NATIONAL SCIENCE FOUNDATION CENTERS

NSF supports a variety of centers programs that contribute to the Foundation's mission and vision. Centers exploit opportunities in science, engineering, and technology in which the complexity of the research program or the resources needed to solve the problem require the advantages of scope, scale, duration, equipment, facilities, and students. Centers are a principal means by which NSF fosters interdisciplinary research.

NSF Centers
(Dollars in Millions)

	Program Initiation	Number of Centers in FY 2015[1]	FY 2015 Actual	FY 2016 Estimate	FY 2017 Request	Change Over FY 2016 Estimate Amount	Change Over FY 2016 Estimate Percent
Centers for Analysis & Synthesis	1995	4	$21.00	$18.60	$16.00	-$2.60	-14.0%
Centers for Chemical Innovation	1998	11	36.66	28.10	29.50	1.40	5.0%
Engineering Research Centers	1985	22	59.69	56.50	61.00	4.50	8.0%
Materials Centers[2]	1994	24	79.66	56.00	56.00	-	-
Nanoscale Science & Engineering Centers	2001	6	11.73	7.71	6.71	-1.00	-13.0%
Science & Technology Centers	1987	14	50.84	59.99	60.10	0.11	0.2%
Science of Learning Centers[3]	2003	3	8.46	-	-	-	N/A
Totals		**84**	**$268.04**	**$226.90**	**$229.31**	**$2.41**	**1.1%**

Totals may not add due to rounding.

[1] Includes centers that received no-cost award extensions in FY 2015 but no additional funding.

[2] Due to delayed awards processing, funding for FY 2015 includes $27.74 million carried over from FY 2014 and obligated in early FY 2015.

[3] The Science of Learning Centers program ended as planned in FY 2015 when the last centers reached the end of their ten-year funding cycles.

Description of Major Changes

Centers for Analysis and Synthesis – BIO

The FY 2017 Request of $16.0 million, $2.60 million below the FY 2016 Estimate, will fund three Centers for Analysis and Synthesis. These centers are described below.

In FY 2017, funding for the Plant Science Cyberinfrastructure Collaborative (iPlant) is reduced $2.0 million below the FY 2016 Estimate to $7.0 million. This reduction is part of this center's planned ramp-down as FY 2017 is the final year of its ten years of support. iPlant is led by scientists at the University of Arizona, the Texas Advanced Computing Center, Cold Spring Harbor Laboratory, and University of North Carolina at Wilmington. It enables new conceptual advances through integrative, computational thinking to address an evolving array of grand challenges in the plant sciences, including innovative approaches to education, outreach, and the study of social networks.

NSF FY 2017 support to the University of Tennessee Knoxville for the National Institute for Mathematical and Biological Synthesis (NIMBioS) is $3.0 million, $600,000 below the FY 2016 Estimate. This includes $200,000 from the Directorate for Mathematical and Physical Sciences (MPS) Division of Mathematical Sciences (DMS). The decrease is part of the planned ramp-down of the center as FY 2017 is the final year of support. At NIMBioS, top researchers from around the world collaborate across disciplinary boundaries to find creative solutions to today's complex biological problems. The education and outreach program

focuses on the interface between mathematics and biology and promotes cross-disciplinary approaches to science for learners of all ages.
The FY 2017 Request for the National Socio-Environmental Synthesis Center (SESync) is $6.0 million, equal to the FY 2016 Estimate. This center will undergo a renewal review in FY 2016, so FY 2017 support is contingent upon a successful review. This Center uses synthetic approaches to advance the frontiers of scientific understanding of environmental complexity to anticipate and manage emerging environmental change.

Centers for Chemical Innovation (CCI) – MPS

The CCI program is designed to address major, long-term fundamental chemical research challenges attracting broad scientific and public interest, as well as to provide a rich environment for education, outreach, and innovation. The CCIs deliver career-shaping educational opportunities for undergraduate and graduate students and for postdoctoral researchers, including collaborative research and mentoring, cross-disciplinary training, international research experiences, entrepreneurial and innovation training, and communication training.

The program is currently structured as a two-phase competition. Phase I centers are funded for three years and may compete for larger Phase II awards, which are funded for five years with potential for renewal for up to ten years.

In FY 2017, CCI program funding (+$1.40 million, to a total of $29.50 million) is expected to support nine Phase II centers and up to three Phase I awards selected in a new competition planned for FY 2017. Total funding required for these centers is $41.40 million, depending on final number of awards made. Of this total, $29.50 million is provided in this request. The remaining amount is expected to be provided via forward funding from prior fiscal years, co-funding by the MPS Office of Multidisciplinary Activities, and support from the National Aeronautics and Space Administration (NASA) through an ongoing interagency agreement.

