

Research Infrastructure in the President's 2012 Budget

A Report to Congress on Federal Investments in Research Facilities Construction and Major
Research Instrumentation

May 2011

Office of Science and Technology Policy

Executive Office of the President

(This report is submitted in fulfillment of Section 1007 of the America COMPETES Act (Public Law 110-69) to accompany the President's Fiscal Year (FY) 2012 Budget)

Summary

The President's 2012 Budget proposes to invest \$2.4 billion in research infrastructure, defined as support for research and development (R&D) facilities construction, renovation, and the purchase of major capital equipment for R&D. The current state of Federal support for research infrastructure requires consideration of the Recovery Act, which provided unprecedented, substantial investments in research facilities construction and renovation and major research instrumentation for intramural and extramural laboratory facilities. These funds have been awarded and construction is underway. These investments, when complete, are likely to significantly change the state of research infrastructure in the Nation's Federal laboratories, national user facilities, and academic institutions. The Committee on Science of the National Science and Technology Council is monitoring the progress of research facilities construction and maintenance as well as procurement of major instrumentation. The Committee's work will be informed by the results of the National Science Foundation's survey of science and engineering facilities at academic institutions, last conducted in FY 2005 but scheduled to be refreshed in 2011, which will provide a comprehensive national assessment of academic research infrastructure. The Committee's work will also be informed by ongoing dialogue between Federal agencies on the state of research infrastructure in Federal intramural and contractor-operated facilities.

Federal Investments in Research Infrastructure

As part of the annual Federal budget, Federal agencies are required to report their investments in R&D to the Office of Management and Budget (OMB) according to the guidelines and definitions established in OMB Circular A-11 Schedule C. Within agencies' R&D portfolios, OMB Circular A-11 requires agencies to distinguish between conduct of R&D (further divided into basic research, applied research, and development), research and development facilities, and major equipment for R&D based on the definitions in Appendix 1.

These agency-reported data are published annually as part of the Budget of the U.S. Government. For the 2012 Budget, these data appear in the Analytical Perspectives volume of the *Budget of the U.S. Government Fiscal Year 2012* in Chapter 22, Research and Development. (The budget data are presented in Table 22-1; R&D facilities and major equipment for R&D are combined into a Facilities and Equipment category in the Table.) Table 1 of this report reproduces the data on Facilities and Equipment from the Research and Development chapter. Tables 2 and 3 subdivide the data in Table 1 into its components. Table 2 of this report presents data on R&D Facilities Construction by Federal agency for Fiscal Years 2010 and 2012; Table 3 of this report presents data on Major Capital Equipment for R&D by Federal agency for Fiscal Years 2010 and 2012. (Although the Circular A-11 provides standard definitions for the various categories of R&D, there are minor inconsistencies among Federal agencies in how they classify programs as conduct of R&D, major equipment for R&D, and R&D facilities construction. Some of these inconsistencies are noted in this report. Because 2011 appropriations were not enacted in time to be included in this report, data are for 2010 and 2012 only.)

Table 1. R&D Facilities Construction and Major Capital Equipment by Agency
(budget authority in millions of dollars)

	FY 2010 Actual	FY 2012 Proposed
R&D Facilities Construction and Major Capital Equipment for R&D		
Defense (military)	69	104
Health and Human Services	145	150
<i>Nat'l Institutes of Health</i>	108	133
NASA 1/	2,313	113
Energy	938	1,100
<i>Office of Science</i>	620	798
<i>Defense Programs</i>	203	266
<i>Energy Programs</i>	115	36
Nat'l Science Foundation	482	443
Agriculture	190	-124
Commerce	269	282
NOAA	158	167
NIST	111	115
Interior	2	2
Transportation	22	28
Homeland Security	155	281
Telecommunications Development Fund	7	0
Smithsonian	46	41
Total	4,638	2,420
Defense	272	370
Nondefense	4,366	2,050

Note: Because 2011 appropriations were enacted after the preparation of the 2012 Budget, data are 2010 and 2012 only.

1/ NASA construction of the International Space Station will be complete in FY 2011.

