GLOBALIZING INDUSTRIAL RESEARCH AND DEVELOPMENT

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FOREWORD

Today's research and development (R&D) enterprise is truly a global entity. Foreign-owned company R&D expenditures accounted for $19.7 billion—nearly 15 percent of total company funded R&D in the United States in 1997. At the end of 1998, foreign companies owned 715 facilities in the United States designated as R&D centers. At the same time, U.S. company–funded R&D overseas has reached over $14 billion, and U.S.-based companies continue to establish laboratories abroad.

The Technology Administration's Office of Technology Policy asked Dr. Manuel Serapio and Dr. Donald Dalton to look at a wide range of practical questions and policy concerns arising from the rapid growth of the global R&D enterprise. How many foreign R&D facilities are there in the United States? In what industries and regions is this investment most concentrated? Are we seeing an erosion of U.S. science and technology leadership? What is the real importance of the globalization of R&D? What motivates firms to invest in R&D facilities overseas? Are there short-term or long-term benefits for the U.S. economy?

Our 1999 edition of *Globalizing Industrial Research and Development* expands and updates the information contained in our earlier study, also performed by Drs. Dalton and Serapio, and based on 1992 data. It demonstrates that investment has changed greatly. In 1992, there were just 250 U.S. research facilities of foreign companies, many newly established. That number grew to 645 facilities owned by 300 parent companies in 1995, and 715 facilities owned by 375 parent companies in 1997. As these earlier facilities have matured, some have changed size and focus. There also are many new players. The number of facilities owned by U.S. companies overseas also has grown, expanding to take advantage of new markets and new pockets of innovation.

What have not changed are the motivations behind these investments. The most frequently cited reasons still are assisting parent companies in meeting customer needs, keeping abreast of technological developments, employing foreign scientists and engineers, and cooperating with foreign laboratories.

Kelly H. Carnes
Assistant Secretary for Technology Policy (Designate)

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EXECUTIVE SUMMARY

Research and development (R&D) spending in the United States by foreign-owned companies is now more than $17 billion, substantially higher than in 1990. This report, an expanded and updated version of our earlier study, sheds important light on the magnitude, nature, and scope of this investment (see Dalton and Serapio 1995). It also explores the major factors influencing the location decisions of foreign R&D facilities in the United States. This information is important in increasing our understanding of the dynamics of R&D as well as the flow of high-value-added jobs.

In a complementary trend to increased foreign R&D investment in the United States, U.S. companies have substantially increased their R&D spending abroad, more than tripling it between 1986 and 1997. Relative to domestic spending, R&D performed in other countries represents nearly 11 percent of the total, up from 5 percent a decade ago. The overall globalization of the R&D enterprise is illustrated clearly by the actions of both U.S. and foreign firms.

Investment motivations for U.S. R&D abroad and for foreign R&D in the United States are strikingly similar. These motivations range from assisting the parent company to meet host country customer needs and monitor technological developments, to allowing the firms to take advantage of specialized skills in the host country. U.S. and foreign companies primarily conduct applied research abroad. The pharmaceutical and biotechnology industries also carry out large-scale basic research in offshore locations.

Foreign R&D Investments in the United States: Key Findings

- R&D expenditures by foreign-owned companies in the United States tripled from $6.5 billion in 1987 to $19.7 billion in 1997, and accounted for nearly 15 percent of total company-funded R&D.[1] R&D spending by foreign-owned companies in the United States increased at a faster pace than domestic R&D spending in the past 15 years, but domestic R&D spending began to outpace foreign R&D growth since 1996.

[1] Figures for 1997 are the most recent available as of July 1999 for foreign R&D expenditures in the United States and U.S. R&D expenditures abroad. The U.S. Department of Commerce's Bureau of Economic Analysis (BEA) will release data for 1997 in fall 1999.

- Foreign companies accelerated the establishment and acquisition of R&D facilities in the United States in the 1990s. At the end of 1998, foreign companies owned 715 facilities designated as R&D centers in the United States. These facilities are owned by 375 foreign parent companies.

- The 251 Japanese R&D facilities in the United States outnumber the U.S. R&D facilities in other countries. Germany has the second largest number of facilities (107), followed by the United Kingdom (103) and France (44). The number of U.S. R&D facilities owned by Korean parent companies has more than doubled, from about a dozen in 1992 to 32 in 1998.

- At the end of 1997, foreign-owned companies conducting R&D in the United States employed more than 115,700 R&D workers.

- Switzerland and Germany rank first in R&D expenditures by foreign companies in the United States, with $3.3 billion in 1997, followed by Japan ($3.2 billion) and the United Kingdom ($3.1 billion).

- The largest recent impact on R&D spending by foreign companies in the United States resulted from several major acquisitions by foreign firms of U.S. pharmaceutical and biotechnology companies with large R&D budgets.

- Industries with the largest number of foreign facilities in the United States are drug and biotechnology (116), chemical and rubber (115), computer software (54), automotive (54), and medical device and instrumentation (53). Japanese firms have the largest number of R&D facilities in the automotive and electronics industries.

- Foreign R&D facilities in the United States are heavily concentrated in certain areas, such as Silicon Valley and greater Los Angeles (CA), Detroit (MI), Princeton (NJ), Research Triangle Park (NC), and Boston (MA).

- The most frequently cited reasons for investing are (1) to assist parent companies in meeting U.S. customer needs; (2) to keep abreast of technological developments in the United States; (3) to employ U.S. scientists and engineers; and (4) to cooperate with other U.S. R&D laboratories.

U.S. R&D Investments Abroad: Key Findings

- U.S. companies have increased their R&D spending abroad from $5.2 billion in 1987 to $14.1 billion in 1997, and represent nearly 11 percent of R&D performed in the United States. More than half of U.S. R&D expenditures abroad are accounted for by five countries: Germany, United Kingdom, Canada, France, and Japan.

- In recent years, R&D spending by U.S. affiliates in newly industrializing or developing countries, including Singapore, Brazil, China, and Mexico, has increased.

- Several major studies show that, while the amount of U.S. R&D abroad has increased, leading-edge R&D on a company's core technology almost inevitably is still performed at home. Nearly 90 percent of R&D expenditures by U.S. companies still is spent at their facilities in the United States.

- In 1997, most of the expenditures on U.S. R&D abroad were concentrated in drugs, automotive, computers, and electronic components.

- The drug industry showed the most global R&D, with a ratio of 30 percent of U.S. R&D abroad to 49 percent of R&D performed by foreign companies in the United States. The U.S. auto industry performs nearly 25 percent of R&D in Europe to develop cars and diesel engines for the European market, but the foreign share of U.S. R&D is only 5 percent.

- Of the 169 U.S. R&D facilities abroad listed, Europe contains 88 facilities, followed by Japan with 45 and Canada with 26.

CHAPTER 1: INTRODUCTION

Foreign involvement in U.S. research and development (R&D) has increased significantly since the mid-1980s. U.S. affiliates of foreign-owned companies, defined as foreign parent company ownership of 10 percent or more of equity in a U.S. affiliate, spent $19.7 billion on R&D in the United States in 1997, or one out of every six dollars spent in the United States on corporate R&D (by both U.S. and foreign-owned companies).[1] In addition, more and more foreign companies have established R&D facilities in the United States in the past decade. In 1998, there were 700 R&D facilities in the United States owned by 365 foreign parent companies from countries including Japan, Germany, the United Kingdom, France, the Netherlands, Switzerland, and the Republic of Korea (Korea).

More and more foreign companies have established R&D facilities in the United States in the past decade.

Only recently have studies begun to be published on foreign R&D activity in the United States (for example, a survey of the operations of foreign R&D facilities in the United States by Richard Florida [1997] and a policy study of the role of foreign research in the United States by the National Academy of Engineering [Reid and Schriesheim 1996]). The impact of growth in U.S. R&D abroad also has attracted some policy interest from the Council on Foreign Relations (Callan et al. 1998).

This report and its earlier versions investigate important and continuing questions generated by the increasing influx of foreign R&D and the growth of U.S. R&D abroad, in terms of both expenditures and number of facilities.[2] In particular, it makes a significant contribution by providing extensive company-level data unavailable elsewhere and by drawing on the most current data from the National Science Foundation (NSF) and the Commerce Department's Bureau of Economic Analysis (BEA).

What is the magnitude of foreign direct investment in R&D in the United States? What are the nature and scope of operations of these R&D facilities?

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[1] This report uses ownership as defined by the U.S. Department of Commerce's Bureau of Economic Analysis (BEA).

[2] This report uses data published by BEA and the National Science Foundation (NSF) and draws on a list of 701 R&D facilities compiled by the Office of Business and Industrial Analysis of the Economics and Statistics Administration. To our knowledge, the database is the most comprehensive listing of foreign R&D facilities in the United States. In addition, it contains the results of interview studies of the motivations for U.S. R&D abroad, and it analyzes patent activity by foreign companies in the U.S. and patents originating in the U.S. R&D facilities abroad. The report also includes extensive appendices listing by country and industry foreign-owned R&D facilities in the United States and U.S.-owned R&D facilities abroad.

Some European company officials also state that they are able to undertake certain types of biotechnology research in the United States that they are restricted from performing in their home countries by various laws and regulations.

What factors influence foreign companies' decisions to invest in R&D in the United States? How do these firms select the location of their R&D facilities in the United States? Why do U.S. firms invest in R&D abroad?

Existing literature on international R&D suggests a number of reasons for undertaking R&D outside one's home country. Vernon (1966) was the first to link R&D abroad to foreign direct investment, arguing that some foreign R&D activity would be required to adapt products produced abroad to suit local market conditions. According to Mansfield, Teece, and Romeo (1979), one of the main purposes of foreign technological activities would be to support foreign production and to service the local market. More recent analysis suggests that other factors, such as the need to monitor new technological developments and the ability to generate entirely new technologies and products from foreign locations (Cantwell 1995, Granstrand, Hakanson, and Sjolander 1992, Kuemmerle 1997) have become increasingly important. Another motive that company officials occasionally mention is pressure by some foreign governments, to establish R&D centers as a condition for foreign direct investment (U.S. Department of Commerce January 1999) as has happened with China. Some European company officials also state that they are able to undertake certain types of biotechnology research in the United States that they are restricted from performing in their home countries by various laws and regulations.

This report supports these general observations. It reveals that foreign and U.S. companies are continuing to (1) expand activities that reap the rewards of foreign scientific and technical discoveries, (2) take advantage of human resources, and (3) tailor their R&D to host-country customer needs. Despite the recent financial crisis in many countries, the trend toward increased globalization of industrial R&D shows no signs of abating.

CHAPTER 2: FOREIGN R&D ACTIVITY IN THE UNITED STATES

Trends in R&D Expenditures

R&D spending in the United States by foreign-owned companies is now large enough to have an influence on the overall size of total private R&D in the United States. During the past seven years, R&D expenditures by foreign-owned businesses in the United States (i.e., U.S. affiliates of foreign firms) have increased faster than total R&D expenditures within the United States by U.S. firms. In the high-technology sector, R&D expenditures by foreign companies account for one out of every four dollars spent on corporate R&D in the United States. The growth in R&D spending by foreign companies in the United States can largely be attributed to the expansion of R&D expenditures by the U.S. affiliates of multinational companies from six countries: Switzerland, Japan, the United Kingdom, Germany, France, and the Netherlands.

The growth in R&D spending by foreign companies in the United States can largely be attributed to the expansion of R&D expenditures by the U.S. affiliates of multinational companies from six countries: Switzerland, Japan, United Kingdom, Germany, France, and the Netherlands.

Company-Funded R&D Expenditures

Data on R&D spending by U.S.- and foreign-owned companies are collected through annual surveys of companies by the U.S. Commerce Department's Bureau of Economic Analysis (U.S. Department of Commerce annual a) and the National Science Foundation (annual). BEA data are based on annual surveys of the R&D expenditures of U.S. affiliates of foreign companies in the United States. The NSF publishes two series of industry R&D statistics: (1) total funds (company, federal, and other) and (2) company and other (except federal) funds. The term "company-funded" R&D refers to the NSF industry R&D series excluding federal funds and covers R&D performed within the United States by both U.S.- and foreign-owned companies.

Both the BEA and NSF surveys use similar Standard Industrial Classification (three-digit) industry classifications for their company or enterprise-based surveys, although some companies perform R&D in various industries. Because the BEA and NSF surveys limit their definition of R&D expenditures by foreign-owned companies to funds spent at company-operated R&D facilities, the data from both surveys are conservative estimates of R&D expenditures. Both surveys exclude other types of foreign-sponsored R&D, such as foreign-company-sponsored research at U.S. universities. The NSF does conduct (at two-year intervals) a separate survey of contract research in the United States; however, there is no separate information for foreign-owned companies.

Rising Share of Foreign Funding of U.S. R&D

According to BEA surveys, R&D spending by U.S. affiliates of foreign companies more than tripled from $6.5 billion in 1987 to $19.7 billion in 1997. R&D expenditures by U.S. affiliates of foreign companies have increased at an average annual rate of 11.6 percent or more per year since 1987.

R&D expenditures by foreign companies in the United States have grown much faster than total R&D expenditures by U.S.-owned firms within the United States every year except for 1991 and 1996. Total R&D spending within the United States by U.S. firms rose about 97 percent from $61 billion in 1987 to $133 billion in 1997. In comparison, R&D expenditures by U.S. affiliates of foreign companies increased by 165 percent during the same period. As shown in figure 1, the foreign share of total company spending in R&D reached a plateau of about 9 percent in the first half of the 1980s, and then quickly increased in the second half of the 1980s to 14.1 percent, when foreign direct investment in the United States accelerated.

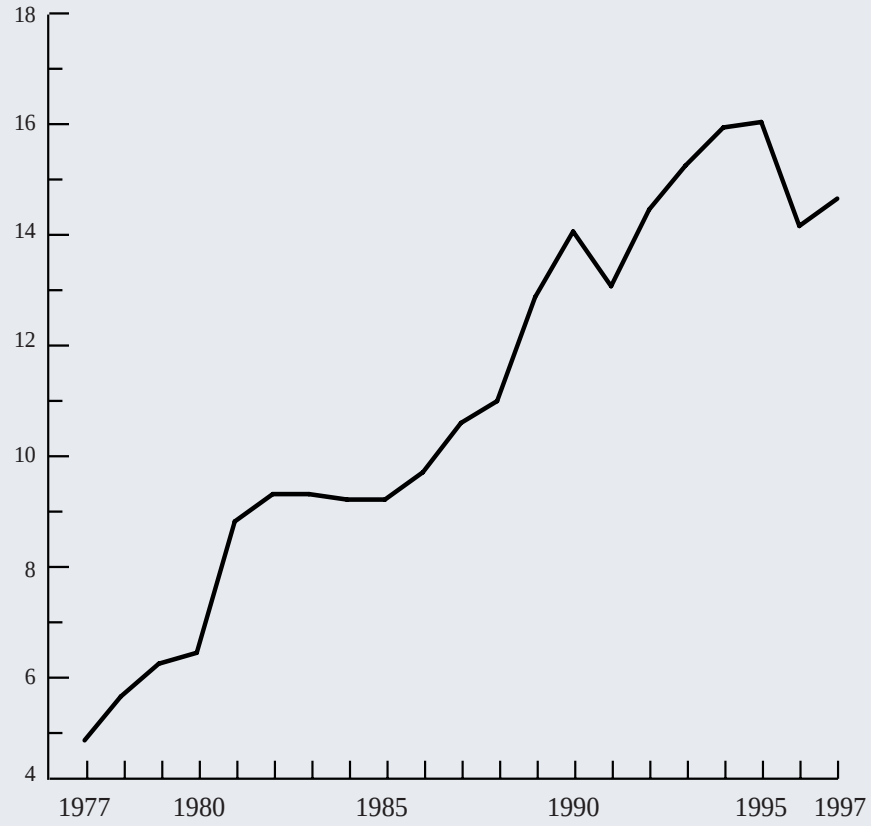
Figure 1 also shows that in 1991, a slowdown in foreign R&D spending because of both the U.S. recession and a sharp decline in foreign direct investment caused the foreign share of U.S. R&D spending to dip to 13.1 percent. After 1991, however, the share of U.S. R&D by foreign-owned companies began growing again, reaching a peak of 16.1 percent in 1995 before a surge in domestic R&D spending in 1996 and 1997 combined with a slight decline in R&D spending by foreign-owned affiliates resulted in a decline in the foreign R&D share to 14.7 percent.

Foreign acquisitions of U.S. companies have had an impact on total U.S. R&D data.

The Role of Global Mergers and Acquisitions

The expansion of foreign direct R&D investments in the United States during the past decade took place amid a significant increase in global mergers and acquisitions. Foreign acquisitions of U.S. companies have had an impact on total U.S. R&D data, both in terms of foreign R&D expenditures and foreign direct investment in R&D in the United States. The effect of acquisitions of U.S. companies on U.S. R&D spending growth has raised questions about whether foreign R&D represents new sources of funding or only shifts the specific R&D statistics from the domestic column to the foreign column. These questions are difficult to answer with the currently available data on the operations of foreign-owned companies. The growth in R&D performed by foreign-owned companies in the United States reflects a mixture of new acquisitions of U.S. companies, expansion of R&D spending by previously acquired companies, and new investment and start-ups by foreign companies. Because the surveys of R&D spending by foreign companies by the BEA do not provide statistics that compare

Figure 1. Foreign-Owned Companies' Share of U.S. R&D



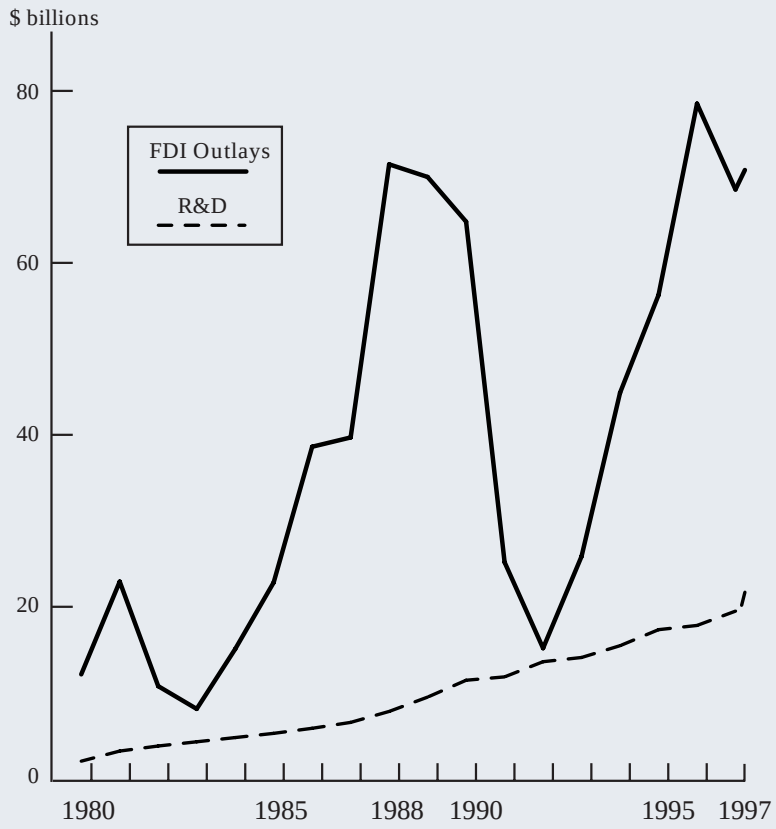
Sources: Bureau of Economic Analysis (foreign) and National Science Foundation (total).

R&D by acquired companies with R&D from new investment, it is difficult to answer these important questions.

Some indirect evidence on the role of acquisitions is available, however. R&D spending by foreign-owned companies tends to rise more rapidly during periods of rapid expansion in foreign direct investment in the United States, such as in the second half of the 1980s and during the economic recovery period the United States has experienced since 1992. Outlays for foreign investment in the United States increased from $15 billion in 1992 to $80 billion in 1996. R&D spending, however, is much more stable than foreign direct investment (FDI), as shown in figure 2, and tends to rise even during periods of weakness in foreign investment. Most of the foreign direct investment in the United States—82 to 86 percent from 1992 to 1996—is due to acquisitions, according to BEA estimates (Zeile 1999).

Although there was a widespread surge in the late 1980s in acquisitions in all industries (e.g., computers, banking, semiconductors, steel, and tires), the largest impact on R&D funding was in the acquisition by foreign multinational companies of U.S. pharmaceutical and biotechnology firms with large R&D budgets.

Figure 2. Foreign Direct Investment Outlays Compared with Foreign R&D



Source: Bureau of Economic Analysis.

Acquisitions and mergers by foreign companies tend to affect the overall R&D data to a greater extent if the foreign investment is concentrated in high-tech industries. Although there was a widespread surge in the late 1980s in acquisitions in all industries (e.g., computers, banking, semiconductors, steel, and tires), the largest impact on R&D funding was in the acquisition by foreign multinational companies of U.S. pharmaceutical and biotechnology firms with large R&D budgets. Hoechst's purchase of Marion Merrill Dow, Beecham's acquisition of SmithKline Beckman, Rhone Poulenc's purchase of Rorer, the merger of Upjohn and Pharmacia, and Hoffman LaRoche's investment in Genentech are examples of these mergers and acquisitions. R&D data released in future years will reflect the surge in foreign investment in communications and utilities and some large investments in other industries, such as Daimler Benz's merger with Chrysler, Corel's purchase of WordPerfect, and Northern Telecom's acquisition of Bay Networks.

Although mergers and acquisitions have played an important role in the rise in foreign R&D in the United States, it is difficult to sort out the effects. The data on U.S. R&D by foreign-owned companies is a mixture of new investment, new acquisitions, and expansion by affiliates acquired a long time ago. In addition, the foreign R&D data from 1995 to 1997 have been affected by large sales of business units in industrial chemicals by Canadian and German affiliates. To complicate matters further, about 40 percent of the source of funding for acquisitions was from U.S. affiliates of foreign companies, according to BEA surveys, and some of these funds were generated by their U.S. operations.

Country Distribution

R&D spending in the United States by foreign-owned businesses increased $13.2 billion between 1987 and 1997. Most of that growth has come from increased R&D spending by U.S. affiliates of multinational companies from four countries with the largest FDI positions in the United States: Switzerland, Germany, United Kingdom, and Japan (see table 1). Japanese-funded R&D in the United States, which increased from $307 million in 1987 to $3.2 billion in 1997, experienced the most rapid growth rate among the large countries. Canadian-funded R&D declined in the same period because of the sale of an equity position in a large U.S. chemical company.

Table 1. R&D Expenditures and Employment for U.S. Affiliates of Foreign Companies

Country	1993 ($ millions)	1997 ($ millions)	R&D Workers, 1996 (thousands)	Expenditures per R&D Worker, 1997
All Countries	14,199	19,690	115.7	$170,182
Switzerland	2,423	3,382	15.4	213,116
Germany	2,209	3,282	17.4	188,621
Japan	1,801	3,195	16.7	191,317
United Kingdom	2,211	3,102	19.6	158,265
France	1,235	1,918	10.4	184,423
Canada	2,159	1,685	11.1	151,802
Netherlands	697	1,002	7.5	133,600
Sweden	200	418	n.a.	n.a.

Source: Bureau of Economic Analysis, *Foreign Direct Investment in the United States: Operations of U.S. Affiliates of Foreign Companies* (annual a).

Switzerland ranked first in total U.S. R&D spending by affiliates in 1997, followed by Germany, Japan, and the United Kingdom. Japan's share of the total R&D expenditures by foreign-owned companies in the United States (16.2 percent) trailed the shares of Switzerland (16.7 percent) and Germany (16.7 percent) but was larger than the shares of the United Kingdom (15.8 percent), France (9.7 percent), and the Netherlands (5.1 percent). Other countries ranked in the top ten were Sweden, Italy, and Korea.

As is also shown in table 1, U.S. R&D expenditures by Korean companies soared to $351 million in 1996 from $55 million in 1993. R&D data for 1997 and 1998 for Korean companies, however, are likely to reflect some retrenchment owing to the recession in the home country (in 1998, Hyundai Electronics announced the sale of Symbios to LSI Logic and Cheil Jedang sold its share of DreamWorks).

R&D employment by U.S. affiliates of foreign companies was 115,700 scientists and engineers in 1997, compared with 103,700 R&D workers in 1995.[3] R&D employment levels ranged from 17,400 workers for German-owned companies to 7,500 for Netherlands-owned companies, as shown in table 1. Increases in R&D employment by affiliates from countries such as Germany and Japan offset a decline in R&D employment at Canadian affiliates.[4]

Foreign-affiliated companies are concentrating their U.S. research activities on a few U.S. industry sectors, reflecting to a large degree the industry concentration of their direct investments in the United States.

Industry Distribution

Foreign-affiliated companies are concentrating their U.S. research activities on a few U.S. industry sectors, reflecting to a large degree the industry concentration of their direct investments in the United States. In 1997, U.S. R&D spending by foreign-owned companies was concentrated in three industries: drugs, electronics, and industrial chemicals. These three industries accounted for 60 percent of R&D expenditures by foreign-owned companies in the United States. Compared with U.S. companies, these foreign-owned companies spent far less of their U.S. R&D funds in the machinery industry (excluding computers) and the transportation equipment industry (aerospace and motor vehicles). About 16 percent of R&D funds by affiliates of foreign companies was allocated to the nonmanufacturing industries of service and wholesale

[3] Employment of R&D Workers by foreign-owned companies is a relatively new data series that was first published in the 1992 BEA benchmark survey for foreign direct investment in the United States.

[4] The decline in Canadian R&D employment was due to the reclassification of a Canadian affiliate after the affiliate's sale of an equity position in a major U.S. chemical company.

trade. Foreign-owned companies spent nearly $1 billion on R&D service industries—primary computer and data processing services—and accounting, research, and management services.

Another measure of the concentration of the R&D expenditures of U.S. affiliates of foreign companies in high-technology industries is the amount of spending relative to the NSF survey data by all companies (see table 2). U.S. affiliates accounted for 20 percent of total private R&D funding in industrial chemicals, plastics and synthetics; 49 percent of all funding in drugs and medicines (including biotechnology); and 26 percent in communications equipment, audio, and video. High concentrations of foreign-funding in R&D generally reflects the concentration of foreign-ownership of businesses in these industries, as measured by sales or employment. Establishment data on foreign-owned shares of U.S. industries from a joint survey program by BEA and Census (U.S. Department of Commerce 1997) show that foreign-owned establishments accounted for nearly 30 percent of shipments for industrial inorganic chemicals, 40 percent for plastic materials, 33 percent for drugs, 12 percent for computer equipment, 19 percent for communications equipment, 64 percent for household audio and video, 13 percent for electronic components, and 12 percent for scientific instrumentation.

Table 2. Ratio of R&D Expenditures by U.S. Affiliates to R&D Expenditures by All Companies in Selected High-Technology Industries, 1997

Industry	U.S. Affiliates ($ millions)	All Companies ($ millions)	U.S. Percent of Total
Industrial chemicals	1,014	4,970	20.4
Drugs and medicine	5,686	11,586	49.1
Computer and office equipment	250	12,787	2.0
Communications equipment, television	1,989	7,529	26.4
Electronic components	633	10,786	5.9
Scientific instruments	638	8,958	7.1

Sources: Bureau of Economic Analysis (U.S. affiliates of foreign companies) and National Science Foundation (all companies, company-funded R&D).

Information on individual facilities attempts to answer these questions: (1) Which foreign companies are involved in U.S. R&D? (2) Where are these labs located? (3) What technology areas are they pursuing? and (4) What are their investment motives?

Foreign-Owned R&D Facilities in the United States

This section provides information that is not available from government surveys of U.S. R&D activity by foreign-owned companies and that helps to explain the patterns of foreign investment in R&D. Information on individual facilities attempts to answer these questions: (1) Which foreign companies are involved in U.S. R&D? (2) Where are these labs located? (3) What technology areas are they pursuing? and (4) What are their investment motives? Lists of foreign-owned companies were developed to supplement the survey data on R&D by foreign companies, which have limitations because of rules on disclosure of individual companies and do not provide detailed industry data. This section is based on information on 701 foreign-owned R&D facilities in the United States, as well as on the results of interview studies of the R&D centers, which examined the motives for investment in U.S. R&D and for the location of facilities.

The Office of Business and Industrial Analysis of the Economics and Statistics Administration, U.S. Department of Commerce, compiled the list of R&D centers from several sources. Most of the information on foreign-owned R&D facilities in the United States was provided by companies through directory surveys, such as the *Directory of American Research and Technology* (R. R. Bowker 1997), and through company announcements. The authors did not attempt to verify the accuracy of every listing and generally relied on company classification and definition of an R&D facility. The full list of foreign-owned R&D facilities in the United States is included as appendices A and B.

Definition of a Foreign-Owned R&D Center in the United States

For purposes of this report, a foreign-owned R&D facility in the United States (also referred to as an R&D center or R&D laboratory) is defined as a freestanding R&D facility (i.e., a location engaged mainly in R&D) of which 50 percent or more is owned by a foreign parent company. The R&D facility typically operates under its own budget, is overseen by its own group of officers, and is located in a freestanding facility outside of and separate from the other U.S. facilities (e.g., sales and manufacturing facilities) of the parent company. The R&D facility usually reports to the R&D department at corporate headquarters in the home country.

The definition of an R&D facility excludes R&D departments or sections within the U.S. affiliates (e.g., marketing offices and manufacturing plants) of foreign-owned companies. (R&D expenditures performed by U.S. affiliates of foreign-owned businesses are discussed in chapter 1 of

this report.) For example, Toyota Motor Corporation conducts R&D at Toyota Technical Center in Torrance, California. Toyota's manufacturing affiliate, New United Motor Manufacturing Inc. (NUMMI), also conducts R&D on a limited basis in its plant in Fremont, California. We define Toyota Technical Center in Torrance as a foreign R&D facility and exclude R&D done at NUMMI because it is not a standalone facility.

The definition of an R&D facility also excludes R&D conducted by third-party organizations, such as research universities, contractors, and joint research projects with other companies. In addition, the definition includes only those foreign R&D facilities in the United States that are majority-owned by the foreign parent company. Because we rely on company classifications of R&D facilities, the range of activities may vary across industries and nationalities. In addition, foreign companies' may include activities that are advanced technology and are not strictly R&D (i.e., product customization, design centers, and technology scanning).