In FY 2017, the Center for Enabling New Technologies through Catalysis (CENTC) will sunset, the Center for Selective C-H Functionalization (CCHF) will be in its 5th year and under consideration for renewal, and the other seven centers will continue in Phase II. An external program evaluation for the CCI program is expected to begin in FY 2017 and completed by FY 2019.

Engineering Research Centers (ERC) – ENG

NSF's ERCs enable innovation, bridging the energy and intellectual curiosity of university research focused on discovery with real-world engineered systems and technology opportunities through partnerships with industry. These centers also are successful in educating a technology-enabled workforce with hands-on real-world experience. ERCs can be funded for up to ten years if they clear two renewal reviews, one in year-three to determine if they are structured effectively to deliver on program goals, and another in year-six to determine if they are delivering effectively, making an impact, and tackling challenging tasks to warrant further support.

The ERC program periodically commissions program-level evaluations by external evaluators to determine the effectiveness of ERC graduates in industry, the benefits of ERC membership to industry and others. In FY 2015, NSF funded the National Academy of Engineering (NAE) in collaboration with the National Research Council (NRC) to study "The Future of Center-Based, Multidisciplinary Engineering Research." This topic arises from discussions NAE held with the NRC on the future of NSF's center-based, multidisciplinary engineering research. The project includes a 21-month study that will articulate a new vision for NSF's center-based research over the next two decades, identify needs and gaps in current

approaches, and provide guiding principles and possible strategies for implementing the new vision. A report is expected in FY 2017.

At the FY 2017 Request level, 18 ERCs will be funded at $61.0 million ($4.50 million above the FY 2016 Estimate). ENG will award the next class of four ERCs in FY 2017, which requires an increased investment to support planned growth of the Class of 2015 centers and increased first year support of the Class of 2017 ERCs. First year support will increase from the traditional funding profile of $3.25 million per center to $3.50 million per center. Funding and numbers of centers include four Nanoscale ERCs, three from the class of FY 2012 and one from the class of FY 2015.

Materials Centers – MPS

Materials Research Science and Engineering Centers (MRSEC) advance materials research and provide students with an interdisciplinary education, including global experiences. These centers address fundamental research problems of intellectual and strategic importance that will advance U.S. competitiveness and the development of new technologies.

The MRSEC program continues to support the Materials Research Facilities Network (MRFN), which links the instrumentation and subject matter expertise of MRSECs to the larger materials community as well as encourages MRSEC-to-MRSEC collaborations. The MRSEC program also continues to support the interaction of MRSEC Education Coordinators with the NSF Directorate for Education and Human Resources/Division of Research on Learning in Formal and Informal Settings (EHR/DRL) to formulate methodologies for standardizing outreach program assessment and evaluation.

Finally, MRSECs interact with minority serving institutions through the Partnership for Research and Education in Materials (PREM) program. Currently, there are 12 active PREM awards at NSF, all of which are connected to MRSECs. MRSECs are encouraged to develop initiatives and/or educational programs to broaden participation.

The FY 2017 Request at $56.0 million (no change from the FY 2016 Estimate) will support approximately 20 MRSECs, with the actual number depending on the outcome of the next MRSEC competition. MRSEC competitions are held every three years. Twelve centers were awarded as the result of the latest completion in FY 2014. In the next MRSEC competition in FY 2017, nine current centers are expected to re-compete along with about 80 new applicants. Awards are typically $1.60 million to $3.60 million per year, depending on the number of interdisciplinary research groups in a center.

Nanoscale Science and Engineering Centers (NSEC) – multi-directorate

Nanotechnology research, which addresses the smallest of scales, is projected to be one of the largest drivers of technological innovation for the next decade and beyond. This potential was recognized in the National Nanotechnology Initiative, particularly in the burgeoning area of nanomanufacturing. Research at the nanoscale aims to advance the development of the ultra-small technology that will transform electronics, materials, medicine, environmental science, and many other fields.

At the FY 2017 Request Level, $6.71 million ($1.0 million below the FY 2016 Estimate) NSF will fund two sunsetting NSECs. This will be the final year of support as the NSEC program ends as planned. Support for nanotechnology-related projects will continue in other programs, such as the Nanosystems Engineering Research Centers within the Engineering Research Centers (ERC) and the Materials Science and Engineering Centers (MRSEC), both of which are described above.

