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Mechanical Engineering in the FY 2005 Budget

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Table 1: Summary of Mechanical Engineering-Related Programs in the FY 2005 Budget (in millions of dollars)

	FY 2003 Budget	FY 2004 Estimate	FY 2005 Request
Department of Defense	10,720	12,069	10,534
Department of Energy	3,414	3,556	3,544
Department of Homeland Security	167	467	438
Environmental Protection Agency	242.4	257.3	256.1
National Aeronautics and Space Admin.	1,719	1,713	2,013
National Institute of Standards and Technology	708.2	612.5	520.4
National Institutes of Health	1,739.7	1,844.5	*
National Science Foundation	328.3	335.9	349.3

Table 2: Detail of Mechanical Engineering-Related Programs in the FY 2005 Budget (in millions of dollars)

	FY 2003 Budget	FY 2004 Estimate	FY 2005 Request
Department of Defense (DOD)			
Army			
Basic Research (6.1)	243	382	318
Applied Research (6.2)	852	1,040	651
Advanced Technology Development (6.3)	1,096	1,205	815
Navy			
Basic Research (6.1)	406	484	477
Applied Research (6.2)	778	724	564
Advanced Technology Development (6.3)	814	1,009	677
Air Force			
Basic Research (6.1)	212	331	346
Applied Research (6.2)	825	897	786
Advanced Technology Development (6.3)	700	1,093	787
Defense Wide			
Basic Research (6.1)	508	207	190

Applied Research (6.2)	1,813	1,763	1,876
Advanced Technology Development (6.3)	2,473	2,934	3,047
Total DOD	10,720	12,069	10,534
Department of Energy (DOE)			
Basic Energy Sciences	1,002	1,011	1,064
Fusion Energy Sciences	241	263	264
Nuclear Energy S&T	130	130	96
Fossil Energy R&D	611	673	636
Energy Efficiency/Renewable Energy	1,202	1,236	1,251
Fuel Cell Tech. (Energy Conservation)	54	65	76
Vehicle Technology (Energy Conservation)	174	178	157
Total DOE	3,414	3,556	3,544
Department of Homeland Security (DHS)			
University and Fellowship Programs	3	69	30
Anti-missile devices	-	60	61
Rapid Prototyping of Technologies	33	73	76
Standards	20	39	40
Radiological and Nuclear Countermeasures	75	126	129
Threat Vulnerability and Assessment	36	100	102
Total DHS	167	467	438
Environmental Protection Agency (EPA)			
Superfund Research	49.0	45.0	46.0
Air Toxics Research	14.2	15.7	17.6
Climate Change Research	22.3	21.5	20.7
Environmental Technology Verification (ETV)	2.6	4.0	3.0
Superfund Innovative Technology Evaluation (SITE)	4.7	6.9	6.9
Particulate Matter Research	64.4	63.6	63.7
Pollution Prevention Research	31.5	38.9	34.1
Safe Drinking Water Research	43.2	46.0	46.1
Science Advisory Board	3.7	4.4	4.8
Tropospheric Ozone Research	4.8	4.9	4.9
Fellowships	2.0	6.4	8.3
Total EPA (with Superfund)	242.4	257.3	256.1
Total EPA (without Superfund)	173.4	212.3	210.1