R&D Facilities by Country and Industry

The classification of R&D facilities by country of ownership is shown in table 3, based on wholly or partially owned facilities of 375 foreign-owned companies from 24 different countries. The 251 Japanese R&D facilities in the United States far outnumber the U.S. R&D facilities in other countries and account for nearly 36 percent of the 701 total foreign-owned facilities. Germany comes in second with 107 facilities, followed by the United Kingdom (103), France (44), and Switzerland (42). Korea has a rapidly growing R&D presence in the United States, with 32 facilities. Japan also ranks first in the number of parent companies with R&D facilities in the United States with 128 companies in 1998, compared with 66 British parent companies, 38 German parent companies, and 20 French parent companies.[5]

The 251 Japanese R&D facilities in the United States far outnumber the U.S. R&D facilities in other countries and account for nearly 36 percent of the 701 total foreign-owned facilities.

In terms of industry distribution, the industries with the largest number of foreign-owned R&D centers in the United States are drugs and biotechnology (116 facilities), chemicals and rubber (115 facilities), computer software (53 facilities), automotive (54 facilities), and medical devices and instrumentation (53). Japanese companies account for most of the

[5] Part of the reason for Japan's ranking in table 3 is that more information is available on the activities of Japanese companies because they have been tracked extensively by the Japan Economic Institute and other organizations engaged in research on Japan. Because of the extensive research of the authors and the others cited in this report, however, the authors feel it is unlikely they have missed a significant number of foreign-owned R&D facilities from other countries.

Table 3. Foreign-Owned R&D Facilities in the United States, by Country, 1999

Country	No. of Companies	No. of Facilities
All Countries	375	715
Japan	128	251
Germany	38	107
United Kingdom	66	103
France	20	44
Switzerland	15	42
Korea	15	32
Canada	23	32
Netherlands	11	30
Sweden	16	25
Italy	7	9
Finland	6	7
Australia	4	4
Hong Kong	4	4
Denmark	3	4
Belgium	3	4
Norway	3	3
Taiwan	3	3
Austria	2	2
Singapore	2	2
Netherlands Antilles	2	2
Venezuela	1	2
Israel	1	1
Ireland	1	1
Spain	1	1

Source: Compiled by the Office of Business and Industrial Analysis.

The largest foreign laboratories are concentrated in pharmaceuticals, automotive, and electronics.

R&D centers in the electronics, computer, computer software, and automotive industries, while European companies taken together have far more drug and chemical R&D laboratories (see table 4).

Size of R&D Facilities

Table 5 lists the 35 largest foreign research centers in the United States in terms of staff size. The largest foreign laboratories are concentrated in pharmaceuticals, automotive, and electronics. Of the 35 foreign R&D facilities in table 5, European companies own 26. The majority of these European R&D facilities are in pharmaceuticals and biotechnology. Japanese companies, mostly in the automotive industry, account for

about 10 percent of the companies listed in table 5. The remainder includes one Canadian company and two Asian companies, one from Taiwan and one from Korea that made the list for the first time.

Although staff size is not available for all of the 701 R&D facilities, the available data indicate that the pharmaceutical, biotechnology, and automotive R&D laboratories are much larger than the electronics R&D facilities. In the electronics industry, the data also indicate that Japanese R&D centers in the United States are much smaller than their European counterparts. The disparity in staff size between the European and Japanese companies has been attributed by Westney (1993) to a difference in research focus. Japanese electronics companies tend to focus their R&D on a single technology at each site in the United States, while European firms tend to establish large central laboratories covering many technologies.

Location of R&D Facilities

Foreign-owned R&D facilities in the United States are located across 39 states, but most are highly concentrated in certain areas of the country. California ranks first in number of foreign-owned R&D facilities with

Table 4. U.S. R&D Facilities of Foreign Companies, 1998

Industry	Japan	Germany	France	Netherlands	Switzerland	Korea	United Kingdom	Canada	Others
Computer	24	2	2	2	0	6	0	1	5
Computer software	35	3	0	2	0	1	8	3	1
Semiconductors	18	2	0	2	0	10	0	0	0
Telecommunications	16	4	2	0	1	1	3	3	4
Optoelectronics	10	2	0	0	0	0	3	0	5
HDTV, other electronics	33	5	3	1	1	5	9	1	3
Drugs, biotechnology	26	26	7	5	15	2	15	0	20
Chemicals, rubber	25	27	14	6	7	1	19	7	9
Metals	8	2	4	0	1	0	5	2	4
Automotive	31	8	2	2	0	4	0	5	2
Machinery	5	3	4	0	2	0	6	3	6
Instrumentation, medical devices	6	7	3	3	6	0	19	2	7
Food, consumer goods, miscellaneous	10	6	1	9	8	1	12	5	10

Source: Compiled by the Office of Business and Industrial Analysis.

Table 5. Largest Foreign Research Centers in the United States, 1997

Company	Location	Professional Staff
1. Hoffman-LaRoche (Swiss)	Palo Alto, CA	2,386
2. SmithKline Beecham (UK)	King of Prussia, PA	1,495
3. Pharmacia (Swe)	Upjohn Laboratories, Kalamazoo, MI	1,400
4. Northern Telecom (Can)	Research Triangle Park, NC	1,260
5. Royal Dutch Shell (UK / NE)	Westhollow Tech. Center, Houston, TX	1,130
6. Glaxo Wellcome (UK)	Research Triangle Park, NC	1,000
7. Burroughs Wellcome (UK)	Research Triangle Park, NC	891
8. ABB (Swiss / Swe)	Norwalk, CT	800
9. Honda (JA)	Marysville & E. Liberty, OH; Torrance, CA	800
10. Hoffman-LaRoche (Swiss)	Genentech, San Francisco, CA	800
11. Sony (JA)	San Jose, CA	600
12. BP Chemicals (UK)	Cleveland, OH	532
13. Hoechst (Ger)	Somerville, NJ	516
14. Toyota (JA)	Ann Arbor, MI; California (2); Arizona	511
15. Nissan (JA)	Farmington Hills, MI; California (2), Arizona	509
16. Hyundai Electronics (KO)	Symbios Logic, Fort Collins, CO	500
17. Bayer (Ger)	West Haven, CT	500
18. Hoechst (Ger)	Hoechst Marion Roussel, Kansas City, MO	411
19. Novartis (Swiss)	Ciba Crop Protection, Greensboro, NC	410
20. Nestle (Swiss)	Alcon Labs, Fort Worth, TX	404
21. Rhone-Poulenc (FR)	Rhone-Poulenc Rorer, Fort Washington, PA	400
22. Bayer (Ger)	Pittsburgh, PA	389
23. Novartis (Swiss)	Ciba Pharmaceuticals, Summit, NJ	386
24. Memorex Telex (NE)	Tulsa, OK	363
25. Rhone-Poulenc (FR)	Research Triangle Park, NC	350
26. Unilever (NE / UK)	Edgewater, NJ	329
27. Northern Telecom (Can)	San Ramon, CA	319
28. Formosa Plastics (Taiwan)	Everex, Fremont, CA	300
29. Akzo Nobel (NE)	Chicago, IL	300
30. Northern Telecom (Can)	Nortel, Rochester, NY	280
31. Ascon (Swiss)	Ascon Timeplex, Woodcliff Lake, NJ	275
32. Bayer (Ger)	Tarrytown, NY	262
33. ABB (Swiss / Swe)	Columbus, OH	261
34. Bayer (Ger)	Agfa, Wilmington, MA	260
35. Novo Nordisk (Den)	Zymogenetics, Seattle, WA	240

Source: Compiled by the Office of Business and Industrial Analysis from R. R. Bowker (1997).

188, followed by New Jersey with 67, Michigan with 41, and Ohio with 40 (see table 6).

Japanese companies initially established R&D laboratories in California and still maintain a large presence with 107 facilities, or nearly 60 percent of all foreign-owned R&D facilities in California. Japanese companies have recently been moving east, however, while European companies began on the east coast and are moving west. For example, Hoffman-LaRoche recently moved its large R&D facility to Palo Alto, California, from New Jersey.

Japanese companies initially established R&D laboratories in California and still maintain a large presence with 107 facilities.

Figure 3 shows that the largest concentration of R&D facilities is in California's Silicon Valley, which has attracted large numbers of laboratories in computers, semiconductors, computer software, and biotechnology. The Los Angeles metropolitan area has a smaller number of R&D facilities, with a more diverse group of companies, including auto design and styling centers.

Another major cluster of R&D centers is in New Jersey, especially around Princeton University (see figure 3). Many of the major European drug and chemical companies have located near U.S. drug company research centers in New Jersey and, to a lesser degree, in Pennsylvania, North Carolina, and Connecticut. New Jersey also attracted a large number of electronics R&D facilities from European and Japanese companies. The Research Triangle Park in North Carolina is a center for biotechnology

Table 6. States with the Most Foreign-Owned R&D Facilities

State	No. of Facilities
California	188
New Jersey	67
Michigan	41
Ohio	40
North Carolina	34
Massachusetts	34
New York	33
Pennsylvania	30
Illinois	24
Connecticut	18
Texas	18

Source: Compiled by the Office of Business and Industrial Analysis.

Figure 3. Location of Foreign-Owned Industrial R&D Facilities in the United States

Source: Dalton and Serapio (1995).

and telecommunications research for both U.S. and foreign companies, and the Boston, Massachusetts, area ranks high as well, especially for its proximity to computer companies and access to the Massachusetts Institute of Technology (MIT) faculty (see figure 3).

Some areas are highly specialized in certain industries, such as Detroit, Michigan, for automotive laboratories and Richardson, Texas, for telecommunications research facilities. Specialized expertise in certain university departments has attracted biotechnology laboratories to the Seattle (University of Washington) area and Silicon Valley (Stanford and Berkeley), while the Boulder-Denver-Longmont area (University of Colorado) has attracted computer disk drive labs.

Nature and Scope of Operations by Industrial Sector

Automotive Industry

Of the 54 automotive R&D facilities listed in table 4, 31 are Japanese companies, 15 are European companies, and four are Korean companies. The U.S. R&D facilities of automotive companies, Japanese automotive companies in

particular, conducted little R&D when they first started operations in the United States. Instead, their main activities were testing emissions for certification requirements and scanning the regulatory environment. They also evaluated the performance of their own and competitors' vehicles and monitored U.S. automotive design and styling trends.

Japanese automotive companies, especially Toyota, Nissan, Mazda, and Honda, have expanded the scope of their R&D activities in the United States in line with the expansion of auto production in the United States. Several facilities have undertaken projects in advanced concept design (i.e., the design of future vehicles), joint research, and vehicle prototype production. Also, these facilities have become more involved in parts and materials design and evaluation from local suppliers. An example of such higher-valued-added activities is the lead involvement by Toyota's Calty Research Design Center, located in California, in the exterior design of the Lexus / Solara Coupe. Mazda's design center in California also assisted in developing the Miata sports car, and Honda's U.S. research facilities in Ohio played a major role in developing a new Accord model for the U.S. market.

Japanese automotive companies, especially Toyota, Nissan, Mazda, and Honda, have expanded the scope of their R&D activities in the United States.

Drugs and Biotechnology

The pharmaceutical and biotechnology industries account for the largest number of foreign R&D facilities in the United States, with 116 facilities in 1998. These industries also have the largest (in terms of staff size) foreign-owned R&D facilities in the United States and are the primary area for basic research by foreign companies. Most of the facilities are owned by European companies, with high concentrations by German, Swiss, and British drug companies. In addition, many of the European drug companies (e.g., BASF, Bayer, and Hoechst) have large operations in the chemicals markets.

Foreign investment in U.S. R&D in drugs and biotechnology has been characterized by acquisitions of U.S. firms. A new wave of mergers is occurring in the industry. In 1995, several major mergers and acquisitions were announced: Hoechst's decision to acquire Marion Merrell Dow; the merger of two large British companies, Glaxo and Burroughs Wellcome; the merger of Sandoz and Ciba Geigy; and the merger of Upjohn with a Swedish company, Pharmacia. In 1994, Ciba Geigy, a Swiss company, increased its stake in Chiron, a U.S. biotechnology company, to 49.9 percent, and Roche Holding, another Swiss company, acquired Syntex. Major acquisitions of U.S. companies in earlier years include Roche's purchase of a majority stake in Genentech and the acquisition of Rorer by Rhone-Poulenc, a French company. In 1987, the British firm Beecham acquired SmithKline Beckman.

In the biotechnology industry, foreign R&D facilities fall into two basic groups: laboratories that conduct research in recombinant DNA and monoclonal antibody technologies and R&D centers involved in pharmaceuticals, chemicals, and agribusiness. The former are small laboratories with a capitalization of $50 million or less; the latter are among the largest foreign-owned R&D facilities in the United States. Dalton and Serapio (1995) provide more detailed analysis.

Electronics

Foreign-owned facilities in the electronics area reflect a diversity of corporate interests and strategies across many industries, from the giant European telecommunications equipment and electronics company facilities to many small, single-technology labs operated by Japanese companies. Japanese R&D facilities far outnumber those of other countries in computers, semiconductors, and computer software, as shown in table 4.

Most of the foreign-owned R&D facilities in electronics conduct applied research, with some activities in developing new applications of existing technologies or products or tailoring products to customer needs. There is also a small group of facilities conducting basic research, including the NEC Research Institute (Princeton, New Jersey), Philips, Siemens, Canon, and Panasonic Technologies (Matsushita).

Investment Motives

Multinational corporations must weigh the benefits and costs of investment in foreign locations. Centralizing R&D in the home country provides greater management control, proximity to headquarters, and, possibly, economies of scale in R&D from purchase of expensive laboratory equipment and specialization of skills. Centrifugal forces that pull R&D away to peripheral locations are the benefits of product adaptations and improvements that better a corporation's competitive position in overseas markets and of tapping into global sources of technology and innovation for the benefit of the whole company.

Surveys of foreign companies that invest in U.S. R&D facilities indicate that accessing or acquiring technologies that complement their own technological capabilities and advantages has played an important and growing role in their decisions.

Surveys of foreign companies that invest in U.S. R&D facilities indicate that accessing or acquiring technologies that complement their own technological capabilities and advantages has played an important and growing role in their decisions. Traditionally, the main motive for foreign investment was to help companies meet the needs of local customers. The findings in this report reinforce the conclusions reached by other researchers' surveys (see Florida 1997 and Kuemmerle 1997).

The results of the survey taken for this report indicate that foreign companies have invested in R&D facilities in the United States for different reasons, which vary from industry to industry. Table 7 lists 10 reasons cited by senior R&D / technical executives of foreign-owned R&D facilities in the U.S. automotive, biotechnology, and electronics industries in 1993. Recent interviews with many of the same companies, as well as with new companies, indicate that these reasons have not changed much in the past five years. Of the 10 reasons, two were cited as important by R&D facilities that deal with technologies where U.S. firms conduct leading research (e.g., biotechnology, software design, certain new materials): (1) to acquire technology and (2) to keep abreast of technological developments in the United States. Companies that deal with technologies where foreign companies lead or are equal to U.S. firms (e.g., consumer electronics), however, cite those reasons as unimportant.

The growth of foreign R&D investments in the U.S. automotive industry is directly linked to the expansion of Japanese and European automotive manufacturing facilities in the United States. Two reasons cited as "extremely important" by automotive firms were (1) "assisting the parent company in meeting U.S. environmental regulations" and (2) "assisting the parent company in meeting U.S. customer needs." Two "important" reasons for investing in U.S. R&D facilities were "assisting the parent company's U.S. manufacturing plants in local procurement" and "keeping abreast of technological developments in the United States."

The biotechnology industry cited as "extremely important," "taking advantage of a more favorable environment for research," and as "important" "cooperating with other U.S. R&D laboratories" and "engaging in basic research," among other motives influencing the decision of foreign firms to invest in U.S. R&D facilities (see table 7). Other studies have noted that "access to U.S. research universities," "availability of scientists for employment by foreign-owned employers," and "spillovers from U.S. private research" are prime inducements for the growth in foreign-owned R&D centers in biotechnology (see Arakaki 1991 and National Research Council 1992). In particular, in their U.S. R&D investments, Japanese drug companies appear to be motivated mainly by their desire to gain access to U.S. biotechnology discoveries, partly because of the relative weakness of their domestic biotechnology research capabilities. Japanese drug companies have established a U.S. presence for other reasons according to Roehl (1994), including to conduct their own clinical testing for new drugs for the U.S. market and to acquire U.S. technology to bolster competitiveness in the Japanese market.

The most important aspect of the favorable research environment in the United States is a U.S. policy encouraging and funding research in biotechnology and related fields. A recent study of biotechnology by the Department of Commerce's Technology Administration (1999) found that the "foundation for this competitive advantage, particularly in the health-care and life sciences areas, was laid by the substantial investment of the U.S. public and private sectors in research and development. American researchers are responsible for much of the science of the new biotechnology, and many of them were trained at the National Institutes of Health and other federally funded institutions." (U.S. Department of Commerce 1997). In contrast, European firms, German companies in particular, have maintained that the biotechnology research environment has been largely unfavorable in Europe, partly because of restrictions on genetic engineering.

The electronics industry cited as an "extremely important motive" for investing in R&D facilities in the United States "assisting the parent company in meeting U.S. customer needs" (see table 7). These firms have relied on their U.S. R&D facilities to monitor technological developments in the United States, customize products to the specifications of U.S. customers, and facilitate concurrent design and development. Another factor influencing the decision by foreign electronics companies to establish U.S. R&D facilities is the growing complexity and

Table 7. Reasons for Foreign R&D Investments in the United States

	Industries		
Reasons	**Electronics**	**Automotive**	**Biotechnology**
Acquire technology	1	2	1
Keep abreast of technological developments	2	2	1
Assist parent company in meeting U.S. customer needs	1	1	3
Employ U.S. scientists and engineers	2	3	2
Follow competition	3	3	4
Take advantage of favorable research environment	4	4	1
Cooperate with other U.S. R&D labs	2	3	2
Assist parent company in meeting U.S. environmental regulations	4	1	4
Assist parent company's U.S. manufacturing plants in procurement	4	2	4
Engage in basic research	3	4	2

Note: 1 = extremely important, 2 = important, 3 = neutral, 4 = unimportant

Source: Interview survey of senior R&D / technical executives of Japanese companies by author, Manuel G. Serapio, Jr., in Serapio and Dalton, "Foreign R&D Facilities in the United States," *Research Technology Management* (1993).

speed of innovation in new technologies. A senior executive of a Japanese company told the authors: "Acquiring technology has become a more complex task. Without an actual presence in the United States, it is difficult for us to judge what technology is worth buying from U.S. companies. We built our R&D centers in the United States to establish a base that will help us make these decisions." A software company executive expressed similar reasoning, explaining that the rapidity of technological change in the computer software industry dictated the company's presence in the United States in order to "keep up with day-to-day developments" in the U.S. software industry.

European firms have maintained that the biotechnology research environment has been largely unfavorable in Europe.

CHAPTER 3: U.S. R&D ABROAD

R&D Expenditures Abroad

R&D expenditures by U.S. multinational companies have more than tripled in the past decade.

Are European, Japanese, and other foreign companies the only organizations expanding their overseas R&D operations? As shown by figure 4, U.S. companies are also doing so. R&D expenditures by U.S. multinational companies have more than tripled in the past decade, increasing from $4.6 billion in 1986 to $14 billion in 1997. These R&D expenditures are collected by the NSF but excluded from the NSF data on U.S. R&D that include only expenditures for R&D performed within the United States. Expenditures for U.S. R&D in other countries should be considered supplemental to the NSF data on domestic U.S. R&D. R&D performed in other countries is a gray area partly because the source of funding is uncertain (i.e., the R&D may be funded partly or wholly by the overseas subsidiary) and partly because the R&D may have a limited purpose of developing specialized products for local markets, just as is true for some foreign R&D in the United States. Although U.S. R&D abroad may result in technology transfer back to the U.S. parent company, most of the direct benefits of R&D spending abroad—employment and spillovers—appear to be localized in other countries.

U.S. R&D Abroad Is Increasing Faster than Domestic R&D

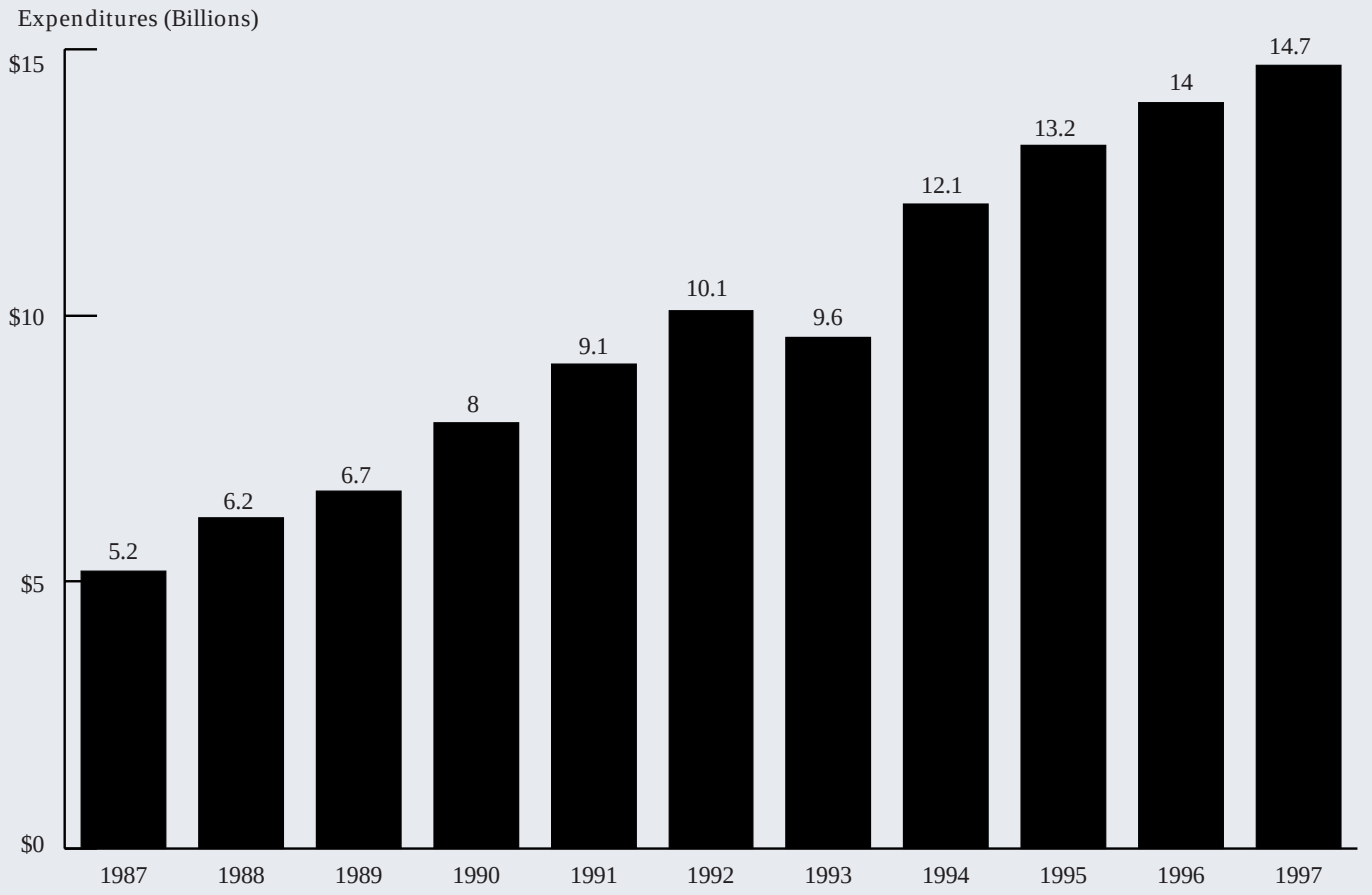
Relative to domestic R&D spending and considering that U.S. R&D has doubled in the past ten years, R&D expenditures by U.S. companies abroad accounted for an additional 10.5 percent of all company-financed U.S. expenditures in 1997, up from 9.7 percent in 1990 and 6.4 percent in 1985. Data on U.S. R&D performed in other countries are collected from separate annual surveys by the NSF (annual) and the BEA (U.S. Department of Commerce annual b; see also Mataloni 1998). The NSF data are reported as "company-financed R&D performed outside the United States by U.S. R&D performing domestic companies and their foreign subsidiaries," and the BEA data are reported as "research and development performed by majority-owned foreign affiliates of U.S. parent companies." Both NSF and BEA data provide a breakdown by industry, but BEA data also include a detailed breakdown by country. The data on U.S. R&D abroad include only research performed at company-owned facilities and exclude R&D performed at universities and overseas contractors, such as software development in Bangalore, India.

Most of the growth in R&D expenditures abroad by U.S. multinational companies is concentrated in five countries with large amounts of U.S.

foreign direct investment (see table 8). The ranking of countries in table 8 is similar to the ranking of countries by foreign-owned R&D in table 1, especially Germany, France, Japan, and the United Kingdom, indicating that globalization of R&D involves significant two-way flows of cross-border research. One exception to the list of largest international R&D nations is Switzerland, which has a high level of R&D in the United States but does not rank high on the list of U.S. R&D investment compared with the larger countries in Europe. One explanation is that Switzerland does not have as much U.S. foreign direct investment.

The high levels of U.S. R&D in Canada are largely due to the evolution of the two nations toward a "rationalized and integrated" North American economy. Both countries are each other's most important trade partner and investor. U.S.-Canada trading is the largest bi-national flow in the world, and the level of American investment in Canada is among the

Figure 4. U.S. R&D Abroad



Source: Bureau of Economic Analysis.

Table 8. U.S. R&D Abroad, Major Recipient Countries

Country	1989 ($ millions)	1997 ($ millions)
All Countries	7,922	14,075
Germany	1,726	2,964
United Kingdom	1,718	2,310
Canada	975	1,825
France	521	1,238
Japan	1,000	1,087
Italy	393	569
Netherlands	367	479
Brazil	92	437
Sweden	31	375
Australia	190	365

Source: Bureau of Economic Analysis.

highest in any industrialized country. This move toward a single continental market largely began with the signing of the Canada-United States Automobile Products Agreement (Auto Pact) in 1965, which removed import tariffs on auto production and led to major investments and cross-border trade by General Motors, Ford, and Chrysler. More recently, the Canada-United States Free Trade Agreement (FTA) in 1989 and the North American Free Trade Agreement (NAFTA) in 1994 have eliminated most remaining tariffs between the two countries. As a result of these trade policies, a large number of corporations—especially in the chemicals and transportation equipment industries—operate on both sides of the border, with much of their trade, investment, and R&D consisting of transfers within firms.

The high levels of U.S. R&D in Canada are largely due to the evolution of the two nations toward a "rationalized and integrated" North American economy. Both countries are each other's most important trade partner and investor.

U.S. R&D Spending in Emerging Markets

U.S. companies are beginning to show wider geographic dispersion of their R&D expenditures among emerging markets. In addition to Brazil, which is now among the top recipients, U.S. R&D spending is growing rapidly in emerging markets. Among these emerging markets, the largest recipients of U.S. R&D, excluding Brazil, are Israel, Mexico, Hong Kong, and Taiwan (see table 9). The role of U.S. R&D in emerging markets may be understated in comparison with that in the major industrial countries if the criteria are based on dollars of R&D expenditures. Salaries in some of the emerging markets may be much lower, especially in China and India. Also, BEA data are for majority-owned foreign affiliates, which

Table 9. U.S. R&D Expenditures in Emerging Markets (majority-owned foreign affiliates)

Country	1992 ($ millions)	1997 ($ millions)
Israel	24	209
Mexico	76	132
Taiwan	54	87
Hong Kong	13	84
Singapore	112	73
Argentina	15	43
Korea	14	42
China	3	35
Malaysia	12	32
South Africa	16	22
India	3	22

Source: Bureau of Economic Analysis.

may exclude some of the joint ventures in China. A more detailed discussion of the R&D investment motivations of U.S. companies in emerging markets is presented in this chapter under "U.S. R&D Investments Abroad."

Industries with the highest levels of R&D globalization are drugs (33 percent), motor vehicles and parts (27 percent), and food and beverages (20 percent). The ratio of foreign R&D to domestic R&D spending for all manufacturing was 13 percent in 1997.

R&D Expenditures Abroad, by Industry

In 1997, most U.S. R&D expenditures abroad were concentrated in drugs, motor vehicles, electronic and electrical equipment, and industrial machinery (including computers). The intensity of R&D globalization can be measured by the ratio of foreign to domestic R&D spending as shown in table 10. Industries with the highest levels of R&D globalization are drugs (33 percent), motor vehicles and parts (27 percent), and food and beverages (20 percent). The ratio of foreign R&D to domestic R&D spending for all manufacturing was 13 percent in 1997.

The data on globalization intensities across industries show some patterns. Some industries require R&D and production to be located abroad to develop products for local markets, especially for motor vehicles in Europe, food and beverages for local tastes, packaged consumer goods (soaps, cleaners, toiletries), and, to a lesser degree, clinical testing of drugs to meet local regulatory standards. In computers, the United States is the market leader and sets worldwide standards, but companies may perform R&D abroad as a source of new technology.

Table 10. Ratio of U.S. R&D Abroad to Domestic R&D for Selected Industries, 1997

Industry	R&D Abroad ($ millions)	Domestic R&D ($ millions)	Ratio of R&D Abroad to Domestic R&D (percent)
All manufacturing	13,156	101,202	13.0
Drugs, medicines	3,845	11,586	33.1
Automotive	3,722	13,758	27.0
Food and beverages	353	1,787	19.8
Industrial chemicals	559	4,970	11.2
Soaps, cleaners, toiletries	146	2,092	7.0
Industrial machinery	1,235	18,393	6.7
Computers	532	12,787	4.2
Electronic, electrical equipment	1,309	22,747	5.6

Sources: Bureau of Economic Analysis (R&D abroad) and National Science Foundation (domestic R&D).

U.S. R&D Investments Abroad

Overseas direct R&D investments by U.S. multinational companies are nothing new. U.S. multinational firms (e.g., IBM, Caterpillar, and Union Carbide) have operated R&D facilities abroad for many years. In a pioneering study of R&D abroad by U.S. multinational companies, Robert Ronstadt (1997) noted that IBM spent about $200 million (roughly 30 percent of its R&D budget) in 1974 in overseas R&D. Ronstadt noted that other companies, such as Otis Elevator, CPC International, and Exxon, spent 50 percent, 38 percent, and 25 percent of their R&D budgets, respectively, in overseas R&D during the same period (Ronstadt 1997).

