

Mechanical Engineering in the FY 2004 Budget

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Table 1: Summary of Mechanical Engineering-Related Programs in the FY 2004 Budget (in millions of dollars)

	FY 2002 Budget	FY 2003 Estimate*	FY 2004 Request
Department of Defense	9,865.6	10,764.1	10,218.3
Department of Energy	2,702.6	2,839.9	2,852.5
Environmental Protection Agency	254.4	274.6	270.6
National Aeronautics and Space Administration	1,457.0	2,583.0	2,462.0
National Institute of Standards and Technology	684.5	712.1	496.8
National Institutes of Health	1,590.9	1,731.6	1,822.0
National Science Foundation	285.7	293.8	316.8

* FY 2003 Request for EPA, NASA; FY 2003 Enacted for DOD, DOE, NIH, NIST, NSF

Table 2: Detail of Mechanical Engineering-Related Programs in the FY 2004 Budget (in millions of dollars)

	FY 2002 Budget	FY 2003 Estimate*	FY 2004 Request
Department of Defense (DOD)			
<i>Army</i>			
Basic Research (6.1)	221.0	244.4	343.0
Applied Research (6.2)	865.3	857.8	641.3
Advanced Technology Development (6.3)	906.9	1040.4	805.7
<i>Navy</i>			
Basic Research (6.1)	394.8	412.3	456.6
Applied Research (6.2)	755.2	805.7	535.9
Advanced Technology Development (6.3)	847.5	813.2	721.8
<i>Air Force</i>			
Basic Research (6.1)	221.7	217.9	322.0
Applied Research (6.2)	749.5	829.2	758.0

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Advanced Technology Development (6.3)	545.9	703.8	1146.1
<i>Defense Wide</i>			
Basic Research (6.1)	512.0	542.5	186.9
Applied Research (6.2)	1,723.7	1,796.0	1,734.8
Advanced Technology Development (6.3)	2,122.1	2,500.9	2,566.2
Total DOD	9865.6	10,764.1	10,218.3
Department of Energy (DOE)			
Basic Energy Sciences	991.7	1,030.0	1,009.0
Fusion Energy Sciences	241.1	250.0	257.3
Nuclear Energy S&T	268.1	301.0	387.6
Fossil Energy R&D	577.8	625.6	519.3
Energy Efficiency/Renewable Energy	396.0	422.3	444.2
Fuel Cell Technology (Energy Conservation)	46.6	57.5	77.5
Vehicle Technology (Energy Conservation)	181.3	153.5	157.6
Total DOE	2,702.6	2,839.9	2,852.5
Environmental Protection Agency			
Superfund Research	36.9	111.2	44.7
Air Toxics Research	18.9	19.9	20.3
Climate Change Research	21.3	21.7	21.5
Environmental Monitoring & Assessment	32.3	38.3	38.9
Environmental Technology Verification (ETV)	3.6	3.6	3.7
<i>Hazardous Substance Research:</i>			
Hazardous Substance Research Centers	4.6	4.6	4.6
Superfund Innovative Technology Evaluation (SITE)	6.5	6.5	6.6
Hazardous Water Research	9.1	9.5	10.8
Particulate Matter Research	65.4	66.7	65.7
Pollution Prevention Research	37.7	44.1	37.9
Safe Drinking Water Research	45.6	49.5	49.2
Science Advisory Board	2.9	3.4	4.4
Tropospheric Ozone Research	6.5	6.8	7.0
Total EPA (with Superfund)	291.3	385.8	315.3
Total EPA (without Superfund)	254.4	274.6	270.6
National Aeronautics and Space Administration (NASA)			
Aeronautics Technology	646.0	1,049.0	959.0
Mission and Science Measurement Technology Support	276.0	431.0	938.0

