MIT Washington Office

The Massachusetts Institute of Technology's Washington, DC, Office was established within MIT's Office of the President in 1991. The office reports to MIT's president and works closely with the vice president for research and other senior administrators. The staff of the office for FY2016 included William Bonvillian, director; Philip Lippel, assistant director; Kate Stoll, senior policy advisor; Helen Haislmaier, program coordinator; Lisa Miller, office representative; and Peter Singer, who began a six-month term as policy advisor starting in June 2016.

The mission of the MIT Washington Office is to support the science and technology advocacy activities of MIT's president, other senior officials, and faculty in Washington, DC, and to extend MIT's historic role as one of the nation's premier research universities in providing leadership on national science and technology issues. The Washington Office facilitates a two-way exchange of information and ideas between MIT and Washington institutions, including executive branch agencies, offices, and departments—particularly the research and development (R&D) agencies; Congress; and university, industry, and science organizations.

Connecting the Institute with the Policy Agenda in Washington, DC

As a major federally funded research university, MIT has had a long history of constructive engagement with and contributions to the federal science and technology enterprise. Its Washington Office staff members communicate with key officials and staff from the legislative and executive branches of the federal government, as well as university and science organizations, on federal science and technology policy, education, and other core Institute concerns. They also help link senior members of the MIT administration and faculty experts to ongoing policy discussions.

With congressionally mandated budget limitations restricting all federal discretionary spending for fiscal years 2013 through 2023, stagnant research funding levels remained a key concern for MIT and other research universities in FY2016. The MIT office joined other universities in supporting prioritization of research funding as a key investment in America's future, while also supporting MIT's major national policy initiatives on energy, online education, advanced manufacturing, and the convergence of the life, engineering, and physical sciences. These policy initiatives make significant contributions to studies and also help policymakers see how science and technology investments can help resolve major societal challenges.

The sections of this report below review the overall funding situation for federal research for FY2016, with brief funding summaries for each of the five major research agencies that support a majority of MIT's research; MIT's major ongoing policy initiatives; key developments and activities with major R&D agencies; and the Washington Office's work with MIT students on science and technology policy issues.

An appendix lists key meetings and other interactions between Washington, DC, officials and MIT administrators, faculty, and staff.

Science Research and Development Support

The Sequestration Challenge to Federal Research Budgets

The 2011 Budget Control Act (BCA, Public Law 112–25), Congress's attempt to control the rising federal deficits that multiplied during the "Great Recession," imposed a decade of strict limits on the discretionary portion of the federal budget. defense and non-defense spending—but not entitlement programs such as Social Security and Medicare, and not tax subsidies—was cut starting in federal FY2012. The BCA forced spending to be initially reduced by nearly $1 trillion below previous official budget projections. Additional provisions in the act subsequently triggered automatic discretionary spending cuts of another $1 trillion in a process termed "sequestration," starting with a $105 billion cut in federal FY2013.

In January 2014, Congress reached a compromise agreement that provided a partial rollback of the sequestration cuts in the FY2014 and FY2015 federal discretionary budgets. In December 2016, Congress again reached a compromise on budget cuts (as detailed below) for federal FY2016 and FY2017. Federal budgets are scheduled to revert back to full sequestration levels as of federal FY2018.

Federal research and development support is part of the discretionary budget and thus subject to sequestration. The initial cuts in 2012 and 2013, followed by stagnant budgets for 2014 and 2015, make it challenging for the federal government to maintain its historic role as the predominant supporter of university-based R&D. Restoration of adequate funding levels for the federal R&D agencies became a major focus for research universities.

Universities have argued that the cuts in R&D will affect the innovation system, in effect creating an innovation deficit. They argued that federal support for research should be treated as an investment, not simply an expenditure. The Obama administration, with a strong innovation policy stance, concurred, and began budgeting as if sequestration was over. However, the investment argument has not yet led to sequestration repeal, only modifications. This was largely because the Budget Control Act protected certain core political positions for each major party from sequestration. Entitlement programs supported by the Democratic Party are largely immune, and for the Republican Party, no tax increases would be required. Instead, the entire 10-year sequestration cut is equally divided between federal defense discretionary programs and non-defense discretionary programs. These programs account for less than 40% of the total federal budget, but include nearly all federally funded research and development activities. The FY2013 sequestration requirements forced significant cuts in R&D funding for that fiscal year, although they were, as noted, modified in subsequent fiscal years by Congress, as reviewed below.

The following chart from the American Association for the Advancement of Science (AAAS) illustrates the current status of sequestration cuts, showing the modifications in place, first for FY2015, and then in December 2015 for FY2017, including adjustments for inflation. (Note that in the chart, the 2017 decrease in "Agreement" is due to use of deflators ["constant 2015 dollars"]. Other data here is in nominal dollars.)

Current Status of Sequestration Cuts from American Association for the Advancement of Science

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Actual Base Budget Authority	1137.8	1111.0	1033.6	1042.0	1030.1	1066.6	1050.8				
Bipartisan Budget Act of 2015					1030.1	1066.6	1050.8				
BCA: Initial Pre-Sequestration Baseline		1111.0	1096.4	1097.6	1103.2	1107.0	1111.1	1114.1	1116.8	1118.9	1120.6
BCA: Sequestration Baseline		1111.0	998.0	1001.8	1009.7	1017.0	1021.7	1026.4	1031.7	1036.5	1040.7
Current Law Beyond FY17							1050.8	1026.4	1031.7	1036.5	1040.7

Budget Agreement for FY2017

On Friday December 18, 2015, Congress approved a $1.1 trillion spending bill in a pair of overwhelming bipartisan votes, capping a frenzied final few weeks of legislating before lawmakers headed home for the holidays and to gear up for the 2016 election year. While under the budget deal, overall discretionary spending can only rise by 5.2% in FY2016, overall R&D did better. In that context, the omnibus numbers are strong for most major R&D agencies. The AAAS estimated that the package provided $148.6 billion in total R&D expenditures for FY2016, an 8.1% increase. The first year of the two-year deal effectively erased about 90% of the sequestration cuts originally in place. For FY2017, only about 60% of the cuts are to be restored. Absent additional congressional action, sequestration will go back in place in FY2018.

Defense and non-defense R&D each rose above both the president's budget request and House and Senate appropriations committee levels from earlier this year. Defense R&D (including the Department of Defense [DOD] and the National Nuclear Security Administration) gains somewhat more. Basic research rose by an estimated 5.1% and applied research by 5.5%.

The omnibus budget agreement also included a tax package with important provisions for universities and their research partners, including extensions of education tax credits for students and their families, and renewable energy tax provisions. By making the R&D tax credit permanent, the bill also realized a decades-long policy goal of the research community.

Among research agencies, the National Institutes of Health (NIH) benefited most from the omnibus package in absolute dollars, with an R&D increase of $2 billion, or 6.6%, from its current budget of $30.1 billion. Spending on science programs at NASA grew by some 6.6% to $5.6 billion, and there was a rise by 5.6% in the Department of Energy's (DOE) Office of Science, to $5.35 billion while the Advanced Research Projects Agency-

Energy (ARPA-E) received a 6% boost, to $291 million. The National Science Foundation (NSF) received an additional $119 million, or 1.6%, to $7.46 billion, and escaped a House attempt to seriously restrict grants in the social, behavioral, and economic sciences or geoscience. DOD's basic research enterprise managed to avoid the 8.3% cuts proposed by the administration's budget and in the House appropriations bill, and instead received $2.3 billion, a 1.4% increase. Overall, defense science and technology programs (6.1, 6.2, and 6.3) gained $1 billion.

The December omnibus also contained an overall funding agreement for FY2017, which sets the total discretionary budget level at slightly below FY2016 levels, but still well above the sequestration levels, which will have to be settled by the FY2017 appropriations process. Overall, DOE applied programs, DOD science and technology, NASA, and United States Department of Agriculture research, as a result of FY2016 funding are now ahead of the pre-sequestration funding they received in FY2012. The DOE Office of Science, NSF and NIH are still slightly below their pre-sequestration funding levels of FY2012.

Congressional leaders in both the Senate and the House of Representatives promised a "return to regular order" as they began to work on FY2017 appropriations. With a presidential election coming in November 2016, both parties wanted to show that they could fulfill their responsibilities and reach agreements on key budget matters. Committees in each chamber reported out their full complement of 12 appropriations bills by the end of June 2016; three bills were approved and one rejected by the full House, and three approved by the full Senate. With relief for only about 60% of the sequestration cuts to the discretionary budget, and major differences in priorities between chambers and between parties, there was little room to negotiate and progress soon stalled. As the MIT fiscal year came to a close, only two bills had begun to resolve differences in conference. It was apparent that agreements on all or most of the bills would not be reached before the new federal fiscal year began in October 2016, necessitating the passage of a continuing resolution to keep the government operating. The only real question was whether that stopgap measure would last just a few months, with Congress returning to try and finish their appropriations work after the election, or if hardline fiscal conservatives would insist on extending the bill into January 2017 or beyond, forcing a new Congress and a new president to hastily address funding for the remainder of FY2017.

