



2024 NSF Grants Conference: Directorate of Engineering (ENG) Programs

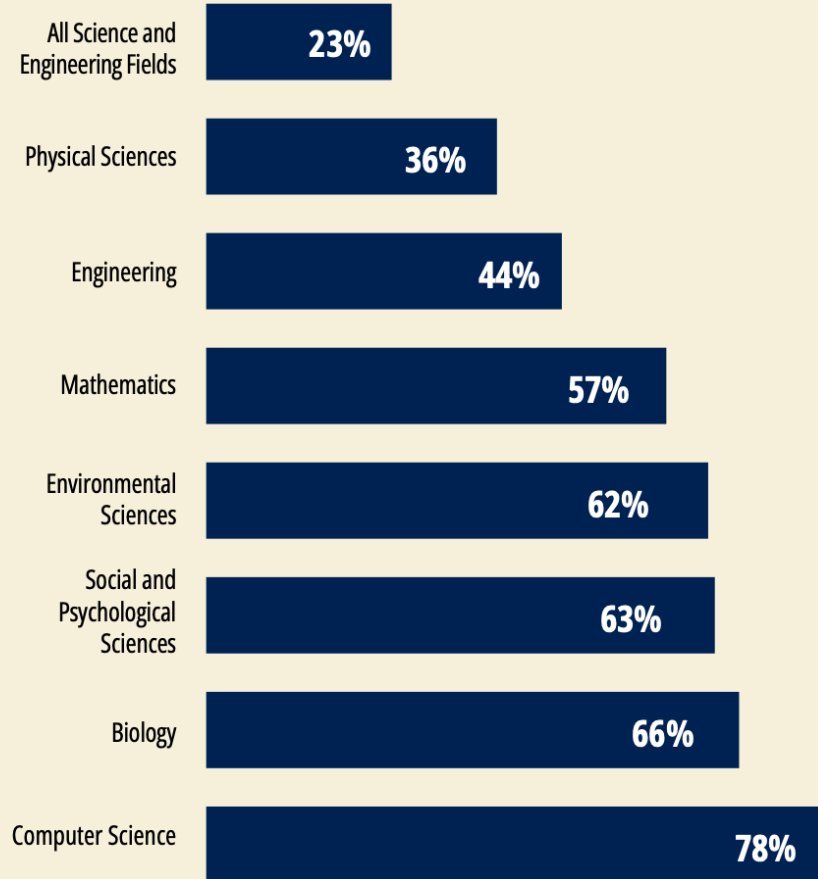
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**Program Director, Division of Chemical, Bioengineering,
Environmental, and Transport Systems (CBET)**

June 4, 2024

NSF's
funding
impact on
academic
research

**NSF SUPPORT OF ACADEMIC BASIC RESEARCH IN
SELECTED FIELDS** (as a percentage of total federal support)



Notes: Biology includes Biological Sciences and Environmental Biology. Biology and Psychological Sciences exclude National Institutes of Health. Source: NSF/National Center for Science and Engineering Statistics, Survey of Federal Funds for Research and Development, FY 2020.





Scale: Single investigator to mid-size teams to centers and networks



Breadth: Single discipline through convergence research



Career stage: Undergraduate to grad to postdoc to early to middle to later career



Innovation cycle: Basic research through translational research

You are at the heart of NSF's mission



NSF Directorate for Engineering (ENG)

ENG Office of the Assistant Director

Emerging Frontiers and Multidisciplinary Activities (EFMA)

Chemical, Bioengineering, Environmental, and Transport Systems (CBET)

Civil, Mechanical, and Manufacturing Innovation (CMMI)

Electrical, Communications, and Cyber Systems (ECCS)

Engineering Education and Centers (EEC)

Emerging Frontiers Research and Innovation

Chemical process systems

Environmental engineering and sustainability

Advanced manufacturing

Engineering for civil infrastructure (NHERI)

