CHAPTER 1

The President's Council of Advisors on Science and Technology (PCAST) Panel on Federal Investment in Science and Technology and its National Benefits was formed to examine trends in federal funding of research and development (R&D) and determine whether these trends were consistent with the nation's present and future needs. The following issues were raised by PCAST:

> Identify major changes in federal R&D policy and spending since 1975. Account for changes in the overall size of the federal R&D portfolio as well as changes in its internal composition and discuss the possible reasons for such changes.

To obtain the necessary facts and figures from which it could draw insights and conclusions, PCAST asked for data on the major changes in federal R&D policy and spending over the last 25 years.[2]

Trends in the Federal R&D Portfolio

Total federal R&D would be at an all-time high in inflation-adjusted terms in fiscal year (FY) 2003 if President Bush's proposals are approved. As Figure 1-1 shows, over the past two and a half decades the trend has been of increasing federal support of R&D, from $60 billion in today's (constant FY 2002) dollars in FY 1976 to over $110 billion in the FY 2003 proposal. These increases, however, have not enabled the federal R&D to grow as a percentage of the U.S. gross domestic product (GDP) (see discussion on page 18). In addition, significant upheavals in federal R&D funding have taken place during this period.

Unlike many other nations, in which government R&D is funded predominantly by a single science agency under the goal of advancing science, the U.S. federal R&D funding system is mission oriented. R&D programs are funded according to their contributions to national goals and broad national missions, each of which is the responsibility of a different government agency or agencies.

From the standpoint of serving the nation's interests, this system makes good sense, since these R&D programs are not ends in themselves but means to the ends (missions) that their sponsoring agencies serve; this system helps to link R&D programs with policy outcomes. From the standpoint of the long-term health of the research enterprise, however, this system may cause problems. The mission orientation of R&D programs may make it difficult for policymakers to assess the overall health of the R&D enterprise, to coordinate programs among different agencies serving different missions, and to address issues of balance among various scientific and engineering fields (see explanation of PCAST Issue Number 3 on R&D Balance for data on federal funding of science and engineering fields).

The relative priority of different R&D programs has varied considerably over the years, reflecting changing national priorities and the role of R&D within them. The federal budget is

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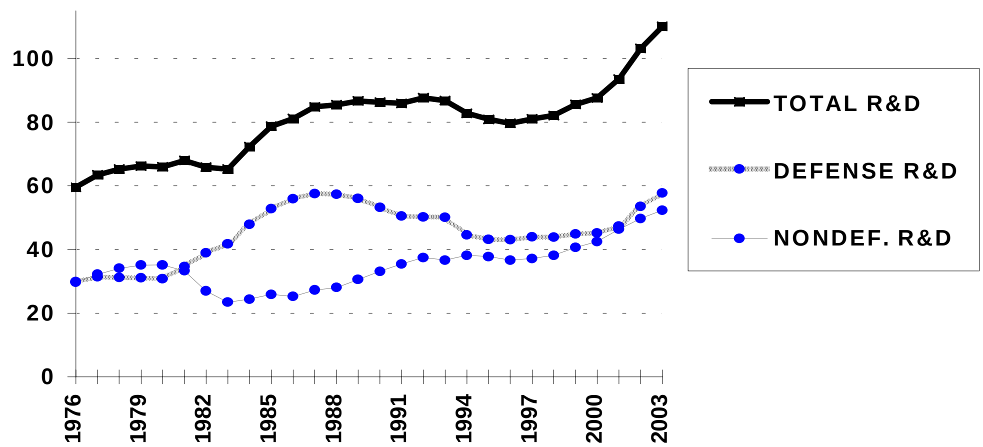
[2] AAAS began collecting and analyzing data on federal R&D spending in FY 1976. The information presented in this chapter is based on the AAAS data, and therefore includes FY 1976 through FY 2003.

formally classified into 20 different functions, or missions; R&D contributes to 15 of these missions, though for most missions the contribution is rather small (NSF, 2001a).

The largest federal mission for R&D has always been national defense. Spending on defense R&D has exceeded all other R&D spending (grouped together as "nondefense R&D") for most of the past several decades, although the relative size of the two sectors has varied considerably over the years (see Figure 1-1 and Appendix I, Table 3). Defense and nondefense R&D have followed divergent paths during the past 25 years, and have tended to move in mirror images of each other until the last few years, when both have been increasing. In FY 1976, defense and nondefense R&D were roughly equal shares of the federal R&D portfolio; after diverging in FY 1982, only in FY 2001 did funding levels approach convergence once again (the FY 2003 budget would increase defense R&D at a greater rate than nondefense R&D).

Figure 1-1. Trends in Federal R&D. FY 1976–2003
(budget authority in billions of constant FY 2002 dollars)