Overall R&D and education budgets for FY2016 and current proposals for FY2017 are presented in the following table from the American Association for the Advancement of Science; additional details for specific agencies are provided in the next section of this report.

Estimates of Congressional Action on FY2017 R&D Budgets by Agency (in millions of dollars)

	FY2015 Actual	FY2016 Estimate	FY2017 Budget	FY2017 House*	Percent Change Request	Percent Change FY2016	FY2017 Senate*	Percent Change Request	Percent Change FY2016
Defense (military)**	66,524	72,237	73,743	73,119	-0.8	1.2	73,699	-0.1	2.0
(6.1–6.3 + medical)	13,723	15,158	13,324	14,530	9.1	-4.1	15,094	13.3	-0.4
All other	52,801	57,079	60,419	58,589	-3.0	2.6	58,605	-3.0	2.7
Health and Human Services	30,177	31,917	30,914	33,295	7.7	4.3	34,014	10.0	6.6
National Institutes of Health	28,750	30,618	29,592	32,014	8.2	4.6	32,780	10.8	7.1
All Other HHS	1,427	1,299	1,322	1,281	-3.1	-1.4	1,235	-6.6	-5.0
Energy	14,385	14,387	16,634	15,675	-5.8	9.0	15,757	-5.3	9.5
Atomic Energy Defense	6,197	5,726	7,082	7,043	-0.5	23.0	6,978	-1.5	21.9
Office of Science	5,099	5,305	5,523	5,352	-3.1	0.9	5,352	-3.1	0.9
Energy Programs	3,089	3,356	4,029	3,280	-18.6	-2.3	3,427	-15.0	2.1
NASA	11,413	13,273	12,170	13,368	9.8	0.7	13,179	8.3	-0.7
Science Mission Directorate	5,243	5,589	5,303	5,597	5.6	0.1	5,395	1.7	-3.5
National Science Foundation	5,990	6,117	6,160	5,929	-3.8	-3.1	6,088	-1.2	-0.5
Agriculture	2,454	2,674	2,598	2,581	-0.7	-3.5	2,567	-1.2	-4.0
Commerce	1,527	1,904	1,879	1,669	-11.2	-12.4	1,814	-3.4	-4.7
NOAA	692	805	810	731	-9.7	-9.2	777	-4.1	-3.5
NIST	669	773	806	702	-12.9	-9.1	794	-1.5	2.7
Transportation	887	924	866	844	-2.5	-8.6	850	-1.9	-8.1
Homeland Security	919	579	585	591	1.0	2.1	630	7.6	8.8
Veterans Affairs	1,178	1,220	1,252	1,252	0.0	2.6	1,275	1.8	4.5
Interior	864	974	1,076	1,022	-5.0	4.9	1,022	-5.0	4.9
US Geological Survey	665	683	787	723	-8.2	5.8	713	-9.5	4.3
Environmental Protection Agency	521	513	512	506	-1.2	-1.4	488	-4.6	-4.9
All Other	1,491	1,585	1,737	1,567	-9.8	-1.2	1,628	-6.3	2.7
Total R&D (excl. Ebola)	**138,328**	**148,305**	**150,126**	**151,417**	**0.9**	**2.1**	**153,011**	**1.9**	**3.2**

*Most figures refer to committee bills, as few spending bills have achieved floor passage.

**Includes Overseas Contingency Operation funding

Excludes R&D funded through new mandatory proposals in FY2017.

FY2016 figures are current estimates. Inflation from FY2017 is 1.8%.

R&D Funding by Agency

Funding for the five major R&D agencies MIT receives the great majority of its funding from, plus funding for key higher education programs at the Department of Education, is summarized below (based on AAAS data and analysis):

Department of Defense

Overall, defense R&D (categories 6.1–6.3) gained $1billion, reaching $13 billion, a 7.5% increase. A noteworthy development is the funding outcome for basic research, to be funded at $2.3 billion, a 1.4% increase over FY2015 levels. This was a victory for the research community, overturning a proposed 8.3% cut proposed by DOD. There were also significant increases for applied research across the military branches in several areas. DOD's Defense Health program received a major increase for peer-reviewed research, to $1.1 billion, a 6.5% gain. On the other side, the Defense Advanced Research Projects Agency (DARPA) budget was reduced slightly, by $25 million.

Department of Energy

The $1.15 trillion FY2016 spending bill was considered a win for the Department of Energy's energy and science programs and the DOE-operated National Laboratories. The Department of Energy saw an $800 million increase for energy programs, to $11 billion, including a $279 million increase for the Office of Science, a $155 million increase for energy efficiency and renewable energy, and an $11 million increase for the Advanced Research Projects Agency-Energy. The Offices of Fossil Energy, Electricity, and Nuclear Energy also saw budget boosts, yet the total remained $528 million short of the president's request.

For the Office of Science, the omnibus' 5.5% increase over FY2015 exceeded the president's request and House and Senate committee marks. Basic Energy Sciences received a 6.7% increase, close to the president's budget request. Biological and Environmental Research programs, which the House wanted to cut by 9.1%, instead obtained a 2.9% increase. The High Energy Physics program received a 3.8% increase, exceeding the request and committee marks, while the Nuclear Physics program received a 3.6% increase, lower than the president's budget but above the House mark. The Fusion Energy Sciences program lost $30 million overall, with a 1.7% increase for domestic research activities counterbalanced by a $35 million dollar cut to the US contribution for continued construction of the international ITER tokamak. The domestic budget included $18 million for the Alcator C-Mod, with DOE asserting that FY2016 would be the final year of operation for the MIT tokamak. Congress rejected DOE's proposal to maintain ITER construction funding at the $150 million level while cutting ongoing research activities by $48 million. The Senate initially proposed zeroing out the ITER contribution altogether before agreeing instead, in the omnibus bill, to reduce the contribution to $115 million.

The bill provided a $61 million increase, to $632 million, for the Office of Fossil Energy, rejecting the president's proposal to cut research in advanced coal, natural gas, and oil technologies by $11 million. Included was $217 million for carbon capture and

storage. Nuclear energy received $986 million, an increase of $73 million, rather than the proposed $6 million cut.

The omnibus bill provided over $2 billion for the Office of Energy Efficiency and Renewable Energy (EERE), including a total of $241 million for solar, some $95 million for wind power, $70 million for water power, and $71 million for geothermal. Despite the House's historic opposition to funding renewable energy research, only wind research was cut, by 10.8%. EERE's Advanced Manufacturing Office, which supports the Manufacturing Innovation Institutes and other administration priorities, settled for a 14.3% boost to $229 million rather than the requested doubling.

Following the announcement at the 2015 Paris Climate Conference that the United States and 19 other countries would double their investments in clean energy research and development over a five-year period, the Department of Energy proposed new programs and requested increases as part of the president's FY2017 budget request. These programs, collected in a new DOE crosscut called Mission Innovation, would grow from a $4.8 billion baseline to $5.8 billion under the president's plan. But Energy and Water Development appropriators in both the House and Senate appeared unwilling to shift funding from other existing DOE programs to these efforts, or, as the Obama administration had proposed in order to remain within the budget caps, from other agencies. As MIT's fiscal year drew to an end, large programmatic differences remained between the Senate and House appropriation bills, which respectively fell 7% and 9% below the president's request. The administration and the two congressional chambers continued to express different program priorities in several areas. Moreover, the House had not yet come up with a plan for reconsideration of their Energy and Water Development appropriations bill, which was roundly defeated in May 2016 in a dispute over policy riders. Funding for the Office of Fusion Energy Sciences remained contentious, with the president proposing a $10 million increase in ITER construction funding and a $50 million cut to domestic research, the Senate seeking once again to halt ITER contributions while also cutting the domestic program slightly, and the House attempting to preserve both programs with an overall increase of $12 million.

National Institutes of Health

The National Institutes of Health was the most successful R&D agency in the FY2016 omnibus bill, gaining a $2 billion increase over FY2015, to $32.3 billion. (Total for research is $30.6 billion as indicated in the table above. Approximately $1.7 billion in additional funding is designated for training and overhead.) That 6.6% increase is the largest that NIH has received in 12 years. The increase matches the amount approved by a Senate spending panel in June 2015 and doubles what President Obama had requested. NIH has received only slight yearly increases since 2003, when Congress completed a five-year doubling of its budget. Adjusted for inflation, its budget has fallen 22%.

All institutes within the agency received generous increases, but none more so than the National Institute on Aging, which secured $350 million in new spending for Alzheimer's disease research, a 60% increase over the 2015 amount and well above the president's request of $51 million. The rest of the institutes saw budget increases in the range of 3% to 6% over FY2015, with Allergy and Infectious Diseases and the

National Center for Advance Translational Science receiving increases of 6.2% and 7.9% respectively.

The agreement provides the $200 million requested for the new Precision Medicine Initiative, and $100 million to address antimicrobial resistance. Also included is $85 million for NIH's contribution to the Brain Research through Application of Innovative Neurotechnologies (BRAIN) Initiative, still $50 million short of the request. However, the language in the bill continues to support the Clinical and Translational Science Awards Program as well as the follow-on to the National Children's Study.

