

## U.S. R&D PROJECTED TO HAVE GROWN MARGINALLY IN 2003

by Brandon Shackelford

NSF projections indicate that U.S. research and development (R&D) increased by 1 percent between 2002 and 2003 after controlling for inflation. Since 2000, there has been little change in total U.S. R&D in real terms (constant or inflation-adjusted dollars). After adjusting for inflation, total R&D increased 1 percent between 2000 and 2001 and declined a marginal amount between 2001 and 2002. This contrasts with the mid- to late 1990s, when R&D performance in the United States surged. In real terms, total R&D performance grew 40.5 percent between 1994 and 2000 with an average annual real growth rate of 5.8 percent over the period. Figure 1 illustrates the growth and changing composition of inflation-adjusted U.S. R&D performance from 1953 through 2003.

Nominal total 2003 R&D performance (current-year dollars) in the United States is projected at \$283.8 billion, up from an estimated \$276.4 billion in 2002 and \$274.2 billion in 2001.<sup>1</sup> The preliminary data and projections continue a trend toward rising total R&D expenditures despite the decline in 2002 of industrial R&D, which historically has fueled growth in total R&D. The business activities of many R&D-performing firms were curtailed following the stock market decline and concurrent economic slowdown of 2001 and 2002. The same sectors that saw impressive increases in the late 1990s (e.g., telecommunications and computer and electronic products) were among those that experi-

enced declines in sales, share prices, and R&D investment in 2001 and 2002. Industrial R&D has declined only two other times in the past 50 years—in 1970 and 1993. Such economic indicators as gross domestic investment in equipment and software suggest, however, that industrial R&D grew modestly in 2003.

By comparison, gross domestic product (GDP), the main measure of the nation's total economic activity, grew in real terms by 3.8 percent per year between 1994 and 2000. R&D performance as a proportion of GDP rose from 2.40 percent in 1994 to 2.69 percent in 2000 as growth in R&D outpaced the growth of the overall economy. The ratio of R&D to GDP rose to 2.72 percent in 2001 as the rate of economic growth slowed from what it was in the late 1990s. After 2001, total R&D grew at a slower pace than the overall economy, resulting in R&D to GDP ratios of 2.65 percent in 2002 and 2.61 percent in 2003.<sup>2</sup>

### R&D by Sector

Organizations that perform R&D often receive outside funding; conversely, organizations that fund R&D do not always perform all the R&D themselves. Therefore, it is useful to analyze R&D expenditure data in terms of who performed the R&D and who funded it.

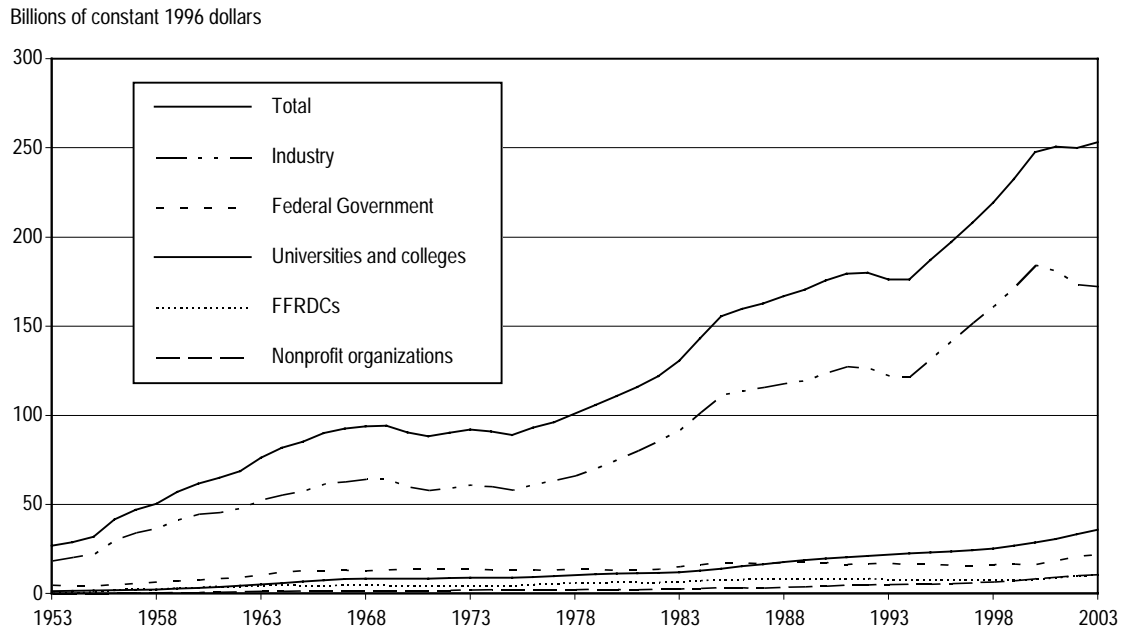
Industry performed most of the nation's R&D and accounted for a projected 68.3 percent of total R&D perfor-