Source: AAAS analyses of R&D in *AAAS Reports I-XXVII*. FY 2003 figures are President's request; FY 2002 figures are latest estimates. Includes conduct of R&D and R&D facilities. Constant dollar conversions based on OMB's GDP deflators.
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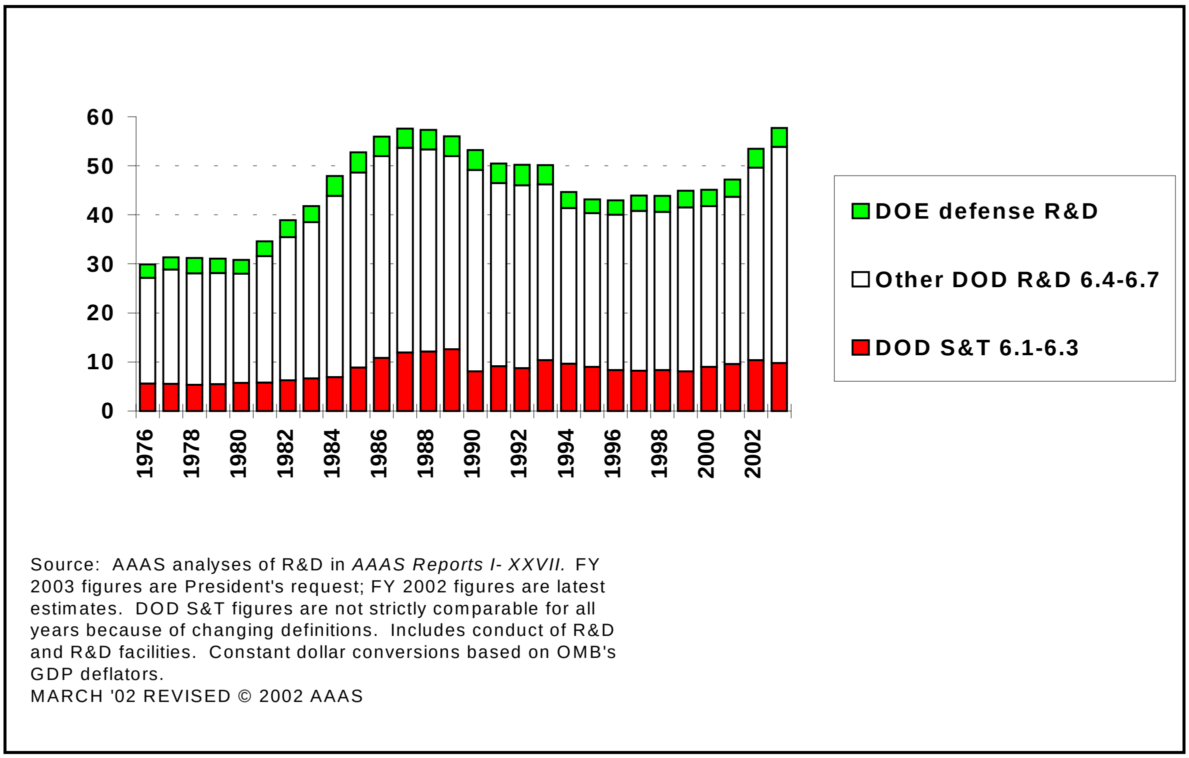
For defense R&D, the most significant trend of the past three decades, as shown in Figure 1-2, has been the dramatic Reagan Administration–era buildup of defense development, followed by equally dramatic post–Cold War cutbacks. From FY 1980 to its peak in FY 1987, defense R&D nearly doubled in real terms as the United States embarked upon a substantial increase in all forms of defense spending, motivated by high Cold War tensions with the Soviet Union and emerging technological priorities, such as the Strategic Defense Initiative. By FY 1987, defense R&D was two-thirds of total R&D, but then funding fell dramatically even before the end of the Cold War. The slide accelerated in the 1990s as the Department of Defense (DOD) and the defense-oriented activities of the Department of Energy (DOE) transitioned to the post–Cold

War era. After bottoming out in FY 1996, defense R&D has been increasing for the past several years.

As the figure shows, nearly all of the defense R&D investment is in the development, testing, and evaluation of specific weapons systems ("6.4" through "6.7" categories in DOD terminology), and this investment fluctuates according to the number and expense of weapons systems in the development stage and the relative priority assigned to weapons development within the Pentagon budget. Weapons development increased dramatically in the 1980s but then fell in the post–Cold War era; in more recent years, weapons development has increased dramatically again.

Figure 1-2. Trends in Defense R&D: FY 1976–2003
(budget authority in billions of constant FY 2002 dollars)

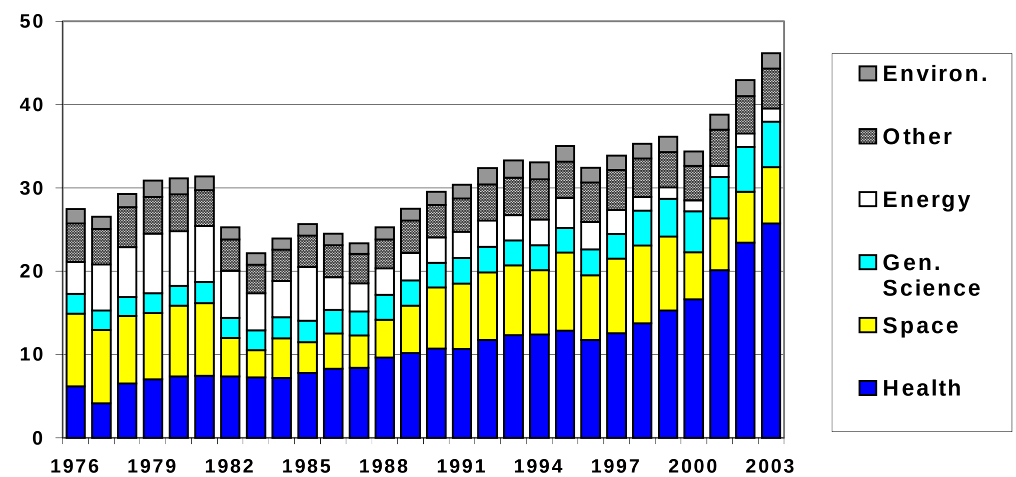


DOE's defense R&D is a relatively small part of the defense R&D portfolio. DOE funds R&D related to the U.S. nuclear weapons stockpile. After a steep post–Cold War drop, DOE defense R&D has been increasing in recent years as the United States has shifted its nuclear weapons strategy from a reliance on nuclear testing to science-based simulations as the best way to ensure the safety and reliability of the U.S. nuclear weapons stockpile. This has required large new investments in scientific facilities; advanced computer simulation research; and fundamental research in fusion, physics, and optics.