National Science Foundation

The total National Science Foundation budget increased by 1.6% above FY2015 funding levels but remained 3.4% below the president's request. NSF's two principal budget lines both saw increases, with Research and Related Activities, up $100 million to $6.03 billion and Education and Human Resources up $96 million to $962 million. The Major Research Equipment and Facilities Construction account was essentially flat-funded at $200 million.

While overall research activities fell short of what the administration sought, the omnibus bill offered an improvement over the subinflationary increase in House appropriations and flat funding in the Senate bill. The legislation also omitted a controversial provision from the House's 2016 appropriations bill that would have made steep cuts to NSF's social science and geosciences research. Language in the omnibus bill allowed the Social, Behavioral, and Economic Sciences Directorate to remain at FY2015 levels and placed no restrictions on the Geosciences Directorate.

The omnibus bill provides $147 million for neuroscience and cognitive science research in NSF's Understanding the Brain activity, including $73.5 million for participation in the interagency BRAIN Initiative. Other agency-wide programs include $256 million for cyber-enabled materials, manufacturing, and smart systems; $47 million for innovations at the intersection of food, water, and energy systems; and $130 million for research on a secure and trustworthy cyberspace. Continuing multiagency activities include NSF participation in the National Nanotechnology Initiative ($415 million); Networking and Information Technology R&D ($1.196 billion); and the Global Change Research Program ($338 million). The agreement also directed NSF to submit to the appropriations committees an independent assessment of the revised cost estimate to complete the National Ecological Observatory Network (NEON), which is expected to be fully operational by 2018. The assessment indicated greater cost overruns than NEON management had reported, forcing NSF to reduce the scope of the project and leading to a change in NEON management. Battelle Memorial Institute was selected to take over the project and became the prime NEON contractor in March 2016.

Pending appropriations bills would give NSF little or no increase for FY2017. Senate legislation would keep NSF research and related activities at $6.03 billion. The House bill would add $45 million (0.8%) as requested by the president, and does not renew the FY2016 attempt to dictate funding levels by research directorate. Both chambers would flat-fund Education and Human Resources, rejecting the president's request

for a 2% increase. The House would also reject the president's $106 million request to begin construction of two new Regional Class Research Vessels, which would be funded through the separate Major Research Equipment and Facilities Construction. The Senate, in contrast, wants the agency to build three vessels and would add $54 million to the request, bringing the Major Research Equipment and Facilities Construction account total to $247 million.

National Aeronautics and Space Administration

NASA did well overall in the budget agreement, rising 7.1% to $19.3 billion. That's substantially more than proposed during the appropriations process, and $756 million more than the president's request. NASA's science budget rose to $5.6 billion in the budget agreement, an increase of 6.6% from 2015 levels.

Both Earth Science and Planetary Science come out ahead of FY2015, resolving a funding disagreement between the administration, House, and Senate. Aeronautics fared better than anticipated, managing to avoid larger cuts slated by the president and Congress. Meanwhile, NASA's Exploration account received a considerable 20.6% increase over last year, which will fund the Orion spacecraft and the Space Launch System (SLS) at significantly higher amounts than the president's budget; SLS will still see funding at least $300 million below what House and Senate appropriators called for. Commercial Space Transportation received the full amount requested by the administration.

NASA's planetary science division, long supported by key congressional appropriators, did best of all, with a 13.4% increase to $1.63 billion. NASA's Earth Science budget was $1.92 billion, a rise of 8.4% from FY2015 levels. The Earth Science division funding nearly matches the president's budget request—a sign that the anti-climate science rumblings from House conservatives dissipated. Last year, language was inserted into the final appropriations for the National Science Foundation that limited some of its climate science research. Not only did that language disappear this year for the NSF, but none appeared in NASA's Earth Science division.

One point of friction remains: The bill directs NASA to scrap plans for the Thermal-Infrared Free-Flyer, a $180 million mission that the White House proposed in February. It would be a backup, in infrared wavelengths, to the long-running Landsat Earth observation program. Instead, Congress gave NASA $100 million to pursue the development of Landsat 9 as a rough copy of its predecessor, which launched in 2013.

In the astrophysics division, the James Webb Space Telescope (JWST) still dominates: It will receive $620 million in funding toward its 2018 launch, while the rest of the division received $730 million, a rise of 6.7% over previous years. But there are also the first signs of life for the division, after JWST: Congress gave NASA $90 million to begin work on the Wide Field Infrared Survey Telescope, the community's top priority in the 2010 survey titled *New Worlds, New Horizons in Astronomy and Astrophysics*, which will aid in the search to understand dark energy and greatly expand exoplanet studies.

Space Technology received a boost to $686.5 million, an increase of $90 million, or 15.2% above the FY2015 enacted level of $596 million while Aeronautics's budget fell by $2

million to $640 million. The president's FY2017 budget would cut the NASA budget by $1.1 billion, targeting both the Orion spacecraft and the SLS. The Senate has proposed a $21 million increase while the House proposed $223 million increase; both would increase funding over FY2016 for Orion and SLS.

The last time a NASA authorization bill was enacted was in 2010. Its policy provisions still apply, but the funding recommendations were only for FY2011 through FY2013. The House advanced additional authorizing legislation in February and April 2015, but they have been stymied by partisan disagreement or lack of movement from the Senate.

Department of Education

The omnibus appropriations bill included $22.5 billion in discretionary funding for Pell grants, the same as the 2015 enacted level and $370 million above the level passed by the House earlier in the year. With additional Pell funding in the mandatory budget, this allowed the Department of Education to raise the maximum grant to an estimated $5,915, an increase of $140, for AY2017. In December, the House and Senate agreed, after intense negotiations led by Senate committee chair Lamar Alexander (R-TN), to extend some lending under the Perkins Loan Program through September 2017, for students currently funded via the program.

The bill also includes level funding for Improving Teacher Quality State Grants ($2.3 billion), and Math and Science Partnerships ($153 million). The Institute for Education Sciences—the statistics, research, and evaluation arm of the department—received a $44 million increase, to $618 million.

MIT Policy Initiatives

MIT faculty and administrators remained deeply involved with national policymakers in significant part through a series of ongoing policy initiatives and studies. These initiatives have major science and technology aspects, tied to national and international policy questions, and also, in effect, provide concrete examples of the importance of federal research. The Washington Office provides ongoing support for these efforts, helps link in policymakers as reports are developed, and assists in bringing completed reports to the attention of Washington policymakers.

Convergence

The MIT Washington Office continued to play an active role in MIT's efforts to advance the convergence research model, which integrates engineering, physical sciences, and computation with the life sciences. Kate Stoll of the Washington Office served as director for a new study of convergence as applied to health science research, co-chaired by Institute Professor Philip Sharp, Koch Institute director Tyler Jacks, and President Emerita Susan Hockfield. With support from three philanthropic foundations, the study brought leading researchers together for two workshops and developed a new report titled Convergence: The Future of Health.

The first workshops, held December 2 and 3, 2015, at the American Academy of Science in Cambridge, MA, helped gather information and ideas from over 30 experts from

around the country to form the basis of a major report—including exploration of initial convergence research themes and strategies for advancing the research model at the federal and institutional level. A second workshop, held on March 24 and 25, 2015 at the American Association for the Advancement of Science in Washington, DC, assembled over 65 experts from academia, industry, government, and the philanthropic community to discuss report content including recommendations for advancing the convergence research model on a national level. AAAS president Rush Holt welcomed the group. MIT president Rafael Reif attended and introduced the keynote speaker, Susan Desmond-Hellmann, CEO of the Bill and Melinda Gates Foundation.

The final report was released on June 24, 2016, at a symposium at the National Academies of Sciences, Engineering, and Medicine (NASEM). Outgoing academies president Ralph Cicerone opened the event, at which Professors Sharp and Jacks summarized key findings of the study. MIT vice president for research Maria Zuber led subsequent discussions with the incoming academies president Marcia McNutt, DARPA director Arati Prabhakar, and NSF director France Córdova. Officials from numerous federal agencies and leading researchers from academia and industry gave presentations on research programs utilizing the convergence model and future opportunities to accelerate progress in health science research via this approach.

Study leaders also briefed key members of Congress and administration officials on the report findings. On June 23, 2016, Sharp met with officials at the White House Office of Science and Technology Policy; Representative Rosa DeLauro (D-CT, ranking member of the House Appropriations Subcommittee on Labor, Health and Human Services, and Education); Representative Joe Kennedy (D-MA, member of the House Energy and Commerce Subcommittee on Health); and senior bipartisan staff of the Senate Committee on Health, Education, Labor, and Pensions (HELP). On June 24, Sharp and Jacks visited the National Institutes of Health, where they discussed the report with senior officials from the Office of the Director, the National Cancer Institute, and the National Center for Advancing Translational Sciences. In parallel with the report release, Professors Sharp, Hockfield, and Jacks published an editorial in *Science* highlighting recent advancements, enduring challenges, and top recommendations for advancing health through convergence.

