DIRECTORATE FOR ENGINEERING (ENG) **$921,430,000**
-$9,490,000 / -1.0%

ENG Funding
(Dollars in Millions)

	FY 2017 Actual	FY 2018 (TBD)	FY 2019 Request	Change over FY 2017 Actual Amount	Percent
Chemical, Bioengineering, Environmental and Transport Systems (CBET)	$183.54	-	$180.00	-$3.54	-1.9%
Civil, Mechanical, and Manufacturing Innovation (CMMI)	221.05	-	216.90	-4.15	-1.9%
Electrical, Communications, and Cyber Systems (ECCS)	113.78	-	111.60	-2.18	-1.9%
Engineering Education and Centers (EEC)	108.61	-	97.25	-11.36	-10.5%
Industrial Innovation and Partnerships (IIP)	250.26	-	248.42	-1.84	-0.7%
Emerging Frontiers and Multidisciplinary Activities (EFMA)	53.67	-	67.26	13.59	25.3%
Total	**$930.92**	**-**	**$921.43**	**-$9.49**	**-1.0%**

About ENG

Fundamental research supported by ENG, combined with the creativity of well-educated engineers and the resources of state-of-the-art facilities, has resulted in many important discoveries. These discoveries have fueled exciting technological innovations—such as nanotechnology-enabled consumer, industrial, and healthcare products and manufacturing; resilient infrastructure to withstand disaster and disruption; novel light-based devices and tools for brain-related research and neurological imaging; secure, efficient devices and systems for communications and computing; and Internet-enabled smart manufacturing systems and supply chains—that in turn have stimulated economic growth and are improving the quality of life for all Americans.

ENG funding of disciplinary and multidisciplinary research lays the groundwork for crucial aspects of NSF's 10 Big Ideas. ENG investments contribute to Harnessing the Data Revolution through, for example, support for cyber–physical systems, smart and connected communities, spectrum efficiency and sharing, and devices and systems for the Internet of Things. The directorate creates a foundation for Quantum Leap through support for topics such as quantum sensing, communication and computing research, and investment in quantum technologies for secure communication systems. ENG investment supports the Future of Work at the Human–Technology Frontier through research in robotics, smart materials, control and communication systems, and other areas. ENG supports Understanding the Rules of Life by investing in nanotechnologies that help reveal life's fundamental processes, biomechanics and tissue engineering, and new methods for engineering biology. ENG investments contribute to Navigating the New Arctic through research in water supply and treatment, sustainability, advanced materials, and resilient infrastructure. The directorate is a committed partner to NSF INCLUDES and provides critical leadership for engineering communities. ENG has made a special contribution to Growing Convergence Research by originating the concept of convergence nearly 15 years ago as an outgrowth of the National Nanotechnology Initiative.

ENG provides about 43 percent of federal funding for basic research at academic institutions in the engineering sciences.

Major Investments

ENG Major Investments
(Dollars in Millions)

Area of Investment	FY 2017 Actual	FY 2018 (TBD)	FY 2019 Request	Change over FY 2017 Actual Amount	Change over FY 2017 Actual Percent
CAREER	$78.00	-	$76.00	-$2.00	-2.6%
CEMMSS[1]	110.00	-	-	-110.00	-100.0%
INFEWS	9.70	-	5.00	-4.70	-48.5%
IUSE	4.97	-	5.00	0.03	0.5%
NSF I-Corps™	12.91	-	13.00	0.09	0.7%
NSF Research Traineeship[2]	2.50	-	-	-2.50	-100.0%
Risk and Resilience[3]	9.12	-	-	-9.12	-100.0%
SaTC	3.25	-	3.25	-	-
Understanding the Brain	23.40	-	16.75	-6.65	-28.4%
BRAIN Initiative	*23.40*	*-*	*16.75*	*-6.65*	*-28.4%*
NSF's Big Ideas					
The Future of Work at the Human-Technology Frontier	*-*	*-*	*30.00*	*30.00*	*N/A*
NSF INCLUDES[4]	*1.20*	*-*	*-*	*-1.20*	*-100.0%*

Major investments may have funding overlap and thus should not be summed.

