Introduction

BACKGROUND

The importance and value of research and development (R&D) is universally recognized. R&D has a profound impact on every aspect of our lives—affecting the air we breath, the food we eat, and the water we drink; the ailments we suffer; the way we communicate; and the manner in which we traverse our cities, our planet, and beyond. This national investment in our future also has a major effect on the economy, because entire industries—transportation, pharmaceuticals, computers, telecommunications—are rooted in R&D and its continuing output. The positive impact of R&D investments of the federal government on the U.S. economy is widely recognized by experts and is credited with underpinning much of the nation's economic growth during the 20th century. In short, science and technology are transforming our society, and the U.S. federal government has driven much of that change due to its investments in R&D.

Underlying these global and national trends, however, are local and regional impacts from federal R&D activities that are equally important and of even more direct consequence to Americans. Specific federal R&D activities are often deeply rooted in the communities in which they are conducted. Such activities attract new businesses to these areas, thereby stimulating local economies and improving the quality of local schools. When the locations of federal laboratories and major federally funded R&D activities at universities are mapped with the locations of high-technology start-up companies, the ripple effects of federal R&D investments on regional and local economies become even clearer. Little wonder that states and localities compete with each other to attract federal R&D support to their jurisdictions.

Given the importance of federal R&D investments to the nation, states, and localities, amazingly little information is available about them that is complete, detailed, and current. Print and electronic media provide occasional information on the substance and location of cutting-edge R&D supported by the federal government, but they tend to be cursory and sporadic. National and some state information can be gleaned from the annual data collections of the National Science Foundation (NSF), most particularly NSF's annual *Survey of Federal Funds for Research and Development*. The best attempt to date to sharpen the focus of the federal R&D activities at the state level is found in a series of pamphlets issued between 1996 and 1999 by the American Association for the Advancement of Science (AAAS). This series, *The Future of Science & Technology in the States*, describes some of the major federal R&D activities in selected states and regions of the nation, with a heavy reliance on the NSF survey noted above. In 1996, this series reported on California, Georgia, Illinois, Indiana, Iowa, Michigan, Minnesota, Ohio, and Wisconsin. In 1997, it reported on Connecticut, Florida, Georgia, Maine, Massachusetts, North Carolina, Oregon, Rhode Island, South Carolina, Vermont, Washington, and Virginia. In 1998, it reported on Arizona and Pennsylvania, and in 1999, it reported on Alabama, Louisiana, and Mississippi.

All of these sources of information have significant limitations, however. Specifically, the R&D activities highlighted in the news media are very selective, focusing on only a few, high-profile areas of R&D. NSF's data, while consistently covering most federal R&D activities, is highly aggregated at the national and international levels and resistant to analysis because it limits the substantive characterization of R&D activities to a general academic field of science or engineering. And AAAS's information is incomplete, mentioning only some of the federally supported R&D activities in a given state and overlooking seven of the top 15 state recipients of federal R&D funds (i.e., the District of Columbia, Maryland, Missouri, New Mexico, New Jersey, New York, and Texas). In addition, much of the information is dated.

Given the importance of federal R&D to the nation, there is an ongoing need for a data system that can provide detailed information on all of these activities as they occur. Recognizing this, the White House

Office of Science and Technology Policy (OSTP) encouraged RAND to develop such a database.

The result of this ambitious undertaking is the Research and Development in the United States (RaDiUS) database, which has made it possible to identify and describe virtually all of the ongoing R&D activities of the federal government by agency, subject, performer, location, and other important criteria (see description in Appendix A). Because the RaDiUS database permits both broad and deep views of the federal R&D portfolio, it allows policymakers and the public, for the first time, to break down the complex federal R&D portfolio into its component state and local elements. While over 30 reports for OSTP and the National Science and Technology Council (NSTC) have to date tapped RaDiUS's potential, this report is by far the most comprehensive use of its extensive capabilities.

