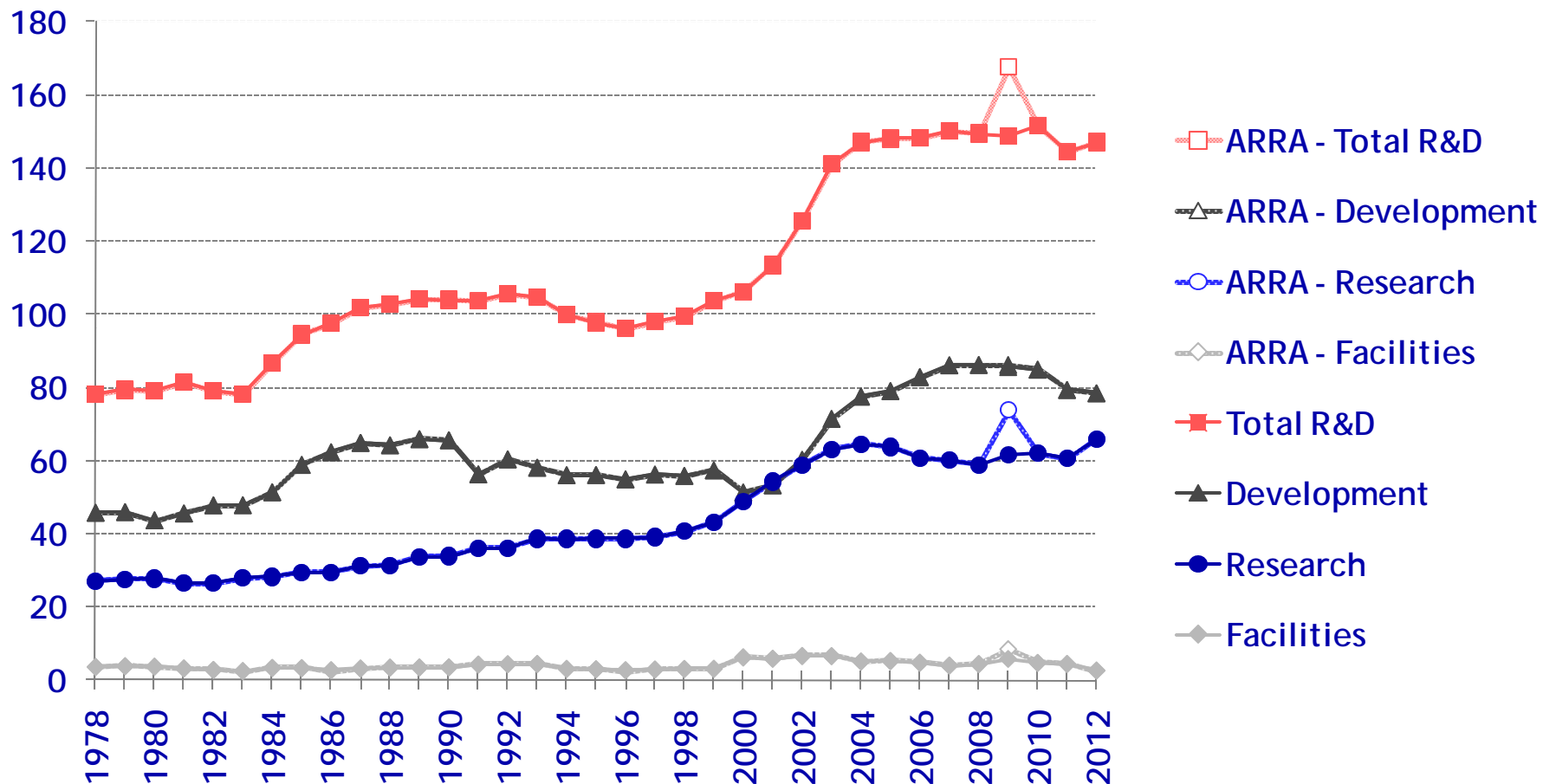
- Total R&D: \$144.4b, -3.5% (-\$5.2b) from FY 2010
  - Basic Research: \$29.3b, +0.0%
  - Applied Research: \$31.2b, -1.8%
  - Development: \$79.4b, -5.3%
  - Equipment and Facilities: \$4.5b, -4.8%
- \$82.1b for defense R&D, -5.4%
- \$62.3b for non-defense R&D, -0.9%

# The FY 2012 Federal R&D Investment

- Total R&D: \$149.1b, +3.3% (+\$4.7b) from FY 2011
  - Basic Research: \$32.6b, +11.1%
  - Applied Research: \$34.3b, +9.9%
  - Development: \$79.5b, +0.2%
  - Equipment and Facilities: \$2.7b, -39.4%
- \$82.3b for defense R&D, +0.2%
- \$66.8b for non-defense R&D, +7.3%
- +1.9% in constant dollars from FY 2011 (Non-defense: +5.8%)
- +0.0% in constant dollars since FY 2004 (Non-defense: +1.2%)
  - Peak in FY 2007

# Trends in Federal R&D

in billions of constant FY 2011 dollars



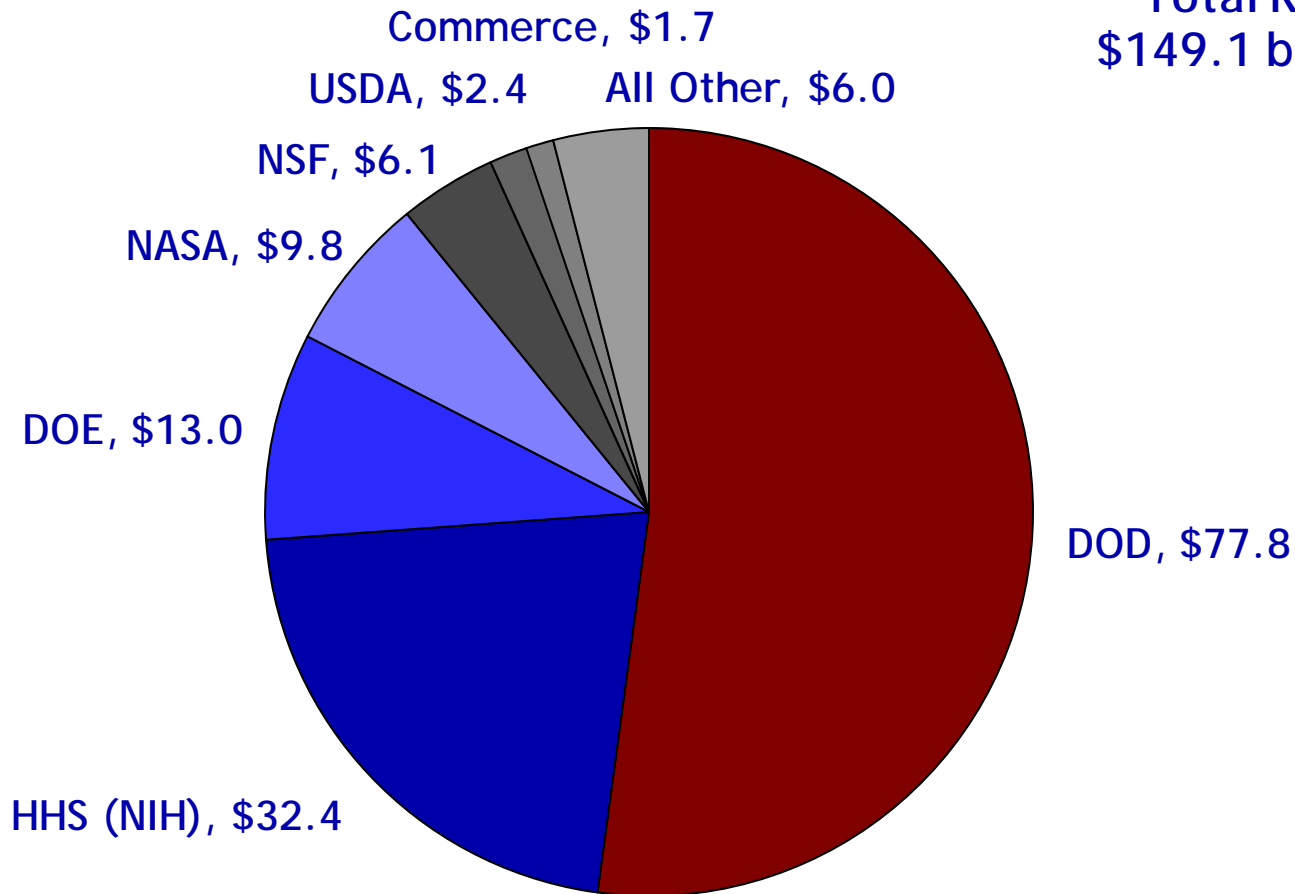
Source: OMB R&D data, AAAS analyses of R&D in annual AAAS R&D reports.  
 FY 2011 and FY 2012 figures are latest AAAS estimates.  
 R&D includes conduct of R&D and R&D facilities.  
 1976-1994 figures are NSF data on obligations in the Federal Funds survey.  
 © 2011 AAAS