[1]The CEMMSS program sunsets in FY 2019.

[2]In FY 2019, NRT funding is provided through CISE and EHR.

[3]Risk and Resilience topics will continue to be funded through ENG core programs in FY 2019.

[4]In FY 2019, NSF INCLUDES funding is provided through the EHR account.

ENG Funding for Centers Programs and Facilities

ENG Funding for Centers Programs
(Dollars in Millions)

	FY 2017 Actual	FY 2018 (TBD)	FY 2019 Request	Change over FY 2017 Actual Amount	Change over FY 2017 Actual Percent
Total	**$72.36**	**-**	**$68.40**	**-$3.96**	**-5.5%**
Engineering Research Centers (EEC)	57.49	-	56.00	-1.49	-2.6%
STC: Emergent Behaviors for Integrated Cellular Systems (CBET)	5.00	-	3.70	-1.30	-26.0%
STC: Engineering Mechano-Biology (CMMI)	4.87	-	5.00	0.13	2.6%
STC: Energy Efficient Electronics Science (ECCS)	5.00	-	3.70	-1.30	-26.0%

For detailed information on individual centers programs, please see the NSF-Wide Investments chapter.

ENG Funding for Facilities

(Dollars in Millions)

	FY 2017 Actual	FY 2018 (TBD)	FY 2019 Request	Change over FY 2017 Actual Amount	Change over FY 2017 Actual Percent
Total	**$25.91**	**-**	**$22.58**	**-$3.33**	**-12.8%**
Cornell High Energy Synchrotron Source (CHESS)	5.00	-	-	-5.00	-100.0%
National Nanotechnology Coordinated Infrastructure (NNCI)	10.92	-	10.83	-0.09	-0.8%
Natural Hazards Engineering Research Infrastructure (NHERI)	14.99	-	11.75	-3.24	-21.6%

For detailed information on individual facilities, please see the Facilities and the Major Research Equipment and Facilities Construction chapters.

Funding Profile

ENG Funding Profile

	FY 2017 Actual Estimate	FY 2018 (TBD)	FY 2019 Estimate
Statistics for Competitive Awards:			
Number of Proposals	13,028	-	13,200
Number of New Awards	2,455	-	2,400
Funding Rate	19%	-	18%
Statistics for Research Grants:			
Number of Research Grant Proposals	9,753	-	9,900
Number of Research Grants	1,801	-	1,700
Funding Rate	18%	-	17%
Median Annualized Award Size	$106,667	-	$108,000
Average Annualized Award Size	$125,140	-	$127,000
Average Award Duration, in years	2.7	-	2.7

People Involved in ENG Activities

Number of People Involved in ENG Activities

	FY 2017 Actual Estimate	FY 2018 (TBD)	FY 2019 Estimate
Senior Researchers	8,811	-	8,600
Other Professionals	2,067	-	2,000
Postdoctoral Associates	527	-	500
Graduate Students	7,607	-	7,500
Undergraduate Students	4,510	-	4,400
K-12 Teachers	-	-	-
K-12 Students	-	-	-
Total Number of People	**23,522**	**-**	**23,000**