Science and Technology Centers: Integrative Partnerships (STCs) - multi-directorate

The Science and Technology Centers: Integrative Partnerships (STC) program advances interdisciplinary discovery and innovation in science and engineering through the integration of cutting-edge research, excellence in education, targeted knowledge transfer, and the development of a diverse workforce. The STC portfolio reflects NSF-supported disciplines. Examples of investments include: understanding the brain; engineering of biological systems; energy-efficient electronics; global and regional environmental systems − sustainability and change; new ways of handling the extraction, manipulation, and exchange of information; and new materials for optical and electronic applications. STCs engage the Nation's intellectual talent and collaborate with partners in academia, industry, national laboratories, and government. STCs strengthen the caliber of the Nation's science, technology, engineering, and mathematics (STEM) workforce through intellectually challenging research experiences for students, postdoctoral fellows, researchers, and educators and advance public scientific understanding through partnerships with K-12 and informal education communities.

The FY 2017 Request of $60.10 million ($110,000 over FY 2016 Estimate) will support twelve STCs and the administrative costs ($900,000) associated with management and oversight of the program. All are continuing awards from the FY 2010, FY 2013, and FY 2016 cohorts. Awards are for five years, with possible renewal for an additional five years, or 10 years total. Award sizes are typically $4.0 million to $5.0 million per year.

Estimates for Centers Participation in 2015

	Number of Participating Institutions	Number of Partners	Total FY 2015 NSF Support (in millions)	Total Leveraged Support (in millions)	Number of Participants
Centers for Analysis & Synthesis	1,910	933	$21	$0	12,680
Centers for Chemical Innovation	86	84	$37	$8	899
Engineering Research Centers	836	385	$60	$134	4,771
Materials Centers[1]	400	296	$80	$49	4,500
Nanoscale Science & Engineering Centers	450	350	$12	$25	4,300
Science & Technology Centers	106	105	$51	$44	905
Science of Learning Centers	203	252	$8	$42	2,162

[1] Due to delayed awards processing, funding includes $27.74 million carried over from FY 2014 and obligated in early FY 2015.

No. of Participating Institutions: All academic institutions participating in activities at the centers.

No. of Partners: The total number of non-academic participants, including industry, states, and other federal agencies at the centers.

Total Leveraged Support: Funding for centers from sources other than NSF.

Number of Participants: The total number of people who use center facilities, not just persons directly support by NSF.

Centers Supported by NSF in FY 2015

Center	Institution	State
Centers for Analysis and Synthesis		
National Evolutionary Synthesis Center[1]	Duke, NC State U, U of N. Carolina	NC
National Institute for Mathematical & Biological Synthesis	U of Tennessee	TN
Plant Science Cyberinfrastructure Collaborative	U of Arizona	AZ
Socio-Environmental Synthesis Center	U of Maryland	MD
Centers for Chemical Innovation		
Center for Aerosol Impacts on Climate and Environment (phase II)	U of California-San Diego	CA
Center for Chemical Evolution (phase II)	Georgia Institute of Tech	GA
Center for Enabling New Technologies through Catalysis (phase II)	U of Washington	WA
Center for Multiscale Theory and Simulation (phase I)[1]	U of Chicago	IL
Center for Selective C-H Functionalization (phase II)	Emory	GA
Center for Sustainable Materials Chemistry (phase II)	Oregon State	OH
Center for Sustainable Nanotechnology (phase II)	U of Wisconsin	WI
Center for Sustainable Polymers (phase II)	U of Minnesota-Twin Cities	MN
Center for Sustainable Renewable Feedstocks (phase I)	U of California-Santa Barbara	CA
Chemistry at the Space-Time Limit (phase II)	U of California-Irvine	CA
CO^2 as a Sustainable Feedstock for Chemical Commodities (phase I)	Brown	RI
Solar Fuels (phase II)	California Institute of Tech	CA
Engineering Research Centers		
Advanced Self-Powered Systems of Integrated Sensors and Technologies	North Carolina State U	NC
Bio-mediated and Bio-inspired Geotechnics (CBBG)	Arizona State U	AZ
Biomimetic Microelectronic Systems[1]	U of Southern California	CA
Biorenewable Chemicals	Iowa State	IA
Center for Ultra-wide-area Resilient Electric Energy Transmission Network (CURENT)	U of Tennessee	TN
Collaborative Adaptive Sensing of the Atmosphere	U of Massachusetts-Amherst	MA
Compact and Efficient Fluid Power	U of Minnesota	MN
Future Renewable Electric Energy Delivery and Management Systems	North Carolina State	NC
Integrated Access Networks	U of Arizona	AZ
Mid-Infrared Technologies for Health and the Environment	Princeton	NJ
Nanomanufacturing Systems for Mobile Computing and Mobile Energy Technologies	University of Texas-Austin	TX
Nanotechnology Enabled-Water Treatment Systems (NEWT)	Rice University	TX
Optimization for Electro-thermal Systems (POETS)	U of Illinois-Urbana Champaign	IL
Quality of Life Technology[1]	Carnegie Mellon/U of Pittsburgh	PA
Quantum Energy and Sustainable Solar Technologies (QESST)	Arizona State	AZ
Re-inventing the Nation's Urban Water Infrastructure	Stanford	CA
Revolutionizing Metallic Biomaterials	North Carolina A&T U	NC
Sensorimotor Neural Engineering	U of Washington	WA
Smart Lighting	Rensselaer Polytechnic Institute	NY
Structured Organic Particulate Systems	Rutgers	NJ
Synthetic Biology	U of California-Berkeley	CA
Translational Applications of Nanoscale Multiferroic Systems	U of California-Los Angeles	CA
Materials Centers		
Brandeis Materials Research Science and Engineering Center	Brandeis	MA
Center for Emergent Materials	Ohio State	OH
Center for Multifunctional Nanoscale Materials Structures	Northwestern	IL
Center for Nanoscale Science	Pennsylvania State	PA