# Total R&D by Agency, FY 2012

budget authority in billions of dollars

Total R&D =  
\$149.1 billion



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

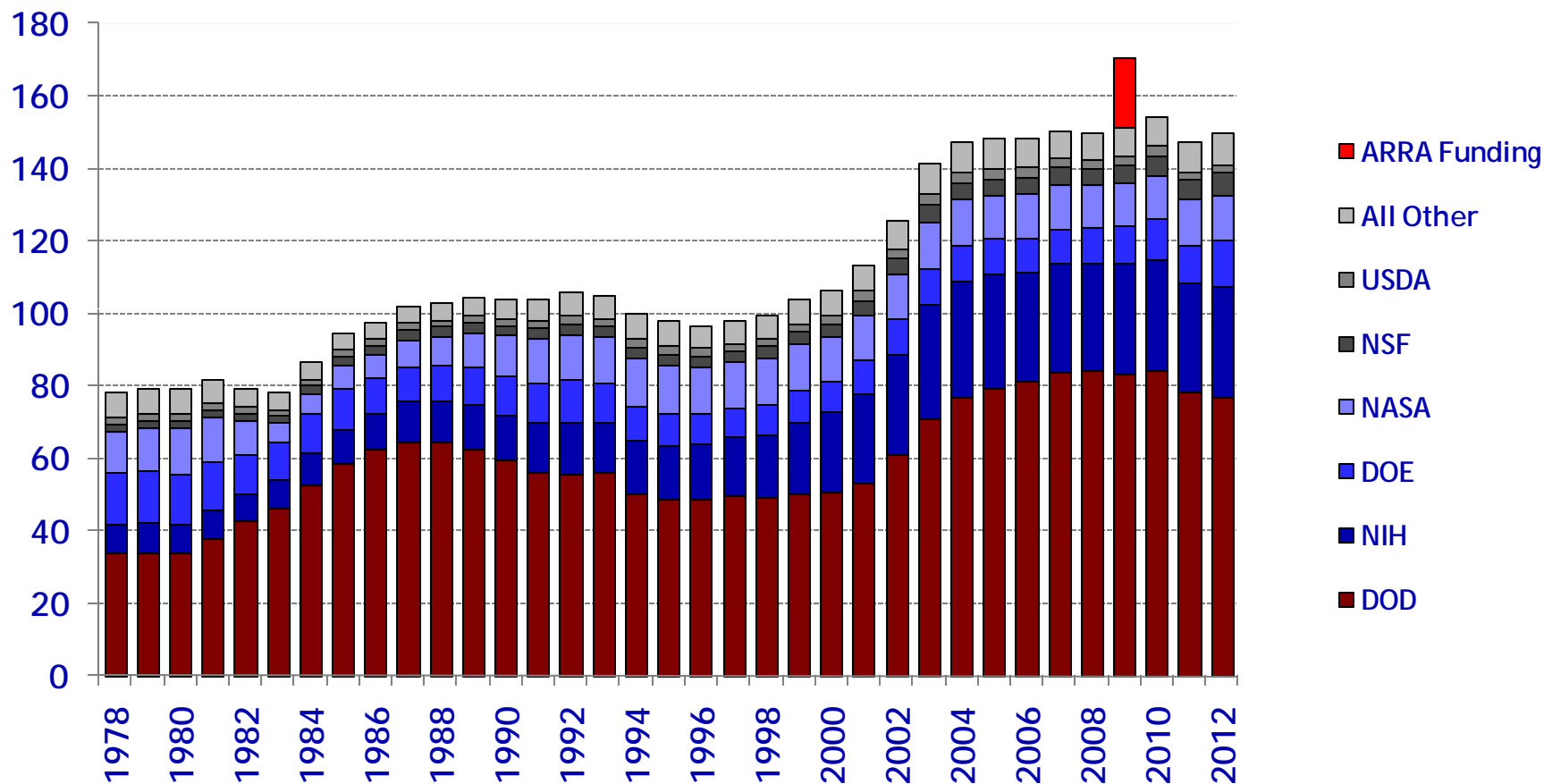
R&D includes conduct of R&D and R&D facilities.

© 2011 AAAS



# Trends in R&D by Agency

in billions of constant FY 2011 dollars

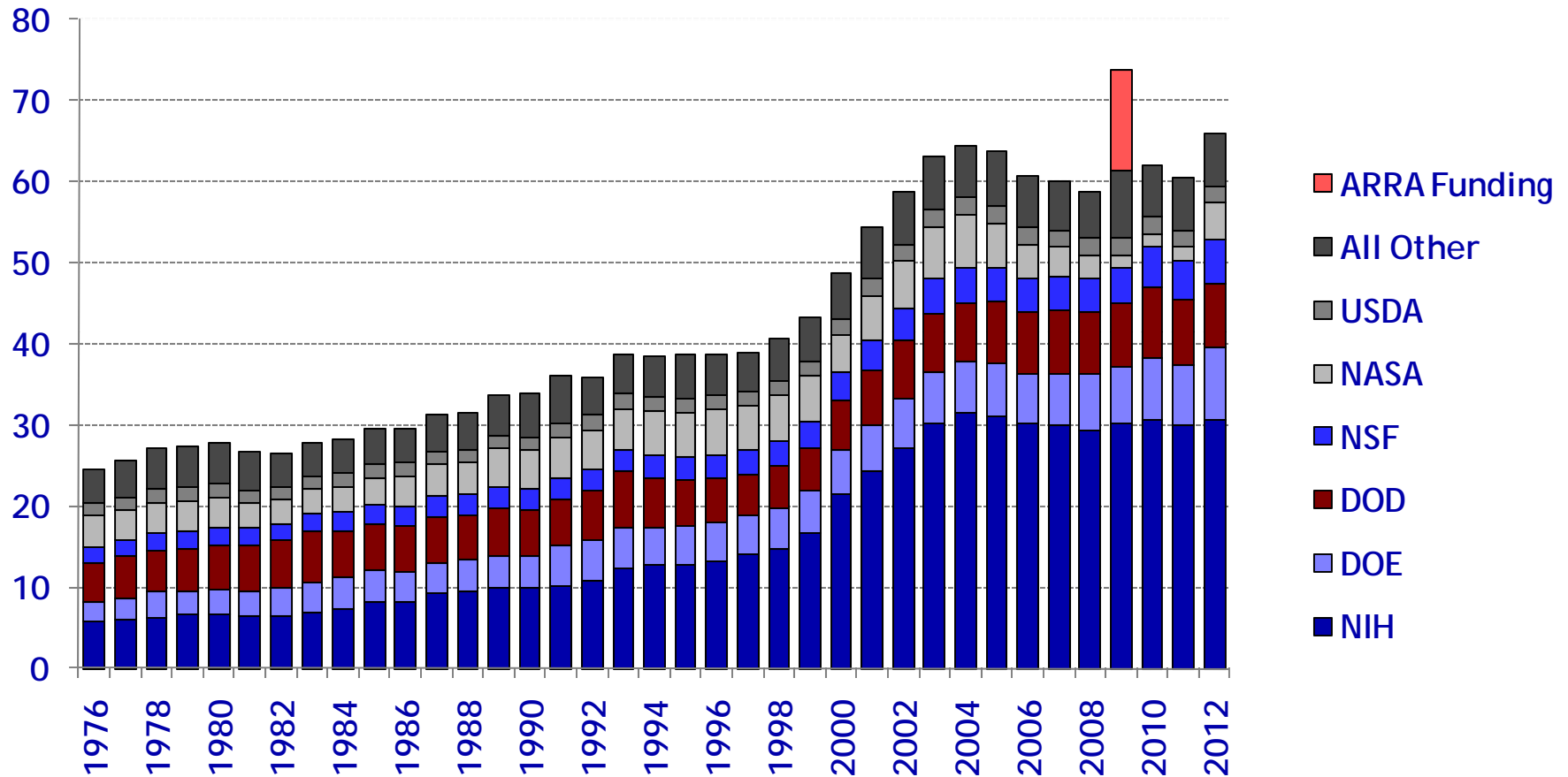


Source: AAAS Report: Research & Development series.  
 FY 2011 and FY 2012 figures are latest estimates.  
 1976-1994 figures are NSF data on obligations in the Federal Funds survey.  
 © 2011 AAAS



# Trends in Research by Agency

in billions of constant FY 2011 dollars



Source: Up to 1994 - National Science Foundation / National Center for Science and Engineering Statistics, Survey of Federal Funds for Research and Development;  
 1995 to Present - AAAS Report: Research and Development series;  
 FY 2011 and FY 2012 figures are latest estimates.  
 Research includes basic research and applied research.  
 © 2011 AAAS

