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 2016[1]	FY 2016 Actual	FY 2017 (TBD)	FY 2018 Request	Change Over FY 2016 Actual Amount	Change Over FY 2016 Actual Percent
Centers for Analysis & Synthesis	1995	4	$18.60	-	$6.00	-$12.60	-67.7%
Centers for Chemical Innovation[2]	1998	9	28.10	-	21.60	-6.50	-23.1%
Engineering Research Centers	1985	20	56.39	-	57.50	1.11	2.0%
Materials Centers	1994	21	55.54	-	55.00	-0.54	-1.0%
Nanoscale Science & Engineering Centers[3]	2001	2	6.74	-	-	-6.74	-100.0%
Science & Technology Centers	1987	12	45.08	-	60.90	15.82	35.1%
Totals		**68**	**$210.44**	**-**	**$201.00**	**-$9.44**	**-4.5%**

[1] Counts include centers that received no-cost award extensions in FY 2016 but no additional funding.

[2] This presents Phase II CCI awards only. The smaller, developmental Phase I awards do not meet the criteria as formal NSF Centers and so are not captured here.

[3] The NSEC program will sunset as planned in FY 2017 as final award increments are made.

Description of Major Changes

Centers for Analysis and Synthesis – BIO

The FY 2018 Request of $6.0 million, $12.60 million below the FY 2016 Actual, will fund the National Socio-Environmental Synthesis Center (SESync). This center underwent external review in FY 2016 and was granted a five-year renewal award that started in FY 2016 and will continue through FY 2020. SESync uses synthetic approaches and provides computational support and training to enable interdisciplinary research teams, postdoctoral fellows, and graduate students, to advance the frontiers of scientific understanding of environmental complexity, and to address pressing societal challenges.

The ten-year center awards for CyVerse (formerly the Plant Science Cyberinfrastructure Collaborative, or iPlant) and the National Institute for Mathematical and Biological Synthesis (NIMBioS) are sunsetting as planned in FY 2017.

Centers for Chemical Innovation (CCI) – MPS

The CCI program explores major, long-term research challenges, producing transformative research that leads to innovation and attracts broad scientific and public interest. Centers often partner with industry, government laboratories, and international organizations to address energy production and storage, sustainable production of commercial chemicals such as polymers and nanomaterials, and complex single-molecule measurements at unprecedented time and spatial resolution.

The CCI program makes awards at two levels: smaller Phase I (three-year awards) for center development, and larger Phase II for full centers (five-year awards with the potential for renewal for up to a total of ten years). Phase I awards are considered part of CHE's core research program investments as they fall under

the funding threshold for formal NSF center awards. In FY 2018, the CCI program (-$6.50 million to a total of $21.60 million) is expected to fund six Phase II Centers (two centers have sunset since FY 2016). These six Phase II CCIs will be supported at a reduced level relative to the standard center award of $4.0 million per year. NASA is expected to provide co-funding support through an ongoing interagency agreement.

In FY 2018, CCI Solar - An NSF Center for Innovation in Solar Fuels will sunset as expected. The Chemistry at the Space-Time Limit (CaSTL) Center will be in its 5th year and under consideration for renewal. The other five centers will continue in Phase II status. An external program evaluation for the CCI program is expected to begin in FY 2018 and be 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 a fifth-year renewal review. This midpoint review will determine if they are: structured effectively to meet program goals; 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 arose from discussions NAE held with the NRC on the future of NSF's center-based, multidisciplinary engineering research. The project includes a study to articulate a vision for the future of NSF–supported center-scale, multidisciplinary engineering research. A report is expected to be delivered at the end of April 2017.

At the FY 2018 Request level, 14 ERCs will be funded at $57.50 million (+$1.11 million to a total of $57.50 million). The program requires an increased investment to support planned growth of the Class of 2015 and Class of 2017 ERCs. 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. These centers address fundamental grand challenge research problems of intellectual and strategic importance of a complexity requiring collaboration among several disciplines. As evidenced in the number of patents and start-up companies generated, MRSECs advance U.S. competitiveness and innovation and are key in 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 and Research Experiences for Undergraduates (REU) program assessment and evaluation. The MRSECs, through a center-wide activity, support over 230 REU students each year.

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 2018 Request (-$540,000 to a total of $55.0 million) represents a very small reduction in the program and will support approximately 20 MRSECs. MRSEC competitions are held every three years. Twelve centers were awarded as the result of the last competition 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.

