The U. S. R&D Enterprise – Status and Future Trends

H. Norman Abramson
Retired Executive Vice President
Southwest Research Institute

The U. S. R&D enterprise is complex and has undergone a fundamental change from a federal based national effort following WWII to the diverse global one of the present. To understand the characteristics of this system and its future trends, one must be aware of who develops the new technologies that are its driving purpose, under what circumstances and funding resources, and the availability of these new developments to industrial users. Taken together, the overall process is known as technology transfer. This lecture will outline the broad character and important role of technology transfer in the U. S., as well as some differences between national efforts (especially the U. S. and Germany). A brief discussion of some of the changes that might affect relationships between science, engineering, and society in the decade ahead will conclude the talk.

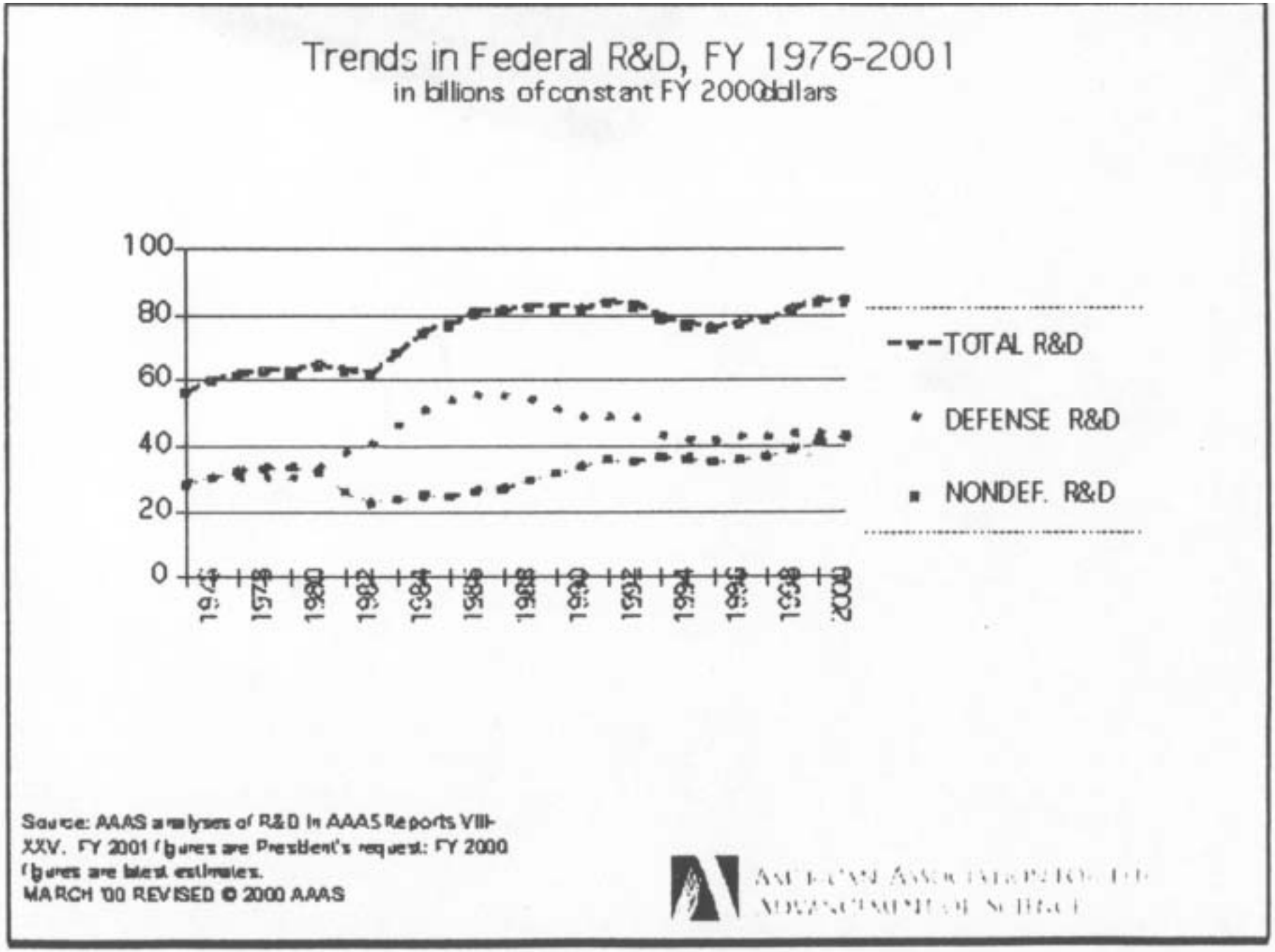


Figure 1 Trends in Federal R&D, 1976-2001

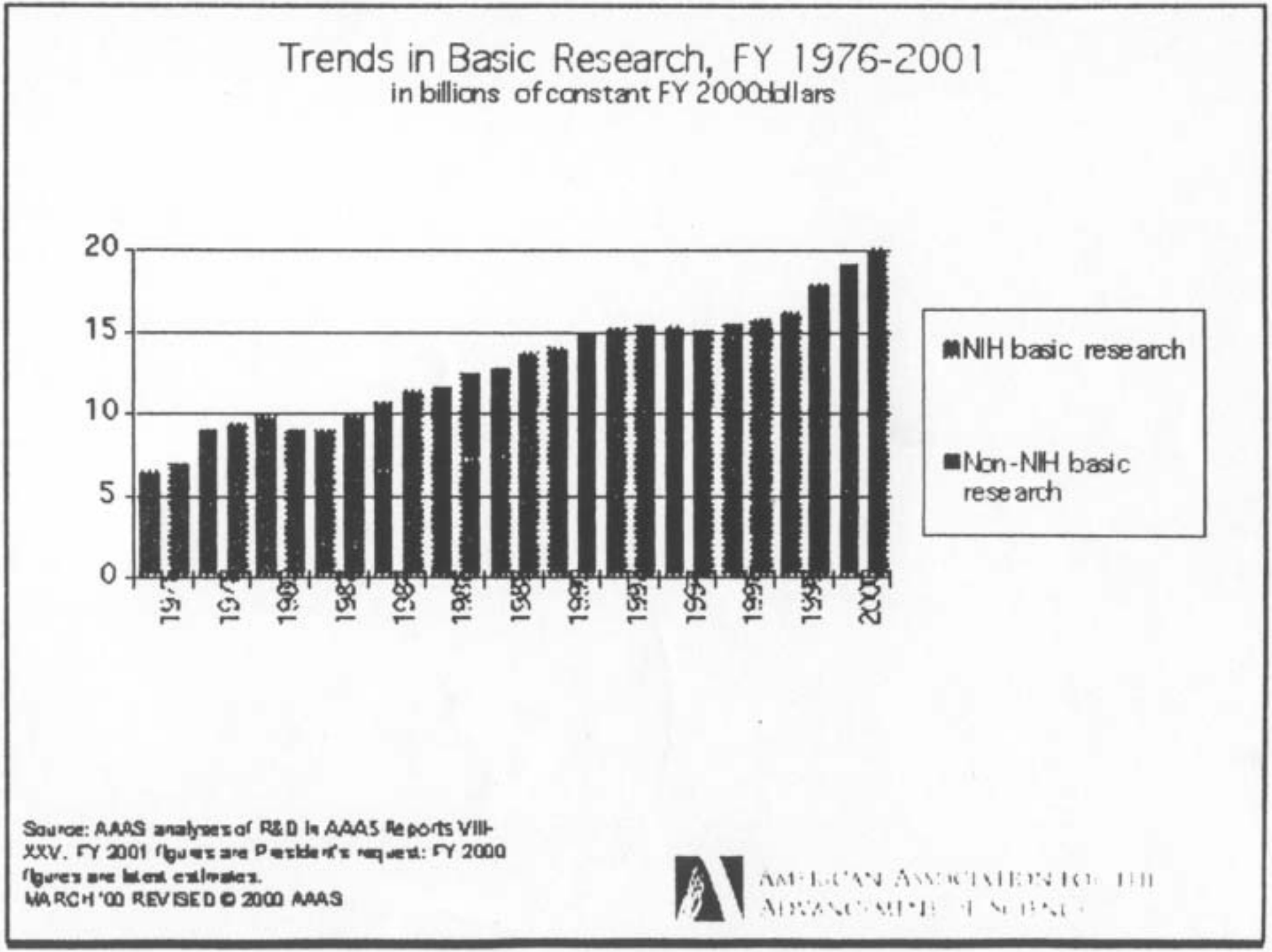