Although various organizations have reported a steady growth in U.S. R&D investments abroad, the data on U.S. direct investments in R&D abroad remain inadequate and fragmented.[6] Several government and industry organizations have recently sponsored large-scale research projects to monitor more closely the globalization of R&D in general and U.S. R&D involvement abroad in particular, including studies sponsored by the Council on Competitiveness, the Council on Foreign Relations, the Industrial Research Institute, and ongoing research for the Office of Technology Policy, U.S. Department of Commerce.

[6] The limitations of data on global R&D and the need to better track U.S. R&D abroad are discussed in *Exporting High Tech*, Council on Foreign Relations, March 1998, p. 19.

Three years ago, the authors of this report began compiling a list of U.S. R&D facilities abroad. The authors first published the list in *Globalizing Industrial Research and Development* (Dalton and Serapio 1995). For this report, the authors have expanded the list of U.S. R&D facilities abroad to 84 companies and 186 facilities, as shown in appendix C.[7] These R&D facilities cover a wide range of industries, including computer hardware, computer software, consumer electronics, motor vehicles, pharmaceutical, consumer products, and chemicals. The list includes most of the top 100 U.S. R&D companies and is a large enough sample to illustrate patterns of R&D spending and investments abroad.

Country and Industry Distribution

Table 11 shows that the list of countries with the most R&D facilities is similar to the list of countries with the largest R&D expenditures abroad. Countries hosting the largest number of U.S. R&D facilities are Japan (43), followed by the United Kingdom (27), Canada (26), France (16), Germany (15), and Singapore (13).

U.S. industries with the largest number of R&D facilities abroad are motor vehicles and parts (32), drugs and biotechnology (28), chemicals and rubber (23), and computers (25). See table 12 for a breakdown by industry and country.

Although U.S. companies have engaged in overseas direct investments in R&D for different reasons, there are a number of common drivers that fall into two major groups: (1) market- or demand-driven reasons and (2) technology- or supply-oriented reasons.

Investment Motives

Although U.S. companies have engaged in overseas direct investments in R&D for different reasons, there are a number of common drivers that fall into two major groups: (1) market- or demand-driven reasons and (2) technology- or supply-oriented reasons. Market- or demand-driven considerations include factors that pull U.S. R&D facilities into the host country for the purposes of (1) customizing/localizing the company's products for the local market, (2) developing new products for the local market, and (3) supporting the parent company's manufacturing, sales, or service facilities in the host country. Technology- or supply-oriented reasons are factors that drive U.S. R&D facilities abroad for the purposes of (1) tapping into R&D personnel (e.g., R&D scientists, engineers, software programmers), (2) developing new science and technology, (3) developing new products for a wider audience (i.e., products that are not just targeted to customers in the host country), (4) monitoring

[7] The authors compiled the list from R. R. Bowker, Inc., *Directory of American Research and Technology* (1997), company reports, and other directories. We gratefully acknowledge the assistance of Professor Takabumi Hayashi in compiling/updating our list of U.S. R&D facilities in Japan.

Table 11. U.S. R&D Facilities Abroad, 1997

Country	No. of Companies	No. of R&D Facilities
All Countries	85*	186
Japan	34	43
United Kingdom	24	27
Canada	23	26
France	16	16
Germany	15	15
Singapore	12	13
China	8	11
Belgium	8	8
Italy	3	3
Mexico	2	3
India	3	3
Netherlands	2	2
Switzerland	2	2
Luxembourg	2	2
Denmark	2	2
Ireland	2	2
Brazil	2	2
Taiwan	2	2
Spain	1	1
Sweden	1	1
Israel	1	1
Czech Republic	1	1

*The total number of companies with R&D facilities abroad is less than the sum of companies listed by country because many companies have R&D facilities in several countries.

Source: Compiled by the Office of Business and Industrial Analysis. See appendix C.

technological developments abroad, and (5) participating in joint/cooperative research projects.

The findings in this report support the conclusions of previous researchers (e.g., Kuemmerle, 1997; Ronstadt, 1977; Serapio, 1993) that both demand and supply factors are significant drivers of U.S. direct investments in R&D abroad. There are, however, two key observations regarding trends. First, technology- or supply-oriented reasons have played an

increasing role in influencing more recent U.S. direct R&D investments abroad and in shaping the nature and scope of overseas R&D conducted by U.S. companies. This is particularly true in the electronics industry, where recent U.S. direct investments in R&D are targeted to acquiring new technologies and enhancing the global innovative capabilities of the parent company. Second, several companies that initially have invested in R&D abroad for the purpose of assisting their manufacturing / sales / service facilities in a local market increasingly are positioning these R&D facilities as regional R&D bases.

Several factors explain the growing importance of supply / technology-oriented reasons as drivers of U.S. direct investments in R&D abroad. The shortage of programmers in the computer software industry often has been cited as a major factor influencing the decision by U.S. software companies to locate development facilities abroad or contract development work to foreign-based companies (U.S. Department of Commerce 1999). Other companies have located R&D facilities abroad in order to exploit specialized resources and expertise available in these markets. Examples of such expertise include work on speech recognition in China and excavators (heavy equipment) in Japan. Still others have maintained that their decision to locate R&D facilities abroad has been driven by more pragmatic considerations, such as the lower costs of conducting R&D work abroad and the need to have R&D facilities in multiple overseas locations to promote or facilitate parallel technology or product development.

Industry Comparisons

According to analysis and interviews for this report, the factors driving U.S. R&D investments abroad vary significantly across industries. Market- or demand-driven considerations, such as the need to support the parent company's manufacturing / sales / service facilities in the local market or engage in product customization, were key investment drivers for automotive, telecommunications, biomedical device, and industrial packaging companies. Technology- or supply-oriented reasons, such as access to high-quality R&D personnel or developing / acquiring new technology, were important factors influencing the investment decisions of computer software, computer hardware, industrial chemicals, and pharmaceutical companies. Microsoft's announcement that it would open a software development center in HITEC City, Hyderabad (India), is an example of a company deciding to invest in R&D abroad in order to access a large and talented pool of software professionals.

The findings of other studies, such as recent studies sponsored by the Council on Competitiveness and the Council on Foreign Relations, confirm the aforementioned differences in investment motives across industries. In addition, the study by the Council on Foreign Relations (Callan et al. 1998) identified other investment motives. These motives include (1) home country regulation and R&D climate (e.g., U.S. biomedical devices companies are conducting more development work and initial clinical testing in their R&D facilities abroad in response to the strict regulatory regime and high risks of legal liabilities in the United States); (2) host country requirements and regulations, such as technology transfer requirements, that have prompted U.S. companies to locate R&D abroad in exchange for market access; and (3) the impact of global mergers and acquisitions on the international R&D landscape (as discussed in chapter 1 of this report).

Microsoft's announcement that it would open a software development center in HITEC City, Hyderabad (India), is an example of a company deciding to invest in R&D abroad in order to access a large and talented pool of software professionals.

Location Decisions

As shown by tables 11 and 12, U.S. R&D investments abroad are concentrated in key geographic locations. In the automotive industry, U.S. R&D spending is concentrated in Germany, which accounts for 60 percent of worldwide U.S. R&D spending in this industry. Two of the largest U.S. R&D facilities abroad are in Germany's automotive industry: GM's Adam-Opel Technical Center in Ruffelsheim and Ford's Research Center in Merkenrich. The largest concentrations of U.S. R&D facilities in the automotive industry are in Japan, Germany, Canada, and France.

U.S. R&D expenditures in the drug industry are concentrated in France and the United Kingdom, which account for 20 percent and 16 percent, respectively, of U.S. worldwide R&D expenditures in this industry. However, U.S. R&D facilities in the pharmaceutical industry are spread across Japan, Canada, and many countries in Europe. In computers, Japan is host to the largest concentration of U.S. R&D centers (7). In instrumentation and controls, U.S. R&D facilities are concentrated in the United Kingdom, while the United Kingdom dominates foreign R&D in the United States in this industry. In Latin America, nearly all U.S. R&D facilities are related to auto parts in Mexico and Brazil. In Asia, Singapore is the second largest recipient of R&D expenditures and investments after Japan.

The concentration of U.S. R&D facilities abroad is partially reflected in the clustering of U.S. R&D facilities (as well as other foreign and local R&D facilities) in a number of technology centers, such as Tsukuba, Japan (electronics and pharmaceuticals); Cambridge, United Kingdom (basic research, software); Singapore (electronics); Taiwan, Israel, Ireland, and Korea (semiconductors and electronics); and Bangalore and Hyderabad, India (computer software).

Table 12. U.S. R&D Facilities Abroad by Industry and Country, 1998

Industry	Japan	Germany	France	United Kingdom	Canada	Others
Automotive	6	5	4	4	4	9
Computers	7	2	1	5	0	10
Computer software	4	0	0	1	1	6
Semiconductors	4	0	1	1	0	6
Optoelectronics, telecommunications	2	1	2	0	2	6
Other electronics	3	1	1	2	2	2
Drug, biotechnology	8	3	3	5	4	5
Chemicals, rubber	9	2	2	1	2	7
Other transportation equipment	0	0	0	0	3	0
Metals, petroleum refining	0	0	0	2	4	6
Instrumentation, medical devices	0	0	0	5	3	2
Food, consumer goods, miscellaneous	1	0	2	3	4	5

Source: Compiled by the Office of Business and Industrial Analysis from appendix C.

U.S. R&D investments abroad continue to be concentrated primarily in developed countries.

Emerging Technology Centers

U.S. R&D investments abroad continue to be concentrated primarily in developed countries. A number of industrializing / developing economies, however, have emerged as important hosts to R&D investments by multinational companies from the United States and other countries. Singapore, Taiwan, and India are three of the most successful emerging economies in attracting foreign R&D and other high-tech investments. In fact, several major U.S. companies have recently established or announced plans to establish research operations in these countries: Microsoft, Texas Instruments, and Oracle in India; Digital Electric Corporation (DEC) in Singapore; and Applied Materials and Cisco, in Taiwan. Table 13 lists selected U.S. companies that have invested or announced plans to invest in R&D in Singapore.

The success of technology centers in emerging markets (e.g., HITEC City, Hyderabad, India; Hsinchu Science Based Industrial Park, Taiwan; Chai Chee Industrial Park, Singapore) in attracting high-tech and R&D investments can be attributed to several factors. These factors include the same factors that companies have cited as important in influencing their R&D location decisions in industrialized countries, namely the availability of high-quality R&D personnel; proximity to companies specializing in the manufacture, design, and development of certain products (e.g., semi-

conductor and computer companies in Taiwan); availability of world-class R&D infrastructure and presence of a vibrant research culture; and government incentives and protection (e.g., particularly protection of intellectual property) extended to investing companies. Other companies have acknowledged that their decision to invest or consider investing in these emerging technology centers also has been partially influenced by a "follow-the-leader" orientation. For example, Microsoft's announcement that it has selected Hyderabad as the site of its development center generated interest among several other U.S. software companies.

Several companies have indicated that other emerging markets are on their radar screen as possible hosts to future R&D investments. China and Russia, in particular, have been mentioned as potential sites. As U.S. companies expand their manufacturing, sales, and service operations in China, they may have to relocate R&D to support their Chinese operations. IBM has recently established a research laboratory in China for a different purpose. The laboratory's initial mandate is to conduct specialized research focusing on Chinese language and speech recognition, as well as to conduct digital library technology research. The research outputs from this laboratory are intended to benefit the Chinese market as well as IBM's worldwide operations.

Table 13. U.S. R&D in Singapore

Company	R&D Activities
Western Digital R&D Center	VLSI development for mass storage applications
Xerox Singapore Software Center	software development, parallel development with Fuji Xerox of technology / software for document products
Seagate R&D Center	disk drive technologies
Compaq Singapore Portable Design Center	design, development, and manufacturing of portable computers
Digital Electric Corporation (DEC) Asia Research Laboratory	Internet-related software and hardware development, ATM networking, electronic commerce, participation in Singapore ONE project
Black and Decker R&D Center	development of portable electric power tools and household appliances
Sonoco R&D Center	product testing, technology transfer, product development for recycled paperboard packaging

Note: This listing includes selected companies that have established or announced plans to establish research, development, and testing facilities in Singapore as of September 1998.

Source: Compiled by the Office of Business and Industrial Analysis from appendix C.

Several companies have indicated that other emerging markets are on their radar screen as possible hosts to future R&D investments. China and Russia, in particular, have been mentioned as potential sites.

Russia's attraction for some companies is its large pool of high-quality R&D personnel, such as research scientists and engineers in the aerospace industry. It is interesting to note that a number of companies from the United States and other countries (e.g., Korea) have already tapped into this expertise through R&D investments and other modes of research collaboration with Russian companies.

Protection of intellectual property remains the major concern for most companies contemplating the location of their overseas R&D facilities in emerging markets such as China and Russia. Other concerns include a weak research infrastructure, economic turbulence, and political instability in some of the emerging markets.

Nature and Scope of Operations

The large majority of R&D facilities listed in appendix C are design and development centers. A small number of companies (primarily in the pharmaceutical and electronics industries) conduct basic research exclusively. A growing number of companies, however, are conducting both fundamental and applied research. A case in point is a U.S. company that one of the authors visited in Europe. The research facility traditionally has focused on design and implementation of existing advanced technologies for manufacturing pilot lines but has expanded its function to include fundamental research, as well as collaborative projects with a European research institute, focusing on a new technology and product line.

Most of the design and development centers work closely with the parent company's manufacturing, sales, and service facilities in the host country. As mentioned previously in this chapter, several companies have actually expanded the operations of these facilities to include support of the parent company's other manufacturing, sales, and service facilities in the region. Xerox's Singapore Software Center recently announced that it will engage in parallel development (with Fuji Xerox in Japan) for Xerox's line of document-processing products in Asia. Other development centers directly support the parent company's R&D operations in the United States.

Over a dozen parent companies listed in appendix C have established multiple R&D sites abroad. Some companies, such as IBM, conduct specialized work in each location (e.g., computer science, storage and semiconductor technology, and manufacturing research in the Tokyo (Yamato) Research Laboratory; communication systems and related information technology solutions, optoelectronics, and physical sciences in the Zurich Research Laboratory; and Chinese language and speech

recognition and digital library technology research and application in China in the China Research Laboratory). Other companies (e.g., telecommunications, automotive companies) conduct similar or overlapping research in their various R&D locations abroad.

Chapter 4: Globalization of Patent Activity

Another measure of the extent of globalization of technology is international patenting activity by U.S.- and foreign-owned multinational corporations. The foreign share of U.S. patents has been increasing, and U.S. companies are generating a growing share of their patents from overseas R&D facilities.

Patenting activity is a useful indicator of R&D output and technical change over time. The main advantages of patents compared with other global technology indicators such as R&D expenditures are that they are available over a long period of time and can be broken down into great statistical detail according to geographic location and technical area, according to Patel and Pavitt (1991). The main disadvantage is that they do not measure two important areas of technology: software and biotechnology. U.S. patenting activity by foreign inventors, however, provides a method of comparing and contrasting the levels of invention across countries and can be used as a leading indicator of new technological competition.

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U.S. Patents by Foreign Companies

About 110,000 U.S. patents were granted in 1996. Of that number, U.S. inventors received about 61,000 patents, or 55 percent of the total. The foreign share of U.S. patents in 1996, about 45 percent of the total, was highly concentrated in five countries: Japan, Germany, United Kingdom, France, and Canada. Japanese inventors received the largest number of U.S. patents in 1996 at 23,000 (21 percent); German inventors received 6,800 (6 percent); the United Kingdom received 2,400 (2 percent); Taiwan, an emerging market, received 2,000; and Korea, also an emerging market, received 1,500. Member countries of the European Union received 16,400 U.S. patents (15 percent).

The long-term trends in patent counts show an acceleration of growth in U.S. patents granted to inventors in emerging markets, as shown in table 14. Among the emerging markets, the countries with the most U.S. patents granted in the 1982–96 period were Taiwan, Australia, Korea, and Israel. Taiwan and Korea are among the leading countries for U.S. patents and are the fastest growing in terms of patents per year. At current rates of growth, in a few years both Taiwan and Korea could surpass the United Kingdom in the rate of patenting in the U.S. patent system, according to CHI Research data.

Table 14. U.S. Patents by Inventor Country, 1982–1996

Inventor Country	No. of U.S. Patents (1982–96)	Share of U.S. Patents (percent)
All Patents	1,276,351	100.00
United States	694,796	54.00
Japan	257,627	20.00
Germany	103,801	8.10
United Kingdom	37,301	2.90
Taiwan	10,836	0.85
Australia	6,037	0.47
Korea	5,899	0.46
Israel	4,072	0.32
Hong Kong	725	0.06
Ireland	671	0.05
Brazil	615	0.05
China	533	0.04
Singapore	354	0.03
India	310	0.02
Malaysia	86	0.01

Source: Office of Technology Policy, *The New Innovators: Global Patenting Trends in Five Sectors,* U.S. Department of Commerce (1998).

U.S. Patents by Industry Sectors

A recent study by the Commerce Department's Office of Technology Policy (1998), CHI Research, Inc., and the Council on Competitiveness analyzed the trends in U.S. patents by foreign inventors for five sectors: information technology, advanced materials, health, automotive, and express package transportation and logistics (EPTL) (see table 15).

The study defined information technology as covering digital, optical, and analog computing hardware and software (including cryptography, voice and image recognition and processing, and data storage). The sector included semiconductor manufacturing and applications patenting, while communications patents were not included.

The study defined advanced materials technologies as including advanced ceramics, alloys (particularly lightweight alloys), composites, diamond thin films, membranes, biomaterials, high-temperature superconductors, and selected polymers. Advanced methods for making

materials, such as combinatorial chemistry and molecular dynamics and materials modeling, were also included in the definition.

CHI defined health technology as drugs, medicines, and biotechnology, including genetic engineering drugs, immunological testing, and diagnostics. Medical devices were not included.

The study defined the automotive sector technologies as covering engines, transmissions, suspensions, brakes, steering, wheels and tires, vehicle bodies and chassis, passenger safety, pollution controls, and automotive manufacturing technology.

The study defined EPTL as including non-bulk materials-handling technologies, including technologies such as conveyors, optical-character recognition systems, and bar coding devices. Most of the patents granted to the leading companies in this sector (FedEx, UPS, U.S. Postal Service) are in materials handling and tracking.

Among these sectors, information technology is the dominant sector for patent activity (see table 15). Information technology patents increased from under 4,000 per year in 1982 to more than 16,000 in 1996 and accounted for 15 percent of all U.S. patents issued each year. The health sector ranked second with 4,700 patents, followed by automotive (2,700 patents) and advanced materials (1,200 patents).

Although U.S. companies rank first in the number of information technology patents, patents filed by some other countries have been growing faster, as shown in table 16. Japanese companies are ranked second in number of information technology patents, followed by Germany. The

Table 15. Growth in U.S. Patents by Sector

Sector	Number of Patents 1982	Number of Patents 1996	Growth (percent)
All U.S. Patents	58,000	110,000	89
Information Technology	4,000	16,000	305
Advanced Materials	250	1,200	333
Health	2,000	4,700	189
Automotive	1,300	2,700	105
EPTL	600	1,500	151

Source: Office of Technology Policy, *The New Innovators: Global Patenting Trends in Five Sectors*, U.S. Department of Commerce (1998).

Table 16. Information Technology Patents Filed in the United States by Country of Ownership

Country	Number of Patents 1982–86	Number of Patents 1992–96	Growth (percent change)
United States	13,202	32,852	149
Germany	1,304	1,712	31
Japan	7,012	25,015	257
United Kingdom	575	921	71
Korea	4	1,629	40,625
Taiwan	12	1,007	8,292
Israel	53	258	387

Source: Office of Technology Policy, *The New Innovators: Global Patenting Trends in Five Sectors*, U.S. Department of Commerce (1998).

The fastest growing countries in patent filings are the Republic of Korea and Taiwan, which surpassed the United Kingdom in the number of information technology patents.

fastest growing countries in patent filings are Korea and Taiwan, which surpassed the United Kingdom in the number of information technology patents.

Patents and Technology Leadership

The study uses two major measures of technology leadership: the share of patents in the sectors and the quality of patents as measured by citations in other patent applications. It found that the United States is the leader in every sector but health. Japan is ranked second, the European Union third, and Germany fourth. The U.S. lead over Japan is widest in the health sector, but it is not as wide in advanced materials and automotive and is weakest in information technology. The United Kingdom is strongest in health. By 1995, Korea and Taiwan exceeded the United Kingdom and Germany in information technology patents issued.

International Comparisons of Patent Activity

Most comparisons of international patenting activity indicate that U.S. firms rank relatively low in globalization, although there has been an upward trend in the past 15 years. In a study of patenting activity by 569 companies from 13 countries, Patel (1997) found that U.S. companies rely mainly on domestic R&D as a source of patents, with only 8 percent of their patents originating from overseas research in the first half of the 1990s (see table 17). Japanese companies were the least internationalized and generated less than 3 percent of their patents abroad, compared with

an average of nearly 23 percent for European companies from 1992 to 1996. Five European countries generated a majority of their patents abroad: the United Kingdom, Italy, the Netherlands, Belgium, and Switzerland.

Other empirical findings from the Patel study indicate that there is a strong home country advantage in developing technology and patents. The largest increases in internationalization have occurred as a result of mergers and acquisitions and not by means of organic growth. The Patel study also found that the most internationalized firms are not in the "high-tech" product groups that are usually considered as having a "world mandate." On the contrary, Patel (1997) concludes that "globalization is concentrated in product groups where adaptation for serving local markets is important. Industries with the highest levels of globalization of technology, as measured by patents, were food and beverages due to local differences in taste and drugs and building materials, which are subject to local regulations."

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Table 17. Geographic Location of the U.S. Patenting Activity of Large Firms According to Country of Origin, 1992–1996

Nationality	Home (percentage share)	Abroad (percentage share)
United States	92.0	8.0
Japan	97.4	2.6
Europe	77.3	22.7
Germany	78.2	21.8
France	65.4	34.6
United Kingdom	47.6	52.4
Italy	77.9	22.1
Netherlands	40.1	59.9
Belgium	33.2	66.8
Sweden	64.0	36.0
Austria	90.6	9.4
Finland	71.2	28.8
Switzerland	42.0	58.0
Norway	63.0	37.0

Source: Patel (1997).

A long-term historical perspective on globalization of patenting activity indicates that globalization does not always follow an upward trend. Cantwell (1997) analyzed U.S. patent data since 1920 and found that the share of patents by U.S. firms that originated abroad was higher in the period between World Wars I and II (1920–1939) at 6.8 percent, compared with a low point in the 1948 to 1968 period at 3.6 percent, followed by a gradual increase in the 1969 to 1990 period back up to 6.8 percent. The Cantwell study also found that European companies have been more active than U.S. companies in sourcing technology from abroad for more than 70 years and have shown a more consistent upward trend in globalization since 1920.

Conclusions

Studies of international patenting activity provide useful information that supplements and supports the patterns of internationalization of research and development. First, both patents and R&D have been increasingly global in the 1990s. Second, Europe and Japan continue to provide the lion's share of international patents and R&D, but Korean firms have shown rapid growth in both patent filings and R&D expenditures in the United States. Third, Japan stands out because it has the largest share of U.S. patents and the largest number of U.S. R&D facilities. Fourth, a large part of the globalization of patents and R&D results from mergers and the requirements of companies to meet customer demands and adapt products to local markets.

CHAPTER 5: CONCLUSION

Foreign R&D activities in the United States began to increase significantly in the mid-1980s and continued that increase during the 1990s. Their rapid growth raised questions about why, where, and in what sectors the investment was occurring. It also led to questions about the potential impact on U.S. competitiveness. Similarly, growth in U.S. R&D abroad led to questions about the possible displacement of domestic U.S. research and how U.S. R&D performed abroad would support innovation.

This study provides a comprehensive review of the extent of that growth and a basis for answering some of the questions raised. It is still difficult, however, to determine the real long-term effect of these activities on competitiveness and employment. The U.S. experience during the 1990s does appear to imply that the overall effect has been reasonably positive.

There are economic benefits from foreign-owned R&D activities in the United States.

There are economic benefits from foreign-owned R&D activities in the United States. One area of consensus is that foreign R&D spending within the United States increases employment opportunities for U.S. scientists and engineers. University researchers have welcomed foreign funding of academic research and equipment purchases. In addition, a study by Jaffe, Trajtenberg, and Henderson (1993) documented local R&D spillovers in new products and processes from foreign investment to U.S. companies in the same industry and to spinoff companies. A study by Coe and Helpman (1993) suggests that international R&D may lead to increased economic growth.

Recent studies have not found much evidence of a negative impact on U.S. competitiveness. A survey by Kuemmerle (1996) concludes, "It would be precipitous, however, to assume that foreign firms investing in local R&D facilities are free riders. Foreign firms also create spillovers for the local environment because R&D sites provide employment and learning opportunities for local researchers." The National Academy of Engineering (Reid and Schriesheim 1996) study on foreign R&D also emphasizes the local benefits of R&D, regardless of nationality.

Some empirical research by Patel and Pavitt (1991) also shows little evidence of displaced research. It finds that large multinational companies file most of their patents in the home country. The results from patent data are supported by the expenditure data on U.S. firms' R&D. These data show that U.S. companies spend 90 percent of R&D expenditures at their facilities in the United States. U.S. companies also told the authors that they are

The globalization of R&D investment does create new challenges for the United States.

benefiting more and more from access to knowledge produced abroad that their foreign facilities afford them.

The Council on Competitiveness (1998) has concluded that the globalization of R&D investment does create new challenges for the United States. If the challenge for the United States in the next century comes not from low-cost producers but from low-cost innovators, then the United States must make a strong, sustained commitment to investment in science and technology, develop the means to rapidly integrate new knowledge and technologies into products, and gain access to growing global sources of innovation. Vernon (1997) argues that policy makers will now have to take into account the increasing presence of foreign-owned R&D in the United States and strategic alliances by U.S. industry.

The data presented in this report support that conclusion. While there has been additional research on this issue since the authors' 1993 benchmark study, much more research needs to be undertaken. It is clear that industrial R&D has become increasingly globalized, with significantly more foreign R&D in the United States and U.S. R&D abroad. Motivations for both are remarkably similar, with access to foreign—especially human—resources and knowledge becoming increasingly important. Patent and other indicators show that a capacity for world-class research is increasing around the world, and that foreign countries, including some smaller countries, increasingly have high-impact patents.

The United States is the creator and repository of much of the world's industrial R&D. It retains a clear technological advantage in most sectors. Foreign corporations still come to the United States to establish R&D facilities because of the size of the U.S. market and, just as important, because it pays to benchmark yourself against the world's best science and technology. The real question is how to continue to tap the incredible dynamism of global R&D so that U.S. companies can remain the leaders in building new industries and creating high-wage jobs.