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Space Launch Initiative	535.0	1,103.0	1,065.0
Total NASA	<u>1,457.0</u>	<u>2,583.0</u>	<u>2,462.0</u>
National Institute of Standards and Technology (NIST)			
<i>Scientific & Tech. Res. & Services</i>			
NIST Laboratories	324.8	354.2	381.8
Baldrige National Quality Program (BNQP)	5.2	5.2	5.8
<i>Industrial Technology Services (ITS)</i>			
Advanced Technology Program (ATP)	184.5	180.0	27.0
Manufacturing Extension Partnership	106.5	106.6	12.6
Construction of Research Facilities	63.6	66.1	69.6
Total NIST	<u>684.5</u>	<u>712.1</u>	<u>496.8</u>
National Institutes of Health (NIH)			
NIH-wide SBIR/STTR	503.0	546.0	602.0
Bioengineering Research (including NIBIB)	825.9	907.6	938.0
National Institute of Biomedical Imaging & Bioengineering (NIBIB)	262.0	278.0	282.0
Total NIH	<u>1,328.9</u>	<u>1,453.6</u>	<u>1,540.0</u>
National Science Foundation (NSF)			
Chemical and Transport Systems	57.2	58.9	66.2
Civil and Mechanical Systems	56.1	57.8	64.4
Design, Manufacture and Industrial Innovation (excluding SBIR)	55.9	57.6	61.9
Engineering Education and Centers (includes ERC and I/UCRC)	116.5	119.5	124.3
Total NSF	<u>285.7</u>	<u>293.8</u>	<u>316.8</u>

* FY 2003 Request for EPA, NASA; FY 2003 Enacted for DOD, DOE, NIH, NIST, NSF.

DEPARTMENT OF DEFENSE (DOD)

Proposed FY 2004 funding for the DOD Science and Technology (S&T) program is \$10.2 billion, 5 percent lower than the FY 2003 appropriated levels. Continuing a trend seen last year, Basic Research (category “6.1”) and Applied Research (“6.2”) are down \$109 million (8 percent) and \$619 million (14 percent), respectively. Advanced Technology Development (“6.3”) is up \$186 million (3.7 percent) but mostly because

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of increased funding for classified Air Force programs. A number of Office of the Secretary of Defense (OSD) “6.1” programs would be transferred to the services, resulting in dramatic increases to service Basic Research accounts. The Multi-University Research Initiatives (MURI) program would be divided among the services with a cumulative increase in funding of \$12.7 million, or 5 percent, over FY 2003 appropriated levels, which brings it close to the FY 2002 funding level. The Army would take ownership of the OSD Defense Experimental Program to Stimulate Competitive Research (DEPSCoR) and Historically Black Colleges and Universities/Minority Institutions programs. The Air Force would take ownership of OSD’s High Energy Laser “6.1”, “6.2” and “6.3” programs. Overall, however, core service Basic Research accounts would decline slightly from FY 2003 levels and total DOD Basic Research would be down \$109 million or 7.7 percent.

After a large funding ramp-up last year for the war on terror, the Chemical and Biological Defense Program’s (CBDP) S&T budget would be down \$90 million or 27 percent. The Defense Advanced Research Projects Agency (DARPA), also a large recipient of increased funding last year is slated for an S&T budget increase of \$261 million or 10 percent. More than \$95 million of this increase would be for a newly created Network-Centric Warfare technology program. After accounting for the transferred Basic Research programs, Defense-Wide S&T is budgeted for a 1 percent decrease over FY 2003. DOD set an S&T funding goal of 3 percent of the department’s total obligational authority (TOA) in FY 2001. That goal was barely achieved in FY 2003 after Congress added an additional \$773 million to the President’s request. S&T funding is 2.7 percent of DOD’s FY 2004 TOA request.

The DOD S&T program contains elements incorporating significant mechanical engineering research. Increases are proposed for aerospace technologies, including propulsion and power, in the Army Air Force and DARPA budgets. Much of this is for a renewed interest in hypersonics, collectively known as the National Aerospace Initiative. (For more on DOD, see Chapter 6.)

DEPARTMENT OF ENERGY (DOE)

DOE’s budget for FY 2004 reflects six priorities of Secretary Abraham: meet DOE’s responsibilities to maintain the nuclear stockpile; expand and make more comprehensive the Department’s non-proliferation

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activities; accelerate the environmental cleanup program; develop 21st Century cutting-edge advanced fuel cell and alternative energy technologies; maintain coal as a major, low-cost, domestically produced energy resource through the Coal Research Initiative; and continue leadership to ensure nuclear power remains a key energy resource. The major enhancement in this year's budget is the addition of the FreedomFuel hydrogen initiative, coupled with continuation of the FreedomCAR fuel cell vehicle program begun in FY 2003. Another major policy initiative is the addition of \$12 million for U.S. participation in the International Thermonuclear Experimental Reactor (ITER).

