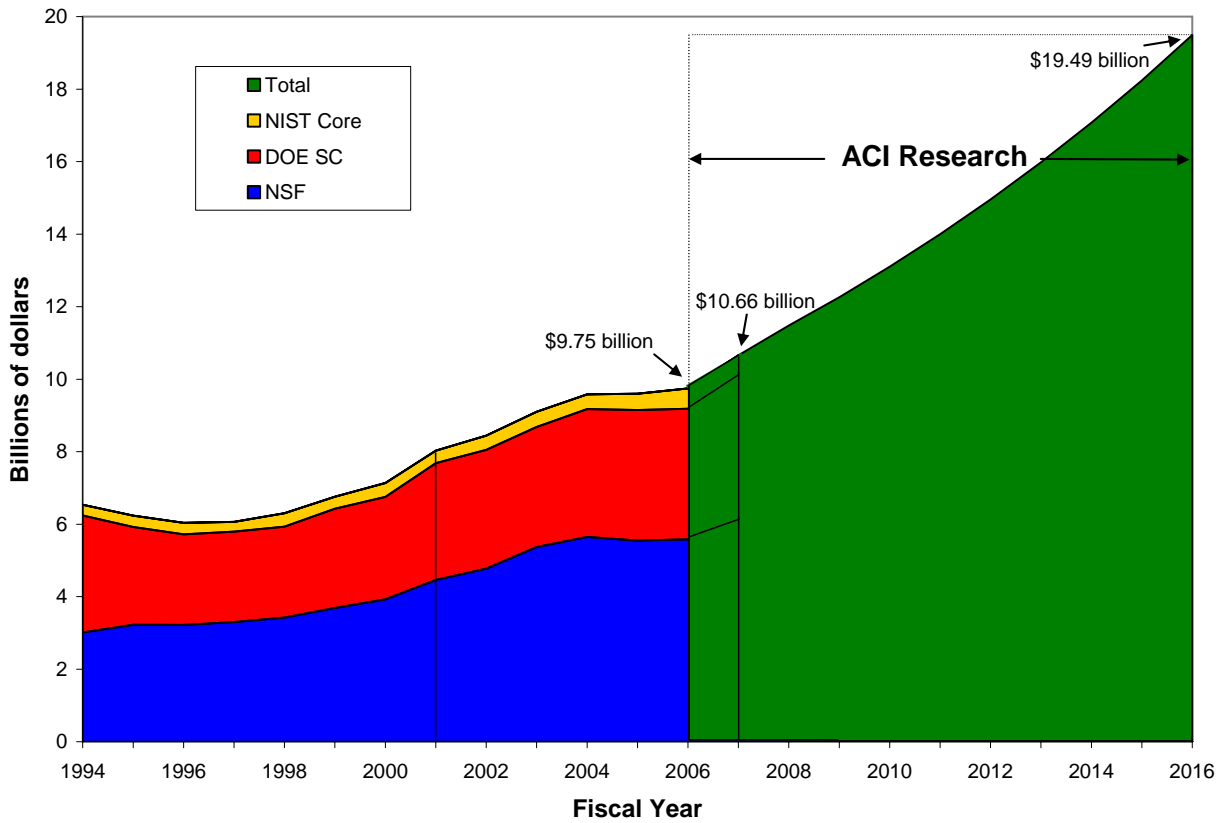


# OFFICE OF SCIENCE AND TECHNOLOGY POLICY

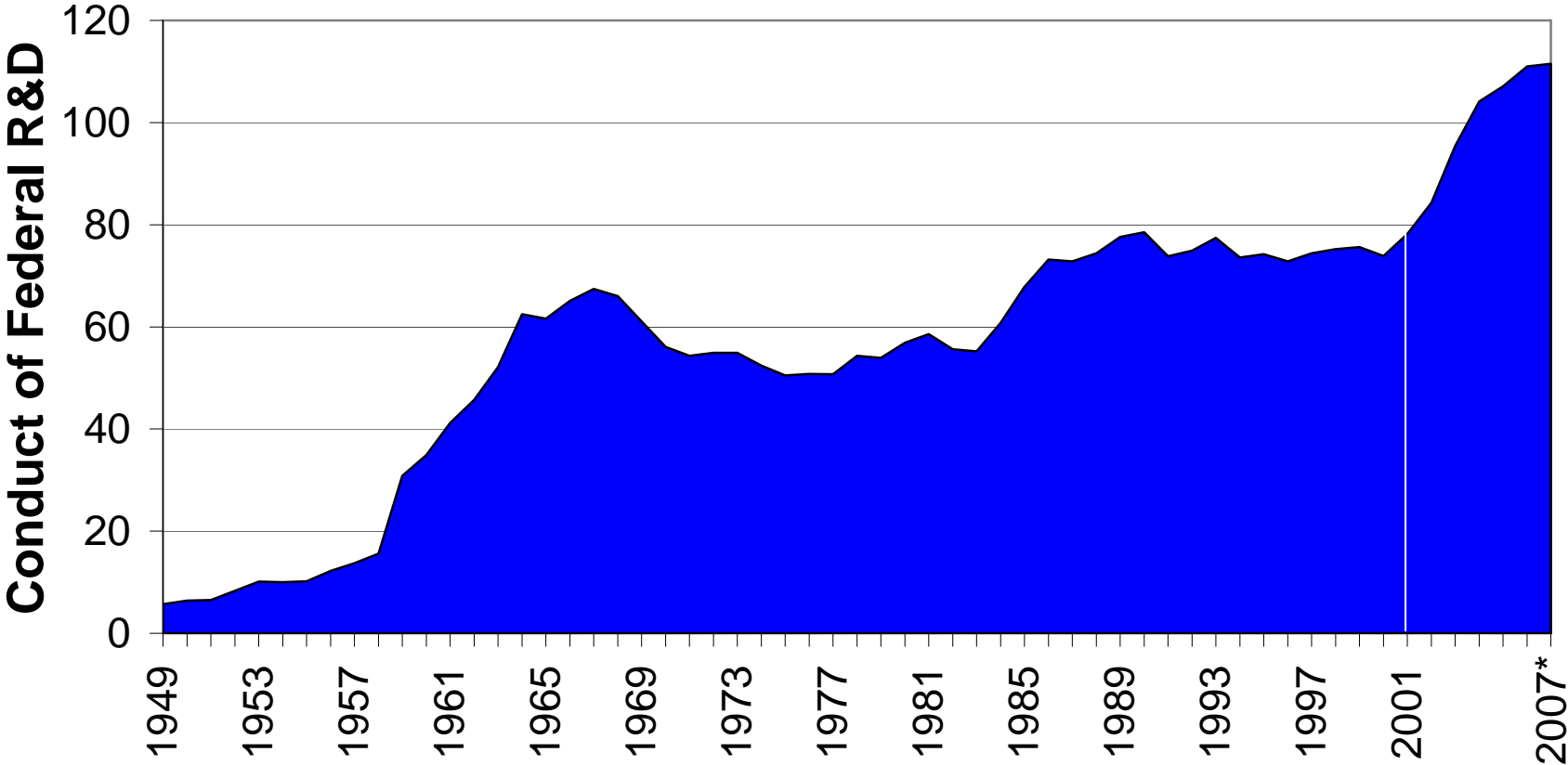
## FY 2007 FEDERAL RESEARCH AND DEVELOPMENT BUDGET PRESENTATION

FEBRUARY 6, 2006

### American Competitiveness Initiative Research: FY 2007- FY 2016

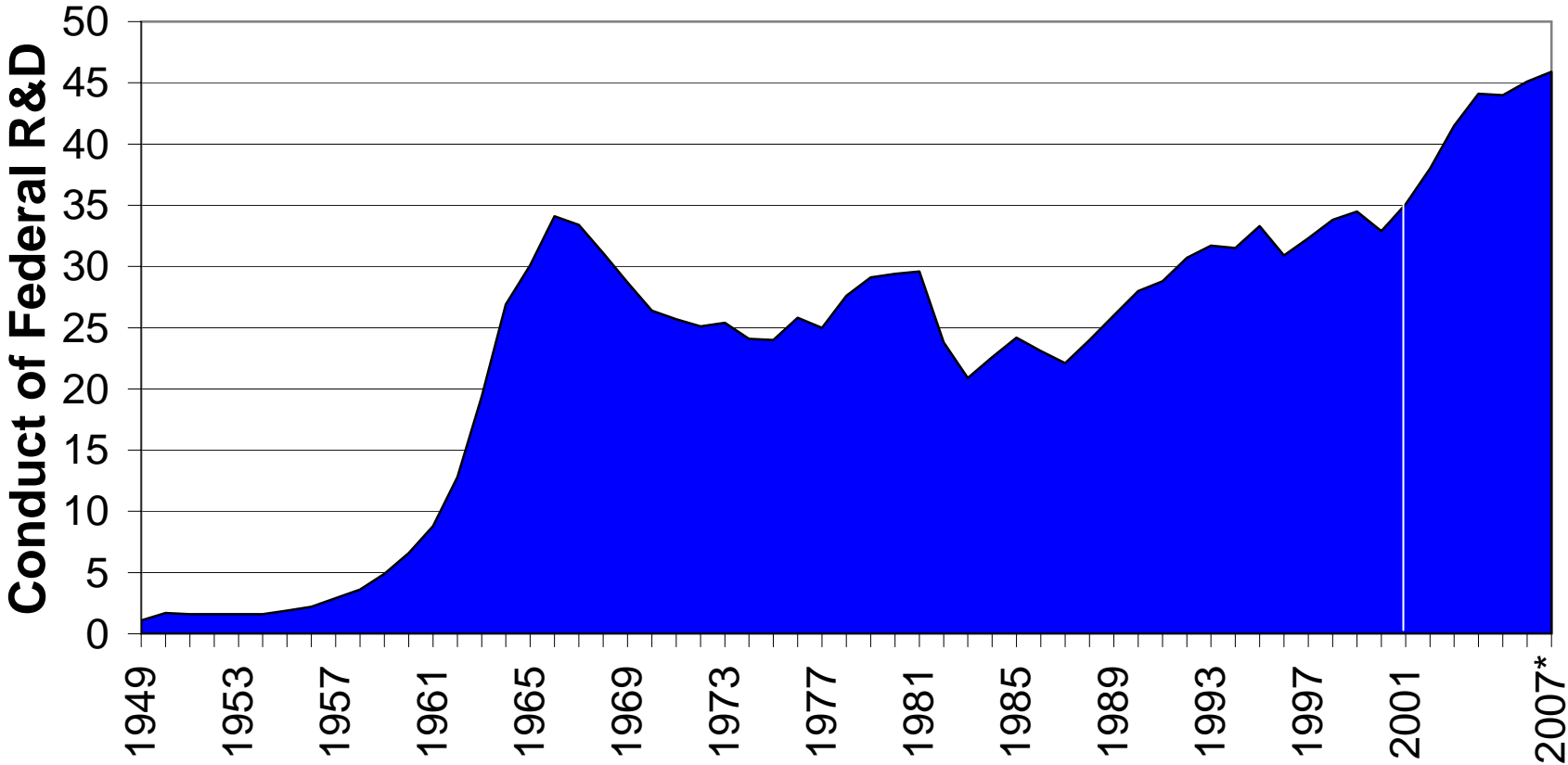


# Federal R&D Spending (Outlays in billions, constant 2000 dollars)



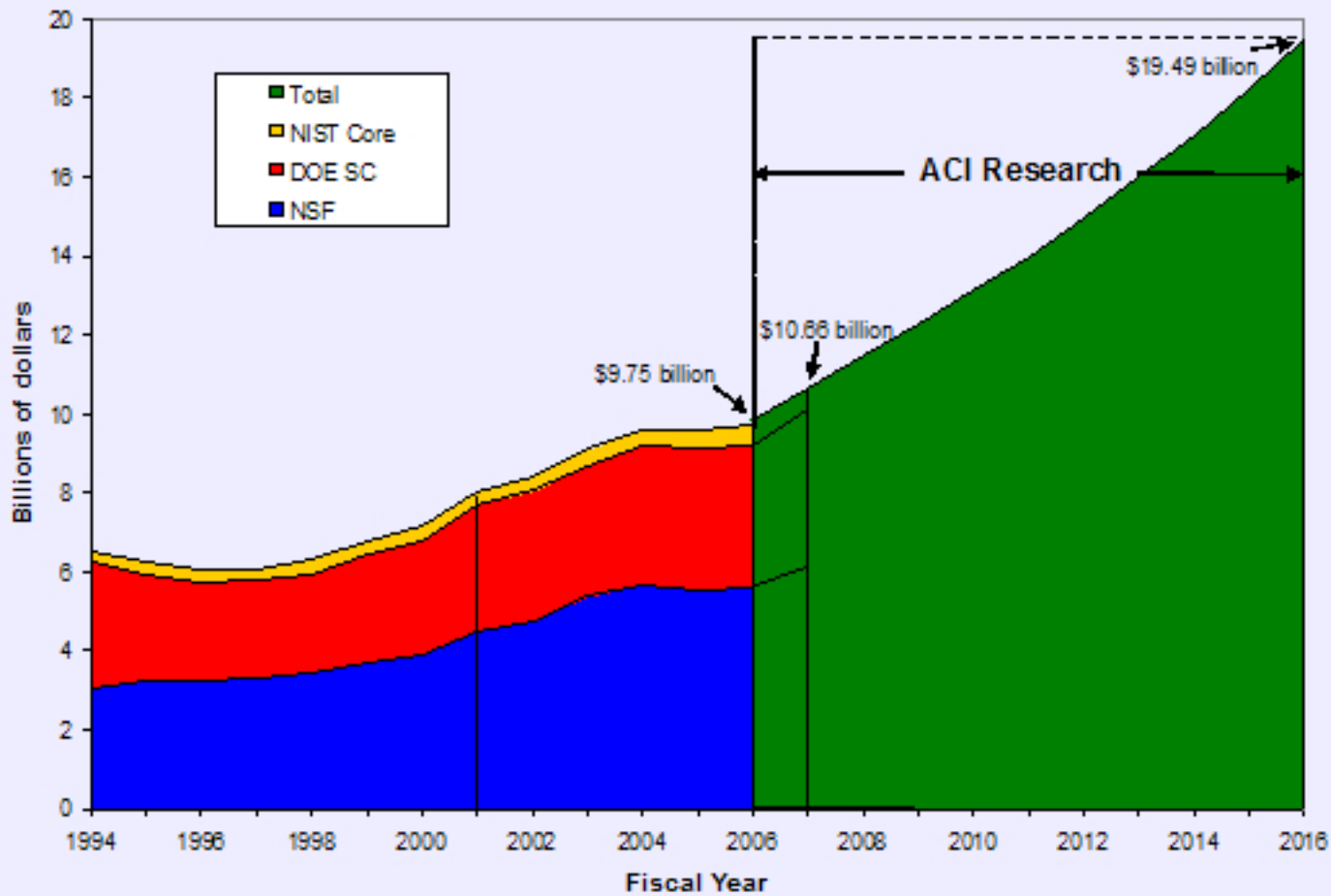
\*President's 2007 Budget

# Federal Non-Defense R&D Spending (Outlays in billions, constant 2000 dollars)



\*President's 2007 Budget

## American Competitiveness Initiative Research: FY 2007 - FY 2016



	<b>FY 2006 Funding</b>	<b>ACI Research FY 2007</b>		<b>ACI Research FY 2016</b>	
	(billions of dollars)	(billions of dollars)	% increase	(billions of dollars)	% increase over FY06
<b>NSF</b>	\$5.58	\$6.02	7.8	\$11.16 <sup>1</sup>	100.0
<b>DoE SC</b>	\$3.60	\$4.10	14.0	\$7.19 <sup>1</sup>	100.0
<b>NIST Core<sup>2</sup></b>	\$0.57 <sup>3</sup>	\$0.54	-5.8 <sup>4</sup>	\$1.14 <sup>1</sup>	100.0
<b>TOTAL</b>	\$9.75	\$10.66	9.3	\$19.49	100.0

<sup>1</sup> ACI doubles total research fund; individual agency allocations remain to be determined.

<sup>2</sup> NIST core consists of NIST lab research and construction accounts.

<sup>3</sup> The 2006 enacted level for NIST core includes \$137 million in earmarks.

<sup>4</sup> Represents a 24 percent increase after accounting for earmarks.