Operations and design

Communications, circuits, and sensing systems

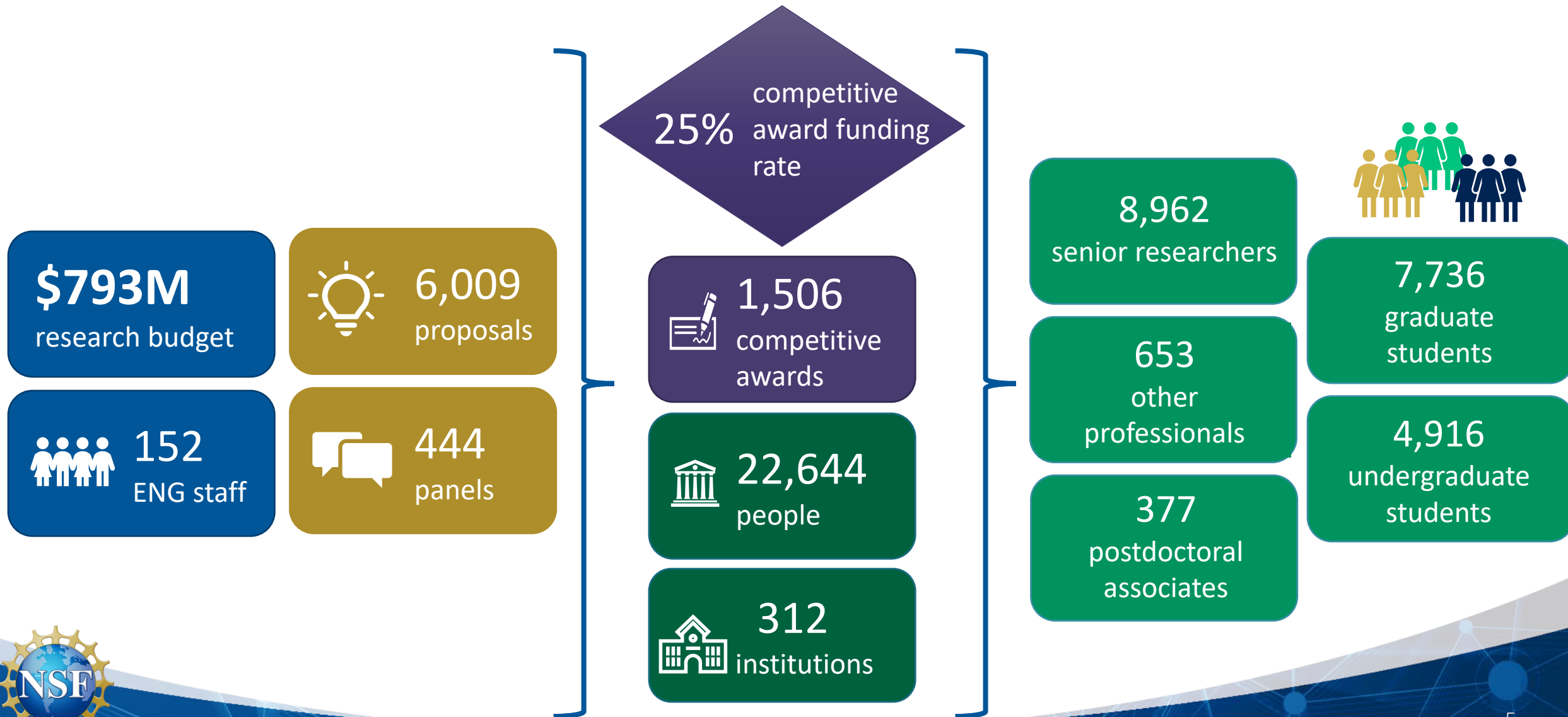
Electronics, photonics, and magnetic devices

Energy, power, control, and networks

Engineering education



ENG by the Numbers: FY 2023



NSF Engineering Strategic Plan

MISSION

To transform our world for a better tomorrow by driving discovery, inspiring innovation, enriching education, and accelerating access

VISION

NSF Engineering will be a global leader in identifying and catalyzing fundamental engineering research, innovation, and education.

GOALS

Propel

U.S. leadership in transformational engineering approaches to problems with societal impact

Expand

opportunities for people

Catalyze

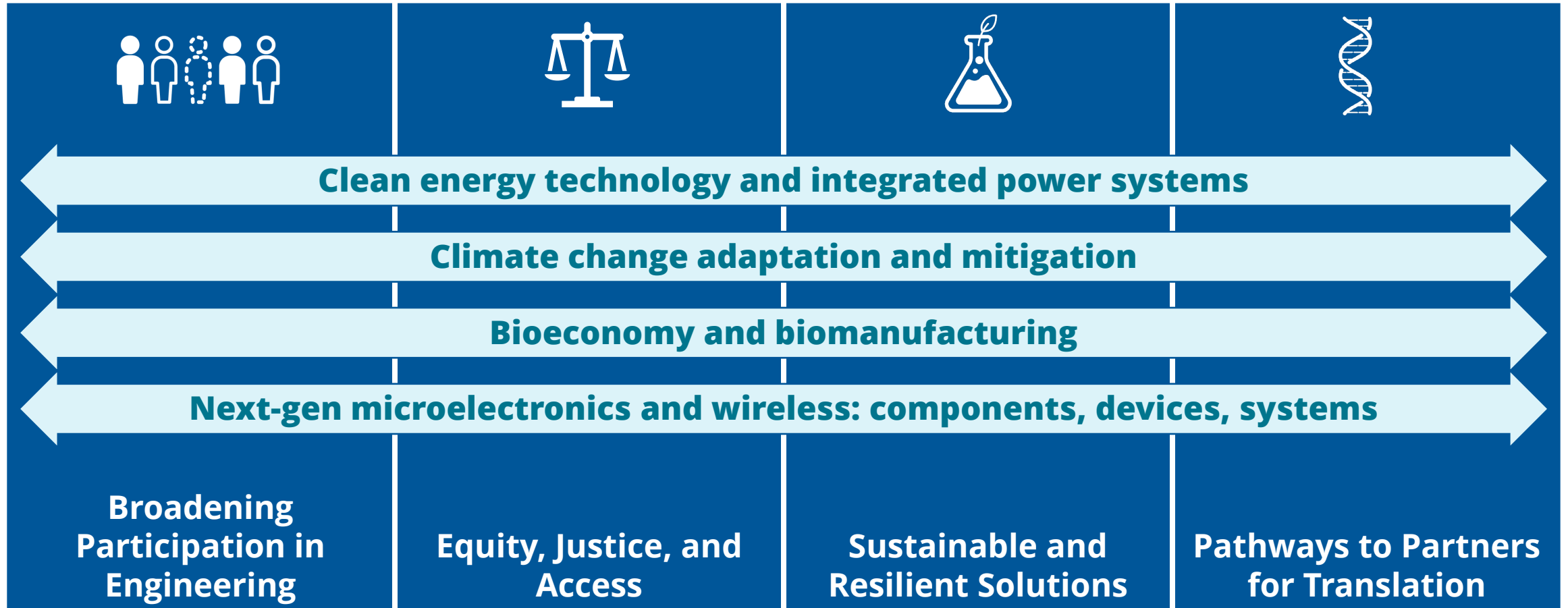
purposeful partnerships



Goal: Propel US Leadership in
Transformational Engineering
Approaches to Problems with
Societal Impact



