1

An Introduction to R&D in the FY 2004 Budget

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FREQUENTLY ASKED QUESTIONS ABOUT R&D IN THE BUDGET

Research and development (R&D) is one of the most important, yet least understood, parts of the federal budget. The federal government invests more than $100 billion in R&D annually. This book is intended to help make sense out of the myriad of budget numbers, percentage increases and decreases, and often-conflicting interpretations that surround R&D budget issues. It seeks to put the Bush Administration's budget for the coming fiscal year in perspective by sorting out the facts behind the rhetoric and discussing the current budget in the context of past trends and future projections. This chapter provides answers to some of the most frequently asked questions about federal funding for R&D:

1. **What is the role of R&D in serving national needs, including building the U.S. economy?**
2. **How much does the U.S. invest in R&D each year overall?**
3. **Why does the federal government fund R&D when the private sector is already investing so much in it?**
4. **Where is federally-funded R&D carried out?**
5. **What is the share of the federal budget devoted to R&D?**
6. **Does the government have an "R&D budget"?**
7. **How does federal R&D relate to other government objectives and priorities?**
8. **How are R&D priorities set in the President's budget?**
9. **How does Congress set its R&D priorities?**
10. **Where does R&D fit among President Bush's priorities for FY 2004?**
11. **How does U.S. investment in R&D compare to other countries?**

1. What is the role of R&D in serving national needs, including building the U.S. economy?

Science and technology are central to the nation's growing counter-terrorism efforts as well as other aspects of national security. The screening devices being installed in airports throughout the country, the high-tech weapons employed by U.S. forces in Afghanistan, and the diagnoses, vaccines, and treatments for anthrax and other bioweapons are but a few of the products of scientific and engineering research, much of it paid for by federal tax dollars.

Science and technology are recognized as key drivers of economic growth, as well as improved health and quality of life in the United States and throughout the world. Economists estimate that up to half of U.S. economic growth over the past five decades is due to advances in technology. A study of recent U.S. patents released several years ago found that nearly two-thirds of the papers cited in these patents were published by researchers at organizations supported by federal funds—and these linkages have been growing at an accelerating pace.

Recent advances in genetics and biotechnology, as well as computers and information technology, have raised public awareness of the vital economic role of research-based technology. High-tech industry is sought after by economic development organizations in virtually every state and locality. Policymakers regard universities as catalysts for high-tech economic development both through entrepreneurial activity that spins off from their research and through the concentrations of highly trained human resources they attract and generate. The federal government plays a central role in research in the nation's universities.

2. How much does the U.S. invest in R&D each year overall?

R&D is a substantial and growing enterprise in the United States. All in all, the U.S. invested an estimated $292 billion in R&D in 2002 (see Table I-11). This represented 2.79 percent of the nation's Gross Domestic Product (GDP). The largest share of this money (66 percent) came from industrial firms. Most of the balance (28 percent) came from the federal government. Colleges and universities, private foundations, other nonprofit institutions, and state and local governments provided the remainder. Industry's share of national R&D funding has been growing steadily for several decades (see Chapter 4 for more information on industry support of R&D). From the end of World War II to 1980, the federal government supported the largest share of the nation's R&D.

3. Why does the federal government fund R&D when the private sector is already investing so much in it?

Despite its relatively modest share of total U.S. R&D funding, the federal government's role is critical to the nation's science and technology enterprise. Federal agencies support a majority of the nation's *basic* research and 58 percent of the R&D performed in U.S. colleges and universities. Basic research is the primary source of the new knowledge that ultimately drives the innovation process. At the same time, federally funded research at colleges and universities plays a key role in educating the next generation of scientists and engineers. (See Chapter 3 and Table II-1 for details of basic research in the FY 2003 budget.) Federal applied research and development programs also provide direct support for key government missions, such as improving the nation's health and medical care, exploring space, and national security.

4. Where is federally-funded R&D carried out?

Although the government maintains several hundred laboratories around the country, only a quarter of federally supported R&D is actually carried out in these labs. The largest share of federally funded R&D is performed by industrial firms under contracts. A significant amount is conducted under federal grants in colleges and universities as well as other nonprofit institutions, including FFRDCs (federally funded R&D centers) operated by contractors, such as the Department of Energy's (DOE) Oak Ridge National Laboratory in Tennessee, which is operated in partnership by the University of Tennessee and the Battelle Memorial Institute.

Altogether, including the research that firms support with their own funds and that which is conducted under government contracts, industry is responsible for performing nearly three-fourths (72 percent) of the nation's total R&D. U.S. academic institutions perform 13 percent, while federal laboratories, nonprofit institutions (research institutes, hospitals, etc.), and FFRDCs perform the remainder (see Tables I-11 through I-14).