## FEDERAL RESEARCH AND DEVELOPMENT SPENDING

(Budget authority, dollar amounts in millions)

	2001 Actual*	2006 Estimate	2007 Proposed	Dollar Change: 2001 to 2007	Percent Change: 2001 to 2007
<b>Total R&amp;D, by Agency</b>					
Defense	42,235	71,946	74,234	31,999	76%
Health and Human Services	21,037	28,767	28,737	7,700	37%
National Aeronautics and Space Administration**	9,675	11,394	12,245	2,570	27%
Energy	7,772	8,563	9,158	1,386	18%
National Science Foundation	3,363	4,199	4,548	1,185	35%
Agriculture	2,182	2,411	2,012	-170	-8%
Homeland Security	N/A	1,484	1,508	1,467	N/A
Commerce	1,054	1,079	1,065	11	1%
Veterans Affairs	748	765	765	17	2%
Interior	622	637	600	-22	-4%
Transportation	792	704	557	-235	-30%
Environmental Protection Agency	598	600	557	-41	-7%
Education	264	299	302	38	14%
Other	922	933	916	-6	-1%
<b>TOTAL</b>	<b>91,264</b>	<b>133,781</b>	<b>137,204</b>	<b>45,940</b>	<b>50%</b>
<b>Basic Research</b>					
Defense	1,271	1,470	1,422	151	12%
Health and Human Services	11,601	15,996	16,037	4,436	38%
National Aeronautics and Space Administration**	1,652	2,305	2,226	574	35%
Energy	2,390	2,987	3,315	925	39%
National Science Foundation	2,894	3,478	3,687	793	27%
Agriculture	801	846	771	-30	-4%
Homeland Security	N/A	95	49	112	N/A
Commerce	50	56	87	37	74%
Veterans Affairs	301	306	306	5	2%
Interior	56	42	40	-16	-29%
Transportation	17	39	39	22	129%
Environmental Protection Agency	105	101	94	-11	-10%
Education	2	13	13	11	550%
Other	190	156	161	-29	-15%
<b>SUBTOTAL</b>	<b>21,330</b>	<b>27,890</b>	<b>28,247</b>	<b>6,917</b>	<b>32%</b>
<b>Applied Research</b>					
Defense	3,673	5,169	4,478	805	22%
Health and Human Services	9,064	12,605	12,540	3,476	38%
National Aeronautics and Space Administration**	2,533	1,759	1,118	-1,415	-56%
Energy	2,330	2,730	2,723	393	17%
National Science Foundation	181	319	379	198	109%
Agriculture	1,045	1,157	974	-71	-7%
Homeland Security	N/A	1,093	943	399	N/A
Commerce	768	779	769	1	0%
Veterans Affairs	432	414	414	-18	-4%
Interior	534	545	510	-24	-4%
Transportation	445	392	305	-140	-31%
Environmental Protection Agency	370	387	359	-11	-3%
Education	172	187	190	18	10%
Other	413	404	404	-9	-2%
<b>SUBTOTAL</b>	<b>21,960</b>	<b>27,940</b>	<b>26,106</b>	<b>4,146</b>	<b>19%</b>

\* 2001 numbers are as published in the 2003 Budget, prior to the creation of the Department of Homeland Security.

\*\* NASA has modified how it accounts for costs since 2001; the numbers in this table are not fully comparable.

## FEDERAL RESEARCH AND DEVELOPMENT SPENDING---Continued

(Budget authority, dollar amounts in millions)

	2001 Actual*	2006 Estimate	2007 Proposed	Dollar Change: 2001 to 2007	Percent Change: 2001 to 2007
<b>Development</b>					
Defense	37,270	65,221	68,315	31,045	83%
Health and Human Services	107	37	37	-70	-65%
National Aeronautics and Space Administration**	2,698	5,174	6,755	4,057	150%
Energy	2,042	1,804	1,990	-52	-3%
National Science Foundation	0	0	0	0	N/A
Agriculture	152	164	155	3	2%
Homeland Security	N/A	195	335	746	N/A
Commerce	170	118	94	-76	-45%
Veterans Affairs	15	45	45	30	200%
Interior	32	47	47	15	47%
Transportation	247	255	194	-53	-21%
Environmental Protection Agency	101	112	104	3	3%
Education	90	99	99	9	10%
Other	306	325	310	4	1%
<b>SUBTOTAL</b>	<b>43,230</b>	<b>73,596</b>	<b>78,480</b>	<b>35,250</b>	<b>82%</b>
<b>Facilities and Equipment</b>					
Defense	21	86	19	-2	-10%
Health and Human Services	265	129	123	-142	-54%
National Aeronautics and Space Administration**	2,792	2,156	2,146	-646	-23%
Energy	1,010	1,042	1,130	120	12%
National Science Foundation	288	402	482	194	67%
Agriculture	184	244	112	-72	-39%
Homeland Security	N/A	101	181	210	N/A
Commerce	66	126	115	49	74%
Veterans Affairs	0	0	0	0	N/A
Interior	0	3	3	3	N/A
Transportation	83	18	19	-64	-77%
Environmental Protection Agency	22	0	0	-22	-100%
Education	0	0	0	0	N/A
Other	13	48	41	28	215%
<b>SUBTOTAL</b>	<b>4,744</b>	<b>4,355</b>	<b>4,371</b>	<b>-373</b>	<b>-8%</b>

\* 2001 numbers are as published in the 2003 Budget, prior to the creation of the Department of Homeland Security.

\*\* NASA has modified how it accounts for costs since 2001; the numbers in this table are not fully comparable.

## FEDERAL SCIENCE AND TECHNOLOGY BUDGET

(Budget authority, dollar amounts in millions)

	2001 Actual	2006 Estimate	2007 Proposed	Dollar Change: 2001 to 2007	Percent Change: 2001 to 2007
<b>By Agency</b>					
<b>National Institutes of Health</b>	<b>20,361</b>	<b>28,410</b>	<b>28,428</b>	<b>8,067</b>	<b>40%</b>
<b>National Aeronautics and Space Administration*</b>	<b>6,945</b>	<b>7,680</b>	<b>7,073</b>	<b>128</b>	<b>2%</b>
Science	4,371	5,254	5,330	959	22%
Aeronautics	975	884	724	-251	-26%
Exploration Systems	1,599	1,542	1,019	-580	-36%
<b>Energy</b>	<b>4,886</b>	<b>5,636</b>	<b>6,155</b>	<b>1,269</b>	<b>26%</b>
Science Programs	3,218	3,596	4,102	884	27%
Electricity Transmission & Distribution	56	136	96	40	71%
Nuclear Energy	238	416	559	321	135%
Energy Efficiency and Renewable Energy Resources	931	896	933	2	0%
Fossil Energy	443	592	465	22	5%
<b>National Science Foundation</b>	<b>4,431</b>	<b>5,581</b>	<b>6,020</b>	<b>1,589</b>	<b>36%</b>
<b>Defense</b>	<b>4,944</b>	<b>6,628</b>	<b>5,900</b>	<b>956</b>	<b>19%</b>
Basic Research	1,271	1,470	1,422	151	12%
Applied Research	3,673	5,158	4,478	805	22%
<b>Agriculture</b>	<b>1,765</b>	<b>2,160</b>	<b>1,921</b>	<b>156</b>	<b>9%</b>
CSREES Research & Education	514	675	569	55	11%
Economic Research Service	69	75	83	14	20%
Agricultural Research Service	936	1,131	1,001	65	7%
Forest Service: Forest and Rangeland Research	246	279	268	22	9%
<b>Interior (USGS)</b>	<b>884</b>	<b>962</b>	<b>945</b>	<b>61</b>	<b>7%</b>
<b>Commerce</b>	<b>662</b>	<b>938</b>	<b>873</b>	<b>211</b>	<b>32%</b>
NOAA: Oceanic & Atmospheric Research	315	370	338	23	7%
NIST: Intramural Research	312	395	467	155	50%
NIST: Intramural Facilities	35	174	68	33	95%
<b>Environmental Protection Agency</b>	<b>746</b>	<b>761</b>	<b>816</b>	<b>70</b>	<b>9%</b>
<b>Veterans Affairs</b>	<b>719</b>	<b>765</b>	<b>765</b>	<b>46</b>	<b>6%</b>
<b>Transportation</b>	<b>521</b>	<b>563</b>	<b>598</b>	<b>77</b>	<b>15%</b>
Highway research: Federal Highway Administration	387	426	468	81	21%
Federal Aviation Administration: Research, Engineering	134	137	130	-4	-3%
<b>Education</b>	<b>298</b>	<b>342</b>	<b>342</b>	<b>44</b>	<b>15%</b>
Special Education Research and Innovation	77	72	72	-5	-6%
National Institute on Disability and Rehabilitation	100	107	107	7	7%
Research, Development, and Dissemination	121	163	163	42	35%
<b>TOTAL</b>	<b>47,162</b>	<b>60,426</b>	<b>59,836</b>	<b>12,674</b>	<b>27%</b>

\* NASA has modified how it accounts for costs since 2001; the numbers in this table are not fully comparable.