This leaves only a small part of the defense R&D portfolio in the so-called "S&T" category, which encompasses DOD basic research, applied research, and technology development not tied to specific weapons systems ("6.1" through "6.3" categories in DOD terminology). These programs contribute to a broad knowledge base with potential applications to a wide variety of military and civilian uses. DOD's S&T investment provides the science and technology knowledge to meet future DOD defense requirements and also trains the next generation of U.S. scientists and engineers in a host of fields, such as mathematics, computer sciences, and engineering. From its S&T budget, DOD supports 12.8 percent of all federal basic and applied research, and is a key sponsor of several science and engineering (S&E) disciplines. DOD supports 35 percent of all federal research in the computer sciences and nearly 40 percent of all engineering research, as well as significant shares of research in oceanography and mathematics (NSF, 2002b).[3]

Investment in DOD S&T reached $10 billion in today's dollars this year (FY 2002) for the first time since the early 1990s. For most of the 1990s, DOD S&T declined in post–Cold War defense cuts. Last September, DOD endorsed (in its Quadrennial Defense Review) the goal of spending 3 percent of the total DOD budget on S&T, and DOD's FY 2002 appropriations met this goal. The FY 2003 budget, however, would see S&T fall to 2.6 percent of the budget, with cuts in DOD basic and applied research programs.

Figure 1-3. Trends in Nondefense R&D by Function: FY 1976–2003
(outlays in billions of constant FY 2002 dollars)

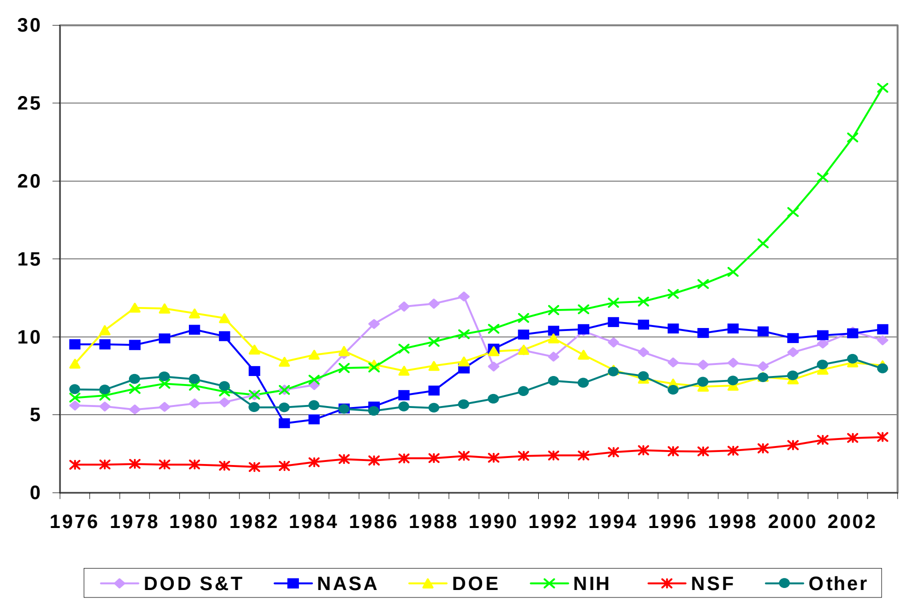


Source: AAAS, based on OMB Historical Tables. Constant dollar conversions based on OMB's Gross Domestic Product deflators. Excludes R&D facilities.
Some Energy programs shifted to General Science beginning in FY 1998. MARCH '02 © 2002 AAAS

[3]DOD's share of federal oceanography research support is 29.5 percent, for mathematics research 15.1 percent. Data are for FY 2000.

For nondefense R&D, the past three decades have seen a series of fluctuations reflecting changes in national goals and priorities, as shown in Figure 1-3. Energy R&D was a high priority in the 1970s because of the energy shocks and oil crises of the era; space R&D declined in priority from the 1970s to the early 1980s, until the shuttle Challenger disaster and subsequent International Space Station project increased its priority in the national R&D portfolio. 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. A large share of the proposed FY 2003 increase in health R&D is devoted to bioterrorism research, part of a shift toward the goals of national security and counterterrorism in the FY 2003 budget. "General science" R&D, or science purely for science's sake, is a relatively small part of the U.S. federal R&D portfolio. And although much of the federal R&D investment, and especially the basic research investment, is purportedly for the purpose of laying the knowledge base for future U.S. economic growth, very little of the federal R&D investment is classified as "commerce" R&D (in Figure 1-3, it is one of many missions in the 'other' category). Thus only a small part of the federal R&D portfolio is funded with economic growth as an explicit goal.

Figure 1-4. Trends in Federal R&D by Agency: FY 1976–2003
(budget authority in billions of constant FY 2002 dollars)



Source: AAAS Reports I-XXVII based on OMB and agency R&D budget data. Includes conduct of R&D and R&D facilities. Excludes DOD weapons systems development. Constant dollar conversions based on OMB's GDP deflators. MARCH '02 © AAAS

As Figure 1-3 shows, the composition of the federal R&D portfolio is capable of changing rapidly and substantially to reflect changing national needs. These changing priorities translate to changing agency R&D budgets, as shown in Figure 1-4 (also see Appendix I, Table 3). The figure shows both nondefense and defense R&D (it excludes DOD weapons development because of its large size; the DOD line includes DOD S&T only). In recent years, the growing priority attached to health has led to a steady increase in R&D funding for the National Institutes of Health (NIH), part of the Department of Health and Human Services (DHHS), growth that has accelerated since 1997 because of a bipartisan campaign to double the NIH budget between FY 1998 and FY 2003. The National Science Foundation (NSF) has also seen budget growth in recent years and would be at an all-time high in FY 2003.