Program Monitoring and Evaluation

External Program Evaluations and Studies

- 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 Academies of Science, Engineering, and Medicine (the National Academies) to study The Future of Center-Based, Multidisciplinary Engineering Research. This topic arose from discussions the National Academies held on the future of NSF's center-based, multidisciplinary engineering research. To help inform the study, the National Academies held a public symposium on April 6, 2016, and published a proceedings.[1] The study report,[2] delivered May 2, 2017, articulates a vision for the future of NSF-supported center-scale, multidisciplinary engineering research, which ENG is carefully analyzing for the path ahead. A new solicitation for the next generation of ERCs is expected in FY 2018.
- A study of the feasibility of performing rigorous impact evaluation of the I-Corps™ Teams program was completed in FY 2014. Based on the feasibility study, NSF initiated a rigorous evaluation of the I-Corps™ Teams program in FY 2016. A report will be available in FY 2018.
- During FY 2017, ENG developed an evaluation framework that identifies outcomes to be monitored across directorate programs. The framework, developed by participants from all ENG divisions, has four areas of activity: (1) research, (2) human capital development and partnerships, (3) centers and networks, and (4) construction of physical, virtual, and cyberinfrastructure. The directorate expects to use this framework to develop an outcome monitoring system for all programs using internal Research Performance Progress Report (RPPR) data, external data sets (patents and bibliometric data), and potentially a common survey. The design of this evaluation framework eliminates the need for individual longitudinal outcome monitoring systems (e.g., for the Emerging Frontiers in Research and Innovation program).
- In FY 2016, IIP collected data for the PFI: Accelerating Innovation Research (AIR) and PFI: Building Innovation Capacity (BIC) programs based on their theories of action. In FY 2017, ENG finalized a report for the longitudinal outcomes of the PFI: AIR program to date. A report for the PFI: BIC program is being finalized. The PFI program was restructured, and the FY 2018 PFI solicitation reflects the changes.

Workshops and Reports

- In FY 2017, to further open pathways into engineering, EEC provided support for "A Workshop to Finalize the Planning for a National Pilot of an advanced placement course in Engineering," held at the University of Maryland College Park, October 12-13, 2017. The three workshop goals were to review and revise the draft curriculum framework for the AP in Engineering course; define the role organizations play in the pilot; and develop training objectives for the pilot teachers. In FY 2018, EEC will continue working with partner universities and high schools to refine and gain approval for the AP curriculum and professional development program for teachers, in preparation for pilot activities.
- In FY 2017, ENG (CBET and EFMA) and BIO co-funded a workshop on "The Subterranean Macroscope: Sensor networks for understanding, modeling, and managing soil processes," held November 1-2, 2017, at the University of Chicago. The workshop goal was to create a vision and framework for how such a subterranean sensor network could be built across different geographical scales, with sensors that will generate dense, useful data that will inform soil science, plant science, and modeling efforts. These efforts, in turn, would lead to the next level of understanding of the physical, chemical, and biological nature of soil and its impact on plant science and food security. The workshop

[1]A Vision for the Future of Center-Based Multidisciplinary Engineering Research symposium proceedings: www.nap.edu/catalog/23645/a-vision-for-the-future-of-center-based-multidisciplinary-engineering-research

[2]A New Vision for Center-Based Engineering Research report: www.nap.edu/catalog/24767/a-new-vision-for-center-based-engineering-research

included diverse scientists and engineers and representatives from industry and the small business community. The workshop is expected to generate cross-directorate research opportunities advancing measurement system capabilities for soil biological, chemical, and physical components over space and time and to contribute to several of NSF's 10 Big Ideas.

- In FY 2017, CMMI supported a workshop on "Disrupting Illicit Supply Networks: New Applications of Operations Research and Data Analytics to End Modern Slavery," held in Washington, D.C., on December 1-2, 2017. The workshop brought together operations researchers, computer scientists, social scientists, business researchers, geographers, social service agency representatives, and federal agencies to increase understanding of both the nature, and the challenges to disruption, of illicit supply chains. This is informing creation of a potential research initiative within the CMMI Operations Engineering program.
- In FY 2016, CBET, EFMA and others co-funded a three-year study on Grand Challenges in Environmental Engineering by the National Academies.[3] The study will identify high-priority challenges for environmental engineering and science for the next several decades. The three planned public workshops associated with the study were held May 4-5, 2017; September 5, 2017; and January 11, 2018. The report, expected in FY 2018, will shape the growth of university departments, inspire the next generation of engineers and scientists to address the most pressing global environmental challenges, and improve the training of environmental engineers and scientists to better meet these challenges. It will also help inform NSF program directors of emerging areas for research.
- In FY 2016, CBET funded a workshop on Challenges and Solutions for Integrated Management of Environmental, Health, and Community Impact Data Pertaining to the Oil and Gas Industry that was held in Arlington, Va., during March 7-8, 2016. Such a framework must integrate heterogeneous, structured and unstructured data into an inter-operable and explorable system, one that can be re-purposed by researchers and other stakeholders in order to transfer knowledge between industry, land-use managers, government officials, and the general public. The workshop and its 2017 report[4] have provided insights to NSF in numerous research domains and for efforts in data and cyberinfrastructure as well as the NSF Big Idea on Harnessing the Data Revolution for 21st Century Science and Engineering.
- In FY 2015, EFMA funded the Exploring Innovation Frontiers Initiative (EIFI), a two-year, national public-private effort to shape and strengthen future U.S. innovation and competitiveness led by the Council on Competitiveness. Diverse leaders from academia, industry, and government have participated in a series of regional dialogues during 2015-2016: at the Georgia Institute of Technology on June 9, 2015; the University of California Riverside on November 23, 2015, and at Texas A&M University on November 15, 2016. A fourth and final regional dialogue was held in June 2017 at Washington University in St. Louis. Summaries of the EIFI workshops and the final report[5], published in 2017, will help inform NSF and the community of actionable, interdisciplinary frameworks for next-generation business and research innovation models.

