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 2020	FY 2020 Actual	FY 2021 Estimate	FY 2022 Request	Change over FY 2021 Estimate Amount	Change over FY 2021 Estimate Percent
AI Research Institutes	2020	7	$33.58	$50.61	$69.11	$18.50	36.6%
Biology Integration Institutes	2020	4	21.63	25.00	35.82	10.82	43.3%
Centers for Analysis & Synthesis	1995	2	4.80	-	4.00	4.00	N/A
Centers for Chemical Innovation	1998	9	23.66	24.00	27.70	3.70	15.4%
Engineering Research Centers[1]	1985	18	54.61	56.90	68.70	11.80	20.7%
Materials Centers	1994	23	55.50	53.48	56.80	3.32	6.2%
Quantum Leap Challenge Insts[1]	2020	3	23.10	50.00	36.00	-14.00	-28.0%
Regional Innovation Accelerators	2022	0	-	-	200.00	200.00	N/A
Science & Technology Centers	1987	12	41.74	57.95	60.97	3.02	5.2%
Spectrum Innovation Initiative Ctr	2021	0	-	5.00	5.00	0.00	-
Total			**$258.62**	**$322.94**	**$564.10**	**$305.48**	**118.1%**

[1] Since FY 2020, funding for the Quantum Leap Challenge Institutes has been a vital part of NSF's overall $50 million investment in multidisciplinary centers for quantum research and education. Also see the Engineering Research Center narrative below and the MPS narrative for additional information on quantum center activities.

Description of Major Changes

Artificial Intelligence Research Institutes – multi-directorate

The FY 2022 Request of $69.11 million will support up to 16 National AI Research Institutes—five institutes launched in FY 2020, up to seven anticipated to be awarded in FY 2021, and up to four additional institutes planned in FY 2022. Two additional FY 2020 institutes are wholly funded by the U.S. Department of Agriculture National Institute of Food and Agriculture (USDA NIFA), with one more anticipated to be entirely funded by USDA NIFA in FY 2021. FY 2021 awards are expected to be made in August 2021.

The National AI Research Institutes program, a multisector collaboration among government, industry, and academia, supports multidisciplinary advances on critical challenges in both foundational and use-inspired AI research. Each funded institute has three missions: (1) to advance fundamental knowledge of AI; (2) to advance use-inspired work on using AI to solve real-world problems of importance to the U.S. economy; and (3) to grow the U.S. AI workforce and build pathways for students from diverse backgrounds. More specifically, the funded institutes provide sustained, large-scale support for academic research groups to work on real-world problems, while also creating critical national AI infrastructure in the form of living laboratories. They serve as nexus points for academic, government, and industry interaction, and integrate research with the development of the next-generation AI workforce. A key motivation for the program is to maintain and grow U.S. leadership and competitiveness in AI at a time when other nations are making massive investments in the field. The National AI Research Institutes program is led by CISE and includes contributions from all NSF directorates along with external partners, including federal agencies and industry. Each year, the program solicits proposals that respond to one of a given set of themes. For

institutes launched in FY 2020 and FY 2021, these themes include Foundations of Machine Learning; Trustworthy AI; AI-Driven Innovation in Agriculture and the Food System; AI-Augmented Learning; AI for Accelerating Molecular Synthesis and Manufacturing; Human-AI Interaction and Collaboration; AI and Advanced Cyberinfrastructure; AI to Advance Biology; and others. Each institute is funded at up to $4.0 million per year for up to five years, with the possibility of a competitive renewal in the fifth year for another five years.

Biology Integration Institutes – BIO

The FY 2022 Request of $35.82 million is expected to support fourteen Biology Integration Institutes (BII). This will include nine continuing BII awards and five new awards.

The BII program supports collaborative teams of researchers investigating frontier questions about life that span multiple disciplines within and beyond the biological sciences. The goal is to foster creative integration of diverse fields using innovative experimental, theoretical, and modeling approaches to discover underlying principles operating across multiple levels of life; from molecules to cells, organisms, species, and ecosystems. Each institute has unique research themes centered around a compelling biological question poised for breakthroughs by collaboration across biological disciplines. The themes address fundamental and use-inspired research that serve to advance discovery and understanding in the life sciences and expand capabilities in biotechnology to control and utilize living systems. Outcomes from BII awards will foster innovation and applications that benefit U.S. security and health, mitigate the impacts of climate change, and spur economic growth.