Advanced Manufacturing

MIT's active engagement in the nation's manufacturing policy continued this year, with Washington Office staff working together with campus experts to support advanced manufacturing efforts. As background, President Reif and previously President Hockfield had served as co-chairs for President Obama's Advanced Manufacturing Partnership (AMP) 1.0 and 2.0 task forces and report. For the second report—AMP 2.0, President Reif delivered the key recommendations to the president at the White House on October 26, 2014, with co-chair Andrew Liveris, the president and CEO of Dow Chemical Company; Secretary of Commerce Penny Pritzker; Presidential Science Advisor John Holdren; and National Economic Council director Jeff Zients—who also participated in the committee's final meeting and White House briefing. The AMP reports—building on MIT's Production in the Innovation Economy research published by the MIT Press, *Making in America: From Innovation to Market* and

Production in the Innovation Economy—made a series of recommendations for renewing advanced industrial production in the United States in an effort to address the loss of manufacturing production and jobs that has occurred over the last three decades.

In AY2016, the emphasis shifted to implementing the recommendations of the report prioritizing advanced manufacturing technologies with manufacturing innovation institutes organized around them; developing advanced manufacturing technology strategies and cross-agency R&D coordination; creating a standing university-industry consortium to guide federal actions; developing better standards and information-sharing mechanisms in manufacturing; and establishing a strong governance structure for the National Network for Manufacturing Innovation, also known as Manufacturing USA. MIT faculty groups were part of successful teams that stood up advanced manufacturing institutes in integrated photonics, flexible electronics, and revolutionary fibers and textiles.

On April 1, 2016 Secretary of Defense Ashton Carter traveled to MIT to announce that a consortium of 89 manufacturers, universities, and nonprofits organized by MIT would lead the Manufacturing Innovation Institute for Revolutionary Fibers and Textiles, with principal federal sponsorship from the Department of Defense. The institute, known as Advanced Functional Fabrics of America, or AFFOA, is focused on securing US leadership in revolutionary fibers and textiles manufacturing.

On July 27, 2016 Vice President Joe Biden announced in Rochester, New York, that DOD's integrated photonics manufacturing innovation institute, known as AIM Photonics, would be headquartered there. MIT has a major role in this consortium of 124 companies, nonprofits, and universities managed by SUNY Polytechnic Institute. Michael Watts, professor of electrical engineering and computer science, is the chief technology officer for the effort. Lionel Kimerling, professor of materials science and engineering is the director of the AIM Academy, overseeing all education and workforce development efforts for the Manufacturing Innovation Institute (MII) as well as industry roadmapping activities.

Professor Yoel Fink, director of MIT's Research Laboratory of Electronics, leads the institute. Major partners include the state of Massachusetts; Drexel University; Cornell University; Clemson University; the Universities of Tennessee, Central Florida, Massachusetts, Texas, and Georgia; and companies of all sizes from brrr°, Warwick Mills, and Bluewater Defense, to FLIR, RTI International, Steelcase, Nike, Corning, and DuPont. MIT president Rafael Reif hosted the event, giving opening and closing remarks. Visiting dignitaries also taking part in the announcement included Massachusetts senator Edward Markey; Massachusetts governor Charlie Baker; Pennsylvania governor Tom Wolf; Representative Joseph Kennedy of the Massachusetts fourth congressional district; and chief product office of AFFOA and brrr° co-founder, Tosha Hays.

To stimulate advanced manufacturing innovation and create career opportunities, President Obama had pledged to create 15 Manufacturing Innovation Institutes across the country during his administration and link them together to anchor the National

Network for Manufacturing Innovation. AFFOA is the eighth MII created. At the end of the fiscal year, groups of MIT faculty were participants on teams competing for three other institutes.

Innovation Initiative—Innovation Orchards

In May 2015 President Reif authored a *Washington Post* op-ed about a growing problem in United States innovation. Calling for a new kind of "innovation orchard" to help scale up startup firms, he emphasized the need for regional and national policy elements to fill a gap he identified in the national innovation system. He noted that startups in non-IT fields face major challenges in scaling up to a point where their technologies are prototyped, demonstrated, tested, accelerated, and placed in range of follow-on financing mechanisms. His orchards proposal became a new element in MIT's Innovation Initiative established the previous year.

In support of his concern, the Washington Office began preparing a detailed evaluation of federal and regional programs supporting early-stage technology innovation, working with others at MIT exploring potential models for orchard spaces. It developed papers on existing federal programs relevant to the problem of scaling up startups, on other orchard-like models, on better linkage between small manufacturers and startups, and on demonstrating the pullback of venture funding from hard technologies. It began work on a major paper supporting the need for an innovation orchard approach, as planning progressed at MIT on the possible creation of such an entity in the Kendall Square area that could be stood up by MIT with partners to fill this gap in Massachusetts and the surrounding region.

Online Education Initiative

MIT continued to demonstrate a strong commitment to the use of online tools to drive innovation in higher education. The edX platform saw increasing use and further development by co-founders MIT and Harvard and a growing list of other universities.

Vice President for Open Learning Sanjay Sarma and Professor Karen Wilcox, with backing from President Reif, initiated the MIT Online Education Policy Initiative (OEPI) to reflect on this trend and guide its future course. Washington Office staff worked this year with Professors Sarma and Wilcox to complete work begun last year on the OEPI, with funding from the Carnegie Foundation of New York.
A committee of participating MIT faculty and an expert outside advisory committee explored pedagogy and efficacy, institutional business models, change agents, and engagement strategies in a series of discussions. This work culminated in the report "Online Education: A Catalyst for Higher Education Reform," coauthored by Sarma, Wilcox, and Philip Lippel of the Washington Office, which was released at the NASEM on April 1, 2016.

The Washington Office worked with OEPI leaders to present findings of the report in briefings at the American Council on Education, with the Senate Commerce and Science Committee, and with the Senate Committee on Health, Education, Labor, and Pensions. Associate Dean of Digital Learning Vijay Kumar and Professor of Eric Klopfer, director of the Scheller Teacher Education Program, also participated in

these discussions, presenting the final report of an NSF-sponsored workshop on the intersection of learning science and online learning. This report was important input to OEPI discussions of designs and models that can use both technology and insights from decades of research into teaching and learning to improve educational outcomes across disciplines, whether in traditional classrooms, blended learning environments, or fully online learning programs.

Wilcox, Sarma, and Klopfer led the public release of their report at a workshop hosted by the Middle Skills Committee of the NASEM's Board on Science, Technology, and Economic Policy.

Professor Willcox introduced four key recommendations that emerged from the initiative:

- Establishing a cross-disciplinary research effort, integrating learning science from education scholars, neuroscience and cognitive science
- Adopting online education as a powerful new tool in the future of blended education
- Creating and celebrating of a new professional category called learning engineers to support faculty in optimizing online and blended courses
- Launching a change agenda across the nation to reform education

Professor Klopfer elaborated on the first two recommendations, and Professor Sarma followed with further discussion of the last two recommendations.

Association of American Universities (AAU) vice president Toby Smith moderated a panel of educators who responded to the recommendations and provided examples of how they might apply. Marshall Smith, visiting scholar at the Carnegie Foundation for the Advancement of Teaching and former deputy secretary of education, started by discussing the potential of Career Technical Education courses in meeting the report goals. Andrea Nixon, director of educational research at Carleton College, focused on how to improve the outcomes of underprepared students. Bror Saxberg, chief learning officer at Kaplan, discussed how the cross-disciplinary approach and "learning engineer" perspective apply in a complex organization such as Kaplan. Smith, Nixon, and Saxberg had been external advisors to the OEPI. Kacy Redd, director of science and mathematics education policy at the Association of Public and Land-Grant Universities (APLU) discussed how the recommendations could move forward in a more concrete way on college campuses.

David Soo, senior policy advisor to the under secretary at the US Department of Education, moderated the final panel of the afternoon, featuring government responders. Soo began by discussing some current Department of Education efforts using its experimental site authority to investigate alternative educational tools and pathways. Susan Singer, division director of undergraduate education at the NSF, discussed the role of data-intensive research in STEM education. Roberto Rodriguez, deputy assistant to the president for education in the White House's Domestic Policy Council, discussed the White House's goals on higher education reform. Mark Mitsui,

deputy assistant secretary for community colleges in the Office of Career, Technical, and Adult Education discussed the role that community colleges can play in education reform of the type called for by the report.

Prior to the National Academy of Science (NAS) forum, Sarma, Willcox, Klopfer, and Kumar met with Washington policy leaders to discuss the OEPI findings and recommendations. Briefings were held at the American Council on Education, with the Senate Commerce and Science Committee, and with the Senate Committee on Health, Education, Labor, and Pensions. OEPI leaders were then invited to contribute to the development of a higher education supplement to the Department of Education's National Education Technology Plan. Leading to participation in a DC-based drafting workshop and to a working session on campus with National Education Technology Plan leaders.