Investing in Cross-ENG Strategic Priorities



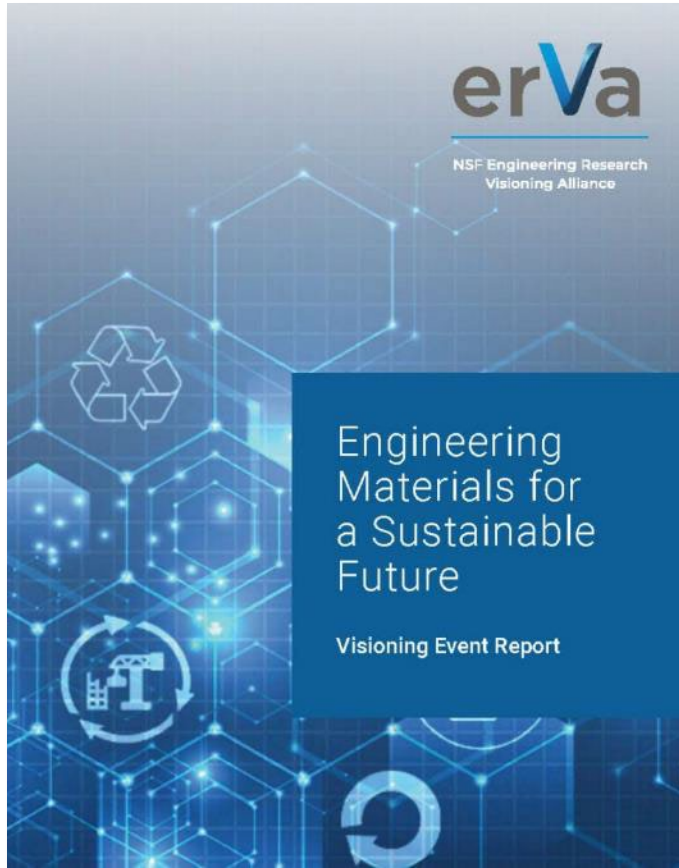
Coordinate

Collaborate

Co-fund



Engineering Research Visioning Alliance



February 2024

Quantum Enabled Technologies

Visioning Event
March 19-20, 2024
Tucson, AZ

Transforming Women's Health Outcomes through Engineering

Visioning Event
June 5-6, 2024
Columbus, OH

Strategic Engineering for Next-Generation Wireless Competitiveness

Visioning Event
June 13-14, 2024
Denver, CO



www.ervacommunity.org

Clean Energy

Funding Opportunities for Engineering Research to Achieve Net-Zero Climate Goals by 2050

- NSF 24-045 mostly continuous submission

Critical Aspects of Sustainability (CAS): Innovative Solutions to Climate Change

- NSF 21-124 submissions accepted at any time

ENG Fluid Dynamics–DOE Wind Energy Technologies Office

opportunity on wind and ocean energy harvesting

- PD 23-1443 submissions accepted at any time

NSF-DOE Geothermal INTERN

- NSF 23-024 submissions accepted at any time



Climate Change Adaptation and Mitigation

Funding Opportunities for Engineering Research to Achieve Net-Zero Climate Goals by 2050

- NSF 24-045 mostly continuous submission

Strengthening American Infrastructure

- NSF 24-519 proposals under review

Civil Infrastructure research for climate change Mitigation and Adaptation (CLIMA)

- NSF 23-079 continuous submission



Expanding Access to Research Infrastructure

Mid-Scale Research Infrastructure provides experimental research capabilities in the range between the Major Research Instrumentation (\$6M) and Major Facilities (\$100M) thresholds.

- Mid-scale RI-1 (<\$20M) [NSF 22-637](#)
- Mid-scale RI-2 (\$20-100M) [NSF 23-570 invited proposals due December 18, 2023](#)
- Dear Colleague Letter: Mid-scale RI — Engineering Conferences
[NSF 22-075 continuous submission](#)



Other ENG Infrastructure Investments:

National Nanotechnology Coordinated Infrastructure – 16 user facility sites

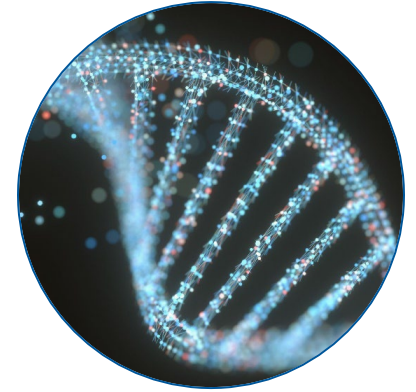
- www.nnci.net

Natural Hazards Engineering Research Infrastructure – 8 experimental facilities, cyberinfrastructure