Figure 2 Basic R&D Trends, 1976-2001

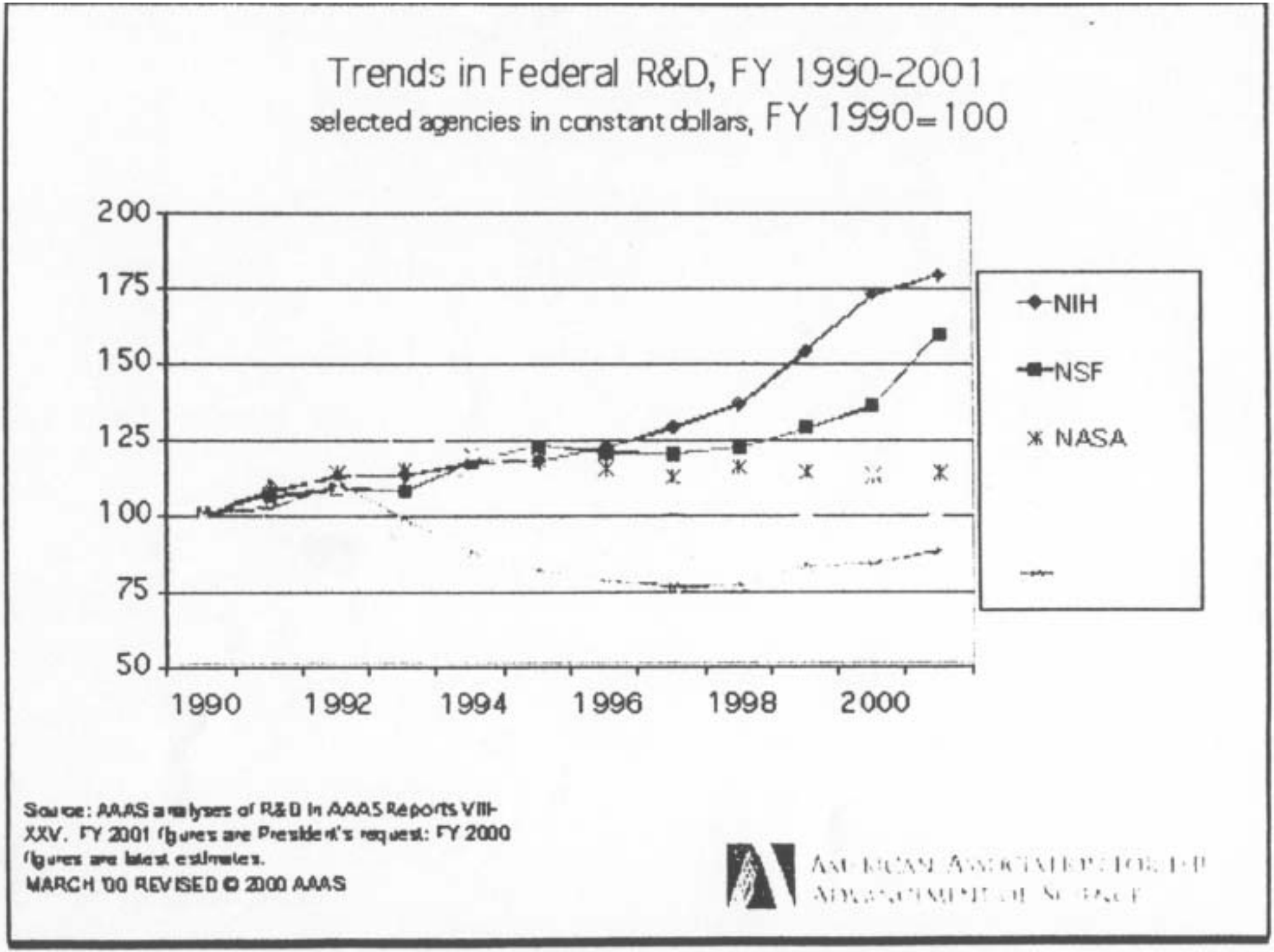


Figure 3 Trends in Federal R&D, 1990-2001

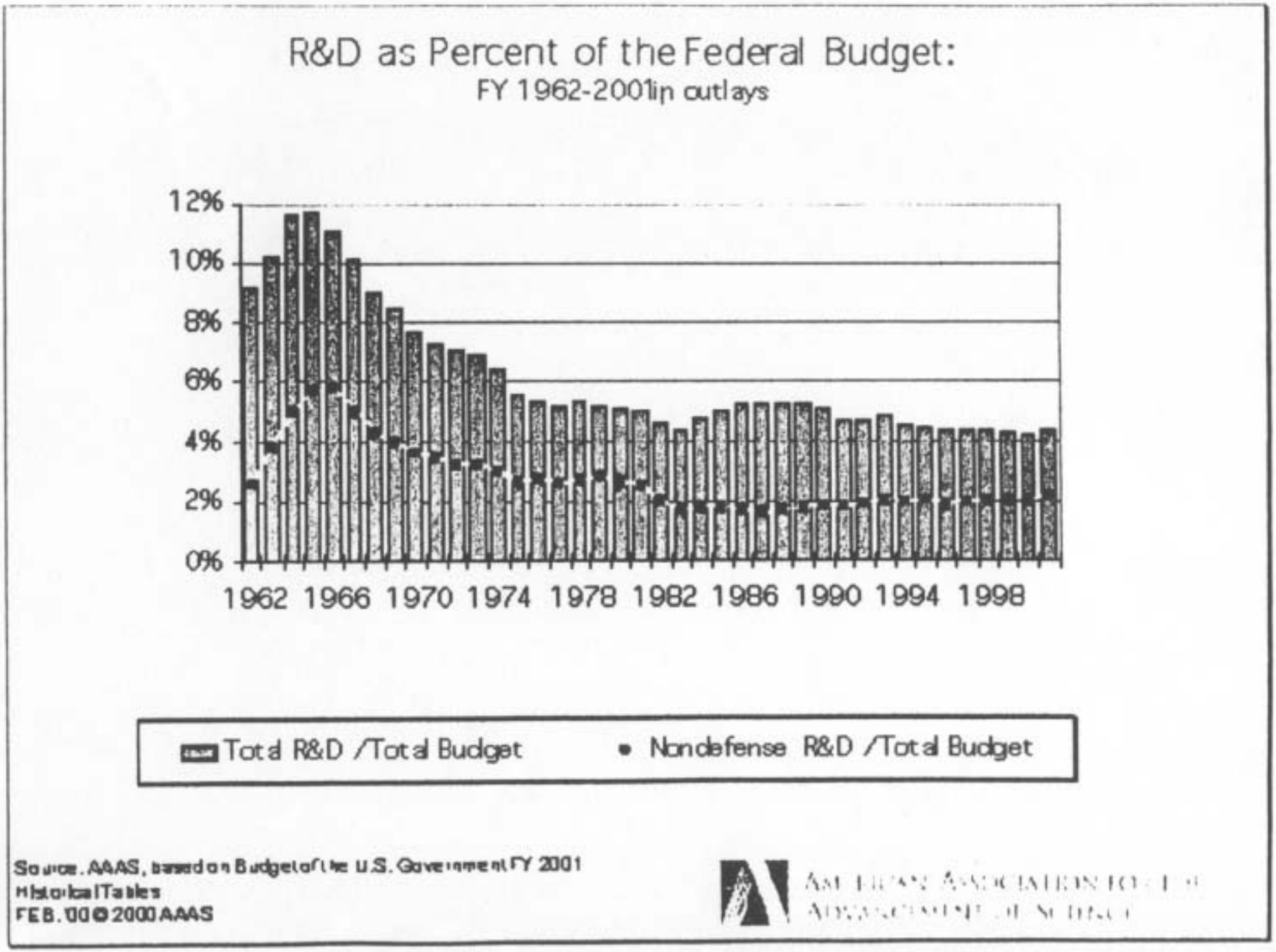


Figure 4 R&D as a Percent of Federal Budget

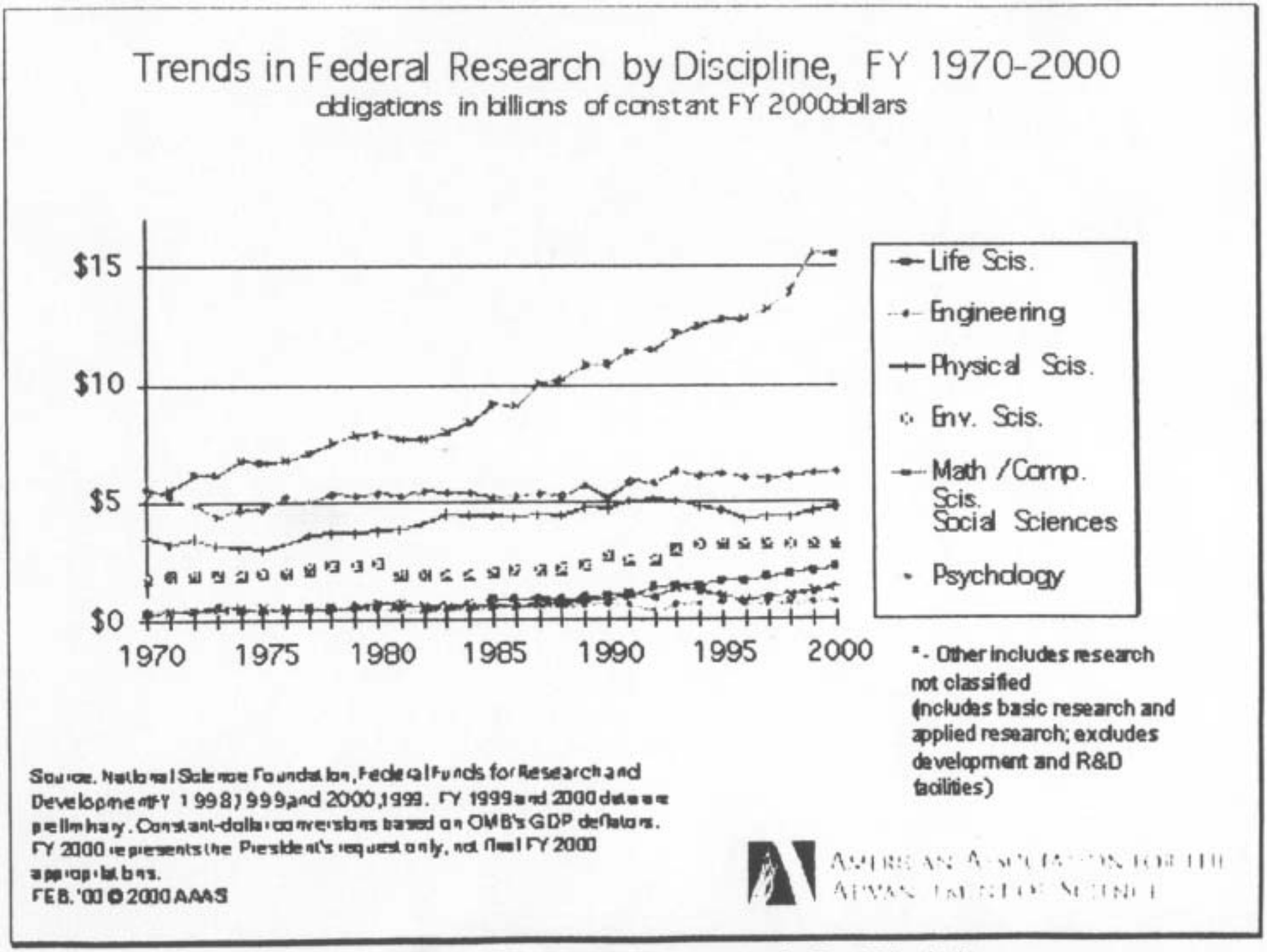
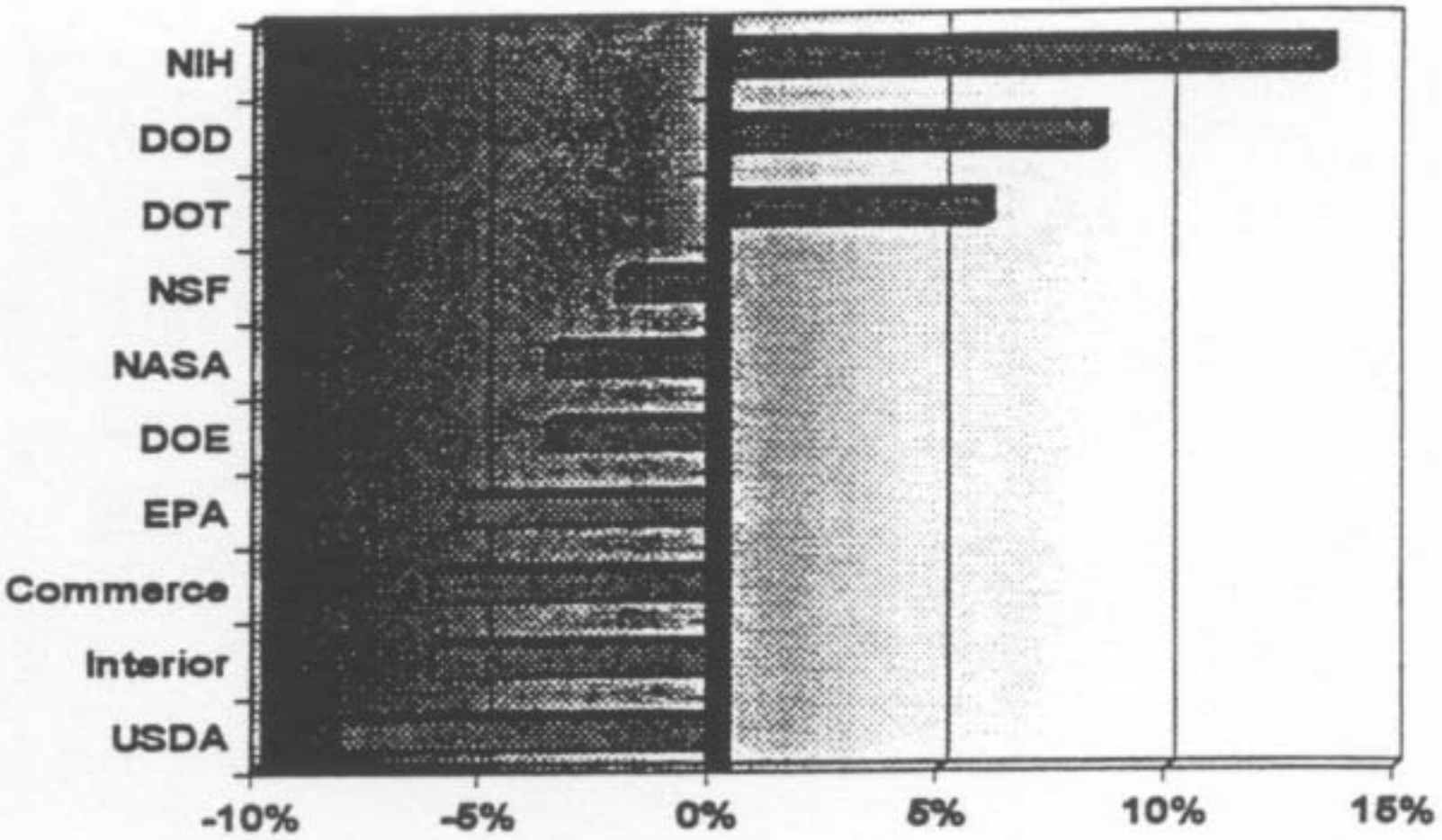