Future Postponed Initiative for Basic Research

Washington Office staff continued to work with the Science Philanthropy Alliance, and its leader, on the Future Postponed effort, seeking to draw attention to promising areas of research that cannot be adequately explored in the current funding environment. Professor of Physics Mark Kastner led an advisory committee that oversaw the second phase of the Future Postponed project, developing 11 new examples with leading scientists from over a dozen institutions and posting them online. The new case studies, ranging from the molecular understanding of the circadian clock, to nanoscale catalysts for renewable fuels, to the study of dark matter in the universe, are also collected in a new report, *The Future Postponed 2.0*, to be released in the fall of 2016, in time for the presidential transition.

Energy and Environmental Initiatives

The Washington Office continued to work closely with the MIT Energy Initiative (MITEI) to coordinate campus-wide energy research with energy technology and energy policy activities at federal agencies. We continued to promote the "Future of" studies, including the *Future of Solar Energy* study completed last year, and to discuss potential future studies with relevant agency and think tank experts. Following the announcements of Mission Innovation and the Breakthrough Energy Coalition (BEC) at the Paris Climate talks, the Washington Office began working with MITEI and with other universities with strong energy research programs to identify synergies and to leverage these opportunities to stimulate the development and adoption of low-carbon energy technologies to address global climate change. Continued administration emphasis on climate action also offered opportunities to begin to discuss MIT's Environmental Solutions Initiative in Washington circles, prior to the planned ramp-up of its off-campus activities in AY2017.

Agency ActivitiesDepartment of Defense

As background, In 2014, the Department of Defense announced that it would undertake a major new effort to address a worsening threat environment, the Defense Innovation Initiative. The then secretary of defense stated that America's potential antagonists were continuing to update their militaries and push their tactical capabilities, requiring a

major response from the United States. Ashton Carter, who was once a research fellow at MIT from 1982 to 1984, was confirmed as secretary by the Senate in 2015, and strongly endorsed the new emphasis on innovation.

Known as the "Third Offset Strategy," DOD created working groups to establish technology development programs based on critical, defense-technology challenges. DOD pressed for a new generation of technology offsets to replace the precision, stealth, and unmanned aircraft vehicle offsets the department had relied on for defense superiority in recent decades.

As part of that new innovation focus, Defense Secretary Carter visited MIT on December 2, 2015, engaging with President Reif and MIT faculty in a roundtable discussion about cutting-edge innovation in such industries as biotechnology, health care, and energy. Secretary Carter was joined by other senior administration officials including Acting Assistant Secretary of Defense for Research and Engineering Stephen Welby, DARPA director Arati Prabhakar, and Assistant Secretary of Defense for Health Affairs Jonathan Woodson. Professor Eric Lander hosted the group for a tour of the Broad Institute where Director of Lead Discovery Josh Bittker led a tour of the Chemical Screening Facility. Twelve Broad-affiliated faculty as well corporate attendees from startups and established companies also participated.

Vice President for Research Maria Zuber hosted the delegation's MIT stops, which included a tour of the Media Lab. Zuber started the faculty roundtable discussions by noting the power of the Kendall Square cluster and MIT's convergence model as a one that could be relevant to DOD. The roundtable discussions with the secretary and other DOD officials were on life science advance areas with Professors Phillip Sharp, Edward Boyden, and Angela Belcher; on physical science advance areas with Daniela Rus and Vladimir Bulovic; and on new technology policy opportunities with Krystyn van Vliet, discussing advanced manufacturing. President Reif closed the session and discussed the innovation orchards concept for scaling up innovations. He noted it could be a model relevant to DOD innovation needs. Secretary Carter then met with MIT ROTC students while the rest of the DOD delegation had a working lunch meeting with MIT faculty.

In May 2016, Secretary Carter announced that the department would establish an East Coast office for Defense Innovation Unit Experimental (DIUx), complementing the Silicon Valley office that opened in 2015, along with structural and management changes, dubbed DIUx 2.0, to accelerate DIUx success in building bridges to entrepreneurs and innovators. The Boston location, the secretary said, would provide important access to a core of innovative companies, universities, and other private institutions in the region, while enhancing its outreach to companies located throughout the country.

National Science Foundation

The National Science Foundation continued to operate without formal authorization as congressional efforts to replace the America COMPETES Act, which expired in 2013, failed to converge. The Senate Commerce Committee chose not to take up the House's

previously passed controversial FIRST Act. A series of hearings and information-gathering sessions, under the leadership of first-term Senators Gary Peters (D-MI) and Cory Gardner (R-CO) led the introduction—as the MIT fiscal year drew to a close—of the American Innovation and Competitiveness Act. The initial bill did not contain authorization levels for technical reasons, but an amendment was widely expected to authorize NSF for fiscal years 2017 and 2018, at levels of $7.5 billion and $7.98 billion respectively. With the House's lower authorized funding levels only extending through 2017, it was evident that no clear message was forthcoming from Congress regarding the foundation's long-term direction. The Senate bill reaffirmed NSF's current merit review processes, rejecting the House's effort to exert additional oversight and require certification that each individual grant is in the national interest. It was also expected to continue to support the NSF's current budget structure, rather than allowing Congress to control research funding at a finer level as the House has sought.

The MIT Washington Office worked closely with the NSF Office of Legislative and Public Affairs and the Division of Mathematical and Physical Sciences on the of the release of the first results from the NSF-sponsored Laser Interferometric Gravitational-Wave Observatory (LIGO). Physics professor Rainer Weiss, co-originator of the LIGO project, was a presenter at the February 11, 2016, National Press Club event announcing that the LIGO team and its collaborators had identified an unmistakable signature of gravitational waves emanating from the merger of two black holes within weeks of turning on their twin upgraded detectors. Vice President for Research Maria Zuber represented the National Science Board at the event. MIT LIGO Lab director David Shoemaker, together with colleagues from Caltech, briefed interested members of Congress on the observations in a two-day series of meetings. Senator Edward Markey (D-MA) read submitted congratulatory remarks to the *Congressional Record* regarding the LIGO breakthrough. Shoemaker returned to Washington two weeks later, at the invitation of the House Science Committee, joining LIGO director David Reitze from the California Institute of Technology (Caltech), LIGO Scientific Consortium director Gabriella Gonzalez, and NSF Mathematical and Physical Science director F. Fleming Crim to discuss the history of the LIGO project, its first successful observations, and plans for the future of the new field of gravitational wave astronomy. In May 2016, Weiss discussed gravitational waves and the LIGO observations at the Senate Science Forum.

It should also be noted that Maria Zuber was named by President Obama in May as chairman of the National Science Board, where she had previously served as a member. The board is the key science advisory entity for NSF, as well as serving a larger role on behalf of science in general.

National Institutes of Health

For another year, the National Institutes of Health maintained strong congressional support with both the House and Senate supporting budget increases. However, in January 2016, a letter signed by more than 50 House Democrats urged NIH and the Department of Health and Human Services (HHS) to put in place guidelines for the use of march-in rights, which can be used to lift the exclusive rights drug companies have to their drugs and treatments. NIH and HHS declined to act, and concerns were raised that the Bayh-Dole Act march-in rights were not intended to be used as price controls.

Over the course of the year President Obama's Precision Medicine Initiative began to take shape. In the budget omnibus bill, NIH received $200 million to fund the initiative. In February 2016, the White House and NIH announced a number of pilot projects to help the initiative recruit its target of 1 million people for a long-term health study. At the end of May 2016, the administration released the final Data Security Policy Principles and Framework.

As he did the year before, President Obama announced a new major initiative during his state of the union address. Vice President Biden is leading the Cancer Moonshot. While speaking at the World Economic Forum about the Cancer Moonshot, Vice President Biden was joined by Francis Collins and panelists, including Professor Paula Hammond from MIT. To help guide the initiative, a 28-member blue panel—a working group of the National Cancer Institute's National Cancer Advisory Board—was formed. MIT cancer biologist Tyler Jacks is one of the three co-chairs.

National Aeronautics and Space Administration

New Horizons executed a flyby of Pluto, returning imagery of the planet's surface. MIT researchers Professor Richard Binzel and graduate student Alissa Earle were members of the NASA team and were congratulated by Senator Edward Markey during a floor speech.

Commercial spaceflight continued to make headway. On November 25, 2015, President Obama signed into law the US Commercial Space Launch Competitiveness Act. Most of the bill is devoted to issues regarding commercial space transportation, including extensions of third-party launch indemnification and restrictions on regulations regarding safety of commercial spaceflight participants.

Department of Energy

MIT continued to engage with Department of Energy leadership on energy policy issues including innovation in low-carbon energy technologies, basic research in energy-related fields from materials science to high-energy physics, energy efficiency, and environmental monitoring related to climate change. In addition to its supporting role in the MITEI activities described above, the Washington Office worked with MIT administrators, faculty, and staff to provide input to DOE's continued reshaping of its applied energy programs as well as direction and priority setting for Office of Science research programs.

Following the historic deal announced in October 2015 to limit Iran's ability to produce fissionable material that could be used in nuclear weapons, the office worked with the American Association for the Advancement of Science to brief interested congressional members and their staff on how the agreement would be enforced. Nuclear science and engineering professor Scott Kemp came to Washington to describe compliance monitoring technologies specified in the agreement.