## CIVILIAN PROGRAMS IN THE FEDERAL SCIENCE AND TECHNOLOGY BUDGET

(Budget authority, dollar amounts in millions)

	2006 Estimate	2007 Proposed	Dollar Change: 2006 to 2007	Percent Change: 2006 to 2007
<b>By Agency</b>				
<b>National Institutes of Health</b>	28,410	28,428	18	0%
<b>National Aeronautics and Space Administration*</b>	7,680	7,073	-607	-8%
Science	5,254	5,330	76	1%
Aeronautics	884	724	-160	-18%
Exploration Systems	1,542	1,019	-523	-34%
<b>Energy</b>	5,636	6,155	519	9%
<b>Science Programs</b>	3,596	4,102	506	14%
Electricity Transmission & Distribution	136	96	-40	-29%
Nuclear Energy	416	559	143	34%
Energy Efficiency and Renewable Energy Resources	896	933	37	4%
Fossil Energy	592	465	-127	-21%
<b>National Science Foundation</b>	5,581	6,020	439	8%
<b>Agriculture</b>	2,160	1,921	-239	-11%
CSREES Research & Education	675	569	-106	-16%
Economic Research Service	75	83	8	11%
Agricultural Research Service	1,131	1,001	-130	-11%
Forest Service: Forest and Rangeland Research	279	268	-11	-4%
<b>Interior (USGS)</b>	962	945	-17	-2%
<b>Commerce</b>	938	873	-65	-7%
NOAA: Oceanic & Atmospheric Research	370	338	-32	-9%
<b>NIST: Intramural Research</b>	395	467	72	18%
<b>NIST: Intramural Facilities</b>	174	68	-106	-61%
<b>Environmental Protection Agency</b>	761	816	55	7%
<b>Veterans Affairs</b>	765	765	0	0%
<b>Transportation</b>	563	598	35	6%
Highway research: Federal Highway Administration	426	468	42	10%
Federal Aviation Administration: Research, Engineering	137	130	-7	-5%
<b>Education</b>	342	342	0	0%
Special Education Research and Innovation	72	72	0	0%
National Institute on Disability and Rehabilitation	107	107	0	0%
Research, Development, and Dissemination	163	163	0	0%
<b>TOTAL</b>	<b>53,798</b>	<b>53,936</b>	<b>138</b>	<b>0.3%</b>

■ Denotes ACI Research Component



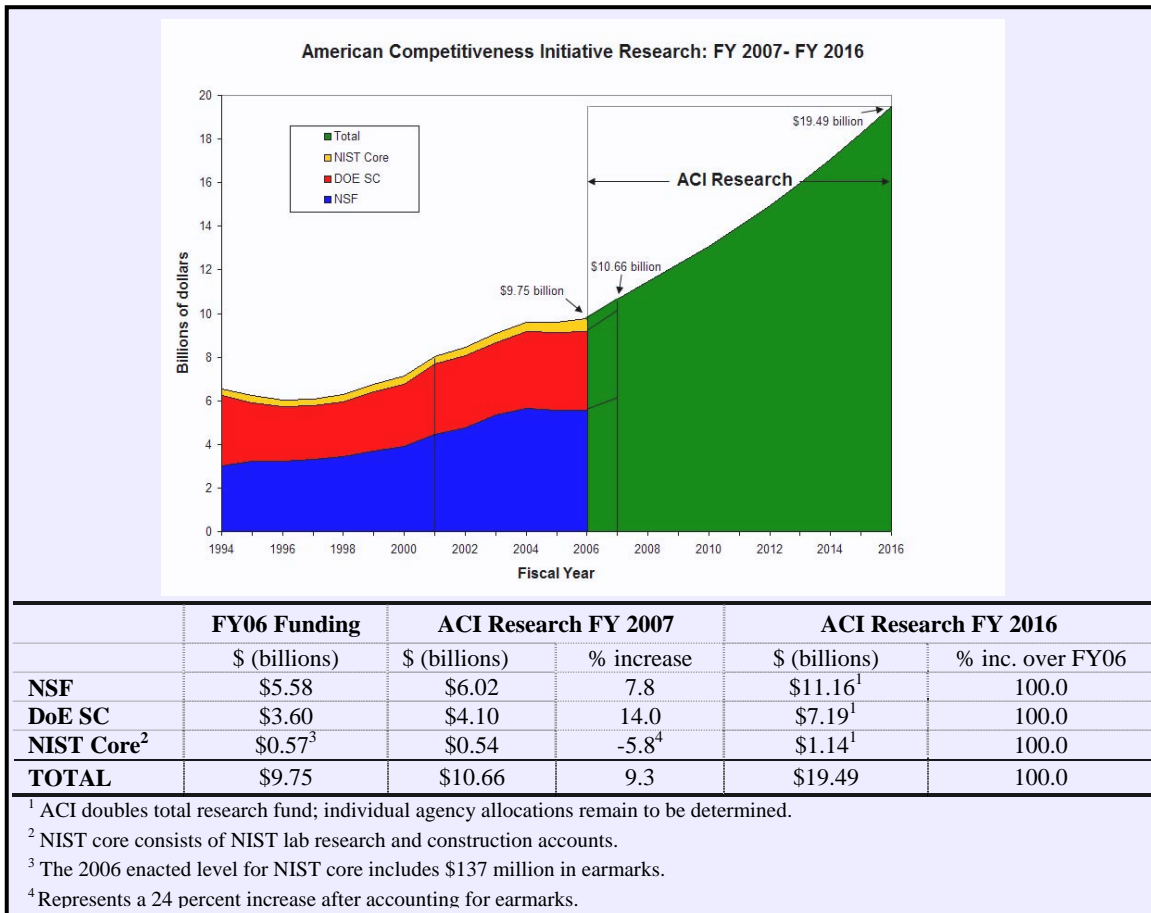


**AMERICAN COMPETITIVENESS INITIATIVE**  
*Research and Development Funding in the President's 2007 Budget*

American economic strength and national security depend on our Nation's rich tradition of innovation. To ensure continued technological leadership in the world and build on the Administration's record of results, President Bush announced the *American Competitiveness Initiative* (ACI) in his State of the Union address. The ACI commits \$5.9 billion in FY 2007, and more than \$136 billion over 10 years, to increase investments in R&D, strengthen education, and encourage entrepreneurship and innovation.

The centerpiece of the *American Competitiveness Initiative* is the President's proposal to double, over ten years, priority basic research in the physical sciences and engineering. Physical sciences research develops and advances knowledge and technologies that are used by scientists in nearly every other field. President Bush seeks to strengthen Federal investments in this area by providing three key, innovation-enabling research agencies with landmark initial investments in 2007: the National Science Foundation (NSF) \$6 billion; the Department of Energy's Office of Science (DoE SC) \$4.1 billion; and the Department of Commerce's National Institute of Standards and Technology (NIST) core programs \$535 million. In addition to the collective doubling effort at these agencies, the President's Budget also prioritizes the similarly high-leverage basic and applied research at the Department of Defense in 2007 by requesting \$5.9 billion, \$440 million (8 percent) more than last year's request.

In 2007, the ACI proposes overall funding increases for NSF, DoE SC and NIST core of \$910 million, or 9.3 percent. To achieve ten-year doubling, overall annual increases for these agencies will average roughly 7 percent. This amounts to a total of \$50 billion in new investments in high-leverage, innovation-enabling research that will underpin and complement shorter-term R&D performed by the private sector. To encourage private investment in innovation to be equally bold, President Bush continues to propose making the R&D tax credit permanent and supports modernizing it to make it even more effective.





## EARMARKS

### *Research and Development Funding in the President's 2007 Budget*

The Administration strongly supports awarding research funds based on merit review through a competitive process. Such a system generally ensures that the best research is supported. Research earmarks—the assignment of money during the legislative process for use only by a specific organization or project—are counter to a merit-based competitive selection process. Earmarks signal to potential investigators that there is an acceptable alternative to creating quality research proposals for merit-based consideration, including the use of political influence or appeals to parochial interests. Such an alternative is seldom the most effective use of taxpayer funds.

Unfortunately, the practice of earmarking to colleges, universities and other entities for specific research projects has expanded dramatically in recent years. The American Association for the Advancement of Science (AAAS) recently estimated that R&D earmarks total \$2.4 billion in FY 2006, an increase of \$275 million, or 13 percent, over the Association's FY 2005 estimate. This figure has increased by 63 percent since FY 2003.

Some argue that earmarks help spread the research money to states or institutions that would receive less research funding through other means. *The Chronicle of Higher Education* has reported that this is not the main role earmarks play. Often only a minor portion of academic earmark funding goes to the states with the smallest shares of Federal research funds.