OBJECTIVES OF THIS STUDY

This report details the full range of federal R&D activities in terms of the individual laboratories, centers, universities, and companies performing the research, doing the studies, and conducting the analyses. No longer will the view of the federal R&D enterprise be limited to only three general dimensions—the *character* (i.e., stage) of the R&D, the scientific or engineering *field* most closely related to the R&D, and the general *category of performer* of R&D. Instead, we can put a human face on it—the office down the road where a friend is employed, the university where a student attends class, and the field station on the mountainside where the forest researcher works. The significance of individual federal R&D activities can now be better understood on a local basis and their true impact brought home to every community in the nation. Although this report shows that federal R&D activities are heavily concentrated in a few regions of the country, it also reveals that virtually every community in the nation has a direct stake in the federal R&D enterprise. Changes in the scope and activities of our national R&D enterprise can now be evaluated in terms of their impact on the local, as well as the national, economy. At the same time, the role that federal R&D activities play in state and local economic development can also begin to be seen in greater detail.

This report was prepared to provide an appreciation of the true scope of the federal R&D enterprise and the challenge of coordinating and managing such an expansive endeavor. In addition, by revealing the qualitative differences between the various activities in the federal R&D portfolio, this report shows with greater clarity than previously available how some of these activities focus on applying the information obtained in prior discoveries and preserving the gains R&D has already brought us, while others seek to push the envelope of knowledge far beyond anything yet imagined. All too often, the emphasis on cutting-edge R&D breakthroughs results in all other R&D activities being undervalued. Hopefully, this report will help to correct this tendency, because both types of R&D are essential.

At the outset, several cautionary points must be made. First, some information in this report will likely prompt questions because it is presented in a different manner. Specifically, the contents of the federal R&D portfolio are described in this report, for the first time, in terms of the actual legal ground rules and conditions under which the R&D work is being conducted (i.e., work performed by federal employees, federal contractors, or federal grant and cooperative agreement recipients). Previous reports focused only on the status of the performing entities (e.g., universities, nonprofits, industry), making no allowance for the fact that frequently these entities are simultaneously conducting federal R&D under the markedly different terms of contracts, grants, and cooperative agreements. The RaDiUS database has made it possible to draw these critical distinctions. In addition, since RaDiUS looks at the substantive focus of the R&D activity, rather than the academic field of the researcher doing the work, it is possible to determine which federal agencies are examining similar R&D topics. These common R&D efforts, several of which are outlined below in Figure S.2, do not necessarily indicate duplicative or redundant R&D activities, and the reader is cautioned not to conclude that they do. Instead, RaDiUS reveals the complementary nature of the R&D activities of federal agencies.

Still other data will reveal the shortcomings of the underlying material upon which it is based. This is to be expected in an undertaking of this size and scope that attempts to gather specific information

from all R&D agencies and bureaus in the federal government. Every attempt has been made to avoid errors, especially double-counting of federal R&D funding and the allocation of personnel between related units and sub-units and programs spanning more than one state and/or city. Under no circumstances should this report be viewed as an accounting or financial management document. Throughout the preparation of this report, decisions had to be made regarding which details to present about every federal R&D unit. Space limitations in this report have caused the mass of data contained in the RaDiUS database to be presented in summary form. As a result, individual activities at specific institutions have had to be combined in many cases. Clearly, opinions will differ as to what is most important and/or representative about a particular unit. All decisions regarding the content of this report were made with the objective of spotlighting actual R&D activities, rather than simply iterating official mission statements. The reader is specifically cautioned against comparing the funding and personnel levels among various R&D units in this report. Some units have large funding-to-personnel ratios, while others do not. These differences are attributable to a variety of factors (e.g., equipment and facilities costs), none of which involve the inefficient operation of a research unit. And finally, while this report was prepared at the request and with the support of OSTP, that office is in no way responsible for its contents. The senior author of this report assumes full responsibility for the content of the pages that follow, as well as any errors of commission or omission therein.

STUDY APPROACH AND DATA LIMITATIONS

Scope

This report focuses exclusively on the activities of the U.S. federal government that comprise the federal R&D portfolio. For FY 2001, $85 billion has been requested for federal R&D activities. The elements of the federal R&D portfolio span 24 federal agencies and annually account for approximately 14 percent of all discretionary

spending of the federal government. Included in these totals are every project, experiment, salary, piece of equipment, or facility charge paid for with federal R&D funds. They include all R&D activities taking place in federal laboratories, some of which are more commonly referred to as "national laboratories," as well as R&D activities at private companies, colleges, universities, nonprofits, etc., paid for with federal R&D funds.

Identifying Federal R&D

The operative definition of federal R&D used in this report is "all activities that are *paid for* with federal R&D funds." This definition requires special emphasis because it can easily be read as "all *R&D activities* that are paid for with federal funds." Distinguishing between these two phrases is critical because of the way these government activities are labeled as R&D.