With the Alcator C-Mod tokamak, an experimental nuclear fusion device operated as a national user facility by MIT's Plasma Science and Fusion Center (PSFC), slated for shutdown in October 2016, Washington Office staff coordinated a series of meetings

regarding future directions for fusion research. Maria Zuber and PSFC director Dennis Whyte each led discussions with the DOE; the Office of Management and Budget; and congressional staff, including Office of Science Director Cherry Murray and Deputy Assistant Secretary for Science and Energy Adam Cohen.

In December 2015, the Obama administration announced that it would seek a doubling, over five years, of the federal funding for clean energy research and development. Part of a multinational effort dubbed Mission Innovation, this initiative to accelerate society's transition to low-carbon energy sources was announced at the 21st Conference of Parties of the United Nations Framework Convention on Climate Change in Paris. A parallel, privately funded initiative, the Breakthrough Energy Coalition, pledged to expand investments in technologies with the potential to drive this transition. Following these announcements, Washington Office staff participated in meetings and strategy sessions with other universities and DOE officials seeking to develop support for Mission Innovation and the Breakthrough Energy Coalition, and to identify technologies and research directions compatible with their goals.

Intellectual Property

Since the America Invents Act of 2011 was enacted, legislation to further reform the patent system has repeatedly been introduced. These efforts slowed substantially this year. The search for a new legislative approach to deal with so called "patent trolls"—one of the key issues Congress has been trying to address—stalled, with emphasis shifting to actions by the court system to interpret current laws.

Both the Innovation Act, which raised widespread concern among universities, and the Patent Act failed to make headway prior to the summer recess in 2015. By the fall some former congressional supporters of the reform effort reversed their positions, signaling there was no path forward for the bills. The Venue Equity and Non-Uniformity Elimination Act was introduced in the fall in an attempt to curb forum shopping, in which certain patent plaintiffs seek to have their cases heard in troll-friendly courts, but by spring it was dead.

A number of important legal disputes involving universities and creating precedents relevant to MIT were resolved over the course of the year. The Wisconsin Alumni Research Foundation won a $234 million suit against Apple, which had used microchip technology in iPhones and iPads without permission. Similarly, Carnegie Mellon ended a seven-year patent dispute with a $750 million settlement in their favor. However, on March 3, 2016, a patent dispute over the CRISPR gene-editing technology began between the Broad Institute involving MIT researchers and the Regents of the University of California and Berkeley researchers, with no signs of a quick resolution.

Science Policy Communications and Work with MIT Students

Communications

The Washington Office prepares periodic news and analysis documents for distribution to several different audiences. When Congress is in session, MIT senior faculty and administrators receive a detailed newsletter each week summarizing policy

developments and budgeting activities of direct interest to the R&D and higher education communities. *Current Events in Science Policy*, news updates also prepared weekly, is distributed to alumni through the MIT Alumni Office Legislative Advocacy Network and sent directly to graduate students active in the Science Policy Initiative (SPI) and the Graduate Student Council Legislative Action Subcommittee. It is also posted online and distributed through social media, covering such issues as federal R&D policy, STEM education, and appropriations. The office also compiles *Endless Frontier: Innovations in Science and Engineering*, an online monthly newsletter distributed to over three thousand congressional staff and executive branch officials, transmitting highlights of MIT research results.

Congressional Visits, Executive Visits Day, and the Science Policy Course

The Washington Office continued to work with the MIT Science Policy Initiative, a student-run group that engages science and engineering students in funding and policy decisions that affect their careers in research and innovation. SPI programs brought teams of students to Washington in the spring and again in the fall for direct engagement with federal policymakers.

On March 17 and 18, 2016, 22 students from SPI traveled to Washington as a part of this effort, to take part in the 20th annual science, engineering, and technology Congressional Visits Day. For many students, this was their first direct interaction with Congress. They met with a total of 51 congressional offices including seven members. In these meetings, students spoke about the importance of robust and sustained federal investment in R&D, highly skilled work visas, and policy issues relating to their individual research areas.

From October 19 through 21, 2015, 18 MIT students visited federal agencies and nongovernmental organizations in the Capitol with SPI's Executive Visits Day program. The students met with staff at the White House Office of Science and Technology Policy (OSTP), the Department of State, NSF, DOE, the Environmental Protection Agency, the National Oceanic and Atmospheric Administration (NOAA), ARPA-E, the United States Agency for International Development, and others to learn about federal policy and explore career options.

In addition, the Washington Office director continued, for the ninth year, his course taught during MIT's Independent Activities Period on science and technology policy, organized in cooperation with SPI. The course again attracted some 35 graduate students interested in learning about federal R&D organization and federal science policy.

Coalitions and Working Groups

The Washington Office amplified its activities through cooperation with other universities and stakeholders in the R&D and innovation enterprise. Participation in the following associations, organizations, and working groups is an essential part of those efforts.

- Ad Hoc Group for Medical Research
- Ad Hoc Tax Group
- American Council on Education
- Association of American Universities, Council on Federal Relations
- Association of Public and Land-Grant Universities, Council on Governmental Affairs
- Coalition for Aerospace and Science
- Coalition for National Science Funding
- Coalition for National Security Research
- Coalition for Plasma Science
- Council of Graduate Schools
- Council on Competitiveness
- Council on Governmental Relations
- Energy Sciences Coalition
- Fusion Energy Sciences
- National Association of Independent Colleges and Universities
- New England Council
- Personalized Medicine Coalition
- Research! America
- STEM Education Coalition
- Task Force on American Innovation
- The Science Coalition
- United for Medical Research

Bill Bonvillian
Director, MIT Washington Office

Appendix

Meetings in Washington, DC

MIT Faculty/ Staff	Date	Topic	Meeting
Maria Zuber	7/16/15	Tech-transfer programs	NIH Small Business Innovation Research and Small Business Technology Transfer programs coordinator Matthew Portnoy, along with Jennifer Shieh, Jodi Black, and Kurt Marek from the National Heart, Lung, and Blood Institute
		DARPA programs in neurotechnology, human-machine interface, human performance, infectious disease, and synthetic biology	DARPA Biological Technologies Office deputy director, Alicia Jackson
		Introduction	Tiffany Watkins-Ahern, Washington director for Massachusetts Governor Charlie Baker
		Energy issues	Department of Energy's Energy Policy and Systems Analysis director (and former MIT Energy Initiative executive director) Melanie Kenderdine; deputy director for State and Local Cooperation Karen Wayland; and a group of advisors and analysts including Desiree Pipkins, Rebecca Dell PhD '13, Alex Breckel SM '14, Lara Pierpont SM '08, PhD '11, Carol Battershell, and Sandra Jenkins SM '14
James DiCarlo	7/16/15	The role of high-performance computing in neuroscience research and the use of brain-inspired computer architectures and algorithms in advanced scientific computing research	Congressional briefing sponsored by the National Laboratory Caucus and IBM
Marc Kastner	7/21/15	Roundtable discussion about how to maximize basic research and maintain US global competitiveness; the roundtables are designed to inform the next Senate COMPETES bill	Senators John Thune (R-SD), Cory Gardner (R-CO), Gary Peters (D-MI), and Amy Klobuchar (D-MN); Norman Augustine, retired CEO, Lockheed Martin; Ralph Cicerone, president, National Academy of Science; Dan Arvizu, chairman, National Science Board; Timothy Sands, president, Virginia Tech; Russell Moore, provost and executive vice chancellor of University of Colorado

MIT Faculty/ Staff	Date	Topic	Meeting
Dennis Whyte	7/28/15	Upcoming final year of operation for Alcator C-Mod and forward-looking ideas in fusion	Lara Pierpoint SM '08, PhD '11, at DOE's Office of Energy Policy and Systems Analysis; professional staff from the House Committee on Science, Space, and Technology and the House and Senate Appropriations Subcommittees on Energy and Water Development; Representative Michael Capuano, along with Massachusetts delegation staffers Bruno Frietas (Senator Elizabeth Warren); Michal Freedhoff and John Phillips (Senator Edward Markey); Sam Rodarte (Representative Capuano); John Moreschi (Representative Katherine Clark); and Becky Cairns (Representative Niki Tsongas)
R. Scott Kemp	9/1/15	The agreement between the P5+1—the five permanent members of the UN Security Council plus the European Union—and the government of Iran, under which Iran is to greatly scale back its nuclear research programs in return for the lifting of economic sanctions; the briefings focused on the adequacy of technology to verify Iran's compliance with research restrictions	Congressional staff briefing, requested by the American Association for the Advancement of Science and the office of Representative Michael Capuano
Claude Canizares	9/22/15	*Optimizing the Nation's Investment in Academic Research: A New Framework for Research Universities in the 21st Century*	Report roll-out by National Academy of Sciences (NAS) Committee on Federal Research Regulations and Reporting Requirements; Professor Canizares was a member of the committee
Barry Posen, Roger Petersen, Richard Nielsen from MIT; and Peter Krause from Boston College	10/23/15	The Organization and Sustainment of Violence in the Greater Middle East: Hidden Challenges to US Counter Terror Policy	Seminar for congressional and executive branch staff on Capitol Hill
18 MIT graduate students	10/19–10/21/15	For students to gain perspective on how the federal government sets research priorities and policies	SPI's Executive Visits Day