5. What is the share of the federal budget devoted to R&D?

Federal R&D expenditures represent 5.2 percent of the overall proposed $2.2 trillion federal budget for FY 2004 and 15.7 percent of the discretionary portion of that budget (see Tables I-3 and I-9). On the whole, trends in R&D funding have closely followed trends in federal discretionary spending. Growth in overall discretionary spending over the past four decades has allowed federal investment to grow in many areas, including R&D. Efforts to balance the federal budget by cutting discretionary spending during the mid-1990s resulted in reductions in most of these areas, including R&D. Subsequent increases have erased these losses in several agencies and produced significant gains for a few.

6. Does the government have an "R&D budget"?

Although the President's budget presentation each year generally contains a section devoted to R&D and a number of tables summarizing proposed federal R&D expenditures, it is important to recognize that *there is no overall "R&D budget"* and no special treatment for R&D within the budget.

Expenditures for R&D programs are regular budget items. They are contained, along with other types of expenditures, within the budgets of more than 20 federal agencies and departments as shown in Table II-1. For some of those agencies, such as the National Science Foundation (NSF), the National Aeronautics and Space Administration (NASA), and the National Institutes of Health (NIH), R&D is a dominant activity. For others, such as the Department of Housing and Urban Development (HUD), it is a small part of a much larger set of programs. Some R&D programs are "line items" in the budget and are relatively easy to identify as R&D. Others are included within larger line items and are more difficult to ferret out.

7. How does federal R&D relate to other government objectives and priorities?

Most of the federal government's R&D is mission oriented; that is, it is intended to serve the goals and objectives of the agency that provides the funds (*e.g.*, agricultural research in the U.S. Department of Agriculture). The only exception to this is NSF, whose mission is to support basic and applied research, research facilities, and education across a wide range of

AN INTRODUCTION TO R&D IN THE FY 2004 BUDGET

science and engineering disciplines. The relative priority of different areas of R&D has varied over the years, reflecting changing national priorities and the role of R&D within them. Spending on defense R&D has exceeded all other R&D spending (grouped together as "nondefense R&D") for most of the past four decades, although the relative size of the two sectors has varied considerably over the years. Figure 1 shows how priorities in nondefense R&D have shifted over the same period. Civilian R&D expenditures reached a high point in the mid-1960s, declining for several years thereafter. After several years of significant growth in the late 1980s and the late 1990s, they are just now returning to the levels of the 1960s in real (*i.e.*, inflation-adjusted) terms.

Priorities, however, are different now than they were in the 1960s. Indeed, they changed significantly after September 11. Space exploration was the dominant function in the 1960s, driven mainly by the Apollo Program. It lost priority after we succeeded in landing on the moon in 1969, however, and has never regained its lead. Energy R&D gained priority following the oil shortages of the 1970s, then retreated as national attention turned elsewhere. Health R&D, meanwhile, has shown practically uninterrupted growth over these years and now represents the largest single share of the civilian R&D portfolio. Homeland security-related R&D has increased in importance since September 11 with the creation this year of a new cabinet-level department devoted to homeland security; its work is divided among several national priorities, including defense, transportation, and health. (See Chapter 3 and Table I-4 for details of national priorities in the FY 2004 budget. See Chapter 12 and Table II-20 for more on the new Department of Homeland Security.)

8. How are R&D priorities set in the President's budget?

Priorities for R&D programs generally depend on the priorities of the agencies in which they are located and the priority of the missions of those agencies. From the standpoint of serving the nation's interests, at least in the short term, this makes good sense, since these R&D programs are not ends in themselves but means to the ends (missions) that their sponsoring agencies serve. From the standpoint of the long-term health of the research enterprise, however, it can cause problems. The mission orientation of R&D programs may make it difficult for policymakers to assess the overall health of the research enterprise, to coordinate programs among different agencies, and to address issues of balance among various scientific and engineering fields and disciplines.

The Office of Management and Budget (OMB), which has overall responsibility for preparation of the President's budget, is able to provide some coordination, although it is hampered by the fact that the agencies that support R&D are treated individually by its different sections in the budget review process. Some coordination also takes place under the National Science and Technology Council (NSTC), an interagency body comprised of cabinet officers and the President. NSTC has organized a number of interagency initiatives in areas of R&D, including global change research, information technology, and nanotechnology. Budgets for three of these initiatives are shown in Table I-10.

9. How does Congress set its R&D priorities?

Even the modest level of coordination in R&D in the executive branch is not matched by Congress. Congressional treatment of R&D, like most other aspects of congressional budget and policymaking, is characterized by fragmentation and diffusion of power. R&D programs are considered at two main levels in Congress, that of authorizations and that of appropriations. Authorizing committees (such as the House Science Committee and the Senate Committee on Health, Education, Labor, and Pensions) develop special expertise in the programs they oversee and review the substance of these programs. However, the legislation they prepare does not directly result in spending but only provides guidance and sets appropriations ceilings.

