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 principle means by which NSF fosters interdisciplinary research.

NSF Centers

(Dollars in Millions)

	Program Initiation	Number of Centers in FY 2013	FY 2013 Actual	FY 2014 Estimate	FY 2015 Request	Change Over FY 2014 Estimate Amount	Change Over FY 2014 Estimate Percent
Centers for Analysis & Synthesis	1995	4	$31.21	$21.46	$20.90	-$0.56	-2.6%
Centers for Chemical Innovation	1998	14	30.19	29.25	32.00	2.75	9.4%
Engineering Research Centers	1985	20	62.24	68.50	64.00	-4.50	-6.6%
Materials Centers	1994	23	46.51	56.00	56.00	-	-
Nanoscale Science & Engineering Centers	2001	13	26.20	14.34	12.20	-2.14	-14.9%
Science & Technology Centers	1987	14	63.05	58.77	48.42	-10.35	-17.6%
Science of Learning Centers	2003	6	22.71	19.00	7.01	-11.99	-63.1%
Totals		**94**	**$282.10**	**$267.32**	**$240.53**	**-$26.79**	**-10.0%**

Totals may not add due to rounding.

Description of Major Changes

Centers for Analysis and Synthesis - BIO

The Centers for Analysis and Synthesis are designed to continue development of new tools and standards for management of biological information and meta-information, support data analysis capabilities with broad utility across the biological sciences, host workshops that bring together scientists from a variety of disciplines, and begin to host and curate databases. The Centers have a critical role in organizing and synthesizing biological knowledge that is useful to researchers, policy makers, government agencies, educators, and society. In FY 2015 three centers are expected to be funded.

iPlant, led by the University of Arizona, uses new computer and information science, and cyberinfrastructure solutions to enable 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. This center is a community-driven effort, involving plant biologists, computer and information scientists, and engineers as well as experts from other disciplines, all working in integrated teams. The FY 2015 Request is $11.0 million (-$400,000 below the FY 2014 Estimate) as it begins to ramp down towards its final year of NSF support in FY 2017.

At the National Institute for Mathematical and Biological Synthesis (NIMBioS), located at the University of Tennessee, the talents of top researchers from around the world collaborate across disciplinary boundaries to find creative solutions to today’s complex biological problems, including national needs research in modeling of infectious diseases of plants and animals. NIMBioS designs education and outreach programs aimed at the mathematics/biology interface, thereby building the capacity of mathematically competent, biologically knowledgeable, and computationally adept researchers needed to

address the vast array of current biological challenges. Although predominantly supported by the Directorate for Biological Sciences, the Directorate for Mathematical and Physical Sciences also contributes to it. The FY 2015 Request is $3.90 million (equal to the FY 2014 Estimate).

The Socio-Environmental Synthesis Center (SESync), led by the University of Maryland, College Park utilizes synthetic approaches to advance the scientific understanding of environmental complexity in order to anticipate and manage environmental challenges. This center allows scientists from diverse disciplines to frame questions, identify resource needs to advance synthesis, reorganize how researchers carry out their research and thus transform approaches to environmental synthesis. Workshops sponsored by this center engage philosophers, sociologists, political scientists, psychologists, anthropologists, and environmental biologists (together with policy makers) to integrate broad disciplines focused on major environmental challenges. They FY 2015 Request is $6.0 million (+$3.09 million above the FY 2014 Estimate). This increase is due to forward funding of part of the FY 2014 award in FY 2013; the annualized award amount remains $6.0 million in both FY 2014 and FY 2015.

The National Evolutionary Synthesis Center (NESCent) at Duke University will finish its 10-year term in FY 2014. Funding decreases by -$3.25 million to zero in FY 2015.

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 program is a structured, two-phase competition. Phase I centers, which are funded for three years, may compete for larger Phase II awards, which are funded for five years with the opportunity to be renewed for an additional five years.

Because the CCI program is a phased competition, future Phase II awards are already in the pipeline. The Division of Chemistry honors these commitments. Three Phase I CCIs, funded as standard awards in FY 2012, will be competing for the new FY 2015 Phase II award. A Phase I competition was not held in FY 2013 and no new Phase I competitions are planned for FY 2014 and FY 2015 while the program is being re-designed.

Staff from Phase II centers have established a Leadership Network as a forum to discuss challenges and coordinate activities; the group is meeting biweekly by videoconference. A meeting for principal investigators and CCI managing directors is planned for late fall of 2014. Center diversity, education, and outreach directors are in the early planning stages for a retreat on broadening participation.