Resources to operate this National Laboratory will be considered "research" instead of "R&D facilities" beginning in FY 2012.

The data in Tables 1 through 3 show that the Federal government makes substantial investments in the construction and renovation of the Nation's laboratory facilities and the Nation's stock of major research instrumentation. Agency proposals in the 2012 Budget include \$2.4 billion for R&D facilities and R&D major equipment within a \$147.9 billion Federal R&D portfolio. The \$2.4 billion total in the 2012 Budget is down substantially (by \$2.2 billion) from the \$4.6 billion 2010 enacted funding level, primarily because of the planned transition of the International Space Station (ISS) within the NASA budget from an R&D facilities construction project to an operational laboratory for the performance of research.

Table 2. R&D Facilities Construction by Agency
(budget authority in millions of dollars)

	FY 2010 Actual	FY 2012 Proposed
Research and Development Facilities Construction		
Defense (military)	69	104
Health and Human Services	121	141
<i>Nat'l Institutes of Health</i>	108	133
NASA 1/	2,183	1
Energy	354	399
<i>Office of Science</i>	234	320
<i>Defense Programs</i>	44	79
<i>Energy Programs</i>	76	0
Nat'l Science Foundation	85	31
Agriculture	150	-161
Commerce	81	85
NOAA	0	0
NIST	81	85
Interior	2	2
Transportation	22	28
Homeland Security	155	281
Telecommunications Development Fund	7	0
Smithsonian	46	41
Total	3,275	952
Defense	113	183
Nondefense	3,162	769

Note: Because 2011 appropriations were enacted after the preparation of the 2012 Budget, data are 2010 and 2012 only.

1/ NASA construction of the International Space Station will be complete in FY 2011.

Resources to operate this National Laboratory will be considered "research" instead of "R&D facilities" beginning in FY 2012.

The current state of Federal support for research infrastructure requires consideration of the American Recovery and Reinvestment Act (ARRA or Recovery Act; Public Law 111-5), which provided unprecedented investments in research facilities construction and renovation and major research instrumentation for intramural and extramural laboratory facilities. These funds were awarded and construction is complete or underway. These investments, when complete, are likely to change the state of research infrastructure in the Nation's Federal laboratories, national user facilities, and academic institutions. (Full information on Recovery Act investments in research infrastructure can be found in the FY 2011 edition of this report (March 2010).)

Table 3. Major Capital Equipment for R&D by Agency
(budget authority in millions of dollars)

	FY 2010 Actual	FY 2012 Proposed
Major Capital Equipment for R&D		
Health and Human Services	24	9
<i>Nat'l Institutes of Health</i>	0	0
NASA	130	112
Energy	584	701
<i>Office of Science</i>	386	478
<i>Defense Programs</i>	159	187
<i>Energy Programs</i>	39	36
Nat'l Science Foundation	397	412
Agriculture	40	37
Commerce	188	197
NOAA	158	167
NIST	30	30
Total	1,363	1,468
Defense	159	187
Nondefense	1,204	1,281

Note: Because 2011 appropriations were enacted after the preparation of the 2012 Budget, data are 2010 and 2012 only.

Federal agencies not listed do not report major R&D equipment spending.

Budget Proposals for Research and Development Facilities Construction in the President's 2012 Budget

The 2012 Budget proposes \$952 million for R&D facilities construction as identified in the annual Federal agency survey of R&D investments in the Federal budget (See Table 2). This total is down from \$3.3 billion 2010 funding level, primarily because of the expected completion of construction of the International Space Station (ISS) in 2011. When the ISS is complete, the NASA ISS budget transitions from "R&D Facilities Construction" to "research" in support of the Station's operation as a National Laboratory for basic and applied research. Therefore, the 2012 Budget categorizes NASA ISS spending as research instead of R&D facilities construction, while the 2010 column in Table 2 includes construction funding for the ISS.