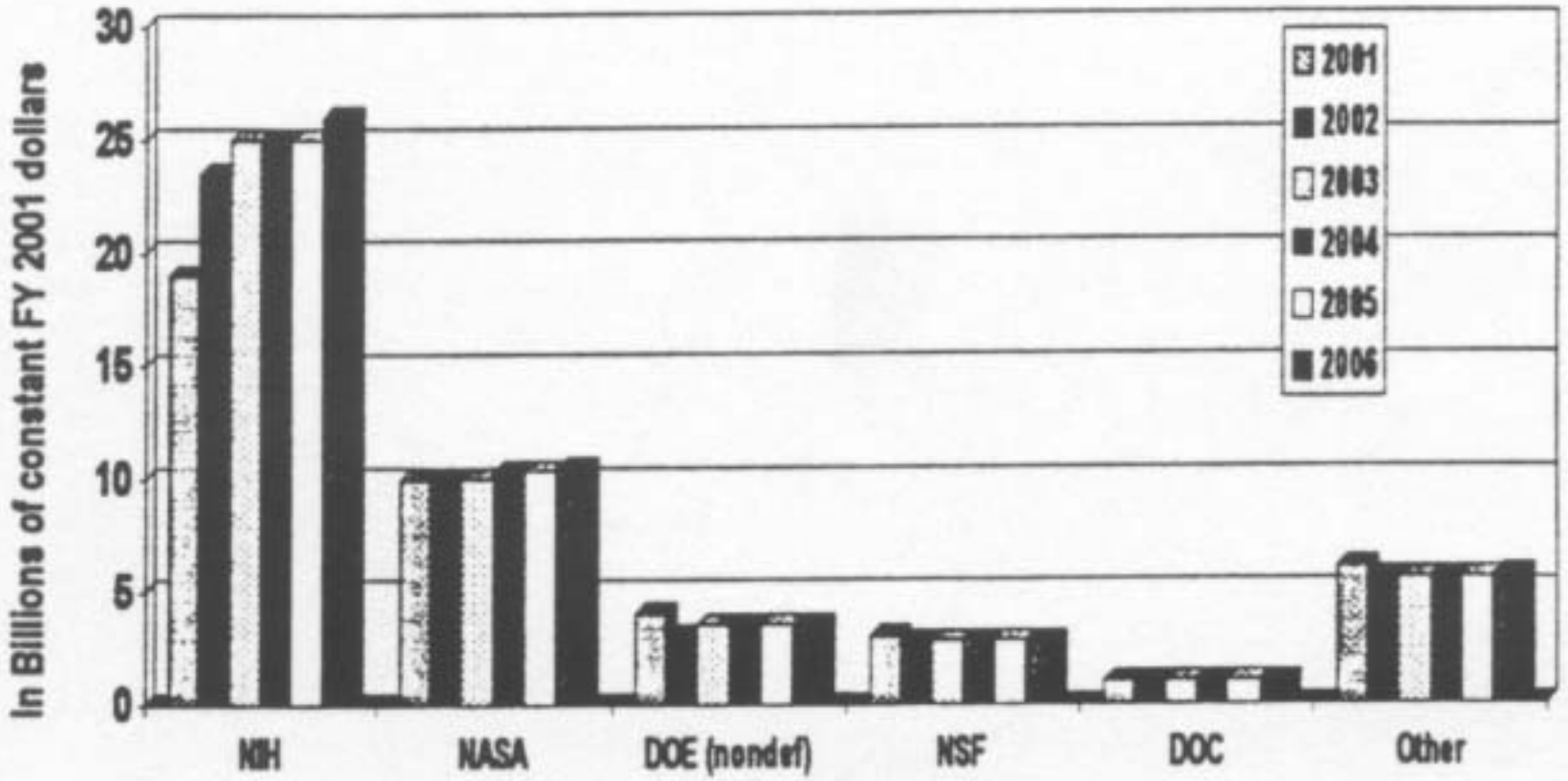
Figure 8 Trends in Federal Research By Discipline