The FY 2015 Request is $32.0 million (+$2.75 million above FY 2014 Estimate). This will support nine Phase II CCIs – eight continuing and a new one. Total funding required is $36.0 million or $4.0 million each. Of this total, $32.0 million is provided in this Request; the remaining $4.0 million was provided via forward funding from prior years through the MPS Office of Interdisciplinary Activities and through an interagency agreement with NASA.

Engineering Research Centers (ERC) – ENG

NSF Engineering Research Centers (ERCs) enable innovation through partnerships, bridging the intellectual curiosity of discovery-focused university research and the engineered systems and technology opportunities of industry research. The centers also educate a technology-enabled workforce with hands-on, real-world experience. These characteristics catalyze the development of marketable technologies to generate wealth and address grand challenges. ERCs are investigating intelligent electric power grid systems to provide electricity from renewable sources, devising healthcare innovations through tissue engineering and microelectronics research, creating sensing systems that improve the prediction of tornados, and demonstrating intelligent robotic systems to assist people who are elderly or disabled in

daily tasks.

ERC awards are typically for five years, with a possible renewal for a second five years, or a total of ten years. ERCs face two renewal reviews, one in year three to determine if they are structured effectively, and another in year six to determine if they are making an impact, delivering on goals and positioning themselves for more 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 and the benefits of ERC membership to industry and others. A recent update of a past survey of the 35 ERCs that have graduated from NSF support after 10 years finds that 29 (83 percent) are self-sustaining with strong financial support and most ERC features remain in place.

The FY 2015 Request is $64.0 million (-$4.50 million below FY 2014 Estimate). In FY 2015, NSF will maintain funding for the existing portfolio of 19 ERC's, which includes ongoing support for three Nanosystems Engineering Research Centers (NERCs) first funded in FY 2012. The funding decrease in FY 2015 is associated with the class of 2006 ERCs beginning their funding ramp down as they enter their final years of NSF support.

Materials Centers – MPS

Materials Research Science and Engineering Centers (MRSECs) 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 FY 2015 Request is $56.0 million (equal to the FY 2014 Estimate). MRSEC competitions are held every three years, the next in FY 2014. In FY 2015, MPS expects to support 18 centers, all in continuing increment status, pending successful annual review. These 18 centers come from these cohorts: 14 on-going centers from FY 2008 are re-competing in FY 2014 along with new proposals; nine are expected to be successful; and nine on-going centers from FY 2011 are expected to re-compete in FY 2017.

The Directorate for Mathematical and Physical Sciences, Division of Materials Research (MPS/DMR) will continue to respond to recommendations of the 2007 NRC report "MRSECs: Looking Back, Moving Forward," which included a recommendation to increase award size; this action was begun in the FY 2011 competition and an additional three to five percent increase is planned for the FY 2014 competition.

The MRSEC program will continue to support the Materials Research Facilities Network (MRFN), which links the instrumentation and subject matter expertise of MRSECs to the larger materials community and encourages MRSEC-to-MRSEC collaborations. In addition, the MRSEC program will continue interactions between MRSEC Education Coordinators and 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, the MRSEC program will continue interactions between MRSECs and minority serving institutions (MSIs) through the Partnership for Research and Education in Materials (PREM) program. In FY 2014 there will be 14 active PREMs, 13 connected to MRSECs. The PREM program is competed triennially with the next competition scheduled for FY 2015.

Nanoscale Science and Engineering Centers (NSEC) – ENG

Nanotechnology is projected to be a driver 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, through NSF-funded NSECs, aims to advance the

development of the ultra-small technology that will transform electronics, materials, medicine, environmental science, and many other fields. Each center has an extended vision. This provides coherence and a long-term outlook to U.S. nanotechnology research and education and also addresses the social and ethical implications of such research. NSEC funding supports education and outreach programs from K-12 to the graduate level, which is designed to develop a highly skilled workforce, advance pre-college training, and further public understanding of nanoscale science and engineering. These centers have strong partnerships with industry, national laboratories, and international centers of excellence, which puts in place the necessary elements to bring discoveries in the laboratory to real-world, marketable innovations and technologies.

The FY 2015 Request is $12.20 million (-$2.14 million below the FY 2014 Estimate). This will support three continuing NSECs. The decrease in FY 2015 funding is primarily associated with two centers that will receive their final year of NSF support in FY 2014. Investments in NSECs will continue to decrease as the program no longer needs as much support due to center graduations and a transition to NERCs (see the ERC section above). The three existing centers are expected to be supported through the end of their current award cycles. No new NSEC competitions are planned.