The \$1.3 billion budget request for energy efficiency, renewable energy and energy conservation reflects a decrease of approximately \$14 million, or 1 percent, over FY 2003 enacted levels. The budget for renewable energy technologies would increase by approximately \$22 million as a result of significant funding increases for hydrogen research and development (\$48 million) and for the new National Climate Change Technology Initiative (\$15 million). Except for hydropower (up \$2.2 million), all renewable energy research programs would be reduced (solar, down \$7.3 million; wind, down \$2.4 million; geothermal, down \$4.5 million; and biomass, down \$11.5 million). The energy conservation budget is proposed for a decrease of \$8.4 million, or 1 percent. Aside from a substantial increase for fuel cell technologies (up \$20 million or 34.8 percent) and a slight increase for vehicle technologies (up \$4 million or 2.6 percent), all other energy conservation programs would decrease or remain the same.

The Fossil Energy (FE) program is concerned with R&D of coal, natural gas, and oil. The FY 2004 request for FE represents a decrease of approximately \$106.3 million from the FY 2003 enacted level of \$625.6 million. The \$519 million request includes a \$7.3 million increase in coal and power systems, and a \$4 million increase in natural gas technologies. The major decreases would be for petroleum technologies. Coal R&D would receive \$367.5 million, a decrease of \$45.7 million from the FY 2003 enacted level. The Clean Coal Power Initiative would decrease \$20 million in FY 2004. Carbon sequestration research would increase \$20.1 million above the FY 2003 enacted level of \$41.9 million. Funding for distributed generation research would decrease \$20 million.

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Natural gas technologies R&D requested funding is \$26.5 million, \$19.8 million below the FY 2003 enacted level of \$46.3 million. Funding for gas hydrates would be set at \$3.5 million. Advanced gas turbines would receive \$14 million. Funding for oil technology would be reduced 57.6 percent, to \$15 million, ostensibly to refocus the program on enhanced oil recovery and carbon dioxide injection.

The FY 2004 proposed budget for nuclear energy (NE) is \$387.6 million, an increase of \$86.5 million above the FY 2003 enacted level of \$301 million. The largest area of increase is in the Advanced Fuel Cycle Initiative. The AFCI would receive \$63 million in FY 2004, an increase of \$44.8 million above the FY 2003 request. The only significant decrease in the NE budget is \$13 million (50 percent) from the Nuclear Energy Research Initiative. University reactor support, which provides educational support for fueling university reactors, fellowships, and research, would receive \$18.5 million, a decrease of \$0.5 million from the FY 2003 enacted level.

The Nuclear Energy Plant Optimization (NEPO) program, which Congress funded at \$5 million in FY 2003, would receive no funding in FY 2004. The Nuclear Energy Research Initiative (NERI) would be reduced by \$13 million (50 percent). A new program, the Nuclear Hydrogen Initiative, would receive \$4 million in FY 2004, to support research into using nuclear power to provide the electricity needed to reform another fuel into hydrogen.

The administration proposes a total of \$3.3 billion for the DOE Office of Science for FY 2004, a very slight increase over the FY 2003 enacted level. While most programs within that office would see increases, there is proposed a slight (1 percent) decrease of \$10.5 million in Basic Energy Sciences, for a total of \$1.0 billion. High-energy physics and nuclear physics would see increases of \$13 million and \$7 million respectively, while fusion energy research would remain almost unchanged at \$257.3 million. Biological and environmental research would receive an increase of \$15.3 million, for a total of nearly \$500 million, about \$30 million less than the FY 2003 enacted level. (For more on DOE, see Chapter 9.)

