95-1209 STM

CRS Report for Congress

Received through the CRS Web

Federal R&D Funding: A Concise History

Updated August 14, 1998

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Summary

Prior to World War II, federal R&D funding was generally small and focused on specific items of direct interest to the federal government such as exploration of federal lands. In the 20th century, the federal role expanded to include research related to public health concerns, national security (World War I), and some limited efforts to help U.S. business, including research on aeronautics and standards.

The research effort accompanying World War II set off a major expansion of federal R&D funding after the war. Total R&D funding increased from a little over $5.5 billion in 1947 to about $71.4 billion in FY1998, in 1998 dollars. Funding for R&D over that period has been largely guided by policy emerging from a 1945 report on science research by Vannevar Bush. Several other policy initiatives, however, have also driven R&D funding over that period including expansion of the space program during the 1960s, response to the oil embargos in the 1970s, the defense buildup of the late 1970s and early 1980s, and actions to assist economic growth in the 1990s.

A major feature of federal R&D funding in the last 50 years has been the steady and growing support of basic research. That the federal government should be the primary funding source for basic research was the key recommendation of the Bush report and has since been a constant of federal R&D policy. While much federally funded basic research is performed in support of agency missions, most is performed at the nation's universities primarily to advance knowledge for its own sake.

Currently, federal R&D support appears to be high in the Congress and Administration. Efforts over the past 4 years to balance the federal budget have not resulted in the reduction in federal R&D funds as was first projected. Indeed, civilian R&D funding has continued to grow in constant dollar terms. In addition, Congress is undertaking efforts to establish a new science policy to guide federal R&D efforts for the next several decades.

There appears to be considerable support in Congress for continuing federal support of R&D as a high budget priority. The pressures on federal spending resulting from the budget caps adopted in 1997, however, will continue to mount even in the face of this support and growing budget surpluses. As a result, continued growth in R&D might be increasingly difficult to achieve.

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Introduction

Federal support of R&D began almost as soon as the Republic was formed. Until World War II, however, federal R&D funds were generally a very small fraction of total federal expenditures. The success of federally funded R&D during the Second World War was the incentive for policy decisions, which greatly accelerated federal R&D support. Although national security was the prime motivation of this increased federal role, other reasons emerged as the recognition grew of the importance of science and technology for meeting most national goals.

The federal government has funded all parts of the R&D cycle — basic and applied research, development, and demonstration. Basic research support, however, has been its particular province. Currently, the federal government provides about 58% of all funds for basic research compared to 36% of funds for all R&D in the United States. The federal government funds basic research to produce new knowledge both for the general benefit of the nation, and to help solve specific problems central to the missions of the various federal agencies. These relatively clear objectives have helped keep federal basic research funding policy fairly stable over the last 50 years.

This report presents a short discussion of the history of federal support of R&D funding. The first section gives a general overview of the course of federal R&D funding since the early days of the nation in terms of the factors that motivated this funding. The next section looks specifically at basic research funding since the end of World War II. Finally, an overview of the current status of, and outlook for, R&D funding is given including a discussion of current policy issues.

Federal R&D - Historical Overview

Prior to World War II

The federal government has sponsored research and development almost from its beginning.[1] Prior to World War II, however, that effort was generally quite small and usually confined to federal facilities and federal lands. Perhaps the most famous R&D project of the early years of the country was the Lewis and Clark expedition, which explored the new territories added to the country through the Louisiana

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[1] This discussion of the history of federal R&D up to World War II is based on material by Hunter A. Dupree, *Science in the Federal Government; A History of Policies and Activities to 1940*, (Boston, MA: Harvard University Press, 1957).

Purchase.[2] As other lands were acquired by the United States, additional surveys were funded by the federal government. During the years following the Civil War, the role of scientific research expanded as the government took on new responsibilities. Among these were agriculture research with the formation of the Department of Agriculture, a continuation of land surveys through the establishment of the Geological Survey, and the attempts to set up a weather bureau to pursue the science of meteorology. One notable example of how federal policy interacted with R&D was the passage of the Pure Food and Drug Act in 1906 which stimulated research into food safety and preservation at the Department of Agriculture. This was perhaps the first example of the linkage between public health and research policy. The Public Health Service, established in 1901, included among its responsibilities the Hygienic Laboratory, which became the National Institutes of Health.