National Aeronautics and Space Administration (NASA)			
Aeronautics Technology	599	1,034	919
Mission and Science Measurement Tech.	305	-	-
Space Launch Initiative	815	-	-
Human and Robotic Technology	-	679	1,094
Total NASA	1,719	1,713	2,013
National Institute of Standards and Technology (NIST)			
Scientific & Tech. Res. & Services			
NIST Laboratories	352.0	332.0	417.0
Baldridge National Quality Program	5.2	5.5	5.4
Industrial Technology Services (ITS)			
Advanced Technology Program (ATP)	179.0	171.0	-
Manufacturing Extension Partnership	106.0	39.0	39.0
Construction of Research Facilities	66.0	65.0	59.0
Total NIST	708.2	612.5	520.4
National Institutes of Health (NIH)			
NIH-wide Research Project Grants	13.7	14.5	14.8
NIH-wide SBIR/STTR	538	602	618
Bioengineering Research (including NIBIB)	908	939	*
National Institute of Biomedical Imaging & Bioengineering (NIBIB)	280	289	298
Total NIH	1,739.7	1,844.5	*
*FY05 request is not yet released.			
National Science Foundation (NSF)			
Chemical and Transport Systems	68.33	68.92	67.21
Civil and Mechanical Systems	63.23	67.17	85.51
Design, Manufacture and Industrial Innovation (excluding SBIR)	64.00	65.81	65.88
Engineering Education and Centers (includes ERC and I/UCRC)	132.72	134.04	130.71
Total NSF	328.28	335.94	349.31

DEPARTMENT OF DEFENSE (DOD)

The proposed FY 2005 budget for Defense S&T ("6.1" basic research, "6.2" applied research, and "6.3" advanced technology development) is $10.5 billion, which is a 12.7 percent reduction from the enacted FY

2004 appropriation of $12.1 billion. As a percentage of the proposed FY 2005 Defense budget of $401.7 billion, S&T represents 2.6 percent. That is less than the 3 percent level recommended by both the Defense Science Board in 1998 and the Quadrennial Defense Review in 2001.

The proposed FY 2005 budget request would provide $1.33 billion for Defense "6.1" basic research programs, 5.3 percent below the FY 2004 level of $1.40 billion. This includes programs funded under the Office of the Secretary of Defense (OSD), as well as Navy, Army, and Air Force research programs. The FY 2005 request would provide $3.88 billion for defense applied research programs, or 12.3 percent below FY 2004.

The FY 2005 Defense budget would continue to fund several programs —including the University Research Initiative (URI)—that were transferred last year from OSD to the individual services. Total FY 2005 funding for URI programs in the services is $274.5 million, which is a three percent reduction from FY 2004 funding.

The Defense Advanced Research Projects Agency (DARPA) would see its R&D funding increase $259 million (9.1 percent) to $3.1 billion in FY 2005, after similar increases in the last two years. DARPA is a research-oriented agency—48 percent of its budget is dedicated to research, with the remainder devoted to "6.3" technology development. DARPA's efforts in areas such as tactical technology, materials, aerospace systems, electronics, networkcentric warfare, and sensors and guidance technologies would all receive large increases. The largest part of DARPA's portfolio is the Materials and Electronics Technology program, which would receive $502 million (up from $465 million).

DOD S&T contains elements incorporating significant mechanical engineering research. Increases are proposed for aerospace technologies, including propulsion and power, most because of a renewed interest in hypersonics, collectively known as the National Aerospace Initiative.

DEPARTMENT OF ENERGY (DOE)

The Department's budget for FY 2005 reflects four stated priorities: protecting national security, ensuring energy security, protecting the environment, and providing a world-class scientific research capability. The following analysis applies to four DOE Programs: Office of Science, Energy Efficiency and Renewable Energy (EERE), Fossil Energy (FE),

and Nuclear Energy (NE). There are no major new policy initiatives, and very few programs would see significant increases. A notable exception is the Yucca Mountain nuclear waste repository which would see its funding increased $300 million to $880 million to fund DOE's plan to apply to the Nuclear Regulatory Commission in early 2005 for permission to begin construction.

The $1.25 billion request for EERE and energy conservation reflects an increase of approximately $15 million over FY 2004. This is due to an increase in the request for hydrogen technology research funding ($13.3 million; 16.3 percent) and modest increases in the requests for hydropower ($1.1 million; 22.3 percent), geothermal technology ($.2 million; 1.1 percent), and wind energy ($.3 million; 0.7 percent). These increases are partially offset by decreases in biomass research ($13.8 million; 16 percent) and solar energy research ($3.1 million; 3.7 percent).