Some proponents of earmarking assert that earmarks provide a means of funding unique projects that would not be recognized by the conventional peer-review process. To address this concern, a number of research agencies have procedures and programs to reward "out-of-the-box" thinking. For example, within the Department of Defense (DoD), the Defense Advanced Research Projects Agency seeks out high-risk, high-payoff scientific proposals, and program managers at the National Science Foundation (NSF) set aside a share of funding for higher-risk projects in which they see exciting potential.

The rapidly growing level of legislatively directed research funds undermines America's research productivity. The Administration commends Congress for taking measures to protect the National Science Foundation and National Institutes of Health from this practice. However, in FY 2006, DoD basic and applied research earmarks total about \$1 billion; \$135 million of the DoE Office of Science is earmarked; and \$137 million in earmarks seriously dilute the core research proposed at the National Institute of Standards and Technology. To maximize the effectiveness of federally-funded research, the President calls upon Congress and the academic community to withhold securing research and facilities funding through earmarks, particularly in the *American Competitiveness Initiative* agencies.



## PHYSICAL SCIENCES

### *Research and Development Funding in the President's 2007 Budget*

Research in the physical sciences and engineering is at the heart of technological innovation for priority areas of nanotechnology, networking and information technologies, energy technologies, defense technologies, and space exploration. Physical science research leads to a better understanding of nature and the universe, and drives innovation in all fields of science, contributing significantly to the Nation's prosperity. The President's 2007 Budget, through the American Competitiveness Initiative, provides substantial increases in the Nation's investment in the physical sciences and engineering, particularly in the areas that stimulate innovation and contribute to the Nation's competitiveness in the global economy.

**National Science Foundation.** The President's 2007 Budget provides a landmark \$6.02 billion for NSF, an increase of 8 percent over 2006 funding. Included within this total is \$1.15 billion for Mathematical and Physical Sciences (MPS), an increase of 6 percent, and increases in Engineering of 8 percent, in Geosciences of 6 percent, and in Computer and Information Science and Engineering of 6 percent. Within MPS, the themes to be emphasized include the Physics of the Universe and elementary particle physics, Physical Sciences at the Nanoscale, and the Molecular Basis of Life Processes. Funding for the Office of Cyberinfrastructure increases by 44 percent to over \$182 million.

**Department of Energy.** The President's Budget provides \$4.1 billion for DOE's Office of Science. The Budget includes funding for priorities such as nanotechnology (\$257M), basic research in support of the hydrogen fuel initiative (\$50M), and high-end computing facilities (\$157M). The Budget also provides funding (\$45M) for project engineering and design and research and development for the National Synchrotron Light Source II-a new x-ray light source that will enable the study of material properties and functions, particularly materials at the nanoscale, at a level of detail and precision never before possible. The U.S. contribution to ITER is fully funded at \$60 million. Robust operations funding will enable peak scientific productivity of major particle physics facilities at Fermilab and Stanford, the nuclear physics facilities at Brookhaven National Laboratory and Thomas Jefferson National Laboratory, and the suite of light sources and neutron sources.

**Department of Commerce.** Also a high priority for 2007, the President's Budget provides \$535 million for the National Institute of Standards and Technology laboratory programs and facilities, an increase of 24 percent after accounting for unrequested earmarks. This includes \$104 million in new initiatives in research and measurements in high-leverage areas such as advanced manufacturing, nanofabrication, homeland security, biosystems and health, new energy sources including hydrogen, and quantum computing.

**National Aeronautics and Space Administration.** The President's Vision for Space Exploration was announced in 2004, focusing on human and robotic exploration of the solar system and it remains a high priority for the President's 2007 Budget by providing \$16.8 billion for NASA, an increase of 3.2 percent over the FY 2006 enacted level after accounting for one-time supplemental funding. The 2007 Budget makes some difficult choices, canceling some projects with high technical risk and whose cost estimates would have led to the certain cancellation and delay of several other important programs. The President's Budget provides \$5.33 billion for Science at NASA, a \$76 million increase over 2006 spending. This investment augments the Exploration Vision by supporting critical science programs that continue our exploration of the universe and help us improve our understanding of life on Earth.

These physical sciences-related programs total \$13.4 billion in the 2007 Budget, which exceeds the 2006 enacted level by \$700 million. It should be noted that the American Association for the Advancement of Science is estimating a new high of \$2.4 billion in R&D earmarks in 2006, which work against a merit-based competitive selection process that tends to fund the best science.

#### **Selected Civilian Physical Science-Related Programs (\$ in millions)**

Department/Agency	2001 Actual	2006 Enacted	2007 Request	Change: 2001 to 2007	% Change: 2001 to 2007
NASA Science	4,371 <sup>1</sup>	5,254	5,330	N/A*	N/A*
DOE Office of Science	3,190	3,596	4,102	912	29%
NSF (MPS, GEO, CISE, ENG)	2,322	2,866	3,050	728	31%
NIST "core" (not including ITS)	347	568 <sup>2</sup>	535	188	54%
NOAA Oceanic & Atmospheric Research	315	370	338	23	7%
<b>TOTAL</b>	<b>10,545</b>	<b>12,654</b>	<b>13,355</b>	<b>2,810</b>	<b>27%</b>

<sup>1</sup>NASA science funding before 2003 is not fully comparable to later years due to full cost accounting. A comparable number for 2001 cannot be derived, but would likely be several hundred million dollars more.

<sup>2</sup>2006 funding for NIST includes \$137 million for unrelated earmarks not consistent with the core research program.



**NETWORKING AND INFORMATION TECHNOLOGY**  
*Research and Development Funding in the President's FY 2007 Budget*

President Bush's 2007 Budget of \$2.8 billion for Networking and Information Technology R&D (NITRD) represents an increase of 9% over 2006 and a 57% increase since 2001. This brings total investment in this area over six years to more than \$13.7 billion. Tools and capabilities that result from research in networking and information technologies propel advances in nearly every area of science and technology, and enhance the Nation's competitiveness. Agencies participating in the NITRD program actively coordinate their research programs, making these programs far more productive than if they were independent.

<b>NITRD Budget Authority (\$ million)</b>					
<b>Department/Agency</b>	<b>2001 Actual</b>	<b>2006 Estimate</b>	<b>2007 Request</b>	<b>Dollar Change: 2001 to 2007</b>	<b>Percent Change: 2001 to 2007</b>
National Science Foundation	\$636	\$810	\$904	\$268	42
Health and Human Services	277	563	548	271	98
Energy	326	291	387	61	19
NASA*	177	78	82	-95	-54
Defense**	310	743	790	480	155
Commerce	38	53	66	28	74
Environmental Protection Agency	4	6	6	2	50
<b>TOTAL</b>	<b>\$1,768</b>	<b>\$2,544</b>	<b>\$2,783</b>	<b>\$1,015</b>	<b>57</b>

\* NASA has modified how it accounts for costs so the 2001 numbers on this line are not fully comparable.

\*\* Includes research areas not reported as NITRD in 2001; does not include research by the military services consistent with historical NITRD reporting.

The National Science Foundation (NSF) provides the largest share of NITRD program funding, due to NSF's mission of supporting fundamental research across all disciplines of science and engineering. The other mission-oriented agencies generally support research to advance networking and information technology that has direct relevance to their specific mission. Coordinating these agency-specific research programs ensures accelerated progress on some of the Nation's highest priorities, including defense and homeland security.

High-end computing (HEC) continues to be a major focus of NITRD. DoE's Office of Science (DoE SC), NSF and NASA are all engaged in developing and/or operating leadership class computing systems as recommended in the 2004 *Federal Plan for High-End Computing*, with the goal of deploying petascale computing systems by the year 2010. The DoE SC 2007 investment of \$103M in leadership class computing, coupled with NSF's investment of \$50M in their Office of Cyber Infrastructure, will ensure that U.S. scientists and researchers have access to the most powerful computational resources in the world. Similarly, NASA continues to emphasize high-end computing within its NITRD portfolio through the operation of the *Project Columbia* supercomputer. All three agencies have pledged to make a portion of their leadership class computing systems available to other Federal users and the larger research community.

A 9% increase in support for advanced networking research in 2007, primarily by NSF, DARPA and DoE SC, will ensure that large-scale networking technologies will keep pace with the rapid development of petascale computing systems, so that the results of petascale computations are immediately accessible for analysis.

The 2007 Budget also includes significant increases in long-term fundamental research in cyber security and information assurance, as recommended by the President's Information Technology Advisory Committee. Budget increases in cyber security and information assurance for NSF (+28%), DHS (+43%) and the National Institute of Standards and Technology (+11%) will support substantial new research activities to help secure the Nation's information infrastructure, including fundamental research, and support for large-scale cyber security test beds and data sets.