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APPENDIX A: FOREIGN-OWNED R&D FACILITIES, BY COUNTRY

Parent Company	Location	Industry
JAPAN		
Advantest	Advantest R&D Center, Santa Clara, CA	Semiconductor testers, electronic instruments (1994)
Ajinomoto	Ajinomoto USA, Raleigh, NC	Biotechnology
Akebono Brake	Engineering Center, Farmington Hills, MI	Auto parts, brakes (1997)
Alpine	Alpine Electronics R&D, Detroit, MI	Parts for electric vehicles, auto navigation (1994)
Anritsu	Wiltron, Morgan Hill, CA	Automated test equipment for telecommunications
Applied Telesis	Seattle, WA	Data communications equipment (1989)
Ascii	San Francisco, CA	Software and media (1990)
Asahi Optical	Pentax Technology, Broomfield, CO	Scanners, laser printers (1985)
Asahi Overseas	Phone-mate, Torrance, CA	Automatic telephone answering machines
BridgeStone	Bridgestone/Firestone Research, Akron, OH	Tires, rubber products
BridgeStone	Akron Technical Division, Akron, OH	Tires, synthetic and natural rubbers, textiles
Brother	Tennessee	Computers, fax machines, printers (1997)
Canon	Canon Research Center, Palo Alto, CA	Personal imaging computer systems (1990)
Canon	Canon Information System, Orange County, CA	Software (1990)
Casio	Casio Computer, San Jose, CA	Personal digital assistants
Chugai Pharm.	Gen-Probe, San Diego, CA	Biotechnology, clinical diagnostics, therapeutics
Dainippon Ink & Chem.	Reichold Chemicals, Research Triangle Park, NC	Synthetic latex, adhesives, emulsive polymers
Dainippon Ink & Chem.	Polychrome Corp., Fort Lee, NJ	Resins, specialty chemicals, coatings, printing inks
Denso	Technical Center, Southfield, MI	Automotive electronics (1985)
Dojindo Laboratories	Dojindo Molecular Technologies, Rockville, MD	Organic analytic & biochemical reagents, biomolecular
Eisai	Andover, MA	Clinical drug testing (1989)
Eisai	Teaneck, NJ	Drugs (1988)
Eisai	Eisai Pharmatechnology, Research Triangle Park, NC	Drugs (1997)
Epson	Advanced System Development	Personal computers, advanced software development
	Epson Research Center, Santa Clara, CA	RISC-based computing (1987)
Epson	ESMOS R&D Center, Santa Clara, CA	Semiconductors
Epson	Imaging System Group, Sunnyvale, CA	Printers, imaging products (1987)
Fanuc	Berkeley, CA	Power sensors for intelligent robotic systems (1994)
Fujisawa Pharm.	PMP Fermentation Products, Milwaukee, WI	Biotechnology
Fujisawa Pharm.	Melrose Park, IL	Drugs, diagnostic aids, biotechnology
Fuji Zerox	Palo Alto, CA	Communications networks for workstations (1992)
Fujitsu	Intellistor Inc., Longmont, CO	Disk storage devices (1987)
Fujitsu	Fujitsu Systems, San Diego, CA	Software for POS, handheld computers, routing systems
Fujitsu	Information Systems, San Jose, CA	Engineering related software, Internet applications
Fujitsu	Open Systems Solutions, Emeryville, CA	Unix software (1991)
Fujitsu	Fujitsu Microelectronics, San Jose, CA	Memories, logic, ASIC, SPARC
Fujitsu	Fujitsu Network Communications, Raleigh, NC	Central office switching equipment (1987)
Fujitsu	Fujitsu Network Communications, Santa Clara, CA	PBX equipment
Fujitsu	Fujitsu Network Communications, Richardson, TX	Telecommunications equipment
Fujitsu	Fujitsu Network Communications, Pearl River, NY	Broadband access and fiber-optic networking
Gradco	Irvine, CA	Sorting equipment for printers and copiers
Green Cross	Alpha Therapeutic, Los Angeles, CA	Biotechnology
Hitachi	Waltham, MA	Workstation and software development (1989)
Hitachi	Hitachi Microsystems, San Jose, CA	Software (1991)
Hitachi	Hitachi Software Engineering, San Fran., CA	Software (1991)
Hitachi	Hitachi Digital Graphics, Sunnyvale, CA	CAD graphics, digitizers
Hitachi	Brisbane, CA	Semiconductors (1989)
Hitachi	Hitachi Telecom, Norcross, GA	PBXs, fax machines (1987)
Hitachi	Hitachi Telecom, Richardson, TX	Telecommunications, synchronous optical network (1996)
Hitachi	Hitachi America, Princeton, NJ	HDTV (1991)
Hitachi	Farmington Hills, MI	Semiconductors for autos (1989)
Hitachi Chemical	University of California, Irvine, CA	Biotechnology (1990)
Hitachi Maxell	Maxell Corp., Santa Clara, CA	Computer disk drives (1997)
Hitachi-Koku & Nissea-Sanyo	Dataproducts, Woodland Hills, CA	Computer printers, printer ink
Honda	Honda R&D N. America, Torrance, CA	Design and develop autos (1975)
Honda	Honda R&D N. America, Marysville, OH	Prototype vehicles, parts testing (1985)
Honda	Swepsonville, GA	Lawnmowers R&D (1993)
Hosakawa	Micron Powder Systems, Summit, NJ	Particle size reduction, separation
Hosakawa	Hosokawa Micron Corp., Augusta, GA	Industrial filter bags (1994)
Hoya	San Jose, CA	Optoelectronics (1989)
Hoya	Hoya Electronics, San Jose, CA	Optoelectronics (1986)
Hoya	Hoya Optics, Fremont, CA	Optical and laser glass (1973)

Hoya	Continuum, Santa Clara, CA	Pulse laser beams (1991)
Hoya	Probe Technology, Santa Clara, CA	Probe cards for semiconductor manufacturing
Ishihara Sangyo	ISK Biosciences, Mentor, OH	Agricultural biotechnology and chemicals
Kaisha	Ricerca, Painesville, OH	Plant biotechnology
Isuzu	Isuzu Technical Center, Cerritos, CA	Vehicle design studio (1985)
Isuzu	Isuzu Technical Center, Plymouth, MA	Components engineering, emissions test (1990)
C. Itoh	Integrated Separation System, Natick, MA	Biotechnology supplies
Iwasaki Electric	Energy Sciences, Wilmington, MA	Electron processing, electron beams
Japan Energy	Gould Electronic, Eastlake, OH	Electronic components, electrolytic foil for printed circuit boards
Japan Metals & Chem.	JMC USA, Research Triangle Park, NC	Materials (1992)
Juki	Union Special Corp., Huntley, IL	Industrial sewing machines and automated systems
Justsystem	San Jose, CA	PC software (1995)
Justsystem	Pittsburgh Research Center, Pittsburgh, PA	Application of artificial intelligence to software
KAO	Cincinnati, OH	Cosmetics, toiletries, soap
Kawasaki Steel	Silicon Valley, CA	Semiconductors (1983)
Kawasaki Steel	Armco (50 percent), Middletown, OH	Carbon and alloy steels, stainless steel
Kawasaki Steel	LNP Engineering Plastics, Exton, PA	Glass and carbon fiber reinforced plastics
Kawasaki Steel	Concept Creation Center, Berkeley, CA	Semiconductors for communications network equipment
Kawasaki Steel	K-Technology Corp, Berkeley, CA	Semiconductors for communications network equipment
Kirin Brewery	La Jolla Institute of Allergies and Immunology, San Diego, CA	Biotechnology (1989)
Kirin Brewery	Twyford International, Santa Paula, CA	Cloning plants and flowers
Kobe Steel	Applied Electronics Center, Stanford Research Park, Palo Alto, CA	Thin-film data recording media and substrate materials for hard disk drives (1990)
Kobe Steel	Electronic Materials Center, Research Triangle Park, NC	GAAS and diamond thin film materials for semiconductors (1989)
Kobe Steel	Midrex Direct Reduction, Charlotte, NC	Steel-making using iron ore pellets
Kobe Steel	Glastic, Cleveland, OH	Fiberglass reinforced materials
Konami	Buffalo Grove, IL	Software for computer and video games (1995)
Konica	Konica Technology, Sunnyvale, CA	Data storage, printers, software (1987)
Kumiai	Kumiai Chemical, Mississippi	Pharmaceutical formulation research (1996)
Kuraya	Institute for Biological R&D, Irvine, CA	Biotechnology (1989)
Kyocera	San Diego, CA	Ceramics (1990)
Kyocera	Advanced Ceramic Technology Center, Vancouver, WA	Silicone nitride ceramics for auto engines, gas turbine parts (1992)
Kyocera	AVX Corp., Myrtle Beach, SC	Ceramics, thin films, capacitors, superconductivity
Kyowa Hakko Kogyo	BioKyowa, Cape Giradeau, MO	Biotechnology
Kyowa Hakko Kogyo	NutriQuest, Chesterfield, MO	Animal and human nutrition (1990)
Lintec	Madico Inc., Woburn, MA	Coating lamination for plastic film (1992)
Matsushita	Panasonic Technology, Palo Alto, CA	Computer document processing systems
Matsushita	Information Technology Lab, Princeton, NJ	Computer graphics, document process., software (1990)
Matsushita	Ind. Equipment Research Lab, Wood Dale, IL	Software for POS (1987)
Matsushita	San Jose, CA	Semiconductors and software (1991)
Matsushita	KMERL-Panasonic, Research Triangle Park, NC	Satellite communications (1991)
Matsushita	Panasonic AVC American Labs, Burlington, NJ	HDTV, digital satellite systems, set-top boxes, receivers
Matsushita	Speech Technology Lab, Santa Barbara, CA	Speech recognition, info. processing (1981)
Matsushita	Avionics Development Corp., Irvine, CA	In-flight audio, video systems for passengers
Matsushita	Electronics Industry Components, Cupertino,CA	Semiconductors for multimedia communications
Matsushita	Silicon Valley, CA	Digital network products for the home, Internet connections
Mazda	Mazda R&D of North America, Irvine, CA	Vehicle design (1972)
Mazda	Mazda R&D Center, Ann Arbor, MI	Emissions testing, engineering research (1988)
Mazda	Mazda R&D of N. America, Flat Rock, MI	Enhance localization of development (1992)
Mazda	Mazda R&D of N. America, Flat Rock, MI	Local parts sourcing, air conditioning (1988)
Mazda	Mazda R&D of N. America, Batavia, OH	Survey of production technology, support for Ford's automatic transmission production
Minolta	Minolta Systems Laboratory, San Jose, CA	Software for copiers and other digital office equipment
Mitsubishi Corp.	Aristech Chemical, Pittsburgh, PA	Chemical and polymer products
Mitsubishi Chemical	Seradyn / Photovolt, Indianapolis, IN	Diagnostics, analytical instruments
Mitsubishi Chemical	Verbatim, Charlotte, NC	Floppy disks and magnetic tape for memory storage
Mitsubishi Electric	Mitsubishi Electric Research Lab, Cambridge, MA	Super parallel computers (1991)
Mitsubishi Electric	Durham, NC	Semiconductors (1984)
Mitsubishi Electric	Horizon Research, Waltham, MA	Data processing (1985)
Mitsubishi Electric	Consumer Electronics Engineering Center Costa Mesa, CA	Audio visual equipment, HDTV (1995)
Mitsubishi Electric	VSIS Inc., Sunnyvale, CA	Interactive TV, 3-D graphics, electronic commerce
Mitsubishi Electric	Information Technology Center, Boston, MA	HDTV (1995)
Mitsubishi International	Photonic Integration Research, Columbus, OH	Basic research in fiber optics
Mitsubishi Materials	Mitsubishi Silicon, Menlo Park, CA	Semiconductor wafers
Mitsubishi Materials	Mitsubishi Silicon, Salem, OR	Silicon materials technology & manufacturing science
Mitsubishi Motors	Research and Design of America, Cyprus, CA	Design studio (1973)
Mitsubishi Motors	Ann Arbor, MI	Emissions and parts testing, safety evaluations, new products (1984)

Mitsubishi Motors	Normal, IL	Development of new models, safety standards (1996)
Mitsui Toatsu	Anderson Development Co., Adrian, MI	Urethane elastomers, catalysts, organic intermediates
MMS	Magnox, Pulaski, VA	Magnetic iron oxides
Murata	State College, PA	Electronics ferroelectrics, dielectic measurement
Nakamichi	Torrance, CA	Disk drives, CD-ROM (1987)
NEC	NEC Technologies Systems Lab, Boxboro, MA	Workstations, laptops
NEC	NEC Research Institute, Princeton, NJ	Fundamental research in computer and physical science
NEC	NEC Open Systems Lab, Princeton, NJ	Software development (1991)
NEC	NEC Electronics, Framingham, MA	Semiconductor design, high density memories (1987)
NEC	Systems Applications Engineering, Mountain View, CA	VLSI, chip sets for multimedia (1986)
NEC	Holontech, San Jose, CA	Network management software (1994)
NEC	San Jose, CA	Multimedia software R&D (1995)
NEC	Richardson, TX	Communications equipment
NGK Insulators	NGK Berylco, Reading, PA	High purity beryllium metal and alloys
Nihon Unisys	Megatec Corp., San Diego, CA	High performance computer graphics
Nikon	Nikon Precision, Belmont, CA	Cameras and steppers, opthalmic prods., measuring, surveying (1992)
Nippo	Irvine, CA	Software for printers, multimedia (1996)
Nippon Columbia	Georgia Institute of Tech., Atlanta, GA	Multimedia R&D center (1992)
Nippon Paint	Michigan	Paints (1994)
Nippon Sanso	Matheson Gas Products, East Rutherford, NJ	Gas analysis, purification & environmental abatement
Nippon Sanso	Isotec, Miamisburg, OH	Separation of stable isotopes and synthesis of carbon
Nippon Seiko	NSK Technical Center, Ann Arbor, MI	Develop bearings for vehicles
Nissan	Nissan Design, San Diego, CA	Design studio (1979)
Nissan	Nissan R&D, Farmington Hills, MI	Engineering of parts, vehicle design (1991)
Nissan	Nissan R&D, Los Angeles, CA	Vehicle testing, market research (1988)
Nissan	Arizona Test Center, Stanfield, AZ	Testing grounds (1986)
Nissan	Japan Electronic Control Systems, MI	Automotive electrical components (1992)
Nissan	Cambridge, MA	Basic science: human sight, cognitive behavior, and physiology (1993)
Nissan Chemical	Purdue University, West Lafayette, IN	Agricultural chemical testing
Nisshin Steel	Wheeling-Pittsburgh Steel, Wheeling, WV	Basic and applied metallurgy
Nitto Boseki	International Immunology, Murietta, GA	Biotechnology
Nitto Boseki	Midland Bioproducts, Boone, IA	Biotechnology
Nitto Denko	Graphic Technology, Gardner, KS	Pressure sensitive bar code labels
Nitto Denko	Permacel, New Brunswick, NJ	Pressure sensitive tapes, electric insulation
Nitsuko	California	Business telephone headsets
NKK	National Steel, Mishawaka, IN	Coated and uncoated steel products
NKK	National Steel, Technical Dept., Trenton, MI	Process technology, new steel compositions
NOF Corp.	U.S. Paint, St. Louis, MO	Industrial finishes, aerospace / marine coatings
NTT	Photonic Integration Research, Columbus, OH	Optoelectronics (1987)
Oki Electric	Advanced Technology Center, San Jose, CA	Laser printers, fax (1990)
Oki	Oki Semiconductor, Sunnyvale, CA	Semiconductors (1989)
Oki	Oki Telecom, Suwanee, GA	Telecommunications (1989)
Oki	Silicon Dynamics, Sunnyvale, CA	Telecommunications and multimedia
Olympus Optical	Torrance, CA	Optical and electronics products
Olympus Optical	Stanbio Laboratory, San Antonio, TX	Clinical test procedures
Omron	Information Technology Center, San Jose, CA	Personal computer software (1995)
Otsuka	Maryland Research Institute, Rockville, MD	Biotechnology, drugs for bronchitis, heart failure, pneumonia (1986)
Pharmaceutical	Biomembrane Institute, Seattle, WA	Biotechnology (1987)
Oyo	Geophysical Survey Systems, North Salem, NH	Fast pulse radar for geological strata profiling
Oyo	Klein Associates, Salem, NH	High resolution search and survey scan sonar
Ricoh	Ricoh Software Research, Santa Clara, CA	Software (1988)
Ricoh	Ricoh Calif. Res. Center, Menlo Park, CA	ASICs, CMOS (1989)
Ricoh	San Jose, CA	Facsimile equipment (1979)
Ricoh	Richoh Silicon Valley, Palo Alto, CA	Network-related products, image communications (1997)
Rohm	Rohm Research Corp., Boulder, CO	Printer heads (1990)
Rohm	Rohm Research Corp., San Jose, CA	Semiconductors design, BiCMOS (1990)
Sanyo	Product Development Center, Mountain View, CA	Multimedia, HDTV
Sega	Sega Soft, Redwood City, CA	Software for multimedia PCs and Internet, video games
Seiko Instruments	San Jose, CA	Computer graphics (1989)
Sekisui Chemical	International Foam Technology Center, Boston, MA	New materials for plastic foam (1998)
Sharp	Camas, WA	Semiconductors (1988)
Sharp	Camas, WA	Multimedia (1995)
Sharp	Hycom Inc., Irvine, CA	Flat panel displays (1989)
Sharp	Mahwah, NJ	Multimedia (1996)
Shionogi	Boston area, MA	Drug discovery center (1997)
Shiseido	Cutaneous Biology Research Center	Biotechnology (1989)
Shiseido	Shiseido America Technocenter, Darien, CT	Biotechnology (1989)
Shiseido	Zotos, Darien, CT	Hair science, hair coloring, shampoos, permanents
SOC Corp.	San-O-Industrial, Holbrook, NY	Fuses for telecommunications industry

Sony	Sony Electronics, Park Ridge, NJ	Basic and applied research in electronic components
Sony	Semiconductor and Systems Lab, San Jose, CA	Future CAD technologies
Sony	Advanced Computer Architecture Lab, Monterey, CA	New OS system using MO as primary storage, Unix software (1992)
Sony	Data Storage Lab, Boulder, CO	Disk drive controller and storage subsystems, erasable optical disks (1989)
Sony	Recording Media Laboratory, Boulder, CO	Recording media, technology infusion to Japan, (1990)
Sony	Telecommunications Research Lab, Montvale, NJ	Digital cellular technology and PCS
Sony	Television of America Engineering, San Diego, CA	Electrical parts engineering, power and electrical design
Sony	Display Systems Engineering, San Diego, CA	Next generation display systems, controllers
Sony	Sony Microsystems, San Jose, CA	Unix systems software, computers (1990)
Sony	Magnetic Products of America E&D, Dothan, AL	Strategic materials, surface treatment agents for ME
Sony	AP6 Sony Professional Products Company Engineering, Boca Raton, FL	Professional audio console and tape equipment
Sony	Sony Transcom, Irvine, CA	In-flight audio and video systems
Sony	Materials Research Corp., Orangeburg, NY	Semiconductor materials and equipment
Subaru	Subaru Technical Center, Garden Grove, CA	Develop and test vehicles (1983)
Subaru	Irvine, CA	Design, styling (1990)
Sumitomo	Sumitomo Electric, Santa Clara, CA	Software development (1985)
Sumitomo	Research Triangle Park, NC	Fiber optics (1983)
Sumitomo Chemical	Valent USA, Walnut Creek, CA	Agricultural chemicals (1994)
Sumitomo Heavy Ind.	Lumonics, Livonia, MI	Lasers for materials processing
Sumitomo Heavy Ind.	Lumonics, Eden Prairie, MN	Motion and delivery systems for lasers
Sumitomo Heavy Ind.	Lumonics, Oxnard, CA	Laser systems for product identification
Sumitomo Rubber	Dunlop Tire Co., West Amherst, NY	Tire products
Takeda Chemical	American Research & Development Center, NJ	Clinical testing of drugs
Tanabe Seiyaku	Tanabe Research Labs USA, San Diego, CA	Biotechnology, immune systems, allergies (1994)
TDK	Components Engineering, Torrance, CA	Applied consumer / industrial electronics research
Terumo	Elkton, MD	Blood collection devices, cardiovascular, IVs
Three Bond	West Chester, OH	Medical appliances, sealants for auto interior industry (1992)
Tokai	Scripto Tokai, Fontana, CA	Mechanical pencils, ball pens, china marking pencils
Toko	Signal Processing Technologies, Colorado Springs, CO	High speed integrated circuits, A / D analogies (1992)
Tokyo Electron	Boston, MA	Semiconductor manufacturing equipment (1997)
Tokuyama Soda	National Beryllia, Haskell, NJ	Ceramics and ceramic packages
Toppan Printing	Los Angeles, CA	Software, image processing (1995)
Toray	Composites Horizons, Covina, CA	Advanced composite materials
Toshiba	Toshiba Am. Info. Systems, San Jose, CA	Laptop, personal computers
Toshiba	Toshiba Elec. Components. Sunnyvale, CA	Semiconductors (1984)
Toshiba	Toshiba Am. Info. Systems, Irvine, CA	PBX, cellular systems, fax (1985)
Toshiba	Advanced TV Tech. Center, Wayne, NJ	HDTV receivers (1990)
Toshiba	Toshiba America MRI, South San Francisco, CA	Nuclear magnetic resonance imaging
Toyoda Gosei	TG Technical Center, Madison Heights, MI	Design and develop plastic, rubber parts
Toyota	Technical Center, Torrance, CA	Test prototype vehicles (1977)
Toyota	Technical Center, Ann Arbor, MI	Evaluate new parts, emissions tests (1977)
Toyota	Technical Center, Phoenix, AZ	Testing ground (1977)
Toyota	Calty Design Research, Newport Beach, CA	Design center (1973)
Toyota	San Francisco, CA	Support for NUMMI
Toyota	Southfield, MI	Testing, emissions testing
Ube Industries	Technical Center, Detroit, MI	Plastics molding equipment (1992)
Ulvac	Fremont, CA	Semiconductor equipment applications lab (1990)
Uniden	Uniden San Diego R&D Center, San Diego, CA	PCS systems, analog cellular phones, digital cellular hones, beepers
Yamaha Motors	Newman, GA	Personal watercraft (1996)
Yamanouchi	Shaklee Corp., San Francisco, CA	Cosmetics, toiletries, nutritional supplements
Yamanouchi	Shaklee Corp., Stanford Research Park, CA	Methods to deliver pharmaceutical and nutritional com
Yamazaki Mazak	Florence, KY	Special purpose machine tools (1996)
Y.O. Systems	Vancouver, WA	Optical fiber temperature and film-thickness control
Zexel	Farmington Hills, MI	Components and related auto parts
Zuken	Santa Clara, CA	Computer-aided design (1991)
Zuken	San Jose, CA	Computer-aided design (1993)
BELGIUM		
Andritz	Muncy, PA	Paper and pulp making machinery
Legent	Computer Associates, Columbus, OH	Mainframe software
Solvay	Solvay Animal Health, St. Paul, MN	Animal biotechnology, vaccines, chemotherapy
Solvay	Marietta, GA	Pharmaceutical science, clinical testing, chemical analytical research
DENMARK		
Dake	Dako, Carpinteria, CA	Biotechnology, diagnostic kits
Denesco	Brown Engineering, Columbia, MD	Suspended particle process operations
Novo-Nordisk	Entotech, Davis, CA	Biotechnology (1993)
Novo-Nordisk	ZymoGenetics, Seattle, WA	Biotechnology: diabetes, thrombosis, bleeding

FINLAND		
Amer Group	Wilson Sporting Goods, Chicago, IL	Golf, tennis, football, baseball, athletic goods
Cultor/E. Kodak	Genecor Int., South San Francisco, CA	Genetic and protein engineering
Duoplan	Ekono, Bellevue, WA	Energy conservation studies for pulp and paper industry
Outokumpu	OMG, Cleveland, OH	Paints, varnish, printing inks, plastics
Outokumpu	Princeton Gamma-Tech, Princeton, NJ	Gamma and x-ray spectroscopy, solid state radiation detectors
Rauma-Repola	Neles-Jamesbury, Worcester, MA	Fluid controls, ball valves, butterfly valves
Tamroc	Eimco Coal Machinery, Bluefield, VA	Underground mining machinery
FRANCE		
Alcatel	Network Systems, Richardson, TX	Lightwave transmission equipment, digital cross-connects
Alcatel	Network Systems, Raleigh, NC	Digital loop carriers
Carnaudmetalbox	Anchor Hocking Packing, Lancaster, OH	Packing, sealing machinery
Cegelec	Linden, NJ	Chemical process analyzers
Elf Aquitane	Technical Center, King of Prussia, PA	Chemical products
Elf Aquitane	Fine Chemical Group, Buffalo, NY	Organic peroxides, foaming agents, fine chemicals
Eridania Beghin-Say	Central Soya, Food Research, Fort Wayne, IN	Chemistry of soy proteins, oil and lecithin
Framatone	Norwalk, CT	Mechanical properties of metals, corrosion, electrical contacts
Group Schneider	EPE Technologies/Square D, Costa Mesa , CA	Computer power protection, electrical distribution
Group Schneider	Columbus, OH	Chemical process automation, computer control systems
LaFarge Coppee	Systech Environmental Corp., Zenia, OH	Liquid and solid waste resource recovery
Lipha	Lipha Tech, Milwaukee, WI	Biotechnology
Michelin	Michelin Americas R&D, Greenville, SC	Synthetic rubber, tires
Pechiney	Howmet Corp., Greenwich, CT	Metallurgy
Pechiney	Technical Center, Whitehall, MI	Superalloy melting and casting
Pechiney	Carbone Lorraine N.A., Parsippany, NY	Carbons, graphites, resins, teflon, corrosion problem
Renault	Mack Trucks, Winnesboro, SC	Heavy duty diesel trucks, transmissions, parts
Rhone Merieux	Athens, GA	Biotechnology
Rhone Merieux	Select Laboratories, Gainesville, GA	Biotechnology
Rhone-Poulenc	CelPril Industries, Manteca, CA	Biotechnology
Rhone-Poulenc	Research Triangle Park, NC	Biotechnology—agricultural chemicals (1986)
Rhone-Poulenc	Rhone-Poulenc Rorer, Collegeville, PA	Biotechnology, drugs, synthesis, prescription dosage
Rhone-Poulenc	Princeton, NJ	Herbicides, fungicides, animal health products
Rhone-Poulenc	North American Chemicals, Cranbury, NJ	Monomers, polymers, surfactants, hydrocolloids, food ingredients
St. Gobain	Norton Co., Worcester, MA	Abrasives, superabrasives, advanced ceramics
St. Gobain	Norton, Troy, NY	Coated abrasives
St. Gobain	Norton, Wayne, NJ	Thermoplastic products
St. Gobain	Cohart Refractories, Louisville, KY	Advanced ceramics, refractories for ceramics
St. Gobain	Bicron Corp., Newbury, OH	Material and systems for measuring ionizing radiation
St. Gobain	Carborundum Corp., Niagara Falls, NY	Ceramics: structural and electronic, fibers, coating
Sanofi	Genetric Systems, Redmond,WA	Biotechnology: blood diagnostic tests
Sanofi	Sanofi Diagnostics Pasteur, Chaska, MN	Biotechnology: vitro diagnostic systems, retrovirology
Schlumberger	Austin Research, Austin, TX	Computer science research
Schlumberger	Austin Systems Center, Austin, TX	Software and systems engineering
Schlumberger	ATE Division, San Jose, CA	Microelectronics, computer science and systems
Schlumberger	EMR Photoelectric, Princeton, NJ	Photomultiplier tubes, gamma ray detectors
Schlumberger	Doll Research Center, Ridgefield, CT	Oil field well products, sonics, geometric modeling
Schlumberger	Dowell, Tulsa, OK	Enhance oil well stimulation
Thomson	Consumer Electronics, Indianapolis, IN	Digital television and electronics research
Thomson	Training and Simulation, Tulsa, OK	Training and simulation devices for aviation and marine vehicles
Thomson	Comark Communications, Southwick, MA	HDTV transmission systems, wave guide systems, (1990)
Total TCP	Cook Composites, Port Washington, WI	Synthetic resins for reinforced plastics
Uqine Acg	J&L Specialty Products, Pittsburgh, PA	Stainless steel products
Valeo	Valeo Engine Cooling, Jamestown, NY	Welding, brazing, metal forming, heat transfer
GERMANY		
AEG	Modular Computer Sys., Fort Lauderdale, FL	Computers, computer systems and services
AEG Capital	Siliconix, Santa Clara, CA	Semiconductor manufacturing
Balcke-Durr	Zurn Balcke-Durr, Tampa, FL	Environmental systems and controls, energy systems
BASF	BASF Bioresearch Corp., Cambridge, MA	Biotechnology (1989)
BASF	BACHEM Bioscience, Philadelphia, PA	Biotechnology
BASF	Agricultural Products, Research Triangle Park, NC	Biotechnology—plants, pesticides(1986)
BASF	Knoll Pharmaceuticals, Mount Olive, NJ	Drugs
BASF	Automotive Research Center, Southfield, MI	Automotive coatings
BASF	R&D Library, Wynadotte, MI	Biochemistry, chemistry, biological sciences, agricultural chemistry
BASF	Coatings and Colorants, Mount Olive, NJ	Polymer science, surface science
BASF	Container Coatings, Milford, OH	Polymer science, chemical coatings
BASF	Research & Development, Freeport, TX	Industrial chemicals, plastics & fiber raw materials
Bayer	Pharmaceutical Division, West Haven, CT	Biotechnology, clinical drug trials (1992)
Bayer	Miles Diagnostic, Mishawaka, IN	Biotechnology
Bayer	Miles, Orangeburg, NY	Medical diagnostic imaging and scanning

Bayer	Pittsburgh, PA	Polyurethanes, thermoplastic, adhesives, industrial chemicals
Bayer	Miles / Haarman & Reimer, Elkhart, IN	Biotechnology, enzymes, drugs
Bayer	Tarrytown, NY	Automatedanalyzers for medical labs, diagnostic equipment
Bayer	Miles, Kankakee, IL	Isolation of blood proteins, biochemical reagents
Bayer	Animal Health Division, Shawnee Mission, KS	Animal health medicines
Bayer	Agricultural Division, Kansas City, MO	Agricultural chemicals
Bayer	Miles, Spokane, WA	Allergy productions, immunology
Bayer	Haarman & Reimer, Springfield, NJ	Colorants, fragrances, flavors, food preservatives
Bayer	H.C. Stark, Newton, MA	Tantalum and niobium
Bayer	Fibers, Organics, Rubber, Akron, OH	Process chemistry, process engineering
Bayer	Agfa, Wilmington, MA	Computerized typographic, offset printing equipment
Bayer	Berkeley, CA	Biotechnology
Benckiser	Coty, Parsippany, NJ	Fragrances, cosmetics
Biotest	Biotest Diagnostics, Danville, NJ	Biotechnology
BMW	California	Auto design center (1991)
Boehringer Ingelheim	Pharmaceuticals, Ridgefield, CT	Immunology
Boehringer Ingelheim	Animal Health, Saint Joseph, MO	Biotechnology, veterinary virus vaccines
Boehringer Ingelheim	Animal Health, Elwood, KS	Biotechnology, parasticides, drugs, feed additives
Bosch, Robert	Technical Center, Farmington Hills, MI	Auto parts, wheels, brakes (1983)
B Braun Biotech	Allentown, PA	Biotechnology, fermentation / cell culture bioreactors,
Continental	General Tire, Technology Dept., Charlotte, NC	Tire and rubber research
Degussa	Leybold Vacuum Products, Export, PA	Vacuum pumping systems
Dieder-Werke	State College, PA	Refractories for steel, iron, glass
E. Merck	Rona Inc., Hawthorne, NY	Pearlescent pigments
E. Merck	EM Science, Gibbstown, NJ	Blood testing kits
GEA PT	Atlantic Pharmaceutical Services, Owings Mills, MD	Drugs
Hartman & Braun	Applied Automation, Barttlesville, OK	Process control instruments
Henkel	Chemical Group, Cincinnati, OH	Fatty acids, ozonization, polymerization
Henkel	Ambler, PA	Metal treating chemicals
Henkel	Parker & Amchem, Madison Heights, MI	Chemicals to enhance corrosion resistance, paints
Henkel	Loctite, Rocky Hill, CT	Adhesives and sealants
Heraeus	DSET Laboratories, Phoenix, AZ	Solar devices
Hertel	Kenilworth, NJ	Cemented tungsten and titanium carbide
Hoechst	Behring Diagnostics, San Jose, CA	Biotechnology, clinical diagnostic test reagents
Hoechst	Mitchell Technical Center, Summit, NJ	Advanced materials process and products
Hoechst	Hoechst-Celanese Fibers & Film, Charlotte, NC	Chemical engineering, synthetic, fibers, film
Hoechst	Hoechst-Roussel Pharm., Somerville, NJ	Endrocrinology, antibiotics, cardiovascular
Hoechst	Animal Health Products, Somerville, NJ	Animal health products & drugs
Hoechst	Corporate Research, Coventry, RI	Dyes, organic pigments, specialty & agricultural chem.
Hoechst	Technical Center, Corpus Christie, TX	New chemical processes
Hoechst	Technical Polymers, Summit, NJ	Dyes, pigments, specialty chemicals
Hoechst	Hoechst Marion Roussel, Kansas City, MO	Toxicology, pharmacology, clinical testing
Hoechst	Hoechst Marion Roussel, Bridgewater, NJ	Biotechnology
Hoechst	Hoechst Marion Roussel, Cambridge, MA	Biotechnology core centers
Huls	Somerset, NJ	Colorants, biochemicals, coatings additives, engineering resins
Huls	Bristol, PA	Industrial organic chemicals
Huls	MEMC Electronic Materials, Saint Peters, MO	Electronics materials
Mercedes	Mercedes Benz Advanced Design, Irvine, CA	Automotive design (1990)
Miltenyi Biotec	Auburn, CA	Biotechnology
OSRAM	OSRAM-Sylvania, Danvers, MA	Lighting R&D
RWE-DEA	Condea Vista R&D, Austin, TX	Surfactants, solvents, PVC
Rotring	Koh-I-Noor, Rapidograph, Bloomsbury, NJ	Engineering supplies, art materials
Rutgerswerke	State College, PA	Process development for chemical industries
SAP	SAP Technology, Palo Alto, CA	Software for business solutions: interface and integration technology
Schering	Berlex Biosciences, Richmond, CA	Biotechnology drugs for cancer, viruses
Schwarz Pharma	Thiensville, WI	Biochemistry, microbiology, pharmaceuticals
SGL Carbon	Charlotte, NC	Research on carbon
SGL Carbon	Sigri Great Lakes Carbon, Niagara Falls, NY	Carbon and graphite electric furnace electrodes
Siemens	Siemens Corporate Research, Princeton, NJ	Software engineering, imaging, learning systems
Siemens	Siemens Components, Cupertino, CA	Industrial integrated circuits, microprocessors, microcontrollers
Siemens	Rolm Communications, Boca Raton, FL	Private telecommunications networks
Siemens	Business Communications, Santa Clara, CA	PBX, voice mail, digital telephones
Siemens	Fuel Systems Components, Newport News, VA	Fuel injection systems, anti-lock brakes
Siemens	Automotive Central Technology, Auburn Hills, MI	Automotive electronic systems, custom IC chips
Siemens	Optoelectronics Division, Cuptertino, CA	Optocouplers, infrared emitters
Siemens	Siecor, Hickory, NC	Fiber optics
Siemens	International Computer Science Institute, Berkeley, CA	Computers
Siemens	Siemens Stromberg-Carlson, Boca Raton, FL	Software packages for PBX, central office switching
Siemens	Siemens Stromberg-Carlson, Lake Mary, FL	Telecommunications equipment

