

Appendix 1: Methodology and Data Sources

The data presented by the AAAS R&D Budget and Policy Program cover only research and development (R&D), not the entire federal budget, except as noted. Within the federal budget there is no separately identified R&D budget as such; nor are most appropriations for R&D so labeled except for certain program areas, such as defense. Consequently, most funds for R&D are not line items in an agency's budget but are included within general program funding. The Office of Management and Budget (OMB) requires agencies to submit data on R&D programs as part of their annual budget submissions. Specifically, the agencies provide data (reported on MAX Schedule C as part of the budget process) on funding levels for basic research, applied research, development, R&D facilities construction, and major capital equipment for R&D (see Appendix 2: Definitions).

R&D figures rarely correspond to budget line items as found in appropriations bills or the President's budget. Agencies make determinations as to what proportion of line items are classified as R&D; many budget line items have both R&D and non-R&D components. Agencies also differ in their reporting. Some agencies classify program direction or management support as R&D; others do not.

The R&D data presented in the tables represent the agencies' best estimates of actual and proposed federal funding for R&D collected during the winter and spring by OMB and AAAS. These figures incorporate information provided to OMB in January by nearly two dozen agencies accounting for more than 99 percent of all federal R&D, and information collected by AAAS from individual agencies after the February release of the full budget. Some adjustments to the original OMB-provided data were made during February and March 2005 to reflect agency revisions, coding errors, AAAS conversations with agency budget officials, agency budget documents, supplemental appropriations, emergency spending, and rescissions.

When year-to-year changes are expressed in constant dollars, the deflators used are the Gross Domestic Product (GDP) deflators from the *Budget of the United States Government FY 2006*, Historical Table 10.1.

Appendix I: Methodology and Data Sources

Budget statistics are presented on three bases: (1) **budget authority**, corresponding to the funds appropriated each year; (2) **obligations**, indicating the amounts of contracts and grants entered into; and (3) **outlays**, representing the amounts actually expended (see Appendix 2: Definitions). Because budget decisions in the Executive Branch and in Congress are almost always made in budget authority, this metric most accurately reflects current changes in budget policies. Outlay trends lag a year or more behind decisions in budget authority, and obligations estimates are often adjusted. We have, therefore, selected budget authority as the most meaningful measure of budget decisions.

Although this report relies mostly on OMB and agency data for R&D, it also relies on data from other sources to provide a context for the federal R&D enterprise. When these other sources are used, they are noted in tables and charts. The reader should be aware that although these sources use the same definitions of R&D as AAAS, there may be discrepancies between different data sources resulting from several factors: 1) the use of performer rather than agency surveys; 2) the use of obligations or expenditures rather than budget authority; 3) the use of a calendar year rather than the federal fiscal year (Oct. - Sept.); and 4) the use of conduct of R&D, rather than total R&D (including R&D facilities and capital equipment).

Special Note on Table I-4, “Major Functional Categories of R&D” and Table I-6, “Federal Homeland Security R&D”: All activities in the federal budget are classified into 20 broad functional categories. (AAAS separates the general science, space, and technology function into its subfunctions of General Science and Space; AAAS also classifies medical research in the Department of Veterans Affairs under Health rather than Veterans Benefits and Services.) Each function often includes programs from multiple agencies. Each R&D program is assigned to only one function, even though the R&D activity may address several functional concerns. For example, NASA’s earth sciences research is classified under the Space function, even though its R&D is also closely related to Natural Resources and Environment and General Science. Homeland security is a government mission that cuts across mission lines and encompasses many agencies outside the DHS: Table I-6 shows all federal homeland security-related R&D as identified in a special analysis conducted by OMB and revised by AAAS.

Appendix 2: Definitions

In this report, R&D refers to actual research and development activities as well as R&D facilities. These definitions are used by the Office of Management and Budget, the National Science Foundation, and AAAS.

Research is systematic study directed toward more complete scientific knowledge or understanding of the subject studied. The federal government classifies research as either basic or applied according to the objective of the sponsoring agency.

- In **basic research** the objective is to gain knowledge or understanding of phenomena without specific applications in mind.
- In **applied research** the objective is to gain knowledge or understanding necessary for meeting a specific need.

Development is the systematic use of the knowledge or understanding gained from research directed toward the production of materials; devices; systems; or methods, including design, development, and improvement of prototypes and new processes. It excludes quality control, routine product testing, and production.

R&D funding normally includes those personnel, program supervision, and administrative support costs directly associated with R&D activities. Laboratory equipment is also included. Defense R&D also includes testing, evaluation, prototype development, and other activities that precede actual production.

Funding for **R&D facilities** (also known as R&D plant) includes construction, repair, or alteration of physical plant (*e.g.*, reactors, wind tunnels, particle accelerators, or laboratories) used in the conduct of R&D (R&D facilities construction). It also includes major capital equipment used for R&D.

The allocation of agency budgets among basic research, applied research, and development is not an exact procedure; a certain arbitrariness is inevitably involved. The severe time pressures under which these figures are compiled for OMB are also a problem. Nevertheless, there is

Appendix 2: Definitions

presumably some consistency within each agency's estimates so that the trends are meaningful.

The federal R&D funding data in this report are presented in terms of **budget authority**. Budget authority is the initial budget parameter for congressional action on the President's proposed budget. Other R&D data sources may express R&D funding in terms of obligations or outlays. There are also R&D data sources that obtain funding data from funding **recipients** (companies, universities) rather than from funding **sources** (agencies).

Budget authority is the legal authorization to expend funds.

Obligations represent orders placed, contracts awarded, services received, and similar transactions during a given period, regardless of when the funds were appropriated and when the future payment of money is required.

Outlays represent checks issued and cash payments made during a given period, regardless of when the funds were appropriated or obligated. Some surveys refer to outlays as expenditures.

As an example, Congress may appropriate \$100 million to NASA in FY 2004 for an R&D laboratory. NASA may then issue contracts to build the lab and sign \$50 million of the contracts in FY 2004 and \$50 million in FY 2005. Upon completion of the lab in FY 2005, NASA may then write checks to the contractors for a total of \$100 million. Budget authority would be \$100 million in FY 2004; obligations would be split \$50 million each in FY 2004 and FY 2005; outlays would be \$100 million in FY 2005. In the federal budget process, there is normally a lag between budget authority and outlays for large capital projects and research contracts; budget authority and outlays usually occur in the same year for recurring expenses such as staff salaries.

(Definitions adapted from National Science Foundation, *Federal R&D Funding by Budget Function: Fiscal Years 2003-2005*, Arlington, VA, 2004.)

Appendix 3: Related Publications

Congressional Action on Research and Development in the FY 2005 Budget, Kei Koizumi, 2004. The AAAS analysis of final appropriations for R&D in the FY 2005 budget. Available in an online edition only at www.aaas.org/spp/rd/ca05main.htm

AAAS Report XXIX: Research and Development FY 2005, Intersociety Working Group, 2004. AAAS Publication Number 04-1A. \$19.95; \$15.96 for AAAS members. Available online at <http://www.aaas.org/spp/rd/rd05main.htm> (The previous edition of this report from April 2004.)

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Updated information on federal funding for R&D, including the complete text of this publication and the other publications listed above, is available on the AAAS R&D Budget and Policy Program home page at:

<http://www.aaas.org/spp/rd>