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R&D Trends and Special Analyses

(R&D by Function; Character of Work;
Outyear Projections to FY 2008; "FS&T" Budget)

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HIGHLIGHTS

- **Defense R&D continues to gain prominence** in the federal R&D portfolio because of the high priority given military defense and homeland security by the Bush Administration. Defense R&D would total 55 percent of the federal R&D portfolio in FY 2004 at $67.5 billion, from near-parity with nondefense a few years ago (see Table I-4). Among national missions, there would be large increases for defense R&D (up 7.2 percent) and general science R&D (up 5.0 percent to $7.4 billion).

- The **total federal investment in research (basic and applied research) would increase just 1.5 percent to $53.7 billion** in FY 2004 (see Table II-1), smaller than the increase for R&D as a whole because defense development activities would increase more dramatically. A $1.7 billion increase for NIH research would make up more than the overall increase, leaving non-NIH research collectively down by 3.4 percent from the FY 2003 level. Many agencies would see their research funding increase slightly in the FY 2004 request, but several would decline significantly (see Table II-1).

- The AAAS analysis of the **outyear projections in the FY 2004 budget** shows that nondefense R&D would increase from $54.3 billion in FY 2003 to $61.0 billion in FY 2008, a gain of 2.6 percent after adjusting for expected inflation (see Table I-8). Defense R&D would climb to $73.4 billion in FY 2008, a 6.5 percent inflation-adjusted gain over FY 2003.

- The **"Federal Science and Technology (FS&T)" budget** is a collection of selected R&D and non-R&D programs that

emphasize basic and applied research and the creation of new knowledge or technologies. The Office of Management and Budget (OMB) created the FS&T budget as a successor to the Clinton Administration's "21st Century Research Fund." The FS&T budget would barely increase 0.1 percent to $58.9 billion in FY 2004 (see Table I-7).

R&D BY NATIONAL MISSIONS (BUDGET FUNCTIONS)

The federal government divides the budget into 20 "functional" groupings to illustrate national priorities, each with a function number. (AAAS separates the general science, space, and technology function (function 250) into its subfunctions of General Science (251) and Space (252). AAAS also counts Department of Veterans Affairs R&D programs in the health (550) function instead of veterans affairs (700).) The congressional budget resolution divides the total budget "pie" into functional "slices," which serve as non-binding guides for appropriators in allocating funds to agencies and programs. Viewing the R&D budget by function sheds light on the funding priorities assigned to different areas over time, and allows for international comparisons with other nations' spending on R&D by objective. Table I-4 shows R&D by function in the FY 2004 budget. (Chapter 1 discusses historical trends in the functional distribution of federal R&D.)

Although there is much talk of homeland security becoming a major mission in the federal government, in the federal budget homeland security spending is counted as spending on other traditional missions such as national defense, transportation, and justice. R&D in the new Department of Homeland Security (DHS) serves the four missions of defense, general science, agriculture, and transportation. (See Chapter 12 for more information on the new DHS.)

The Bush Administration would once again, as it did last year, place a high priority on defense R&D, but would lessen the priority assigned to health R&D compared to past years. Both defense R&D (up 7.2 percent to $67.5 billion) and health R&D (up 2.3 percent to $29.0 billion) would increase, substantially in the case of defense, and would together make up a record-breaking 79 percent of the federal R&D portfolio. R&D funding for many other national missions would decline or fall short of the expected inflation rate of 2 percent (see Figure 1).

Defense (050) R&D, which includes R&D activities in the Department of Defense (DOD) and the defense-related atomic energy activities of the Department of Energy (DOE), has accounted for the majority of R&D for the past two decades. Nondefense and defense R&D almost reached parity in FY 2001, but in the aftermath of the September 11 terrorist attacks defense R&D climbed sharply in FY 2002 and FY 2003. Beginning in FY 2002, this category also includes the defense-related homeland security activities transferring to the new Department of Homeland Security (DHS), which were housed in DOD and DOE previously.

The Bush Administration would continue to widen the gap between defense and nondefense by aggressively expanding defense R&D investments to build up DOD capabilities to fight current and future wars (see Chapter 6 for more information on the DOD portion of the defense request; see Chapter 9 for more information on DOE's defense R&D). At $67.5 billion for FY 2004, the defense R&D investment would be a record in inflation-adjusted terms, and would also represent 55 percent of the total federal R&D portfolio.