Siemens	Medical Systems, Iselin, NJ	Medical equipment development
Siemens	Medical Systems, Hoffman Estates, IL	Nuclear medical imaging, x-ray imaging
Siemens	Solar Industries, Camarillo, CA	Photovoltaic devices and systems
Siemens	Cardion, Woodbury, NY	Communication and detection systems, scan converters
Siemens	Potter & Brumfield, Princeton, IN	Solid state switching devices, dry reed relays, circuit breakers
SIGRI	Great Lakes Carbon, Niagara Falls, NY	Carbon and graphite electric furnace electrodes
SIGRI	Great Lakes Research, Elizabethton, TN	Petroleum coke, graphite electrodes and products
Software AG	Reston, VA	Database management systems, software
Thyssen	Budd Technical Center, Auburn Hills, MI	Advanced material investigation, highway vehicle design
Thyssen	Troy, MI	Structures, metal fabrication, plastic fabrication
Volkswagen	Simi Valley, CA	Design center (1990)
Wacker Chemie	Wacker Silicones, Adrian, MI	Industrial silicone products, silicone applications
IRELAND		
Kerry Group	Kerry Ingredients, Beloit, WI	Flavoring and seasoning, protein
ITALY		
Ferruzzi	Central Soya Feed Research, Decatur, IN	Nutrition research on livestock and poultry
Ferruzzi	Wayne, IN	Soy protein, food research
FIAT	Incstar Corp., Stillwater, MN	Biotechnology: diagnostic immunoassays—RIA and EIA
Montecatini	SP Systems, Los Angeles, CA	Composites
Montedison	Adria Laboratories, Columbus, OH	Biotechnology
Montedison	Montell, Wilmington, DE	Polymer science, plastics, fibers, catalysis
Perelli	Perelli Armstrong Tire, New Haven, CT	Materials, components for tires
Pirelli Cabls & Systems	Research and Development Center, Lexington, SC	Energy and communications cables, superconductivity
SKF	CR Industries, Elgin, IL	Oil seals and rubber technology
NETHERLANDS		
Akzo Nobel	Chicago, IL	Fatty chemicals, organics peroxides, catalysts
Akzo Nobel	Organon Teknik, Durham, NC	Biotechnology, molecular antibodies
Akzo Nobel	Organon Teknika Biotechnology Research Institute, Rockville, MD	Biotechnology
Akzo Nobel	Organon Inc., West Orange, NJ	Drugs
Akzo Nobel	Intervet, Millsboro, DE	Animal vaccines
Akzo Nobel	Central Research, Dobbs Ferry, NY	Chemicals, plastics, lubricants, plastics, pollution
Akzo Nobel	Akzo Coatings, Troy, MI	Automotive paints, plastic coatings, polymers
Baan	Menlo Park, CA	Computer software, database software
DSM	Copolymer, Baton Rouge, LA	Solution and emulsion polymerization of polymers
DSM	Engineering Plastic Products, Reading, PA	Polyamides, polyacetals, polyethelene
Gist-Brocades	Inter'l Bio-Synthetics, Charlotte, NC	Biotechnology
Memorex Telex	Tulsa, OK	Magnetic recording materials, computer peripheral equipment
Naamaloze Vennootschap	Copolymer, Baton Rouge, LA	Solution and emulsion polymerization
OCE	Santa Clara, CA	Computer graphics plotter printers
Philips	Philips Research, Briarcliff, NY	Integrated circuits, computers, software, HDTV, electronic materials
Philips	Philips Components, Slatersville, RI	Discrete semiconductors, plumicons
Philips	Philips Ultrasound, Irvine, CA	Diagnostic ultrasound
Philips	Electronic Instruments/EDAX, Mahwah, NJ	X-ray instrumentation, spectrometry
Philips	Philips Automotive Electronics, Cheshire, CT	Motors, timing devices, indicators
Philips	Airpax Protector Group, Frederick, MD	Interruptors, disc thermostats
Royal Dutch/Shell	Bellaire Technology Center, Houston, TX	Research on exploration, production of oil and gas
Royal Dutch/Shell	Westhollow Technology Center, Houston, TX	Fuels and lubricants, refining processes, chemicals
Unilever	Lipton Co., Englewood Cliffs, NJ	Tea, soup and beverage mixes, salad dressing
Unilever	Unilever Research U.S., Edgewater, NJ	Household and personal consumer products
Unilever	Cheesebrough-Pond, Greenwich, CT	Toiletries, cosmetics, over the counter drugs
Unilever	Quest International Flavors, Owings Mills, MD	Food, beverages, tobacco, flavors, essential oils
Unilever	Diversey Lever, Sharonville, OH	Laundry and housekeeping products, vehicle cleaners,
Unilever	Van den Bergh Foods, Lisle, IL	Edible fats, seasonings, dairy and baking products
Unilever	Van den Bergh R&D, Baltimore, MD	Edible fats and oils, dairy and baking products
Wolters Kluwer	Aspen Systems, Silver Spring, MD	Management consulting to government and industry
NORWAY		
Dyno	Dyno Nobel, Salt Lake City, UT	Industrial explosives
Borregaard	Ligno Tech, Rothschild, WI	Chemicals from lignin and raw cellulose
Simrad	San Marcos, CA	Harsh environment imaging systems: TV cameras, thermal imaging
SPAIN		
Pesa	Manchester, NH	Broadcasting equipment and antennas
SWEDEN		
Atalas Copco	Rotoflow Corp., Gardena, CA	Large power recovery turbines for geothermal systems
Electrolux	White Consolidated Industries, LaGrange, IN	Forced air furnaces
Electrolux	Richards-Wilcox, Aurora, IL	Industrial electric doors, overhead conveyors and controls, carousels
Ericsson	Richardson, TX	Central office switching equipment

Ericsson	Private Radio Systems, Lynchburg, VA	Digital trunked radio for dispatch market
Ericsson	Ericsson GE Mobile, Research Triangle Park, NC	Digital cellular equipment
Fermenta	Kansas City, MO	Feed additives, parasiticides
Fermenta	Fort Collins, CO	Drugs for animal health
Gambro	Cobe Laboratories, Lakewood, CO	Medical equipment
Incentive	Hagglunds Denison, Marysville, OH	Oil hydraulic components
Kanthal	Bethel, CT	High temperature tubing, thermo-coupling alloys
Karishamns	Columbus, OH	Fats, oils, fatty derivatives
Perstorp Analytical	Nirsystems, Silver Spring, MD	Application of near infrared spectrophotometry for quality control
Pharmacia	Pharmacia Biotech, Milwaukee, WI	Biotechnology
Pharmacia	Upjohn Laboratories, Kalamazoo, MI	Immunology, virology, biotechnology, drugs
Pharmacia	Agricultural R&D Laboratory, Kalamazoo, MI	Animal diseases and parasites
Pharos AB	Spectro Physics Lasers, Mountain View, CA	Lasers: gas, helium ion, ring dye, ion
Procordia	Kabi, Clayton, NC	Biotechnology
Procordia	Pharmacia Biotech, Piscataway, NJ	Biotechnology
Seco Tools	Cabroloy, Detroit, MI	Sintering, bonding, carbides, tools
SKF	Process Development Lab, Elgin, IL	Rubber molding, oil seals
Spectra Physics	Dayton, OH	Laser-based alignment systems for construction
Spectra Physics	Agema Infrared Systems, Seacaucus, NJ	Temperature measurement systems, control systems
Volvo	Monitoring and Concept Center, Camarillo, CA	Design center (1986)
Volvo	Volvo GM Heavy Trucks, Greensboro, SC	Trucks, materials handling, emissions, noise,
SWITZERLAND		
ABB	Combusiton Engineering,Windsor, CT	Combustion technology, nuclear reactor design
ABB	Industrial Systems, Columbus, OH	Measurement systems, control systems, infrared
ABB	Industrial Systems, Rochester, NY	Pneumatic & electronic instruments, control systems
ABB	Research Triangle Park, NC	Technology transfer
Allusuisse-Lonza	Lonza, Annandale,NJ	Hydantoin, amide, ester carbohydrate
Allusuisse-Lonza	Lawson, Mardon & Wheatley, Millville, NJ	Processing of plastics, organics, inorganics
Ares-Serono	Serono Laboratories, Norwell, MA	Biotechnology: mammalian cell culture. Drugs
Ascon / MIT	Ascon Timeplex, Woodcliff Lake, NJ	Data communications, multiplexing, telecommunications
Contraves	Pittsburgh, PA	Range tracking, inertial guidance systems
Forbo	Hazelton, PA	Surface coatings
Fuchs	Metal Lubricants, Harvey, IL	Industrial lubrication oils, rust inhibitors
Hartmetall	Metal Carbides, Youngstown, OH	Refractory metals of tungsten, titanium, cobalt, etc.
Hoffman-LaRoche	Roche BioScience, Palo Alto, CA	Drugs
Hoffman-LaRoche	Roche Institute for Molecular Biology, Nutley, NJ	Biotechnology (1991)
Hoffman-LaRoche	Roche Biomedical Labs, Burlington, NC	Biotechnology
Hoffman-LaRoche	Genentech, South San Francisco, CA	Biotechnology, drugs (1990)
Hoffman-LaRoche	Givaudan-Roure, Clifton, NJ	Fragrances, flavors, cosmetics, sunscreen agents
Landis & Gyr	Landis & Gyr Metering, Lafayette, IN	Instruments for measuring electricity
Landis & Gyr	Buffalo Grove, IL	Building control systems, software
Nestle	Alcon Laboratories, Fort Worth, TX	Opthmalogy and pharmaceuticals
Nestle	Alcon Lab, Irvine, CA	Surgical instruments
Nestle	Nestle Food, Glendale, CA	Dairy, meat, dietary foods, food processing
Nestle	Stouffer, Solon, OH	Frozen prepared main dishes, side dishes
Nestle	Westreco, New Milford, CT	Coffee, tea, confections, dairy products
Novartis	Agricultural Biotechnology, Research Triangle Park, NC	Biotechnology (1984)
Novartis	Crop Protection, Greensboro, NC	Biotechnology, herbicides, insecticides
Novartis	Ciba Seeds, Greensboro, NC	Biotechnology, plant breeding, genetics
Novartis	Ciba-Corning, Diagnostic, Medfield, MA	Biotechnology
Novartis	Ciba-Corning, Oberlin, OH	Spectral scanning, chromotography
Novartis	Ciba Pharmaceuticals, Summit, NJ	Psychotherapeutic drugs, cardiovascular drugs
Novartis	Polymers Division, Brewster, NY	Resins, plastics, epoxy
Novartis	Additives Development Laboratory, McIntosh, AL	Complex organic synthesis, systems for process controls
Novartis	Sandoz Agro Research, Palo Alto, CA	Biotechnology (1972)
Novartis	Sandoz Pharmaceuticals, East Hanover, NJ	Biotechnology, basic research on new drugs
Novartis	Gerber Products, Fremont, MI	Food science, nutrition, biochemistry
Novartis	Rogers NK Seed, Boise, ID	Genetics and plant breeding
Novartis	Sandoz Pharmaceutical Laboratories, Lincoln, NE	Applied research on new drugs
Novartis	Sandoz Nutrition, Saint Louis Park, MN	New food products, processes, snacks
Novartis	Genetic Therapy, Rockville, MD	Biotechnology
SGS	U.S. Testing Co., Hoboken, NJ	Biology, chemistry, quality control, materials
Sika Finanz	Lydhurst, NJ	Epoxy resins, specialty cement, urethane polymer
Sulzer	Intermedics, Angleton, TX	Implanting medical products, pacemakers, orthopedic

UNITED KINGDOM

AGIE Ltd.	Davidson, NC	Electrical discharge machining equipment
Amersham Int'l	Arlington Heights, IL	Biotechnology
BBA	RM Engineered Prods., North Charleston, SC	Exotic coatings, elastomeric composites
BICC PLC	BICC Cables Corp., West Nyack, NY	Electrical materials for wire tubing, raw materials for electronic components
Bowater	Rexham, Charlotte, NC	Coated, uncoated paper, paperboard, packaging
British-American Tobacco	Brown & Williamson, Macon, GA	Tobacco and tobacco technology
British Petroleum	BP Chemicals, Cleveland, OH	Biotechnology, environmental science, catalysts
British Petroleum	BP Chemicals, Gardena, CA	Graphite fibers, epoxy, composites
BTR	Aerospace Avionics, Bohemia, NY	Aerospace avionics
BTR	Stewart Warner, Indianapolis, IN	Pneumatic and hydraulic equipment
BTR	Stewart Warner, Pittsburgh, PA	Measurement and flow controls, heat transfer equipment
BTR	Hobbs Corp., Springfield, IL	Hour meters, pressure and vacuum switches
BTR	Stearns Division, Milwaukee, WI	Research on brakes, clutches
BTR	Power Conversion, Elmwood Park, NJ	Lithium cells and batteries
Coats ViYella	Charlotte, NC	Sewing thread, crochet, zippers
Cookson Group	Vesuvius Research, Pittsburgh, PA	Redractories for ferrous molten metals
Courtaulds	Courtaulds Aerospace, Burbank, CA	Caulking, sealing for aerospace vehicles
Corange	Boehringer Mannheim Corp., Concord, CA	Biotechnology: diagnostic reagent kits
Cray Electronics	Annapolis Junction, MD	Data communications, integrated circuit design
Dobson Park	Revere Aerospace, Wallingford, CT	Sensors: pressure, temperature, speed, proximity
Dobson Park	Revere Transducers, Artesia, CA	Resistance strain gauges, force pressure calibration
Dowty Group	RFL Communications, Boonton, NJ	Telecommunications instrumentation
English China Clays	Calgon, Pittsburgh, PA	Water treatment chemicals
Fairey	Lasermike, Dayton, OH	Electro-optical and laser gauges
Ferranti	Chicago, IL	Electron beam, lasers
Ferranti	Lancaster, PA	High frequency communications
Fisons	J&W Scientific, Folsom, CA	Organic and analytical chemistry
Fisons	Kevex Instruments, Valencia, CA	X-ray spectrometry and materials analysis
Fisons	Rochester, NY	Medical science, pharmacology, clinical research
FKI	Bristol Babcock, Waterbury, CT	Multiloop controllers, control languages
GE Ltd.	A.B. Dick, Niles, IL	Copiers, lithographic offset, micrographics
GEC PLC	Lear Astronics, Santa Monica, CA	Automatic flight controls, avionics
GEC PLC	Lear Astronics Developmental Science, Ontario, CA	Engineering of prototypes, unmanned vehicles
GEC Marconi	W.W. Gaertner Research, Norwalk, CT	Real time graphics, systems design
Geotech	Ford New Holland, New Holland, PA	Agricultural and light industrial machines
Glaxo Wellcome	Affymax Research Institute, Palo Alto, CA	Research in new drug discovery, testing
Glaxo Wellcome	Research Triangle Park, NC	Drugs, biotechnology
Glaxo Wellcome	Sir Paul Girolami Research Center, Triangle Park, NC	Biotechnology (1991)
Glaxo Wellcome	Sterling Drug Research, Rensselaer, NY	Medicinals and drugs (1994 acquisition)
Diageo	Pillsbury Agricultural Research, Le Seur, MN	Plant biotechnology, genetics
Diageo	Heublein, Hartford, CT	Wine and spirits chemistry, microbiology
Diageo	Pillsbury Technology Center, Minneapolis, MN	Consumer and institutional food products
Hanson Trust	SCM-Glidco Organics, Jacksonville, FL	Terpene chemistry, fragrances, flavors
Hanson Trust	Hanson Industries, Woodbridge, NJ	Food technology, meat packing
IMI	Norgren, Littleton, CO	Regulating, controlling compressed air
Imperial Chemical	Tamaqua Tech. Center, Tamaqua, PA	High explosives, blasting initiators
Imperial Chemical	ICI Film Division, Hopewell, VA	Polyester films and polymers
Imperial Chemical	ICI Paints Reserch Center, Cleveland, OH	Polymers and coatings for can coating and architectural markets
Imperial Chemical	ICI Fiberite, Tempe, AZ	Advanced composite materials
J. Bibby	Melles Griot, Irvine, CA	Optical sciences, optical thin films
Kratos	Kratos Analytical, Ramsey, NJ	Surface analysis, mass spectrometry
Life Sciences	Savant Instruments, Farmingdale, NY	Biotechnology, biomedical R&D
Logical PLC	Logica, Waltham, MA	Software for banking, insurance, telecom
Lucas	Lucas Aerospace Aircraft Systems, Brea, CA	Microwave components
Lucas	Lucas Aerospace Power Equip., Aurora, OH	Alternating current generating systems
Lucas	Lucas Aerospace Power Transmission, Utica, NY	Flexible power transmission shafts
Lutton	Alpha Chemical, Pineville, NC	Polymers, plastics
Medeva	Armstrong Pharmaceuticals, West Roxbury, MA	Drugs
Morgan Crucible	Laser Diode, New Brunswick, NJ	Semiconductor lasers, laser systems
Morgan Crucible	TGM Detectors, Parsippany, NJ	Gas filled radiation detectors, Geiger-Mueler tubes
Morgan Crucible	Westgo-Duramic, Fairfield, NJ	Electrical and electronic components, safety tools
Morgan Crucible	Matroc Electro Ceramic Division, Bedford, OH	Piezoelectric materials, bandpass filters, sonar transducers
Oxford Molecular	Townsend, MD	Computer software for chemical databases
PA Holdings	PA Consulting, Hightstown, NJ	R&D of products processes
Pearson	Reed Tool, Houston, TX	Metals and elastomers used in drilling operations
Pilkington	Pilkington Aerospace, Garden Grove, CA	Thermoplastics, optical thin films
Pilkington	Pilkington Barnes Hind, Sunnyvale, CA	Opthamology and optometry, contact lenses
Plersey	Sippican, Marion, MA	Oceanographic instruments

Proton International	JRH Biosciences, Lenexa, KS	Biotechnology
Racal	Racal Group, Sunrise, FL	Electronic data communications
Racal	Racal Communications, Rockville, MD	Military radio communications
Racal	Racal Instruments, Irvine, CA	Time and frequency analysis
Reckitt & Colman	Wayne, NJ	Odor control, cleaners, air fresheners, waxes
Reed Elsevier	Technology Center, Cambridge, MA	Electronic publishing software, CD-ROM
Reuters	Reuters America, El Segundo, CA	Database software for financial information services
Rio Tinto-Zinc	U.S. Borax, Tech. Dept., Santa Clara, CA	Metallurgy, industrial minerals
RTZ PLC	Kennecott Corp., Salt Lake City, UT	Extractive metallurgy of titanium minerals
RTZ PLC	Kennecott Computing Center, Bingham Canyon, UT	Information systems, operations research, computer services
Sage Group	Telemagic, Carlsbad, CA	Research and development of software
Seven Trent	Stoner Associates, Houston, TX	Software, pipeline applications
Siebe	Foxboro Co., Foxboro, MA	Process control, factory automation
Siebe	Barber Colman, Loves Park, IL	Temperature controls, power controls
Siebe	Ranco / Paragon Electric, Two Rivers, WI	Timing devices, time controls, energy management
Siebe	Robertshaw Controls, Long Beach, CA	Gas, electric, pneumatic and hydraulic controls
Siebe	Environmental Controls Systems, Richmond, VA	Electronic products
SmithKline Beecham	Clinical Labs, Van Nuys, CA	New diagnostic tests, clinical laboratory services
SmithKline Beecham	Consumer Health Care, Parsippany, NY	Proprietary medicines, feminine health care
SmithKline Beecham	Pharmaceuticals R&D, King of Prussia, PA	Neurosciences, inflammation & tissue repair, vaccines
Smiths Industries	Grand Rapids, MI	Instrument systems for aircraft navigation, missile guidance
Staveley	Stavely NDT Technologies, Kennewick, WA	Ultrasonics and electronics
TI Group	Dowty Aerospace, Yakima, WA	Hydraulic controls for aerospace
Tomkins	Gates Corp., Denver, CO	Electrochemistry, materials research, belt develop.
Twyford Internat'l	Twyfod Plant Labs, Santa Paula, CA	Biotechnology
United Biscuits	Keebler Co., Elmhurst, IL	Bakery and confectionery products
United Parts	AP Parts, Toledo, OH	Auto parts, metallurgy, acoustics
USM Texon	Wilmington, MA	Latex, resin saturated fiber materials for footwear
Wassall	DAP Inc., Dayton, OH	Caulks, sealants, putty, adhesives, wood fillers, finishes, paints
Whatman	Whatman Reeve Angel, Clifton, NJ	Thin lay chromatography products, ion exchange cellulose
Zeneca	Biomedical Research, Wilmington, DE	Basic research in medicinal chemistry, pharmacology, toxology
Zeneca	Zeneca Pharmaceuticals, Wilmington,DE	Biomedical research, drugs, biotechnology
Zeneca	Richmond Research Center, Richmond, CA	Agricultural chemicals, biotechnology, pollution abatement
Zeneca	Zeneca Agric. Products, Whitaker, NC	Agricultural chemicals
Zeneca	Specialty Chemicals, Wilmington, DE	Specialty chemicals, polyols, resins, activated carbons, surfactants
AUSTRALIA		
CSL Limited	JRH Biosciences, Lenexa, KS	Bioscience research for the pharmaceutical industries
F.H. Faulding	Purepac Pharmaceuticals, Elizabeth, NJ	Generic drugs
Lincoln Scott	Honolulu, HI	Mechanical, electrical engineering
Pacific Dunlop	GNB, St. Paul, MN	Secondary production of lead, lead oxide
CANADA		
Alcan	Cambridge Technical Center, Cambridge, MA	Metals, alloys, ceramics
Bombadier	Learjet, Wichita, KS	Business jet aircraft
CAE	CAE Electronics, Binghamton, NY	Medical research, marine control systems
CCL Industries	Kolmar Laboratories, Port Jervis, NY	Cosmetics, toiletries, topical pharmaceutical preparations
Canadian Marconi	Cincinnati Electronics, Cincinnati, OH	Military electronic systems
Can Test Ltd.	Am Test, Redmond, WA	Quality control and chemical analysis
Chubb Security	National Foam, Exton, PA	Chemistry, fire-fighting chemicals, hardware systems
Firan	Denro, Gaithersburg, MD	Communications systems integration, electronic instruments
GEAC Computer	Newtonville, MA	Library application software packages
Corel	Orem, UT	Computer software, word processing (WordPerfect)
EMCO	Emco Wheaton, Cary, NC	Valves, fittings, automatic nozzles, fueling systems
Inter-City Products	La Vergne, TN	Residential and commercial heating & air conditioning
IVACO	Laclede Steel, St. Louis, MO	High and low carbon & low-alloy steels, steel prods.
Laidlaw	Laidlaw Environmental Services, Laurel, MD	Hazardous waste storage, disposal, and transportation
Magna	Michigan (five locations)	Auto parts
Molson	Diversey Technical Services Laboratory Lavonna, MI	Potable waters, fuel additives, bacteriology
Molson	Diversey Corp., Sharonville, OH	Laundry and housekeeping products, vehicle cleaners
Molson	Diversey Water Technology, Chagrin Falls, OH	Corrosion control for boilers and cooling systems, energy saving
Moore	Moore Research Center, Grand Island, NY	Printing equipment, business forms handling equip.
Northern Telecom	BNR, Inc. Research Triangle Park, NC	Telecommunication network products (1987)
Northern Telecom	Nortel, San Ramon, CA	PBX systems, central office switching
Northern Telecom	Richardson, TX	PBX, central office switching
Northern Telecom	Nortel, Rochester, NY	Computer systems for offices and communications ind.
Nova	Nova Chemicals, Leominster, MA	New polymers, kinetics, microstructure & monomers
Quartex	CMS Data, Tallahassee, FL	Computer integrated systems design for the legal industry
Seagram	White Plains, NY	Alcoholic beverages, fermentation
Tridel	Edoco, Long Beach, CA	Construction chemicals
United Dominion Ind.	Robertson, Ambridge, PA	Building products for commercial & industrial construction

HONG KONG		
Astec	Beckman Industries, Fullerton, CA	Electroceramics, thin film materials
ECI Telecom	Telematics International, Fort Lauderdale, FL	Networking systems
ELOP	Optronic Devices, Hauppauge, NY	Laser systems, night vision systems
Scitex	Scitex Digital Printing, Dayton, OH	Array ink jet printing, image processing, process control
ISRAEL		
Teva Pharmaceutical	Lemmon Co., Sellersville, PA	Drugs
KOREA		
Daewoo Electronics	Santa Clara, CA	Computer research (1988)
Daewoo Electronics	Technology Research Institute, New Jersey	Semiconductors, HDTV, digital video disks (1996)
Kolon Data Comm.	MIT Industrial Park, Cambridge, MA	Software for data services, Internet searches (1996)
Korean Air	San Francisco, CA	Aircraft research (1997)
LG Chemical	University of Maryland, College Park, MD	Chemicals (1996)
LG Electronics	Goldstar Electronics, San Jose, CA	Semiconductors, DRAMs (1983)
LG Electronics	United Micro Tech, NJ	Semiconductors, PCs (1984)
LG Electronics	Phoenix, AZ	Advanced wireless telecommunications equipment (1990)
LG Electronics	North American Lab, Chicago, IL	HDTV (1991)
LG Electronics	Zenith Electronics, Glenview, IL	Color TV, HDTV, picture tubes, VCRs, computer monitors
LG Electronics	GSEA, San Diego, CA	Semiconductor technology
Hyundai Motors	Detroit, MI	Automotive (1986)
Hyundai Motors	Hyundai California Design Studio, Fountain View, CA	Auto design center (1989)
Hyundai Electronics	Symbios Logic, Fort Collins, CO	ASIC devices, comm. ICs, VLSI fabrication (1994)
Hyundai Electronics	Symbios Logic, Colorado Springs, CO	SCSI controllers, ROMs, software drivers (1994)
Hyndai Electronics	SEMR Research Institute, San Jose,	Semiconductor research
Hyundai Electronics	Maxtor, San Jose, CA	Hard disk drives (1995)
Hyundai Electronics	Maxtor, Longmont, CO	Hard disk and tape drives (1995)
Kia Motors	Detroit, MI	Development of powertrain parts (1996)
Lucky	Lucky Biotech, Emeryville, CA	Genetic engineering, biotechnology
Sambo Computer	San Jose, CA	Computers, wireless computer communications (1995)
Samsung	Advanced Media Lab, Lawrence, NJ	HDTV (1988)
Samsung	Samsung Semiconductor, Santa Clara, CA	Semiconductor (256K DRAM) design (1983)
Samsung	U.S. PC R&D Center, San Jose, CA	Next generation PCs (1990)
Samsung	Boston, MA	Computer research center (1988)
Samsung	AST Research, Irvine, CA	Personal computers, peripherals (1995)
Samsung	Harris Semiconductor Prods., Melbourne, FL	Integrated circuits, microprocessors, CMOS, PROMs (1994)
Samsung	Advanced Graphics Technology, CA	Logic chips, processors for DVD players (1997)
Samsung Motors	Los Angeles, CA	Auto design center (1996)
TAE IL Media	National Micronetics, Kingston, NY	Solid state ferrite tech., recording heads
Young-Chang Akki	Young-Chang Boston Research Institute Boston, MA	Synthetic sound, multi-media chips (1990)
Yukong	Bio-Pharmaceutical R&D Center, NJ	Drug materials, pharmacology, clinical tests (1997)
NETHERLANDS ANTILLES		
Fuel Tech	Stamford, CT	Combustion, energy transfer, emissions reduction
AVO International	Blue Bell, PA	Electrical measuring instruments
SINGAPORE		
Avimo	Wheeling, IL	Night vision optics
Singapore Technology	Micropolis Ltd., Chatsworth, CA	Winchester hard disk drives
TAIWAN		
Acer	San Jose, CA	PCs, microcomputer terminals
Formosa Plastics	Everex Systems, Fremont, CA	Personal computer peripherals
Taiwan Lite-on	Lite-on Corp., Milpitas, CA	Optoelectronics for communications
VENEZUELA		
Petroleos de Venezuela	Citgo Petroleum, Tulsa, OK	Fuel and lubricant products