Nearly all of the investments in Table 2 are for intramural or federally funded research and development center (FFRDC) facilities. R&D Facilities Construction funds in the Department of Defense (DOD), the National Institutes of Health (NIH), the Department of Energy (DOE), the Smithsonian Institution (SI), and the National Institute of Standards and Technology (NIST) will be devoted to Federal or FFRDC facilities. National Science Foundation (NSF) funds will

support construction projects that are managed by the extramural research community. The U.S. Department of Agriculture (USDA) proposes to cancel unobligated balances from construction projects that were not requested in prior budget requests, partially-funded facility projects, and unobligated balances from completed projects. The Department of Homeland Security (DHS) proposes \$150 million in the 2012 Budget to begin construction of the National Bio- and Agro-defense Facility (NBAF) as a new, state-of-the-art biosafety level 3&4 facility for the development of vaccines and anti-virals and enhanced diagnostic capabilities for protecting the United States against emerging agricultural diseases.

Budget Proposals for Major Instrumentation Acquisitions in the President's 2012 Budget

In addition to investments in the construction of R&D facilities, the 2012 Budget proposes \$1.5 billion for major capital equipment for R&D (see Table 3). Nearly all of these investments are equipment purchases for intramural or FFRDC (federally owned, contractor operated) laboratories. Customarily, these equipment and instrumentation purchases are funded out of general program funds rather than separate programs for equipment and instrumentation. One exception is the National Science Foundation's Major Research Equipment and Facilities Construction (MREFC) account; the 2012 Budget proposes \$225 million for 5 projects to support the acquisition, construction and commissioning of major research facilities and equipment that provide unique capabilities at the frontiers of science and engineering. Other NSF support of major capital equipment for R&D (\$178 million in the 2012 Budget) is funded within the Research and Related Activities (R&RA) account.

There are also dedicated funds in the 2012 Budget to support major research instrumentation acquisitions in the extramural research community through the programs listed below, totaling \$199 million in the 2012 Budget:

National Science Foundation, Major Research Instrumentation, \$90 million

NSF's Major Research Instrumentation (MRI) program is an NSF-wide, crosscutting program that strengthens the U.S. scientific enterprise by investing in state-of-the-art research instrumentation at our Nation's institutions of higher education, research museums, and non-profit research organizations. The MRI program promotes the acquisition and development of instrumentation for shared use. MRI funds are awarded through a competitive, merit review process based on proposals. The 2012 Budget proposes \$90 million for the MRI program, the same as the 2010 enacted funding level.

Department of Health and Human Services, National Institutes of Health, National Center for Research Resources, Shared Instrumentation Grants, \$61 million

The National Center for Research Resources (NCRR) within the National Institutes of Health (NIH) supports the Shared Instrumentation/High-End Instrumentation Grants programs. Although these programs are not typically included in the annual R&D budget survey of major capital equipment for R&D funding, these one-year awards help NIH-supported investigators acquire commercially available equipment, typically too costly to obtain through a research project grant. Instrumentation purchased with an award must be shared by at least three NIH-supported scientists. The Shared Instrumentation program funds equipment in the \$100-\$600 thousand range and the High-End Instrumentation program funds instrumentation in the \$750

thousand - \$2 million range. These funds are awarded through a competitive, merit review process based on proposals. The 2012 Budget proposes \$61 million for the Shared Instrumentation/High-End Instrumentation Grants programs, a decrease of \$5 million from the 2010 enacted funding level.

Department of Defense, Defense University Research Instrumentation Program, \$48 million

The Department of Defense's (DOD) Defense University Research Instrumentation Program (DURIP) funds competitive grants for research instrumentation to enhance universities' capabilities to conduct world class research critical to DOD needs. DURIP generally funds equipment in the \$50 thousand to \$1 million range. DURIP is funded by the three services (Army, Navy, and Air Force) in each service's University Research Initiatives (URI) program. The 2012 Budget proposes \$48 million combined for DURIP (\$13 million Army, \$19 million Navy, \$16 million Air Force).

In addition to these dedicated programs, other Federal programs offer support for research instrumentation as part of general infrastructure support. The National Science Foundation's (NSF) Experimental Program to Stimulate Competitive Research (EPSCoR) program, for example, proposes \$116 million in the 2012 Budget for its Research Infrastructure Improvement (RII) program of awards to strengthen academic research infrastructure to institutions in EPSCoR-eligible states. While the program does not generally fund research instrumentation exclusively, the program does support awards for instrumentation as part of complex, multifaceted statewide awards to develop research infrastructure.