Science and Technology Centers: Integrative Partnerships (STC) - 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; new ways of handling the extraction, manipulation, and exchange of information; new nano-atomic scale imaging modalities, 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 2018 Request of $60.90 million (+$15.82 million to a total of $45.08 million) 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 2016

	Number of Participating Institutions	Number of Partners	Total FY 2016 NSF Support ($ in millions)	Total Leveraged Support ($ in millions)	Number of Participants
Centers for Analysis & Synthesis	2,416	981	$19	$0	16,532
Centers for Chemical Innovation	91	124	28	6	748
Engineering Research Centers	836	399	56	134	4,771
Materials Centers	367	263	56	44	4,500
Nanoscale Science & Engineering Centers	700	346	7	25	4,000
Science & Technology Centers	14	135	45	11	1,457

Number of Participating Institutions: All academic institutions participating in activities at the centers.

Number 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 2016

Center	Institution	State
Centers for Analysis and Synthesis		
National Evolutionary Synthesis Center[16]	Duke, NC State, U of North 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[17]		
Center for Aerosol Impacts on Climate and the Environment	U of California-San Diego	CA
Center for Chemical Evolution	Georgia Institute of Tech	GA
Center for Chemical Innovation in Solar Fuels	California Institute of Tech	CA
Center for Enabling New Technologies through Catalysis	U of Washington	WA
Center for Selective C-H Functionalization	Emory	GA
Center for Sustainable Materials Chemistry	Oregon State	OH
Center for Sustainable Nanotechnology	U of Wisconsin	WI
Center for Sustainable Polymers	U of Minnesota	MN
Chemistry at the Space-Time Limit	U of California-Irvine	CA
Engineering Research Centers		
Advanced Self-Powered Systems of Integrated Sensors and Technologies (ASSIST)	North Carolina State	NC
Bio-mediated and Bio-inspired Geotechnics (CBBG)	Arizona State	AZ
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	MA
Compact and Efficient Fluid Power (CCEFP)[1]	U of Minnesota	MN
Future Renewable Electric Energy Delivery and Management Systems (FREEDM)	North Carolina State	NC
Integrated Access Networks (CIAN)	U of Arizona	AZ
Mid-Infrared Technologies for Health and the Environment (MIRTH)[1]	Princeton	NJ
Nanomanufacturing Systems for Mobile Computing and Mobile Energy Technologies (NASCENT)	U of Texas	TX
Nanotechnology Enabled-Water Treatment Systems (NEWT)	Rice University	TX
Optimization for Electro-thermal Systems (POETS)	U of Illinois	IL
Quantum Energy and Sustainable Solar Technologies (QESST)	Arizona State	AZ
Re-inventing the Nation's Urban Water Infrastructure (ReNuWit)	Stanford	CA
Revolutionizing Metallic Biomaterials (RMB)	North Carolina A&T U	NC
Sensorimotor Neural Engineering (CSNE)	U of Washington	WA
Smart Lighting	Rensselaer Polytechnic Institute	NY
Structured Organic Particulate Systems[1]	Rutgers	NJ
Synthetic Biology (SynBERC)[1]	U of California-Berkeley	CA
Translational Applications of Nanoscale Multiferroic Systems (TANMS)	U of California-Los Angeles	CA
Materials Centers		
Brandeis Bioinspired Soft Materials 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
Center for Nanostructured Interfaces	U of Wisconsin	WI
Center for Photonic and Multiscale Nanomaterials	U of Michigan	MI

[16] These centers received no-cost award extensions in FY 2016 but no additional funding.
[17] This presents Phase II CCI awards only. The smaller, developmental Phase I awards do not meet the criteria as formal NSF Centers and so are not captured here.

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 Superstratic And Superatomic Solids	Columbia	NY
Cornell Center for Materials Research	Cornell	NY
Harvard Materials Research 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	U of Minnesota	MN
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
Research Triangle Materials Research Science and Engineering Center	Duke, North Carolina State, NC Central U, U of North Carolina	NC
Soft Materials Research Center	U of Colorado	CO
Nanoscale Science and Engineering Centers		
Center for the Environmental Implications of Nanotechnology (CEINT)	Duke	NC
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	MI
Biology with X-Ray Free Electron Lasers	SUNY Buffalo	NY
Center for Brains, Minds, and Machines: The Science and the Technology of Intelligence	Massachusetts Institute of Tech	MA
Center for Bright Beams	Cornell	NY
Center for Cellular Construction	U of California-San Francisco	CA
Center for Dark Energy Biosphere Investigations	U of Southern California	CA
Center for Emergent Behaviors of Integrated Cellular Systems	Massachusetts Institute of Tech	MA
Center for Energy Efficient Electronics Science	U of California-Berkeley	CA
Center for Engineering MechanoBiology	U of Pennsylvania	PA
Center for Integrated Quantum Materials	Harvard	MA
Science and Technology Center on Real-Time Functional Imaging	University of Colorado	CO
Center for Science of Information	Purdue	IN