ENVIRONMENTAL PROTECTION AGENCY (EPA)

At press time, the final EPA budget for FY 2003 had not been published. Consequently, all comparisons are made to the FY 2003 request, rather

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than to an enacted budget. Overall, the funding request for Science and Technology programs within the FY 2004 budget reflects an increase of \$61 million, or 9.1 percent to \$731 million. The research portion of the FY 2004 request, not including Superfund Research, is \$270.6 million, an overall decrease of 1.1 percent as compared to the FY 2003 request. Within the overall R&D budget, funds have been reallocated such that programs supporting Homeland Security receive higher priority. Consequently, some research within the goals of Safe Drinking Water and Clean Air has been delayed, while that in Waste Management has been accelerated. After the one-time increase of \$70 million in FY 2003 is taken out, the Superfund Budget shows an 8 percent increase to \$44.7 million. (For more on EPA, see Chapter 13.)

Programs relevant to Mechanical Engineering experiencing the greatest percentage increases include Hazardous Waste Research (13.7 percent) and the Science Advisory Board (29.4 percent). The budget request also includes restoration of the STAR fellowship to the EPA S&T programs.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)

NASA would see its total budget increase to \$15.5 billion in FY 2004, a \$469 million increase, or 3.1 percent increase over the FY 2003 request of \$15 billion. NASA's R&D (two-thirds of the agency's budget) would climb 9.3 percent to \$11 billion. The Columbia shuttle disaster may have significant repercussions for NASA's programs and their budgets may be reallocated or augmented in the next few months. (For more on the NASA budget, including final FY 2003 estimates, please see Chapter 10 and Table II-12.)

NASA has restructured its budget into two new accounts entitled Science, Aeronautics, and Exploration (SAE), which reflects NASA's science- and research-driven agenda, and Space Flight Capabilities (SFC). The FY 2004 budget request for NASA SAE includes: Space Science, which is \$4,007 million, a 17.3 percent increase over the FY 2003 request of \$3,414 million; Earth Science is \$1,552 million, down 4.7 percent from the FY 2003 request of \$1,628 million; Biological and Physical Research in FY 2004 is \$973 million, a 15.6 percent increase over the FY 2003 request of \$842 million; and Aeronautics Technology is \$959 million, a 2.7 percent decrease over the FY 2003 request of \$986 million.

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The NASA Office of Aeronautics Technology (OAT) restructuring resulted in three thematic areas for FY 2003 and beyond, Aeronautics Technology, Mission and Science Measurement Technology, and the Space Launch Initiative. Funding in each of the thematic areas is indicated in Table 2. Overall, the OAT FY 2004 request indicates a 4.7 percent decrease from FY 2003 requested funding. As a result of going to full-cost accounting, figures for FY 2003 and FY 2004 are not directly comparable to FY 2002 figures.

Mechanical engineering-related research is conducted primarily in OAT programs and includes funding for advanced propulsion technologies, lightweight high-strength adaptable structures, adaptive controls, advanced vehicle designs, and new collaborative design and development tools.

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

The FY 2004 request for mechanical engineering-related R&D for NIST is \$496.8 million, down \$66.3 million from the FY 2003 request and down \$215.3 million, or 30 percent, from the FY 2003 enacted level. The huge discrepancy is due to dramatic proposed reductions in Industrial Technology Services, specifically the Manufacturing Extension Partnership (MEP) and the Advanced Technology Program (ATP).

The budget request for ATP is \$27 million, \$153 million below the FY 2003 enacted level. The MEP program request is for \$12.6 million, a reduction of \$94 million, or 88 percent. Although the administration and the House are likely to agree on the large reductions, the Senate has generally taken the alternate point of view in recent years. In the past the money has been restored in the House-Senate conference committee.

The portion of the NIST budget related to mechanical engineering consists of three distinct components: Scientific and Technical Research Services (STRS; \$387.6 million proposed, \$28.8 million above FY 2003), Industrial Technology Services (ITS; \$39.6 million, \$247 million below FY 2003), and Construction of Research Facilities (CRF; \$69.6 million, \$3.5 million above FY 2003).

The STRS portion includes an increase (\$22.4 million) to further provide U.S. industry and the science/technology community with the measurement capabilities, standards, evaluated reference data and the test

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methods needed to support innovation, improve quality and lower transaction costs in virtually all technology-intensive sectors.