- www.designsafe-ci.org



Bioeconomy: Biotechnology Research



Emerging Frontiers in Research and Innovation (EFRI): Biocomputing through EnGINeering Organoid Intelligence (BEGIN OI)

- To advance the design, engineering, and fabrication of organoid systems that can process information dynamically while interfacing with non-living systems
- NSF 24-508 letters of intent (required) due January 17, 2024; full proposals due February 22, 2024

Bioinspired Design Collaborations to Accelerate the Discovery-Translation Process (BioDesign)

- To inform and generate new directions for engineered systems, devices, materials or products
- NSF DCL 23-055 deadlines vary by program

Sentinel Systems that Detect, Recognize, Actuate, and Mitigate Emergent Biological Threats (DREAM Sentinels)

- For sensing and responding to known and unknown biological threats
- NSF DCL 22-077 continuous submission



Future Manufacturing Research

Future Manufacturing

- For manufacturing that either does not exist today or exists only at such small scales that it is not viable
- FY 2020-2023: ~\$135 million in new projects
 - Biomanufacturing
 - Cyber-manufacturing
 - Eco-manufacturing
- FY 2023: \$35 million in 21 projects

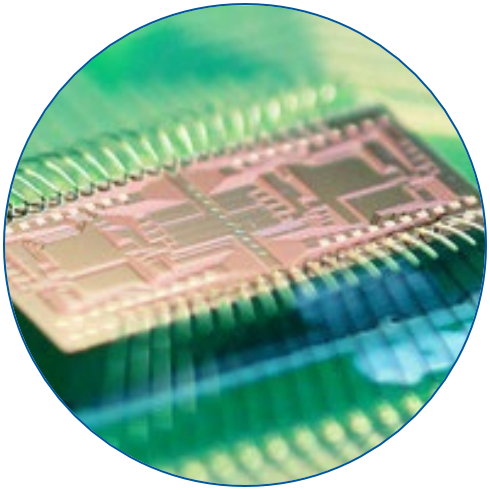


Next Generation Supply Chains

- NSF DCL 23-080 submissions accepted at any time



Next-Gen Microelectronics: Semiconductor Lab to Fab



Supplements for Access to Semiconductor Fabrication (ASF)

- NSF DCL 22-113 proposals accepted at any time

Advanced Chip Engineering Design and Fabrication (ACED Fab)

- NSF 22-636 proposals under review

Next-Gen Microelectronics: Quantum Technologies

Dear Colleague Letter: Quantum Manufacturing

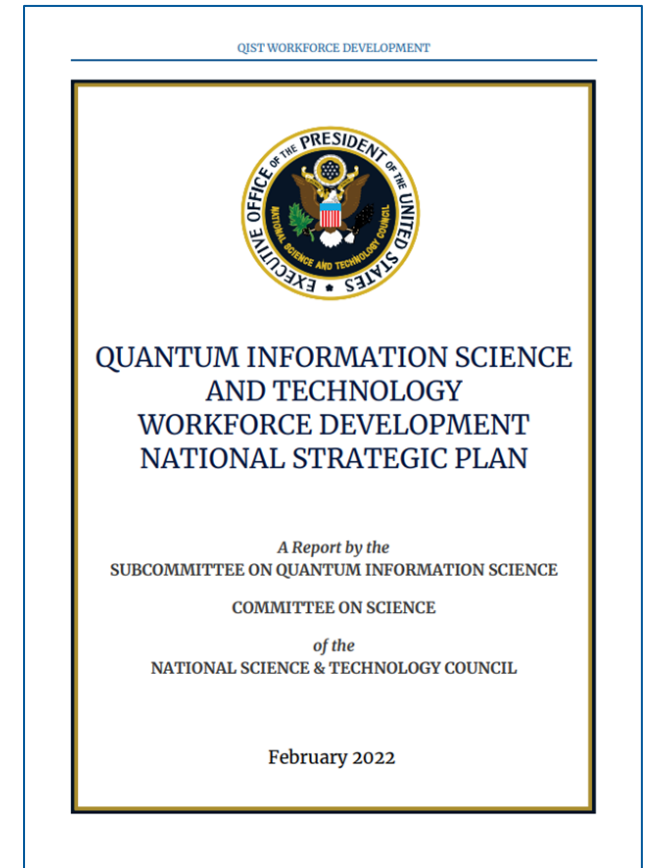
- NSF 22-074 continuous submission of EAGER and standard research proposals

Expanding Capacity in Quantum Information Science and Engineering NSF (ExpandQISE)

- NSF 24-523 - \$38 million from across NSF in 22 projects in FY 2023

National Quantum Virtual Lab

- NSF 23-604 proposals due November 30, 2023



Goal: Expand Opportunities for People



Broadening Participation in Engineering: NSF 22-514

- Planning and Conference Grants: *accepted anytime*
- Research in Broadening Participation in Engineering: *accepted anytime*
- Inclusive Mentoring Hubs: *target date: 3rd Wed in Nov*
 - Connect and dynamically build networks for racial and ethnic groups not sufficiently represented
 - Could engage students, faculty, academic leaders, postdoctoral and career transitioning researchers, small businesses and industry professionals, K-12 educators, or others
- Centers for Equity in Engineering: *target date: 3rd Wed in Nov*
 - Catalyze culture change in engineering colleges to create equitable and inclusive practices that recruit and retain a diverse community of students



Broadening Participation



Centers of Research Excellence in Science and Technology (CREST Centers) Interest in Engineering Research

- Encourages MSIs to submit proposals that focus on engineering research
 - Microelectronic and semiconductor technology
 - Wireless communication
 - Clean energy technology
- NSF 23-124 preliminary proposals/supplement requests due December 6, 2024

HBCU Excellence in Research (HBCU-EiR)

- Cross-NSF activity that supports research at HBCUs
- Letters of Intent due July 11, 2024



Revolutionizing Engineering Departments (RED)

The goal is to catalyze revolutionary changes to the education of the next generation of engineers while expanding the reach of changes that have proven effective.