At the beginning of the 20th Century, other R&D activities were started to address specific national needs through technical solutions. The National Bureau of Standards (NBS, now the National Institute of Standards and Technology) was established in 1901 to provide the government with the expertise it needed to maintain standards of weights and measures in the face of rapid technological expansion. The invention of the airplane and its potential importance stimulated the Congress to establish the National Advisory Committee on Aeronautics (NACA) in 1915. The role of NACA was to direct the federal aeronautics research effort. NACA did so for the next 43 years (in 1958, NACA was absorbed by the National Aeronautics and Space Administration), contributing several significant advances to the early development of aeronautics. Both the NBS and NACA, as well as the Bureau of Mines, were a result of the government's desire to help U.S. industry. As such, they were the first attempts of federal R&D policy to assist economic development by performing research on technical problems that the affected industries either were unable or unwilling to do by themselves.

The advent of World War I spawned new research efforts although no new major federal R&D establishments. Much of the research done in support of the war effort was coordinated by the National Research Council, which was established by the National Academy of Sciences as its research operating arm.[3] The NRC is not a government agency, but it was given wide latitude in advising and coordinating federal research efforts. This arrangement stayed in place during the 1920s, as federal research continued to support industrial development, agriculture development, resource conservation, and public health. The rapid growth of industrial R&D during this decade created new opportunities for cooperation between the government and private industry, much of which was centered in the Department of Commerce.

The next major stimuli to federal R&D were the programs of the second "New Deal" beginning in 1935. Attempts to solve major social and economic problems of

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[2] The Lewis and Clark expedition is considered research since one of its primary mission was to gather and record data on the natural history, geography and inhabitants of the region, and to report back to the President and the Congress. op. cit., Dupree, p. 27.

[3] The National Academy of Sciences was chartered by Congress in 1863 to advise the Congress and the Administration on scientific matters.

the period created many new research opportunities and sources of support. In particular, research in health expanded as federal funding to the Public Health Service increased as part of the Social Security Act. One result was the growth of the National Institutes of Health (NIH) established in 1931. In 1937, the Congress authorized the National Cancer Institute which resulted in further expansion of the NIH.

Post-World War II

The history of federal R&D policy prior to World War II demonstrated a growing belief by many decisionmakers that R&D could be an important element of public policy to improve the nation's standard of living and promote national security. The war itself, however, greatly enhanced this belief. During the early years of the war, just prior to the entrance of the United States, President Roosevelt set up a research establishment, the Office of Scientific Research and Development (OSRD), to coordinate R&D efforts in support of the war. The culmination of this activity was the Manhattan District, which developed the first nuclear weapons.

Yet, even before the successful completion of the atomic bomb, the nation set itself on a path to develop an expanded R&D structure after the war. On November 17, 1944, President Roosevelt asked Vannevar Bush, then director of OSRD, to advise him on how the wartime experience with R&D could be applied in peacetime. The report was delivered to President Truman in July, 1945.[4] The findings of the report argued that new knowledge developed by scientific research was essential for improving many aspects of the nation's well being, primarily health, economic growth, and national security. Further, the report stated that the government had an important responsibility to support both scientific research and the training of new scientific talent. The principal recommendation of the report was the establishment of a central research funding agency, the National Research Foundation, to implement those responsibilities.

After considerable debate about the administrative arrangement of the new agency, the National Science Foundation (NSF) was established in 1950. The NSF did not have the broad research mandate envisioned in the Bush report, but it did have a charter for funding basic research, primarily at the nation's universities, in a number of fields. In addition, other federal agencies that had been funding R&D begin a period of rapid expansion. In the early 1950s, the largest of these were the Department of Defense, created in 1949, and the Atomic Energy Commission, created in 1948.

Figures 1 and 2 show the history of federal R&D funding since 1950 in constant, 1998 dollars. The first figure shows the breakdown by defense R&D and total civilian R&D while the second figure shows the distribution of civilian R&D by major function. Tables giving funding data are in the appendix.

