



University Research Space Increased by 5.5 Million Square Feet between FY 2015 and FY 2017

by Michael T. Gibbons¹

Science and engineering (S&E) research space reached 220 million net assignable square feet (NASF) at research-performing universities and colleges in FY 2017 (table 1). This amount was 5.5 million NASF (2.6%) more than the FY 2015 total, according to the biennial Survey of Science and Engineering Research Facilities, conducted by the National Center for Science and Engineering Statistics within the National Science Foundation (figure 1) (see “Data Notes” for definitions of research space and NASF).

Research space in biological and biomedical sciences grew by 1.6 million NASF from FY 2015 to FY 2017, after a net loss of 1.3 million NASF between FY 2013 and FY 2015. Overall, biological and biomedical sciences accounted for 40% of total S&E research space growth over the past 10 years and utilize the most research space of any field (57.5 million NASF). Research space in all S&E fields increased from 2007 to 2017, except for computer and information sciences, which declined 13% from 4.8 million to 4.2 million NASF. The other S&E fields increased to varying extents over the past decade, with the most space added in biological

and biomedical sciences (12.7 million NASF) and engineering (6.7 million NASF).

New Construction of Research Space

New research space is added each year through new construction projects and the repurposing of existing space. Similarly, some space is withdrawn from use through decommissioning and repurposing. As part of this process, academic institutions broke ground on 7.0 million NASF of new S&E research space construction projects in FYs 2016–17, costing more than \$6.1 billion.² This was the largest amount of new research space construction started since FYs 2010–11 (8.1 million NASF) (table 2). Projects designed for biological and biomedical sciences (2.0 million NASF), engineering (1.5 million NASF), and health sciences (1.4 million NASF) accounted for 70% of new research space construction started in FYs 2016–17.

U.S. universities and colleges planned to start 9.4 million NASF of new research space construction in FY 2018 or FY 2019 with projected costs of \$8.5 billion. However, because institutions’

budgets and priorities may change unexpectedly, not all planned projects are started during the projected time frame. In FY 2015, academic institutions reported 9.6 million NASF of planned new research space construction for FY 2016 or FY 2017. The actual amount reported in FY 2017 for that period was 7.0 million NASF, which was 73% of what was reportedly planned.

Repair and Renovation

Academic institutions expended \$5.1 billion on major repairs and renovation of S&E research space started in FY 2016 or FY 2017 (table 3). Costs for research space improvements exceeded \$1 billion in three fields: biological and biomedical sciences (\$1.3 billion), health sciences (\$1.3 billion), and engineering (\$1.0 billion). Research space in physical sciences also underwent sizeable repairs and renovations, totaling \$740 million for projects started in FY 2016 or FY 2017. Combined, these four major fields accounted for 85% of all research space repair and renovation costs.

Institutions anticipate \$5.0 billion in costs for planned repair and renovation with

TABLE 1. Science and engineering research space in academic institutions, by field and research animal space: FYs 2007–17
(Net assignable square feet in millions)

Field and research animal space	FY 2007	FY 2009	FY 2011	FY 2013	FY 2015	FY 2017
All research space	187.9	196.1	202.2	211.8	214.5	220.0
Agricultural sciences	27.9	29.5	27.6	30.5	28.3	28.1
Biological and biomedical sciences	44.8	50.3	53.7	57.2	55.9	57.5
Computer and information sciences	4.8	5.2	5.0	4.3	4.3	4.2
Engineering	28.4	30.2	31.7	33.5	34.2	35.1
Geosciences, atmospheric sciences, and ocean sciences	8.4	8.0	7.8	7.8	8.1	8.5
Health sciences	37.0	36.3	36.7	38.0	39.2	40.0
Mathematics and statistics	1.6	1.5	1.5	1.7	1.8	1.8
Natural resources and conservation	na	na	na	na	3.5	4.3
Physical sciences	20.3	20.5	21.8	22.9	22.7	23.1
Psychology	4.9	5.2	5.5	5.5	5.5	5.6
Social sciences	6.0	5.5	5.7	5.7	6.0	6.1
Other fields of S&E	3.7	3.9	5.2	4.8	4.9	5.8
Research animal space ^a	17.8	18.1	18.4	18.9	19.2	19.1

na = not applicable; see notes below.