MIT Faculty/ Staff	Date	Topic	Meeting
Gigi Hirsch and Kenneth Oye	10/27–10/28/15	Better Science, Better Health, New Healthcare Models, topics covered included international collaboration on drug approval regulatory reform, improving patient outcomes through big data and analytics, new models for using health care data, means to implement personalized medicine, innovations in regulatory science and approvals, and new approaches for patient participation in health care	2-day forum at House of Representatives Cannon Caucus with senior figures from the US Food and Drug Administration, from European drug regulatory agencies, from US and European pharmaceutical and biotech firms, patient groups, and congressional officials, and introduced by Senator Sheldon Whitehouse (D-RI)
Sanjay Sarma, Vijay Kumar, and Eric Klopfer	5/6/15	Online Education Policy Initiative	Seeking comments on preliminary draft report from APLU; AAU; NSF (including Susan Singer, division director for undergraduate education; DUE deputy division director Lee Zia; DUE program directors Gül Kremer, Myles Boylan, Yvette Weatherton, and Gregg Solomon; Division of Research on Learning senior advisor John Cherniavsky; AAAS fellow Britt Lundgren; Education Center Program director Elliot Douglas from the Engineering Directorate; and science assistant Kris Pachla; White House Office of Science and Technology Policy for a discussion with OSTP deputy director for Technology and Innovation Tom Kalil, Policy Advisor Lena Shi, and assistant director for Education and Learning Science Danielle Carnival; US Department of Education staff Mark Mitsui, Deputy Assistant Secretary for Community Colleges; Sharon Leu, Higher Education Innovation Specialist; Roger Nozaki, senior policy advisor to the Under Secretary, and Joseph South, deputy director for Educational Technology

MIT Faculty/ Staff	Date	Topic	Meeting
Maria Zuber and Kerry Emanuel	11/20/15	Weather forecasting research, focusing on the connections between the weather research community and the forecasting models and operations of the National Weather Service	NOAA: Kathryn Sullivan; Chief Scientist Richard Spinrad, National Weather Service director Louis W. Uccellini; and Senior Advisor Christine Blackburn House Space, Science, and Technology Committee: Minority Staff Director Richard Obermann; majority staffers Cliff Shannon (staff director, Subcommittee on Research and Technology) and Taylor Jordan (Subcommittee on the Environment) Senate Commerce, Science, and Transportation Committee: Nicholas Cummings (minority staff director); Sara Gonzalez-Rothi Kronenthal (counsel); and Alicia Brown, Owen Berger, and Josh Manning.
		Relationship between weather and climate modeling and prediction	US Global Change Research Program executive director Michael Kuperberg; Deputy Executive Director Benjamin DeAngelo; and Gary Geernaert from the Department of Energy, vice chairman of the interagency Subcommittee on Global Change Research
Yoel Fink	11/17/15	Tizard Mission	Celebration of 75th Tizard Mission with OSTP director John Holdren, and British and Canadian officials, Sponsored by ONR at the Canadian Embassy
Rafael Reif	12/17/15	Innovation Orchards, and the status of the Defense Technology Initiative	Stephen Welby, deputy assistant secretary of Defense for Systems Engineering
		Innovation orchards, Advanced Manufacturing and online education	NSF: Richard Buckius, deputy director; Joan Ferrini-Mundy, assistant director of Education and Human Resources; Bruce Kramer, senior advisor; and Susan Singer, director of Undergraduate Education
		Innovation orchards, Advanced Manufacturing	DOE: Ernest Moniz, secretary of Energy; and David Danielson, of EERE
Krystyn van Vliet	12/18/15	National Network for Manufacturing Innovation	John Phillips, senior advisor to Senator Edward Markey (D-MA); Arun Seraphin and Anish Goel, professional staff of the Senate Armed Services Committee National Institute of Standards and Technology (NIST): Mike Molnar, AMNPO director; Frank Gayle, deputy director; Robert Rudnitsky, senior advisor; and Phillip Singerman, assistant director for Innovation and Industry Services

MIT Faculty/ Staff	Date	Topic	Meeting
Rai Weiss and David Shoemaker	2/11/16	LIGO Scientific Collaboration announcement about gravitational waves emanating from black holes	Maria Zuber represented the National Science Board at the National Press Club event David Shoemaker briefed Senator Edward Markey and his staff, as well as Massachusetts delegation science staffers from the offices of Senator Elizabeth Warren and Representatives Capuano, Clark, Kennedy, and Tsongas, as well as Congress and their staff on the discovery after the press conference. Together with Stan Whitcomb, a senior scientist from Caltech's LIGO team, Shoemaker met with staff from the House Space, Science, and Technology Committee; the Senate Commerce, Science, and Transportation Committee; the Senate Appropriation Subcommittee for Commerce, Justice, and Science; the offices of Senators Dianne Feinstein (D-CA), Barbara Boxer (D-CA), Maria Cantwell (D-WA), and Patricia Murray (D-WA); and the office of Representative Adam Schiff (D-CA).
Maria Zuber and Dennis Whyte	3/18/16	Energy research programs, with a focus on fusion energy; overall direction of Office of Fusion Energy Sciences (part of DOE's Office of Science); and MIT's latest ideas for accelerating the pace of fusion research Overall funding situation for fusion research and the need to ensure that DOE's fusion programs include opportunities to explore innovative technologies Progress in moving fusion forward to the point where it is a viable generator of baseline electricity	DOE: Adam Cohen, deputy assistant director for Science and Energy; Cherry Murray, the new director of the Office of Science; Whyte also met with Deputy Director of Budget Analysis David Lippold At the Office of Management and Budget's Energy division, they met with Tali Bar-Shalom, Christine McDonald, and Paul Rehmus Bipartisan Policy Center–Energy Project: Energy Project director Tracy Terry; assistant director for Energy Innovation, Brad Townsend; and Senior Advisor Sam Brinton (MIT '14)
Rafael Reif, Phil Sharp, Susan Hockfield, and Tyler Jacks	3/24–3/25/16	"Convergence: The Future of Health"	Workshop for 65 experts at AAAS; keynote by Susan Desmond-Hellman, CEO of the Bill and Melinda Gates Foundation. Representatives from NSF, NIH, DARPA, and OSTP, and industry leaders from Verily and Polaris Partners also contributed their perspectives. The workshop was supported by the Raymond and Beverly Sackler Foundation, The Kavli Foundation, and the Burroughs Wellcome Fund.

MIT Faculty/ Staff	Date	Topic	Meeting
Rafael Reif	3/24/16	"Convergence: The Future of Health"	Barry Pallotta, acting director DARPA Biological Technologies Office; Susan Desmond-Hellmann, CEO of the Bill and Melinda Gates Foundation; former congressman Rush Holt, CEO of the AAAS; Ambassador William Burns, president of the Carnegie Endowment for International Peace; joined by Professor Tyler Jacks, he also met with Greg Simon, special assistant to the president and senior advisor to the vice president and executive director of the new "Cancer Moonshot" and Danielle Carnival, assistant director, White House OSTP
Karen Wilcox, Sanjay Sarma, Eric Klopfer, and Vijay Kumar	4/1/16	"Online Education: A Catalyst for Higher Education Reform"	Report release at the NAS. Participants were: Toby Smith, AAU VP; Marshall Smith, visiting scholar at the Carnegie Foundation for the Advancement of Teaching and former deputy secretary of education; Andrea Nixon, director of Educational Research at Carleton College; Bror Saxberg, chief learning officer at Kaplan; Kacy Redd, director of Science and Mathematics Education Policy at the APLU; David Soo, senior policy advisor to the Under Secretary at the US Department of Education; Susan Singer, division director of Undergraduate Education at the NSF; Roberto Rodriguez, deputy assistant to the president for Education in the White House's Domestic Policy Council; Mark Mitsui, deputy assistant secretary for Community Colleges in the Office of Career, Technical, and Adult Education in the Department of Education
Karen Wilcox	4/4/16	First in the World Program, develop educational technology for scalable differentiated instruction	Karen gave a short presentation on the project to White House and Department of Education officials, and had further discussions with Under Secretary of Education Ted Mitchell and the new deputy under secretary, Kim Hunter Reed.
26 MIT Students	4/12–13/16	Congressional Visits Day	Science Policy Initiative students visited the offices of more than 30 members and senators, including Massachusetts delegation staffers working in the offices of Representatives Katherine Clark, Michael Capuano, Joseph Kennedy, Seth Moulton, and Niki Tsongas, and of Senators Edward Markey and Elizabeth Warren.