Committees of Visitors (COVs)

- In 2017, no COV meetings were held.
- In 2018, COVs will review ECCS and EFMA.
- In 2019, COVs will review CBET and CMMI.

The Performance chapter provides details regarding the periodic reviews of programs and portfolios of

[3]Grand Challenges in Environmental Engineering project site: www8.nationalacademies.org/cp/projectview.aspx?key=49849
[4]Challenges and Solutions for Integrated Management of Environmental, Health, and Community Impact Data Pertaining to the Oil and Gas Industry report: https://data.airwatergas.org/workshop/files/comfy/cms/files/19/files/original/Data_Workshop_Report_2016-12-28.pdf
[5]Transform: A New Agenda to Boost U.S. Innovation-Driven Competitiveness in the 21st Century report: www.compete.org/storage/reports/transform.pdf

programs by external Committees of Visitors and directorate Advisory Committees. See this chapter for additional information.

DIVISION OF CHEMICAL, BIOENGINEERING, ENVIRONMENTAL, AND TRANSPORT SYSTEMS (CBET) **$180,000,000**
-$3,540,000 / -1.9%

CBET Funding
(Dollars in Millions)

	FY 2017 Actual	FY 2018 (TBD)	FY 2019 Request	Change over FY 2017 Actual Amount	Percent
Total	**$183.54**	**-**	**$180.00**	**-$3.54**	**-1.9%**
Research	**177.47**	**-**	**174.16**	**-3.31**	**-1.9%**
CAREER	37.62	-	36.00	-1.62	-4.3%
Centers Funding (total)	5.00	-	3.70	-1.30	-26.0%
STC: Emergent Behaviors for Integrated Cellular Systems	5.00	-	3.70	-1.30	-26.0%
Education	**2.39**	**-**	**2.15**	**-0.24**	**-10.1%**
Infrastructure	**3.68**	**-**	**3.69**	**0.01**	**0.3%**
NNCI	3.68	-	3.69	0.01	0.3%

CBET Summary

CBET supports research to enhance and protect U.S. national health, energy, food, water, environment, process manufacturing, and security. Through CBET, the physical, chemical, life, and social sciences are integrated in engineering research and education, resulting in advances in the rapidly evolving fields of biotechnology, bioengineering, biomanufacturing, advanced materials, environmental engineering, and sustainable energy. CBET also invests in areas that involve the transformation and/or transport of matter and energy by chemical, thermal, or mechanical means. CBET investments contribute significantly to the knowledge base and to the workforce development of major U.S. economy components, such as chemicals, pharmaceuticals, medical devices, specialty chemicals, and materials for advanced manufacturing, natural gas and petroleum production, food, textiles, utilities, and microelectronics.

CBET supports the chemical, environmental, biomedical, mechanical (transport), and civil (environmental) engineering disciplines. To serve these communities and achieve its goals, CBET is organized into four thematic clusters: Chemical Process Systems; Engineering Biology and Health; Environmental Engineering and Sustainability; and Transport Phenomena.