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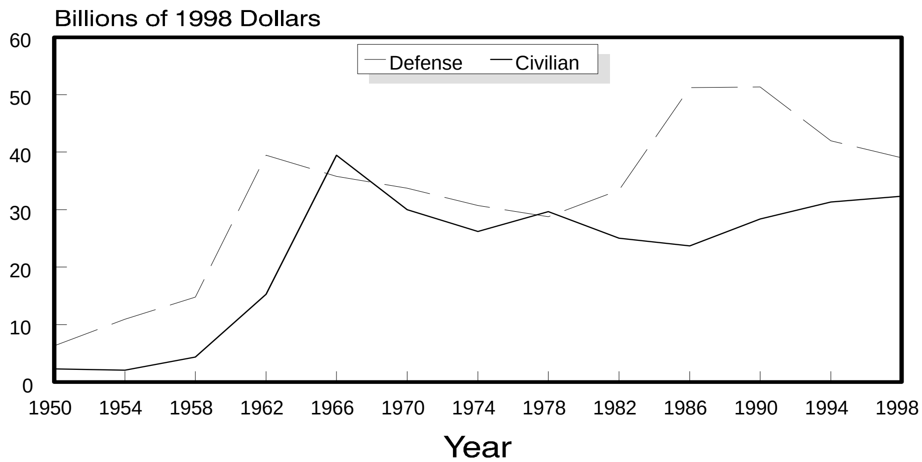
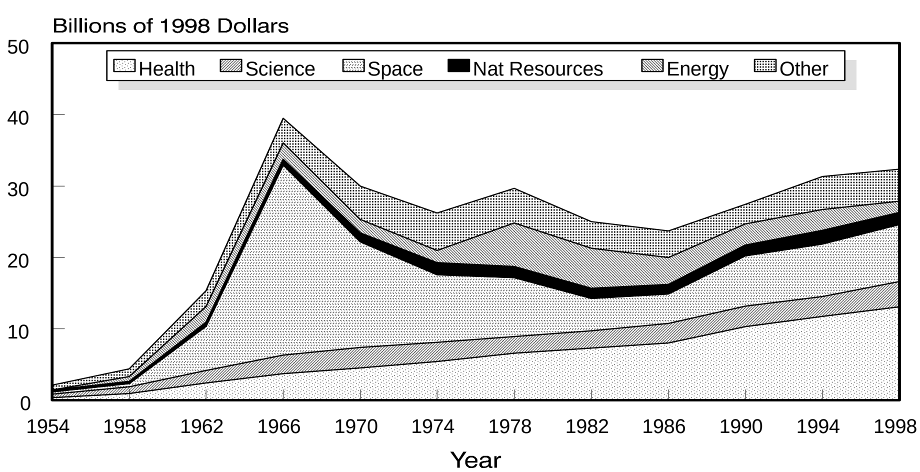
[4]Vannevar Bush, *Science: The Endless Frontier; A Report to the President on a Program for Postwar Scientific Research*, (Washington, D.C.: Reprinted by National Science Foundation, 1960),3. Originally published November 1944.

Figure 1. Civilian and Defense R&D Outlays: 1954-1998



Source: Office of Managment and Budget

Figure 2. Civilian R&D Outlays by Function: 1954-1998



Source: Office of Management and Budget

Both the Department of Defense and the AEC saw substantial budget growth during the late 1950s in response to the Cold War. The AEC was given responsibility for developing and maintaining the nation's nuclear weapons stockpile. In addition to weapons research, the Commission also assumed primary support of nuclear and high energy physics, along with a variety of other civilian research areas connected with nuclear energy and radiation. Health research also grew as the Nation became committed to a strong research component to support both public and private health care goals. Nearly all of that research was funded by the National Institutes of Health, although both the AEC and the NSF supported basic research in the biological sciences.

In the 1960s, research priorities shifted somewhat with the start of the space program driven largely as a response to the launch of Sputnik in 1957. Foremost were the establishment of the National Aeronautics and Space Administration (NASA) and the decision to put a man on the moon by the end of the 1960s, the Apollo project. By the end of the decade, NASA had become the second largest R&D funding agency after DOD. Total R&D funding peaked in 1964. In constant dollar terms, it reached a level not exceeded until the 1990s. Total R&D funding was 35% of the discretionary portion of the federal budget, a level that has not been approached since. After that peak, funding begin to fall off. A major reason was that the Apollo project funding began to decline sharply after reaching its peak in 1966. Budget pressures created by the buildup of the war in Vietnam and the beginning of several large entitlement programs, particularly Medicare and Medicaid, also contributed to this flattening.