S&E = science and engineering.

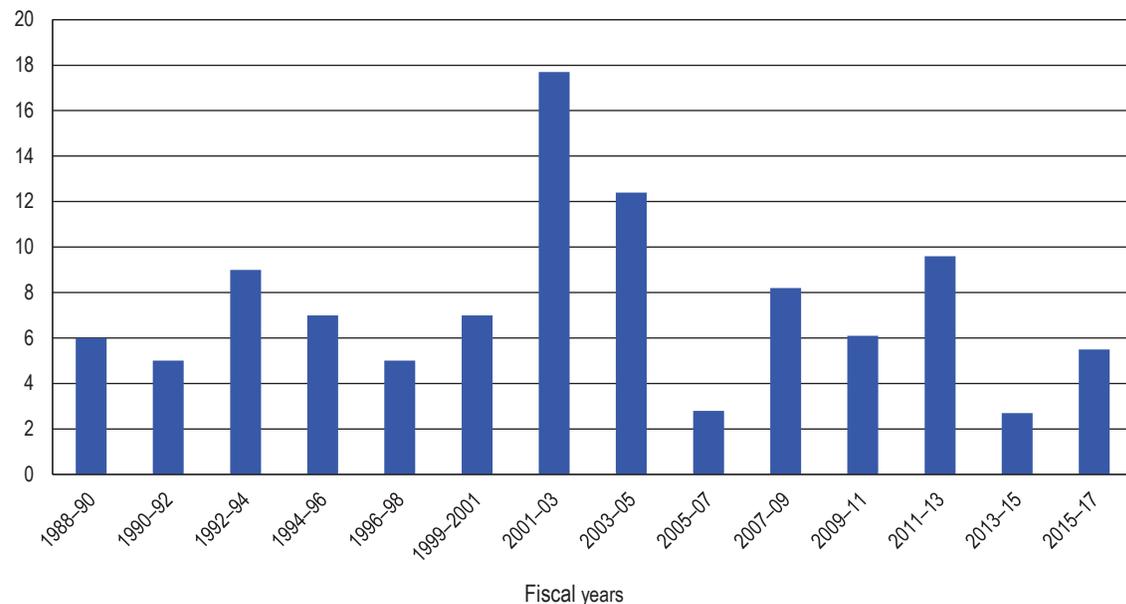
^a Research animal space is listed separately and is also included in individual field totals.

NOTES: Fields of science and engineering and their disciplines were revised in FY 2015. Specifically, "Agricultural sciences and natural resources sciences" was split into "Agricultural sciences" and "Natural resources and conservation." Physical sciences and its subfields "Earth, atmospheric, and ocean sciences" and "Astronomy, chemistry, and physics" are now reported under "Geosciences, atmospheric sciences, and ocean sciences" and "Physical sciences," respectively. Data were not collected separately for "Natural resources and conservation" prior to the FY 2015 survey and are included in the "Agricultural sciences" field for earlier cycles. Details may not add to totals due to rounding.

SOURCE: National Science Foundation, National Center for Science and Engineering Statistics, Survey of Science and Engineering Research Facilities.

FIGURE 1. Science and engineering research space in academic institutions, change over 2-year period: FYs 1988–2017

Net assignable square feet in millions



NOTE: The biennial survey cycle ran on even years from 1988 to 1998 and on odd years from 1999 to 2017.

SOURCE: National Science Foundation, National Center for Science and Engineering Statistics, Survey of Science and Engineering Research Facilities.