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. Investments include: 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; cyber security; 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 2015 Request of $48.42 million (-$10.35 million below FY 2014 Estimate) will support the continuation of 12 existing STCs and the administrative costs ($1.30 million) associated with management and oversight of the program. Decreased funding is due to the sunset of two STCs from the 2005 cohort. Awards range from $2.65 million per year for the 2006 cohort to $5.0 million per year for the 2010 and 2013 cohorts. Awards are usually for five years, with possible renewal for an additional five years, or 10 years total. In FY 2014, a solicitation for a new class of STCs will be issued to replace the sunsetting 2005/2006 cohort with associated awards expected to be made in FY 2016.

Science of Learning Centers (SLC) - multi-directorate

The Science of Learning Centers (SLC) program supports large-scale, long-term centers that create the intellectual, organizational, and physical infrastructure needed for the advancement of an integrative, interdisciplinary Science of Learning. It supports research that harnesses and integrates knowledge across multiple disciplines to create a common groundwork of conceptualization, experimentation, and explanation that anchor new lines of thinking and inquiry towards a deeper understanding of learning. The SLC program goal is to advance the frontiers of all the sciences of learning through integrated research; to connect the research to specific scientific, technological, educational, and workforce challenges; to enable research communities to capitalize on new opportunities and discoveries; and to respond to new challenges. The SLC portfolio represents synergistic, exciting research efforts that address many different dimensions of learning.

Each SLC's scientific and other activities are reviewed each year through a site visit review.

The first cohort of four SLCs was funded in FY 2004. One center was decommissioned in its second year due to its failure to show adequate progress. Support for the three remaining centers in this cohort – Pittsburgh Science of Learning Center (PSLC), Learning in Formal and Informal Environments (LIFE), and the Center of Excellence for Learning in Education, Science and Technology (CELEST) – will end in FY 2014. The second cohort of three SLCs was first funded in FY 2006. Of this group, support for the Visual Language and Visual Learning Center (VL2) will end in FY 2014 and support for the Temporal Dynamics of Learning Center (TDLC) and the Spatial Intelligence and Learning Center (SILC) will end in FY 2015.

SBE will continue to oversee management of the SLC program. Matching co-funding from the Directorate for Computer and Information Science and Engineering (CISE) and the Directorate for Engineering (ENG) will end in FY 2014. The Directorate of Biological Sciences (BIO) will provide co-funding through FY 2015.

During FY 2013, SBE charged the SBE Advisory Committee to conduct a review of the centers and the field. This review resulted in recommendations that a new program in the Science of Learning be established with a set of new mechanisms that do not necessarily involve centers as the sole model of support. For more information, see the discussion of this new investment – Science of Learning Program – in the Directorate for Social, Behavioral, and Economic Sciences (SBE) chapter.

The FY 2015 Request is $7.01 million (-$11.99 below the FY 2014 Estimate). This supports the remaining two SLCs of the six total centers. As planned, a ramp down of SLC funding was initiated in FY 2012. Four of the six SLCs will reach the end of their ten-year funding cycles by the end of FY 2014 and the final two in FY 2015.

Estimates for Centers Participation in 2013

(Dollars in Millions)

	Number Participating Institutions	Number Partners	Total FY 2013 NSF Support	Total Leveraged Support	Number Participants
Centers for Analysis & Synthesis	453	109	$31	$0	1,478
Centers for Chemical Innovation	71	47	$30	$21	904
Engineering Research Centers	814	355	$62	$144	4,919
Materials Centers	401	296	$47	$48	5,568
Nanoscale Science & Engineering Centers	770	750	$26	$29	4,600
Science & Technology Centers	159	190	$63	$26	1,814
Science of Learning Centers	55	86	$23	$35	1,205