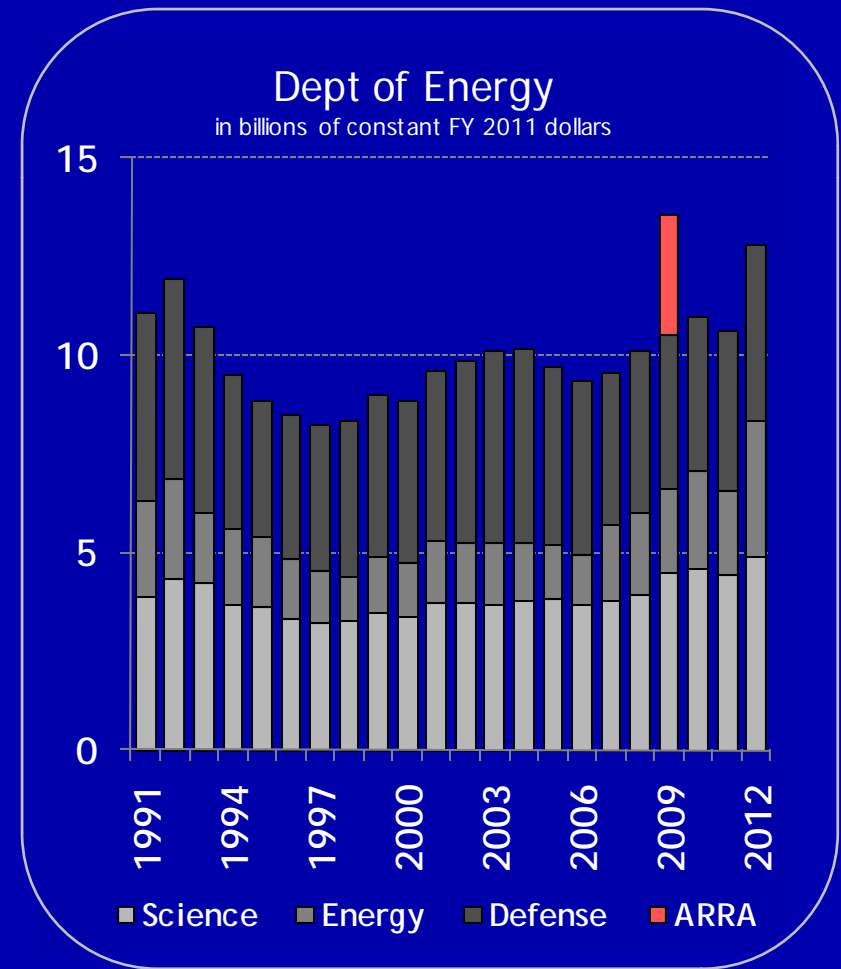


# R&D Investment Priorities

- Jumpstarting Innovation / Scientific Discovery
  - Research Funding: \$66.9b, +10.5% (\$6.4b)
  - \$13.9b combined NSF, DOE SC, NIST, +13.7% (\$1.7b)
- Clean Energy Future / Climate Science
  - DOE Sci and Energy: +\$1.9b (29.3%) 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

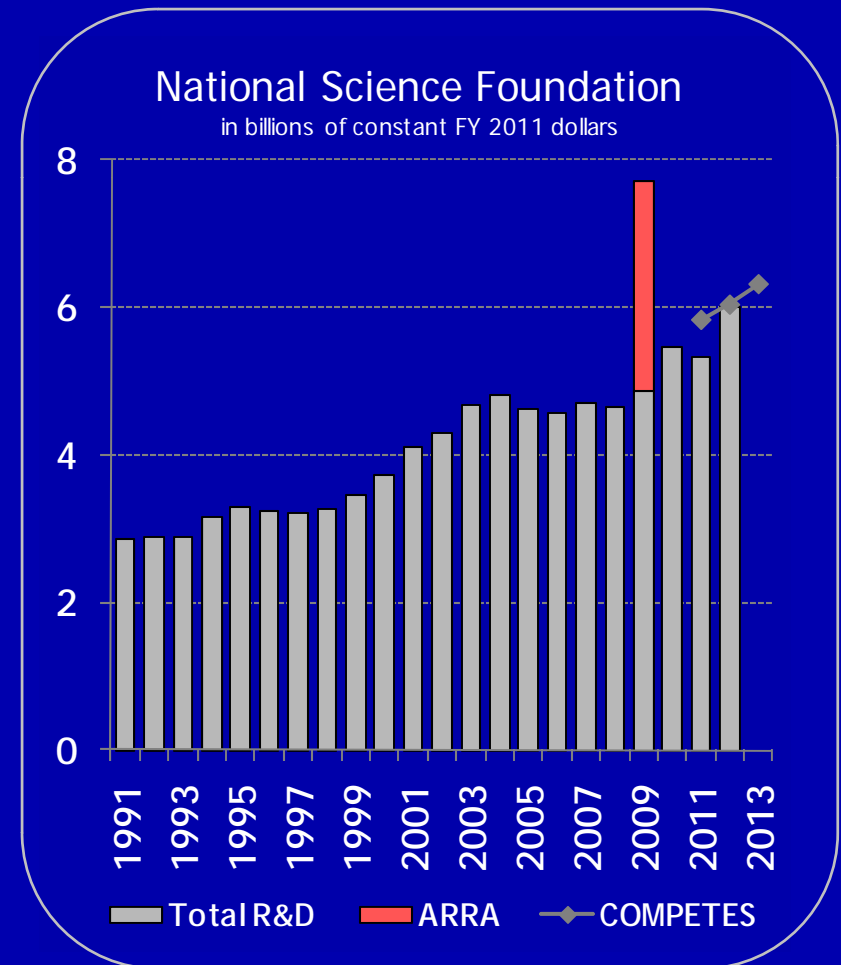
# Department of Energy

- Total R&D
  - FY 11 CR: \$10.6b, -1.8%
  - FY 12 Request: \$13.0b, +22.1%
- Office of Science R&D
  - FY 11 CR: \$4.5b, -1.6%
  - FY 12 Request: \$4.9b, +10.9%
- Energy Programs R&D
  - FY 11 CR: \$2.1b, -14.6%
  - FY 12 Request: \$3.5b, +68.2%
- ARPA-E
  - FY 11 CR: \$180m
  - FY 12 Request: \$550m + \$100m WI<sup>3</sup>
- Energy Innovation Hubs doubled to six
  - Batteries and Energy Storage
  - Critical Materials
  - Smart Grid Technology and Systems



# National Science Foundation

- Total Budget
  - FY 11 CR: \$6.8b, -1.0%
  - FY 12 Request: \$7.8b, +14.1%
- Total R&D
  - FY 11 CR: \$5.3b, -1.3%
  - FY 12 Request: \$6.1b, +14.6%
- 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



# NSF Engineering – FY 2012 Request

- 22.1% increase to \$908.3 million
  - Chem, Bioeng, Env & Trans (CBET) - \$194 million (+23.7%)
  - Civil, Mech & Manuf Innov (CMMI) - \$226 million (+20.3%)
  - Elect, Comm & Cyber Sys (ECCS) - \$131 million (+39.4%)
  - Eng Education and Centers (EEC) - \$132million (+6.7%)
  - Ind Innov Partnerships (IIP) - \$192 million (+26.0%)
    - SBIR/STTR - \$147 million (+16.8%)
  - Emerging Frontiers in Res Innov (EFRI) - \$33 million (+14.5%)

