Highlights

National R&D Support

- **Since 1994, research and development (R&D) in the United States has risen sharply, from $169.2 billion to an estimated $265 billion in 2000.** In real terms (adjusting for inflation), this rise reflects an increase of $71 billion in 1996 dollars, which was the greatest real increase in R&D for any six-year period in the nation's history.
- **Private industry, which provided 68 percent of total R&D funding in 2000, pays for most of the nation's R&D.** Private industry itself used nearly all (98 percent) of these funds in performing its own R&D; most (71 percent) of the funds were used to develop products and services rather than to conduct research.
- **Federal R&D support, in absolute terms, expanded between 1980 and 2000, from $30 billion to $70 billion, which, after inflation, amounted to a small real growth rate of 1 percent per year.** In 1980, Federal R&D support accounted for 47 percent of the nation's total R&D effort. By 2000, Federal sources accounted for considerably less (26 percent) of the U.S. R&D total.
- **In fiscal year (FY) 2001, the Department of Defense (DOD) will obligate the most funds among Federal agencies for R&D support—$36 billion or 45 percent of all Federal R&D obligations.** The agency obligating the second largest amount in R&D support is the Department of Health and Human Services with $19 billion, followed by the National Aeronautics and Space Administration with $10 billion, the Department of Energy with $7 billion, and the National Science Foundation with $3 billion.
- **The budget allocation for health-related R&D increased dramatically between FY 1982 and FY 2001 with an average real annual growth rate of 5.8 percent.** As a result, health-related R&D rose from approximately one-quarter of the Federal, nondefense, R&D budget allocation in FY 1982 to nearly one-half by FY 2001.

National R&D Performance

- **Industry performed the largest share of the nation's R&D—75 percent.** Universities and colleges performed 11 percent, and the Federal Government performed 7 percent. Federally Funded Research and Development Centers (FFRDCs), which are administered by various industrial, academic, and nonprofit institutions, accounted for an additional 4 percent, and other nonprofit organizations accounted for 3 percent.
- **From 1994 to 2000, R&D performed by industry (including their FFRDCs) grew at a remarkable rate of 7 percent per year in real terms.** In contrast, Federal intramural research over the same period increased by less than 1 percent per year in real terms.
- **In the industrial sector in 1999, computer and electronic products alone accounted for 20 percent of all industrial R&D and 15 percent of the nation's total R&D.** Computers and electronics accounted for $36 billion in performance R&D, which exceeded the total amount of R&D performed by all universities and colleges and their administered FFRDCs combined ($34 billion). The next largest industrial sector, transportation equipment, also performed $34 billion in R&D in 1999. The chemicals sector performed $20 billion in R&D, as did trade, a nonmanufacturing sector. Another nonmanufacturing sector, information, performed $15 billion in R&D.
- **A recent NSF survey has led to upward revisions in R&D performance estimates for the nonprofit sector.** R&D performance by nonprofit organizations is expected to reach $9 billion in 2000, reflecting an average annual growth of 6 percent in real terms since 1990.
- **In 1999, California had the highest level of R&D expenditures within its borders, $48 billion.** The six states with the highest levels of R&D expenditures, California, Michigan, New York, Texas, Massachusetts, and Pennsylvania (in descending order), accounted for approximately one-half of the entire national effort.
- **The nation spent $48 billion on basic research in 2000, $55 billion on applied research, and $162 billion on development.** These totals are the result of continuous increases over several years. Since 1980 they reflect, in real terms, a 5 percent annual increase for basic research, a 4 percent increase for applied research, and a 4 percent increase for development.

Federal R&D Tax Credit

- **In 1998, 9,800 corporate tax returns claimed $5.2 billion in research and experimentation (R&E) credits, up 18.4 percent from 1997 claims.** The unusual doubling of the credit over 1996–97 followed a 12-month gap in the credit.
- **The tax credit claims were equivalent to $3.3 billion (4.6 percent) of Federal R&D outlays in FY 1998.** Although R&E claims data for tax year 2000 are not available, the credit generated an estimated outlay equivalent of $2.5 billion, or 3.4 percent of Federal R&D outlays in FY 2000.

Domestic R&D Collaborations

- **More than 800 research joint ventures (RJVs) were formed in the United States from 1985 to 2000 (including 39 in 2000) according to filings required by the National Cooperative Research and Production Act (NCRPA).** New filings peaked in 1995 at 115 after increasing successively since 1986. These research collaborations involved more than 4,200 unique businesses and

organizations, of which more than 3,000 (about three-fourths) were U.S.-based.