In general, 81 percent of the CBET portfolio is comprised of new research grants, and 19 percent supports continuing grants.

DIVISION OF CIVIL, MECHANICAL, AND MANUFACTURING INNOVATION (CMMI) **$216,900,000**
-$4,150,000 / -1.9%

CMMI Funding
(Dollars in Millions)

	FY 2017 Actual	FY 2018 (TBD)	FY 2019 Request	Change over FY 2017 Actual Amount	Change over FY 2017 Actual Percent
Total	**$221.05**	**-**	**$216.90**	**-$4.15**	**-1.9%**
Research	**200.50**	**-**	**200.55**	**0.05**	**0.0%**
CAREER	22.91	-	25.00	2.09	9.1%
Centers Funding (total)	5.05	-	5.00	-0.05	-1.0%
Engineering Research Centers	0.18	-	-	-0.18	-100.0%
STC: Mechano-Biology	4.87	-	5.00	0.13	2.6%
Education	**3.67**	**-**	**2.70**	**-0.97**	**-26.4%**
Infrastructure	**16.89**	**-**	**13.65**	**-3.24**	**-19.2%**
NHERI	14.99	-	11.75	-3.24	-21.6%
NNCI	1.90	-	1.90	-	-

CMMI Summary

CMMI funds fundamental research in support of the Foundation's strategic goals directed at advances in civil, mechanical, industrial, systems, manufacturing, and materials engineering. In addition, the division has a focus on the reduction of risks and damage resulting from earthquakes, wind, and other hazards. CMMI encourages discoveries enabled by cross-cutting technologies such as adaptive systems, nanotechnology, and high-performance computational modeling and simulation. The division promotes cross-disciplinary research partnerships at the intersections of traditional research disciplines to achieve transformative research results that promote innovative manufacturing technology; enable the design and analysis of complex engineered systems; enhance the sustainability and resilience of U.S. infrastructure (for example, buildings, transportation, and communication networks); help protect the Nation from extreme natural and human-induced events; and apply engineering principles to improve the Nation's service and manufacturing enterprise systems, such as healthcare.

In general, 82 percent of the CMMI portfolio is comprised of new research grants and 18 percent supports continuing grants.

DIVISION OF ELECTRICAL, COMMUNICATIONS, AND CYBER SYSTEMS (ECCS) **$111,600,000**
-$2,180,000 / -1.9%

ECCS Funding
(Dollars in Millions)

	FY 2017 Actual	FY 2018 (TBD)	FY 2019 Request	Change over FY 2017 Actual Amount	Percent
Total	**$113.78**	**-**	**$111.60**	**-$2.18**	**-1.9%**
Research	**107.06**	**-**	**104.66**	**-2.40**	**-2.2%**
CAREER	15.74	-	15.00	-0.74	-4.7%
Centers Funding (total)	5.00	-	3.70	-1.30	-26.0%
STC: Energy Efficient Electronics Science	5.00	-	3.70	-1.30	-26.0%
Education	**1.38**	**-**	**1.70**	**0.32**	**22.9%**
Infrastructure	**5.34**	**-**	**5.24**	**-0.10**	**-1.9%**
NNCI	5.34	-	5.24	-0.10	-1.9%

ECCS Summary

ECCS addresses fundamental research issues underlying electronic and photonic devices and component technologies (such as bioelectronic, flexible, and quantum devices), power, controls, computation, networking, communications (such as secure, efficient spectrum utilization for wireless), and cyber technologies. The division supports the integration and networking of intelligent systems principles at the nano, micro, and macro scales for applications in: healthcare, security, disaster mitigation, energy, telecommunications, transportation, robotics, manufacturing, and other systems-related areas. ECCS research and education investments emphasize interdisciplinary collaboration and the convergence of technologies to take on major technological challenges for future generations of innovative devices and systems.

In general, 80 percent of the ECCS portfolio is comprised of new research grants and 20 percent supports continuing grants.