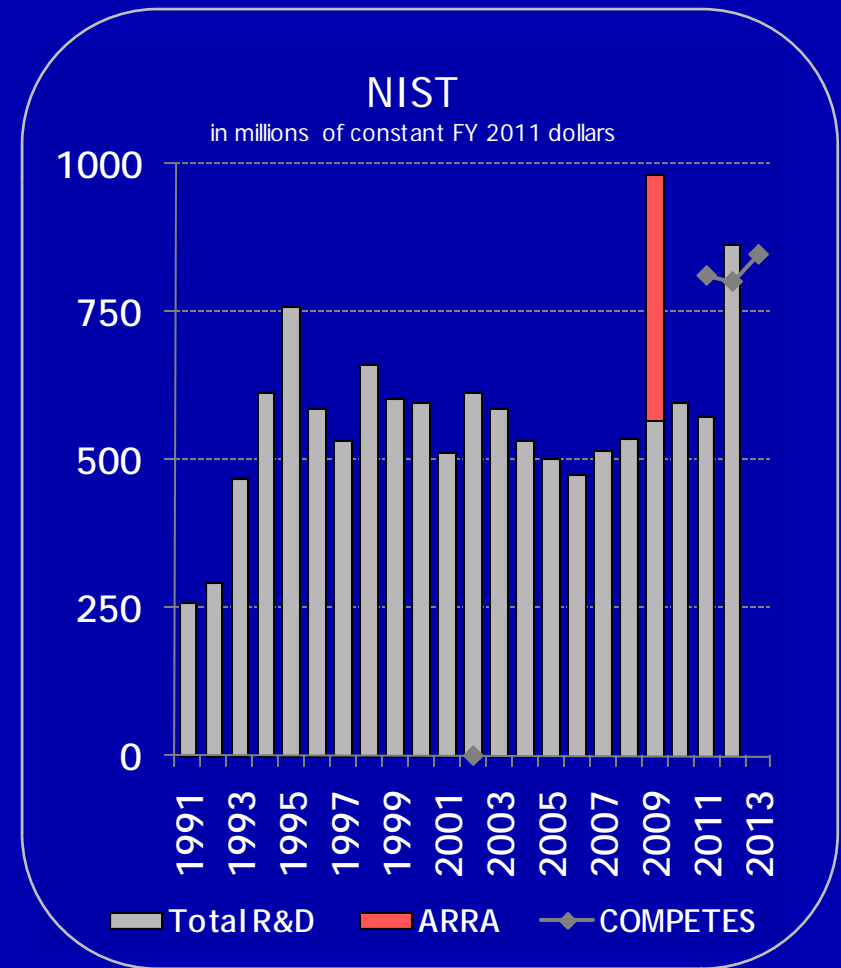
# NSF Engineering – FY 2012 Request

- Major Investments

- Clean Energy: +\$57m (49.9%) to \$173m
- SEES: +\$54m (49.7%) to \$162m
- Advanced Manufacturing: +\$27m (70.3%) to \$65m
- NNI: +\$26m (17.8%) to \$174m
- ERCs: +\$26m (47.5%) to 81m
- CIF21: \$9m
- S&T Centers: +7m (197.6%) to \$10m
  - Emergent Behaviors of Integrated Cellular Systems (CBET)
  - Energy Efficient Electronics Science (ECCS)

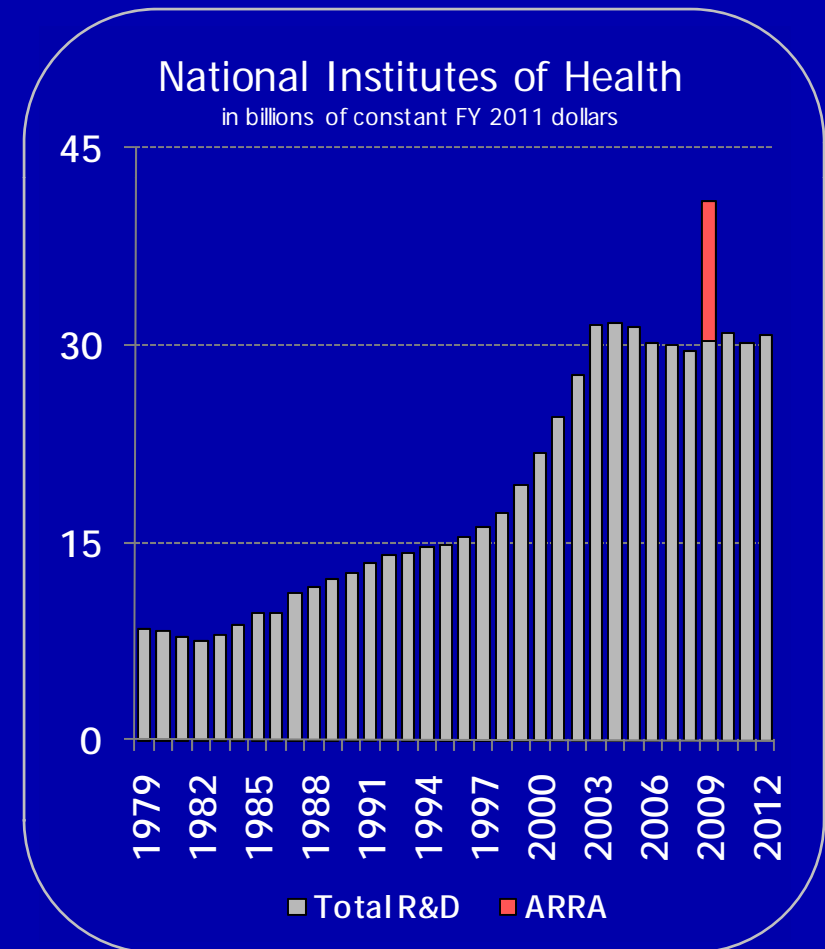
# NIST

- Total R&D
  - FY 11 CR: \$573m, -2.5%
  - FY 12 Request: \$874m, +52.5%
- NIST Labs Total Budget (STRS)
  - FY 11 CR: \$507m, -2.5%
  - FY 12 Request: \$674m, +32.8%
- Secure and Robust Cyber Infrastructure: +\$43.4m
- 21<sup>st</sup> Century Manufacturing: Faster, Smarter & Cleaner: +13.3m
- Wireless Innovation Fund: \$100m



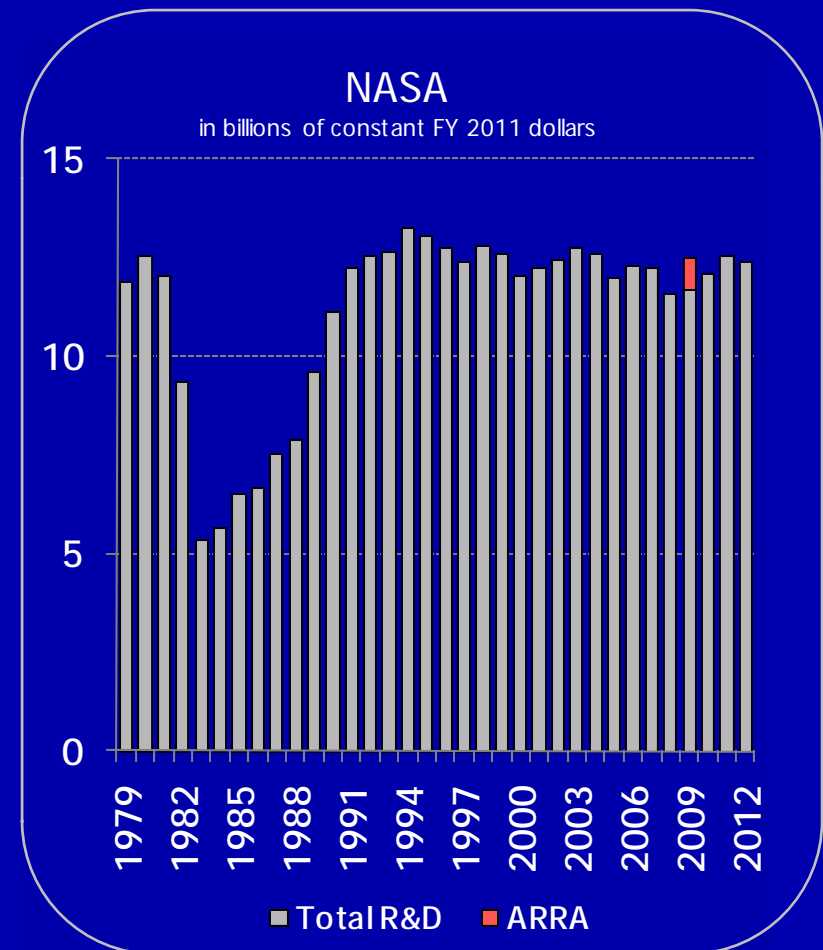
# National Institutes of Health

- Total R&D
  - FY 11 CR: \$30.2b, -1.1%
  - FY 12 Request: \$31.2b, +3.4%
- National Center for Advancing Translational Science (NCATS)
- Tech to accelerate discovery
- Comparative effectiveness and personalized medicine
- New Innovator Award and Early Independence Award



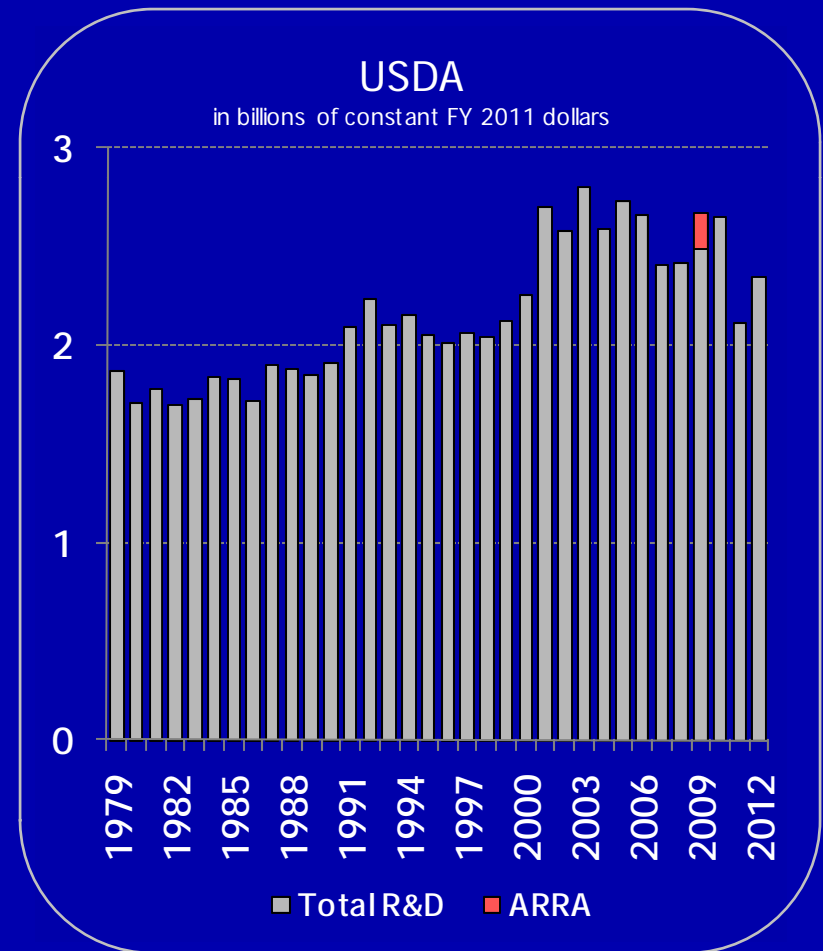
# NASA

- Total R&D
  - FY 11 CR: \$9.9b, +6.5%
  - FY 12 Request: \$9.8b, -0.5%
- 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