BII awards support team-research and training environments that are conducive to an integration of ideas, expertise, and exploration of new modes of collaboration, which will prepare the next generation of biological scientists to pursue multidisciplinary research throughout their careers. Typically, BII awards bring together multiple organizations to leverage interdisciplinary talent and infrastructure, and to broaden participation of undergraduate and graduate students from underrepresented groups in the life sciences. In this way, BII awards build a diverse and inclusive workforce that can address the challenges of climate change and emerging infectious diseases, and that fulfill the needs of an expanding U.S. bioeconomy.

Centers for Analysis and Synthesis - BIO

The FY 2022 Request of $4.0 million for Centers for Analysis and Synthesis is expected to support one new center in environmental science and eco-forecasting. The Center will develop the teams, concepts, resources, and expertise to enable inclusive, effective, and coordinated efforts to answer broad scientific questions that emerge at interfaces between biological and environmental sciences, including climate change, land use change, biodiversity loss, and ecosystem services. The award will be determined after an open competition conducted in FY 2021. The center would leverage data being provided by the National Ecological Observatory Network (NEON), Long-Term Ecological Research (LTER) and other environmental observatories and databases to support community efforts in ecological modeling to develop a national capability for eco-forecasting.

Centers for Chemical Innovation - MPS

The FY 2022 Request level of $27.70 million is to fund up to seven Phase II Centers for Chemical Innovation (CCI). This includes up to six continuing centers and one new center. Each Phase II center is slated to be funded at $4.0 million per year.

The CCI program makes awards at two levels: smaller Phase I awards (three-year) for center development, and larger Phase II awards (five-year awards with potential for renewal up to a total of ten years) for full centers. In FY 2022, up to six continuing Phase II CCIs will be funded. In addition, three FY 2019 Phase I CCIs will be eligible to compete for Phase II in FY 2022; up to one new Phase II CCI is anticipated. A Phase I CCI competition will be held in FY 2022, supporting up to three new developmental awards.

These research centers focus on major, long-term fundamental chemical research challenges. CCIs are agile, collaborative entities that respond rapidly to emerging opportunities by integrating research with innovation, higher education, broadening participation, and informal science communication. A broad range of chemical research is currently represented in CCIs advancing fundamental understanding in chemical synthesis and catalysis; characterization, theory, computation, and modeling; data science, machine learning, and AI for molecular synthesis; and advanced manufacturing of nanomaterials; along with training for students at all levels. CCIs are also actively engaged in knowledge transfer to industry and the commercialization of their discoveries and new technologies.

The themes of the CCIs are varied and include Administration priorities such as AI, QIS, biotechnology, clean energy technologies, and advanced manufacturing; NSF's Big Ideas: URoL, and HDR; as well as sustainable chemistry. The Center for Aerosol Impacts on the Chemistry of the Environment (CAICE) is studying the fundamental properties of sea spray aerosols and how these reactive particles impact air quality, weather, and cloud formation. The Center for Genetically Encoded Materials, CGEM, is on the cutting edge of synthetic biology, adapting the ribosome to make sequence-defined synthetic polymers. Several CCIs are studying various aspects of sustainability and clean energy technologies: the Center for Sustainable Nanotechnology (CSN) is examining how technologically important nanoparticles found in batteries interact with biological systems and how those nanoparticles can be redesigned to be environmentally benign; the Center for Synthetic Organic Electrochemistry (CSOE) is developing new electrosynthesis reactions that are safer, more energy-efficient, and generate less waste; and the Center for Sustainable Polymers (CSP) works on the discovery and development of new sustainable, degradable, and chemically recyclable plastics with improved performance, providing alternative solutions to the growing global plastics crisis.