<sup>1</sup>Data for 2002 are based on preliminary reporting of information, and 2003 data are projections based on information available when this report was written.

<sup>2</sup>The estimated U.S. gross domestic product (GDP) for 2001, 2002, and 2003 in constant 1996 dollars was \$9.215 trillion, \$9.440 trillion, and \$9.710 trillion, respectively. Source: U.S. Office of Management and Budget.



FIGURE 1. National R&amp;D performance, by performing sector: 1953-2003



FFRDC = federally funded research and development center.

NOTES: Data for 2002 are preliminary. Data for 2003 are projections.

SOURCE: National Science Foundation, Division of Science Resources Statistics, *National Patterns of R&D Resources*, <http://www.nsf.gov/sbe/srs/nprdr.start.htm>.

mance in 2003 (table 1).<sup>3</sup> The projected \$193.7 billion in industrial R&D performance represents a 2.2 percent average annual decrease in real terms from the 2000 level. Of the industrial R&D performed in 2003, 91.1 percent was funded by industry; the remaining 8.9 percent was federally funded. The federally funded share of industry's R&D performance total has fallen considerably from the most recent peak of 31.9 percent in 1987.

Universities and colleges are projected to have performed 14.2 percent (\$40.3 billion) of national R&D in 2003, an average annual increase of 7.8 percent in real

<sup>3</sup>Any mention of a sector excludes federally funded research and development centers (FFRDCs). These 36 R&D-performing organizations are exclusively or substantially financed by the Federal Government and are administered by industrial firms, universities, and nonprofit institutions (see <http://www.nsf.gov/sbe/srs/nsf02317>).

terms over their R&D in 2000.<sup>4</sup> The Federal Government performed 8.8 percent (\$25.0 billion) of U.S. R&D in 2003, an average annual increase in real terms of 9.9 percent over the 2000–2003 period. All federally funded research and development centers (FFRDCs) combined performed a projected \$12.2 billion of R&D in 2003, or 4.3 percent of the U.S. total. The nonprofit sector performed a projected \$12.7 billion in 2003, or 4.5 percent of the U.S. total (figure 2).

Industry is also the largest funding sector of R&D in the United States and is projected to have provided 63.3 percent (\$179.6 billion) of total R&D funding in

<sup>4</sup>Recent methodological improvements have resulted in revisions from the amounts previously reported for total academic R&D expenditures. See *Academic R&D Spending Maintains Growth From All Major Sources in FY 2001* (NSF 03-327; <http://www.nsf.gov/sbe/srs/infbrief/nsf03327>).

TABLE 1. U.S. R&amp;D expenditures, by performing sector, source of funds, and character of work: 2003 (projected)