NSF 24-564

- Track 1-RED Planning
- Track 2-RED Adaptation and Implementation
- Track 3-RED Innovation
- Track 4-RED Innovation Partnerships

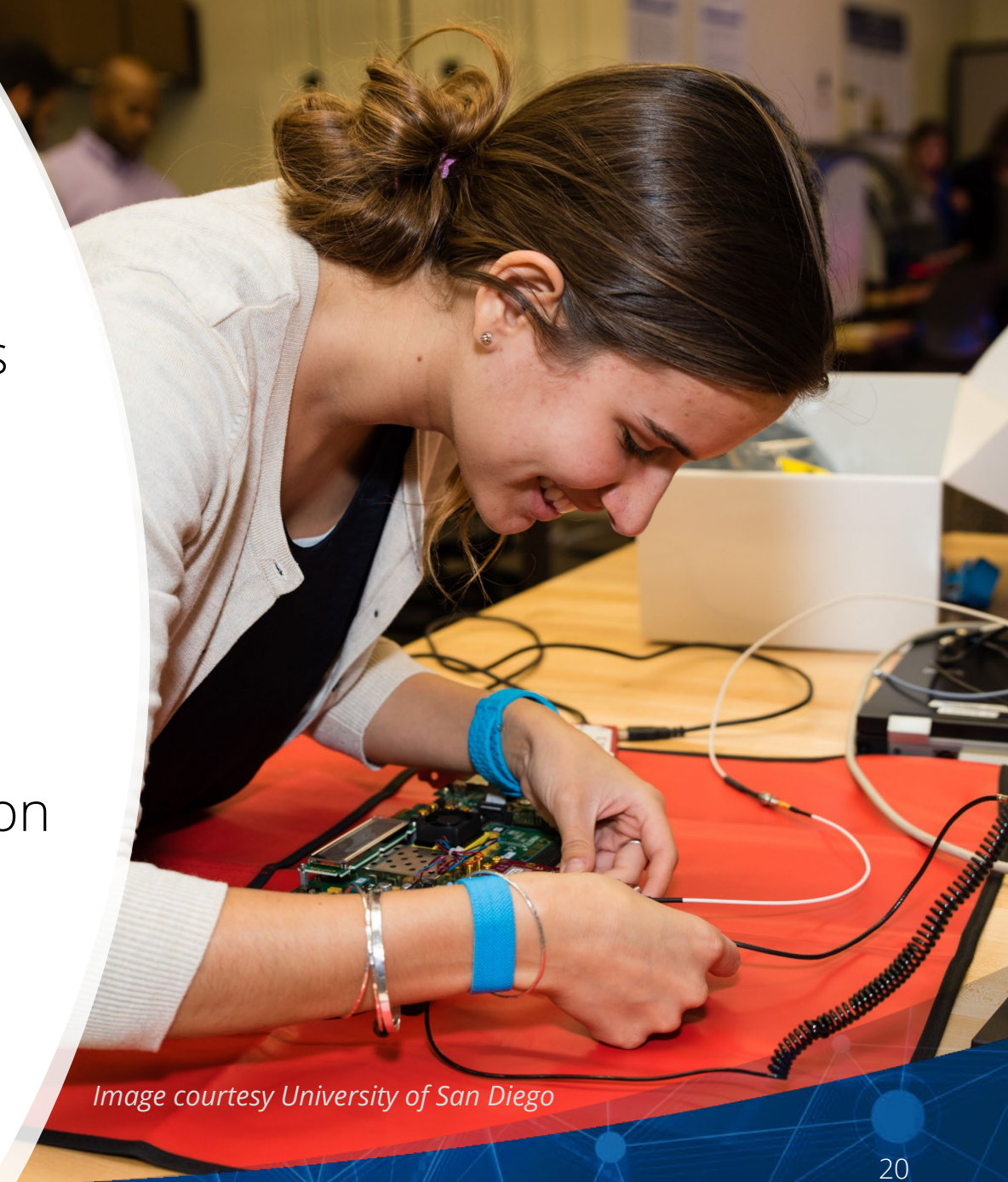


Image courtesy University of San Diego



Early Career Support

- Engineering Postdoctoral Fellowship Program
 - Places early career PhDs in engineering fields in university research postdoctoral fellowships
 - [Contact: \[efellows.asee.org\]\(https://efellows.asee.org\)](https://efellows.asee.org)
- Engineering Research Initiation
 - Support for investigators who have yet to receive research funding from Federal Agencies and who are at non-R1 institutions.
 - *NSF 22-595 proposals under review*
- Faculty Early Career Development Program (CAREER)
 - Annual ENG CAREER proposal-writing workshop
 - *NSF 22-586 deadline July 24, 2024*