FY 2002 R&D Request

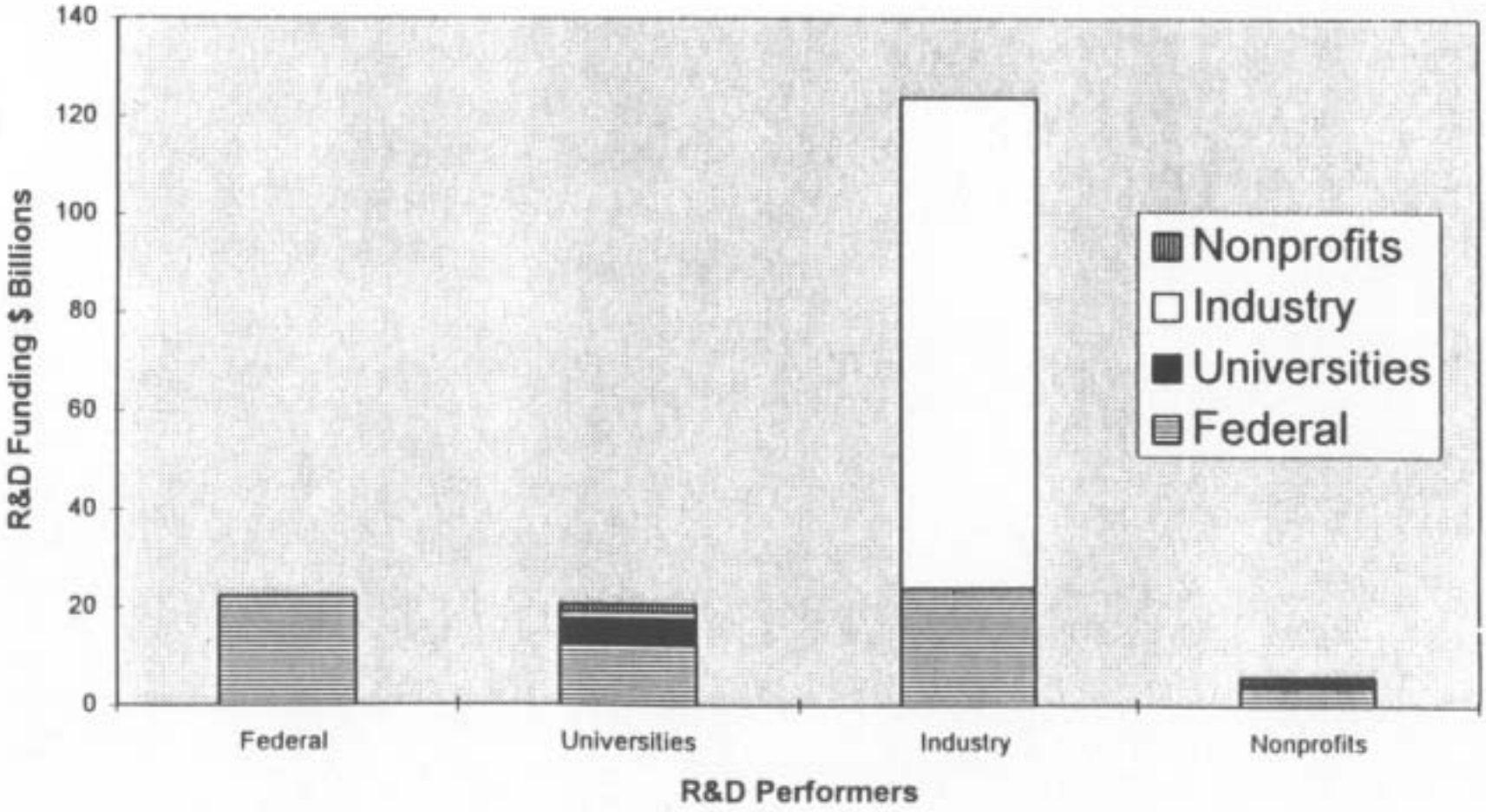
Percent change from FY 2001



Projected Non-defense R&D



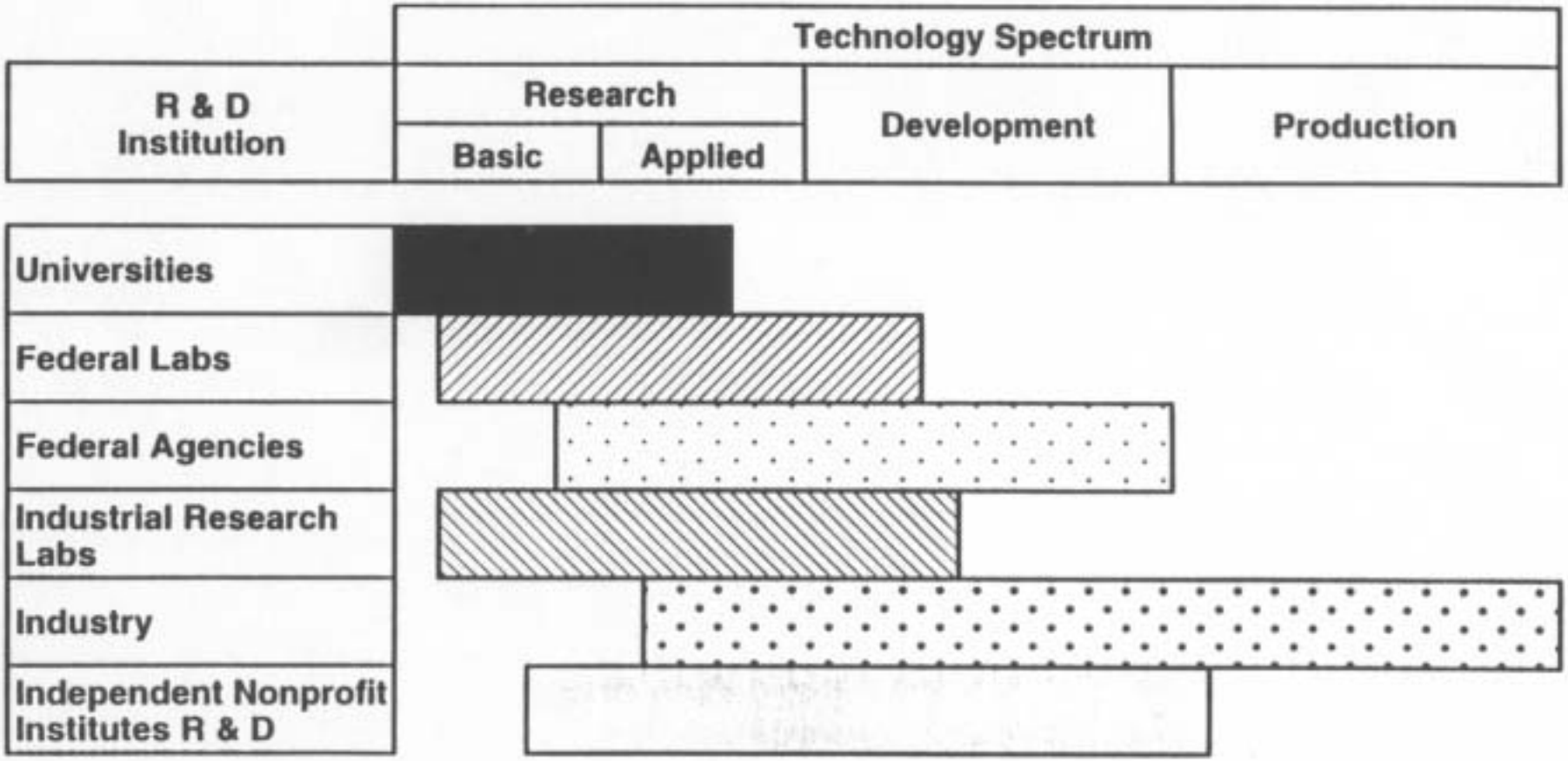
U.S. R&D Performers and Fund Sources, 1994



Source: NSF/AAAS

Federal column includes FFRDCs

R & D INSTITUTIONS IN THE TECHNOLOGY SPECTRUM



Southwest Research Institute

Major Distinguishing Characteristics of National R&D/Technology Transfer Enterprises

Germany

- *Enterprise stable, structured, homogeneous within sectors.*
- *Institutions national, differentiated by industry and technology area, interconnected.*
- *Limited intersector mobility of researchers; tighter inter-institutional linkages.*
- *Barriers linked to regulation of civil service, public employment*

United States

- *Enterprise highly diversified, less coordinated, more flexible, and more rapidly evolving.*
- *Large number of highly distributed, autonomous and weakly coordinated organizations.*
- *Significant inter- and intra-sector mobility of researchers.*
- *Public policies and private strategies: few barriers, and many incentives and opportunities.*

Major Distinguishing Characteristics of National R&D Technology Transfer Enterprises (Cont'd)

Germany

- *Enhanced cross-institutional communication and learning.*
- *Rapid incremental innovation and diffusion in techn. stable industries.*
- *Stable composition of industrial production and R&D base.*

United States

- *Greater flexibility in reacting to changing conditions.*
- *Perpetual opening up of new technological frontiers and industries.*