Each year, CCIs include nearly 80 participating academic institutions, 74 non-academic partner institutions, and over 165 Senior Personnel, 140 Postdoctoral Associates, 250 Graduate Students, and 80 Undergraduate Students.

Engineering Research Centers - ENG

The FY 2022 request is $68.70 million to support 15 NSF Engineering Research Centers (ERC). The total includes support for four Gen-4 ERCs, funded as part of the Class of 2022 that will advance convergent engineering research to tackle high-impact challenges that have the potential to benefit U.S. security, prosperity, health, and society. The Class of FY 2022 ERCs will implement strategies for effective team formation and engagement with stakeholder communities to maximize their impacts. Three centers from the Class of 2011 will receive their final year of NSF funding in FY 2021.

All NSF ERCs enable innovation, combining the energy and intellectual curiosity of university research focused on discovery with real-world engineered systems and technology opportunities through partnerships with industry. Since the program began in 1985, products of ERC innovation include more than 2,500 inventions disclosures, nearly 2,200 patent applications filed, 883 patents awarded, and 1,378 licenses. ERCs also have a successful track record for educating a technology-enabled workforce with hands-on, real-world experience. On average, NSF ERCs graduate over 110 Bachelor's, 100 Master's, and 150 Doctoral degree students each year. Over that time, they have also impacted, on average over 2,500 K-12 teachers and students. NSF ERCs are also effective at broadening participation from underrepresented groups. For example, across currently active ERCs, women comprise approximately 43 percent of those involved in center activities, in comparison to the national average of 24 percent across engineering. Also, the percentage of people from underrepresented groups participating is more than double that of engineering's national average.

The ERC program periodically commissions studies by external evaluators to examine aspects of the

program, such as the effectiveness of ERC graduates in industry and the benefits of ERC membership to industry. In FY 2015, NSF funded the National Academies of Sciences, Engineering, and Medicine to study the future of center-based, multidisciplinary engineering research. The study report, delivered May 2, 2017, articulates a vision for the future of NSF-supported center-scale, multidisciplinary engineering research.[1] After careful consideration, in FY 2018 ENG sparked new convergent engineering research collaborations through planning grants, providing 60 awards to build capacity for a new generation of ERCs. In October 2018, ENG released a solicitation (NSF 19-503)[2] for the 4th-generation of ERCs and supported the first four awards in FY 2020, including the Center for Quantum Networks (CQN). The center will lay the foundations for a socially responsible quantum internet that will enable secure communications, provide public access to distributed quantum computers and sensors, and spur new technology industries and a competitive marketplace of quantum service providers and application developers. CQN complements other QIS investments across the Federal government through its unique focus on designing and building the quantum internet's full stack, educating diverse quantum engineers, and transferring knowledge through industry partnerships.

In FY 2021, NSF expects the results of a study on the sustainability of ERCs once NSF funding has ended. A previous 2010 report[3] "Post-Graduation Status of National Science Foundation Engineering Research Centers" (SciTech Communications), augmented by a 2015 update, found that 29 of the 35 centers (83 percent) that graduated after 10 years of NSF support are self-sustaining, with most NSF ERC features in place and strong financial support from other government sources and industry partners.

Materials Centers - MPS

The FY 2022 Request level of $56.80 million is expected to support 19 continuing Materials Research Science and Engineering Centers (MRSEC). A MRSEC competition is not planned for FY 2022 as this long-standing, flagship program completed its triennial competition in FY 2020. Funding in FY 2022 will support three new centers established in FY 2020, eight existing centers that successfully recompeted for funding in FY 2020, as well as eight other existing centers funded in 2017.

MRSECs function as hubs to solve complex grand challenge materials problems requiring broad multidisciplinary expertise within the physical sciences and engineering to understand materials phenomena, exploit materials behavior, and to create and discover new materials. Research in materials science is inherently interdisciplinary and the MRSEC program is a prime example of convergent research encompassing physics, chemistry, mathematics, biology, materials science, and engineering. Through collaborative efforts involving academics, industry, national laboratories experts, and international and educational partners, MRSECs advance materials research and education in the United States, and in many cases are international leaders.