The FY 2003 proposed budget would continue the agency trends of recent years. The FY 2003 R&D request of $112.0 billion in budget authority would be $8.9 billion or 8.6 percent more than the current FY 2002 funding level. The proposed increases for DOD weapons development ($5.6 billion) and NIH R&D ($3.7 billion) would make up more than the entire increase, leaving all other R&D funding agencies combined with less money than in FY 2002. Four of the eleven largest R&D funding agencies would see their R&D decline in FY 2003, five if only DOD S&T (excluding development, testing, and evaluation of weapons systems) is included.

Over the past decade, the top five R&D funding agencies, DOD, DHHS, NASA, DOE, and NSF, have accounted for more than 90 percent of the total federal R&D budget. DOD and NIH have commanded the largest shares of each year's R&D budget; DOD (including weapons development) has steadily hovered around the 50 percent mark, while NIH now accounts for nearly a quarter of federal R&D activity; as Figure 1-4 shows, NIH's share has been expanding rapidly. In the meantime, other R&D funding agencies would face FY 2003 with essentially the same levels of R&D funding as over the past decade, despite steady growth in the U.S. population, the U.S. economy, and the federal budget during this period.

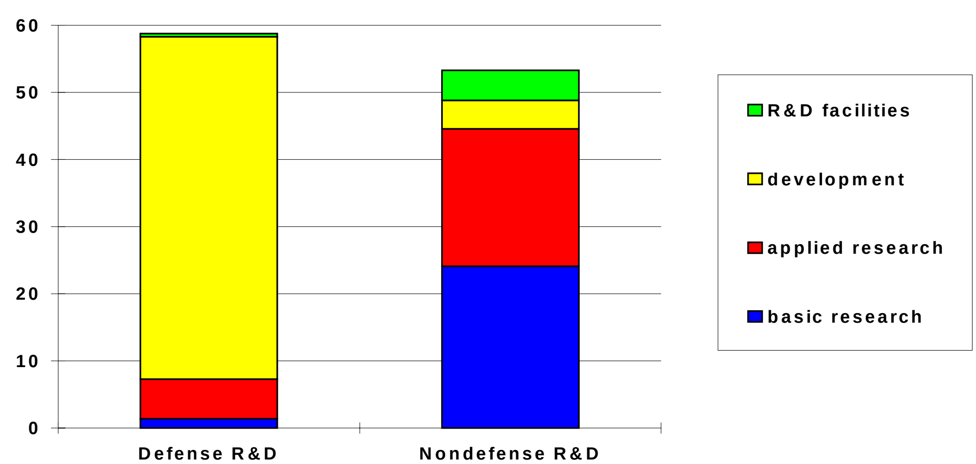
Another way to examine the federal R&D portfolio is by character of work. Statistics on federally funded R&D generally make distinctions among the character of work categories of basic research, applied research, development, and R&D facilities and capital equipment. (See Definitions of "Research and Development" and Other Terms.)

The data shown in Appendix I, Table 4 represent agencies' best attempts to classify character of work within their R&D portfolios. Except for DOD, which as noted above has separate budget categories for basic research ("6.1"), applied research ("6.2"), and various stages of development ("6.3" through "6.7"), the data reported here are imprecise and reflect the agencies' judgments as to how their R&D fits into the definitions. Appendix I, Table 4 shows that basic research would climb 7.9 percent or $1.9 billion to an all-time high of $25.5 billion in the Bush Administration's FY 2003 budget, primarily because of a 9.0 percent requested increase for basic research in the NIH budget. NIH would provide the majority (56 percent) of federal basic research. Basic research excluding NIH would rise by 6.5 percent to $11.1 billion in FY 2003.

The total federal investment in research (basic and applied research) would increase 6.5 percent to $51.9 billion (see Appendix I, Table 4), but excluding a large increase for NIH, all other federal research would fall 0.2 percent to $23.8 billion. NIH's applied research would increase by a particularly large $2.0 billion, or 20.4 percent, outpacing growth in basic research, because the FY 2003 high-priority areas of cancer and counter-bioterrorism involve significant work in applied rather than basic fields.[4] Development would increase 11.8 percent to $55.2 billion in FY 2003 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.

The character of work is quite different in defense and nondefense R&D, a point illustrated in Figure 1-5 and Appendix I, Table 4. Development would be by far the largest component of defense R&D, accounting for 87 percent of the FY 2003 total, while applied research would be 10 percent and basic research would be only 2 percent. In nondefense R&D, by contrast, basic research would be the largest category at 45 percent, with development at only 8 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. The remainder of the R&D budget for FY 2003 consists of R&D facilities and capital equipment costs, which make up 8 percent of nondefense R&D and only 1 percent of defense R&D. The nondefense ratio is up sharply from previous years because NASA has recently reclassified the International Space Station from a mostly development project to a mostly facilities construction project.