The energy conservation budget is proposed for a decrease of $2 million, or 0.2 percent. Within that program, there are increases in fuel cell technologies ($12.3 million) and weatherization grants ($64 million), and decreases in vehicle technologies ($21.3 million), industrial technologies ($35 million), and distributed energy resources ($7.9 million).

The FY 2005 request of $635.8 million for FE represents a decrease of $37 million from the FY 2004 level of $672.7 million, and includes a $19.5 million increase in coal and power systems, including an $8.7 million increase to $40.3 million in carbon sequestration research. Programs facing decreases include natural gas technologies ($17 million; 39.5 percent), petroleum technologies ($20 million; 57.2 percent), and cooperative R&D ($5.4 million; 64.3 percent).

Coal R&D is proposed at $470 million, an increase of $19.5 million above FY 2004. The President's Coal Research Initiative, the mainstay of the coal R&D budget, would get a $68.6 million increase. The Administration proposes a dramatic shift in the coal research program in FY 2006. Rather than the previously planned funding of several clean coal demonstration projects around the country, the proposed budget would shift nearly all those funds into the FutureGen program to create a zero-emission coal-fired power plant simultaneously creating hydrogen.

Natural gas technologies R&D requested funding is $26 million, a decrease of $17 million below the FY 2004 enacted level. Decreases

would also occur in gas hydrates research ($6 million, down $3.4 million), exploration and production ($17 million, down $5.2 million), and advanced gas turbines ($11.8 million, down from $12.7 million in FY 2004). Funding for oil technology would be reduced 57.2 percent, to $15 million, reflecting "reordered priorities."

The FY 2005 proposed budget for nuclear energy (NE) is $412.6 million, an increase of $4.7 million above the FY 2004 enacted level. The major increase within NE ($300 million) is for infrastructure related to creation of the Idaho National Laboratory, an entity to be created by merging the Idaho National Engineering and Environmental Laboratory and Argonne National Laboratory-West. Also within NE, nuclear energy R&D is decreased to $90 million, or 26 percent. Increases within R&D would go to the Nuclear Hydrogen Initiative ($3.5 million, for a $9 million total) and the Generation IV Nuclear Energy Systems Initiative ($2.8 million; $30.5 million total), while the Advance Fuel Cycle Initiative would be significantly decreased, down $20.4 million from its $66.7 million FY 2004 level. The Nuclear Energy Research Initiative (NERI) and Nuclear Energy Plant Optimization (NEPO) program would be eliminated.

The Administration proposes a total of $3.43 billion for the DOE Office of Science for FY 2005, a slight decrease from the FY 2004 enacted level of $3.45 billion. With the exception of the biological and environmental research program (down $140 million; $501.6 million total), most programs within the office would see modest increases. Basic Energy Sciences, the largest program within the office, would increase $53 million, for a total of $1.064 billion and the Fusion Energy Sciences Program would remain essentially constant at $264 million. (For more on DOE, see Chapter 9.)

DEPARTMENT OF HOMELAND SECURITY (DHS)

DHS R&D programs would receive $1.2 billion in FY 2005, a 15.5 percent increase. The emphasis would shift slightly toward a more balanced portfolio of basic and applied research and development. The basic and applied research is planned to increase by nearly 152 percent, to approximately $430 million. (See Chapter 12 for more on DHS.)

Mechanical-engineering related R&D is predominantly contained in five thrust areas of the S&T portfolio. The funding for R&D in anti-missile devices for commercial aircraft would remain essentially constant at $61

million. The rapid prototyping of technologies to speed their deployment would be increased by 4 percent to $76 million. R&D in standards for security and safety will be funded at the level of $40 million in FY 2005. There also would be small increases in radiological and nuclear countermeasures ($3 million to $129 million) and threat vulnerability and assessment ($2 million to $102 million).

ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA's R&D is primarily funded within the Science and Technology account, which would total $535 million in the FY 2005 budget request, a reduction of $26 million or 4.7 percent. Overall R&D would decrease by 4.4 million (7.1 percent) to $572 million. Much of the proposed decrease is due to an effort to eliminate congressional R&D earmarks. Most research areas would see flat or declining funding. EPA's Science to Achieve Results (STAR) program of extramural research grants would receive only $65 million in FY 2005, down a third from the $100 million level of this year and the previous three years. (See Chapter 13 for more information on EPA.)

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)

The overall NASA budget request is $16.2 billion, up from $15.4 billion (5.6 percent) in FY 2004. The President's proposed budget would reprogram $11.6 billion in funding for NASA over the next five years, as well as add $1 billion to implement the President's space exploration goals. NASA's programs now employ full-cost accounting, which includes the cost of institutional activities (personnel, facilities, and support) within each program. (See Chapter 10 and Table II-12 for more information on NASA.)

NASA proposes $4.3 billion for the Space Shuttle, a 9 percent increase above FY 2004, which includes an estimated $238 million for Return to Flight (RTF) activities in FY 2005. The Space Shuttle will be phased out when assembly of the International Space Station (ISS) is complete, planned for the end of the decade. NASA's new space policy establishes the Office of Space Exploration (OSE) and realigns the Mission and Science Measurement (MSM) and Space Launch Initiative (SLI) themes from the Office of Aeronautics to the OSE. The FY 2005 budget proposes $428 million to begin a new Crew Exploration Vehicle, named Project Constellation, that will provide crew transport for exploration

missions beyond low-Earth orbit, and $70 million for robotic lunar test beds, increasing to $420 million by FY 2009. The policy envisions the first human expedition to the lunar surface as early as 2015.

Mechanical engineering-related research is primarily conducted in the Office of Aeronautics (OA) and in the newly formed Office of Space Exploration (OSE). NASA proposes $919.2 million for aeronautics technology in FY 2005, a decrease of $115.1 million from the FY 2004 appropriation. This would include $188 million, a 4 percent increase above FY 2004, for the Aviation Security and Safety Program, $154.4 million for the Airspace Systems Program, decreased from $233.9 million, and $576.8 million for the Vehicle Systems Program, decreased from the FY 2004 appropriation of $620.4 million. The OSE Human and Robotic Technology program ($1.1 billion) would replace MSM.

NASA also proposes funding for critical institutional capabilities, including $77 million for the NASA Engineering Safety Center, $10 million for the Science and Technology Scholarship program, and $14 million for the NASA Explorer Schools, which seeks to attract students to mathematics and science during the critical middle school years. Congress recently passed the NASA Workforce Flexibility Act providing $25 million in FY 2005 to begin to address critical workforce issues.

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

The FY 2005 request for mechanical engineering-related R&D at NIST is $456.7 million, down $84.3 million from FY 2004. The reduction is, in part, a result of the Aministration's proposal to eliminate the Advanced Technology Program, which was funded at $170.5 million in FY 2004.

The portion of the NIST budget related to mechanical engineering consists of two components: The NIST laboratory portion of the Scientific and Technical Research Services line item ($417.5 million proposed, $85.7 million above FY 2004) and Industrial Technology Services, which consists of the Advanced Technology Program and the Manufacturing Extension Partnership ($39.2 million proposed; up $464,000 from the current level).

The laboratory budget request reflects an increase ($84.3 million) to further provide U.S. industry and the science/technology community with the measurement capabilities, standards, advanced encryption

technologies, evaluated reference data, and the test methods needed to support innovation, improve quality, and lower transaction costs in virtually all technology-intensive sectors. (For more on ATP and NIST, see Chapter 13.)