APPENDIX B: FOREIGN-OWNED R&D FACILITIES, BY INDUSTRY

Parent Company	Location	Products and Technology
AUTOMOTIVE		
Akebono Brake	Engineering Center, Farmington Hills, MI	Auto parts, brakes (1997)
Akzo Nobel	Akzo Coatings, Troy, MI	Automotive paints, plastic coatings, polymers
Alpine	Alpine Electronics R&D, Detroit, MI	Parts for electric vehicles, auto navigation (1994)
BASF	Automotive Research Center, Southfield, MI	Automotive coatings
BMW	California	Auto design center (1991)
Bosch, Robert	Technical Center, Farmington Hills, MI	Auto parts, wheels, brakes (1983)
Denso	Technical Center, Southfield, MI	Automotive electronics (1985)
Honda	Honda R&D N. America, Marysville, OH	Prototype vehicles, parts testing (1985)
Honda	Honda R&D N. America, Torrance, CA	Design and develop autos (1975)
Hyundai	Hyundai California Design Studio, Fountain View, CA	Auto design center (1989)
Hyundai	Detroit, MI	Automotive (1986)
Isuzu	Isuzu Technical Center, Cerritos, CA	Vehicle design studio (1985)
Isuzu	Isuzu Technical Center, Plymouth, MI	Components engineering, emissions test (1990)
Kia Motors	Detroit, MI	Development of powertrain parts (1996)
Magna International	Michigan: five locations	Auto parts
Mazda	Mazda R&D of N. America. Batavia, OH	Survey of production technology, support for Ford's automatic transmissions.
Mazda	Mazda R&D of N. America, Flat Rock, MI	Local parts sourcing, air conditioning (1988)
Mazda	Mazda R&D of N. America, Flat Rock, MI	Enhance localization of development (1992)
Mazda	Mazda R&D Center, Ann Arbor, MI	Emissions testing, engineering research (1988)
Mazda	Mazda R&D of North America, Irvine, CA	Vehicle design (1972)
Mercedes	Mercedes Benz Advanced Design, Irvine, CA	Automotive design (1990)
Mitsubishi Motors	Research and Design of America, Cypress, CA	Design studio (1973)
Mitsubishi Motors	Southfield, MI	Emissions testing (1984)
Mitsubishi Motors	Normal, IL	Development of new models, safety standards (1996)
Nissan	Arizona Test Center, Stanfield, AZ	Testing grounds (1986)
Nissan	Nissan R&D, Farmington Hills, MI	Engineering of parts, vehicle design (1991)
Nissan	Cambridge, MA	Basic science: human sight, cognitive behavior
Nissan	Nissan R&D, Los Angeles, CA	Vehicle testing, market research (1988)
Nissan	Nissan Design, San Diego, CA	Design studio (1979)
Nissan	Japan Electronic Control Systems, MI	Automotive electrical components (1992)
Philips	Philips Automotive Electronics, Cheshire, CT	Motors, timing devices, indicators
Renault	Mack Trucks, Winnesboro, SC	Heavy duty diesel trucks, transmissions, parts
Samsung Motors	Los Angeles, CA	Auto design center (1996)
Siemens	Fuel Systems Components, Newport News, VA	Fuel injection systems, anti-lock brakes
Siemens	Automotive Central Technology, Auburn Hills, MI	Automotive electronic systems, custom IC chips
Subaru	Irvine, CA	Design, styling (1990)
Subaru	Subaru Technical Center, Garden Grove, CA	Develop and test vehicles (1983)
Thyssen	Budd Technical Center, Auburn Hills, MI	Advanced material investigation, vehicle design
Toyoda Gosei	TG Technical Center, Madison Heights, MI	Design and develop plastic, rubber parts
Toyota	Southfield, MI	Testing, emissions testing
Toyota	Calty Design Research, Newport Beach, CA	Design center (1973)
Toyota	San Francisco, CA	Support for NUMMI
Toyota	Technical Center, Ann Arbor, MI	Evaluate new parts, emissions tests (1977)
Toyota	Technical Center, Torrance, CA	Test prototype vehicles (1977)
Toyota	Technical Center, Phoenix, AZ	Testing ground (1977)
Valeo	Valeo Engine Cooling, Jamestown, NY	Welding, brazing, metal forming, heat transfer
Volkswagen	Simi Valley, CA	Design center (1990)
Volvo	Monitoring and Concept Center, Camarillo, CA	Design center (1986)
Volvo	Volvo GM Heavy Trucks, Greensboro, SC	Trucks, materials handling, emissions, noise, safety
Zexel	Farmington Hills, MI	Components and related auto parts
COMPUTERS & EQUIPMENT		
Acer	San Jose, CA	PCs, microcomputer terminals
Advantest	Advantest R&D Center, Santa Clara, CA	Semiconductor testers, electronic instruments (1994)
AEG	Modular Computer Sys., Fort Lauderdale, FL	Computers, computer systems and services
Asahi Optical	Pentax Technology, Broomfield, CO	Scanners, laser printers (1985)
Brother	Tennessee	Fax machines, printers, computers (1997)
Canon	Canon Research Center, Palo Alto, CA	Personal imaging computer systems (1990)
Casio	Casio Computer, San Jose, CA	Personal digital assistants
Daewoo Electronics	Santa Clara, CA	Computer research (1988)
Epson	Advanced System Development	Personal computers, advanced software development
Epson	Imaging System Group, Sunnyvale, CA	Printers, imaging products (1987)
Formosa Plastics	Everex Systems, Fremont, CA	Personal computer peripherals

Fuji Zerox	Palo Alto, CA	Communications networks for workstations (1992)
Fujitsu	Intellistor Inc., Longmont, CO	Disk storage devices (1987)
Hitachi	Waltham, MA	Workstation and software development (1989)
Hitachi Maxell	Maxell Corp., Santa Clara, CA	Computer disk drives (1997)
Hitachi-Koku	Dataproducts, Woodland Hills, CA	Computer printers, printer ink
Hyundai Electronics	Maxtor, Longmont, CO	Hard disk and tape drives (1995)
Hyundai Electronics	Maxtor, San Jose, CA	Hard disk drives (1995)
Konica	Konica Technology, Sunnyvale, CA	Data storage, printers, software (1987)
Matsushita	Silicon Valley, CA	Digital network products related to the home
Memorex Telex	Tulsa, OK	Magnetic recording materials, computer peripherals
Mitsubishi Electric	Mitsubishi Electric Research Lab, Cambridge, MA	Super parallel computers (1991)
Mitsubishi Electric	Horizon Research, Waltham, MA	Data processing (1985)
Nakamichi	Torrance, CA	Disk drives, CD-ROM (1987)
NEC	NEC Technologies Systems Lab, Boxboro, MA	Workstations, laptops
NEC	NEC Research Institute, Princeton, NJ	Fundamental research in computer and physical science
Northern Telecom	Nortel, Rochester, NY	Computer systems for offices and communications
OCE	Santa Clara, CA	Computer graphics plotter printers
Oki Electric	Advanced Technology Center, San Jose, CA	Laser printers, fax (1990)
Ricoh	Ricoh Silicon Valley, Palo Alto, CA	Network-related products, image communications (1997)
Rohm	Rohm Research Corp., Boulder, CO	Printer heads (1990)
Sambo Computer	San Jose, CA	Computers, wireless computer communications (1995)
Samsung	Boston, MA	Computer research center (1988)
Samsung	AST Research, Irvine, CA	Personal computers, peripherals (1995)
Samsung	U.S. PC R&D Center, San Jose, CA	Next generation PCs (1990)
Schlumberger	ATE Division, San Jose, CA	Microelectronics, computer science and systems
Schlumberger	Austin Research, Austin, TX	Computer science research
Siemens	International Computer Science Institute, Berkeley, CA	Computers
Singapore Technology	Micropolis Ltd., Chatsworth, CA	Winchester hard disk drives
Sony	Data Storage Lab, Boulder, CO	Disk drive controller and storage subsystems, erasable optical disks
Sony	Advanced Computer Architecture Lab, Monterey, CA	New OS system using MO as primary storage, Unix Software
Toshiba	Toshiba Am. Info. Systems, San Jose, CA	Laptop, personal computers

COMPUTER SOFTWARE

Ascii	San Francisco, CA	Software and media (1990)
Baan	Menlo Park, CA	Computer software, database software
Canon	Canon Information System, Orange County, CA	Software (1990)
Corel	Orem, UT	Computer software, word processing (WordPerfect)
FKI	Bristol Babcock, Waterbury, CT	Multiloop controllers, control languages
Fujitsu	Open Systems Solutions, Emeryville, CA	Unix software (1991)
Fujitsu	Information Systems, San Jose, CA	Engineering related software, Internet applications
Fujitsu	Fujitsu Systems, San Diego, CA	Software for POS, handheld computers, routing systems
GEAC Computer	Newtonville, MA	Library application software packages
GEC Marconi	W.W. Gaertner Research, Norwalk, CT	Real time graphics, systems design
Hitachi	Hitachi Microsystems, San Jose, CA	Software (1991)
Hitachi	Hitachi Software Engineering, San Francisco, CA	Software (1991)
Hitachi	Hitachi Digital Graphics, Sunnyvale, CA	CAD graphics, digitizers
Justsystem	Pittsburgh Research Center, Pittsburgh, PA	Artificial intelligence software (1996)
Justsystem	San Jose, CA	PC software (1995)
Kolon Data Comm.	MIT Industrial Park, Cambridge, MA	Software for data services, Internet apps. (1996)
Konami	Buffalo Grove, IL	Software for computer and video games (1995)
Legent	Computer Associates, Columbus, OH	Mainframe software
Logical PLC	Logica, Waltham, MA	Software for banking, insurance, telecom
Matsushita	Information Technology Lab, Princeton, NJ	Computer graphics, document processing, software (1990)
Matsushita	Panasonic Technology, Palo Alto, CA	Computer document processing systems
Matsushita	Ind. Equipment Research Lab, Wood Dale, IL	Software for POS (1987)
Matsushita	Speech Technology Lab, Santa Barbara, CA	Speech recognition, info. processing (1981)
Minolta	Minolta Systems Laboratory, San Jose, CA	Software for copiers and digital office equipment
Mitsubishi Electric VSIS Inc.	Sunnyvale, CA	Interactive TV, 3-D graphics, electronic commerce
NEC	Holontech, San Jose, CA	Network management software (1994)
NEC	NEC Open Systems Lab, Princeton, NJ	Software development (1991)
NEC	San Jose, CA	Multimedia software R&D (1995)
Nihon Unisys	Megatec Corp., San Diego, CA	High performance computer graphics
Nippo	Irvine, CA	Software and controllers for printers, multimedia (1996)
Nippon Columbia	Georgia Institute of Tech., Atlanta, GA	Multimedia R&D center (1992)
Oki	Silicon Dynamics, Sunnyvale, CA	Telecommunications and multimedia
Omron	Information Technology Center, San Jose, CA	Personal computer software (1995)
Oxford Molecular	Townsend, MD	Computer software for chemical databases
Quartex	CMS Data, Tallahassee, FL	Computer integrated systems design for the legal industry

Reed Elsevier	Technology Center, Cambridge, MA	Electronic publishing software, CD-ROM
Reuters	Reuters America, El Segundo, CA	Database software for financial information services
Ricoh	Ricoh Software Research, Santa Clara, CA	Software (1988)
RTZ PLC	Kennecott Computing Center, Bingham Canyon, UT	Information systems, operations research, computer services
Sage Group	Telemagic, Carlsbad, CA	Research and development of software
SAP	SAP Technology, Palo Alto, CA	Software for business solutions: interface and integration technology
Schlumberger	Austin Systems Center, Austin, TX	Software and systems engineering
Sega	Sega Soft, Redwood City, CA	Software for multimedia PCs and Internet, video games
Seiko Instruments	San Jose, CA	Computer graphics (1989)
Seven Trent	Stoner Associates, Houston, TX	Software, pipeline applications
Sharp	Camas, WA	Multimedia (1995)
Sharp	Mahwah, NJ	Multimedia (1996)
Siemens	Siemens Corporate Research, Princeton, NJ	Software engineering, imaging, learning systems
Software AG	Reston, VA	Database management systems, software
Sony	Sony Microsystems, San Jose, CA	Unix systems software, computers (1990)
Sumitomo	Sumitomo Electric, Santa Clara, CA	Software development (1985)
Toppan Printing	Los Angeles, CA	Software, image processing (1995)
Zuken	San Jose, CA	Computer-aided design (1993)
Zuken	Santa Clara, CA	Computer-aided design (1991)

SEMICONDUCTORS

AEG Capital	Siliconix, Santa Clara, CA	Semiconductor manufacturing
Epson	ESMOS R&D Center, Santa Clara, CA	Semiconductors
Fujitsu	Fujitsu Microelectronics, San Jose, CA	Memories, logic, ASIC, SPARC
Hitachi	Brisbane, CA	Semiconductors (1989)
Hitachi	Farmington Hills, MI	Semiconductors for autos (1989)
Hyundai Electronics	SEMR Research Institute, San Jose, CA	Semiconductor research
Hyundai Electronics	Symbios Logic, Fort Collins, CO	ASIC devices, comm. ICs, VLSI fabrication (1994)
Hyundai Electronics	Symbios Logic, Colorado Springs, CO	SCSI controllers, ROMs, software drivers (1994)
Kawasaki Steel	Silicon Valley, CA	Semiconductors (1983)
Kawasaki Steel	K-Technology Corp, Berkeley, CA	Semiconductors for communications network equipment (1997)
LG Electronics	GSEA, San Diego, CA	Semiconductor technology
LG Electronics	United Micro Tech, NJ	Semiconductors, PCs (1984)
LG Electronics	Goldstar Electronics, San Jose, CA	Semiconductors, DRAMs (1983)
Matsushita	San Jose, CA	Semiconductors and software (1991)
Matsushita	Electronics Industry Components, Cupertino, CA	Semiconductors for multimedia communications
Mitsubishi Electric	Durham, NC	Semiconductors (1984)
NEC	Systems Applications Engineering, Mountain View, CA	VLSI, chip sets for multimedia (1986)
NEC	NEC Electronics, Framingham, MA	Semiconductor design, high density memories (1987)
Oki	Oki Semiconductor, Sunnyvale, CA	Semiconductors (1989)
Philips	Philips Research, Briarcliff, NY	Integrated circuits, computers, software, HDTV, electronic materials
Philips	Philips Components, Slatersville, RI	Discrete semiconductors, plumicons
Ricoh	Ricoh Calif. Res. Center, Menlo Park, CA	ASICs, CMOS (1989)
Rohm	Rohm Research Corp., San Jose, CA	Semiconductors (1990)
Samsung	Samsung Semiconductor, Santa Clara, CA	Semiconductor (256K DRAM) design (1983)
Samsung	Advanced Graphics Technology, CA	Logic chips, processors for DVD players (1997)
Samsung	Harris Semiconductor, Melbourne, FL	Integrated circuits, microprocessors, CMOS, PROMs (1994)
Sharp	Camas, WA	Semiconductors (1988)
Siemens	Siemens Components, Cupertino, CA	Industrial integrated circuits, microprocessors, microcontrollers
Sony	Semiconductor and Systems Lab, San Jose, CA	Future CAD technologies
Toko	Signal Processing Technologies, Colorado Springs, CO	High speed integrated circuits, A / D analogies (1992)
Toshiba	Toshiba Elec. Components. Sunnyvale, CA	Semiconductors (1984)
Young-Chang Akki	Young-Chang Boston Research Institute, Boston, MA	Synthetic sound, multi-media chips (1990)

OPTOELECTRONICS

Avimo	Wheeling, IL	Night vision optics
ELOP	Optronic Devices, Hauppauge, NY	Laser systems, night vision systems
Fairey	Lasermike, Dayton, OH	Electro-optical and laser gauges
Ferranti	Chicago, IL	Electron beam, lasers
Hoya	Contininuum, Santa Clara, CA	Pulse laser beams (1991)
Hoya	San Jose, CA	Optoelectronics (1989)
Hoya	Hoya Electronics, San Jose, CA	Optoelectronics (1986)
Hoya	Hoya Optics, Fremont, CA	Optical and laser glass (1973)
Mitsubishi Intern'l	Photonic Integration Research, Columbus, OH	Basic research in fiber optics
Morgan Crucible	Laser Diode, New Brunswick, NJ	Semiconductor lasers, laser systems
NTT	Photonic Integration Research, Columbus, OH	Optoelectronics (1987)
Pharos AB	Spectro Physics Lasers, Mountain View, CA	Lasers: gas, helium ion, ring dye, ion
Siemens	Siecor, Hickory, NC	Fiber optics

Siemens	Optoelectronics Division, Cupertino, CA	Optocouplers, infrared emitters
Spectra Physics	Dayton, OH	Laser-based alignment systems for construction
Sumitomo Heavy Ind.	Lumonics, Eden Prairie, MN	Motion and delivery systems for lasers
Sumitomo Heavy Ind.	Lumonics, Livonia, MI	Lasers for materials processing
Sumitomo Heavy Ind.	Lumonics, Oxnard, CA	Laser systems for product identification
Taiwan Lite-on	Lite-on Corp., Milpitas, CA	Optoelectronics for communications
Y.O. Systems	Sekidenko, Vancouver, WA	Optical-fiber temperature and film-thickness measuring equipment
TELECOMMUNICATIONS		
Alcatel	Network Systems, Raleigh, NC	Digital loop carriers
Alcatel	Network Systems, Richardson, TX	Lightwave transmission equipment, digital cross-connects
Applied Telesis	Seattle, WA	Data communications equipment (1989)
Asahi Overseas	Phone-mate, Torrance, CA	Automatic telephone answering machines
Ascon / MIT	Ascon Timeplex, Woodcliff Lake, NJ	Data communications, multiplexing, telecommunications
Cray Electronics	Annapolis Junction, MD	Data communications, integrated circuit design
ECI Telecom	Telematics International, Fort Lauderdale, FL	Networking systems
Ericsson	Richardson, TX	Central office switching equipment
Ericsson	Private Radio Systems, Lynchburg, VA	Digital trunked radio for dispatch market
Ericsson	Ericsson GE Mobile, Research Triangle, NC	Digital cellular equipment
Ferranti	Lancaster, PA	High frequency communications
Fujitsu	Fujitsu Network Communications, Raleigh, NC	Central office switching equipment (1987)
Fujitsu	Fujitsu Network Communications, Pearl River, NY	Broadband access and fiber-optic networking platforms
Fujitsu	Fujitsu Network Communications, Richardson, TX	Telecommunications equipment
Fujitsu	Fujitsu Network Communications, Santa Clara, CA	PBX equipment
Hitachi	Hitachi Telecom, Norcross, GA	PBXs, fax machines (1987)
Hitachi	Hitachi Telecom, Richardson, TX	Telecommunications, synchronous optical network (1996)
LG Electronics	Phoenix, AZ	Advanced wireless telecommunications equip. (1990)
Matsushita	KMERL-Panasonic, Research Triangle Park, NC	Satellite communications (1991)
NEC	Richardson, TX	Communications equipment
Northern Telecom	Richardson, TX	PBX, central office switching
Northern Telecom	Nortel, San Ramon, CA	PBX systems, central office switching
Northern Telecom	BNR, Inc. Research Triangle Park, NC	Telecommunication network products (1987)
Oki	Oki Telecom, Suwanee, GA	Telecommunications (1989)
Racal	Racal Group, Sunrise, FL	Electronic data communications
Ricoh	San Jose, CA	Facsimile equipment (1979)
Siemens	Rolm Communications, Boca Raton, FL	Private telecommunications networks
Siemens	Siemens Stromberg-Carlson, Lake Mary, FL	Telecommunications equipment
Siemens	Business Communications, Santa Clara, CA	PBX, voice mail, digital telephones
Siemens	Siemens Stromberg-Carlson, Boca Ration, FL	Software packages for PBX, central office switching
Sony	Telecommunications Research Lab, Montvale,	Digital cellular technology and PCS
Sumitomo	Research Triangle Park, NC	Fiber optics (1983)
Toshiba	Toshiba Am. Info. Systems, Irvine, CA	PBX, cellular systems, fax (1985)
Uniden	Uniden San Diego R&D Center, San Diego, CA	PCS systems, analog cellular phones, digital cellular phones, pagers
TELEVISION, HDTV		
Daewoo Electronics	Technology Research Institute, NJ	Semiconductors, HDTV, digital video disks (1996)
Hitachi	Hitachi America, Princeton, NJ	HDTV (1991)
LG Electronics	North American Lab, Chicago, IL	HDTV (1991)
LG Electronics	Zenith Electronics, Glenview, IL	Color TV, HDTV, picture tubes, VCRs, computer monitor
Matsushita	Panasonic AVC American Labs, Burlington, NJ	HDTV, digital satellite systems, set-top boxes, receivers (1991)
Mitsubishi Electric	Information Technology Center, Boston, MA	HDTV (1995)
Mitsubishi Electric	Consumer Electronics Engineering Center, Costa Mesa, CA	Audiovisual equipment, HDTV (1995)
Samsung	Advanced Media Lab, Lawrence, NJ	HDTV (1988)
Sanyo	Product Development Center, Mountain View, CA	Multimedia, HDTV
Sony	Television of America Engineering, San Diego, CA	Electrical parts engineering, power and electrical design
Thomson	Comark Communications, Southwick, MA	HDTV transmission systems, wave guide systems (1990)
Thomson	Consumer Electronics, Indianapolis, IN	Digital television and electronics research
Toshiba	Advanced TV Tech. Center, Wayne, NJ	HDTV receivers (1990)
OTHER ELECTRONICS		
Astec	Beckman Industries, Fullerton, CA	Electroceramics, thin film materials
BTR	Aerospace Avionics, Bohemia, NY	Aerospace avionics
Canadian Marconi	Cincinnati Electronics, Cincinnati, OH	Military electronic systems
Contraves	Pittsburgh, PA	Range tracking, inertial guidance systems
GE Ltd.	A.B. Dick, Niles, IL	Copiers, lithographic offset, micrographics
Heraeus	DSET Laboratories, Phoenix, AZ	Solar devices
Hoya	Probe Technology, Santa Clara, CA	Probe cards for semiconductor manufacturing
Huls	MEMC Electronic Materials, Saint Peters, MO	Electronics materials
Iwasaki Electric	Energy Sciences, Wilmington, MA	Electron processings, electron beams

Japan Energy	Gould Electronic, Eastlake, OH	Electronic components, electrolytic foil for printed circuit boards
Kobe Steel	Applied Electronics Center, Stanford Research Park, Palo Alto, CA	Thin-film data recording media and substrate materials for hard disk drives (1990)
Kobe Steel	Electronic Materials Center, Research Triangle Park, NC	GAAS and diamond thin film materials for semiconductors (1989)
Kyocera	AVX Corp., Myrtle Beach, SC	Ceramics, thin films, capacitors, superconductivity
Lucas	Lucas Aerospace Aircraft Systems, Brea, CA	Microwave components
Matsushita	Avionics Development Corp., Irvine, CA	In-flight audio, video systems for passengers
Mitsubishi Chemical	Verbatim, Charlotte, NC	Floppy disks and magnetic tape for memory storage
Mitsubishi Materials	Mitsubishi Silicon, Salem, OR	Silicon materials technology and manufacturing science
Mitsubishi Materials	Mitsubishi Silicon, Menlo Park, CA	Semiconductor wafers
Morgan Crucible	Westgo-Duramic, Fairfield, NJ	Electrical and electronic components, safety tools
Morgan Crucible	Matroc Electro Ceramic Division, Bedford, OH	Piezoelectric materials, bandpass filters, sonar transducers
Murata	State College, PA	Electronics ferroelectrics, dielectic measurement
Nitsuko	California	Business telephone headsets
Olympus Optical	Torrance, CA	Optical and electronics products
OSRAM	OSRAM-Sylvania, Danvers, MA	Lighting R&D
Oyo	Geophysical Survey Systems, North Salem, NH	Fast pulse radar for geological strata profiling
Oyo	Klein Associates, Salem, NH	High resolution search and survey scan sonar
Pesa	Manchester, NH	Broadcasting equipment and antennas
Racal	Racal Instruments, Irvine, CA	Time and frequency analysis
Racal	Racal Communications, Rockville, MD	Military radio communications
Schlumberger	EMR Photoelectric, Princeton, NJ	Photomultiplier tubes, gamma ray detectors
Sharp	Hycom Inc., Irvine, CA	Flat panel displays (1989)
Siemens	Solar Industries, Camarillo, CA	Photovoltaic devices and systems
Siemens	Cardion, Woodbury, NY	Communication and detection systems, scan converters for data
Simrad	San Marcos, CA	Harsh environment imaging systems: TV cameras, thermal imaging
Smiths Industries	Grand Rapids, MI	Instrument systems for aircraft navigation, missile guidance
SOC Corp.	San-O-Industrial, Holbrook, NY	Fuses for telecommunications industry
Sony	AP6 Sony Professional Products Company Engineering, Boca Raton, FL	Professional audio console and tape equipment
Sony	Magnetic Products of America E&D, Dothan, AL	Strategic materials, surface treatment agents for ME tape
Sony	Recording Media Laboratory, Boulder, CO	Recording media, technology infusion to Japan (1990)
Sony	Sony Transcom, Irvine, CA	In-flight audio and video systems
Sony	Materials Research Corp., Orangeburg, NY	Semiconductor materials and equipment
Sony	Sony Electronics, Park Ridge, NJ	Basic and applied research in electronic components
Sony	Display Systems Engineering, San Diego, CA	Next generation display systems, controllers
Staveley	Stavely NDT Technologies, Kennewick, WA	Ultrasonics and electronics
TAE IL Media	National Micronetics, Kingston, NY	Solid state ferrite tech., recording heads
TDK	Components Engineering, Torrance, CA	Applied consumer / industrial electronics research
Thomson	Training and Simulation, Tulsa, OK	Training and simulation devices for aviation and marine vehicles
Tokyo Electron	Boston, MA	Semiconductor manufacturing equipment (1997)

INSTRUMENTATION AND CONTROLS

ABB	Industrial Systems, Rochester, NY	Pneumatic & electronic instruments, control systems
Anritsu	Wiltron, Morgan Hill, CA	Automated test equipment for telecommunications, radar, navigation
AVO International	Blue Bell, PA	Electrical measuring instruments
Balcke-Durr	Zurn Balcke-Durr, Tampa, FL	Environmental systems and controls, energy systems
Bayer	Tarrytown, NY	Automated analyzers for medical laboratories, diagnosis equipment
BTR	Hobbs Corp., Springfield, IL	Hour meters, pressure and vacuum switches
BTR	Stewart Warner, Pittsburgh, PA	Measurement and flow controls, heat transfer equipment
CAE	CAE Electronics, Binghamton, NY	Medical research, marine control systems
Cegelec	Linden, NJ	Chemical process analyzers
Dobson Park	Revere Aerospace, Wallingford, CT	Sensors: pressure, temperature, speed, proximity
Dobson Park	Revere Transducers, Artesia, CA	Resistance strain gauges, force pressure calibration
Dowty Group	RFL Communications, Boonton, NJ	Telecommunications instrumentation
Fanuc	Berkely, CA	Power sensors for intelligent robotic systems (1994)
Firan	Denro, Gaithersburg, MD	Communications systems integration, electronic instruments
Gambro	Cobe Laboratories, Lakewood, CO	Medical equipment
GEC PLC	Lear Astronics, Santa Monica, CA	Automatic flight controls, avionics
Gradco	Irvine, CA	Sorting equipment for printers and copiers, paper handling
Group Schneider	Columbus, OH	Chemical process automation, computer control systems
Group Schneider	EPE Technologies / Square D, Costa Mesa, CA	Computer power protection, electrical power distribution
Hartman & Braun	Applied Automation, Bartlesville, OK	Process control instruments
IMI	Norgren, Littleton, CO	Regulating, controlling compressed air
J. Bibby	Melles Griot, Irvine, CA	Optical sciences, optical thin films
Kratos	Kratos Analytical, Ramsey, NJ	Surface analysis, mass spectrometry
Landis & Gyr	Buffalo Grove, IL	Building control systems, software
Landis & Gyr	Landis & Gyr Metering, Lafayette, IN	Instruments for measuring electricity
Morgan Crucible	TGM Detectors, Parsippany, NJ	Gas filled radiation detectors, Geiger-Mueler tubes
Nestle	Alcon Lab, Irvine, CA	Surgical instruments
Nikon	Nikon Precision, Belmont, CA	Cameras and steppers, opthalmic prods, measuring, surveying (1992)

Novartis	Ciba-Corning, Oberlin, OH	Spectral scanning, chromotography
Outokumpu	Princeton Gamma-Tech, Princeton, NJ	Gamma and x-ray spectroscopy, solid state radiation detectors
Perstorp Analytical	Nirsystems, Silver Spring, MD	Application of near infrared spectrophotometry for quality control
Philips	Airpax Protector Group, Frederick, MD	Interruptors, disc thermostats
Plersey	Sippican, Marion, MA	Oceanographic instruments
Rauma-Repola	Neles-Jamesbury, Worcester, MA	Fluid controls, ball valves, butterfly valves
Siebe	Robertshaw Controls, Long Beach, CA	Gas, electric, pneumatic and hydraulic controls
Siebe	Foxboro Co., Foxboro, MA	Process control, factory automation
Siebe	Barber Colman, Loves Park, IL	Temperature controls, power controls
Siebe	Ranco / Paragon Electric, Two Rivers, WI	Timing devices, time controls, energy management
Siebe	Environmental Controls Systems, Richmond, VA	Electronic products
Siemens	Potter & Brumfield, Princeton, IN	Solid state switching devices, dry reed relays, circuit breakers
Spectra Physics	Agema Infrared Systems, Seacaucus, NJ	Temperature measurement systems, control systems
TI Group	Dowty Aerospace, Yakima, WA	Hydraulic controls for aerospace
Whatman	Whatman Reeve Angel, Clifton, NJ	Thin lay chromatography products, ion exchange cellulose
MEDICAL DEVICES		
Bayer	Miles, Orangeburg, NY	Medical diagnostic imaging and scanning
Fisons	Kevex Instruments, Valencia, CA	X-ray spectrometry and materials analysis
Philips	Philips Ultrasound, Irvine, CA	Diagnostic ultrasound
Philips	Electronic Instruments / EDAX, Mahwah, NJ	X-ray instrumentation, spectrometry
Pilkington	Pilkington Barnes Hind, Sunnyvale, CA	Opthamology and optometry, contact lenses
Siemens	Medical Systems, Iselin, NJ	Medical equipment development
Siemens	Medical Systems, Hoffman Estates, IL	Nuclear medical imaging, x-ray imaging
Sulzer	Intermedics, Angleton, TX	Implanting medical products, pacemakers, orthopedic implants
Terumo	Elkton, MD	Blood collection devices, cardiovascular, IVs
Toshiba	Toshiba America MRI, South San Francisco, CA	Nuclear magnetic resonance imaging
DRUGS AND BIOTECHNOLOGY		
Ajinomoto	Ajinomoto USA, Raleigh, NC	Biotechnology
Akzo Nobel	Intervet, Millsboro, DE	Animal vaccines
Akzo Nobel	Organon Teknik, Durham, NC	Biotechnology, molecular antibodies
Akzo Nobel	Organon Inc., West Orange, NJ	Drugs
Akzo Nobel	Organon Teknika Biotechnology Research	Biotechnology
Amersham Int'l	Arlington Heights, IL	Biotechnology
Ares-Serono	Serono Laboratories, Norwell, MA	Biotechnology: mammalian cell culture. Drugs
Astra	Boston, MA	Drugs for ulcers (1997)
BASF	Agricultural Products, Research Triangle Park, NC	Biotechnology—plants, pesticides (1986)
BASF	BACHEM Bioscience, Philadelphia, PA	Biotechnology
BASF	Knoll Pharmaceuticals, Mount Olive, NJ	Drugs
BASF	BASF Bioresearch Corp., Cambridge, MA	Biotechnology (1989)
Bayer	Miles, Spokane, WA	Allergy productions, immunology
Bayer	Miles, Kankakee, IL	Isolation of blood proteins, biochemical reagents
Bayer	Pharmaceutical Division, West Haven, CT	Biotechnology, clinical drug trials (1992)
Bayer	Miles Diagnostic, Mishawaka, IN	Biotechnology
Bayer	Miles / Haarman & Reimer, Elkhart, IN	Biotechnology, enzymes, drugs
Bayer	Berkeley, CA	Biotechnology
Bayer	Animal Health Division, Shawnee Mission, KS	Animal health medicines
Biotest	Biotest Diagnostics, Danville, NJ	Biotechnology
Boehringer Ingelheim	Animal Health, Elwood, KS	Biotechnology, parasticides, drugs, feed additives
Boehringer Ingelheim	Animal Health, Saint Joeseph, MO	Biotechnology, veterinary virus vaccines
Boehringer Ingelhem	Pharmaceuticals, Ridgefield, CT	Immunology
Chugai Pharm.	Gen-Probe, San Diego, CA	Biotechnology, clinical diagnostics, therapeutics
Corange	Boehringer Mannheim Corp., Concord, CA	Biotechnology: diagnostic reagent kits
CSL Limited	JRH Biosciences, Lenexa, KS	Bioscience research for pharmaceutical industry
Cultor / E. Kodak	Genecor Int., South San Francisco, CA	Genetic and protein engineering
C. Itoh	Integrated Separation System, Natick, MA	Biotechnology supplies
Dake	Dako, Carpinteria, CA	Biotechnology, diagnostic kits
Diageo	Pillsbury Agricultural Research, Le Seur, MN	Plant biotechnology, genetics
Eisai	Eisai Pharmatechnology, Research Triangle Park, NC	Drugs (1997)
Eisai	Teaneck, NJ	Drugs (1988)
Eisai	Andover, MA	Clinical drug testing (1989)
E. Merck	EM Science, Gibbstown, NJ	Blood testing kits
Fermenta	Fort Collins, CO	Drugs for animal health
FIAT	Incstar Corp., Stillwater, MN	Biotechnology: diagnostic immunoassays—RIA and EIA
Fisons	Rochester, NY	Medical science, pharmacology, clinical research
Fujisawa Pharm.	PMP Fermentation Products., Milwaukee, WI	Biotechnology
Fujisawa Pharm.	Melrose Park, IL	Drugs, diagnostic aids, biotechnology
F.H. Faulding	Purepac Pharmaceuticals, Elizabeth, NJ	Generic drugs
GEA PT	Atlantic Pharmaceutical Services, Owings Mills, MD	Drugs