Figure 1-5. Character of Defense and Nondefense R&D FY 2003 Budget
(budget authority in billions of dollars)



Source: AAAS, based on OMB R&D budget data for FY 2003 and agency budget justifications. Defense R&D = DOD + DOE defense programs. FY 2003 data are President's request.
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The composition of the federal R&D portfolio has been shifting dramatically over the years, 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)

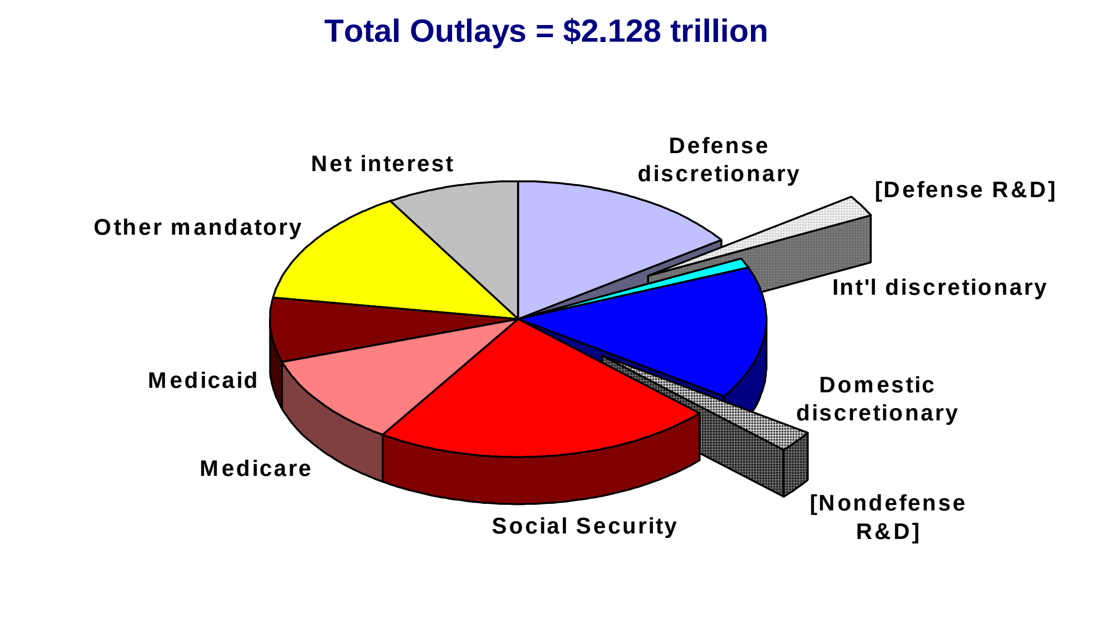
[4] The explanation of PCAST Issue 3 on R&D Balance provides data on the federal research portfolio by science and engineering field; development and R&D facilities are not classified by field.

made up nearly two-thirds of the federal R&D portfolio, but now makes up only 49 percent. Basic research, meanwhile, has steadily expanded its share of the federal R&D portfolio, from 14 percent in FY 1980 to 17 percent in FY 1990 to 23 percent in FY 2003.

R&D Within the Federal Budget

Federal R&D expenditures represent 5.0 percent of the overall proposed $2.1 trillion budget for FY 2003 and 13.6 percent of the discretionary (appropriated) portion of that budget (OMB, 2002; AAAS, 2002a). As Figure 1-6 shows, discretionary spending, the part of the budget that Congress and the President control every year, makes up only one-third of the total federal budget. The remaining two-thirds of the annual federal budget is made up of entitlement programs (e.g., social security, veterans benefits, medicare, etc.) and other mandatory spending, all of which is permanently authorized in law and therefore does not require annual approval by Congress. Because nearly all R&D programs are within the discretionary one-third of the budget, spending decisions on R&D programs must be made annually within the discretionary appropriations process, and R&D programs must compete annually for resources against all other discretionary programs. Discretionary spending is customarily divided into defense and nondefense components (the nondefense component is sometimes divided into a small international component and a larger domestic component); as Figure 1-6 shows, defense and nondefense discretionary are roughly equal in size.

Figure 1-6. Composition of the Proposed FY 2003 Budget



Note: Projected Unified deficit is $80 billion. Defense and nondefense R&D are components of defense and domestic discretionary, respectively.
Source: AAAS, based on *Budget of the United States Government FY 2003.*
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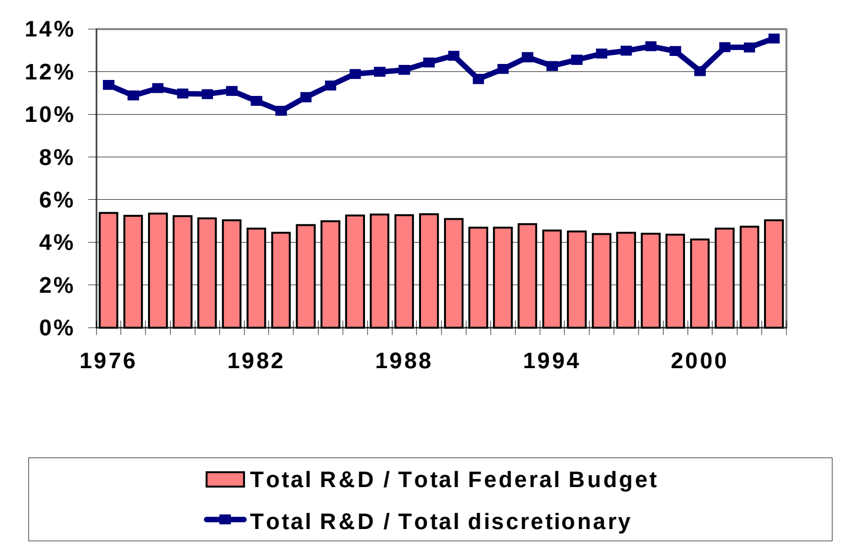
Defense and nondefense R&D make up nearly one out of every seven dollars of defense and nondefense discretionary spending, respectively, a ratio that has actually increased slightly over time as defense R&D has increased as a share of the defense budget (see Figure 1-7). On the whole, trends in R&D funding have closely followed trends in discretionary spending. Over the past 20 years, federal R&D has consistently remained within one or two percentage points of 12 percent of all discretionary spending. Growth in overall discretionary spending over the past several decades has allowed federal investment to grow in many areas, including R&D.