- **Half of the RJVs over the entire 1985–2000 period involved companies in three industries: electronic and electrical equipment, communications, and transportation equipment.** Universities participated in 15 percent of all RJVs, and 11 percent had at least one Federal laboratory member.
- **In 2000, Federal agencies involved in R&D and technology transfer activities reported 4,209 invention disclosures, 2,159 patent applications, and 1,486 patents issued.** Since fiscal year 1997, a total of 5,655 patents have been issued to federal agencies.
- **A total of 2,924 Cooperative Research and Development Agreements (CRADAs) involving 10 Federal agencies and laboratories were active in 2000.** The largest participants by far are DOD laboratories (1,364 active CRADAS or 47 percent of the total) and DOE (687 or 23 percent). The number of active CRADAs increased rapidly in the early- and mid-1990s, reached a peak of 3,688 in fiscal year 1996, and stabilized around 3,000 since then.
- **The Small Business Innovation Research (SBIR) program, designed to increase small firms' participation in Federal R&D activity, awarded a total of $1.1 billion in R&D money to approximately 4,600 projects in 1999.** Ten agencies participated in the program in FY 1999. DOD and HHS accounted for $514 million (47 percent) and $314 million (29 percent), respectively, of SBIR funding.

International Comparisons of National R&D Trends

- **The United States accounts for approximately 44 percent of total R&D expenditures in all Organisation for Economic Co-operation and Development (OECD) countries combined. R&D investments in the United States continue to outdistance, by more than 150 percent, R&D investments made by Japan, the second largest performer.** The United States spent more on R&D activities in 1999 than did all other "group of seven" (G-7) countries (Canada, France, Germany, Italy, Japan, and the United Kingdom) combined. In 1998, total nondefense R&D spending in those six countries was slightly more (6 percent) than nondefense R&D spending in the United States.
- **The ratio of R&D spending to gross domestic product (GDP) is one of most widely used indicators of a country's commitment to growth in scientific knowledge and technology development.** As a result of a worldwide slowing in R&D spending during the early 1990s, the latest R&D/GDP ratio for most G-7 countries is no higher now than it was a decade ago. The United States ranked fifth among OECD countries in terms of reported R&D/GDP ratios for the 1996–98 period (2.7 percent). Sweden leads all countries for GDP devoted to R&D (3.7 percent), followed by Japan (3.0 percent), Finland (2.9 percent), and Switzerland (2.7 percent).
- **Although reported data by character of the work are somewhat sparse, development spending (typically performed by industry) accounts for the largest R&D share in most countries (usually approximately 60 percent of the total).** Relative to shares reported in other countries, basic research spending in the United States (16 percent of its R&D total) is less than the shares reported for France and Italy (25 and 22 percent, respectively) but higher than reported for Japan and South Korea (12 and 14 percent, respectively). Basic research accounts for 16 percent of Russia's R&D total.
- **Structural R&D shifts are under way in many G-7 and other OECD countries.** As an indication of an overall pattern of increased university-firm interactions, the proportion of academic R&D funding from industry sources (for G-7 countries combined) climbed from 2.5 percent of the academic R&D total in 1981 to 5.4 percent in 1990 and to 6.4 percent in 1998.
- **Even though most OECD countries perform R&D in support of multiple industry sectors, the distribution of the industrial R&D effort in the United States is among the most widespread and diverse.** This circumstance may indicate a national inclination and ability to become globally competitive in numerous industries rather than specialize in a few industries or niche technologies. Within countries, the electrical equipment sector often is among the largest performers of the industrial R&D effort, accounting for 20 percent or more of the industry R&D total. In addition to the United States, numerous countries report substantial increases in their service sector R&D expenditures during the past 25 years.
- **The most noteworthy trend among G-7 and other OECD countries has been the relative decline in government R&D funding.** In 1998, 31 percent of all OECD R&D funds was derived from government sources—down considerably from the 41 percent share reported for 1988. In aggregate terms, this change reflects a decline in industrial reliance on government funds for R&D performance. In 1988, the government provided 20 percent of the funds used by industry conducting R&D within OECD countries. By 1998, the government's share of the industry R&D total had fallen by one-half, to 10 percent of the total.
- **Government R&D priorities also have shifted somewhat among OECD countries during the past decade.** As a result of relative decreases not only in the United States but also in the United Kingdom and France, the national defense share of the government R&D total in all OECD countries combined declined from 43 percent in 1988 to 30 percent in 1998.
- **Among nondefense objectives, government R&D spending shares also changed somewhat during the 1988–98 period: government R&D shares have increased most for health and the environment and for various nondirected R&D (including many basic research) activities.**