National Coordination of Research Infrastructure

The Office of Science and Technology Policy (OSTP) and Federal agencies are taking steps to provide national coordination of research infrastructure through the National Science and Technology Council (NSTC). The Committee on Science of the NSTC is the primary mechanism for this interagency effort. As Recovery Act projects are completed and follow-on FY 2011 and FY 2012 funds are awarded, the Committee on Science will be monitoring the progress of research facilities construction and maintenance projects as well as the procurement of major instrumentation.

For extramural facilities, the Committee's work will be informed by the results of the National Science Foundation's survey of science and engineering facilities at academic institutions, last conducted in FY 2005 and published in July 2007 as *Science & Engineering Research Facilities: Fiscal Year 2005*. The next edition of the survey is scheduled for 2011. The FY 2005 survey found that U.S. academic institutions had 185.1 million net assignable square feet of science and engineering research space, continuing a steady upward trend from previous years (for example, 155 million net assignable square feet in the FY 2001 survey). At that time, academic institutions reported that 22 percent of their research space either required renovations or required replacement, and estimated that the backlog (deferred plans) of renovation or replacement of facilities in their institutional plans totaled \$3.6 billion. Although the next survey of S&E research facilities may not fully capture Recovery Act investments, it is clear that the approximately \$1.8 billion in Recovery Act funds for research infrastructure (the bulk of which

was awarded to academic institutions) will have a substantial impact on the state of U.S. academic research infrastructure.

Although there is no similar survey of R&D facilities at Federal or FFRDC (government-owned, contractor-operated) laboratories, the Committee's work will be informed by ongoing dialogue between Federal agencies on the state of research infrastructure in Federal intramural and contractor-operated facilities. As the substantial Recovery Act investments for intramural research infrastructure are completed, there will be ongoing coordinated interagency assessments of the state of intramural research infrastructure and efforts to identify deficiencies in research infrastructure when matched against national research needs in areas relevant to the specific mission requirements of Federal agencies.

Conclusion

The President's 2012 Budget proposes a substantial Federal investment of \$2.4 billion in research infrastructure. The Committee on Science of the National Science and Technology Council is monitoring the progress of research facilities construction and maintenance as well as procurement of major instrumentation for both intramural and extramural facilities. As the substantial Recovery Act investments for research infrastructure are completed, there will be ongoing coordinated interagency assessments of the state of research infrastructure and efforts to identify deficiencies in research infrastructure when matched against national research needs in areas relevant to the specific mission requirements of Federal agencies.

Appendix 1.

Definitions of conduct of R&D, R&D facilities, and major equipment for research and development

(reproduced from the July 2010 edition of OMB Circular A-11):

Conduct of research and development in OMB Circular A-11:

Research and development (R&D) activities comprise creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications. Include:

- Administrative expenses for R&D.

Exclude:

- Physical assets for R&D such as R&D equipment and facilities.
- Routine product testing, quality control, mapping, collection of general-purpose statistics, experimental production, routine monitoring and evaluation of an operational program, and the training of scientific and technical personnel.

Research and development facilities in OMB Circular A-11:

Amounts for the construction and rehabilitation of research and development 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 the international space station and such fixed facilities as reactors, wind tunnels, and particle accelerators.

Major equipment for research and development in OMB Circular A-11:

Amounts for major equipment for research and development. Includes acquisition or design and production of movable equipment, such as spectrometers, research satellites, detectors, and other instruments. At a minimum, this line should include programs devoted to the purchase or construction of R&D equipment.

The R&D facilities category listed above is also known as “R&D facilities construction.” The Major equipment for R&D category listed above is also known as “major capital equipment for R&D” and includes major research instrumentation. In this report, the terms “major equipment for R&D” and “major research instrumentation” are used interchangeably. These two categories are commonly combined into one category known variously as “R&D plant” or “research infrastructure” or “R&D facilities and equipment” or “R&D Facilities Construction and Major Capital Equipment for R&D.”