In the 1970s, however, R&D funding once again started to grow as a result of federal policy actions in three areas. First, the oil embargoes of 1973 and 1979 stimulated a large increase in energy R&D. After the first embargo, energy research was concentrated in a new agency, the Energy Research and Development Administration (ERDA). That agency also assumed all the R&D functions of the AEC. In 1978, ERDA was replaced by the newly formed Department of Energy, placing its R&D responsibilities at the cabinet level. The second policy action was the launching of the war on cancer in 1971. That step resulted in a major buildup on R&D at the NIH for the first half of the decade. Finally, at the end of the decade the Carter Administration begin a major buildup in the Nation's defense capabilities because of increased concerns about the Soviet Union. As a consequence, R&D spending by the Department of Defense began to grow rapidly. At the same time, however, civilian R&D begin to decline in constant dollar terms as the buildup in energy R&D came to an end and NASA funding begin to fall sharply. Whereas federal civilian and defense R&D funding had been about the same since 1966, in 1978 they begin to diverge.

This divergence, which grew rapidly in the 1980s, was pushed along by another shift in R&D policy, again reflecting changes in broader policy objectives. The military buildup continued with an even greater emphasis on technological superiority. This result is reflected by a very rapid increase of DOD R&D. Another objective was the Reagan Administration's desire to reduce federal involvement in the nation's economy. A consequence of this was a significant reduction in support of civilian R&D that appeared to be aimed at developing products or processes that were deemed to have commercial potential. According to the Reagan Administration, such research was best left to the private sector. The major effect of these actions was a substantial reduction in energy-related research at the Department of Energy. As a result of these two policy actions, funding for defense R&D constituted 61% of all federal R&D by 1988 compared to 45% in 1980.

In the mid-1980s, the appearance of AIDS also resulted in a rapid increase in health R&D. Nearly all of this work was supported by NIH as federal public health policy assigned a major role to research as part of its response to the disease.

In the late part of the 1980s through the start of the Clinton Administration, the federal government shifted policy on funding R&D that directly supported development of new or improved technologies and processes with potential commercial applications. Support for this policy shift originated in the Congress. A significant expansion of funding took place of joint government-private sector projects, such as the Advanced Technology Program in the National Institute of Standards and Technology (NIST). The principal agencies involved in these efforts were NIST, the Department of Energy and the Department of Defense. Within DOE, programs in applied energy technology development began to receive more money, and greater emphasis was placed on technology transfer activities, particularly at the National laboratories. A principal tool of the latter was the Cooperative Research and Development Agreement (CRADA), which allowed the private sector and federal government researchers to join together on a project of potential benefit for the private partner(s). Most CRADAs supported by DOE involved researchers and facilities at the DOE National laboratories. In DOD, dual-use technology development — technologies with both civilian and defense applications — was emphasized, both to expand the commercial manufacturing base for producing military products and to help exploit military technology for civilian purposes. While the dollar amounts of all of these programs were small compared to total federal R&D funds, they signified a definite shift in the willingness of the federal government to support of technology development with commercial applications.

Basic Research Since World War II

Support for basic research was one of the principal goals of expanded federal support of R&D that began at the end of World War II. Indeed, as described above, just such support was one the principal recommendations of the Bush report. As a consequence, acceptance of the federal government's role as the principal supporter of basic research has been one of the few constants in federal R&D policy over the last 50 years. That research policy also emphasized that federally funded basic research should be conducted primarily in the Nation's research universities. The National Science Foundation, which emerged from those policy decisions, directed its funding primarily at those universities.