MRSECs have five major coordinated components: (1) interdisciplinary research groups, (2) education and outreach, (3) industrial outreach/partnerships, (4) the materials research facilities network—providing access to more than 1,250 state-of-the art equipment instrumentation to materials researchers across the Nation—and (5) the seed program, which enables MRSECs to rapidly react/move into new high-risk and potentially transformative areas not yet fully explored. In FY 2019, seeding efforts within each MRSEC were targeting emerging research areas relevant to the Division of Materials Research. These areas include NSF's Big Ideas QL, FW-HTF, URoL, and HDR, as well as recyclable plastics and alternative materials for sustainable development, synthetic materials biology, structural materials under extreme conditions, and the use of machine learning to accelerate materials discovery.

[1] www.nap.edu/catalog/24767/a-new-vision-for-center-based-engineering-research
[2] www.nsf.gov/pubs/2019/nsf19503/nsf19503.htm
[3] http://erc-assoc.org/sites/default/files/topics/Grad_ERC_Report-Final.pdf

Each year, MRSECs produce over 180 Ph.Ds. in STEM fields, mentor nearly 400 Research Experiences for Undergraduate students and 60 Research Experiences for Teachers participants, and impact over one million students and their parents through outreach activities such as summer camps, K-12 science curriculum development, K-12 in-school science demonstrations, development and deployment of science kits, and partnering with the Nation's top museums to create STEM-related exhibits that impact the public. Since 1994, the program has created approximately 180 startups and annually produces about 60 awarded patents and 35 patent licensures. MRSECs engage and assist more than 500 other individuals from industry, national laboratories, and international partners per year in advancing fundamental materials research that can be translated into the marketplace.

Quantum Leap Challenge Institutes – MPS

The FY 2022 Request level of $36.0 million will support the third year of the three Quantum Leap Challenge Institutes (QLCI) established in FY 2020 along with the second year of additional institutes that are anticipated to result from the second phase of the QLCI competition being held in FY 2021. Each of the existing institutes is addressing a different key area of QIS research, one in sensing, one in computing, and one in networking. The FY 2021competition, in addition to providing an opportunity for increased effort in these three areas, will also allow expansion of the areas to be covered to include quantum simulation. Total award sizes for each institute are $25.0 million over five years.

Quantum information science and engineering utilizes profound aspects of quantum physics such as superposition, interference, and entanglement to develop revolutionary approaches for information processing. Such approaches include quantum computation, quantum communication, quantum simulation and quantum sensing. These rapidly developing fields have been bolstered by recent discoveries and breakthroughs. However, several foundational and technological challenges must be overcome before the full potential of quantum information science and engineering can be realized. The QLCI's program goal is to support timely and bold research agendas aimed at making breakthroughs on one of these clearly identified and compelling challenges within a five-year period. QLCIs are expected to: engage an intellectually-diverse community in the pursuit of identified challenges; develop cohesive, collaborative and national-scale approaches to research in quantum information science and engineering; and enable the development of a well-trained workforce with strong cross-disciplinary skill sets needed for quantum information science and engineering.

The QLCI program, along with other NSF multidisciplinary centers related to quantum research and education, collectively address Section 302 of the 2018 National Quantum Initiative Act. In addition, as all of the institutes funded under the QLCI program address topics that have been identified by the NSTC Subcommittee on Quantum Information Science as being critical to the U.S. investment in QIS, the program exercises a key role in the NSF response to this need.

Regional Innovation Accelerators – TIP

The FY 2022 Request amount of $200.0 million will support up to 20 Regional Innovation Accelerators (RIAs) starting in FY 2022. The RIAs will simultaneously address major scientific and technological goals while ensuring broad societal benefits and global leadership. They will advance use-inspired, solution-oriented research and innovation in a range of technology areas (e.g., AI, QIS, advanced wireless, advanced manufacturing, semiconductors) as well as in a diverse set of national challenges (e.g., climate change and the bioeconomy). These accelerators will bring together multiple disciplines, institutions, and sectors. They will balance technical and geographic (i.e., local and regional challenges, capabilities, and perspectives) innovation; incentivize partnerships between NSF, academia, industry, nonprofits, state and local governments, and venture capital; and serve as hubs for NSF's broader portfolios of investment in their respective areas of focus. The RIAs are expected to be funded at $10.0 million per year for 10 years.