As a share of the total federal budget, however, R&D has declined over time because discretionary spending has declined as a share of the federal budget. Because of automatic growth in spending on entitlement programs, such as Social Security, Medicare, and Medicaid, to account for growth in eligible populations, automatic cost-of-living increases, and medical inflation, mandatory programs have grown from less than half of the federal budget in the 1970s to two-thirds in the 2000s. As a result, R&D has declined slightly as a share of the federal budget, as shown in Figure 1-7. In particular, R&D has declined from 5.4 percent of the budget in FY 1976 to 5.0 percent in FY 2003.

Figure 1-7. R&D as Percent of Discretionary Spending and All Federal Spending: FY 1976–2003
(percent of outlays)



Source: AAAS, based on Budget of the U.S. Government FY 2003 Historical Tables. Excludes R&D facilities.
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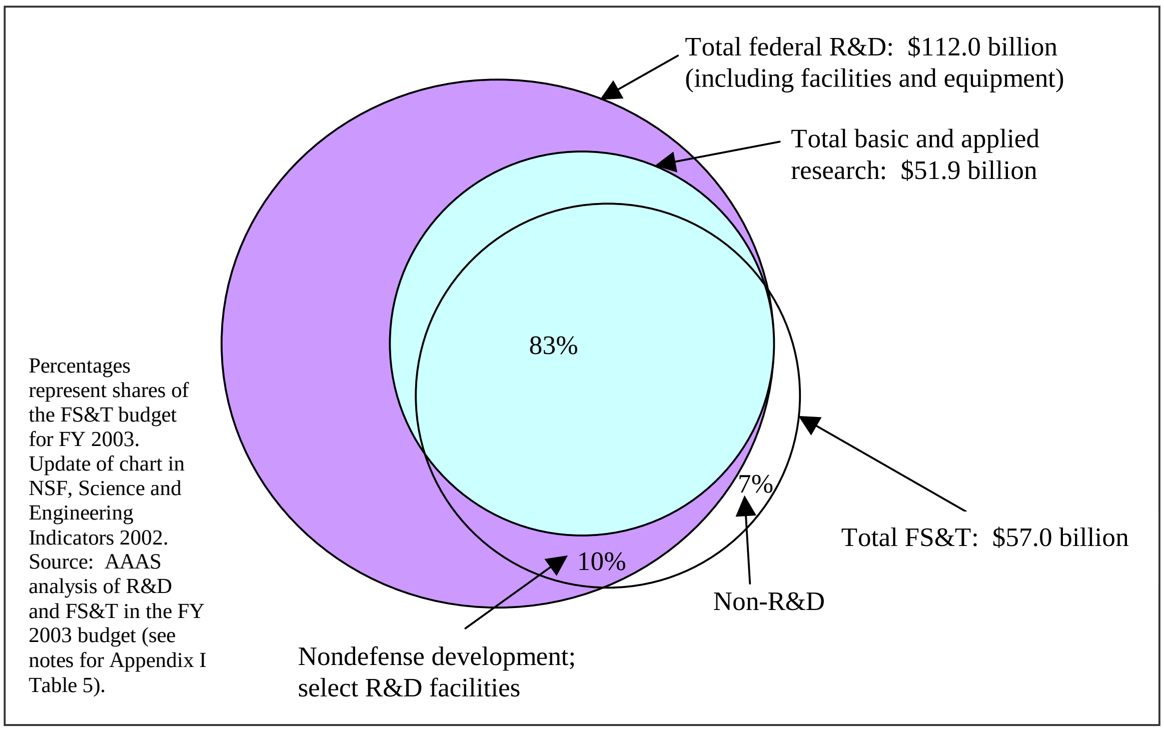
Although the federal government's budget proposals generally contain a section devoted to R&D and several tables and charts summarizing proposed and actual R&D expenditures, it is important to recognize that unlike many other nations, the U.S. does not have an "R&D budget" and no single coordinated authority to set priorities or allocate resources 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 23 federal departments and independent agencies (the exact number varies from year to year as some small agency programs are created or eliminated). For some of these agencies, such as the NSF, NASA, and 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 larger set of programs. Some R&D programs are line items within the budget and are relatively easy to identify as R&D. Others are included within larger line items and are more difficult to find.

Figure 1-8. Comparison of R&D, Research, and FS&T in the Proposed FY 2003 Budget



In an attempt to make it easier to track the federal investment in science and technology through the federal budget process and also to establish a measure of federal S&T investments that excludes weapons systems development, the Office of Management and Budget (OMB) has developed the “Federal Science and Technology Budget” (FS&T) concept in recent years. (See also the “Definitions” section at the beginning of this report.) Unlike the established definitions for R&D, there is no definition for FS&T. The FS&T portfolio is a set of federal programs selected by OMB that consists of easily identified budget line items, that approximates as closely as possible the federal basic and applied research portfolio and nondefense development. The current FS&T budget also includes some non-R&D education and human resources programs and some R&D facilities investments and excludes DOD weapons systems development and some large facilities projects, such as the International Space Station. Appendix I, Table 5 compares FS&T with total R&D by agency. Because it excludes DOD weapons systems development and DOE defense R&D, there is a large difference between R&D and FS&T on the defense side; but nondefense R&D and nondefense FS&T match fairly closely. As Figure 1-8 shows, although FS&T is constructed differently than R&D, there is a great deal of overlap with the federal research portfolio. However, because FS&T contains fewer agencies than R&D and contains whole budget accounts instead of only the R&D components of programs, it is easier to track than R&D.