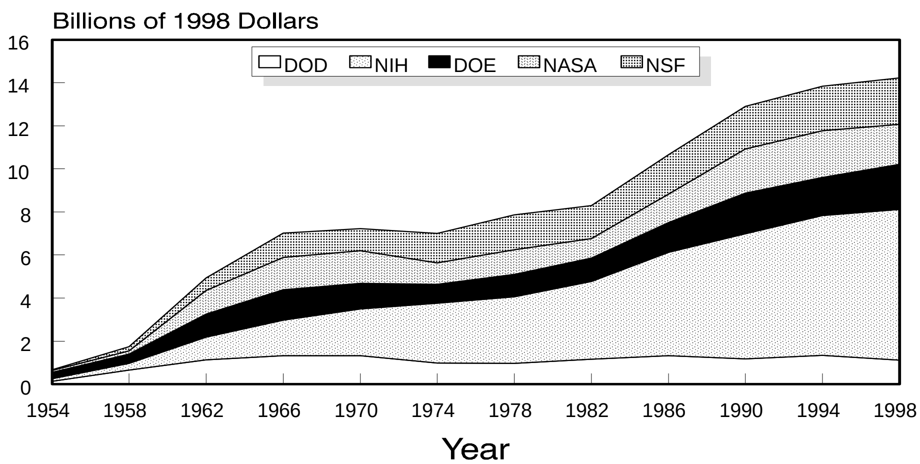
Federal support of basic research, however, did not begin with the establishment of NSF. Immediately after the war the military services, the Atomic Energy Commission, the Public Health Service (through the National Institutes of Health), and National Advisory Committee for Aeronautics (the predecessor agency to NASA) provided most of the basic research funds from the federal government. These agencies (including the Department of Defense after 1948 and NASA after 1958) remained the principal federal supporters of basic research through much of the 1950s. The NSF did not become an important player until about 1957.

While DOD and AEC basic research was carried out primarily at agency funded laboratories, the majority of that supported by NIH and NSF was performed by the Nation's research universities. By the end of the 1950s, universities had become the largest single performer of federally funded basic research.

These five agencies — DOD, AEC(now DOE), NSF, NASA, and NIH — have remained the major supporters of basic research to this day. Funding from the AEC was taken over by the Energy Research and Development Administration and finally the Department of Energy (DOE) during the 1970s. Figure 3 shows the funding history of these agencies over the period 1952 to 1994 in current dollars. The two agencies with the highest growth rate over this period, NIH and NSF, now rank first and second in federal support of basic research. Actual funding data appear in the Appendix.

The dominance of the nation's universities among all performers of basic research also has grown since the end of the 1950s primarily due to the high percentage of support flowing to universities from NIH and NSF. Since much of the

Figure 3. Basic Research Obligations by Agency: 1954-1998



Source: National Science Foundation

basic research funded by DOD, DOE, and NASA went to their respective laboratory systems, federal labs — both those directly administered by the agencies and those classified as Federally Funded Research and Development Centers[5] — also captured a growing fraction of the nation's basic research enterprise.

The trends in basic research support since the early 1950s reflect both the original policy statements set forth after World War II, and the recognition of the importance of basic research to the missions of science and technology agencies. Only NSF has funded basic research primarily for the sake of creating new knowledge in general. In addition, a principal function of NSF research support has been for training scientists and engineers. The scientific research funded by the other

[5] Federally Funded Research and Development Centers (FFRDCs) are organizations that perform R&D and that receive most or all of their funds from the federal government. The centers are administered by a private firm, university, or nonprofit institution under contract with the agency.

agencies has been primarily directed at creating new knowledge in specific areas vital to the mission of the agency. In some cases, expansion of scientific knowledge has been sought as part of the process leading to attainment of the agencies' goals. For example, in NIH, research in biological science is carried on in order to help develop treatments for and prevention of various diseases. In other cases, the output of the basic research is an end itself. At NASA, space science research is carried out to enhance our understanding of the regions beyond the Earth's atmosphere, and notnecessarily to support space exploration or development. In the case of DOE, the function of basic research it supports has been a combination of the two.[6]

Federal R&D - Current Status[7]

Over the past few years, federal R&D policy has entered a period of intense scrutiny by policy makers in the Administration and Congress. The primary reason has been the efforts to balance the budget. The budget resolutions adopted by Congress for FY1996, FY1997, FY1998, and by the House and Senate for FY1999, and the President's budget requests starting in 1996 have projected declining outyear discretionary spending in constant dollar terms. Also, the balanced budget agreement reached between Congress and the President in 1997 calls for declining federal discretionary spending in constant dollar terms through 2002. If the portion of such spending going to R&D remains fixed over that period, all of these actions project substantial decline in federal R&D funding in constant dollar terms.