NATIONAL INSTITUTES OF HEALTH (NIH)

The total FY 2005 NIH budget request is $28.8 billion, which represents an increase of $729 million, or a 2.6 percent increase over the FY 2004 enacted level. The largest increase ($60 million; 10 percent) would go to the Office of the Director for the NIH Roadmap for Biomedical Research, an initiative to reinvigorate NIH's clinical research, high-risk basic research, and collaborative research.

The roadmap initiative should prove beneficial to biomedical engineers accustomed to working in collaborative environments consistent with the mission of the National Institute of Biomedical Imaging and Bioengineering (NIBIB). The NIBIB mission is to improve health by leading the development and application of emerging and breakthrough technologies based in the biological, physical, and engineering sciences. One key focus of the roadmap and the NIBIB is molecular libraries and imaging; a component of the New Pathways to Discovery Initiative. Other areas of immediate interest to the NIBIB under the roadmap include nanomedicine, new tools for the study of proteomics and metabolic pathways, computational biology, and bioinformatics. Under the roadmap effort, NIH institutes and centers, including the NIBIB, have developed a 10-year plan to create approximately eight National Centers of Excellence in Biomedical Computing to cover areas such as image processing, modeling, genomics, systems biology, computer-assisted surgery, and computer-aided diagnosis and treatment of disease.

The President's FY 2005 budget requests $298 million for the NIBIB, an increase of $9 million (3.1 percent) over the FY 2004 enacted level. Most NIH institutes would receive increases between 2.8 and 3.3 percent.

In FY 2004, the NIBIB organizational structure and management plan was modified to reflect the emerging mission of the Institute. Numerous funding initiatives for the NIBIB were announced, including optical biopsies, brain-computer interface, a bioinformatics toolkit for the modern biologist, a NIBIB postdoctoral scholar development and faculty

transition award, and a NIBIB supplemental program for medical resident research training.

The estimate for NIH-wide bioengineering research was $938.6 million in FY 2004, and $907.6 million in FY 2003. NIH continues to support the Biomedical Research Partnerships (BRP) and Bioengineering Research Grants (BRG) funding mechanisms. In FY 2002, NIH funded 45 BRP and 46 BRG grants. In FY 2003, these numbers increased to 125 and 75, respectively. (For more on NIH, see Chapter 8.)

NATIONAL SCIENCE FOUNDATION (NSF)

The total FY 2005 NSF request is $5.7 billion, representing a $167.2 million or 3 percent increase over FY 2004. The request is divided into six appropriation accounts. Research and Related Activities (R&RA) comprises the dominant part of the total NSF request at $4.5 billion, a 4.7 percent increase. The next largest is Education and Human Resources with a request for $771.4 million, down 17.9 percent. Requests for the remaining three categories are Major Research Equipment and Facilities Construction ($213.3 million), Salaries and Expenses ($294 million), National Science Board ($3.95 million), and the Office of the Inspector General ($10.1 million). (For more on NSF, see Chapter 7.)

NSF continues to include funding for major initiatives or priority areas in its budget request. The only standing major initiatives to show an increase is Nanoscale Science and Engineering, which would increase by 20.3 percent to $305.1 million. The new thrust area, Workforce for the 21st Century, is budgeted for $20 million. Biocomplexity in the Environment and Mathematical Sciences remain approximately the same, at $99.8 million and $89.1 million, respectively. The budget for Human and Social Dynamics is reduced by 4.1 percent to $23.3 million.

Funding for mechanical engineering related research within ENG reflects an increase of 4 percent, to $349.3 million. Although this exceeds NSF's overall 3 percent rate of increase and ENG's 1.9 percent increase, this is due to initiation of the operations phase of Network for Earthquake Engineering Simulation (NEES), appearing in the Civil and Mechanical Systems Subactivity for FY 2005. The other subactivities would decrease by 1.9 percent. Details of the mechanical engineering component of the NSF budget appear in Table 1. Note that mechanical engineering related R&D is often funded outside the selected group and even outside ENG.