The official definition of R&D, which applies to all federal agencies, is found in Office of Management and Budget's (OMB's) Circular A-11. It distinguishes among the Conduct of R&D, R&D Equipment, and R&D Facilities and states specifically:

Conduct of R&D	Basic Research	Systematic study directed toward greater knowledge or understanding of the fundamental aspects of phenomena and of observable facts without specific applications toward processes or products in mind.
	Applied Research	Systematic study to gain knowledge or understanding necessary to determine the means by which a recognized and specific need may be met.
	Development	Systematic application of knowledge toward the production of useful materials, devices, and systems or methods, including design, development, and improvement of prototypes and new processes to meet specific requirements.
R&D Equipment	The acquisition of major equipment for R&D. Includes expendable or movable equipment (e.g., spectrometers, microscopes) and office furniture and equipment. Routine purchases of ordinary office equipment or furniture and fixtures are normally excluded.	
R&D Facilities	The construction and rehabilitation of R&D facilities. Includes the acquisition, design, and construction of, or major repairs or alterations to all physical facilities for use in R&D activities. Facilities include land, buildings, and fixed capital equipment, regardless of whether the facilities are to be used by the government or by a private organization, and regardless of where title to the property may rest. Includes such fixed facilities as reactors, wind tunnels, and particle reactors. Excludes movable R&D equipment.	

While this definition of federal R&D appears clear and concise on its face, it is interpreted and applied differently by a wide range of people located in dozens of offices throughout the federal government. Because of the varying interpretations, a specific activity that is considered R&D by a person in one federal agency may not be similarly considered R&D by a person in another federal agency. The nature, magnitude, and significance of these variations have never been explored or discussed, however, because the myriad individual activities that ultimately end up being included in the federal R&D portfolio have never been systematically identified. The RaDiUS database has identified in detail all of the activities—and only those activities—the costs of which have been paid for with federal R&D dollars. In so doing, the RaDiUS database allows comparisons of federally supported R&D activities to be made reliably across the entire federal government. The process of building this database, however, has also uncovered a number of inconsistencies with regard to what has been officially reported as federal R&D.

For example, while many outside the Department of Commerce (DOC) have long considered the activities of the Manufacturing Extension Program (MEP) to be R&D, the DOC does not. A more subtle inconsistency is evident in the treatment by various agencies of the data gathering, study, and analysis activities conducted in support of federal standard setting. In some agencies (e.g., DOC), these activities appear to be consistently defined as R&D. In others (e.g., the Department of Health and Human Services (HHS) and the Environmental Protection Agency (EPA)), they do not. In still other agencies, it appears that R&D is only envisioned as basic laboratory science; hence, the definition of R&D is narrowly construed (e.g., by the NSF).

While not central to this report, it is worthwhile to note that the lack of uniformity in applying the definition of federal R&D among agencies is perhaps most apparent when it involves distinguishing among the various stages (i.e., character) of R&D—Basic Research versus Applied Research versus Development. Specifically, the dividing line between Basic Research and Applied Research seems to shift depending on whether the judging unit is a "pure science" agency (e.g.,

NSF) or a "mission" agency (e.g., the Departments of Defense (DOD), Agriculture (USDA), and Transportation (DOT), and the Smithsonian Institution). These latter differences do not affect the content of this report, however, because every federal R&D activity is included regardless of its stage or character. Suffice it to say that the uniform application of the definition of R&D and its components is important as federal R&D policies are formulated and resources are allocated using these definitions.

R&D Versus S&T

By far, the biggest challenge in creating the RaDiUS database, as well as preparing this report, has been to accurately distinguish the R&D activities from the science and technology (S&T) activities of the federal government. Although there is a government-wide definition of R&D, there is no comparable government-wide definition of S&T. Indeed, as discussed below, the term "S&T" has at least two conflicting meanings. Further complicating the picture is the fact that, although these terms have been used interchangeably for years, they do not refer to the same set of activities. Specifically, for the military portion of the federal government, S&T activities are a subset of R&D activities. In contrast, for the civilian portion of the federal government, R&D activities are a subset of S&T activities.