**NATIONAL NANOTECHNOLOGY INITIATIVE**  
**Research and Development Funding in the President's 2007 Budget**

The President's 2007 Budget provides over \$1.2 billion for the multi-agency National Nanotechnology Initiative (NNI), bringing the total investment since the NNI was established in 2001 to over \$6.5 billion and nearly tripling the annual investment of the first year of the Initiative. This sustained investment is advancing our understanding of the unique phenomena and processes that occur at the nanometer scale and expedite the responsible use of this knowledge to achieve advances in medicine, manufacturing, high-performance materials, information technology, and energy and environmental technologies.

The NNI supports fundamental and applied research on nanotechnology by funding cutting-edge research, creating multidisciplinary centers of excellence, and developing key research infrastructure. It also supports activities aimed at addressing the societal implications of nanotechnology, including ethical, legal, human and environmental health, and workforce related issues.

Critical, broad-ranging investments continue to be made by NSF, reflecting the agency's mission in supporting fundamental research across all disciplines of science and engineering, whereas the DoD investment emphasizes development of materials, devices, and systems that address the department's mission. DOE is in the process of completing five Nanoscale Science Research Centers that will make research equipment and infrastructure available to researchers from across the scientific research community. The 2007 request by HHS includes programs at NIH emphasizing nanotechnology-based biomedical advances occurring at the intersection of biology and the physical sciences and at the National Institute of Occupational Safety and Health (NIOSH) that address implications and applications of nanotechnology for health and safety in the workplace. The 2006 estimate and 2007 request include, for the first time, contributions from the DOE Office of Fossil Energy and the USDA Forest Service.

**National Nanotechnology Initiative (dollars in millions)**

	<b>2001 Actual</b>	<b>2006 Estimate</b>	<b>2007 Proposed</b>	<b>Dollar Change 2001 to 2007</b>	<b>% Change 2001 to 2007</b>
National Science Foundation	150	344	373	223	149%
Defense	125	436	345	220	176%
Energy*	88	207	258	170	193%
Health & Human Services *	40	175	173	133	333%
Commerce (NIST)	33	76	86	53	161%
NASA	22	50	25	3	14%
EPA	5	5	9	4	80%
Agriculture *	0	5	5	5	N/A
Homeland Security	0	2	2	2	N/A
Justice	1	1	1	0	0.0%
<b>TOTAL</b>	<b>464</b>	<b>1,301<sup>†</sup></b>	<b>1,277</b>	<b>813</b>	<b>175%</b>

\* 2006 and 2007 funding levels for: DOE includes Basic Energy Sciences and Fossil Energy; HHS includes NIH and NIOSH funding; and USDA includes CSREES and Forest Service.

† 2006 estimate includes Congressional earmarks that are outside the NNI plan totaling over \$100 million at DOD and over \$10 million at NASA.

In addition to supporting the development of nanotechnology for beneficial uses, the NNI funds research on the human and environmental health implications of nanotechnology and methods for managing potential risks. The funding within the EPA will almost double in 2007 and additional efforts in this area are funded by NSF, HHS, NIST, DoD, and USDA.

In response to recommendations by the President's Council of Advisors on Science and Technology (PCAST) in its May 2005 report assessing the NNI, the Departments of Labor and Education have become participants in the interagency group that manages the NNI, thereby facilitating progress toward the education and workforce goals of the Initiative.

Additional information about the NNI is available at [www.nano.gov](http://www.nano.gov).



**ADVANCED ENERGY INITIATIVE**  
**Research and Development in the President's 2007 Budget**

In his State of the Union address, President Bush outlined the Advanced Energy Initiative (AEI) in pursuit of a national goal of replacing more than 75% of U.S. oil imports from the Middle East by 2025. Since 2001, nearly \$10 billion has been invested by the Federal government to develop cleaner, cheaper and more reliable alternative energy sources. The AEI provides a 22% increase in this clean-energy R&D at the Department of Energy (DOE). The Initiative will accelerate breakthroughs in two vital areas.

The Administration will work to diversify energy sources for American homes and businesses through: the President's Coal Research Initiative, with \$281 million in FY 2007 for development of clean coal technologies—nearly completing the President's \$2 billion commitment four years ahead of schedule; the FutureGen project, a key part of the Coal Research Initiative, with \$54 million in 2007 to support the partnership between government and the private sector to build a near-zero atmospheric emissions demonstration coal plant that captures the carbon dioxide it produces and stores it in deep geologic formations; the President's new \$148 million Solar America Initiative—an increase of \$65 million over FY 2006—to accelerate the development of semiconductor materials that convert sunlight directly to electricity; \$44 million for wind energy research—a \$5 million increase over the 2006 level; and clean and safe nuclear energy under the new \$250 million global nuclear energy partnership.

The President also proposes acceleration of the development of domestic, renewable alternatives to gasoline and diesel fuels through: \$150 million for the Biofuels Initiative—a \$59 million increase over FY 2006—to help develop bio-based transportation fuels such as “cellulosic ethanol” from agricultural waste products, such as wood chips, stalks, or switch grass; \$31 million to speed the development of advanced battery technology to extend the range of hybrid vehicles and make possible “plug-in” hybrids and electric cars—a 27 percent increase over FY 2006; and \$289 million for the President's Hydrogen Fuel Initiative.

Program (funding in millions)	2006 Enacted	2007 Budget	2007-2006 (\$)	2007-2006 (%)
<b>Energy Efficiency and Renewable Energy (EERE) Programs</b>				
Hydrogen Technology	80	114	34	42%
Fuel Cell Technology	75	82	7	9%
Vehicle Technology	182	166	-16	-9%
Biomass	91	150	59	65%
Solar	83	148	65	78%
Wind	39	44	5	13%
Geothermal	23	0	-23	-100%
Program Management (pro-rata)	58	67	9	0%
<b>Subtotal, EERE</b>	<b>632</b>	<b>771</b>	<b>139</b>	<b>22%</b>
<b>Fossil Energy (FE) Programs</b>				
Clean Coal/Fossil Energy R&D (Coal Research Initiative)	314	281	-33	-11%
Other Power Generation / Stationary Fuel Cells	62	64	2	3%
Program Management (pro-rata)	86	99	14	16%
<b>Subtotal, FE</b>	<b>461</b>	<b>444</b>	<b>-17</b>	<b>-4%</b>
<b>Nuclear Energy (NE) Programs</b>				
Global Nuclear Energy Partnership/Adv. Fuel Cycle Initiative	79	250	171	216%
Generation IV	54	31	-23	-43%
Nuclear Power 2010	65	54	-11	-17%
Nuclear Hydrogen Initiative	25	19	-6	-24%
Program Management (pro-rata)	28	38	10	34%
<b>Subtotal, NE</b>	<b>251</b>	<b>392</b>	<b>141</b>	<b>56%</b>
<b>Science Programs</b>				
ITER fusion project	25	60	35	140%
Fusion (not including ITER)	263	259	-4	-2%
Solar	28	62	34	121%
Biomass	28	35	7	25%
Hydrogen	58	101	43	74%
Program Management (pro-rata)	19	22	4	21%
<b>Subtotal, Science</b>	<b>421</b>	<b>539</b>	<b>119</b>	<b>28%</b>
<b>Total, Advanced Energy Initiative</b>	<b>1,765</b>	<b>2,146</b>	<b>381</b>	<b>22%</b>



**HYDROGEN FUEL INITIATIVE**  
*Research and Development Funding in the President's 2007 Budget*

The Hydrogen Fuel Initiative (HFI) seeks to scientifically support industry efforts to develop practical and cost-effective technologies for producing, distributing, and using hydrogen to power automobiles. Widespread use of hydrogen fuel-cell vehicles would make the United States much less dependent on foreign sources of energy. The 2007 Budget for HFI is \$289 million, \$53 million (23 percent) greater than the FY 2006 level. The Initiative remains on track to meet President Bush's five-year, \$1.2 billion commitment to hydrogen research and development announced in his 2003 State of the Union address.