Those forecasts have caused great concern among the nation's research community. Thus far, however, those concerns appear to be somewhat unjustified. As seen in Figure 4 (next page), which compares the actual appropriations with the those forecast by the congressional budget resolutions, when the fiscal year actually arrived, Congress thus far has consistently appropriated more funds for R&D than was projected in the years prior to the fiscal year in question.[8] The increases for FY1996 and FY1997 were a result of Congress appropriating more money for domestic discretionary spending — even when adjusted for inflation — than had been projected. For FY1998, Congress also increased the portion of such funds going to R&D. The percentage of domestic discretionary funds going to R&D jumped from 12.7% in FY1997 to 14.4% in FY1998. For FY1998, federal funds for

[6] Since this report was first issued in 1995, the concept that basic research can have different objectives has been generalized. Most notably, Donald Stokes proposed that basic research can be classified as curiosity-driven or use-driven. The former is pure research for the creation of new knowledge for its own sake. The latter is research driven by a desire to solve a practical problem. See, Donald Stokes, *Pasteur's Quadrant: Basic Science and Technological Innovation* (Washington, DC: Brookings Institution Press, 1997).

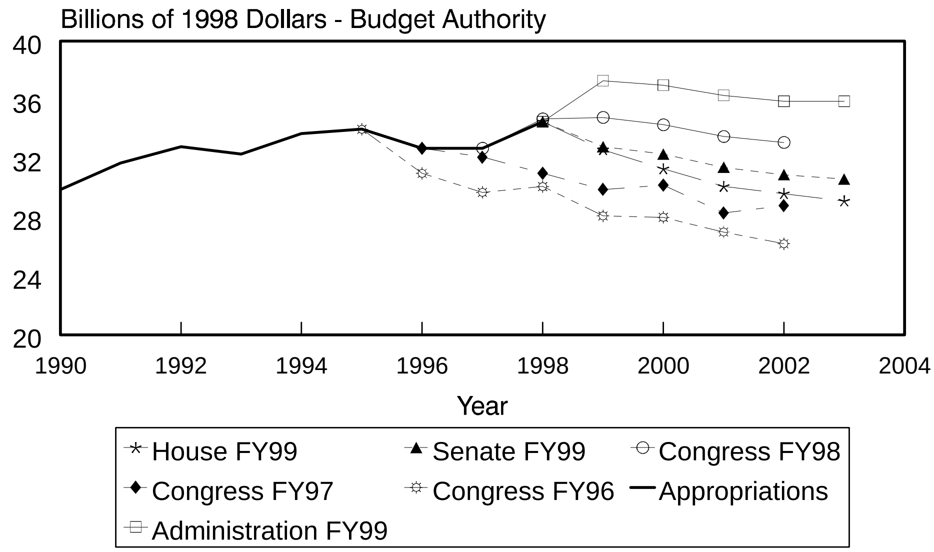
[7] For a more detailed discussion of the current status of federal R&D funding see; Congressional Research Service, *Research and Development Funding: Fiscal Year 1999,* by Michael Davey, CRS Issue Brief 98011, regularly updated.

[8] A similar analysis has been carried out by the American Association for the Advancement of Science. Kei Koizumi, "R&D Trends and Special Analysis", in *AAAS Report XXIII: Research and Development. FY1999,* Intersociety Working Group (Washington, DC:American Association for the Advancement of Science, 1998), 35-36.

civilian R&D increased in constant dollar terms, which continued a trend going back to 1986.

The Congress now appears to consider the funding of civilian R&D an

Figure 4. Civilian R&D - Projections and Appropriations Comparison



important budget priority. Another sign of that support has been the introduction of legislation calling for continued increases in civilian R&D. The most recent is S. 2217, the Federal Research and Development Act, which calls for a doubling of federal support for civilian R&D over the next 12 years. That bill was recently passed by the Senate Commerce Committee.

Another factor driving the current R&D policy debate has been a shift by Congress since the Republicans assumed control in 1995 in what it considers acceptable R&D for federal support. Since that time, Congress has approved funding for technology development programs, such as the Advanced Technology Program and DOE applied energy R&D programs, significantly below the Administration's request. The congressional majority has argued that such programs are the responsibility of the private sector and federal funding of such research constitutes unwarranted interference in the market place.