Gist-Brocades	Inter'l Bio-Synthetics, Charlotte, NC	Biotechnology
Glaxo Wellcome	Affymax Research Institute, Palo Alto, CA	Research in new drug discovery, testing, and analyzing
Glaxo Wellcome	Sterling Drug Research, Rensselaer, NY	Medicinals and drugs (1994 acquisition)
Glaxo Wellcome	Sir Paul Girolami Research Center, Research Triangle Park, NC	Biotechnology (1991)
Glaxo Wellcome	Research Triangle Park, NC	Drugs, biotechnology
Green Cross	Alpha Therapeutic, Los Angeles, CA	Biotechnology
Hitachi Chemical	University of California, Irvine, CA	Biotechnology (1990)
Hoechst	Animal Health Products, Somerville, NJ	Animal health products & drugs
Hoechst	Hoechst-Roussel Pharm., Somerville, NJ	Endrocrinology, antibiotics, cardiovascular
Hoechst	Hoechst Marion Roussel, Kansas City, MO	Toxicology, pharmacology, clinical testing
Hoechst	Behring Diagnostics, San Jose, CA	Biotechnology, clinical diagnostic test reagents
Hoechst	Hoechst Marion Roussel, Bridgewater, NJ	Biotechnology
Hoechst	Hoechst Marion Roussel, Cambridge, MA	Biotechnology core research
Hoffman-LaRoche	Roche Biomedical Labs, Burlington, NC	Biotechnology
Hoffman-LaRoche	Roche BioScience, Palo Alto, CA	Drugs
Hoffman-LaRoche	Roche Institute for Molecular Biology, Nutley, NJ	Biotechnology (1991)
Hoffman-LaRoche	Genentech, South San Francisco, CA	Biotechnology, drugs (1990)
Kirin Brewery	Twyford International, Santa Paula, CA	Cloning plants and flowers
Kirin Brewery	La Jolla Institute of Allergies and Immunology, San Diego, CA	Biotechnology (1989)
Kumiai	Kumiai Chemical, Mississippi	Pharmaceutical formulation research (1996)
Kuraya	Institute for Biological R&D, Irvine, CA	Biotechnology (1989)
Kyowa Hakko Kogyo	BioKyowa, Cape Giradeau, MO	Biotechnology
Life Sciences	Savant Instruments, Farmingdale, NY	Biotechnology, biomedical R&D
Lipha	Lipha Tech, Milwaukee, WI	Biotechnology
Lucky	Lucky Biotech, Emeryville, CA	Genetic engineering, biotechnology
Medeva	Armstrong Pharmaceuticals, West Roxbury, MA	Drugs
Miltenyi Biotec	Auburn, CA	Biotechnology
Mitsubishi Chemical	Seradyn / Photovolt, Indianapolis, IN	Diagnostics, analytical instruments
Montedison	Adria Laboratories, Columbus, OH	Biotechnology
Nestle	Alcon Laboratories, Fort Worth, TX	Opthamalogy and pharmaceuticals
Nitto Boseki	Midland Bioproducts, Boone, IA	Biotechnology
Nitto Boseki	International Immunology, Marietta, GA	Biotechnology
Novartis	Ciba-Corning, Diagnostic, Medfield, MA	Biotechnology
Novartis	Rogers NK Seed, Boise, ID	Genetics and plant breeding
Novartis	Genetic Therapy, Rockville, MD	Biotechnology
Novartis	Agricultural Biotechnology, Research Triangle Park, NC	Biotechnology (1984)
Novartis	Sandoz Pharmaceutical Laboratories, Lincoln, NE	Applied research on new drugs
Novartis	Sandoz Agro Research, Palo Alto, CA	Biotechnology (1972)
Novartis	Ciba Seeds, Greensboro, NC	Biotechnology, plant breeding, genetics
Novartis	Sandoz Pharmaceuticals, East Hanover, NJ	Biotechnology, basic research on new drugs
Novartis	Ciba Pharmaceuticals, Summit, NJ	Psychotherapeutic drugs, cardiovascular drugs
Novo-Nordisk	Entotech, Davis, CA	Biotechnology (1993)
Novo-Nordisk	ZymoGenetics, Seattle, WA	Biotechnology: diabetes, thrombosis, bleeding
Olympus Optical	Stanbio Laboratory, San Antonio, TX	Clinical test procedures
Otsuka Pharm.	Maryland Research Institute, Rockville, MD	Biotechnology, drugs for bronchitis, heart failure, pneumonia (1986)
Otsuka Pharm.	Biomembrane Institute, Seattle, WA	Biotechnology (1987)
Pharmacia	Agricultural R&D Laboratory, Kalamazoo, MI	Animal diseases and parasites
Pharmacia	Pharmacia Biotech, Milwaukee, WI	Biotechnology
Pharmacia	Upjohn Laboratories, Kalamazoo, MI	Immunology, virology, biotechnology, drugs
Procordia	Pharmacia Biotech, Piscataway, NJ	Biotechnology
Procordia	Kabi, Clayton, NC	Biotechnology
Proton International	JRH Biosciences, Lenexa, KS	Biotechnology
Rhone Merieux	Athens, GA	Biotechnology
Rhone Merieux	Select Laboratories, Gainesville, GA	Biotechnology
Rhone-Poulenc	Rhone-Poulenc Rorer, Collegeville, PA	Biotechnology, drugs, synthesis, prescription dosage
Rhone-Poulenc	CelPril Industries, Manteca, CA	Biotechnology
Sanofi	Genetric Systems, Redmond, WA	Biotechnology: blood diagnostic tests
Sanofi	Sanofi Diagnostics Pasteur, Chaska, MN	Biotechnology: vitro diagnostic systems, retrovirology
Schering	Berlex Biosciences, Richmond, CA	Biotechnology drugs for cancer, viruses
Schwarz Pharma	Thiensville, WI	Biochemistry, microbiology, pharmaceuticals
Shionogi	Boston area, MA	Drug discovery center (1997)
Shiseido	Cutaneous Biology Research Center	Biotechnology (1989)
Shiseido	Shiseido America Technocenter, Darien, CT	Biotechnology (1989)
SmithKline Beecham	Pharmaceuticals R&D, King of Prussia, PA	Neurosciences, inflammation and tissue repair, vaccines
SmithKline Beecham	Consumer Health Care, Parsippany, NJ	Proprietary medicines, feminine health care, gastrointestinal
SmithKline Beecham	Clinical Labs, Van Nuys, CA	New diagnostic tests, clinical laboratory services
Solvay	Solvay Animal Health, St. Paul, MN	Animal biotechnology, vaccines, chemotherapy, diagnostics

Solvay	Marietta, GA	Pharmaceutical science, clinical testing, chemical analytical research
Tanabe Seiyaku	Tanabe Research Labs USA, San Diego, CA	Biotechnology, immune systems, allergies (1994)
Teva Pharmaceutical	Lemmon Co., Sellersville, PA	Drugs
Twyford Internat'l	Twyfod Plant Labs, Santa Paula, CA	Biotechnology
Yamanouchi	Shaklee Corp., Stanford Research Park, CA	Methods to deliver pharmaceutical and nutritional compounds
Yukong	Bio-Pharmaceutical R&D Center, NJ	Drug materials, pharmacology, clinical tests (1997)
Zeneca	Biomedical Research, Wilmington, DE	Basic research in medicinal chemistry, pharmacology, toxology
Zeneca	Zeneca Pharmaceuticals, Wilmington, DE	Biomedical research, drugs, biotechnology

CHEMICALS, RUBBER, AND MATERIALS

Akzo Nobel	Central Research, Dobbs Ferry, NY	Chemicals, plastics, lubricants, plastics, pollution
Akzo Nobel	Chicago, IL	Fatty chemicals, organics peroxides, catalysts
Allusuisse-Lonza	Lawson, Mardon & Wheatley, Millville, NJ	Processing of plastics, organics, inorganics, coating
Allusuisse-Lonza	Lonza, Annandale, NJ	Hydantoin, amide, ester carbohydrate
BASF	Coatings and Colorants, Mount Olive, NJ	Polymer science, surface science
BASF	Research & Development, Freeport, TX	Industrial chemicals, plastics and fiber raw materials
BASF	R&D Library, Wynadotte, MI	Biochemistry, chemistry, biological sciences, agricultural chemicals
BASF	Container Coatings, Milford, OH	Polymer science, chemical coatings
Bayer	Agricultural Division, Kansas City, MO	Agricultural chemicals
Bayer	H.C. Stark, Newton, MA	Tantalum and niobium
Bayer	Pittsburgh, PA	Polyurethane, thermoplastic, adhesives, industrial chemicals
Bayer	Fibers, Organics, Rubber, Akron, OH	Process chemistry, process engineering
BBA	RM Engineered Prods., North Charleston, SC	Exotic coatings, elastomeric composites
Borregaard	Ligno Tech, Rothschild, WI	Chemicals from lignin and raw cellulose
BridgeStone	Bridgestone/Firestone Research, Akron, OH	Tires, rubber products
BridgeStone	Akron, Technical Division, Akron, OH	Tires, synthetic and natural rubbers, textiles, plastics
British Petroleum	BP Chemicals, Cleveland, OH	Biotechnology, environmental science, catalysts, chemicals
British Petroleum	BP Chemicals, Gardena, CA	Graphite fibers, epoxy, composites
BTR	Power Conversion, Elmwood Park, NJ	Lithium cells and batteries
Can Test Ltd.	Am Test, Redmond, WA	Quality control and chemical analysis
Chubb Security	National Foam, Exton, PA	Chemistry, fire-fighting chemicals, hardware systems
Continental	General Tire, Technology Dept., Charlotte, NC	Tire and rubber research
Courtaulds	Courtaulds Aerospace, Burbank, CA	Caulking, sealing for aerospace vehicles
Dainippon Ink & Chem	Polychrome Corp., Fort Lee, NJ	Resins, specialty chemicals, coatings, printing inks
Dainippon Ink & Chem.	Reichold Chemicals, Research Triangle Park, NC	Synthetic latex, adhesives, emulsive polymers,
Denesco	Brown Engineering, Columbia, MD	Suspended particle process operations
Dojindo Laboratories	Dojindo Molecular Technologies, Rockville, MD	Biomolecular research, organic analytical and biochemical reagants
DSM	Copolymer, Baton Rouge, LA	Solution and emulsion polymerization of polymers
DSM	Engineering Plastic Products, Reading, PA	Polyamides, polyacetals, polyethelene
Dyno	Dyno Nobel, Salt Lake City, UT	Industrial explosives
Elf Aquitane	Technical Center, King of Prussia, PA	Chemical products
Elf Aquitane	Fine Chemical Group, Buffalo, NY	Organic peroxides, foaming agents, fine chemicals
English China Clays	Calgon, Pittsburgh, PA	Water treatment chemicals
E. Merck	Rona Inc., Hawthorne, NY	Pearlescent pigments
Fisons	J&W Scientific, Folsom, CA	Organic and analytical chemistry
Forbo	Hazelton, PA	Surface coatings
Hanson Trust	SCM-Glidco Organics, Jacksonville, FL	Terpene chemistry, fragrances, flavors
Henkel	Parker & Amchem, Madison Heights, MI	Chemicals to enhance corrision resistance, paint adhesives
Henkel	Ambler, PA	Metal treating chemicals
Henkel	Loctite, Rocky Hill, CT	Adhesives and sealants
Henkel	Chemical Group, Cincinnati, OH	Fatty acids, ozonization, polymerization
Hoechst	Technical Polymers, Summit, NJ	Dyes, pigments, specialty chemicals
Hoechst	Dreyfus Research Park, Charlotte, NC	Chemical engineering, textile fibers, technical fibers, polyester yarn
Hoechst	Mitchell Technical Center, Summit, NJ	Advanced materials process and products
Hoechst	Celanese Technical Center, Corpus Christie, TX	New chemical processes
Hoechst	Corporate Research, Coventry, RI	Dyes, organic pigments, specialty and agricultural chemicals
Huls	Somerset, NJ	Colorants, biochemicals, coatings additives, engineering resins
Huls	Bristol, PA	Industrial organic chemicals
Imperial Chemical	ICI Film Division, Hopewell, VA	Polyester films and polymers
Imperial Chemical	ICI Paints Reserch Center, Cleveland, OH	Polymers & coatings for can & architectural prods.
Imperial Chemical	ICI Fiberite, Tempe, AZ	Advanced composite materials
Ishihara Sangyo	ISK Biosciences, Mentor, OH	Agricultural biotechnology and chemicals
Japan Metals & Chem.	JMC USA, Research Triangle Park, NC	Materials (1992)
Kaisha	Ricerca, Painesville, OH	Plant biotechnology
Kawasaki Steel	LNP Engineering Plastics, Exton, PA	Glass and carbon fiber reinforced plastics
Kobe Steel	Glastic, Cleveland, OH	Fiberglass reinforced materials
Kyocera	San Diego, CA	Ceramics (1990)
Kyocera	Advanced Ceramic Technology Center, Vancouver, WA	Silicone nitride ceramics for auto engines, gas turbine parts (1992)
LG Chemical	University of Maryland, College Park, MD	Chemicals (1996)
Lintec	Madico Inc., Woburn, MA	Coating lamination for plastic film, metalizing plastic film (1992)
Lutton	Alpha Chemical, Pineville, NC	Polymers, plastics

Michelin	Michelin Americas R&D, Greenville, SC	Synthetic rubber, tires
Mitsubishi Corp.	Aristech Chemical, Pittsburgh, PA	Chemical and polymer products
Mitsui Toatsu	Anderson Development Co., Adrian, MI	Urethane elastomers, catalysts, organic intermediates
Molson	Diversey, Sharonville, OH	Laundry and housekeeping products, vehicle cleaners
Molson	Diversey Water Technology, Chagrin Falls, OH	Corrosion control for boilers and cooling systems
Molson	Diversey, Technical Services Laboratory, Lavonna, MI	Fuel additives, lubricating oils, nutritional analyses of foods
Montecatini	SP Systems, Los Angeles, CA	Composites
Montedison	Montell, Wilmington, DE	Polymer science, plastics, fibers, catalysis
Naamaloze	Copolymer, Baton Rouge, LA	Solution and emulsion polymerization
Nippon Paint	Michigan	Paints (1994)
Nippon Sanso	Matheson Gas Products, East Rutherford, NJ	Gas analysis, purification and environmental abatement
Nippon Sanso	Isotec, Miamisburg, OH	Separation of stable isotopes and synthesis of carbon-13, nitrogen-15
Nissan Chemical	Purdue University, West Lafayette, IN	Agricultural chemical testing
NOF Corp.	U.S. Paint, St. Louis, MO	Industrial finishes, aerospace / marine coatings
Nova	Nova Chemicals, Leominster, MA	New polymers, kinetics, microstructure and monomer synthesis
Novartis	Crop Protection, Greensboro, NC	Biotechnology, herbicides, insecticides
Novartis	Polymers Division, Brewster, NY	Resins, plastics, epoxy
Novartis	Additives Development Laboratory, McIntosh, AL	Complex organic synthesis, process control systems
Outokumpu	OMG, Cleveland, OH	Paints, varnish, printing inks, plastics
Pechiney	Carbone Lorraine N.A., Parsippany, NY	Carbons, graphites, resins, teflon, corrosion problem
Perelli	Perelli Armstrong Tire, New Haven, CT	Materials, components for tires
Pilkington	Pilkington Aerospace, Garden Grove, CA	Thermoplastics, optical thin films
Rhone-Poulenc	Princeton, NJ	Herbicides, fungicides, animal health products
Rhone-Poulenc	North American Chemicals, Cranbury, NJ	Monomers, polymers, surfactants, hydrocolloids, food
Rhone-Poulenc	Research Triangle Park, NC	Biotechnology—agricultural chemicals (1986)
Rutgerswerke	State College, PA	Process development for chemical industries
RWE-DEA	Condea Vista R&D, Austin, TX	Surfactants, solvents, PVC
Sekisui Chemical	International Foam Technology Center, Boston, MA	New materials for foam products, polyethylene foam sheets (1998)
SGL Carbon	Sigri Great Lakes Carbon, Niagara Falls, NY	Carbon and graphite electric furnace electrodes
SGL Carbon	Charlotte, NC	Research on carbon
Sika Finanz	Lydhurst, NJ	Epoxy resins, specialty cement, urethane polymer
SKF	CR Industries, Elgin, IL	Oil seals and rubber technology
SKF	Process Development Lab, Elgin, IL	Rubber molding, oil seals
St. Gobain	Norton, Troy, NY	Coated abrasives
St. Gobain	Norton Co., Worcester, MA	Abrasives, superabrasives, advanced ceramics
St. Gobain	Cohart Refractories, Louisville, KY	Advanced ceramics, refractories for ceramics
St. Gobain	Bicron Corp., Newbury, OH	Material and systems for measuring ionizing radiation
St. Gobain	Carborundum Corp., Niagara Falls, NY	Ceramics: structural and electronic; fibers, coating
St. Gobain	Norton, Wayne, NJ	Thermoplastic products
Sumitomo Chemical	Valent USA, Walnut Creek, CA	Agricultural chemicals (1994)
Sumitomo Rubber	Dunlop Tire Co., West Amherst, NY	Tire products
Three Bond	West Chester, OH	Medical appliances, sealants for auto interior industry
Thyssen	Troy, MI	Structures, metal fabrication, plastic fabrication
Tokuyama Soda	National Beryllia, Haskell, NJ	Ceramics and ceramic packages
Tomkins	Gates Corp., Denver, CO	Electrochemistry, materials research, belt development
Toray	Composites Horizons, Covina, CA	Advanced composite materials
Total TCP	Cook Composites, Port Washington, WI	Synthetic resins for reinforced plastics
Tridel	Edoco, Long Beach, CA	Construction chemicals
Unilever	Diversey Lever, Sharonville, OH	Laundry & housekeeping products, vehicle cleaners, water treatment
USM Texon	Wilmington, MA	Latex, resin saturated fiber materials for footwear
Wacker Chemie	Wacker Silicones, Adrian, MI	Industrial silicone products, silicone applications
Wassall	DAP Inc., Dayton, OH	Caulks, sealants, putty, adhesives, wood fillers, finishes, paints
Zeneca	Zeneca Agric. Products, Whitaker, NC	Agricultural chemicals
Zeneca	Specialty Chemicals, Wilmington, DE	Specialty chemicals, polyols, resins, activated carbons, surfactants
Zeneca	Richmond Research Center, Richmond, CA	Agricultural chemicals, biotechnology, pollution abatement
MACHINERY		
ABB	Research Triangle Park, NC	Technology transfer
ABB	Industrial Systems, Columbus, OH	Measurement systems, control systems, infrared applications
AGIE Ltd.	Davidson, NC	Electrical discharge machining equipment
Andritz	Muncy, PA	Paper and pulp making machinery
Atalas Copco	Rotoflow Corp., Gardena, CA	Large power recovery turbines for geothermal systems
B Braun Biotech	Allentown, PA	Biotechnology, fermentation / cell culture bioreactors, shakers
Bayer	Agfa, Wilmington, MA	Computerized typographic, offset printing equipment
BTR	Stewart Warner, Indianapolis, IN	Pneumatic and hydraulic equipment
BTR	Stearns Division, Milwaukee, WI	Research on brakes, clutches
Carnaudmetalbox	Anchor Hocking Packing, Lancaster, OH	Packing, sealing machinery
Degussa	Leybold Vacuum Products, Export, PA	Vacuum pumping systems
Electrolux	White Consolidated Industries, LaGrange, IN	Forced air furnaces

Electrolux	Richards-Wilcox, Aurora, IL	Industrial electric doors, overhead conveyors and controls, carousels
EMCO	Emco Wheaton, Cary, NC	Valves, fittings, automatic nozzles, fueling systems
Geotech	Ford New Holland, New Holland, PA	Agricultural and light industrial machines
Incentive	Hagglunds Denison, Marysville, OH	Oil hydraulic components
Inter-City Products	La Vergne, TN	Residential and commercial heating and air conditioning
Juki	Union Special Corp., Huntley, IL	Industrial sewing machines and automated systems
LaFarge Coppee	Systech Environmental Corp., Zenia, OH	Liquid and solid waste resource recovery
Lucas	Lucas Aerospace Power Equip., Aurora, OH	Alternating current generating systems
Lucas	Lucas Aerospace Power Transmission, Utica, NY	Flexible power transmission shafts
Moore	Moore Research Center, Grand Island, NY	Printing equipment, business forms handling equipment
Nippon Seiko	NSK Technical Center, Ann Arbor, MI	Develop bearings for vehicles
Schlumberger	Doll Research Center, Ridgefield, CT	Oil field well products, sonics, geometric modeling
Schlumberger	Dowell, Tulsa, OK	Enhance oil well stimulation
Tamroc	Eimco Coal Machinery, Bluefield, VA	Underground mining machinery
Ube Industries	Technical Center, Detroit, MI	Plastics molding equipment (1992)
Ulvac	Fremont, CA	Semiconductor equipment applications lab (1990)
Yamazaki Mazak	Florence, KY	Special purpose machine tools (1996)
METALS		
Alcan	Cambridge Tech. Center, Cambridge, MA	Metals, alloys, ceramics
BICC PLC	BICC Cables Corp., West Nyack, NY	Electrical materials for wire tubing, raw materials
Cookson Group	Vesuvius Research, Pittsburgh, PA	Redractories for ferrous molten metals
Dieder-Werke	State College, PA	Refractories for steel, iron, glass
Framatone	Norwalk, CT	Mechanical properties of metals, corrosion, electrical materials
Hartmetall	Metal Carbides, Youngstown, OH	Refractory metals of tungsten, titanium, cobalt, etc.
Hertel	Kenilworth, NJ	Cemented tungsten and titanium carbide
Hosakawa	Micron Powder Systems, Summit, NJ	Particle size reduction, separation
IVACO	Laclede Steel, St. Louis, MO	High & low carbon and low-alloy steels, steel products
Kanthal	Bethel, CT	High temperature tubing, thermo-coupling alloys
Kawasaki Steel	Armco (50 percent), Middletown, OH	Carbon and alloy steels, stainless steel
Kobe Steel	Midrex Direct Reduction, Charlotte, NC	Steel-making using iron ore pellets
MMS	Magnox, Pulaski, VA	Magnetic iron oxides
NGK Insulators	NGK Berylco, Reading, PA	High purity beryllium metal and alloys
Nisshin Steel	Wheeling-Pittsburgh Steel, Wheeling, WV	Basic and applied metallurgy
NKK	National Steel, Mishawaka, IN	Coated and uncoated steel products
NKK	National Steel, Technical Dept., Trenton, MI	Process technology, new steel compositions
Pacific Dunlop	GNB, St. Paul, MN	Secondary production of lead, lead oxide
Pearson	Reed Tool, Houston, TX	Metals and elastomers used in drilling operations
Pechiney	Howmet Corp., Greenwich, CT	Metallurgy
Pechiney	Technical Center, Whitehall, MI	Superalloy melting and casting
Pirelli Cables & Systems	Research and Development Center, Lexington, SC	Energy and communications cables, superconductivity
Rio Tinto-Zinc	U.S. Borax, Tech. Dept., Santa Clara, CA	Metallurgy, industrial minerals
RTZ PLC	Kennecott Corp., Salt Lake City, UT	Extractive metallurgy of titanium minerals
Seco Tools	Cabroloy, Detroit, MI	Sintering, bonding, cardides, tools
Uqine Acg	J&L Specialty Products, Pittsburgh, PA	Stainless steel products
FOOD PRODUCTS		
Diageo	Pillsbury Technology Center, Minneapolis, MN	Consumer and institutional food products
Diageo	Heublein, Hartford, CT	Wine and spirits chemistry, microbiology
Ferruzzi	Wayne, IN	Soy protein, food research
Hanson Trust	Hanson Industries, Woodbridge, NJ	Food technology, meat packing
Kerry Group	Kerry Ingredients, Beloit, WI	Flavoring and seasoning, protein
Kyowa Hakko Kogyo	NutriQuest, Chesterfield, MO	Animal and human nutrition (1990)
Nestle	Nestle Food, Glendale, CA	Dairy, meat, dietary foods, food processing
Nestle	Westreco, New Milford, CT	Coffee, tea, confections, dairy products
Nestle	Stouffer, Solon, OH	Frozen prepared main dishes, side dishes, Lean Cuisine
Novartis	Sandoz Nutrition, Saint Louis Park, MN	New food products, processes, snacks
Novartis	Gerber Products, Fremont, MI	Food science, nutrition, biochemistry
Seagram	White Plains, NY	Alcoholic beverages, fermentation
Unilever	Van den Bergh Foods, Lisle, IL	Edible fats, seasonings, dairy and baking products
Unilever	Van den Bergh R&D, Baltimore, MD	Edible fats and oils, dairy and baking products
Unilever	Lipton Co., Englewood Cliffs, NJ	Tea, soup and beverage mixes, salad dressing
United Biscuits	Keebler Co., Elmhurst, IL	Bakery and confectionery products
MISCELLANEOUS		
ABB	Combustion Engineering, Windsor, CT	Combustion technology, nuclear reactor design
Amer Group	Wilson Sporting Goods, Chicago, IL	Golf, tennis, football, baseball, athletic goods
Bayer	Haarman & Reimer, Springfield, NJ	Colorants, fragrances, flavors, food preservatives
Benckiser	Coty, Parsippany, NJ	Fragrances, cosmetics
Bombadier	Learjet, Wichita, KS	Business jet aircraft
Bowater	Rexham, Charlotte, NC	Coated, uncoated paper, paperboard, packaging
British-American Tobacco	Brown & Williamson, Macon, GA	Tobacco and tobacco technology

OFFICE OF TECHNOLOGY POLICY

CCL Industries	Kolmar Laboratories, Port Jervis, NY	Cosmetics, toiletries, topical pharmaceutical preparations
Coats ViYella	Charlotte, NC	Sewing thread, crochet, zippers
Duoplan	Ekono, Bellevue, WA	Energy conservation studies for pulp & paper industry
Eridania Beghin-Say	Central Soya, Food Research, Fort Wayne, IN	Chemistry of soy proteins, oil and lecithin
Fermenta	Kansas City, MO	Feed additives, parasitcides
Ferruzzi	Central Soya Feed Research, Decatur, IN	Nutrition research on livestock and poultry
Fuchs	Metal Lubricants, Harvey, IL	Industrial lubrication oils, rust inhibitors
Fuel Tech	Stamford, CT	Combustion, energy transfer, emissions reduction
GEC PLC	Lear Astronics Developmental Science,	Engineering of prototypes, unmanned vehicles
Hoffman-LaRoche	Givaudan-Roure, Clifton, NJ	Fragrances, flavors, cosmetics, sunscreen agents
Honda	Swepsonville, GA	Lawnmowers R&D (1993)
Hosakawa	Hosokawa Micron Corp., Augusta, GA	Industrial filter bags (1994)
Imperial Chemical	Tamaqua Tech. Center, Tamaqua, PA	High explosives, blasting initiators
KAO	Cincinnati, OH	Cosmetics, toiletries, soap
Karishamns	Columbus, OH	Fats, oils, fatty derivatives
Korean Air	San Francisco, CA	Aircraft research (1997)
Laidlaw	Laidlaw Environmental Services, Laurel, MD	Hazardous waste storage, disposal, and transportation
Lincoln Scott	Honolulu, HI	Mechanical, electrical engineering
Nitto Denko	Permacel, New Brunswick, NJ	Pressure sensitive tapes, electric insulation
Nitto Denko	Graphic Technology, Gardner, KS	Pressure sensitive bar code labels
PA Holdings	PA Consulting, Hightstown, NJ	R&D of products processes
Petroleos de Venezuela	Citgo Petroleum, Tulsa, OK	Fuel and lubricant products
Reckitt & Colman	Wayne, NJ	Odor control, cleaners, air fresheners, waxes
Rotring	Koh-I-Noor, Rapidograph, Bloomsbury, NJ	Engineering supplies, art materials
Royal Dutch / Shell	Shell Oil, Bellaire Technology Center, Houston, TX	Research on exploration, production of oil and gas
Royal Dutch / Shell	Shell Oil, Westhollow Technology Center, Houston, TX	Fuels and lubricants, refining processes, chemicals
Scitex	Scitex Digital Printing, Dayton, OH	Array ink jet printing, image processing, process control
SGL Carbon	SIGRI Great Lakes Research, Elizabethton, TN	Petroleum coke, graphite electrodes and products
SGL Carbon	SIGRI Great Lakes Carbon, Niagara Falls, NY	Carbon and graphite electric furnace electrodes
SGS	U.S. Testing Co., Hoboken, NJ	Biology, chemistry, quality control, materials
Shiseido	Zotos, Darien, CT	Hair science, hair coloring, shampoos, permanents
Tokai	Scripto Tokai, Fontana, CA	Mechanical pencils, ball pens, china marking pencils
Unilever	Cheesebrough-Pond, Greenwich, CT	Toiletries, cosmetics, over the counter drugs, skin care, hair care
Unilever	Quest International Flavors, Owings Mills, MD	Food, beverages, tobacco, flavors, essential oils
Unilever	Unilever Research U.S., Edgewater, NJ	Household and personal consumer products
United Dominion	Robertson, Ambridge, PA	Building products for commercial and industrial construction
Wolters Kluwer	Aspen Systems, Silver Spring, MD	Management consulting to government and industry
Yamaha Motors	Newman, GA	Personal watercraft (1996)
Yamanouchi	Shaklee Corp., San Francisco, CA	Cosmetics, toiletries, nutritional supplements