To better manage its portion of the federal R&D portfolio and reflect the fact that it engages in a range of R&D activities that other agencies tend not to, DOD subdivides the "D" portion of R&D into seven categories (see Appendix B). DOD then takes one of these subcategories of development (i.e., 6.3) and groups it with Basic Research (i.e., 6.1) and Applied Research (i.e., 6.2) and calls the trio S&T. In so doing, DOD officially renders S&T a subset of R&D for all military activities of the federal government. Hence, this report covers all R&D and S&T activities of the military portion of the federal government.

For the civilian side of the federal government, however, some S&T activities are not simultaneously designated as R&D activities. Specifically, for three civilian agencies—the National Aeronautics and Space Administration (NASA), the Department of Energy (DOE), and

NSF—a substantial portion of their activities falls within a function category officially known as General Science, Space, and Technology (Budget Function 250). This category is generally referred to as the S&T function in the federal budget. As a result, most, if not all, of the activities that fall within this budget function are commonly referred to as S&T. Only a portion of the activities contained in the S&T Budget Function, however, are defined as R&D. Hence, because of the interplay between two coexisting sets of definitions, R&D activities are a subset of S&T activities for NASA, DOE, and NSF. A similar phenomenon occurs for parts of DOC and EPA, where specific budget accounts carry S&T labels, yet only a portion of their contents are designated as R&D. This pattern appears to prevail for all civilian agencies in the federal government, although for most, the extent of their S&T activities is more difficult to determine because they fall into function categories not specifically labeled S&T. Because R&D is a subset of S&T for the civilian portion of the federal government, this report does not cover all civilian S&T activities. With two exceptions (the Science and Technology Policy Institute and the Center for Strategic Tax Administration Modernization), this report covers only the civilian S&T activities of the federal government that are also designated to be R&D activities.

All of these examples of "R&D-like" activities excluded from the federal R&D portfolio are indeed S&T activities that reside in the "halo" around the civilian R&D category depicted in Figure S.1. A large share of the time involved in preparing this report has been devoted to identifying the precise boundary between the R&D and the S&T activities in each of the civilian agencies in the federal government. Often the actual performers themselves of a specific federal activity could not pinpoint which side of the R&D versus S&T definition line they were on. In such cases, through a series of conversations, e-mail exchanges, and faxes, the funding of the activity in question was traced and its proper designation ultimately confirmed by the budget office of the appropriate federal agency. As a result of this effort, we are confident that this report includes only those activities that are a part of the federal R&D portfolio. A similar process was used to distinguish as clearly as possible the portion of each civilian facility's activities that were R&D as opposed to only S&T.

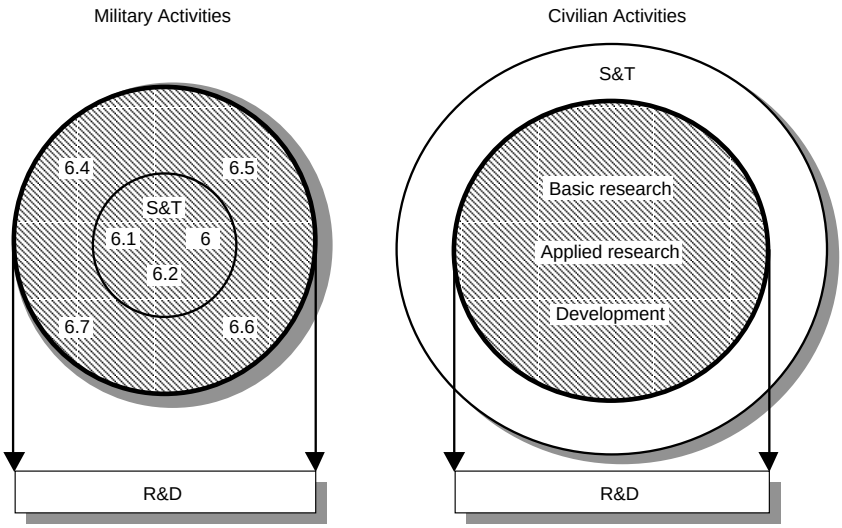

Figure S.1 – R&D Versus S&T

Assessing Current Data Limitations

The best available information until now on the overall contents of the federal R&D portfolio has been compiled by NSF. It does not permit the federal R&D portfolio to be broken out into operationally meaningful substantive or technical areas, however, because it describes all federal R&D activities only in terms of the general scientific field or discipline involved. By categorizing activities in this manner, rather than by the goal or objective of the research, it is difficult to support many of the detailed analyses required by policymakers and the public to evaluate the specific contents of the federal R&D portfolio. In addition, these data do not identify the general ground rules under which federally supported R&D is conducted, that is, whether the R&D is performed under the terms and conditions of a grant, contract, or cooperative agreement. As a consequence, who controls the R&D work, who owns any resulting intellectual property, and who has title to any acquired equipment cannot be considered in any analyses.