Conversely, the relative share of government R&D support provided for economic development programs (which include the promotion of agriculture, fisheries and forestry, industry, infrastructure, and energy) has declined considerably, from 31 percent of the combined OECD governments' nondefense total in 1981 to 23 percent in 1998.

International R&D Alliances

- **In 2000, 574 new technology or research alliances worldwide were reported in six major sectors: information technology (IT), biotechnology, advanced materials, aerospace and defense, automotive, and nonbiotechnology chemicals.** The vast majority involved companies from the United States, Japan, and countries of Western Europe. The number of new alliances reported in this international database between 1990 and 2000 (6,477) was nearly twice the number formed during the previous 10-year period, 1980–89 (3,826). The 1990–2000 total includes 2,658 (41 percent) alliances involving exclusively U.S.-owned companies.
- **The share of biotechnology partnerships reached an all-time high of 35 percent in 2000 (199 of 574), continuing an increasing trend that began in 1991.** This is the first year that biotechnology alliances have outnumbered IT partnerships.
- **The United States and Europe were prime locales for biotechnology alliances during the 1990s.** Of the 1,500 biotechnology alliances in the past decade, 41 percent involved only companies in the United States and another 34 percent involved pairings of U.S. companies and European companies.

International Industrial R&D Investments

- **As of 1998, the latest year for which data are available, 715 R&D facilities in the United States were operated by 375 foreign-owned companies, including 251 (35 percent) owned by Japanese parent companies.** Other countries with significant presence were Germany with 107 facilities (15 percent), and the United Kingdom with 103 facilities (14 percent). On the other hand, by 1997 U.S. companies had established at least 186 R&D facilities overseas.
- **R&D spending by U.S. affiliates of foreign companies in the United States increased 28 percent in 1997–98, from $17 billion to $22 billion, the largest single-year increase since 1990.** When combined with the $15 billion spent abroad on R&D by U.S.-based companies, this yields a "net inflow" of R&D expenditures of more than $7 billion, compared with $3 billion a year earlier.
- **Chemical and computer and electronic product manufacturing had the largest single-industry shares of foreign R&D spending in the United States in 1998 (33 and 20 percent, respectively).** They include the largest subsectors attracting foreign R&D funding: pharmaceuticals and communications equipment. More than one-half of the R&D performed on chemicals and pharmaceuticals by foreign-owned subsidiaries in the United States is performed by Swiss and German units.
- **Of the $15 billion spent abroad in R&D by the nation's majority-owned foreign affiliates in 1998, more than two-thirds took place in five countries: Canada, France, Germany, Japan, and the United Kingdom.** Approximately three-fourths of all R&D performed overseas is in four manufacturing sectors: transportation equipment (30 percent), chemicals (27 percent), electronic equipment (8 percent), and industrial machinery (7 percent). R&D performed in chemicals and pharmaceuticals overseas reached $4 billion in 1998; nearly $1 billion was located in the United Kingdom. Of the $4.5 billion in automotive and other transportation equipment research performed overseas, 42 percent was located in Germany, and 21 percent in Canada.
- **Within the IT sector, foreign R&D in the U.S. emphasizes the manufacturing component, whereas R&D by foreign affiliates of U.S. companies emphasizes the services component.** The share of information services in R&D spending abroad (8.3 percent) was five times larger than that industry's share in foreign R&D (1.5 percent) in 1998. On the other hand, computer and electronic product manufacturing accounted for 20 percent of total foreign R&D in the United States, or double its 10 percent share in R&D funds spent abroad.
- **The Industrial Globalization R&D (IGRD) index, defined as the average of foreign and overseas R&D spending shares for a given industry, is an indicator of the degree of internationalization of R&D spending.** By this measure, chemical R&D flows exhibit the highest degree of internationalization (IGRD index of 25), followed by transportation equipment (IGRD index of 19) and computer manufacturing (IGRD index of 15).