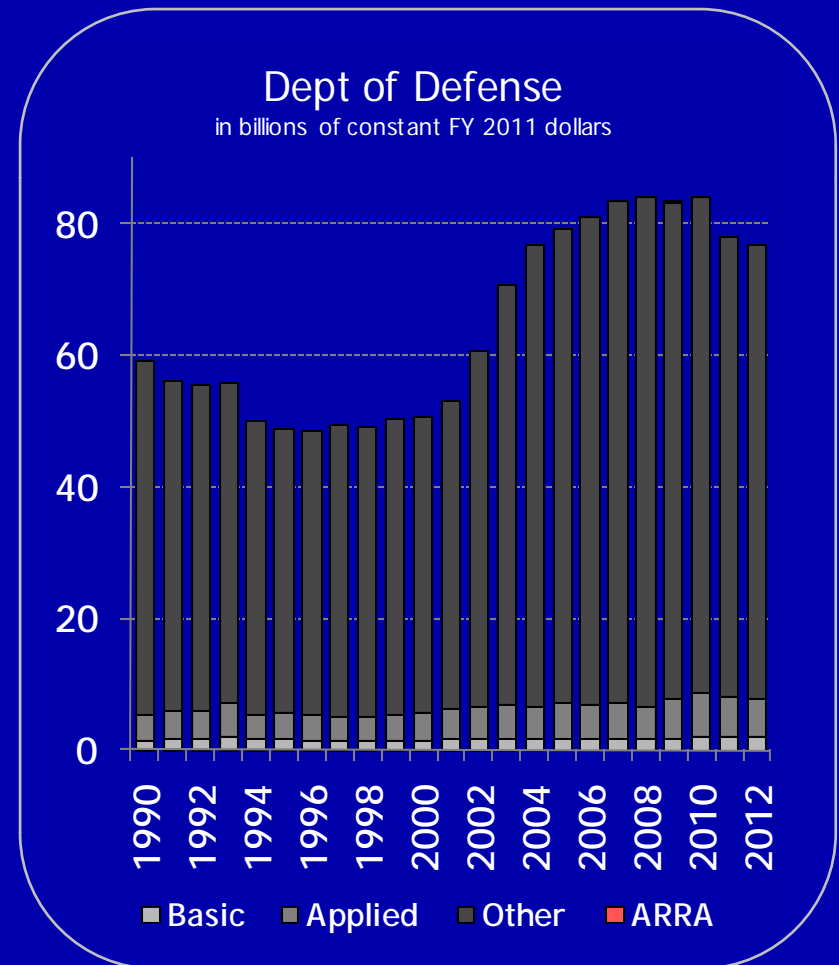
# USDA

- Total R&D
  - FY 11 CR: \$2.2b, -19.2%
  - FY 12 Request: \$2.4b, +5.5%
- ARS (Intramural)
  - Buildings and Facilities: -\$71m
  - \$230m in B&F rescissions in CR
  - Directed Projects: -\$42m
  - +\$59m in program increases
- NIFA (Extramural)
  - R&D: \$741m, -11.8% (-\$99m) from FY 2010
  - AFRI: \$325m, +24.0% (+\$62m)
  - Directed Projects: -\$141m



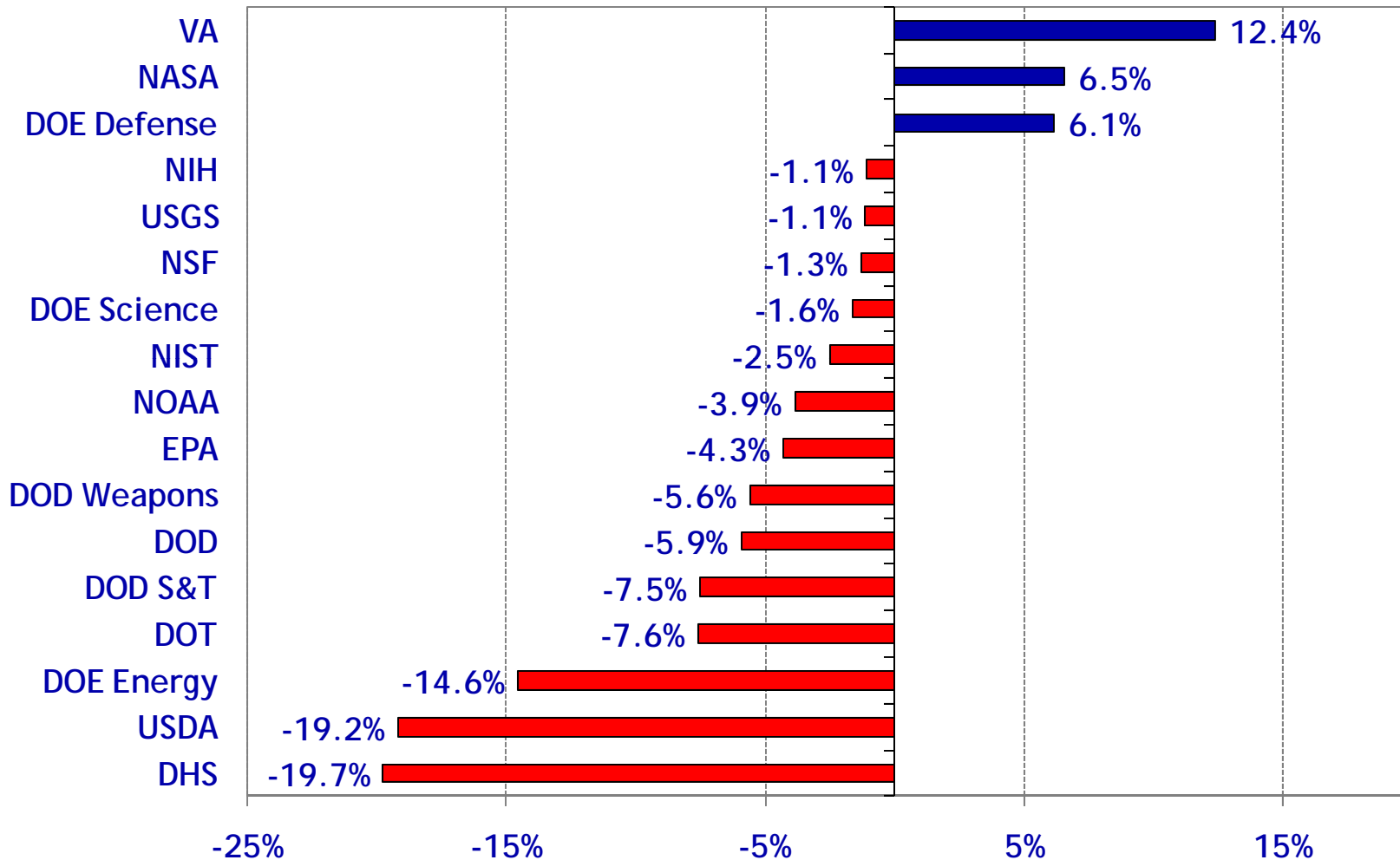
# Department of Defense

- Total R&D
  - FY 11 CR: \$78.0b, -5.9%
  - FY 12 Request: \$77.8b, -0.3%
- Basic Research
  - FY 11 CR: \$1.9b, +7.3%
  - FY 12 Request: \$2.1b, +6.7%
- Total S&T
  - FY 11 CR: \$13.6b, -7.5%
  - FY 12 Request: \$13.0b, -4.6%
- Defense Efficiencies Initiative: -\$178b over 5 yrs, \$100b reinvested
- UAVs: \$4.8b, Cyber: \$2.3b, F-35: \$9.7b and restructured