This shift appears to be a component of a larger issue as to just what is the proper role for the federal government in the support of research and development. Along with the prospects of substantially lower resources for R&D, the emergence of that issue energized many in the scientific community and spawned a number of studies about the future of federally funded R&D and U.S. science policy.[9] Currently, a major effort to develop a new science policy is underway in the House Science Committee led by Representative Ehlers. The goal is to provide a vision for science policy that will guide the nation for the next several decades much as the Bush report provided the framework for U.S. science policy since World War II. It is the intent of the committee to have the final statement adopted as a congressional resolution.

Outlook

Total federal R&D funding has grown dramatically since the end of World War II, although, with the exception of basic research, the growth has been anything but smooth. Furthermore, there have been notable shifts in emphasis within the R&D portfolio. These shifts have been the result of major additions to that portfolio and changes in the proportion of funds going to defense and civilian R&D. In addition to the growth in total funding, there has been growth in the number of federal agencies funding R&D. Currently, 33 federal agencies support R&D at some level compared to about 17 in 1952.

Despite the recent upturn in federal R&D funding and the apparent high level of support it enjoys with the Congress and Administration, the future is still problematical. Even though the federal government is enjoying a large budget surplus that is likely to grow substantially in coming years, there remain tight constraints on spending. The Budget Enforcement Act signed into law last year puts caps on discretionary spending that will not allow any significant growth until at least 2003. The effect of this Act is shown clearly in Figure 4. The budget resolutions approved by the House and Senate each project R&D funding, in constant dollar terms, to decline through 2003 at least, and to fall below those based on the congressional budget resolution for FY1998 approved in 1997. The caps have resulted in a reversal of the trend from 1995 that saw each succeeding budget resolution approve a higher level of domestic discretionary funds.

Further, the House and Senate FY1999 projections are well below those based on the Administration's FY1999 budget request. While both the Administration and Congress are operating under the same budget capes, the Administration included funds from the proposed tobacco settlement, which allowed a significant increase in proposed discretionary budget authority for 1999 to 2002 above the caps, nearly all of which went to domestic discretionary spending. The Senate's version of the FY1999 budget resolution adhered to the caps, and the difference between its outyear projections in Figure 4 and the Administration's represents the added tobacco money. The failure of that settlement to date means that those funds are not available. In addition, even if a settlement is approved by Congress, there is no guarantee that any funds will go for domestic discretionary spending. The House's version went below the caps resulting in even greater gap between it and the Administration.

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[9] For a review of several of those studies, see, Congressional Research Service, *Analysis of Ten Selected Science and Technology Policy Studies*, coordinated by William C. Boesman, CRS Report 97-836, 24 October 1997.

Therefore, increases in civilian R&D funding will likely have to come from reductions in other domestic accounts. Appropriations action thus far suggests that Congress is willing to do this to some extent.[10] In addition, the Senate adopted a resolution during debate on its version of the FY1999 budget resolution that states that adoption of the budget resolution will not prevent attaining the goals laid out in S. 2217. Nevertheless, as long as Congress and the Administration adhere to the budget caps, the pressures are likely to mount and continued increases for civilian R&D funding will be more and more difficult to achieve.

In addition to the budget pressures, the debate over what is appropriate R&D for the federal government will likely continue, affecting priorities for R&D funding. The least controversial aspect of federal science policy is federal support of basic research. As a result, it appears that basic research will become a greater fraction of total federal civilian R&D funding. Among the various functions, health research is likely to continue to take a larger share of the federal R&D dollar, while the energy and space research share will probably decline. Finally, there likely will be closer scrutiny of the actual research being funded and its relationship to the missions of the agencies doing the funding.

[10] In the FY1999 Labor and HHS Appropriations bill, the House Appropriations Committee recommended elimination of the Low Income Home Energy Assistance Program and using the $1.1 billion savings for, among other things, health research.

Appendix - R&D Funding Data

This appendix presents the detailed data from the graphs appearing in the text. All dollar amounts are in current dollars.