Workforce Development Opportunities

REU: Research Experiences for **Undergraduates** sites and supplements: NSF 23-601 **deadline August 21, 2024 (Third Wednesday in August thereafter)**

RET: Research Experiences for **Teachers** sites and supplements: NSF 24-503 **deadline October 9, 2024 (Second Wednesday in October, Annually Thereafter)**

VRS: **Veterans** Research Supplement Program: Veterans - Undergraduates, grad students, teachers. NSF 23-161 **accepted anytime**

START Supplements: Skills Training in Advanced Research and Technology for **Community College** students/faculty in NSF Centers: IUCRC and ERC: nsf.gov/START, **accepted anytime**

REM Research Experiences and Mentoring Supplement NSF 23-012: cohorts of **high school students/teachers**, undergraduates, faculty, and veterans. **accepted Aug-Nov each year**

INTERN supplements: Non-academic Research Internships for **Graduate Students**
nsf.gov/INTERN **accepted anytime**



NSF INTERN : Immersive Exposure to hard and soft skills!

- Technical training and skills
- Innovation and entrepreneurship
- Business and economics
- Strategic thinking
- Working in diverse teams
- Project and time management
- Communication written & oral



Supplements for Non-Academic Research Internships for Graduate Students (INTERN)

- Up to \$55K for up to 6 months for internship with host.
- International students OK.
- Funds: travel, tuition and fees, health insurance, stipend, temporary relocation costs, materials + faculty co-mentoring.
- 250+ INTERNs supported each year

Governed by Intellectual Property (IP) agreement between university and Host. **NSF waives its IP rights.**



Goal: Catalyze Purposeful Partnerships



GOAL: Grant Opportunities for Academic Liaison with Industry

- Basic research with strong academic-industrial collaboration
- **Available NSF-wide** as a specialized type of Proposal (or Supplement) that can be submitted to most programs
- Typical grant is 3-5 years and \$100-150K per year.
- Requires an industrial partner (industry co-PI)
- **Up to 1/3rd funds for eligible small business partner**
- Requires intellectual property agreement completed in advance of funding

**NEW
feature!**

Faculty & Students:

Industrial collaboration, education and training

Industry:

Access top university research capacity and talent

NSF:

Catalyze transformative research & collaborations

Universities:

Build pathways to new/stronger links with industry



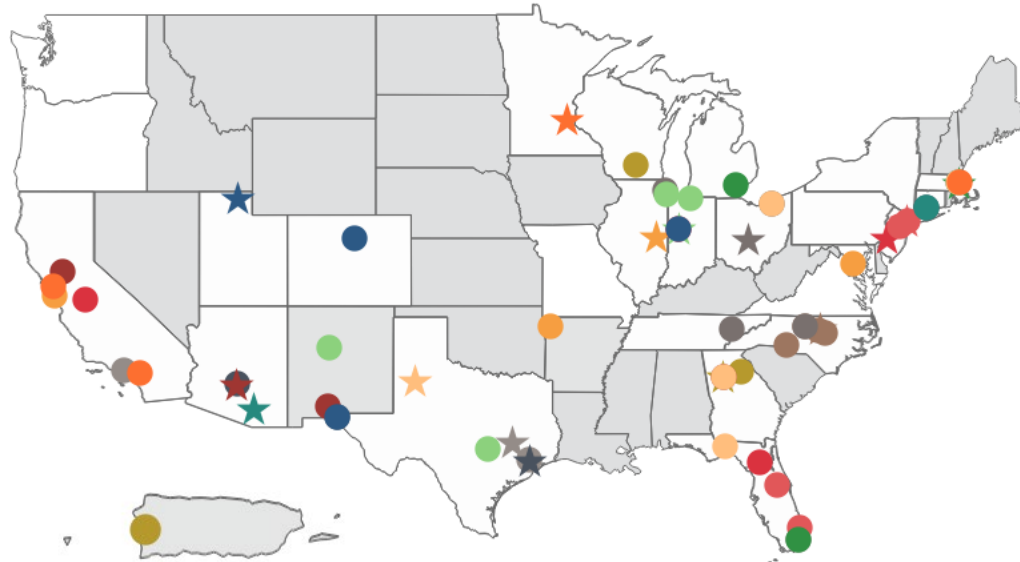
NSF Engineering Research Centers

The ERC program supports broad, multidisciplinary high-impact and high-risk/high-payoff engineering research.

Gen-4 ERCs emphasize integrating convergent research, engineering workforce development, a culture of diversity and inclusion, value creation and innovation for societal impact.

- *NSF 22-580 competition underway*
- Investment of up to \$156 million for up to 6 awards in summer 2024

15 ERCs involve 42 unique institutions and 241 industrial participants in FY 2022.



ERCs span 33 distinct jurisdictions, including Puerto Rico and Washington, DC, with 5 EPSCoR jurisdictions, and include 10 MSIs in FY 2022.

1985 through 2023

79	ERCs
250	Spinoffs
1,400	Licenses
2,740	Invention disclosures
950	Patents
190	Textbooks
14,900	Students



FY 2022 Engineering Research Centers

ERC for Advancing Sustainable and Distributed Fertilizer Production



- Enables resilient and sustainable food production by developing efficient, modular, and distributed technology for capturing, recycling, and producing decarbonized nitrogen-based fertilizers.



ERC for Precision Microbiome Engineering

- Creates microbiome technologies that address challenges at the interface of human health and the built environment.