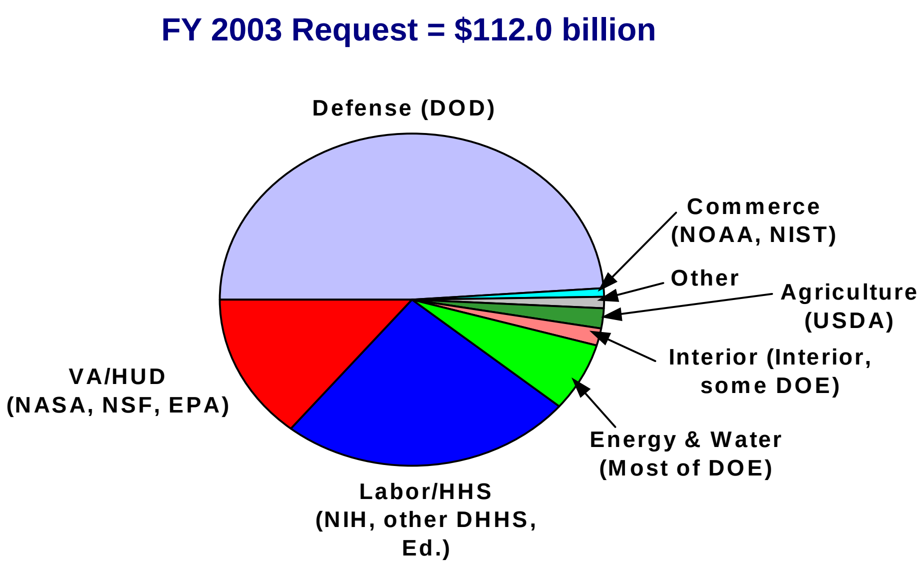
The OMB, in consultation with the Office of Science and Technology Policy (OSTP; both are within the Executive Office of the President), has overall responsibility for preparation of the President's budget and is able to provide some coordination between the scattered programs of the federal R&D portfolio, although OMB is hampered by the fact that R&D funding agencies are treated individually by its different divisions (organized along mission lines) in the budget formulation and 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, whose day-to-day functions come under OSTP jurisdiction. These organizations help to coordinate several interagency initiatives in S&T that have grown in funding over the years, including the National Nanotechnology Initiative (NNI), the National Information Technology Research and Development (NITRD) initiative, and the U.S. Global Change Research Program (USGCRP). Funding for these initiatives is shown in Appendix I, Table 6.

Although the federal counterterrorism R&D investment is a multiagency effort for which budget data are collected (an estimated $1.5 billion investment in FY 2002 according to an AAAS analysis), it is not yet a multiagency initiative with its own coordinating mechanisms. At present, each agency's counterterrorism R&D program is formulated separately and is only informally coordinated through OMB (AAAS, 2002b). The newly created Office of Homeland Security may, in cooperation with OMB and OSTP, be in a position in the future to coordinate agencies' counterterrorism R&D investments and, in the process, to coordinate R&D with other counterterrorism spending. Appendix I, Table 7 shows the federal counterterrorism R&D investment by agency. Most, though not all, of this R&D investment would come under the purview of the proposed Department of Homeland Security under the Bush Administration proposal.

Even the modest level of coordination in R&D in the executive branch is not matched by Congress. Congressional treatment of R&D, as with 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: authorizations and 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 recommends 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. Figure 1-9 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 approved by Congress and signed into law separately (also see Appendix I, Table 8).

Figure 1-9. R&D Funding by Appropriations Subcommittee



Source: AAAS, based on estimates of R&D in FY 2003 budget.
Includes conduct of R&D and R&D facilities.
Other = Transportation; Foreign Operations; Treasury-Postal
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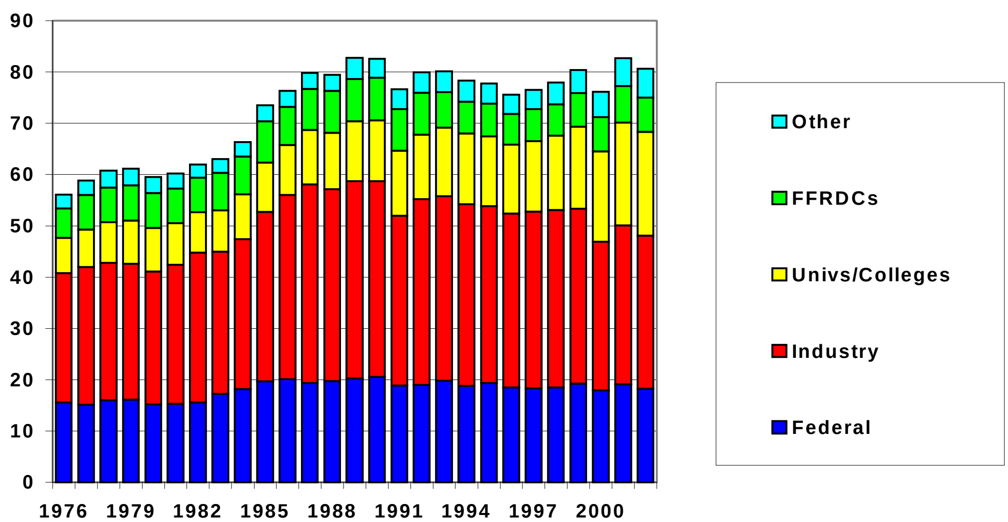
The division of the budget into 13 appropriations bills limits the extent to which it is possible to coordinate or trade off increases and decreases in agency R&D budgets in the congressional process. For example, three R&D agencies—NSF, NASA, and the Environmental Protection Agency (EPA)—come under 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 2002 did not come from the same pot of money that funds NSF and NASA. Unlike industrial R&D budgets, then, which are usually allocated in a central manner allowing for trade-offs between priorities within the R&D portfolio and against other priorities, the federal R&D investment is decided in a highly decentralized and uncoordinated manner that makes trade-offs and priority-setting within the portfolio extremely difficult. Conversely, the decentralized decision-making process tends to inhibit sudden swings in R&D funding and smoothes out year-to-year changes in the composition of the federal portfolio.