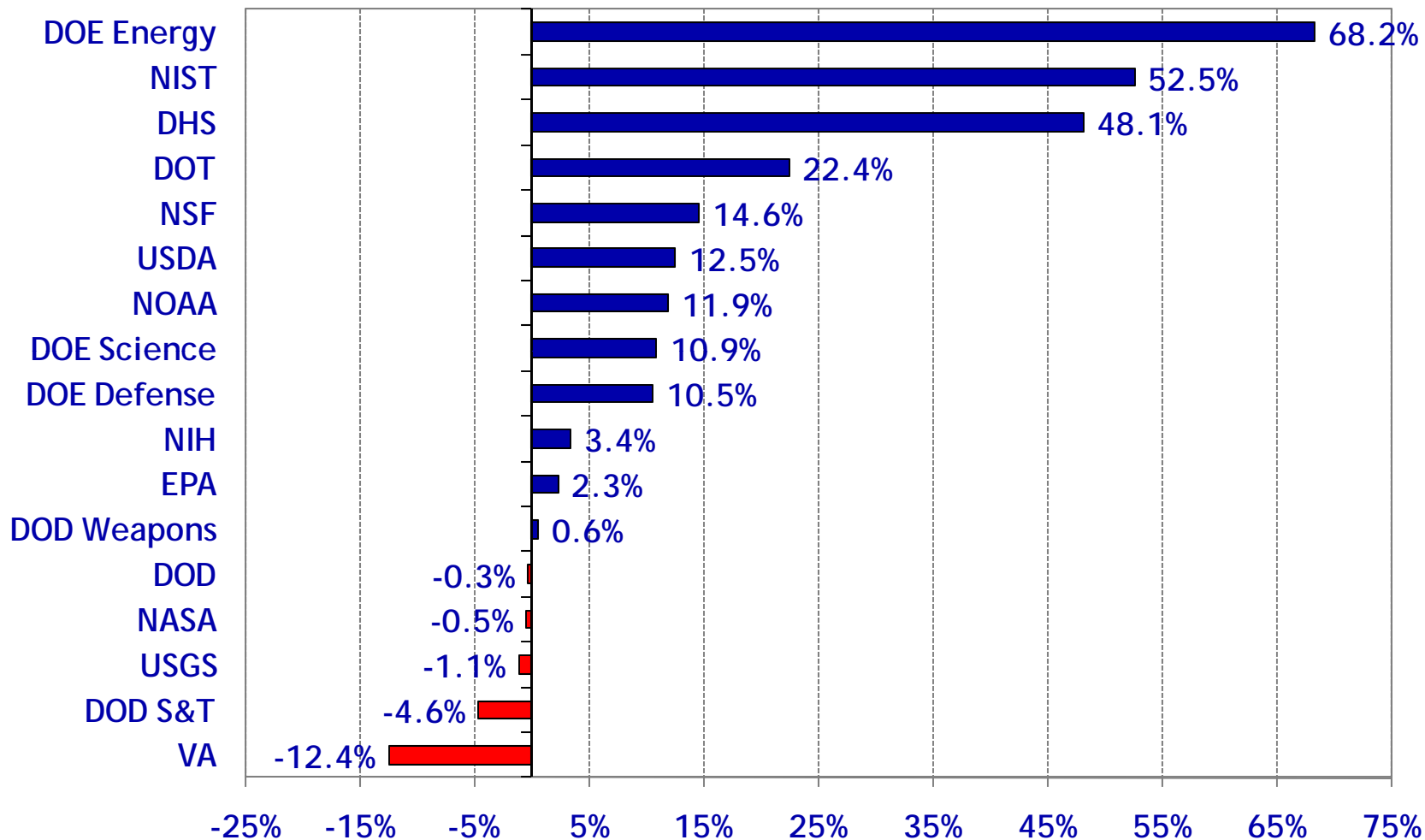
# R&D in the FY 2011 Budget

percent change from FY 2010



# R&D in the FY 2012 Budget Request

percent change from FY 2011



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

© 2011 AAAS

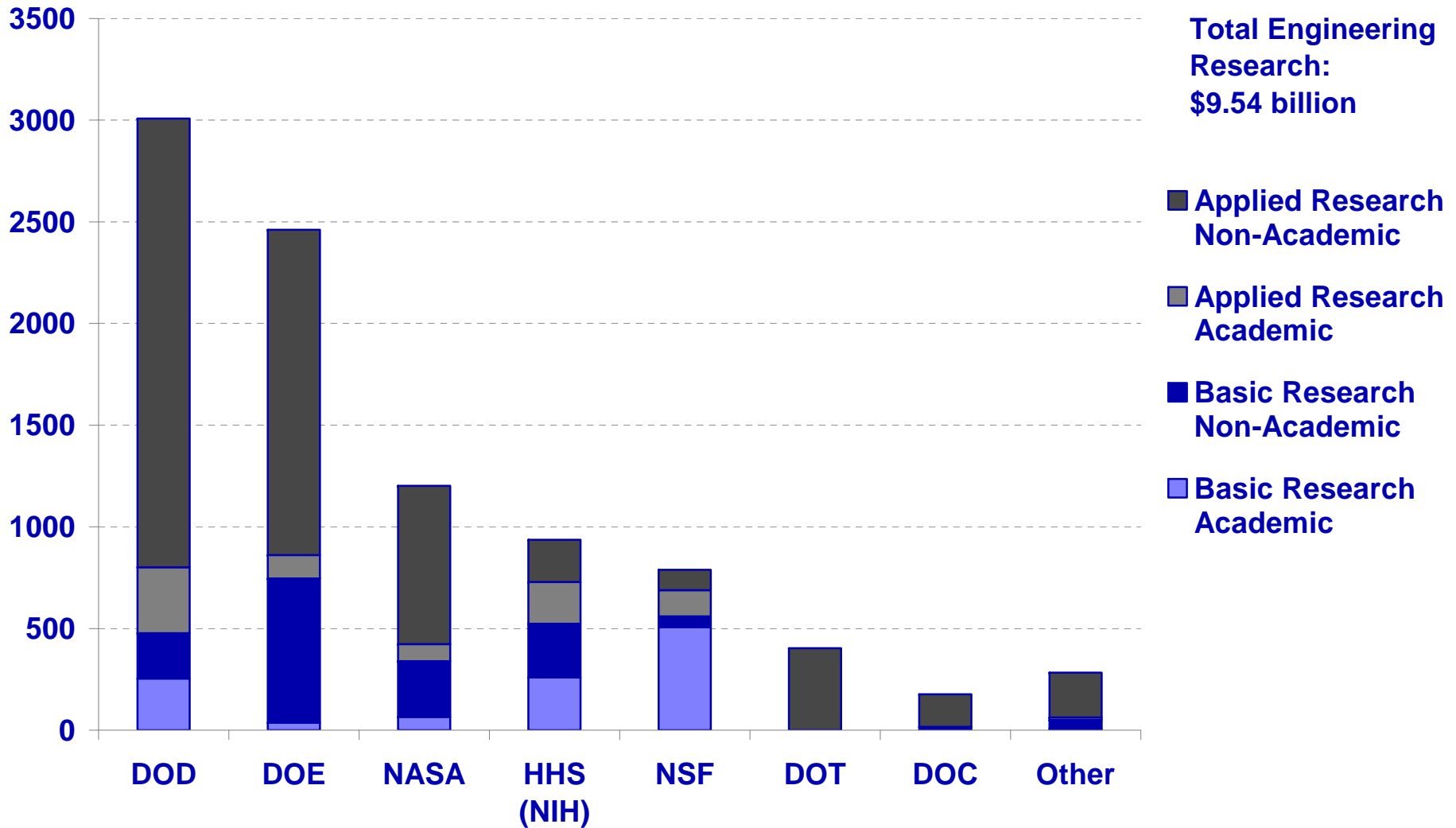


# FY 2012 House Action

- Homeland Security
  - R&D: -41.5% to \$416m; Program funding down 83.9% to \$107m
- Agriculture
  - R&D: -16.2% to \$1.7b; Extramural faces slightly bigger cuts
- Defense
  - RDT&E: -2.8% to \$73.4b
- Energy and Water:
  - Energy Efficiency and Renewable Energy: -27.3% to \$1.3b
  - Office of Science: -0.9% to \$4.8b
  - ARPA-E: -44.3% to \$100b
  - \$35m for Yucca Mountain, \$10m for license review

# Federally Funded Engineering Research: FY 2008

obligations in millions of dollars



Source: National Science Foundation, *Federal Funds for Research and Development*.