TABLE 2. New construction of science and engineering research space in academic institutions, by field and time of construction: FYs 2008–19 (Net assignable square feet in millions)

Field	Started in FY 2008 or FY 2009	Started in FY 2010 or FY 2011	Started in FY 2012 or FY 2013	Started in FY 2014 or FY 2015	Started in FY 2016 or FY 2017	Planned to start in FY 2018 or FY 2019
All research space	9.9	8.1	6.6	5.1	7.0	9.4
Agricultural sciences	0.4	0.4	0.4	0.4	0.2	0.8
Biological and biomedical sciences	3.5	2.0	2.0	1.5	2.0	1.7
Computer and information sciences	0.3	0.1	0.2	0.1	0.3	0.2
Engineering	2.1	1.3	1.4	0.9	1.5	2.8
Geosciences, atmospheric sciences, and ocean sciences	0.1	0.3	0.2	0.2	0.2	0.2
Health sciences	1.9	2.8	1.6	1.0	1.4	1.8
Mathematics and statistics	*	*	*	*	*	0.1
Natural resources and conservation	na	na	na	*	0.1	0.1
Physical sciences	0.9	0.6	0.6	0.7	0.6	0.8
Psychology	0.3	0.1	*	0.1	0.1	*
Social sciences	0.2	0.1	0.1	*	0.2	*
Other fields of S&E	0.3	0.3	0.1	0.2	0.3	0.8

* = value > 0 but < 50,000 net assignable square feet; na = not applicable; see notes below.

S&E = science and engineering.

NOTES: Fields of science and engineering and their disciplines were revised in FY 2015. Specifically, "Agricultural sciences and natural resources sciences" was split into "Agricultural sciences" and "Natural resources and conservation." Physical sciences and its subfields "Earth, atmospheric, and ocean sciences" and "Astronomy, chemistry, and physics" are now reported under "Geosciences, atmospheric sciences, and ocean sciences" and "Physical sciences," respectively. Data were not collected separately for "Natural resources and conservation" prior to the FY 2015 survey and are included in the "Agricultural sciences" field for earlier cycles. Details may not add to totals due to rounding.

SOURCE: National Science Foundation, National Center for Science and Engineering Statistics, Survey of Science and Engineering Research Facilities.

start dates in FY 2018 or FY 2019. They expect to spend over \$1.5 billion improving research space in health sciences and another \$1.2 billion in biological and biomedical sciences research space improvements. In addition to these slated improvements, academic institutions reported another \$4.8 billion in deferred repair and renovation projects included in their institutional plans, as well as \$3.8 billion not included in their institutional plans. Projects in these latter categories were not funded and not scheduled to begin before FY 2020.

Shared Research Space

The FY 2017 Facilities Survey collected new data on the ways in which research space is shared at academic institutions. Respondents were asked whether any of their research space was shared

among fields or used for purposes other than research (e.g., instruction). Of the 562 responding institutions, 56% of universities ($N = 315$) reported that at least some research space is also used for nonresearch purposes and 52% ($N = 295$) reported research space in at least one field that was shared with another field for research purposes (table 4). The rate at which institutions shared research space in one of the 12 S&E fields for nonresearch purposes ranged from 42% in agricultural sciences to 51% each in engineering, mathematics and statistics, and physical sciences. The rate at which institutions shared research space across fields for research purposes was more varied, ranging from 17% each in psychology and in mathematics and statistics to 35% in engineering and 36% in biological and biomedical sciences. "Other fields of

S&E" had the highest rate of shared space (45%) largely because this category includes space for multidisciplinary research.

Research Space at the Largest Institutions

Of the 575 institutions surveyed, the top 30 institutions ranked by total S&E NASF accounted for 34% of all research space in FY 2017 (table 5). This share is virtually unchanged from the shares reported for FY 2015 (35%), FY 2013 (35%), and FY 2011 (36%). In FY 2017, the top 30 institutions accounted for 50% of all research space in the agricultural sciences and 43% of space in the natural resources and conservation fields. They also reported a large percentage of total academic research space in health sciences (38%), engineering (36%), and social sciences (35%).

