26

Mechanical Engineering in the FY 2003 Budget

Michael Reischman,[1]
Fellow, American Society of Mechanical Engineers International

INTRODUCTION

The information in this chapter relates specifically to agency programs with significant mechanical engineering components. Table 1 summarizes the FY 2003 funding requests for mechanical engineering-related research and development (R&D) in seven federal agencies. A more detailed breakdown of individual agencies' R&D budgets and analyses follows.

Table 1: Summary of Mechanical Engineering-Related Programs in the FY 2003 Budget (in millions of dollars)

	FY 2001 Budget	FY 2002 Estimate	FY 2003 Request
Department of Energy	2602.3	2,894.9	2,838.3
Department of Defense	8,988.0	9,869.0	9,670.0
Environmental Protection Agency	288.0	275.2	366.8
National Aeronautics and Space Administration	1,392.9	1,617.4	1,842.6
National Institutes of Health	882.9	*	*
National Institute of Standards and Technology	592.1	681.1	577.5
National Science Foundation	265.3	285.3	293.8

* Figures not available

[1] Chair, ASME Inter-Council Committee on Federal R&D (ICCFR&D)

Table 2: Detail of Selected Mechanical Engineering-Related Programs in the FY 2003 Budget (in millions of dollars)

	FY 2001 Budget	FY 2002 Estimate	FY 2003 Request
Department of Energy (DOE)			
Basic Energy Sciences	973.8	999.6	1019.6
Fusion Energy Sciences	245.0	247.5	257.3
Nuclear Energy S&T	277.1	293.9	250.7
Fossil Energy R&D	442.6	587.2	494.2
Energy Efficiency/Renewable Energy	370.5	386.4	407.7
Energy Conservation	293.3	380.3	408.8
Total DOE	2602.3	2894.9	2838.3
Department of Defense (DOD)			
Air Force			
Basic Research (6.1)	213.0	226.0	219.0
Applied Research (6.2)	657.0	768.0	698.0
Advanced Technology Development (6.3)	587.0	572.0	743.0
Army			
Basic Research (6.1)	210.0	231.0	237.0
Applied Research (6.2)	823.0	910.0	642.0
Advanced Technology Development (6.3)	815.0	910.0	730.0
Navy			
Basic Research (6.1)	394.0	405.0	410.0
Applied Research (6.2)	659.0	777.0	580.0
Advanced Technology Development (6.3)	786.0	870.0	617.0
Defense Wide			
Basic Research (6.1)	500.0	513.0	499.0
Applied Research (6.2)	1533.0	1632.0	1860.0
Advanced Technology Development (6.3)	1811.0	2055.0	2435.0
Total DOD	8988.0	9869.0	9670.0
National Institute of Standards and Technology (NIST)			
Scientific & Techn. Res. & Services (STRS)			
NIST Laboratories	301.8	321.1	396.4
Baldrige National Quality Program (BNQP)	5.2	5.4	5.8
Industrial Technology Services (ITS)			
Advanced Technology Program (ATP)	145.4	184.5	107.9
Manufacturing Extension Partnership (MEP)	104.9	106.5	12.9
Construction of Research Facilities (CRF)	34.8	63.6	54.5
Total NIST	592.1	681.1	577.5

Environmental Protection Agency (EPA)			
Superfund Basic Research	35.4	36.9	111.2
Climate Change Research	22.5	21.3	21.7
Hazardous Substance Research Centers	4.5	4.6	4.6
Hazardous Waste Research	7.0	9.1	9.6
Superfund Innovative Technology	6.6	6.5	6.6
Safe Drinking Water Research	51.5	45.6	49.5
Particulate Matter Research	68.8	65.4	66.6
Tropospheric Ozone Research	6.5	6.5	6.8
Air Toxics Research	22.2	18.9	19.8
Pollution Prevention	24.4	21.6	25.1
Environmental Tech. Verification	6.3	3.6	3.6
Environmental Monitoring & Assessment	29.5	32.3	38.3
Science Advisory Board	2.8	2.9	3.4
Total EPA	288.0	275.2	366.8
National Aeronautics and Space Administration (NASA)			
Revolutionize Aviation			
Vehicle System Technology Base	184.2	207.5	156.9
Propulsion & Power	129.1	126.1	74.9
Flight Research	83.3	59.1	65.6
Rotorcraft	31.6	12.5	0.0
Aerospace Base	39.9	40.0	40.0
Aviation Systems Capacity	68.4	94.4	94.6
Aviation Safety	70.9	86.0	85.0
Ultra Efficient Engine Technology (UEET)	47.9	50.0	50.0
Small Air Transport Systems (SATS)	9.0	15.5	20.0
X-34 Technology Demonstrator	17.9	0.0	0.0
Quiet Airplane Technology (QAT)	19.9	20.0	20.0
Advanced Space Transportation			
2nd Generation RLV	271.5	467.0	759.2
Space Transfer and Launch Technology	76.6	69.6	127.1
Pioneer Revolutionary Technologies			
Computing, Info. & Commun. Tech.	158.2	206.4	202.4
High Performance Computing & Commun.	22.1	0.0	0.0
Commercialize Technology	162.4	163.8	146.9
Total NASA	1392.9	1617.4	1842.6
National Institutes of Health (NIH)			
Bioengineering Research	814.9	*	*
Biomedical Imaging & Bioengineering	68**	111.2	120.5
Total NIH	882.9	*	*