NSF's surveys describe the substance of the entire federal R&D portfolio only in terms of the scientific or engineering *field* (i.e., discipline) most closely related to the R&D. Specifically, they note only

whether the R&D activities relate to life sciences, psychology, physical sciences, environmental sciences, mathematics and computer sciences, engineering, social sciences, other sciences, or development. When compiled, these data show that virtually every federal R&D agency is involved in almost every field of science and engineering. Such information is of little use in identifying specific areas of common interest among federal R&D agencies and helping them coordinate their R&D activities. To do this, the federal R&D portfolio must be examined in finer detail by specific substantive or technical area.

A fresh approach, made possible by the magnification capabilities of the RaDiUS database, is illustrated in Figure S.2. It compares the two dozen federal R&D agencies with some of their current R&D focus areas. Although many federal agencies share a common interest in particular areas of R&D, a review indicates there is little duplication of R&D effort among federal agencies. Instead, various agencies are tackling different aspects of a common problem. For example, while HHS is clearly the center of federal cancer research, its activities focus on identifying the molecular and genetic mechanisms that cause cancer and searching for chemical compounds to treat it. At the same time, EPA studies the connection between environmental estrogens and cancer and NASA explores the production of anti-cancer drugs in microgravity. NSF develops statistical models to determine cancer risks and machines to microscopically image cancer, DOD explores the connection between Persian Gulf War service and exposure to jet fuel and the incidence of cancer, and USDA studies human diets and cancer risk factors and the potential for growing a sufficient amount of a cancer-fighting plant to guarantee a supply for cancer patients. Meanwhile, the Department of Veterans Affairs (DVA) studies the efficacy of a variety of cancer treatments in clinical settings and DOE explores the possibility of using radioisotopically altered antibodies and neutron radiotherapy to treat cancer. The existence of RaDiUS has enabled researchers in different federal agencies to learn of work on related R&D problems being tackled by other agencies. In addition, such information helps federal agencies to better plan and leverage their R&D investments.

Focus Area*	DOD	HHS	NASA	DOE	NSF	USDA	DOC	DOT	EPA	DOI	DVA	DED	AID	SMITH	DOL	DOJ	USPS	NRC	HUD	TVA	SSA	TREA	ACDA**	MMC
Cancer	X	X	X	X	X	X	X		X		X			X										
Elderly	X	X			X	X	X		X		X	X												
Flood	X		X		X	X	X	X	X	X										X				
Fuel Cell	X	X	X	X	X	X		X			X													
HIV	X	X		X	X	X	X				X	X	X			X								
Hazardous Waste	X	X	X	X	X	X	X	X	X	X														
Homeless		X			X	X					X				X				X					
MRI	X	X	X	X	X	X	X				X	X		X										
Optical	X	X	X	X	X	X	X	X			X			X			X							
Pesticide	X	X			X	X	X		X				X											
Remote Sensing	X	X	X	X	X	X	X	X	X	X				X										
Seismic	X	X	X	X	X	X	X	X		X								X						
Substance Abuse	X	X			X	X		X			X					X					X			
Titanium	X	X	X	X	X	X	X	X		X	X													
Violence	X	X			X	X					X					X								
Wheat		X	X	X	X	X	X				X													

* All information was obtained by searching RaDiUS using the specific terms noted, with one exception. The search for "substance abuse" also includes the term "chemical abuse."

** As of FY 2000, ACDA ceased to categorize any of its activities as R&D.

NOTE: While many federal agencies may share a common interest in particular areas of R&D, there is little duplication of R&D effort among federal agencies. Instead, various agencies are tackling different aspects of a common problem.