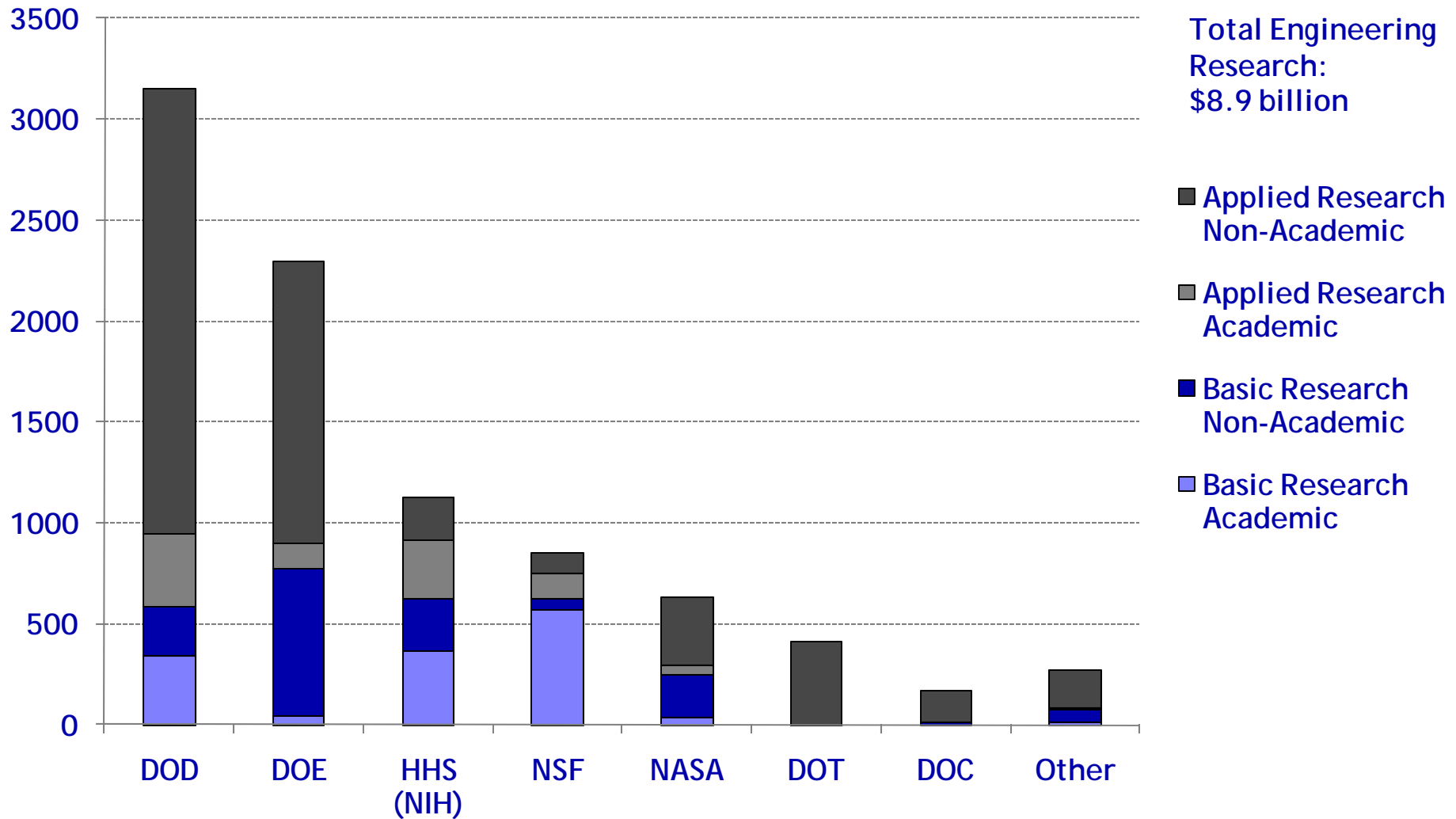
FY 2008 figures are preliminary.

© 2009 AAAS



# Federally Funded Engineering Research: FY 2009

obligations in millions of dollars



Source: National Science Foundation, *Federal Funds for Research and Development*.

FY 2009 figures are preliminary.

© 2010 AAAS



# Industry Innovation Initiatives

- SBIR/STTR Extended through September 30, 2011
  - Keeps same percentages (SBIR: 2.5%, STTR: 0.3%)
- R&D Tax Credit Proposal
  - Make the tax credit permanent
  - Increase simple formula credit from 14 to 17 percent
- ARRA Report: \$100 billion in innovation
  - \$18.7 billion in R&D
- H.R.5297 - Small Business Jobs and Credit Act
  - \$30 billion small business lending fund; \$12 billion in tax breaks
- "Make it in America" and "Startup America" Initiatives
- Patent Reform: S.23 and H.R.1249
- Manufacturing Investments and Training: NSF, DARPA, NIST, DOE

# Policy Discussions

- Spending cuts vs. revenue increases
- Federal applied research funding (esp. DOE, DOT)
- Stimulus funding cliff
- Climate Science Funding
- NASA: Human space flight
- NIH: National Center for Advancing Translational Sciences
- NIH: Research capacity
- NSF: Innovation agency
- USDA: Adapting to fewer earmarks

# STAR-METRICS

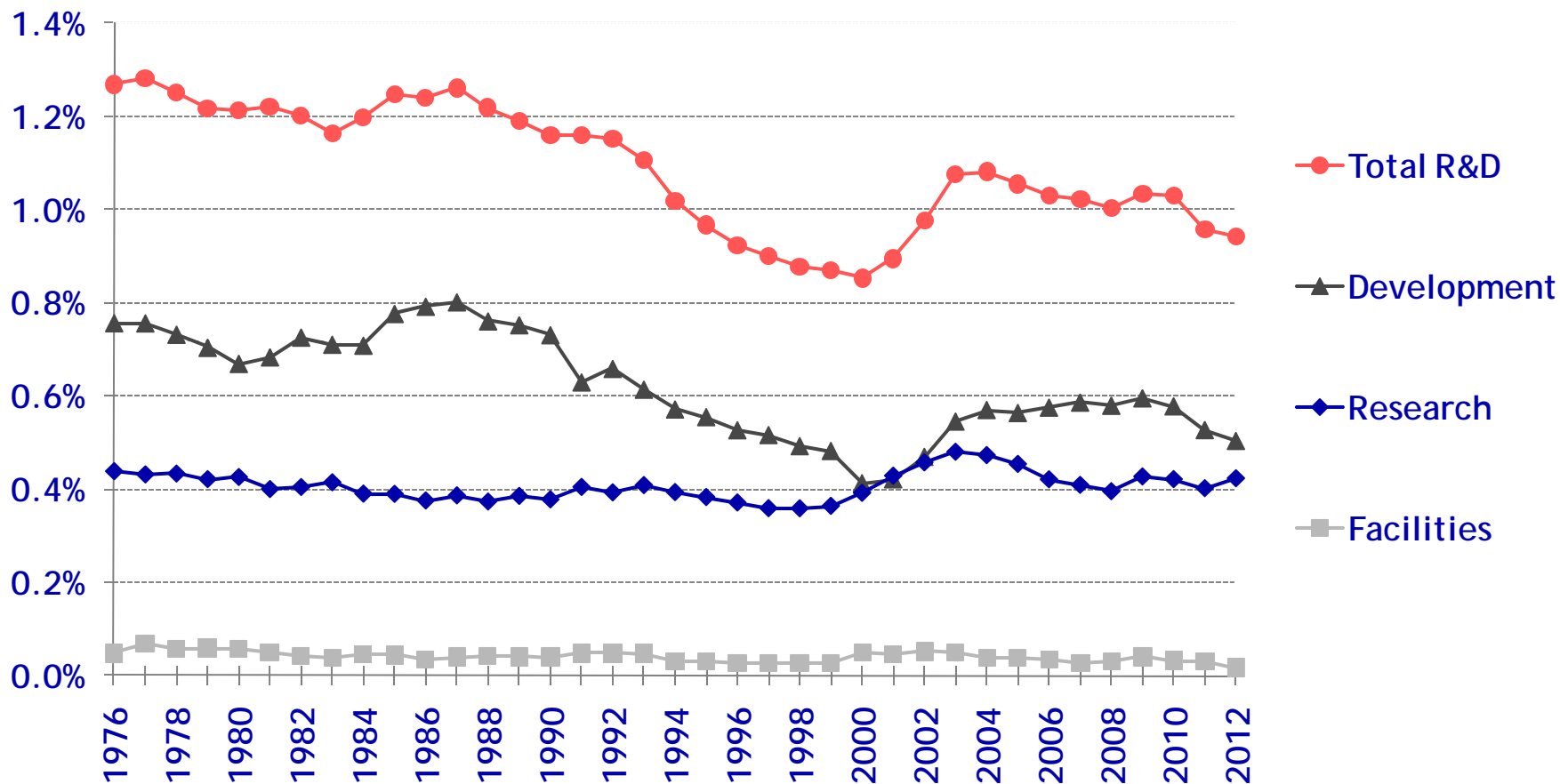
- \$1 million to measure the impact of R&D funding
  - OSTP, NSF, NIH initially involved
- Starting with Recovery Act monies
- Phase 1 - Employment statistics from university records
- Phase 2 - Measure economic growth, scientific knowledge, social outcomes from a broader set of records
- Phase x - Measure impact of yearly budgetary funding

# International R&D Investment

- The United States leads the world in R&D investment
  - \$398b PPP, 34.6% 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