Science and Technology Centers: Integrative Partnerships – multi-directorate

The FY 2022 Request level of $60.97 million will support at least 12 Science and Technology Centers (STC) and the administrative costs associated with program management and oversight. These include STCs from the FY 2013, FY 2016, and FY 2021 cohorts. In FY 2022, the three FY 2013 cohort centers will be in their final year of funding. In FY 2019, a solicitation for a new STC class was issued to replace the sunsetting 2010 cohort. The program received 188 preliminary proposals with the expectation of making at least five new awards for the FY 2021 cohort. It is anticipated that a solicitation for the Class of 2023 will be released in summer 2021 with awards made in FY 2023. Currently, full STC awards are for five years, with possible renewal for an additional five years, or 10 years total. The award sizes of the existing STCs are approximately $5.0 million per year with ramp down in years nine and ten.

The 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 include: creation of atomic-scale devices and systems based on quantum materials; elucidating the mechanisms and architecture of intelligence in the human brain; studying mechanical forces in molecules, cells, and tissues of plants and animals; and developing atomic scale imaging. STCs conduct world-class research through partnerships among institutions of higher education, national laboratories, industry, other public or private entities, and via international collaborations. STCs strengthen the caliber of the Nation's STEM workforce through intellectually challenging research experiences for students, postdoctoral fellows, researchers, and educators. One of the goals of STCs is to increase involvement of traditionally underrepresented groups in science and engineering, which they achieve through dedicated mentoring and partnerships, most notably with MSIs. Additionally, STCs advance public scientific understanding through partnerships with K-12 and informal education communities. The knowledge transfer activities focus on engaging stakeholders with the intent of supporting innovation, providing information to policy-makers, and disseminating knowledge across scientific disciplines. The STC program uses a network of evaluators working with the centers to share information and lessons learned about the most effective way to measure progress. NSF anticipates convening a Committee of Visitors to review the program in FY 2022.

Spectrum Innovation Initiative: National Center for Wireless Spectrum Research (SII-Center) – MPS

The FY 2022 Request level of $5.0 million is to fund the continuing operations of a single national center to be awarded in FY 2021. In FY 2020, NSF began the process of standing up a National Center for Wireless Spectrum Research through the provision of 17 SII-Center planning grants under solicitation NSF 20-557. In FY 2021, NSF expects to continue this process and provide funding for this program under NSF 21-558.

The worldwide growth of wireless communication, navigation, and telemetry has provided immense societal benefits including mobile broadband data, Internet of Things (IoT), mobile healthcare, and intelligent transportation systems. These and other applications call for innovations that can circumvent the challenges of radio spectrum scarcity and interference, and foster the growth of ubiquitous, high speed, low latency connectivity. Commercial applications like the above must operate in harmony with scientific uses of spectrum (e.g., radio astronomy, Earth and atmospheric sciences, and polar research) and other nationally vital spectrum-dependent services (e.g., weather prediction). NSF continues to support wireless spectrum research and the scientific uses of the electromagnetic spectrum through multiple programs that enable fast, accurate, dynamic coordination and usage of the limited spectrum resource. These programs have created an opportune ground to build and create a large center-based ecosystem for spectrum research, which is the target of this SII-Center program. The goal of this program is to chart out a trajectory to ensure United States leadership in future wireless technologies, systems, and applications in science and engineering through the efficient use and sharing of the radio spectrum. A key expectation is establishing harmony between scientific uses of the electromagnetic spectrum and the forthcoming technological advances for high-speed, low latency, secure connectivity among pervasive devices, autonomous vehicles, and numerous

other platforms. The SII-Center will serve as a focal point for sustained research in the most challenging topics in spectrum. Research in these areas is expected to create advanced wireless technologies and systems that benefit society, of which 5G and future wireless broadband networks are an example. The SII-Center is also expected to facilitate the education and development of an agile workforce needed to support emerging industries. These industries will rely heavily on wireless technologies and will require new advanced and automated spectrum management techniques. NSF's goal is to promote transformative use and management of the electromagnetic spectrum, resulting in profound benefits for science, engineering, industry, and other national interests.