The CRF budget includes \$21.3 million to continue the high priority construction at the Boulder, Colorado laboratories, \$10.5 million for safety, maintenance, and repair improvements at the Boulder and Gaithersburg (MD) complexes, and \$3.3 million to begin renovation of one of the general-purpose laboratories in Gaithersburg.

NATIONAL INSTITUTES OF HEALTH (NIH)

The total FY 2004 NIH budget request is \$27 billion, which represents an increase of \$701 million, or a 2.7 percent increase over FY 2003. The increase from FY 2002 to FY 2003 was \$3.5 billion (15 percent), completing the doubling of the NIH budget between FY 1998 and 2003.

In FY 2004, NIH-wide bioengineering research support is estimated at \$938 million. Similar support in FY 2003 was \$908 million. The National Institute of Biomedical Imaging and Bioengineering (NIBIB) was established in FY 2002 was funded with the transfer of existing biomedical imaging and bioengineering grants from other NIH Institutes and Centers. NIBIB's goal is to develop fundamental new knowledge, to foster potent new technologies, to nurture a new generation of researchers, and to facilitate crosscutting capabilities. The ultimate goal of the NIBIB is to translate research findings from the laboratory into practical solutions that will benefit the public health. The FY 2004 budget requests \$282 million for the NIBIB, an increase of \$4 million (1.4 percent). The percentage increases for most of the other institutes would be in the 2 to 4 percent range, with the exception of NIAID (17 percent) and NIDDK (5.6 percent). Numerous funding initiatives for the NIBIB were announced in 2002-2003, including the development of novel drug and gene delivery systems and devices; research opportunities in tissue engineering; development of advanced biomaterials; image-guided interventions; telehealth technologies development; operation of sensors in vivo; research on microbial films; and innovative exploratory studies and technology development in neuroinformatics research.

NATIONAL SCIENCE FOUNDATION (NSF)

The total FY 2004 NSF budget request is \$5.48 billion representing a \$450 million, or 9 percent, increase over the FY 2003 request. The

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request is divided into five accounts. Research and Related Activities (R&RA) comprise the dominant part of the total NSF request at \$4.11 billion. This is an 8.5 percent increase relative to the FY 2003 request. The next largest category is Education and Human Resources with a request for \$940 million, up 3.3 percent from FY 2003. (For more on NSF, including final FY 2003 figures, see Chapter 7 and Table II-7.)

There are nine activities under R&RA including the Engineering Directorate (ENG). The FY 2004 budget request for ENG is \$540 million, a 10 percent increase over the FY 2003 request. ENG remains the fifth largest activity in R&RA behind Mathematical and Physical Sciences (\$1.06 billion), Geosciences (\$690 million), Computer and Information Science and Engineering (\$580 million) and Biological Sciences (\$560 million). US Polar Research Programs (\$260 million), Social, Behavioral and Economic Sciences (\$210 million), Integrative Activities (\$130 million) and US Antarctic Logistical Support Activities (\$700 million) round out this category.

NSF continues to include funding for major initiatives or Priority Areas in its budget request. The five standing major initiatives will increase. Information Technology Research will increase by \$17 million to \$303 million. Nanoscale Science and Engineering will go up by \$28 million to \$249 million. Increases of \$21 million for Biocomplexity in the Environment (to \$100 million), \$29 million for Mathematical Sciences (to \$89 million) and \$14 million for Human and Social Dynamics (to \$24 million) have also been requested. In addition, NSF has identified a new thrust area for FY 2004 called Workforce for the 21st Century (\$9 million).

Funding for mechanical engineering related research within ENG would increase 7.8 percent to \$320 million. This is below NSF's overall 9 percent rate of increase and ENG's 10 percent increase. Details of the mechanical engineering component of the NSF budget appear in Table 1. It should be noted that, given the multidisciplinary nature of modern engineering research, funding for mechanical engineering related research may be, and often are, obtained from programs outside of the selected group and outside of ENG overall. Detailed examination of individual programs, however, is beyond the scope of this analysis. Data in Table 1 may be construed as reflecting traditional sources for funding for mechanical engineering related research.