Health (550) R&D would continue to be the dominant mission on the nondefense side as a result of the now-completed campaign to double the NIH budget between FY 1998 and FY 2003. Health-related R&D would total $29.0 billion in FY 2004, a modest increase of 2.3 percent coming after nearly 15 percent increases for each of the past five years of the doubling campaign. Health R&D would make up a majority of the nondefense R&D portfolio and 23.7 percent of the total R&D portfolio, reflecting consistent growth in NIH's budget over the past few decades.

General science R&D would be a big winner with a 5.0 percent increase to $7.4 billion, primarily because of increases for new science-oriented DHS programs; funding in NSF would increase only slightly and DOE's Office of Science budget would decline slightly.

R&D funding for most of the other national missions would decline or at best fall behind expected inflation (see Figure 1). Space (252) R&D would increase just 1.1 percent to $10.0 billion, with most of the increase coming from a shift in NASA funding away from transportation. There would be steep cuts to commerce R&D (370; down 24.7 percent to $424 million) because of the proposal to eliminate the Advanced Technology Program (ATP) in the Department of Commerce. There would also be

steep cuts to environment (450) R&D (down 1.7 percent to $2.2 billion) and agriculture (350) R&D (down 12.0 percent to $1.7 billion). Environmental R&D would decline because of cuts to a broad portfolio of R&D funding agencies including the Environmental Protection Agency (EPA), the U.S. Geological Survey (USGS), the National Oceanic and Atmospheric Administration (NOAA), and the Corps of Engineers. Agriculture R&D would decline primarily because the Administration would not renew more than $200 million in congressionally designated research projects.

CHARACTER OF WORK FOR R&D

Statistics on federally funded R&D generally make distinctions among basic research, applied research, development, and R&D facilities and capital equipment—terms that describe the "character of work" in R&D programs. (See Appendix 2 for definitions.)

The figures shown in Tables I-5, I-6, and II-1 represent agencies' best attempts to classify basic and applied research, development, and R&D facilities within their R&D portfolios. The data reported here are imprecise and reflect the agencies' judgments as to how their R&D fits into the definitions for character of work. Table II-1 shows that basic research would increase 3.1 percent or $813 million to an all-time high of $26.9 billion in the FY 2004 budget, primarily because of a $713 million requested increase for basic research in NIH. NIH would provide the majority (55 percent) of federal basic research. Basic research excluding NIH would rise by just 0.8 percent or $100 million to $12.1 billion in FY 2004.

The total federal investment in research (basic and applied research) would increase an even more modest 1.5 percent to $53.7 billion (see Table II-1), but excluding an increase for NIH all other federal research would fall 3.4 percent to $26.9 billion. NIH's research would increase by a particularly large $1.7 billion or 7.0 percent, outpacing growth in the NIH budget as a whole or NIH basic research, because the FY 2004 high-priority areas of cancer and counter-terrorism involve significant work in applied research. For the other research funding agencies, FY 2004 would involve overall cuts, with increases for the new DHS, NSF, and defense research at DOE offset by cuts for almost everyone else.

Development would increase 9.7 percent to a record-breaking $64.3 billion in FY 2004 because of an enormous infusion of funds for DOD's development of weapons systems, including national missile defenses, new fighter planes, and an array of other expensive future weapons systems (see Chapter 6 for more on DOD development).

The character of work is quite different in defense and nondefense R&D, a point illustrated in Table I-6. Development would be by far the largest component of defense R&D, accounting for 88 percent of the FY 2004 total, while applied research would be 9 percent and basic research would be only 2 percent. In nondefense R&D, by contrast, basic research would be the largest category at 46 percent, with development at only 9 percent and applied research at 38 percent. A major reason for the difference between the character of defense and nondefense R&D is that development in DOD includes testing and evaluation of weapons systems. These activities are extremely expensive compared to other types of R&D. R&D facilities and capital equipment costs make up 7 percent of nondefense R&D and only 1 percent of defense R&D; the nondefense ratio is down from this year because NIH would discontinue funding for most extramural facilities construction projects.

The composition of the federal R&D portfolio has been shifting dramatically over the years, as shown in Table I-5, primarily because of declines in defense development in the post-Cold War era and increases in NIH support of basic research. At the height of the Cold War, development (mostly in DOD) made up nearly two-thirds of the federal R&D portfolio, but now makes up only 53 percent, though that share has been increasing in recent years. Basic research, meanwhile, has expanded its share of the federal R&D portfolio from 14 percent in FY 1980 to 17 percent in FY 1990 to 22 percent in FY 2004, though not steadily; in recent years, as DOD development has grown substantially, the share of basic research in the total portfolio has declined slightly.