APPENDIX C: U.S. R&D FACILITIES ABROAD, BY COUNTRY

Parent Company	Location	R&D Activities
JAPAN		
Air Products & Chemicals	Tsukuba, Ibaraki	Industrial gases, processing equipment (1994)
Amgen KK		Drugs (1992)
Apple Technologies	Tokyo	PCs, software
Applied Materials	Technology Center, Narita	Semiconductor equipment
Bristol-Myers Squibb	Aikawa, Kanagawa	Drug toxicity tests, chemical analysis (1994)
Compaq	DEC	Workstations, software
Dana	Engineering Center	Auto parts (1999)
Delphi Automotive	Technical Center, Tokyo	Auto parts (1992)
Digital Equipment		Workstations, software
Dupont Maiu	Dupont Maiu Technology, Yokohama	Chemicals, plastics
Eastman Kodak	Yokohama	Photography, film, optics
Eli Lilly	Kobe	Drugs
Exxon		Petroleum refining
Ford Motor	Ford Technical Development Lab, Yokohama	Powertrain, fuel controls, audio (1995)
Ford Motor	Ford Research Center, Hiroshima	Electronic components (1992)
Fuji Xerox	General Research Institute, Kanagawa	Copiers
Fuji Xerox	KSP Lab, Kanagawa	Copiers
Goodyear	Tsukuba	Rubber and tires
W.R. Grace	Japan Research Center, Atsugishi, Kanagawa-Ken	Polymer chemistry (latex, epoxy), biomedical
W.R. Grace	Japan Technical Office, Atsugishi, Kanagawa-Ken	Polymer chemistry, biomedical (1992)
Hewlett-Packard Japan	Kanagawa	Computers, printers, instrumentation
IBM Japan	Tokyo Research Lab, Yamato	Computer science, storage and semiconductor technology
IBM Japan	Fujisawa	
Intel	Tsukuba	Semiconductors
Merck	Tsukuba	Drugs
Meritor Automotive	Body and Chassis Systems, Nagoya	Components for heavy duty trucks (1993)
Meritor Automotive	Nippon Automotive, Hiroshima	Auto parts
Microsoft	Tokyo	PC software
Monsanto	Ibaraki	Agricultural chemicals
Motorola	Sendai, Miyagi	Semiconductors (1995)
Motorola	Tokyo	Semiconductors
NCR	Engineering & Manufacturing, Oiso	Retail POS terminals, financial terminals, ATM
Nihon Unisys	Tokyo Bay Dev. Center	Computers, electronics
Parexel	Tokyo	Drugs (1997)
Parexel	Osaka	Drugs (1995)
Pfizer	Nagoya	Production process for drugs
PPG Industries	Otowa, Aichi	Automotive coatings (1995)
Rockwell International	Technical Center, Tokyo	Telecommunications
Rockwell International	Graphics Systems, Tokyo	Computer graphics
Silicon Graphics	Tokyo	Software development
Silicon Graphics	Ogaki	Software development
Texas Instruments	Tsukuba R&D Center, Tsukuba Science City	Computers, semiconductors
Texas Instruments	Tokyo (formerly Silicon Systems)	Semiconductor design
Upjohn	Tsukuba General Research, Tsukuba Science City	Drugs
Watkins-Johnson	Kawasaki Science Park, Kanagawa	Chemical vapor deposition systems (1996)
EUROPE		
Belgium		
Ampco-Pittsburgh	Union Electric Steel, Tessenderlo	Forged hardened steel roll
Colgate-Palmolive	European Household Product Liege Laboratory, Milmort	Fabric and dish detergents, cleaners
Crompton & Knowles	Terte, Belgium	Dyes for synthetic and natural fibers
Eli Lilly	Brussels	Drugs
Exxon		Petroleum refining
M.A. Hanna Co.	Wilson Color, Assesse	Formulated colorants for plastics industries
Johnson & Johnson	Janssen Pharmaceutical, Beerse	Drug development projects, animal drugs
Procter & Gamble	European Technical Center, Brussels	Detergents, soaps, cleaners, fabric softeners
Czech Republic		
Honeywell	Technical Center, Prague	Systems engineering for control, computer systems communications systems for commercial buildings
Denmark		
Alfarma	Dumex, Copenhagen	Pharmaceuticals, drug delivery systems
NCR	Copenhagen	Systems engineering

France		
Allied-Signal	Bendix Europe, Drancy	Brake systems, anti-lock brakes, auto parts
Bristol-Myers Squibb	Logues	Research and development on drugs
Corning	Corning Europe, Avon Cedex	Glass and related materials, optoelectronics
Delphi Automotive	Cedex	Auto parts
Eastman Kodak	Chalon	Photography, film, optics, chemicals
Eli Lilly	Rion	Drugs
Exxon		Petroleum refining
General Motors	European Technical Center, Strasbourg	Powertrain group, automatic transmissions
Hannna, M.A.	Wilson Color, Aumone	Formulated colorants for the plastics industry
IBM	LaGote	Computers
Merck	Rion	Drugs
Meritor	Body and Chassis Systems	Components for heavy duty trucks, buses
Motorola	Toulouse	Cellular phones and switching, semiconductors
Stepan	Stepan Europe, Grenoble	Surfactants, personal care prods., cleaners
Texas Instruments	Grenoble	Semiconductors
Xerox	Grenoble	Copiers, printers
Germany		
Allied-Signal	Jurid Werke GmbH, Hamburg	Friction materials for automotive, aircraft
Amphenol	Amphenol Tuchel Electronics, Heilbronn	Military, aerospace electrical connectors
Battelle	European Operations, Frankfurt	Laser technology, biotechnology, sensors
Bristol-Myers Squibb	Regensberg	Exploratory research in pharmaceuticals
Corning	Hazelton Deutschland, Munster	Chronic toxicology
Delphi Automotive	Wuppertal	Auto parts
Exxon		Petroleum refining, chemicals
Ford Motor	Ford Research Center, Merkenich	Automotive
General Motors	Adam-Opel Technical Center, Ruffelsheim	Automotive
Hewlett Packard	Bobaland	Computers
IBM		Computers
Meritor Automotive	Body and Chassis Systems	Components for heavy duty trucks, buses
NCR	Engineering & Manufacturing, Augsburg	Personal computers
NL Industries	Kronos, Leverkusen	Titanium pigments
Warner Lambert	Goedecke, Freiburg	Pharmaceuticals
Ireland		
Allied-Signal	Garrett Ireland Ltd, Waterford	Casting forming technology
Nellcore Puritan Bennett	Mervue	Medical equipment, respirators
Italy		
Allied-Signal	Bendix Heavy Vehicle Sys., Milano	Pneumatic brakes, parts for heavy trucks
Colgate-Palmolive	European Process Development Laboratory, Anzio	Process engineering for production of soaps, etc.
Merck	Pomezia	Drugs
Luxembourg		
Delphi Automotive	Bascharage	Auto parts
Goodyear	European Technical Center, Colmar-Berg	Rubber and tires
Netherlands		
Ameron	Geldermalsen	Corrosion resistant coatings
Procter & Gamble	J.T. Baker, Deventer	Reagents to be used in hospital laboratories
Spain		
Allied-Signal	Bendix Espana, Granoccles Barcelona	Truck power steering, struts, shock absorbers
Switzerland		
Dow Chemical	Dow R&D, Horgen	Chemicals
IBM	Zurich Research Laboratory, Rueschlikon	Communications and computer science, optoelectronics, superconductivity
Sweden		
EDS	Operations and Research, Stockholm	Network applications for retail users
United Kingdom		
Allied-Signal	Bendix Heavy Vehicles, Bristol	Pneumatic braking systems for trucks and buses
Bristol-Myers Squibb	Moreton	Development of drugs
Chevron	Chevron Research, London	Petroleum refining, products
Clayton Environmental Consultants	Birmingham	Physical, chemical measurement of pollution
Corning	Hazelton Labs, Harrogate	Safety evaluation of drugs, chemicals, toxicology
Dames & Moore	Dames & Moore-London, Twickenham	Earthquake engineering, seismology
Ford	Jaguar, Whitley R&D Center, Coventry	Motor vehicles
Eli Lilly		Drugs
Elsag Bailey	Fluid Data, Kent	Analyzers for petroleum products
Emerson Electric	Rosemount, Bognor Regis	Instruments for sensing temperature, pressure
Exxon	Abingdon, Scotland	Chemicals

Exxon	Leatherhead	Petroleum refining
Ford	Ford Research Center, Dunton	Automotive
Ford	Jaguar, Whitley R&D Center, Coventry	Motor vehicles
Hewlett-Packard	Bristol	Computers, printers, instrumentation
Learonal	Derbyshire	Plating for circuit boards, connectors
MA-COM	Dunstable	Microwave semiconductors, amplifiers, circuits
Merck	Terlings Park	Drugs
Meritor	Body and Chassis Systems	Components for heavy duty trucks, buses
Microsoft	Cambridge	Software
NCR	Financial systems, Dundee, Scotland	Self-service terminals, peripherals
Pfizer	Pfizer Central Research, Sandwich	Drug metabolism, biometrics, animal health
Procter & Gamble	Newcastle Technical Center, Newcastle-on-Tyne	Detergents, soaps, fabric softeners, cleansers, toothpaste, shampoos, disposable diapers, drugs
Procter & Gamble	Egham, Surrey	Drugs, toiletry, cosmetics, personal health prods.
Radix Corp.	IBS Radix, Milton Keynes	Harsh environment portable computers, printers
Raytheon	Cossor Electronics, Harlow	Air traffic control, radar, displays, military
Telematics International	Hampshire	Networking systems and network management
Xerox	Cambridge	Copiers, printers (1986)
CANADA		
Allied-Signal	Bendix Avelex, Montreal, PQ	Aerospace fuel systems, fluid dynamics
Allied-Signal Aerospace	Rexdale, ON	Control systems, digital signal processing
Amphenol	Scarborough, ON	Military / aerospace filter connectors
Bristol-Myers Squibb		Exploratory research on drugs
Chrysler	Windsor, ON	Alternate fuels
Cooper Industries	Moog Division, Vaughan, ON	Steering and suspension components and brakes
EDO	Calgary, AB	Manufacturing of refueling stations for natural gas
EG&G	EG&G Optoelectronics, Vaudreuil, PQ	Optical emitters and detectors
Exxon	Imperial Oil Ltd., Toronto	Petroleum refining
General Motors	Oshawa, ON	Automotive: cold weather testing
General Motors	ON	Diesel-electric locomotives
Lilly Industries	London Laboratory, London, ON	Mirror technology
MCI	SHL Systemhouse, Ottawa, ON	Computer aided systems design
Merck	Kirkland	Drugs
Meritor	Body and Chassis Systems	Components for heavy duty trucks, buses
Monsanto	Searle Canada, Oakville, ON	Drugs, clinical testing
NCR	Imaging systems, Waterloo, ON	Document management systems, proof and encoder
Pfizer	Kirkland, PQ	Drugs
Philip Morris	Kraft Canada, Don Mills, ON	Package development and food research
Philip Morris	Operations Technology, Montreal, PQ	Beverages and cereals, packaged and convenience foods
Procter & Gamble	Toronto, ON	Detergents, soaps, fabric softeners, cleansers
SDL	SDL Optics, Saanichton, BC	Fiber optics
Stackpole	Mississauga, ON	Powder metallurgy
Uniroyal Chemical	Guelph, ON	Organic and agricultural chemicals
Wolverine Tube	London, ON	Extended surface tubing, non-ferrous and finned tubing
Xerox	Research Center, Mississauga, ON	Chemical physics, chemical engineering
BRAZIL		
Allied-Signal	São Paulo	Brake systems, components, turbochargers
Delphi Automotive	Materials Engineering Labs, São Paulo	Materials development: physical and metallographic testing: infrared spectrophotometer
MEXICO		
Allied-Signal	San Luis Potosi	Brake systems, auto parts
Delphi Automotive	Technical Center, Juarez	Auto parts
Delphi Automotive	Dorada	Auto parts
INDIA		
Microsoft	Software Development Center	Software, Windows NT, Microsoft Office
Phyton		Biotechnology (1998)
Texas Instruments	IC and Software Design Center, Bangalore	ASIC, digital signal processing, memory chips, software for semiconductor design.
ISRAEL		
IBM	Haifa Research Laboratory	Applied mathematics, computer science and engineering
SINGAPORE		
Adaptec	Adaptec R&D Center	I / O interfaces for computer systems
Black & Decker	R&D Center	Portable electric power tools, appliances
Compaq	Singapore Portable Design Center	Portable computers
Compaq	DEC Asia Research Laboratory	Internet hardware & software, ATM networks, e-commerce
Exxon		Petroleum refining
Hewlett-Packard		Disk drives, computers
Lucent	Bell Labs Network Planning & Design	Network planning
Motorola	Motorola Innovation Center	Pagers, communications related equipment

Seagate	Seagate R&D Center	Disk drives
Sonoco	Sonoco R&D Center	Paperboard packaging
Texas Instruments (formerly Silicon Systems)		Semiconductor design
Western Digital	Western Digital R&D Center	VLSI integrated circuits
Xerox	Singapore Software Center	Software for document products
CHINA		
General Motors	Shanghai	Automotive
Intel	Information Technology Research Center Beijing	Semiconductors (1998)
IBM	China Research Laboratory, Beijing	Chinese language & speech recognition, digital library tech.
IBM	Software Development Center, Beijing	Hypertext links for digitized video, photographic images
Lucent Technologies	Bell Labs, Beijing	Optical, wireless, multimedia communications
Lucent Technologies	Bell Labs, Shanghai	Digital signal processing, network planning and design
Motorola	Asia Manufacturing Research Center, Beijing	Advanced communication and computers (1995)
Microsoft	Microsoft Research Center,	Software development
Silicon Graphics	Beijing Technology Center	Supercomputing and visualization application
Sun Microsystems	Beijing Software Development Center	Software
Texas Instruments	Design / technology Center	Semiconductors
Taiwan		
Cisco Systems		Computer networks, multimedia
Texas Instruments	IC Design Center	Digital signal processing solutions

Sources: R. R. Bowker, Inc. *Directory of American Research and Technology;* Japan Economic Institute, *Japan-U.S. Monthly Business Report;* company press releases.

APPENDIX D: U.S. R&D FACILITIES ABROAD, BY INDUSTRY

Parent Company	Location	Products and Technology
AUTOMOTIVE		
Allied-Signal	Jurid Werke, Hamburg, Germany	Friction materials for automotive, aircraft
Allied-Signal	Bendix Heavy Vehicles, Bristol, UK	Pneumatic braking systems for trucks and buses
Allied-Signal	Bendix Heavy Vehicle Systems, Milano, Italy	Pneumatic brakes, parts for heavy trucks
Allied-Signal	Bendix Europe, Drancy, France	Brake systems, anti-lock brakes, auto parts
Allied-Signal	São Paulo, Brazil	Brake systems, components, turbochargers
Allied-Signal	Bendix Espana, Barcelona, Spain	Truck power steering, struts, shock absorbers
Allied-Signal	San Luis Potosi, Mexico	Brake systems, auto parts
Chrysler	Windsor, Canada	Alternative fuels
Cooper Industries	Moog Division, Vaughan, Canada	Steering and suspension components, brakes
Dana	Engineering Center, Japan	Auto parts (1999)
Delphi Automotive	Bascharage, Luxembourg	Auto parts
Delphi Automotive	Wuppertal, Germany	Auto Parts
Delphi Automotive	Cedex, France	Auto parts
Delphi Automotive	Technical Center, Tokyo, Japan	Auto parts (1992)
Delphi Automotive	Dorada, Mexico	Auto parts
Delphi Automotive	Technical Center, Juarez, Mexico	Auto parts
Delphi Automotive	Materials Engineering Labs, São Paulo, Brazil	Materials development; physical and metallurgical tests
Ford	Ford Research Center, Merkenich, Germany	Automotive
Ford	Ford Research Center, Dunton, UK	Motor vehicles
Ford	Ford Research Center, Hiroshima, Japan	Electronic components for autos (1992)
Ford	Ford Technical Development Lab, Japan	Powertrain, fuel controls, audio (1995)
Ford	Jaguar, Whitley R&D Center, Coventry, UK	Motor vehicles
General Motors	European Technical Center, France	Powertrain group, automatic transmissions
General Motors	Shanghai, China	Automotive
General Motors	Oshawa, Canada	Automotive: cold weather testing
General Motors	Adam-Opel Technical Center, Germany	Automotive
Meritor Automotive	Nippon Automotive, Hiroshima, Japan	Auto parts
Meritor Automotive	Body and Chassis Systems, UK	Components for heavy duty trucks, buses
Meritor Automotive	Body and Chassis Systems, France	Components for heavy duty trucks, buses
Meritor Automotive	Body and Chassis Systems, Germany	Components for heavy duty trucks, buses
Meritor Automotive	Body and Chassis Systems, Canada	Components for heavy duty trucks, buses
Meritor Automotive	Body and Chassis Systems, Nagoya, Japan	Components for heavy trucks (1993)
COMPUTERS AND PERIPHERALS		
Adaptec	Singapore	I/O interfaces for computers
Apple Technologies	Tokyo, Japan	Personal computers, software
Cisco Systems	Taiwan	Computer networks, multimedia
Compaq	DEC Asia Research Center, Singapore	Internet software, electronic commerce, ATM
Compaq	Digital Equipment, Japan	Workstations, software
Compaq	Singapore Portable Design Center, Singapore	Portable computers
Hewlett Packard	Bobaland, Germany	Computers
Hewlett-Packard	Singapore	Disc drives, computers
Hewlett-Packard	Bristol, UK	Computers, printers, instrumentation
Hewlett-Packard	Kanagawa, Japan	Computers, printers, instrumentation
IBM	Zurich Research Laboratory, Switzerland	Communications and computer science
IBM	Beijing, China	Computers
IBM	IBM Haifa Research Laboratory, Israel	Applied mathematics, computer science, engineering
IBM	UK	Computers, computer services, software
IBM	LaGote, France	Computers
IBM Japan	Yamato Lab, Japan	Computers, software
IBM Japan	Fujisawa, Japan	Computers, software
NCR	Engineering & Manufacturing, Augsburg, Germany	Computers, personal computers
NCR	Engineering & Manufacturing, Oiso, Japan	Retail POS terminals, financial terminals, ATMs
NCR	Financial Systems, Dundee, Scotland	Self-service terminals, peripherals
Radix	IBS Radix, Milton Keynes, UK	Harsh environment portable computers, print
Seagate	Seagate R&D Center, Singapore	Computer disk drives
Silicon Graphics	Beijing Technology Center, China	Supercomputing and visualization applications
Telematics Intern'l	Hampshire, UK	Networking systems and network equipment
Unisys	Tokyo Bay Development Center, Japan	Computers, electronics
COMPUTER SOFTWARE		
EDS	Operations and Research, Stockholm, Sweden	Network applications for retail users
IBM	Software Development Center, Beijing, China	Hypertext links for digitized video, photographic images
MCI	SHL Systemhouse, Ottawa, Canada	Computer-aided systems design
Microsoft	Tokyo, Japan	PC software

Microsoft	Cambridge, UK	Software
Microsoft	Software Development Center, India	Software development, Windows NT, MS Backoffice
Microsoft	Microsoft Research Center, China	Software development
NCR	Copenhagen, Denmark	Systems engineering
Rockwell	Graphics Systems, Tokyo	Computer graphics
Silicon Graphics	Tokyo, Japan	Software development
Silicon Graphics	Osaka, Japan	Software development
Sun Microsystems	Beijing Software Development Center, China	Software
SEMICONDUCTORS		
Intel	Tsukuba, Japan	Semiconductors
Intel	Information Technology Research, Beijing	Semiconductors
MA-COM	Dunstable, UK	Microwave semiconductors, amplifiers
Motorola	Sendai, Japan	Semiconductors (1995)
Texas Instruments	Tokyo, Japan	Semiconductor design
Texas Instruments	Grenoble, France	Semiconductors
Texas Instruments	Tsukuba R&D Center, Japan	Semiconductors
Texas Instruments	Singapore	IC design
Texas Instruments	IC & Software Design Center, Bangalore, India	ASIC, DSP, memory products, MSP
Texas Instruments	IC Design Center, Taiwan	Digital signal processing solutions lab
Texas Instruments	Design and Technology Center, China	Semiconductors
Western Digital	Western Digital R&D Center, Singapore	VLSI integrated circuits
OPTOELECTRONICS		
Battelle	European Operations, Frankfurt, Germany	Laser technology, biotechnology, sensors
Corning	Corning Europe, Avon Cedex, France	Glass and related materials, fiber optics
EG&G	EG&G Optoelectronics, Vaudreuill, Canada	Optical emitters and detectors
SDL	SDL Optics, Saanichton, Canada	Fiber optics
TELECOMMUNICATIONS		
Lucent	Bell Labs Network Planning, Singapore	Network switching and planning
Lucent	Bell Labs, Beijing, China	Chinese language and speech recognition, digital library technology
Lucent	Bell Labs, Shanghai, China	Digital signal processing, network planning and design
Motorola	Singapore	Pagers, semiconductors
Motorola	Toulouse, France	Cellular phones and switching, semiconductors
Motorola	Beijing, China	Advanced communication and computers (1995)
Motorola	Tokyo, Japan	Pagers, cellular phones
Motorola	Innovation Center, Singapore	Pagers, communications equipment, semiconductors
Rockwell	Technical Center, Tokyo, Japan	Telecommunications
OTHER ELECTRONICS		
Amphenol	Scarborough, Canada	Military / aerospace filter connectors
Amphenol	Amphenol Tuchel Electronics, Germany	Military, aerospace electrical connectors
Applied Materials	Narita, Japan	Semiconductor equipment
Honeywell	Technical Center, Prague, Czech Republic	Systems engineering for control, computer
Learonal	Derbyshire, UK	Plating for circuit boards, connectors
NCR	Imaging Systems, Waterloo, Canada	Document management systems, proof readers
Xerox	KSP Lab, Kanagawa, Japan	Copiers
Xerox	General Research Institute, Kanagawa, Japan	Copiers
Xerox	Grenoble, France	Copiers, printers
Xerox	Cambridge, UK	Copiers, printers (1986)
Xerox	Software Center, Singapore	Software development, document processing products
INSTRUMENTATION AND CONTROLS		
Clayton Environment	Birmingham, UK	Physical, chemical measurement of pollution
Elsag Bailey	Fluid Data, Kent, UK	Analyzers for petroleum products
Emerson Electric	Rosemont, Bognor Regis, UK	Instruments for sensing temperature, pressure
Nellcore Puritan Bennett	Mervue, Ireland	Medical equipment, respirators
Raytheon	Cossor Electronics, Harlow, UK	Air traffic control, radar, displays, military
DRUGS AND BIOTECHNOLOGY		
Alfarma	Dumex, Copenhagen, Denmark	Pharmaceuticals, drug delivery systems
Amgen KK	Japan	Drugs (1992)
Bristol-Myers Squibb	Canada	Exploratory research on drugs
Bristol-Myers Squibb	Aikawa, Japan	Drug toxicity tests, chemical analysis (1994)
Bristol-Myers Squibb	Logues, France	Research and development on drugs
Bristol-Myers Squibb	Regensberg, Germany	Exploratory research in pharmaceuticals
Bristol-Myers Squibb	Moreton, UK	Development of drugs
Corning	Hazelton Deutschland, Munster, Germany	Chronic toxicology
Corning	Hazelton Labs, Harrogate, UK	Safety evaluation of drugs, chemicals, toxicology
Eli Lilly	Rion, France	Drugs
Eli Lilly	UK	Drugs
Eli Lilly	Kobe, Japan	Drugs
Eli Lilly	Brussels, Belgium	Drugs
Johnson & Johnson	Janssen Pharmaceutical, Beerse, Belgium	Drug development projects, animal drugs

Merck	Pomezia, Italy	Drugs
Merck	Tsukuba, Japan	Drugs
Merck	Rion, France	Drugs
Merck	Terlings Park, UK	Drugs
Merck	Kirkland, Canada	Drugs
Monsanto	Searle Canada, Oakville,	Drugs, clinical testing
Parexel	Tokyo, Japan	Drugs (1997)
Parexel	Osaka, Japan	Drugs (1995)
Pfizer	Nagoya, Japan	Production process for drug manufacturing
Pfizer	Kirkland, Canada	Drugs
Pfizer	Pfizer Central Research, Sandwich, UK	Drug metabolism, biometrics, animal health
Phyton	India	Biotechnology (1998)
Upjohn	Tsukuba General Research Center, Japan	Drugs
Warner Lambert	Goedecke, Freiburg, Germany	Pharmaceuticals
CHEMICALS, RUBBER, AND MATERIALS		
Air Products & Chemicals	Tsukuba, Japan	Industrial gases, processing equipment (1994)
Ameron	Gelderrmalsen, Netherlands	Corrosion resistant coatings
Crompton & Knowles	Terte, Belgium	Dyes for synthetic and natural fibers
Dow Chemical	Dow R&D, Horgen, Switzerland	Chemicals
Dupont Maiu	Yokohama, Japan	Chemicals, plastics
Exxon	Japan	Petroleum refining, chemicals
Exxon	Abingdon, Scotland	Chemicals
Exxon	Germany	Petroleum refining, chemicals
Exxon	France	Petroleum refining, chemicals
Goodyear	European Technical Center, Colmar, Luxembourg	Rubber and tires
Goodyear	Tsukuba, Japan	Rubber and tires
Hanna, M.A.	Wilson Color, Aumone, France	Formulated colorants for the plastics industry
Hanna, M.A.	Wilson Color, Assesse, Belgium	Formulated colorants for plastics industries
Monsanto	Ibarki, Japan	Agricultural chemicals
NL Industries	Kronos, Leverkusen, Germany	Titanium pigments
PPG Industries	Otowa, Japan	Automotive coatings (1995)
Procter & Gamble	J.T. Baker, Deventer	Reagents to be used in hospital laboratories
Uniroyal Chemical	Guelph, Canada	Organic and agricultural chemicals
Watkins-Johnson	Kawasaki Science Park, Kanagawa, Japan	Chemical vapor deposition systems (1996)
W.R. Grace	Japan Research Center, Atsugishi, Japan	Polymer chemistry (latex, epoxy), biomedical
W.R. Grace	Japan Technical Office, Atsugishi	Polymer chemistry, biomedical (1992)
Xerox	Research Center, Mississauga, Canada	Chemical physics, chemical engineering
METALS		
Allied-Signal	Garrett Ireland Ltd., Waterford, Ireland	Casting forming technology
Ampco-Pittsburgh	Union Electric Steel, Tessenderlo, Belgium	Forge hardened steel roll
Stackpole	Mississauga, Canada	Powder metallurgy
Wolverine Tube	London, Canada	Extended surface tubing, nonferrous and finned tubing
FOOD PRODUCTS		
Phillip Morris	Kraft Canada, Don Mills, Canada	Package development and food research
Phillip Morris	Operations Technology, Montreal, Canada	Beverages and cereals, packaged, convenience food
MISCELLANEOUS		
Black & Decker	Singapore R&D Center	Portable electric power tools, appliances
Eastman Kodak	Yokohama, Japan	Photography, film, optics
Eastman Kodak	Chalon, France	Photography, film, optics, chemicals
Chevron	Chevron Research, London, UK	Petroleum refining, products
Colgate-Palmolive	European Household Products, Liege, Belgium	Fabric and dish detergents, cleaners
Colgate-Palmolive	European Process Development, Italy	Process engineering for production of soap, etc.
Dames & Moore	Dames & Moore-London, Twickenham, UK	Earthquake engineering, seismology
EDO	Calgary, Canada	Manufacturing of refueling stations for natural gas
Exxon	Leatherhead, UK	Petroleum refining
Exxon	Belgium	Petroleum refining, chemicals
Exxon	Singapore	Petroleum refining
Exxon	Imperial Oil Ltd., Toronto, Canada	Petroleum refining
Lilly Industries	London Laboratory, London, Canada	Mirror technology
Procter & Gamble	Newcastle Technical Center, UK	Detergents, soaps, fabric softeners, cleansers
Procter & Gamble	Egham, Surrey, UK	Drugs, toiletry, cosmetics, personal health prods.
Procter & Gamble	European Technical Center, Brussels, Belgium	Detergents, soaps, cleaners, fabric softeners
Procter & Gamble	Toronto, Canada	Detergents, soaps, fabric softeners, cleansers
Sonoco	Sonoco R&D Center, Singapore	Paperboard packaging
Stepan	Stepan Europe, Grenoble, France	Surfactants, personal care products, cleansers
TRANSPORTATION EQUIP.		
Allied-Signal	Bendix Avelex, Montreal, Quebec, Canada	Aerospace fuel systems, fluid dynamics
Allied-Signal Aerospace	Rexdale, Ontario, Canada	Control systems, digital signal processing
General Motors	Canada	Diesel-electric locomotives