Table A-1. Total Federal R&D Outlays - 1950-1998
(billions of dollars)

Year	Defense		Civilian		Total	
	Actual	1998 $	Actual	1998 $	Actual	1998$
1950	0.77	6.33	0.28	2.31	1.05	8.64
1954	1.55	10.94	0.30	2.10	1.85	13.04
1958	2.46	14.78	0.73	4.38	3.19	19.16
1962	7.09	39.50	2.75	15.30	9.84	54.80
1966	7.10	35.81	7.82	39.46	14.92	65.78
1970	8.02	33.71	7.13	29.97	15.15	63.68
1974	9.41	30.70	8.03	26.20	17.44	56.90
1978	12.08	28.78	12.46	29.68	24.54	58.46
1982	19.81	33.38	14.85	25.02	34.65	58.40
1986	35.66	51.25	16.48	23.70	52.14	74.95
1990	41.08	51.34	22.73	28.41	63.81	79.75
1994	38.06	41.97	28.40	31.32	66.46	73.29
1998	39.02	39.02	32.35	32.35	71.37	71.37

Source: Historical Tables: Budget of the United States Government, FY1999

Table A-2. Federal Civilian R&D Outlays by Function
(millions of dollars)

Year	Function					
	Health	Science	Space	Nat Res	Energy	Other
1954	51	68	48	38	-	92
1958	157	157	72	54	109	180
1962	434	315	1,112	100	397	389
1966	738	515	5,275	160	452	681
1970	1,073	685	3,518	301	451	1,104
1974	1,658	831	2,900	511	525	1,603
1978	2,764	975	3,454	675	2,542	2,045
1982	4,341	1,421	2,697	838	3,330	2,224
1986	5,574	1,909	2,863	924	2,622	2,593
1990	8,253	2,304	5,624	1,220	2,342	2,191
1994	10,628	2,442	6,663	1,747	2,654	4,163
1998	13,069	3,549	7,975	1,734	1,527	4,501

Notes: Health R&D funding is primarily within the National Institute of Health. Science R&D funding includes NSF and the general science program of DOE. Space R&D funding is primarily within NASA. Natural Resources (Nat Res) includes funding from the Department of Interior, DOE, and the Department of Commerce. Energy R&D funding is all within DOE. The major components of the other category are Agriculture (Department of Agriculture), Environment (DOE and the Environmental Protection Agency), and Transportation (Department of Transportation and NASA).
Source: National Science Foundation.

Table A-3. Federal Civilian R&D Outlays by Function
(millions of 1998 dollars)

Year	Function					
	Health	Science	Space	Nat Res	Energy	Other
1954	360	480	339	268	0	649
1958	944	944	433	325	655	1082
1962	2,418	1,755	6,194	557	2,212	2,167
1966	3,724	2,599	26,617	807	2,281	2,167
1970	4,509	2,879	14,785	1,265	1,895	4,640
1974	5,411	2,712	9,465	1,668	1,713	5,232
1978	6,587	2,324	8,231	1,609	6,058	4,873
1982	7,314	2,394	4,544	1,412	5,611	3,747
1986	8,012	2,744	4,115	1,328	3,769	3,727
1990	10,315	2,880	7,029	1,525	2,927	2,738
1994	11,721	2,803	7,348	1,927	2,927	4,591
1998	13,069	3,549	7,975	1,734	1,527	4,501

Notes: See Table A-2.
Source: National Science Foundation.

Table A-4. Basic Research Obligations - 1954-1998
(millions of dollars)

Year	DOD		NIH		DOE		NASA		NSF	
	Actual	1998$	Actual	1998 $	Actual	1998$	Actual	1998$	Actual	1998$
1954	20	141	17	121	40	285	14	97	5	32
1958	111	667	50	298	72	433	14	154	33	197
1962	204	1,136	190	1,061	192	1,067	196	1,093	104	579
1966	262	1,324	326	1,647	281	1,417	299	1,509	222	1,123
1970	317	1,332	513	2,156	287	1,205	358	1,502	245	1,030
1974	303	989	850	2,775	270	880	306	998	415	1,322
1978	410	978	1,292	3,080	440	1,050	480	1,143	678	1,616
1982	689	1,160	2,144	3,613	642	1,082	536	903	916	1,543
1986	924	1,328	3,339	4,799	960	1,380	917	1,318	1,275	1,833
1990	948	1,184	4,649	5,811	1,504	1,881	1,637	2,046	1,586	1,983
1994	1,222	1,348	5,884	6,489	1,603	1,768	1,964	2,166	1,871	2,063
1998	1,117	1,117	7,004	7,004	2,096	2,096	1,858	1,858	2,147	2,147

Source: National Science Foundation.