Federal R&D by Performer

Although the federal government maintains several hundred laboratories around the country, only 23 percent of federally supported R&D in FY 2002 is actually carried out in these laboratories (see Figure 1-10). The largest share of federally funded R&D is performed by industrial firms under contracts. This total has fluctuated greatly over time because nearly all DOD development is performed by military contractor firms; as noted earlier, funding for this category has been volatile because of changing military development priorities. Industrial firms also perform a large portion of DOD "S&T" (i.e., DoD's R&D categories 6.1-6.3) and NASA R&D. A significant amount of R&D is performed under federal grants in universities and colleges, as well as other nonprofit institutions, including federally funded research and development centers (FFRDCs) operated by contractors, such as the Department of Energy's Argonne National Laboratory in Illinois, which is operated by the University of Chicago. As Figure 1-11 shows, the mix of R&D performers varies greatly by agency because of agencies' differing missions and the flexibility each agency has to award its R&D funds to the best performer for the task. From the chart, it is clear that NIH is the dominant funding source for R&D performed by universities and colleges; NIH now provides nearly two-thirds of all federal R&D funds to universities and colleges. Because of steady budget growth at NIH over the past several decades, total federal R&D performed by universities and colleges has grown steadily for the past few decades even as the performance of R&D by federal laboratories (which figure heavily in the R&D portfolios of non-NIH agencies) has declined and as performance of R&D by industrial firms has fluctuated.

Figure 1-10. Federal R&D Funding by Performer: FY 1976–2002
(obligations in billions of constant FY 2002 dollars)



Source: AAAS, based on NSF, Federal Funds for Research and Development Fiscal Years 2000, 2001, and 2002 and Federal Funds Historical Tables, 2002. FY 2001 and 2002 data are preliminary. Excludes R&D facilities funding.
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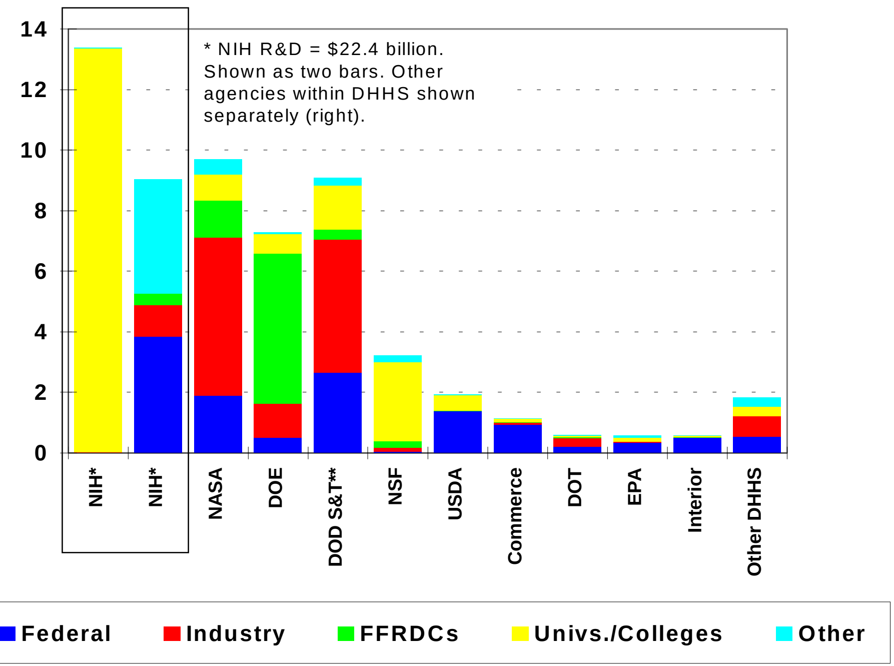
Figure 1-11. Federal R&D by Performer at Selected Agencies
(billions of dollars of FY 2002 obligations—preliminary)



Source: AAAS, based on NSF, Federal Funds for Research and Development, Fiscal Years 2000, 2001, and 2002, 2002. R&D includes research, development, and R&D facilities.
** - DOD R&D in "6.1" through "6.3" categories. APRIL '02 © 2002 AAAS

In summary, there has been overall growth in the federal R&D portfolio over the past few decades, although growth has not always been steady. In the mission-oriented federal R&D system, changing national priorities in areas such as health and defense have resulted in shifts in the composition of the federal R&D portfolio; in recent years, health and defense have grown significantly to become the largest missions in the R&D portfolio. R&D is a small but significant part of the federal budget, and is therefore responsive to larger trends in the federal budget; in particular, the overall federal investment in federal R&D has closely followed trends in the discretionary part of the federal budget.

Although it is common to talk about a federal R&D budget, R&D programs are actually scattered among 26 different federal agencies, which are handled individually in the congressional and executive budget processes, with only limited coordination because of the decentralized nature of the federal budget process. Federal R&D is also performed by a diverse collection of R&D performers, and the mix of performers varies by agency depending on the agency's R&D needs.