National Science Foundation (NSF)			
Chemical and Transport Systems	50.6	56.8	58.9
Design, Manufacture and Industrial Innovation (excluding SBIR)	51.9	55.7	57.6
Engineering Education and Centers (includes ERC and I/UCRC)	109.5	116.7	119.5
Civil and Mechanical Systems	53.3	56.1	57.8
Total NSF	265.3	285.3	293.8

*Figures not available
**transferred from various NIH Institutes and Centers for biomedical imaging and bioengineering activities.

DEPARTMENT OF ENERGY (DOE)

The DOE budget request for FY 2003 is clearly oriented toward near-term activities like the weatherization program and energy supply issues, but it also includes some longer-term activities such as the Nuclear Power 2010, the President's Coal Research Initiative, and FreedomCAR —the fuel cell vehicle program.

The overall Office of Science budget request is essentially level with current funding levels. Two areas within the Office of Science of most concern to mechanical engineering, Basic Energy Sciences and Fusion Energy Sciences, would receive $1.3 billion, a nearly 5 percent increase over current levels.

Energy Supply programs within DOE are in fossil, nuclear, and renewable energy, and include energy conservation. The $1.3 billion total budget for Energy Efficiency and Renewable Energy programs (including programs not spelled out in Table 2) is up less than 1 percent from FY 2002. The Department's weatherization program (not R&D) is housed in the energy efficiency program, and is slated for a $47 million increase. Accounting for this, the R&D budget is reduced 3.5 percent ($37 million) compared with FY 2002 levels. Renewable Energy Technologies funding is increased by 6 percent ($21 million) with a substantial re-prioritization of activities in this area. There are increases in funding for R&D of hydrogen and for solar buildings, increases of $10.7 and $7.3 million (37 percent and 155 percent), respectively. Within this budget, a proposed increase for high-temperature superconductivity R&D ($15.4 million, or 48 percent) is counteracted by

a corresponding reduction in Distributed Energy Systems of $15.7 million (41 percent). The Energy Conservation budget is reduced by $18.6 million (14 percent) when the proposed Weatherization Program increase is taken into account.

The Department's Fossil Energy program is concerned with R&D of coal, natural gas, and oil. Its budget is down $93 million (16 percent), with major cuts in the areas of the Vision 21 Program to develop low-emission, high-efficiency power plants for 2010, and in the national laboratory-industry partnerships in oil and gas research. Coal R&D is funded at $326 million, a decrease of $13 million (4 percent) for FY 2003. The program includes the President's Coal Research Initiative at level funding ($150 million), central systems down $11 million (12 percent), sequestration (up $22 million or 68 percent), and fuels (down $27 million or 84 percent). Distributed generation systems, which also are reduced in the energy efficiency budget, are reduced by $8.6 million (15 percent). Natural gas R&D is decreased by $22 million (50 percent) with cuts in all areas. Even though the National Energy Policy (NEP) calls for R&D for exploration and production, R&D in those areas is reduced by $5 million (25 percent), as is gas hydrates R&D (54 percent). The infrastructure program involving gas storage was eliminated, and the integrity/reliability of the pipeline infrastructure is moved to the DOT Office of Pipeline Safety (OPS), resulting in a cut of $10.5 million.

The budget for Nuclear Energy is $251 million, a $43 million reduction (15 percent) over FY 2002. The budget request includes level funding of $17.5 million for University Reactor Support, which provides educational support for fueling university reactors, fellowships, and research. The Nuclear Energy Plant Optimization (NEPO) program is eliminated, and the Nuclear Energy Research Initiative (NERI) is reduced by $7 million (22 percent). The Nuclear 2010 program and the Generation IV program together are increased by $34.5 million (288 percent). The budget for Spent Fuel Pyroprocessing and Transmutation is reduced by $59 million (76 percent).