<u>Program</u>	<u>2005 Enacted</u>	<u>2006 Enacted</u>	<u>2007 Budget</u>	<u>Dollar change</u>	<u>Percent change</u>
<u>Department of Energy</u>					
Hydrogen production storage, and infrastructure	94	80	114	34	42%
Fuel Cells	75	75	82	6	8%
Hydrogen from Coal	17	22	24	2	9%
Nuclear Hydrogen Initiative	9	25	19	-6	-24%
Science (basic research)	29	33	50	18	54%
<u>Department of Transportation</u>					
RITA and NHTSA (standards/safety)	1	1	1	0	1%
<b>Total</b>	<b>225</b>	<b>236</b>	<b>289</b>	<b>53</b>	<b>23%</b>

The HFI focuses on development of technologies for the production, storage and delivery of hydrogen, and fuel cell technologies. Specifically, it supports research on safe and effective hydrogen storage systems; affordable hydrogen fuel cells for consumer automobiles; and hydrogen production and distribution from renewable energy, coal, nuclear energy, and biomass. The HFI complements the Administration's FreedomCAR initiative, which focuses on developing other advanced automotive technologies (e.g., power electronics, batteries, lightweight materials) used in hydrogen-powered fuel cell vehicles and gasoline-electric hybrid vehicles. The initiatives are coordinated with the domestic auto industry and major energy companies through the FreedomCAR and Fuel Partnership. The OSTP-led Hydrogen R&D Interagency Task Force serves as the mechanism for collaboration among the eight federal agencies that fund hydrogen-related research and development.

By spurring increased hydrogen technology development efforts among private-sector, state and international stakeholders, the HFI has already contributed to significant technological advances. For example, in 2005, the cost of a fuel cell system was more than 50 percent lower than in 2002. Costs still need to be reduced by a factor of four, however, for fuel cells to compete with internal combustion engines.

The 2007 Budget for HFI includes \$19 million in funding for the Nuclear Hydrogen Initiative, a sustained level of effort after accounting for earmarking. This initiative will conduct R&D on enabling technologies, demonstrate nuclear-based hydrogen production technologies, and study potential hydrogen production schemes to support the President's vision for a future hydrogen economy.

The 2007 Budget includes \$50 million, a 54% increase, to support innovative basic research in DoE's Office of Science (SC) to establish the scientific basis that underpins the physical, chemical, and biological processes governing the interaction of hydrogen with materials. SC will support fundamental research that provides the foundation for the innovative design of materials and processes. High-priority research directions are the focus of the following activities: (1) novel materials for hydrogen storage; (2) membranes for separation, purification, and ion transport; (3) design of catalysts at the nanoscale; (4) solar hydrogen production; and (5) bio-inspired materials and processes.



---

**CLIMATE CHANGE SCIENCE AND TECHNOLOGY**  
***Research and Development Funding in the President's 2007 Budget***

**Climate Change Science Program**

The U.S. Global Change Research Program, authorized by the Global Change Research Act of 1990, and the President's Climate Change Research Initiative of 2001 are integrated in the comprehensive U.S. Climate Change Science Program (CCSP). The CCSP published the *Strategic Plan for the U.S. Climate Science Program* in 2003, describing a strategy for developing knowledge of climate variability and change and for application of this knowledge.

Based on the Strategic Plan, the CCSP has focused on nine key priority areas to accelerate the delivery of critical science-based information in support of decision making on climate change science issues:

- Aerosols-clouds-climate: Integrating new remote-sensing observations with expanded in situ observations to advance climate prediction capabilities
- Development of an integrated Earth system analysis capability
- Integration of water cycle observations, research and modeling: A prototype project
- Global Landsat data for answering critical climate questions
- North American carbon program integration
- Impacts of climate variability and change on ecosystem productivity and biodiversity
- Coping with drought through research and regional partnerships
- International Polar Year
- Integrated Ocean Observing System

The 2007 CCSP budget sustains the level enacted in 2006. The CCSP comprises over 13 agencies, but nearly 90% of the CCSP funding is distributed among NASA, NSF, NOAA and DOE. The Climate Change Research Initiative, a focused component of CCSP, is sustained at \$200 million in 2007.

**Climate Change Technology Program**

The U.S. Climate Change Technology Program (CCTP) supports research, development, deployment, and voluntary programs to reduce greenhouse gas emissions via renewable energy, fossil energy and nuclear energy, and also to improve efficiency and carbon sequestration. Led by DOE, CCTP recently published a Vision and Framework for Strategy which outlines six strategic goals that will guide the CCTP strategy planning and interagency coordination. These goals are:

- Reduce Emissions for Energy End-Use and Infrastructure
- Reduce Emissions from Energy Supply
- Capture and Sequester Carbon Dioxide
- Reduce Emissions of Non-CO<sub>2</sub> Greenhouse Gases
- Improve Capabilities to Measure and Monitor GHG Emissions
- Bolster Basic Science Contributions to Technology Development

CCTP will work toward these goals by employing several core approaches that will stimulate participation by others and ensure progress in this important area. These approaches include strengthening climate change technology research and development by helping to coordinate and prioritize ongoing activities, creating new opportunities for partnerships and international collaboration, and providing technology policy recommendations.





---

## EARTH OBSERVATIONS

### *Research and Development Funding in the President's FY 2007 Budget*

Over the past year, natural disasters in the United States and abroad have illustrated the need for a better understanding of the Earth system. The U.S. supports a large number of space-based, airborne and ground-based instruments to observe, monitor and measure a multitude of the Earth's characteristics around the globe. The President is committed to optimizing these scientific efforts by developing sustained and integrated Earth observation systems for the Nation and by making these systems an integral part of a global system.

Global Earth observations support research in a wide range of sciences important for society. The *U.S. Strategic Plan for an Integrated Earth Observations System* (IEOS) provides guidance for agencies contributing to these efforts. Sixteen federal agencies, with primary leadership from NOAA, NASA, and OSTP, have been actively planning an integrated Earth Observations System under the National Science and Technology Council's U.S. Group on Earth Observations (USGEO).

One critical area of Earth Observations is the ability to observe the land's surface from space—land observations are critical to all of the 9 societal benefits identified in the *U.S. Strategic Plan for an Integrated Earth Observations System*. The FY2007 budget includes \$98 million for NASA to procure a next-generation Landsat instrument to continue the 30-year record of land imagery. In addition, the administration has directed the USGEO to develop a long-term plan to meet U.S. land observing needs for decades to come. This will ensure that the US will continue to have access to this critical satellite imagery of the Earth's land surface and that we will maintain our global leadership in land observations.

The USGEO is also developing plans for six near-term activities that integrate the nation's Earth Observation capabilities to address specific national and global needs. These plans address multiple societal benefit areas, ranging from reducing loss of life and property from disasters to supporting sustainable agriculture, to improving public health.

The near-term plans make recommendations for:

- 1) An Air Quality Assessment and Forecast System
- 2) Improved Observations for Disaster Reduction
- 3) A Global Land Observation System
- 4) Improved Observations for a National Integrated Drought Information System
- 5) A Sea Level Observation System
- 6) An Architecture and Data Management System for the U.S. integrated system.

The U.S. national strategy is being developed in parallel to the international Global Earth Observation System of Systems (GEOSS). The U.S. plan was submitted at the third Earth Observation Summit in 2005 as the U.S. contribution to GEOSS. The intergovernmental Group on Earth Observations, now 60 countries strong, is working to integrate energy and environment research initiatives that are critical for achieving sustained global economic growth while ensuring a healthy environment.



---

## HOMELAND SECURITY

### *Research and Development in the President's 2007 Budget*

Research and development (R&D) continue to play a key role in securing the Nation against the terrorist threat. The President's FY 2007 Budget maintains an aggressive investment of over \$4.8 billion in scientific research, technology development, and research infrastructure aimed at continuing to enhance our Nation's domestic security. Priority research areas include:

**Protecting the Nation from Nuclear Terrorism:** To continue to develop the tools necessary to prevent the terrorist use of a nuclear weapon against the United States, the President's FY 2007 budget request supports aggressive R&D and operational programs for nuclear defense, including a requested \$535 million in FY 2007 (a 70 percent increase over FY 2006 funding) to expand and support the capabilities of the Domestic Nuclear Detection Office (DNDO) within the Department of Homeland Security (DHS). DNDO is working to develop and deploy a comprehensive system to detect and mitigate any attempt to import, assemble or transport a nuclear explosive device, fissile material or radiological material intended for illicit use within the U.S.

**Countering the Threat from Explosives:** Conventional explosives used in the form of improvised or vehicle born explosive devices remain one of the most accessible weapons available to terrorists to attack and cripple critical infrastructure, or to inflict severe casualties. The President's FY 2007 budget request will provide substantial funding for R&D projects to address this threat, including \$86.5 million for explosives countermeasures research in DHS, and \$20 million within the National Science Foundation (NSF).