Performing sector	Total	Source of funds				Distribution (percent)
		Industry	Federal	U&C	Other nonprofit institutions	
			Government			
(millions of current dollars)						
(percent)						
R&D	283,795	179,615	85,280	10,654	8,247	100.0
Industry	193,729	176,415	17,314	-	-	68.3
Industry-administered FFRDCs	2,383	-	2,383	-	-	0.8
Federal Government	24,959	-	24,959	-	-	8.8
U&C	40,262	2,123	24,499	10,654	2,986	14.2
U&C-administered FFRDCs	7,421	-	7,421	-	-	2.6
Other nonprofit institutions	12,661	1,077	6,323	-	5,261	4.5
Nonprofit-administered FFRDCs	2,381	-	2,381	-	-	0.8
Distribution by sources (percent)	100.0	63.3	30.0	3.8	2.9	-
Basic research	54,103	9,020	32,712	7,380	4,990	100.0
Industry	7,725	6,952	773	-	-	14.3
Industry-administered FFRDCs	651	-	651	-	-	1.2
Federal Government	4,463	-	4,463	-	-	8.2
U&C	29,941	1,470	19,022	7,380	2,069	55.3
U&C-administered FFRDCs	3,625	-	3,625	-	-	6.7
Other nonprofit institutions	6,709	598	3,190	-	2,921	12.4
Nonprofit-administered FFRDCs	988	-	988	-	-	1.8
Distribution by sources (percent)	100.0	16.7	60.5	13.6	9.2	-
Applied research	67,780	39,551	23,458	2,685	2,086	100.0
Industry	42,434	38,743	3,691	-	-	62.6
Industry-administered FFRDCs	1,040	-	1,040	-	-	1.5
Federal Government	8,837	-	8,837	-	-	13.0
U&C	8,927	535	4,954	2,685	753	13.2
U&C-administered FFRDCs	1,968	-	1,968	-	-	2.9
Other nonprofit institutions	4,215	273	2,609	-	1,333	6.2
Nonprofit-administered FFRDCs	359	-	359	-	-	0.5
Distribution by sources (percent)	100.0	58.4	34.6	4.0	3.1	-
Development	161,911	131,042	29,109	589	1,171	100.0
Industry	143,569	130,719	12,850	-	-	88.7
Industry-administered FFRDCs	692	-	692	-	-	0.4
Federal Government	11,658	-	11,658	-	-	7.2
U&C	1,394	117	523	589	165	0.9
U&C-administered FFRDCs	1,828	-	1,828	-	-	1.1
Other nonprofit institutions	1,736	206	524	-	1,006	1.1
Nonprofit-administered FFRDCs	1,034	-	1,034	-	-	0.6
Distribution by sources (percent)	100.0	80.9	18.0	0.4	0.7	-

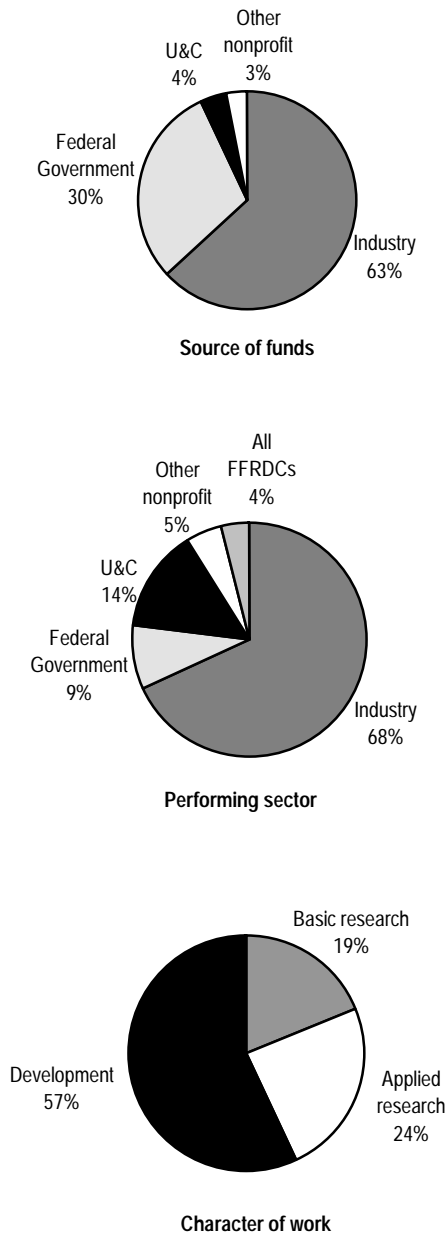
FFRDC = federally funded research and development center.

U&C = universities and colleges.

NOTES: State and local government support to industry is included in industry support for industry performance. State and local government support to U&C (\$2,710 million in total R&D) is included in U&C support for U&C performance.

SOURCES: National Science Foundation, Division of Science Resources Statistics (NSF/SRS), *Research and Development in Industry: 2001*; NSF/SRS, *Academic Research and Development Expenditures: Fiscal Year 2002*; NSF/SRS, *Federal Funds for Research and Development: Fiscal Years 2001, 2002, and 2003*; and NSF/SRS, *Survey of R&D Funding & Performance by Nonprofit Organizations: Fiscal Years 1996 and 1997* (Arlington, VA).