DEPARTMENT OF DEFENSE (DOD)

Requested FY 2003 funding for the DOD Science and Technology (S&T) Program is $9.67 billion, two percent lower than the FY 2002 appropriated levels. Basic Research (category "6.1") and Applied Research (category "6.2") are down $10 million (0.7 percent) and $307

million (7.5 percent), respectively. Advanced Technology Development (category "6.3") is up $124 million. Individually, the Army and Navy are experiencing cuts of 20 percent to 30 percent in the combined Applied Research and Advanced Technology Development categories. Air Force Applied Research is down nine percent. To compensate for these cuts, Defense Wide Applied Research and Advanced Technology Development programs are proposed to increase by $228 million (14 percent) and $380 million (18 percent), respectively. The Chemical and Biological Defense Program (CBDP) and Defense Advanced Research Projects Agency (DARPA) are slated for the largest gains within the Defense Wide research accounts, with increases of $383 million (70 percent) and $432 million (19 percent), respectively. Increases in the CBDP are concentrated in Applied Research and Advanced Technology Development, while DARPA's increases are evenly distributed across all three categories. Basic research is the least-impacted category with changes of no more than plus-or-minus three percent within individual service budgets. While Defense Wide Basic Research is down $14 million (2.7 percent), much larger cuts, specifically to Office of the Secretary of Defense-led university initiatives, were made to offset the large Basic Research funding increases to CBDP and DARPA. Last year, DOD set an S&T funding goal of three percent of DOD's total budget. After subtracting the newly created $10 billion War Contingency Fund from DOD's FY 2003 budget, S&T funding is 2.6 percent.

DOD S&T contains elements incorporating significant mechanical engineering research. Increases are proposed for counter-terrorism, improvements in the safety and security of the nation's physical information technology (IT) infrastructure, advanced nano-materials, advanced "bottom-up" manufacturing, and innovative power sources.

ENVIRONMENTAL PROTECTION AGENCY (EPA)

The FY 2003 request for mechanical engineering-related R&D at the EPA, not including Superfund Basic Research, is $255.52 million, an overall increase of 6.75 percent from FY 2002 levels. Much of the engineering research funding comes through the Science and Technology (S&T) portion of the budget at EPA, of which the largest share goes to the Office of Research and Development (ORD).

The total S&T budget request within EPA amounts to $685.2 million, 3.9 percent lower than the $712.9 million estimated in FY 2002.

However, the FY 2002 budget request was $640.5 million. The enacted FY 2002 budget contained an additional $72.4 million in the form of special appropriation earmarks from Congress. Hence, the FY 2003 budget reflects an actual increase in the research portion of the budget.

Significant additional funding ($90.3 million) was added in the middle of FY 2002 to the Science and Technology budget to assist with new research associated with terrorism. The additional funding is to be used primarily for research into drinking water safety, indoor air safety, and building/HVAC decontamination. The bulk of this additional "Homeland Security" budget is found in the Superfund program in FY 2003.

All research-related budget categories would see a net gain in actual dollar funding between FY 2002 and FY 2003. Aside from the Superfund Basic Research program, the largest proposed increase is in Environmental Monitoring and Assessment (18.6 percent), while substantial gains are also proposed in Pollution Prevention (16.2 percent), the Science Advisory Board (15.8 percent), and Safe Drinking Water Research (8.6 percent). Highlights of the safe drinking water research include methods for minimization of microbial contaminants in water, while the pollution prevention research focuses on methods to evaluate endpoints of toxicity, such as biomarkers.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)

NASA would see its total budget increase to $15 billion in FY 2003, a $98 million increase, or 0.7 percent over the FY 2002 appropriation (see Table II-12). NASA's R&D (two-thirds of the agency's budget) would climb 5.3 percent to $10.1 billion. The NASA budget is divided into two categories: Human Space Flight, which would decrease 10.2 percent to $6.2 billion; and Science, Aeronautics and Technology (SAT), a 10.3 percent increase to $8.9 billion. The SAT account funds nearly all of NASA's R&D not related to the Space Station.

Mechanical engineering-related research is conducted primarily in the programs of NASA's Aerospace Technology Enterprise within the SAT account, and includes funding for vehicle systems technology, propulsion and power, flight research, rotorcraft, space transfer and launch technology, and information technology. Mechanical engineering activities constitute a portion of research in three other areas within

SAT: Space Science, Earth Science, and Biological and Physical Research.

NASA has proposed a restructuring of its Aerospace Technology Enterprise into four strategic goals in FY 2003: Revolutionize Aviation; Advance Space Transportation; Pioneer Revolutionary Technology; and, Commercialize Technology. NASA continues to restructure elements within the four strategic goal areas.

NASA's FY 2003 budget request for mechanical engineering-related R&D highlights a 14 percent increase to $1.84 billion in funding for Aerospace Technology, primarily due to an increase to $759.2 million (up 63 percent) for the 2nd Generation Reusable Launch Vehicle. Funding for some programs within Revolutionize Aviation (such as Propulsion and Power Advanced Vehicle Concepts and Breakthrough Vehicle Technologies) would decrease in FY 2003. The FY 2003 budget request eliminates the Rotorcraft R&D program.