**Enhancing the Nation's Biological, Chemical, and Radiological Defenses:** The President's FY 2007 budget request continues to provide strong support for the development of novel medical countermeasures against biological, chemical, and radiological threats. The Department of Health and Human Services (HHS) continues to lead this effort with \$1.89 billion in funding requested to support the National Institute of Allergy and Infectious Disease's research programs. This funding will also address the challenges of bringing new countermeasures to market, and includes \$159.5 million to support advanced development.

**Securing the Nation's Information Technology Infrastructure:** The FY 2007 Budget provides additional investments in cyber security and information assurance R&D. These investments are aimed at enhancing the security of the Nation's information technology infrastructure, which underpins every sector of the economy, enables network-centric national defenses, and facilitates coordination of federal, state and local government. This includes a 28 percent increase for NSF to invest in long-term cyber security research under their Cyber Trust and related programs; and a 38 percent increase in R&D for DHS to enhance the basic security of the Internet, support large-scale cyber security test beds and data sets, and develop highly scalable identity management technology.

**Protecting the Nation's Food and Livestock:** \$539.7 million is allocated for the U.S. Department of Agriculture, HHS and DHS to continue efforts to improve food and agriculture defense. This includes funding for an interagency office to coordinate the advanced development of countermeasures to prevent and mitigate the effects of threats to our Nation's animal agricultural industry.

**Protecting Water Infrastructure and Improving Decontamination:** The President has requested a total of \$94 million to fund new and ongoing research in water security and post-incident decontamination at the Environmental Protection Agency. This includes research and development for monitoring and surveillance of terrorist threat agents in drinking water and the strengthening of decontamination capabilities.



---

**SPACE SCIENCE AND EXPLORATION**  
***Research and Development Funding in the President's 2007 Budget***

Two years ago, the President outlined a bold vision for sustained and affordable human and robotic exploration of space, with the Moon as a first step toward human missions to Mars and beyond. NASA instituted various organizational and programmatic steps to pursue this vision in the initial months after its release. Over the last year, NASA has continued working to redirect its existing human spaceflight programs—the Space Shuttle and International Space Station (ISS)—toward the goal of supporting the vision. Further, it has determined the launch and spacecraft architecture requirements necessary to implement the vision in earnest. An exciting array of space science missions is also being planned that will enhance our understanding of the solar system, the complex interaction between the Earth and space and its impact on our environment, and the origin, structure, evolution, and destiny of the universe.

The President's 2007 Budget for NASA is \$16.8 billion, a 3.2% increase over the enacted 2006 level (excluding one-time supplementals), reflecting a strong commitment by the Administration to continued pursuit of the exploration vision. Out of necessity, the FY 2007 NASA budget also makes some difficult decisions, canceling some projects with high technical risk and/or whose cost would have led to the certain delay or cancellation of other important programs. The budget request maintains NASA's emphasis on science and exploration, while seeking to reinforce the capabilities necessary for long-term technical excellence and success.

- **A Better Understanding of Space and Earth.** NASA requests \$5.33 billion for earth and space science in FY 2007 (1.4% increase) to continue advancing our understanding of the Sun, Earth, planets and the broader universe. Following up on recent robotic investigations of Mars and Saturn, NASA is sending ever-more capable robotic spacecraft to Mars and will explore some of the least-known areas of the solar system, including Mercury, the asteroids, and Pluto. NASA also will build on its legacy of revolutionizing astronomy by continuing operations of space telescopes such as Hubble, Chandra, and Spitzer, while planning for the next generation of spacecraft that will enhance our ability to find planets around other stars and peer deep into the history of the universe. The FY 2007 budget continues to fund operations for 56 on-going space missions as well as critical investments in Earth science satellites, technologies and research, including Landsat. NASA will continue to play a major part in the interagency Climate Change Science Program, and contribute to the international initiative on the Global Earth Observing System of Systems.
- **Moving Forward on Exploration.** NASA requests \$3.98 billion in FY 2007 for new vehicles and technologies to enable sustained human and advanced robotic exploration far from Earth. NASA has identified the major design features and requirements (and related launch architecture) for a Crew Exploration Vehicle (CEV) that will carry astronauts to the Moon. NASA plans to initiate the acquisition process for certain elements of this architecture in 2006 and stage its first crewed flight no later than 2014. At the same time, robotic exploration—including a series of lunar robotic missions starting in 2008—will help acquire information on where human explorers should travel and the technologies necessary to support them upon arrival. NASA will continue pursuing critical new technologies to support exploration, such as advanced thermal protection and propulsion for the CEV, as well as technologies for using lunar resources. In addition, NASA is pursuing innovative means to engage private industry, including offering space prizes to spur innovation and procuring commercial launch services to support the ISS.
- **Assembling and Utilizing the ISS.** The 2007 NASA budget proposes \$6.23 billion for operating the Space Shuttle and continuing assembly and operations of the ISS. NASA has selected a configuration for the ISS that is consistent with the President's vision and meets the needs of our international partners, while employing the minimum number of Shuttle flights required to complete assembly of the ISS before Shuttle retirement in 2010. NASA is refocusing U.S. research on the ISS to prepare human explorers to travel beyond low Earth orbit, including developing countermeasures against space radiation and understanding long-term physiological effects of reduced gravity.



---

## MATH AND SCIENCE EDUCATION

### *American Competitiveness Initiative Education Funding in the President's 2007 Budget*

Improving K-12 education remains one of the President's highest priorities. The Nation is beginning to see positive results as schools uphold the requirements of and utilize the opportunities provided by the No Child Left Behind (NCLB) Act. Moving forward, successful programs that provide teachers with research-based solutions for improving student proficiency in reading will serve as a model for new programs focused on improving math and science education. In his 2007 Budget, President Bush introduced the American Competitiveness Initiative (ACI), which includes a number of new initiatives aimed at improving math and science education across the country.

#### **Advanced Placement (AP)/International Baccalaureate (IB) Program**

The 2007 budget requests \$122 million, an addition of \$90 million over the 2006 enacted level, to expand the AP/IB program such that low-income students will have greater access to rigorous math and science coursework. The Administration calls on States and the private sector to match, dollar-for-dollar, the Federal Government's investment in this program to meet the five-year goal of training 70,000 new teachers and increasing the number of students with passing AP/IB scores to 700,000.

#### **Adjunct Teacher Corps**

The 2007 Budget provides \$25 million to establish the Adjunct Teacher Corps. This Department of Education initiative will support partnerships between school districts and public or private organizations that encourage and prepare science, mathematics, and engineering professionals to teach specific high school math, science and technology courses as adjunct teachers. It will tap the skills of well-qualified individuals who reside outside of the public education system to meet specialized needs in secondary schools. This investment, matched by States and the private sector, is the first step towards building a 30,000 member Adjunct Teacher Corps by 2015.

#### **National Math Panel**

A pillar of NCLB is its requirement that schools utilize research-based curricula and proven methods to raise student performance. The National Reading Panel, established by Congress in 1997, made great strides in understanding how children learn to read, and as a result, identified best practices, teaching materials, and diagnostic tools that have led to improvements in student reading scores. Through the ACI, the 2007 Budget provides \$10 million to establish a National Math Panel, based on the model of the successful National Reading Panel, to identify effective teaching methods and instructional materials that best facilitate student learning in mathematics.

#### **Math Now Programs**

Armed with empirical information, proven materials and effective methods identified by the National Math Panel, the ACI establishes two new mathematics programs based on the successful Reading First model. The 2007 Budget requests \$125 million each to establish two Math Now programs. The dual programs will provide resources, models, diagnostic tools, and proven remediation strategies for use with elementary and middle school students, respectively. These initiatives are designed to help students develop a strong foundation in mathematics so that they can successfully complete more rigorous coursework in middle school and high school.

#### **Evaluating the Impact of Government-Wide Investments in Math and Science**

There are over 200 federally-funded programs which aim to improve math and science instruction, teacher preparation, teacher professional development, and student learning. However, only a small number of those programs have been evaluated to determine their effectiveness in meeting their stated goals or in improving student outcomes. The 2007 Budget includes \$5 million to establish a comprehensive program that will review federally-funded education programs to determine what works in preparing teachers and educating students in math and science.

#### **Math and Science Partnerships**

The 2007 Budget requests sustained funding of \$182 million for Math and Science Partnerships (MSP) at the Department of Education. This program is intended to increase the academic achievement of students in mathematics and science by enhancing the content knowledge and teaching skills of classroom teachers. Partnerships between high-need school districts and the science, technology, engineering, and mathematics (STEM) faculty in institutions of higher education are at the core of these improvement efforts. The 2007 Budget also provides \$46 million to the National Science Foundation to fund its ongoing MSP projects.