DIVISION OF ENGINEERING EDUCATION AND CENTERS (EEC) **$97,250,000**
-$11,360,000 / -10.5%

EEC Funding
(Dollars in Millions)

	FY 2017 Actual	FY 2018 (TBD)	FY 2019 Request	Change over FY 2017 Actual Amount	Percent
Total	**$108.61**	**-**	**$97.25**	**-$11.36**	**-10.5%**
Research	**85.60**	**-**	**80.15**	**-5.45**	**-6.4%**
CAREER	1.73	-	-	-1.73	-100.0%
Centers Funding (total)	57.15	-	56.00	-1.15	-2.0%
Engineering Research Centers	57.15	-	56.00	-1.15	-2.0%
Education	**23.01**	**-**	**17.10**	**-5.91**	**-25.7%**

EEC Summary

EEC integrates disciplinary basic research and education conducted in other ENG divisions and across NSF into strategic frameworks critical for addressing societal grand challenges and promoting innovation. Research included in the EEC portfolio spans both the physical/life sciences and engineering, from nanostructured materials to new device concepts, subsystems, and systems. Applications range across a wide spectrum, such as energy, medicine, telecommunications, nanoelectronics, manufacturing, civil infrastructure, the environment, computer networks, cybersecurity, and others. Also included are formal scholarly studies in the professional formation of engineers, which can lead to innovations in engineering education and career development.

The complex, integrative role of EEC requires a comprehensive infrastructure of people, equipment, and centers. Fresh, creative approaches to developing the engineering workforce are vital, as a lack of properly prepared engineers is a critical barrier to a healthy U.S. economy. EEC invests in faculty, graduate and undergraduate students, post-doctoral scholars, and K-12 teachers. As nontraditional students—such as part-time, delayed enrollment, veteran, and others—comprise more than 70 percent of the general undergraduate population, EEC is defining unique alternative pathways for these students, especially veterans, to successfully earn degrees in engineering.

The programs in EEC are administratively managed within four categories: (1) Major Centers and Facilities; (2) Engineering Education Research; (3) Engineering Workforce Development; and (4) Broadening Participation in Engineering. The Major Centers and Facilities category is comprised of the signature Engineering Research Centers (ERC) program. The ERC program provides the framework for interdisciplinary research and education, development, and technology transfer in partnership with academia, industry, and government. Engineering Education Research advances new productive engineering pedagogy and learning strategies in traditional and non-traditional environments. This category also includes EEC's participation in the NSF-wide activity, IUSE, which integrates the agency's investments in undergraduate education. Engineering Workforce Development includes programs such as REU and Research Experiences for Teachers (RET). Broadening Participation in Engineering supports research and activities that enhance opportunities for underrepresented groups by addressing structural inequalities and biases within educational and workforce systems. This category also includes EEC's engagement with the NSF INCLUDES initiative, which integrates the agency's investments to build on and scale up what works in broadening participation programs.

In general, 28 percent of the EEC portfolio is comprised of new research grants. The remaining 72 percent funds continuing grants and cooperative agreements made in previous years. This high fraction of multi-

year commitments is primarily a consequence of centers funding, which includes awards made as five-year cooperative agreements.

DIVISION OF INDUSTRIAL INNOVATION AND PARTNERSHIPS (IIP) **$248,420,000**
-$1,840,000 / -0.7%

IIP Funding
(Dollars in Millions)

	FY 2017 Actual	FY 2018 (TBD)	FY 2019 Request	Change over FY 2017 Actual Amount	Change over FY 2017 Actual Percent
Total	**$250.26**	**-**	**$248.42**	**-$1.84**	**-0.7%**
Research	**249.74**	**-**	**248.02**	**-1.72**	**-0.7%**
SBIR/STTR	199.05	-	198.57	-0.48	-0.2%
Education	**0.52**	**-**	**0.40**	**-0.12**	**-23.5%**

IIP Summary

IIP contributes to the NSF innovation ecosystem by: (1) supporting innovation research that builds on fundamental research discoveries that exhibit potential for societal and economic impact; (2) encouraging research partnerships between academia and industry; and (3) offering hands-on experience in the innovation process to current and future hi-tech entrepreneurs and innovators.