NATIONAL INSTITUTES OF HEALTH (NIH)

The total FY 2003 NIH budget request is $27.3 billion, which represents an unprecedented increase of $3.7 billion, or 15.7 percent, over FY 2002 (see Table II-9). This request would complete the doubling of the NIH budget between FY 1998 and FY 2003.

In FY 2001, bioengineering research support was $814.9 million, or 7.3 percent of total NIH Research Project Grants (RPG). The National Institute of Biomedical Imaging and Bioengineering (NIBIB) was established in FY 2001. Its first operating budget was FY 2002, and its initial research portfolio was achieved with the transfer of already funded biomedical imaging and bioengineering grants from other NIH Institutes and Centers in FY 2001. The goals of the new Institute are to develop fundamental new knowledge, to foster potent new technologies, to nurture a new generation of researchers, and to facilitate cross-cutting capabilities. The ultimate goal of the NIBIB is to translate research findings from the laboratory into practical solutions that will benefit public health. The FY 2003 budget requests $120.5 million for the NIBIB, which represents an increase of $9.3 million (8.4 percent) over FY 2002. The FY 2003 request includes funding for two research centers and support for an estimated 74 pre- and postdoctoral full time trainees, the same number as in FY 2002. Biomaterials and tissue engineering,

imaging and non-destructive evaluation technologies to diagnostic medicine, and biosensors represent rich opportunities since they are areas of special interest to the NIBIB. Specific initiatives will be launched in FY 2003 in nanoparticle materials for drug production and delivery, in the development of molecular probes and contrast agents for biomedical imaging, in biosensors, and in bioformatics.

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

The FY 2003 request for mechanical engineering-related R&D for NIST is $577.0 million, down 14.5 percent from FY 2002. The portion of the NIST budget related to mechanical engineering consists of three distinct components: Scientific and Technical Research Services (STRS; $402.2 million); Industrial Technology Services (ITS; $120.8 million); and, Construction of Research Facilities (CRF; $54.5 million).

The STRS portion reflects an increase (23.2 percent) to further provide U.S. industry and the science/technology community with the measurement capabilities, standards, evaluated reference data, and the test methods needed to support innovation, improve quality, and lower transaction costs in virtually all technology-intensive sectors. This budget supports the NIST Laboratories ($396.4 million) and the Baldridge National Quality Program (BNQP; $5.8 million).

Most of the budget decreases for FY 2003 are in the ITS component, which has two major elements: the Manufacturing Extension Partnership (MEP) and the Advanced Technology Program (ATP). The MEP request for $12.9 million would be an 87.9 percent cut due to the Administration's desire to discontinue federal support to a majority of the centers serving small manufacturers. MEP would continue funding two centers less than six years old and some central coordination. The FY 2003 budget would return the MEP to its original funding plan, which called for the phase-out of federal monies to the MEP after six years of funding to a nationwide network of centers serving all 50 states and Puerto Rico.

ATP shares the cost with industry of developing cutting-edge technologies for a broad range of applications. ATP's budget would decrease by $76.6 million (41.5 percent) from the FY 2002 level. The request would provide a budget of $107.9 million to cover continued funding requirements in FY 2002 to industry for high-risk R&D.

Commerce Secretary Don Evans has evaluated the ATP and has recommended several modifications to stabilize the program.

The CRF budget request reflects a decrease of 14.3 percent. The budget includes $17.3 million to begin the high priority construction at the Boulder, Colorado laboratories, and $15 million to complete construction of the Advanced Measurements Laboratory in Gaithersburg, Maryland.

NATIONAL SCIENCE FOUNDATION (NSF)

The total FY 2003 NSF budget request is $5.04 billion, a 5.0 percent increase over the current budget (see Table II-7). The request is divided into five appropriation accounts. Research and Related Activities comprise the dominant part of the total NSF request at $3.78 billion. This is a 5.1 percent increase relative to FY 2002. The next largest category is Education and Human Resources (EHR) with a request for $0.91 billion, up 3.8 percent from FY 2002.

The budget request for Computer Information Science and Engineering (CISE) reflects a 2.3 percent increase from $515 million to $527 million. NSF will continue its leadership role of the nation's Information Technology Research (ITR) initiative. The CISE funding request for ITR will increase from $174 million to $191 million in FY 2003.

The FY 2003 budget request for the Engineering Directorate (ENG) is $488 million, a 3.3 percent increase over the current year plan. Funding for mechanical engineering related research within ENG would increase 3.1 percent to $294 million, below NSF's overall 5.0 percent rate of increase. Details of the mechanical engineering component of the NSF budget appear in Table 2. It should be noted that, given the multidisciplinary nature of modern engineering research, funding for mechanical engineering related research may be, and often is, 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 2 may be construed as reflecting traditional sources for funding for mechanical engineering related research.