[1] These centers received no-cost award extensions in FY 2015 but no additional funding.

Center for Nanostructured Interfaces	U of Wisconsin	WI
Center for Photonics and Multiscale Nanomaterials	U of Michigan	MI
Center for Plasmonics and Organic Spintronics	U of Utah	UT
Center for Polarization and Spin Phenomena in Nanoferroic Structures	U of Nebraska	NE
Center for Research on Interface Structures and Phenomena	Yale	CT
Chicago Materials Research Centers	U of Chicago	IL
Columbia Center for Precision Assembly of Solids	Columbia	NY
Cornell Center for Materials Research	Cornell	NY
Harvard Materials Research Science and Engineering Center	Harvard	MA
Laboratory for Research on the Structure of Matter	U of Pennsylvania	PA
Materials Research Laboratory at UCSB	U of California-Santa Barbara	CA
Materials Research Science and Engineering Center	Georgia Institute of Tech	GA
Materials Research Science and Engineering Center	U of Minnesota	MN
Materials Research Science and Engineering Center on Polymers	U of Massachusetts-Amherst	MA
MIT Center for Materials Science and Engineering	Massachusetts Institute of Tech	MA
NYU Materials Research Science and Engineering Center	New York U	NY
Princeton Center for Complex Materials	Princeton	NJ
Renewable Energy Materials Science and Engineering Center	Colorado School of Mines	CO
Research Triangle Materials Research Science and Engineering Center	Duke	NC
Soft Materials Research Centers	U of Colorado	CO
Nanoscale Science and Engineering Centers		
Center for the Environmental Implications of Nanotechnology (CEINT)	Duke	NC
Center for Integrated and Scalable Nanomanufacturing[2]	U of California-Los Angeles	CA
Nanotechnology in Society Network: Center at ASU	Arizona State U	AZ
Nanotechnology in Society Network: Center at UCSB	U of California-Santa Barbara	CA
National Nanomanufacturing Network: Center for Hierarchical Manufacturing	U of Massachusetts-Amherst	MA
Predictive Toxicology Assessment & Safe Implementation of Nanotechnology in the Environment (CEIN)	U of California-Los Angeles	CA
Science and Technology Centers		
BEACON: An NSF Center for the Study of Evolution in Action	Michigan State U	MI
Biology with X-Ray Lasers	SUNY Buffalo	NY
Center for Brains, Minds, and Machines: The Science and the Technology of Intelligence	Massachusetts Institute of Tech	MA
Center for Coastal Margin Observation and Prediction	Oregon Health and Science U	OR
Center for Dark Energy Biosphere Investigations	U of Southern California	CA
Center for Energy Efficient Electronics Science	U of California-Berkeley	CA
Center for Integrated Quantum Materials	Harvard	MA
Center for Layered Polymeric Systems	Case Western Reserve	OH
Center for Microbial Oceanography: Research and Education	U of Hawaii-Manoa	HI
Center for Multi-Scale Modeling of Atmospheric Processes	Colorado State	CO
Emergent Behaviors of Integrated Cellular Systems	Massachusetts Institute of Tech	MA
Center for the Science of Information	Purdue	IN
Science of Learning Centers		
Center for Excellence for Learning in Education, Science, and Technology	Boston U	MA
Spatial Intelligence and Learning Center	Temple	PA
The Temporal Dynamics of Learning Center	U of California-San Diego	CA

[2] These centers received no-cost award extensions in FY 2015 but no additional funding.