ERC for Hybrid Autonomous Manufacturing Moving from Evolution to Revolution

- Accelerates the development and deployment of intelligent, autonomous manufacturing systems, enabling mass customization in local production facilities.



ERC for Smart Streetscapes

- Forges livable, safe, and inclusive communities through real-time, hyperlocal technologies for streets and their surroundings



Industry-University Cooperative Research Centers (IUCRC)

*Execute cutting-edge **pre-competitive** basic research in science & engineering to drive innovation and societal impact*



Government

NSF catalyzes partnership
Other government entities fund research relevant to their needs



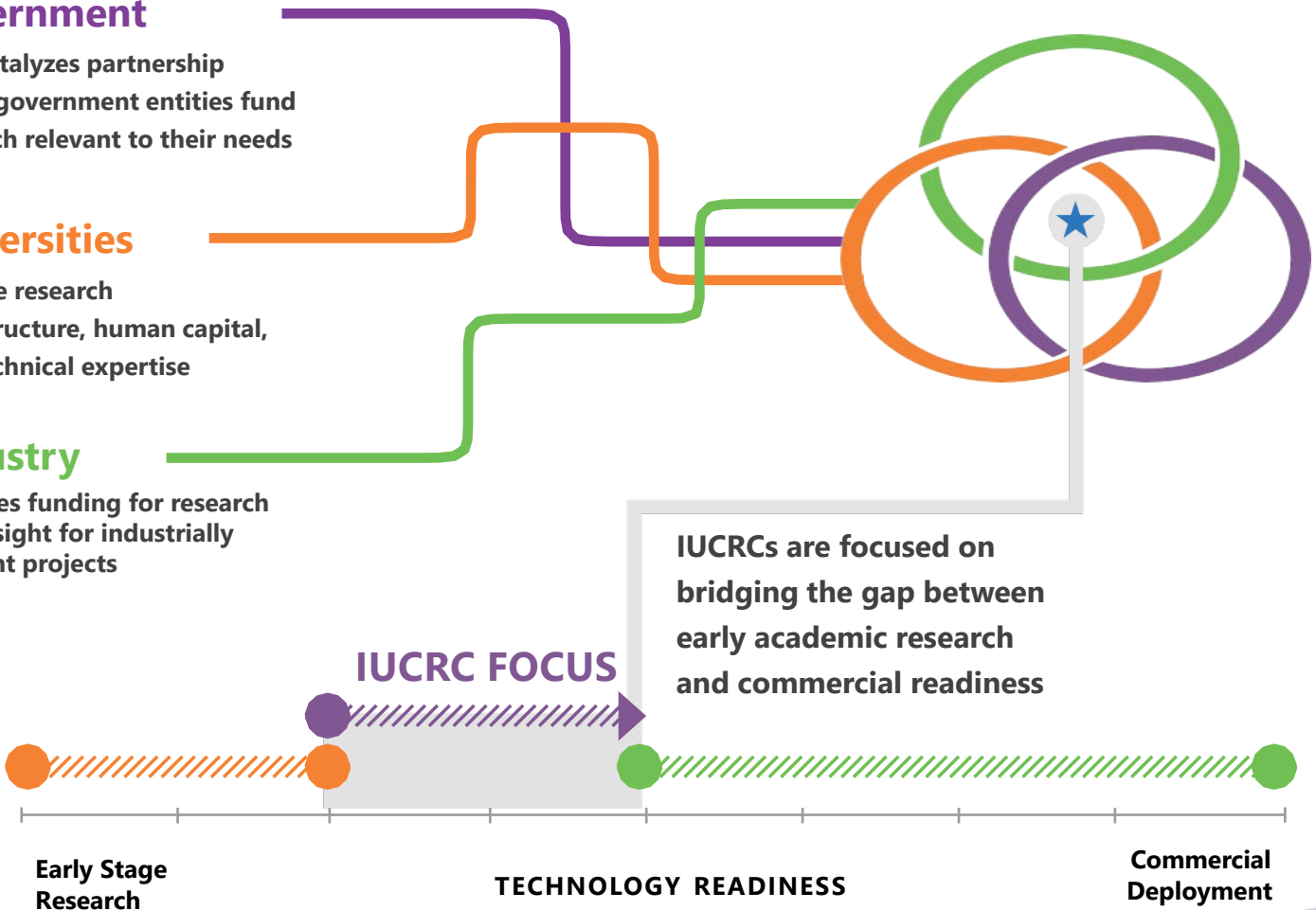
Universities

Provide research infrastructure, human capital, and technical expertise



Industry

Provides funding for research and insight for industrially relevant projects



IUCRC – Nationwide Portfolio

~ 500 – 700

**Center-trained students
graduate each year**

**800+
Member
Organizations**

**1180+
Memberships**

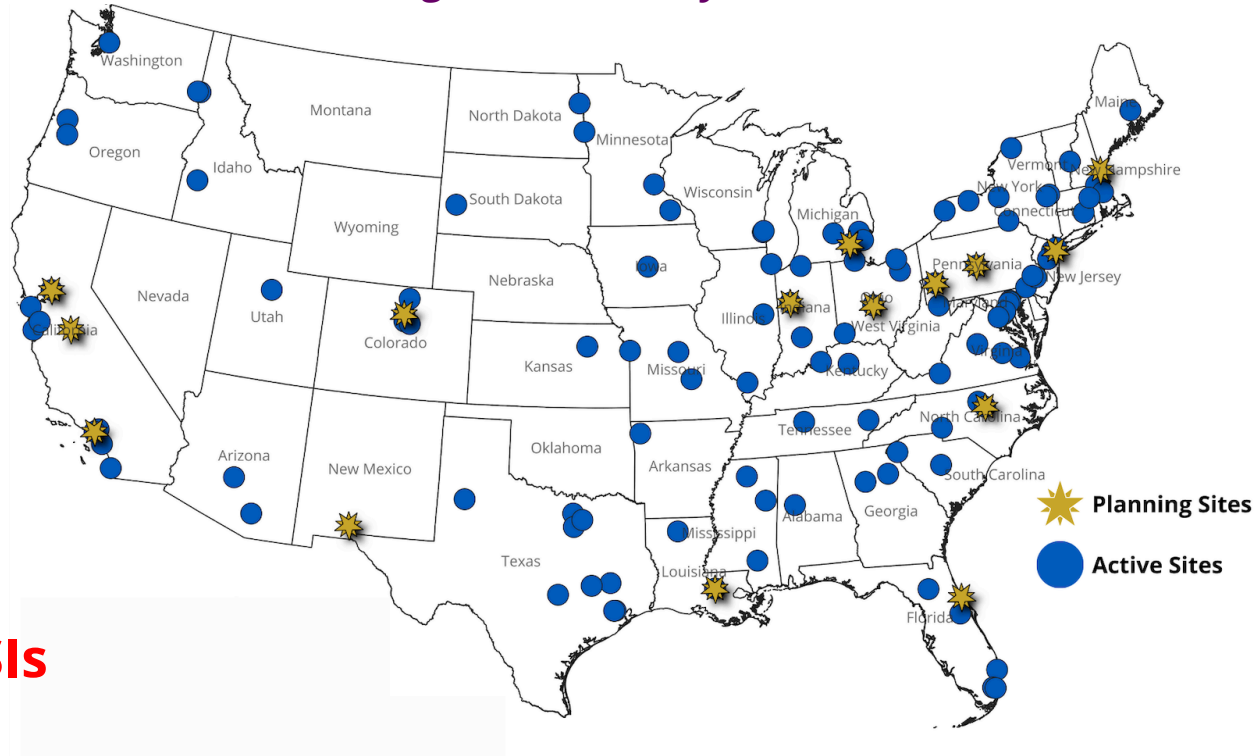
**20+
Federal Agencies**

**80+
Active
Centers**

**120+
U.S.
Universities**

**24
EPSCoR
Sites**

**15
MSIs**



**Members ~\$60M
NSF ~\$20M**

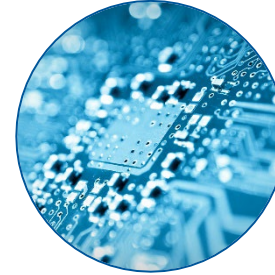
***Source: NSF award 1732084 survey data**



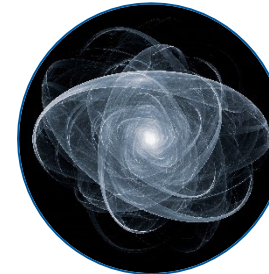
IUCRC – Broad Areas and Research Themes

- Advanced Electronics and Photonics
- Advanced Manufacturing
- Advanced Materials
- Biotechnology
- Civil Infrastructure Systems
- Energy and Environment
- Forensic science
- Geosciences
- Health and Safety
- IT, Communication, and Computing

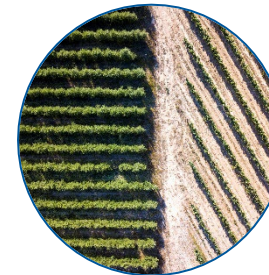
Wide open to
transformative
new center
ideas!