Figure S.2 – Federal Agencies Supporting R&D Related to Focus Area

NSF's surveys also divide the federal R&D portfolio according the *category of performer of R&D* (i.e., a general description of the parties performing the R&D). That is, they note whether the R&D work is conducted intramurally by federal employees or extramurally by industrial firms, colleges or universities, nonacademic nonprofits, state or local governments, or federally funded research and development center (FFRDCs). The view of the federal R&D portfolio provided by this cross section of the data is perhaps the most problematic, because it focuses on the legal status of federal R&D performers rather than the legal terms and conditions under which federal R&D work is actually conducted. While these matters are related, they are far from synonymous. Indeed, it is quite common for a single type of R&D performer (e.g., a university) to simultaneously have R&D grants, R&D contracts, and R&D cooperative agreements from the federal government. Consequently, the legal terms and conditions under which

federal R&D work is performed are critical, because they enable an observer to know who controls the conduct of the R&D work, who owns the results of the R&D work, and who owns any R&D equipment purchased in the course of doing the work.

For federal R&D conducted intramurally, the work is clearly controlled by the federal government, the results are definitely owned by the federal government, and all equipment acquired during the course of the work is the property of the federal government. For federal R&D conducted extramurally, however, depending on the type of legal instrument used by the federal government to transfer the federal R&D dollars to the extramural performer, who controls the conduct of the R&D and who owns the results of the R&D can differ markedly. Similarly, who ends up owning any equipment purchased during the course of the R&D work depends on the precise terms of each specific legal instrument.

The legal instruments that transfer federal R&D dollars to extramural performers are grants, contracts, and cooperative agreements. Each of these specifies a different set of terms and conditions under which the extramural R&D is to be performed. Contracts are used by federal agencies to get R&D work performed that satisfies a specific need of the federal government. A contract specifies the nature of the R&D work to be performed, the manner in which the R&D work will be conducted, and the penalties that will result if the R&D work is not performed as stipulated. Grants and cooperative agreements are used to transfer federal R&D dollars when federal agencies want to achieve a public purpose rather than fulfill specific needs of the federal government. A grant is used when the agency does not expect to be substantially involved in the R&D effort, while a cooperative agreement is used when a federal agency expects to be substantially involved in the R&D effort. Neither instrument specifies the manner in which the work is to be performed and no penalties result under either a grant or a cooperative agreement for failure to perform the work.

The type of legal instrument used by agencies to transfer federal R&D dollars to extramural performers differs markedly from one agency to another, as well as across programs within an agency. For example, DOD, NASA, and DOE favor the use of contracts to transfer

R&D funds to extramural performers, while HHS and NSF favor the use of grants. The primary user of cooperative agreements is USDA. About 75 percent of all federal R&D dollars are transferred each year to extramural performers—60 percent through contracts, 35 percent through grants, and 5 percent through cooperative agreements. Given the significance of these legal instruments in determining the terms and conditions under which federal R&D is performed, they are a central organizing theme of this report.

HOW THIS REPORT IS ORGANIZED

The body of this report consists of 52 chapters that describe the federal R&D activities that take place in the 50 states, the District of Columbia, and Puerto Rico (hereinafter collectively referred to as "states"). Each of the chapters begins with a general overview of federal R&D activities in the state, followed by sections describing the federal R&D units in the state, the federal R&D grants awarded to entities located in the state, and any other federal R&D activities involving entities located in the state.

Specifically, the profile of every state begins with an estimate of the total federal R&D dollars spent in the state, the proportion of all direct federal dollars received by the state that are R&D dollars, and where the state ranks in terms of federal R&D dollars received. It also includes a summary of which federal agencies fund R&D activities in the state and which federal R&D facilities are located in the state. Because complete expenditure information did not become available for Fiscal Year (FY) 1999 until after this report was completed, the focus year of this report is FY 1998. In several instances when it was known that federal R&D units were opening or closing in FY 1999, that information has been included in this report. The estimates of total spending by state are based on federal R&D obligations for Fiscal Years 1993 through 1998 reported to NSF by 10 of the 24 federal R&D agencies. While alternatives were considered, this was found to be the only information source available that consistently included the salaries of federal R&D personnel. A detailed explanation of the limitations with

these data, how they were addressed, and how these estimates were derived is provided in Appendix C. These estimates were used to determine the rankings of the states. The information on the total dollars received by each state from the federal government was obtained from the *Consolidated Federal Funds Report* prepared annually by the Bureau of the Census in the Department of Commerce (Table 1 of the Summary of Federal Government Expenditures, by State and Outlying Area: Fiscal Year 1998). This detail was included to provide a uniform gauge across states of the significance that federal R&D activities play in the overall context of all the direct federal support provided annually to each state.