TABLE 3. Costs for repair and renovation of science and engineering research space in academic institutions, by field and time of repair and renovation: FYs 2006–19
(Costs in millions of dollars)

Field	Started in FY 2016 or FY 2017	Planned to start in FY 2018 or FY 2019	Deferred projects	
			Included in institutional plan	Not included in institutional plan
All research space	5,079.5	5,036.1	4,782.4	3,788.3
Agricultural sciences	135.5	290.5	427.8	162.7
Biological and biomedical sciences	1,301.4	1,207.6	1,177.4	816.9
Computer and information sciences	149.3	66.2	92.6	40.1
Engineering	1,002.3	647.4	520.8	674.0
Geosciences, atmospheric sciences, and ocean sciences	210.8	154.7	222.8	189.5
Health sciences	1,250.0	1,535.3	850.5	552.6
Mathematics and statistics	28.4	29.8	95.2	118.0
Natural resources and conservation	31.7	38.1	70.1	68.5
Physical sciences	739.7	711.5	610.7	767.0
Psychology	67.6	109.8	203.5	189.6
Social sciences	60.7	125.5	359.3	156.6
Other fields of S&E	102.2	119.6	151.7	52.8

S&E = science and engineering.

NOTES: Fields of science and engineering and their disciplines were revised in FY 2015. Specifically, "Agricultural sciences and natural resources sciences" was split into "Agricultural sciences" and "Natural resources and conservation." Physical sciences and its subfields "Earth, atmospheric, and ocean sciences" and "Astronomy, chemistry, and physics" are now reported under "Geosciences, atmospheric sciences, and ocean sciences" and "Physical sciences," respectively. Data were not collected separately for "Natural resources and conservation" prior to the FY 2015 survey and are included in the "Agricultural sciences" field for earlier cycles. Deferred projects are those that (1) are not funded and (2) are not scheduled for FY 2018 or FY 2019. Details may not add to totals due to rounding.

SOURCE: National Science Foundation, National Center for Science and Engineering Statistics, Survey of Science and Engineering Research Facilities.

These institutions accounted for less than 30% of the nation's research space in the six other major fields: biological and biomedical sciences (28%), computer and information sciences (28%), geosciences, atmospheric sciences, and ocean sciences (27%), mathematics and statistics (27%), physical sciences (27%), and psychology (25%).³

Data Notes

Data Sources and Availability

The data presented in this InfoBrief were obtained from the Survey of Science and Engineering Research Facilities, conducted by the National Center for Science and Engineering Statistics within the National Science Foundation. The survey is a census of 575 colleges and universities that expended at least

\$1 million in S&E research and development funds in FY 2016. The response rate for this survey was 97.9%.

The full set of data tables are available in the report *Science and Engineering Research Facilities: Fiscal Year 2017* at <https://www.nsf.gov/statistics/srvyfacilities/#tabs-2>. Please contact the author for more information.

TABLE 4. Academic institutions with science and engineering research space shared with other fields or used for purposes other than research, by field: FY 2017

Field	Institutions with research space ^a	Institutions with research space shared with other fields		Institutions with research space also used for nonresearch purposes	
		Number	Percent	Number	Percent
All research space	562	295	52	315	56
Agricultural sciences	199	56	28	84	42
Biological and biomedical sciences	547	199	36	247	45
Computer and information sciences	419	103	25	208	50
Engineering	377	133	35	192	51
Geosciences, atmospheric sciences, and ocean sciences	351	82	23	170	48
Health sciences	406	123	30	191	47
Mathematics and statistics	365	62	17	187	51
Natural resources and conservation	256	74	29	115	45
Physical sciences	475	141	30	240	51
Psychology	435	76	17	198	46
Social sciences	392	87	22	194	49
Other fields of S&E	145	65	45	62	43

S&E = science and engineering.

^a Includes only those institutions that reported on shared space.