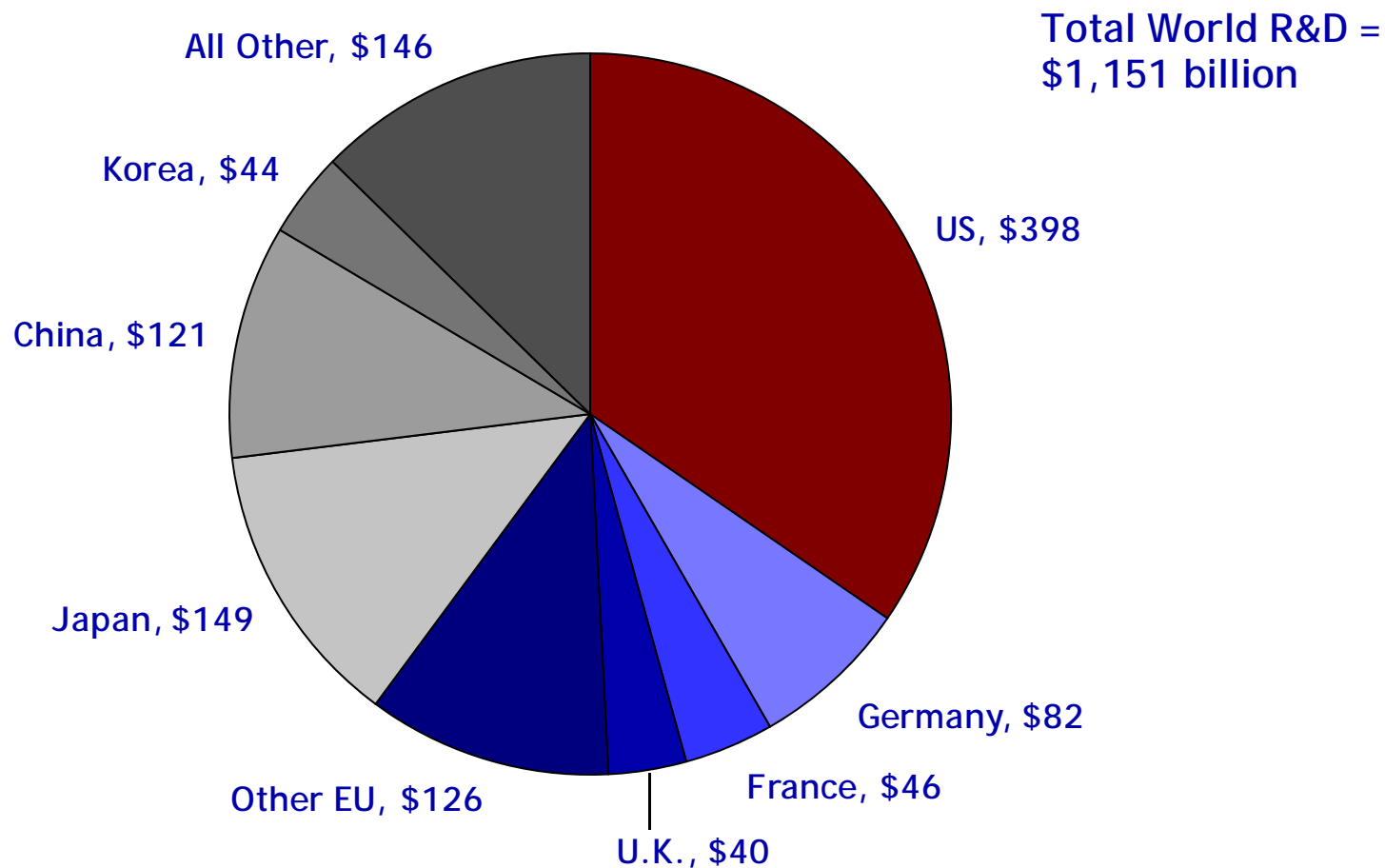


Source: Up to 1994 - National Science Foundation / National Center for Science and Engineering Statistics, Survey of Federal Funds for Research and Development; 1995 to Present - AAAS Report: Research and Development series; GDP figures are from Budget of the U.S. Government FY 2012. FY 2011 and FY 2012 figures are latest estimates.  
© 2011 AAAS



# Total World R&D, 2008

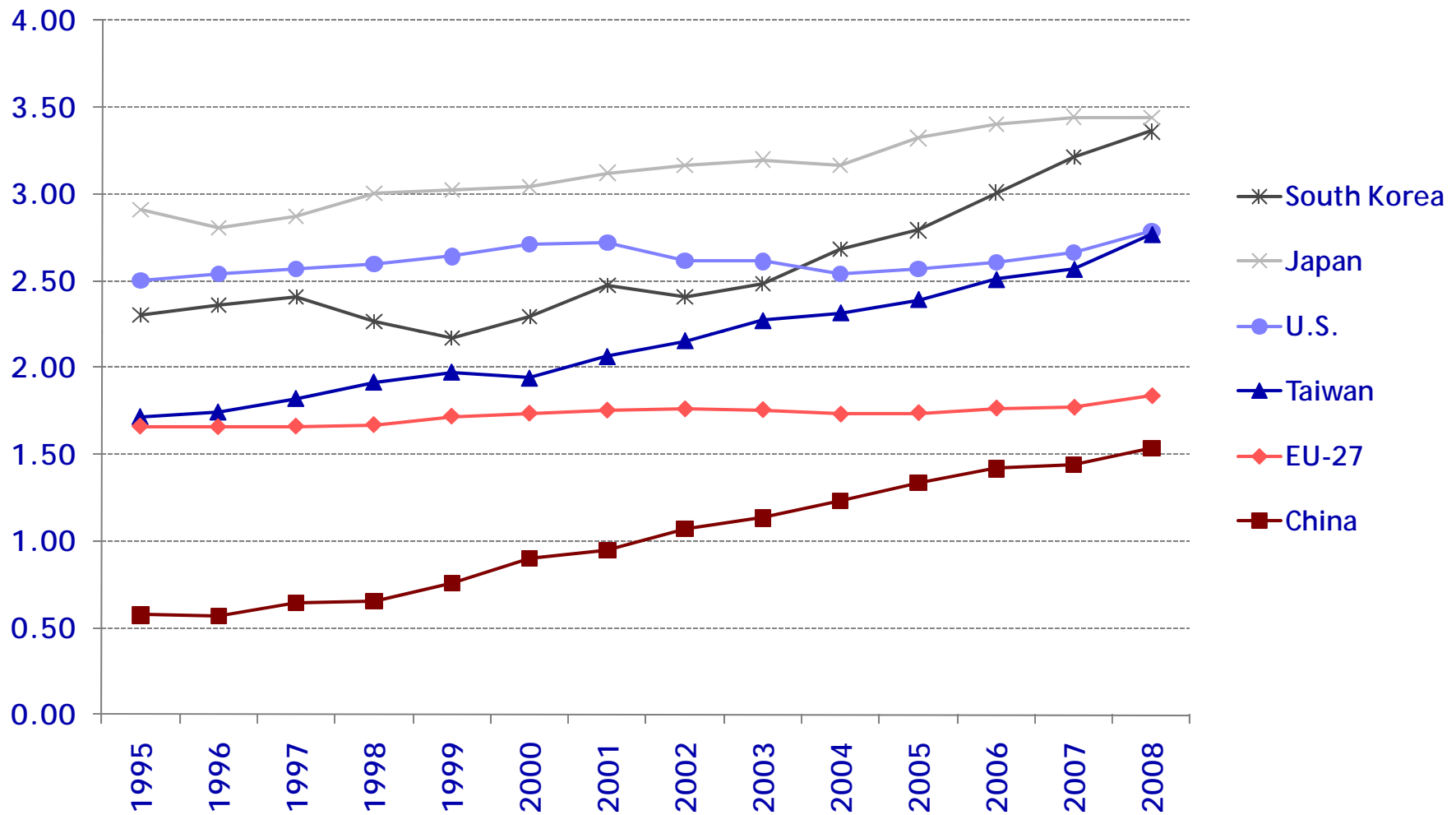
in billions of PPP \$



Source: OECD, Main Science and Technology Indicators, February 2011.  
World = OECD members plus Argentina, China, Romania, Russian Federation,  
Singapore, South Africa, Taiwan.  
Calculated using purchasing power parities.  
© 2011 AAAS

# National R&D Investment

percent of GDP



Source: OECD, Main Science and Technology Indicators, February 2011.

© 2011 AAAS



# Next Steps

- Debt Ceiling Limit Increase
  - \$14.3 trillion limit was reached on May 16.
  - Treasury can delay default until August 2.
- FY 2012
  - House budget resolution passed: \$1.019 trillion
  - President's budget: \$1.116 trillion originally
  - Senate "Gang of Six/Five": Long-term plan
  - Biden negotiations: Short-term plan for debt limit increase
  - Budget will continue to be in the limelight

## For More Information...

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

Twitter: @AAAS\_RDBudget

### AAAS REPORT XXXVI Research & Development FY 2012

Intersociety Working Group