Center for Advanced Semiconductor Chips with Accelerated Performance (ASAP), University of Illinois at Urbana-Champaign



Center for Quantum Technologies, Purdue University, Indiana University, and University of Notre Dame



Center for Soil Technologies, University of Southern California, Iowa State, University of Connecticut, and University of Washington

Opportunities to Engage

- Workshops, information sessions, ERVA
- NSF Website – Funding Opportunities
- Continuous submission and application deadlines
- RFIs, Metaprograms, DCLs, Solicitations
- Contact PDs directly (proposal review, idea one-pagers)
- Connect with us! www.nsf.gov/eng/connect.jsp



SIGN UP FOR UPDATES >



A few key takeaway messages...

- Learn about what has been funded in your area of interest: [nsf.gov/awardsearch](https://www.nsf.gov/awardsearch)
- Explore open opportunities [nsf.gov/funding](https://www.nsf.gov/funding)
- **Contact** the program director early and seek input.
 - Read funding announcements and start with an introductory email with a succinct description of your need for NSF support
- **Contribute** your knowledge and expertise as a Reviewer
- **Share** your suggestions for new initiatives/programs that NSF should consider



Volunteer to Review ENG Proposals!



- Learn about leading-edge work
- Understand NSF merit review
- Network with other experts
- Serve the STEM community



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Connect with the Engineering Directorate!

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**We seek to Transform
our world for a better
tomorrow!**

***by driving discovery, inspiring
innovation, enriching
education, and accelerating
access***

Thank you!

Carole Read, cread@nsf.gov