NOTES: Institutions were asked to indicate whether any of the net assignable square feet of research space reported in individual field totals was shared with other fields or used for purposes other than research. Percentages are based on the number of institutions with research space in each field of science and engineering.

SOURCE: National Science Foundation, National Center for Science and Engineering Statistics, Survey of Science and Engineering Research Facilities, FY 2017.

Definitions

Net assignable square feet (NASF) is the sum of all areas on all floors of a building assigned to, or available to be assigned to, an occupant for a specific use, such as research or instruction. NASF is measured from the inside faces of walls.

Research space is the NASF of space in buildings within which research activities take place. Research facilities are located within buildings. A building

is a roofed structure for permanent or temporary shelter of persons, animals, plants, materials, or equipment. Structures should be included if they are (1) attached to a foundation, (2) roofed, (3) serviced by a utility, exclusive of lighting, and (4) a source of significant maintenance and repair activities.

Notes

1. Michael T. Gibbons, Research and Development Statistics Program, National Center for Science and Engi-

neering Statistics, National Science Foundation, 2415 Eisenhower Avenue, Suite W14200, Alexandria, VA 22314 (mgibbons@nsf.gov; 703-292-4590).

2. Data on costs for new construction of S&E research space are available in the full set of data tables in tables 12 through 17.

3. Data on institutional rankings by field are available in the full set of data tables in table 3.

TABLE 5. Thirty institutions reporting the most FY 2017 research space in all fields: FYs 2013 to 2017
(Net assignable square feet in thousands)

Rank	Institution	FY 2013	FY 2015	FY 2017
	All institutions	211,775	214,493	220,046
	Leading 30 institutions	74,245	74,837	75,633
1	U. Florida	3,110	4,156	4,187
2	U. Georgia	3,777	3,891	3,950
3	U. Minnesota, Twin Cities	3,673	3,400	3,791
4	Johns Hopkins U.	3,265	3,548	3,267
5	U. California, Davis	2,930	3,052	3,058
6	U. Illinois, Urbana-Champaign	3,109	3,034	3,058
7	Texas A&M U., College Station and Health Science Center	2,895	2,926	3,041
8	U. California, Los Angeles	2,718	2,806	2,824
9	U. Wisconsin-Madison	2,774	2,904	2,804
10	Michigan State U.	2,254	2,446	2,790
11	U. California, San Diego	2,555	2,694	2,742
12	North Carolina State U.	2,695	2,633	2,678
13	U. Kentucky	2,287	2,394 i	2,611
14	U. California, Berkeley	2,382	2,551	2,484
15	Harvard U.	2,482	2,420	2,410
16	Yale U.	2,307	2,372	2,387
17	Pennsylvania State U., University Park and Hershey Medical Center	2,733	2,561	2,311
18	Washington State U.	2,055	2,161	2,202
19	Mississippi State U.	2,157	2,140	2,173
20	U. Washington, Seattle	1,796	1,935	2,002
21	Columbia U. in the City of New York	1,869	1,878	2,002
22	Cornell U.	2,121	2,218	1,967
23	U. Pittsburgh, Pittsburgh	1,614	1,882	1,924
24	Georgia Institute of Technology	1,633	1,782	1,922
25	Rutgers, State U. New Jersey, New Brunswick	1,167	1,772	1,921
25	U. Michigan, Ann Arbor	1,897	1,878	1,900
27	U. California, San Francisco	2,053	2,024	1,895
28	U. Utah	1,697	1,677	1,786
29	Massachusetts Institute of Technology	2,023	1,927	1,783
30	U. Pennsylvania	1,749	1,723	1,764

i = imputed.

NOTES: Totals for the leading 30 institutions reflect the institutions in the top 30 for that given year. Some institutions in the FY 2015 ranking were not in the top 30 in FY 2013. Some institutions in the FY 2017 ranking were not in the top 30 prior to FY 2017. Tied institutions ordered according to unrounded totals.

SOURCE: National Science Foundation, National Center for Science and Engineering Statistics, Survey of Science and Engineering