FIGURE 2. Shares of national R&D expenditures, by source of funds, performing sector, and character of work: 2003 (projected)



FFRDC = federally funded research and development center, U&C = universities and colleges.

NOTES: Figures are rounded to nearest whole number. National R&D expenditures were an estimated \$284 billion in 2003.

SOURCE: National Science Foundation, Division of Science Resources Statistics, *National Patterns of R&D Resources*, annual series.

2003. Most of these funds (98.2 percent) flowed to industrial performers of R&D. The Federal Government provided the second largest share of R&D funding, 30.0 percent (\$85.3 billion), with only 43.6 percent of these funds financing Federal intramural R&D and FFRDCs. The other sectors of the economy (i.e., state governments, universities and colleges, and non-profit institutions) contributed the remaining 6.7 percent (\$18.9 billion).

### R&D by Character of Work

In 2003 the United States is projected to have performed an estimated \$54.1 billion of basic research, \$67.8 billion of applied research, and \$161.9 billion of development. As a share of all 2003 R&D expenditures, basic research represented 19.1 percent, applied research represented 23.9 percent, and development represented 57.1 percent. Universities and colleges performed 55.3 percent of basic research in 2003, more than any other sector. The Federal Government has historically provided the majority of funding for basic research, supporting 60.5 percent of all basic research and 63.5 percent of the basic research performed by universities and colleges in 2003. Industry devoted only a projected 5 percent of its total R&D support to basic research in 2003, representing 17 percent of the national total for basic research. Basic research generally involves a high degree of uncertainty in terms of both technical success and commercial value.

In contrast, U.S. applied research, which totaled \$67.8 billion in 2003, is performed largely by nonacademic institutions. Industrial performers accounted for a projected 62.6 percent of all applied research in 2003, with the remainder largely performed by Federal agencies and FFRDCs (17.9 percent). Industrial support accounts for 58.4 percent (\$39.6 billion) of the 2003 total for applied research and Federal support accounts for 34.6 percent (\$23.5 billion). The Federal Government's investment in research has historically emphasized basic research over applied research. In 2003 Federal funding for applied research was about 72 percent of that for basic research, according to research performers.

Development expenditures totaled a projected \$161.9 billion in 2003, representing the majority of U.S. R&D

expenditures. The development of new and improved goods, services, and processes is dominated by industry, which performed 88.7 percent of all U.S. development in 2003. Federal agencies and FFRDCs performed a projected 9.4 percent of U.S. development; universities and colleges and nonprofit institutions performed the remainder.

Industry and the Federal Government together funded 98.9 percent of all development in 2003, with industry's share constituting 80.9 percent. The Federal Government generally invests in the development of products for which it is the only consumer, such as tactical nuclear weapons and space exploration vehicles. The Federal investment in development is dominated by the Department of Defense, which invests 85 percent of its R&D funds in development.

#### **User Notes**

U.S. R&D expenditures data are derived from these National Science Foundation surveys: Survey of Industrial R&D, Survey of R&D Expenditures at Universities and Colleges, Survey of Federal Funds for R&D, and Survey of R&D Funding & Performance by Nonprofit Organizations. Preliminary estimates and projec-

tions for 2002 and 2003 were based in part on time-series modeling and econometric techniques.

R&D expenditure levels from Federal sources, presented here based on performer-reported surveys, differ from Federal R&D funding totals reported by the Federal agencies that provide those funds. The difference in the Federal R&D totals appears to be concentrated in the funding of industry R&D by the Department of Defense. See *National Patterns of R&D Resources: 2003* (forthcoming) for further discussion of these differences and a more detailed analysis of national R&D trends. *National Patterns* reports can be found online at <http://www.nsf.gov/sbe/srs/nprdr/start.htm>.

For more information, contact

Brandon Shackelford  
Research and Development Statistics Program  
Division of Science Resources Statistics  
National Science Foundation  
4201 Wilson Boulevard, Suite 965  
Arlington, VA 22230  
703-292-4685  
[bshackel@nsf.gov](mailto:bshackel@nsf.gov)

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