For discretionary programs, including R&D, the power to write the legislation that provides actual spending authority resides in the Appropriations Committees of the House and Senate. These committees are each divided into 13 subcommittees, each of which is responsible for a bill that controls one portion of the budget. Table I-9 shows the distribution of R&D funds among these appropriations subcommittees; each subcommittee produces its appropriations bill separately from the others, and each bill is usually signed into law separately. In March 2003, Congress reorganized its appropriations structure to accommodate the new Department of Homeland Security (DHS) by creating a new subcommittee for DHS appropriations and consolidating the Treasury/Postal and Transportation subcommittees into a single one, to keep the total number of subcommittees at 13.

R&D is contained in 10 of the 13 annual appropriations bills (see Table I-9). Four subcommittees (Defense, VA/HUD, Labor/HHS, and Energy/Water) fund 94 percent of the total federal R&D portfolio; in each of these subcommittees, R&D funding makes up more than 15 percent of discretionary spending.

The division of the budget into 13 appropriations bills limits the extent to which it is possible to coordinate or trade off increases and decreases in agency R&D budgets in the congressional process. For example, three R&D agencies—NSF, NASA, and the Environmental Protection Agency (EPA)—come under the jurisdiction of the Subcommittee on Veterans' Affairs, Housing and Urban Development, and Independent Agencies. NIH appropriations are decided by the Labor, Health and Human Services, and Education subcommittee. This means, for example, that money used for the large increase in NIH's budget in FY 2003 did not come from the same pot of money that funds NSF and NASA. But this system does mean that R&D programs compete with non-R&D programs in the same appropriations bill for limited funds.

10. Where does R&D fit among President Bush's priorities for FY 2004?

The President's FY 2004 budget would provide $122.5 billion for the federal investment in R&D, about $5.2 billion (4.4 percent) more than the current FY 2003 estimate (see Table I-1). The proposed increases for the Department of Defense (DOD; up $4.2 billion) and DHS (up $332 million) make up nearly all of the overall increase, consistent with the overall budget which emphasizes spending on national defense and homeland security. Adding in a $700 million increase for R&D in NIH, all other agencies combined would have less money for R&D than they had in FY 2003.

Because of these priorities, while defense R&D would continue to increase because of DHS and DOD increases, nondefense R&D would decline slightly in inflation-adjusted terms after seven straight years of increases (see Figure 2). Even the NIH increase would fall short of expected inflation coming after five years of large increases, and funding for all other nondefense R&D agencies collectively would also decline, extending flat or stagnant funding for these agencies to more than a decade (see Figure 2).

Four of the eleven largest R&D funding agencies would see their R&D decline in FY 2004. (Please see Chapters 6 through 13 and Tables II-1 through II-20 for more information on R&D in the largest R&D funding agencies.) The Environmental Protection Agency (EPA) and the Departments of Agriculture, Commerce, and Transportation would all see their R&D budgets decline. Despite the large increase in overall defense R&D, basic and applied research in DOD would also decline.

Three major multi-agency initiatives would receive increases in the FY 2004 budget. After growing by 11 percent in FY 2003, funding for the National Nanotechnology Initiative would rise by another 9.7 percent to $849 million in FY 2004 (see Chapter 25). The largest increase would be in the Department of Energy, whose nanoscale work would grow 48 percent to $197 million. The Networking and Information Technology R&D initiative would rise by a more modest 5.9 percent to $2.2 billion, while the Climate Change Science Program (CCSP) would just barely increase 0.1 percent to $1.7 billion. (See Table I-10 for funding details; see Chapter 24 for more information on IT R&D, and Chapter 16 for more information on CCSP.)

11. How does the U.S. investment in R&D compare to other countries?

In absolute terms, the $292 billion spent on R&D from all sources in the U.S. in 2002 was larger than the total R&D expenditures of Japan and the entire 15-nation European Union combined. For 2000, the latest year for which full international data are available, the U.S. spent 41 percent of all world R&D, a share that has held steady over the past decade even as emerging R&D powers such as South Korea and China have dramatically increased spending.

When one looks at the national R&D expenditures of various countries in relation to the size of their economies, however, the picture is somewhat different. R&D represents 2.79 percent of gross domestic product (GDP) in the United States. This places the U.S. below Japan but above most other major industrialized countries—including the United Kingdom, France, and Germany. A significant share of the U.S. R&D investment is on the military side, where it has relatively little impact on the civilian economy and U.S. industrial competitiveness. This is very different from the situation in Germany and Japan, which devote only a small portion of their R&D resources to defense.