NSF is working closely with the Federal Communications Commission and the National Telecommunications Information Administration to ensure that NSF SII investments in spectrum research and development are in alignment with national spectrum regulatory and policy objectives, principles, and strategies.[4]

Estimates for Centers Participation in 2020

	Number of Participating Institutions[1]	Number of Partners[2]	Total FY 2020 NSF Support ($ in millions)	Total Leveraged Support ($ in millions)[3]	Number of Participants[4]
AI Research Institutes[5]	47	84	$33.58	$8.00	N/A
Biology Integration Institutes[5]	N/A	N/A	21.63	N/A	N/A
Centers for Analysis & Synthesis	266	136	4.80	0.45	1,002
Centers for Chemical Innovation	65	60	23.66	5.89	632
Engineering Research Centers	953	56	54.61	91.50	4,586
Materials Centers	268	213	55.50	27.00	4,295
Quantum Leap Challenge Insts[5]	16	30	23.10	TBD	250
Regional Innovation Accelerators[6]	N/A	N/A	N/A	N/A	N/A
Science & Technology Centers	191	174	41.13	55.50	2,071
Spectrum Innovation Initiative Ctr[7]	N/A	N/A	N/A	N/A	N/A

[1] All academic institutions participating in activities at the centers.

[2] The total number of non-academic participants, including industry, states, and other federal agencies at the centers.

[3] Funding for centers from sources other than NSF.

[4] The total number of people who use center facilities, not just persons directly support by NSF.

[5] New NSF Centers activity in FY 2020. Full estimates for Centers Participation are not available at this time.

[6] New NSF Centers activity in FY 2022.

[7] New NSF Centers activity in FY 2021.

[4] www.fcc.gov/document/fcc-federal-partners-sign-spectrum-innovation-cooperation-agreement

Centers Supported by NSF in FY 2020

Center	Institution	State
Artificial Intelligence Research Institutes		
Institute for Trustworthy AI in Weather, Climate, and Coastal Oceanography	U of Oklahoma	OK
Institute for Foundations of Machine Learning	U of Texas at Austin	TX
Institute for Student-AI Teaming	U of Colorado at Boulder	CO
Molecule Maker Lab Institute (MMLI): An AI Institute for Molecular Discovery, Synthetic Strategy, and Manufacturing	U of Illinois Urbana-Champaign	IL
AI Research Institute for Fundamental Interactions	Massachusetts Institute of Techn	MA
AI Institute for Next Generation Food Systems	U of California-Davis	CA
AI Institute for Future Agricultural Resilience, Management, and Sustainability (AIFARMS)	U of Illinois at Urbana-Champaign	IL
Biology Integration Institutes		
Behavioral Plasticity Research Institute (BPRI)	Baylor College of Medicine	TX
Emergent Ecosystem Responses through Genes-to-Ecosystems Institute (EMERGE)	Ohio State University	OH
Advancing Spectral biology in Changing Environments to understand Diversity (ASCEND)	University of Minnesota-Twin Cities	MN
Genomics and Eco-evolution of Multi-scale Symbioses Institute (GEMS)	University of Illinois at Urbana-Champaign	IL
Centers for Analysis and Synthesis		
National Institute for Mathematical & Biological Synthesis	U of Tennessee	TN
Socio-Environmental Synthesis Center	U of Maryland	MD
Centers for Chemical Innovation (Phase II awards only)[5]		
Center for Chemical Evolution	Georgia Institute of Tech	GA
Center for Chemistry at the Space-Time Limit	U of California-Irvine	CA
Center for Sustainable Materials Chemistry	Oregon State	OR
Center for Sustainable Nanotechnology	U of Wisconsin	WI
Center for Sustainable Polymers	U of Minnesota	MN
NSF Center for Aerosol Impacts on Chemistry and the Enviro.	U of California-San Diego	CA
NSF Center for Selective C-H Functionalization	Emory	GA
NSF Center for Genomically Encoded Materials (C-GEM)	U of California-Berkeley	CA
NSF Center for Synthetic Organic Electrochemistry (CSOE)	U of Utah	UT
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
Center for Ultra-wide-area Resilient Electric Energy Transmission Network (CURENT)	U of Tennessee	TN
Engineering Research Center for Re-Inventing America's Urban Water Infrastructure (ReNUWIt)	Stanford University	CA
Engineering Research Center for Innovative and Strategic Transformation of Alkane Resources (CISTAR)	Purdue	IN
Engineering Research Center for Precise Advanced Technologies and Health Systems for Underserved Populations (PATHS-UP)	Texas A&M	TX
Nanomanufacturing Systems for Mobile Computing and Mobile Energy Technologies (NASCENT)	U of Texas	TX
Nanosystems Engineering Research Center for Directed Multiscale Assembly of Cellular Metamaterials with Nanoscale Precision (CELL-MET)	Boston College	MA
Nanotechnology Enabled-Water Treatment Systems (NEWT)	Rice University	TX
NSF Engineering Research Center for Cell Manufacturing	Georgia Institute of Tech	GA