- *Major shifts in composition of industrial production and R&D.*

Government Role in Civilian Industrially Relevant Applied R&D and Technology Transfer

Germany

- Public R&D portfolio widely distributed over missions and industrial sectors
- Civilian technology major focus of public R&D spending.
- Support of technology diffusion and use extensive.
- TT of publicly funded R&D institutions focussed on particular industries & technical fields.

United States

- Public R&D portfolio concentrated in defense and health (& associated industrial sectors).
- Civilian technology minor focus of public R&D spending.
- Support of technology diffusion and use limited, except in biomed.
- TT of publicly funded R&D institutions focussed on broader population of industries, geographic regions, multiple technical fields (biomed exception).

Roie of High-Technology Start-up Companies in Transfer and Commercialization of Fast-Moving Technologies

Weak in Germany

Contributing Factors:

- ***Weak venture capital, limited public equity markets***
- ***Unsupportive labor, company, and bankruptcy laws***
- ***Tax code and regulatory impediments***

Strong in United States

Contributing Factors:

- ***Strong venture capital sophisticated equity markets***
- ***Supportive labor companies and bankruptcy laws***
- ***Highly mobile technical workforce***
- ***Conducive public policy and private practices***
- ***Large scale and accessibility of university research enterprise***
- ***Large scale & high-tech intensity of homogeneous segments of domestic market***
- ***Large scale of federal govt. procurement***