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 2013

Center	Institution	State
Centers for Analysis and Synthesis		
National Evolutionary Synthesis Center	Duke, NC State, U of N. Carolina	NC
National Institute for Mathematical & Biological Synthesis	U of Tennessee	TN
Plant Science Cyberinfrastructure Collaborative	U of Arizona	AZ
SocioEnvironmental Synthesis Center	U of Maryland	MD
Centers for Chemical Innovation		
Chemistry at the Space-Time Limit (phase II)	U of California-Irvine	CA
Center for Aerosol Impacts on Climate and Environment (phase I)	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)	U of Chicago	IL
Center for Nanostructured Electronic Materials (phase I)	U of Florida	FL
Center for Stereoselective C-H Functionalization (phase II)	Emory	GA
Center for Sustainable Materials Chemistry (phase II)	Oregon State	OH
Center for Sustainable Nanotechnology (phase I)	U of Wisconsin	WI
Center for Sustainable Polymers (phase I)	U of Minnesota-Twin Cities	MN
Center for Sustainable Renewable Feedstocks (phase I)	U of California-Santa Barbara	CA
CO^2 as a Sustainable Feedstock for Chemical Commodities (phase I)	Brown	RI
Powering the Planet (phase II)	California Institute of Tech	CA
Quantum Information Center for Quantum Chemistry (phase I)	Purdue	IN
Engineering Research Centers		
Advanced Self-Powered Systems of Integrated Sensors & Technologies	North Carolina State U	NC
Biomimetic Microelectronic Systems	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
Extreme Ultraviolet Science and Technology	Colorado State	CO
Future Renewable Electric Energy Delivery & Mgmt. 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
Quality of Life Technology	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
Princeton Center for Complex Materials	Princeton	NJ
Center for Emergent Materials	Ohio State	OH
Cornell Center for Materials Research	Cornell	NY
Center for Materials Science and Engineering	Massachusetts Institute of Tech	MA
Center for Multifunctional Nanoscale Materials Structures	Northwestern	IL
Quantum and Spin Phenomena in Nanomagnetic Structures	U of Nebraska	NE
Center for Nanoscale Science	Pennsylvania State	PA

Center for Nanostructured Interfaces	U of Wisconsin	WI
Center for Interface Structures and Phenomena	Yale	CT
Center for Photonics and Multiscale Nanomaterials	U of Michigan	MI
Liquid Crystals Materials Research Center	U of Colorado	CO
Laboratory for Research on the Structure of Matter	U of Pennsylvania	PA
Materials Research Center	U of Chicago	IL
Materials Research Science and Engineering Center	Harvard	MA
Materials Research Science and Engineering Center	Georgia Institute of Tech	GA
Materials Research Science and Engineering Center	New York U	NY
Materials Research Science and Engineering Center	U of California-Santa Barbara	CA
Materials Research Science and Engineering Center	U of Minnesota	MN
Materials Research Science and Engineering Center	U of Utah	UT
Materials Research Science and Engineering Center on Polymers	U of Massachusetts-Amherst	MA
Renewable Energy Materials Science and Engineering Center	Colorado School of Mines	CO
Triangle Materials Research Science and Engineering Center	Duke	NC
Nanoscale Science and Engineering Centers		
Affordable Nanoengineering of Polymer Biomedical Devices	Ohio State	OH
Center for Environmental Implications of Nanotechnology (CEIN)	Duke	NC
Center for Integrated and Scalable Nanomanufacturing	U of California-Los Angeles	CA
High Rate Nanomanufacturing	Northeastern, U of New Hampshire, U of Massachusetts-Lowell	MA, NH
Integrated Nanomechanical Systems	U of California-Berkeley, Cal Tech, Stanford, U of California-Merced	CA
Molecular Function at the Nano/Bio Interface	U of Pennsylvania	PA
Nanotechnology in Society Network: Center at ASU	Arizona State U	AZ
Nanotechnology in Society Network: Center at UCSB	U of California-Santa Barbara	CA
Nanoscale Chemical-Electrical-Mechanical Manufacturing Systems	U of Illinois	IL
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
Probing the Nanoscale	Stanford, IBM	CA
Templated Synthesis and Assembly at the Nanoscale	U of Wisconsin	WI
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
Center for Remote Sensing of Ice Sheets	U of Kansas	KS
Emergent Behaviors of Integrated Cellular Systems	Massachusetts Institute of Tech	MA
Emerging Frontiers of Science Information	Purdue	IN
Team for Research in Ubiquitous Secure Technology	U of California-Berkeley	CA
Science of Learning Centers		
Center for Excellence for Learning in Education, Science, & Tech.	Boston U	MA
Pittsburgh Science of Learning Center - Studying Robust Learning with Learning Experiments in Real Classrooms	Carnegie Mellon	PA
LIFE Center - Learning in Formal and Informal Environments	U of Washington	WA
Spatial Intelligence and Learning Center	Temple	PA
The Temporal Dynamics of Learning Center	U of California-San Diego	CA
Visual Language and Visual Learning	Gallaudet	DC