[5] Smaller, developmental Phase I awards do not meet the criteria as formal NSF Centers and so are not captured here.

Technologies (CMaT)		
Optimization for Electro-thermal Systems (POETS)	U of Illinois	IL
Quantum Energy and Sustainable Solar Technologies (QESST)	Arizona State	AZ
Sensorimotor Neural Engineering (CSNE)	U of Washington	WA
Translational Applications of Nanoscale Multiferroic Systems (TANMS)	U of California-Los Angeles	CA
NSF Engineering Center for Quantum Networks (CQN)	U of Arizona	AZ
NSF Engineering Research Center for the Internet of Things for Precision Agriculture (IoT4Ag)	U of Pennsylvania	PA
NSF Engineering Research Center for Advancing Sustainability Through Powered Infrastructure for Roadway Electrification (ASPIRE)	Utah State University	UT
NSF Engineering Research Center for Advanced Technologies For Preservation of Biological Systems (ATP-Bio)	U of Minnesota	MN
Materials Centers		
Brandeis Bioinspired Soft Materials Center	Brandeis	MA
Center for Complex and Active Materials	U of California-Irvine	CA
Center for Dynamics and Control of Materials	U of Texas at Austin	TX
Center for Emergent Materials	Ohio State University	OH
Center for Hybrid, Active and Responsive Materials	U of Delaware	DE
Center for Multifunctional Materials	Northwestern	IL
Center for Nanoscale Science	Pennsylvania State	PA
Center for Polarization and Spin Phenomena in Nanoferroic Structures	U of Nebraska	NE
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
Illinois Materials Research Center	U of Illinois at Urbana-Champaign	IL
Laboratory for Research on the Structure of Matter	U of Pennsylvania	PA
Materials Research Science and Engineering Center at UCSB	U of California-Santa Barbara	CA
Materials Research Science and Engineering Center	U of California-San Diego	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
Soft Materials Research Center	U of Colorado	CO
UW Molecular Engineering Materials Center	U of Washington	WA
Wisconsin Materials Research Center	U of Wisconsin	WI
Quantum Leap Challenge Institutes		
Enhanced Sensing and Distribution Using Correlated Quantum States	U of Colorado Boulder	CO
Hybrid Quantum Architectures and Networks	U of Illinois-Urbana Champaign	IL
Present and Future Quantum Computing	U of California-Berkeley	CA
Nanoscale Science and Engineering Centers		
Center for the Environmental Implications of Nanotechnology (CEINT)[6]	Duke	NC
Predictive Toxicology Assessment & Safe Implementation of Nanotechnology in the Environment (CEIN)[6]	U of California-Los Angeles	CA
Science and Technology Centers		
BEACON: An NSF Center for the Study of Evolution in Action	Michigan State	MI

[6] CEINT and CEIN are operating on no-cost extensions. No funds were obligated for the centers in FY 2020.

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