Following the introductory and background material for each state are three sections that describe the specific federal R&D activities taking place in each state. The first describes the substance and location of all federal R&D units in each state, and covers all R&D units owned by the federal government and staffed by federal employees and/or uniformed military. Because FFRDCs are contractor-operated units established by the federal government to meet special long-term R&D needs that cannot be met effectively by existing federal in-house or conventional contractor resources, FFRDCs are also included in this section. This section does not include government-owned, contractor-operated R&D units that are not FFRDCs. Such units are conventional contract operations and, therefore, are discussed in the portion of the third section of each chapter that describes federal R&D activities performed under contract. All information in the first section is presented alphabetically according to the city in which the federal R&D units are located. To the extent possible, while the headquarters of federal R&D units are duly noted in their proper locations, the separate locations of the many field units, satellite offices, and remote facilities that collectively make up these major federal R&D units are also noted. When appropriate, military R&D units are listed under the cities to which they are immediately adjacent. To the extent practicable, all the subunits of a federal R&D unit are included in the states in which they are respectively located.

While a substantial portion of the information presented in the first section comes directly from the individual R&D units and/or their web-

sites, some comes from the RaDiUS database. To ensure that the funding and staffing information for individual R&D units was accurate, it was obtained directly in most cases from the central budget and finance offices of federal agencies and bureaus or directly from individual R&D units. While every effort was made to obtain comparable funding and staffing information for every R&D unit, it ultimately proved impossible to totally overcome the unevenness of the available data. As a result, while in most cases the funding provided is obligations, in a few it is outlays or budget authority. All funding amounts should therefore be considered estimates. Similarly, some staffing figures are head counts, while others are FTEs. With minor exception, all funding amounts are only for R&D activities that actually take place on the premises of the unit described. It is important to note that several of DOE's laboratories also regularly conduct a significant amount of R&D work for other federal agencies. This "reimbursable" R&D work is not reflected in the funding amounts shown for these units, however, because that would result in double counting. The information provided for each DOD unit does include the reimbursable work performed for other DOD units, as this is the standard way in which R&D funding is tracked throughout DOD. Because the same definition was uniformly applied to all DOD units, no DOD R&D funds were simultaneously credited to the accounts of two different DOD units; hence, none of these funds were double counted.

Considerable effort was taken to describe accurately which type of staffing figures is presented to minimize the chances of misleading the reader. Furthermore, the reader is cautioned not to assume that all funding presented for a particular unit covers only the salaries of staff because many units also spend a significant portion of their R&D funds on equipment and special facilities. To the extent possible, this fact is noted in the information provided on individual units. In addition, while figures for military staff are not included for DOD units, the reader can safely assume that there is at least some military staff present at all DOD R&D units. As noted previously, great care has been taken to distinguish between the R&D and S&T activities of civilian R&D units. In addition, extraordinary efforts have been made to

avoid double counting of any kind and to verify and validate all information presented.

The second section describes the federal R&D activities conducted in each state funded through federal grants. Because a few agencies do not report the specific dollar amount associated with absolutely every grant they award (e.g., USDA), the funding amounts presented in the table in this section should be considered conservative estimates. The third section describes the federal R&D activities that are funded through contracts and cooperative agreements. With minor exceptions, all of the information presented in both sections comes exclusively from the RaDiUS database. Detailed information on every grant, contract, and cooperative agreement referenced in the text and tables of these two sections is available in the RaDiUS database. For example, a search of RaDiUS reveals that an institution like Pennsylvania State University had over 1,300 active federal grants, contracts, and cooperative agreements from over a dozen federal agencies in a recent year. Among these awards were ones from DOC's Sea Grant program, USDA's National Research Initiative, DOD's Defense Advanced Research Projects Agency, DOE's Fossil Energy program, NSF's Engineering program, HHS's National Institutes of Health, DOI's U.S. Geological Survey, NASA's Aeronautical Research and Technology program, and DOJ's Justice Assistance program. Because of obvious space limitations, however, this report provides only summary data and selected details of the information contained in the RaDiUS database on federal R&D grants, contracts, and cooperative agreements.