OUTYEAR PROJECTIONS FOR FEDERAL R&D TO FY 2008

The FY 2004 budget also contains detailed projections for federal spending, as required by law, to FY 2008. Although these projections are mostly mere extrapolations of current policies, they are a statement of the Bush Administration's budgetary priorities and their implications for the future of federal R&D. The AAAS analysis of these outyear projections reveals that the Bush budget would hold most discretionary programs to

inflationary growth over the next several years, allowing most R&D programs to just stay even or slightly ahead of expected inflation.

Federal support for R&D is projected to increase from $117.3 billion in FY 2003 to $134.4 billion in FY 2008, a 4.7 percent increase after adjusting for expected inflation (see Table I-8). The nondefense R&D portion would climb 2.6 percent over the time period. The only agency projected to receive a large increase over this time period is DHS because of its contributions to the high priority of homeland security and because DHS will ramp up its R&D funding with new programs. The new DHS would see its R&D budget climb from an initial $669 million this year to $1.0 billion in FY 2004 with small increases each year thereafter, resulting in a 48.9 percent boost over five years after adjusting for inflation.

Included in the budget projections are some substantial projected increases over the next five years.[1] NASA R&D would increase from $11.0 billion in FY 2003 to $13.0 billion in FY 2008 (up 7.6 percent after inflation). The increase is even larger for key R&D programs because the International Space Station would see its R&D budget decline by 20.7 percent to FY 2008, leaving more room for other programs. NASA plans a dramatic expansion of the Space Science program from $3.6 billion in FY 2003 to $5.6 billion in FY 2008 (up 43.2 percent after inflation). NASA Biological and Physical Research would jump from $935 million this year to $1.1 billion in five years (up 11.6 percent after inflation), with much of this research slated to take place aboard the Space Station. Other programs slated for increases include energy supply R&D in DOE (up 45.6 percent by FY 2008) for increased investments in hydrogen R&D and nuclear energy R&D; Major Research Equipment and Facilities Construction (MREFC) in NSF (up 35.6 percent by FY 2008) to build major laboratory facilities, and both aviation security R&D (up 55.4 percent to FY 2008) and general science R&D (up 11-fold to $297 million by FY 2008) in the new DHS.

Most other programs' projections generally show modest increases over the next few years, clustered just below or just above expected inflation. Some programs would face steep cuts over the next several years:

[1] For a program-by-program look at the outyear projections, please see the detailed analysis of projected R&D, available on the AAAS Web site at http://www.aaas.org/spp/R&D in the "Guide to R&D Funding Data - Outyear Projections" section.

NASA's aeronautics R&D investments would fall 20.2 percent to FY 2008 as the agency's resources shift to space; DOE's fossil energy R&D (down 17.4 percent) would fall as resources shift to other forms of energy R&D; and the Advanced Technology Program in Commerce would disappear entirely in FY 2004.

Projections, of course, are always wrong. They are not predictions. The FY 2004 appropriations process is just now getting under way in a Congress with different priorities than the President, and future appropriations will be decided one year at a time. At best, projections are statements of the Bush Administration's current priorities, and priorities always change in the give-and-take process of federal policymaking; nevertheless, they illuminate this Administration's future plans of plenty for the new DHS, and increases just keeping pace with inflation for most of the other agencies.

THE "FEDERAL SCIENCE AND TECHNOLOGY (FS&T)" BUDGET

Two years ago, the Office of Management and Budget (OMB) introduced a new "Federal Science and Technology" (FS&T) budget in the FY 2002 budget, and continues to advance this concept in the FY 2004 budget (see Table I-7). The **FS&T budget** is successor to the Clinton Administration's "21st Century Research Fund" (see previous editions of this report) and contains most of the same programs. FS&T is a collection of selected R&D and non-R&D programs that emphasize basic and applied research and the creation of new knowledge or technologies. It also includes some S&T education and training activities but excludes most development, and is designed to be an alternative measure for the federal investment in science and technology and an alternative way to track federal S&T investments in the budget process. (This FS&T budget has a similar emphasis but different definitions from the FS&T concept proposed in 1995 by the National Academy of Sciences (NAS) as a subset of federal R&D; thus, the data in Table I-7 differ from NAS discussions of its version of FS&T in previous editions of this report.)

Because of the tight situation for domestic discretionary programs in the FY 2004 budget, FS&T would increase a negligible 0.1 percent to $58.9 billion in FY 2004, with an increase for NIH offset by cuts in most other FS&T programs.