MIT Faculty/ Staff	Date	Topic	Meeting
Vijay Kumar and Claudia Urrea	4/15–17/16	4th USA Science and Engineering Festival in Washington, DC	Led MIT delegation doing hands-on experiments and demonstrations from across MIT's outreach programs; participants included students, staff, and faculty from AeroAstro Space Systems Laboratory, Zero Robotics, Beaver Works, ClubChem, Koch Institute, Office of Engineering Outreach Programs, OpenCourseWare, and the Society of Women Engineers
Maria Zuber	4/25/16	Innovation Orchards	Melissa Frame, DOD deputy assistant secretary for research Steven Linder and Scott Frost of DOD's Mantech program, which oversees DOD's new Manufacturing Innovation Institutes
Rai Weiss	5/10/16	LIGO Program and recent successes	France Cordova, NSF director, at a meeting of the Senate Science Forum; Senators Barbara Mikulski (D-MD), Lamar Alexander (R-TN), Gary Peters (D-MI), Cory Gardner (R-CO), and Mark Warner (D-VA); Professor Teri Odom of Northwestern University and Professor Kevin Fu of the University of Michigan also participated, discussing advanced manufacturing and cybersecurity, respectively
Rafael Reif	6/9/16	The need to restore growth to R&D levels when Sequestration returns for FY2018 Innovation Orchards	Massachusetts Delegation Senators Warren and Markey, and Representatives Tsongas, Clark, Capuano, and Kennedy John Hamre, president of the CSIS think tank and former deputy secretary of defense
Phillip Sharp	6/23/16	Review findings, "Convergence: The Future of Health"	Tom Kalil, OSTP deputy director for policy; Representative Rosa DeLaurof (D-CT), ranking minority member on the House Labor HHS appropriations subcommittee; Representative Joseph Kennedy (D-MA), of the health subcommittee of the House Energy and Commerce Committee; and senior bipartisan staff of the Senate HELP Committee

MIT Faculty/ Staff	Date	Topic	Meeting
Phillip Sharp, Tyler Jacks, and Maria Zuber	6/24/16	"Convergence: The Future of Health"	Report release. Participants were: Ralph Cicerone, outgoing NAS president; Marcia McNutt, incoming Academies president and current editor-in-chief of the journal *Science*; Arati Prabhakar, DARPA director; France Cordova, NSF director; Cato Laurencin, UConn professor; Melody Swartz, professor at University of Chicago; William Hait, global head of Jansen and Jansen's R&D division; Philip Bourne, NIH associate director for data science and leader of the Precision Medicine Initiative; Robbie Barbero, assistant director for biological innovation at the White House OSTP; Jerry Lee, Health Science director at the National Cancer Initiative and the new deputy director for research at the Cancer Moonshot
Phillip Sharp and Tyler Jacks	6/24/16	Review findings, "Convergence: The Future of Health"	Senior officials from the NIH Director's Office, the National Cancer Institute, and the National Center for Advancing Translational Sciences

Federal Officials—Visits to MIT

Government Official	Date	Topic	Meeting
Robin Staffin, DOD's director of Basic Research and key staff from his office	7/14–7/15/15	Quantum information and computing, Neuroscience and Synthetic Biology	Professors Dirk Englund, Peter Shor, Edward Farhi, and Terry Orlando regarding quantum; Professors James DiCarlo, Li-Huei Tsai, Kay Tye, Matthew Wilson, and John Gabrieli regarding brain and cognitive science; and in the Center for Synthetic Biology with Professors Ron Weiss and Domitilla Del Vecchio; these fields are focus areas for the department's basic research
Frank Kendall, undersecretary of defense for AT&L and a team of seven from DOD's Office of the Secretary, including Deputy Assistant Secretaries Kristen Baldwin, Andre Gudger, Ron Jost, and David Walker	7/22/15	Semiconductor technology, biofabrication and synthetic biology, and cybersecurity	They met with Provost Martin Schmidt and Professor Duane Boning on semiconductor technology issues; with Professors Angela Belcher and Chris Voight on biofabrication and synthetic biology issues; and with MIT's Computer Science and Artificial Intelligence Laboratory director Daniela Rus, Principal Research Scientist Howard Shrobe, and Professor Polina Golland on cybersecurity issues.
Representative Lamar Smith (R-TX), chairman of the House Committee on Science, Space and Technology	8/25/15	Nanomaterials for lighting, displays, solar cells, the MIT Innovation Initiative and the new MIT Nano Lab	Vladimir Bulovic
		Hurricanes and the physics of the atmosphere	Kerry Emanuel
		The future of fusion and fission	Dennis Whyte, Jacopo Buongiorno, and Nuclear Science and Engineering graduate student Kevin Woller
		Tour of the Transitioning Exoplanet Survey Satellite Lab	Sarah Seager
Twelve senior congressional staff from a range of committees, hosted by the Information Technology and Innovation Foundation—a Washington think tank	9/2/15	Bio/Pharma at the Koch Institute	Welcome by Maria Zuber; briefings by Ann Deconinck, executive director of Koch, and Professors Philip Sharp, Paula Hammond, and Angela Belcher
		Brain and Cognitive Science	James DiCarlo and Professors Guoping Feng, Alan Jasanoff, Josh McDermott, and Laura Schulz

Government Official	Date	Topic	Meeting
Susan Singer, NSF director of Undergraduate Education	9/2/15	Online Education	Vijay Kumar, Sanjay Sarma, and Kim Kimerling
Representative Joseph Kennedy (D-MA)	9/3/15	Scaling STEM, how to use technology to improve access to quality STEM education for all students	Co-hosted event with President Reif at the Media Lab
Ellen Williams, ARPA-E director	9/10/15	ARPA-E's role among the Department of Energy's research sponsoring offices, highlighting its solar-focused research programs such as ADEPT and MOSAIC as well as programs seeking innovation in electronics, grid technologies, and energy storage	MITEI's Solar Day event at the Media Lab
Penny Pritzker, secretary of commerce	9/18/16	On the Innovation Agenda for the rest of the Obama administration	Armchair discussion at Koch with President Reif
Lynn Orr, under secretary for science and energy at DOE	9/24/16	DOE Quadrennial Technology Review	Hosted by the MITEI
Ashton Carter, US secretary of defense; Stephen Welby, acting assistant secretary of defense for research and engineering; Arati Prabhakar, DARPA director; Jonathan Woodson, assistant secretary of defense for health affairs; Dhanurjay "DJ" Patil, White House chief data scientist; Eric Smith, senior military assistant to the secretary brigadier general; Eric Rosenbach, chief of staff to the secretary; and Sasha Rogers, special assistant to the secretary	12/2/15	Roundtable discussion about cutting-edge innovation in industries such as biotechnology, health care, and energy, plus tours of Broad and its chemical screening facility They also discussed the power of the Kendall Square cluster and MIT's convergence model; life science advance areas; and new technology policy opportunities regarding innovation orchards. Secretary Carter also met with MIT ROTC students.	President Reif participated in the roundtable, then Eric Lander and Josh Bittker led tours at Broad. Twelve Broad-affiliated faculty as well corporate attendees from startups and established companies also participated. Maria Zuber accompanied the group for the day including a tour of the Media Lab conducted by Deputy Director Peter Cohen and the faculty discussions.
Ernest Moniz, US secretary of energy	3/4/16	Opportunities in Energy	Addressed the student-run MIT Energy Conference
Christine Lagarde, managing director of the International Monetary Fund	3/4/16	"Demographic Change and Economic Well-being: The Role of Fiscal Policy"	Compton Lecture, introduced by President Reif

Government Official	Date	Topic	Meeting
Phillip Singerman, associate director for Innovation and Industry Services at NIST	3/22/16	Nanoscale coatings developments	Kripa Varanasi
		Flexible electronics and photonics	Brian Anthony
		Robotics	Harry Asada
		Bio-manufacturing issues	Stacy Springs
		Advanced fiber technologies	Yoel Fink
Susan Singer, division director of the division of Undergraduate Education of the National Science Foundation	3/31/16	Virtual Campus session of MIT's *The Campus—Then, Now, Next* symposium	Sanjay Sarma, Moderator Also, meetings with Isaac Chuang, John Gabrieli, Eric Klopfer, and Vijay Kumar
Michelle Lee, under secretary of commerce for intellectual property and director of the United States Patent and Trademark Office	3/31/16	Promoting Innovation	Talk to community hosted by Maria Zuber and MIT's graduate student Science Policy Initiative Additional meetings on campus with campus leaders from the Technology Licensing Office, Innovation Initiative, Martin Trust Center for MIT Entrepreneurship, and the Desphande Center for Technological Innovation
Ashton Carter, secretary of defense	4/1/16	Unveiling $317 million Manufacturing Institute for Innovative Fibers and Textiles	Hosted by President Reif, and attended by Senator Edward Markey; Massachusetts Governor Charlie Baker; Pennsylvania Governor Tom Wolf; Representative Joseph Kennedy of the Massachusetts 4th Congressional District; and Brrr° co-founder Tosha Hays

Faculty Testimony in Washington, DC

MIT Faculty/Staff	Date	Topic	Committee
David Shoemaker	2/24/16	LIGO detection of gravitational waves	Testified in front of 21 members of the House Space, Science, and Technology Committee; 12 of 22 Republican committee members, and nine of 17 Democrats participated in the hearing, including the Chair (Lamar Smith [R-TX]) and Ranking Member (Eddie Bernice Johnson [D-TX]) of the full Committee and the Chairs of each subcommittee