IIP is home to two cross-agency small business research programs, the SBIR program and the STTR program. These programs seek to transform scientific discovery into societal and economic benefit by catalyzing private sector commercialization of technological innovations. SBIR/STTR programs provide the opportunity for startups and small businesses to undertake cutting-edge, high-quality scientific research and development with the goal of achieving technology commercialization and enabling new products, processes, or services. SBIR/STTR technology topics draw upon the breadth of NSF scientific and engineering research disciplines and are aligned with national and societal priorities.

IIP also supports academic research through three research programs: IUCRCs, PFI, and GOALI. These programs aim to stimulate academia–industry partnerships, leverage industrial support, accelerate technology commercialization, and empower future generations in science and engineering. University grantees in these programs collaborate with industry to create enabling technologies that meet national needs, such as managing the electrical power system, improving manufacturing and biological processing, and supporting new information and communications technologies.

IIP also leads the I-Corps™ program that connects NSF-funded science and engineering research with the technological, entrepreneurial, and business communities, and fosters a national innovation ecosystem that links scientific discovery with technology development, societal needs, and economic opportunities.

In general, 97 percent of the IIP portfolio is comprised of new research grants and 3 percent supports continuing grants.

OFFICE OF EMERGING FRONTIERS AND MULTIDISCIPLINARY ACTIVITIES (EFMA) **$67,260,000**
+$13,590,000 / 25.3%

EFMA Funding
(Dollars in Millions)

	FY 2017 Actual	FY 2018 (TBD)	FY 2019 Request	Change over FY 2017 Actual Amount	Change over FY 2017 Actual Percent
Total	**$53.67**	**-**	**$67.26**	**$13.59**	**25.3%**
Research	**44.67**	**-**	**67.16**	**22.49**	**50.4%**
Big Idea: The Future of Work at the Human-Technology Frontier	-	-	30.00	30.00	N/A
Centers Funding (total)	0.16	-	-	-0.16	-100.0%
Engineering Research Centers	0.16	-	-	-0.16	-100.0%
Education	**4.01**	**-**	**0.10**	**-3.91**	**-97.5%**
Infrastructure	**5.00**	**-**	**-**	**-5.00**	**-100.0%**
CHESS	5.00	-	-	-5.00	-100.0%

EFMA Summary

EFMA strategically pursues and funds projects in important emerging areas in a timely manner. The office provides support to multidisciplinary research and is responsible for the financial stewardship of new investments in The Future of Work at the Human Technology Frontier (FW-HTF) Big Idea. The largest activity in EFMA is the Emerging Frontiers in Research and Innovation (EFRI) program.

Each year EFRI recommends, prioritizes, and funds interdisciplinary project at the frontiers of engineering research and education that have the potential for transformative impacts on national needs and/or grand challenges. Technological innovations have given rise to new industries, expanded access to quality healthcare, and fueled prosperity even as global competition has grown. To help ensure the Nation's continued success and competitiveness in research and innovation, EFRI provides critical, strategic support of fundamental discovery, particularly in areas that may lead to breakthrough technologies and strengthen the economy's technical underpinnings. EFRI is intended to have the necessary flexibility to target long-term challenges, while retaining the ability and agility to adapt as new challenges demand.

EFRI encourages the engineering community to submit new and paradigm-shifting proposals at the interface of disciplines and fields in important emerging areas. Their ideas and discoveries may potentially lead to new research areas for NSF and other agencies, new industries, or capabilities that result in a leadership position for the country, and/or significant progress on a recognized national need or grand challenge. Recent EFRI topics have included areas such as: integrated processes and systems designed to make U.S. infrastructures more resilient; highly secure communication using advanced quantum technologies; advances in soft robotics; flexible technologies and regenerative engineering for healthcare; and biomolecular engineering technologies that will lead to transformative strategies for the screening and treatment of pre-cancers, to solve persistent environmental problems, and uncover new plant traits for agriculture.

In general, about 63 percent of the EFMA portfolio is comprised of new research grants, and about 37 percent supports continuing increments for grants made in previous years.