Computer and Information Science and Engineering (CISE)
U.S. National Science Foundation

Amy Apon, PhD
Program Director
NSF/CISE/OAC

Outline of Talk

NSF & CISE Overview

Selected Programs

Closing Thoughts

NSF Directorates

- Biological Sciences
- **Computer and information Science and Engineering**
- Engineering
- Geosciences
- Mathematical and Physical Sciences
- Social, Behavioral and Economic Sciences
- STEM Education
- Technology Innovation and Partnerships

Ref.: https://www.nsf.gov/staff/organizational_chart.pdf

CISE by the Numbers

NSF funds **80%** of federally-funded CS in the US at academic institutions.

$1,035.9 M
FY2023 enacted budget

6,401
Proposals evaluated

1,847
Awards made

29%
Funding rate

371
Institutions supported

6,647
Grad students

21, 623
Individuals from senior researchers to undergrads

48 states
+ D.C.
+ 1 territory

89
Minority-serving Institutions

62
Institutions funded in EPSCoR states

All data depicted is for fiscal year 2023.

CISE Organization and Core Programs

Katie Antypas
Office Director

Office of Advanced Cyberinfrastructure (OAC)

- OAC core
  - Data/Software
  - Leadership and Advanced Computing
  - Networking/Cybersecurity
  - Learning and Workforce

Amy Walton
Deputy Office
Director

Computing & Communication Foundations (CCF)

- Algorithmic Foundations
- Communications and Information Foundations
- Software and Hardware Foundations
- Foundations of Emerging Technologies

Dilma Da Silva
Division
Director

Irina Dolinskaya
Deputy Division
Director

CISE Leadership

Greg Hager
Assistant Director

Joydip Kundu
Deputy Assistant Director

Ellen Zegura
Division
Director

Computer & Network Systems (CNS)

- Computer Systems Research
- Networking Technology and Systems
- Education and Workforce Development

Information & Intelligent Systems (IIS)

- Human-Centered Computing
- Information Integration and Informatics
- Robust Intelligence

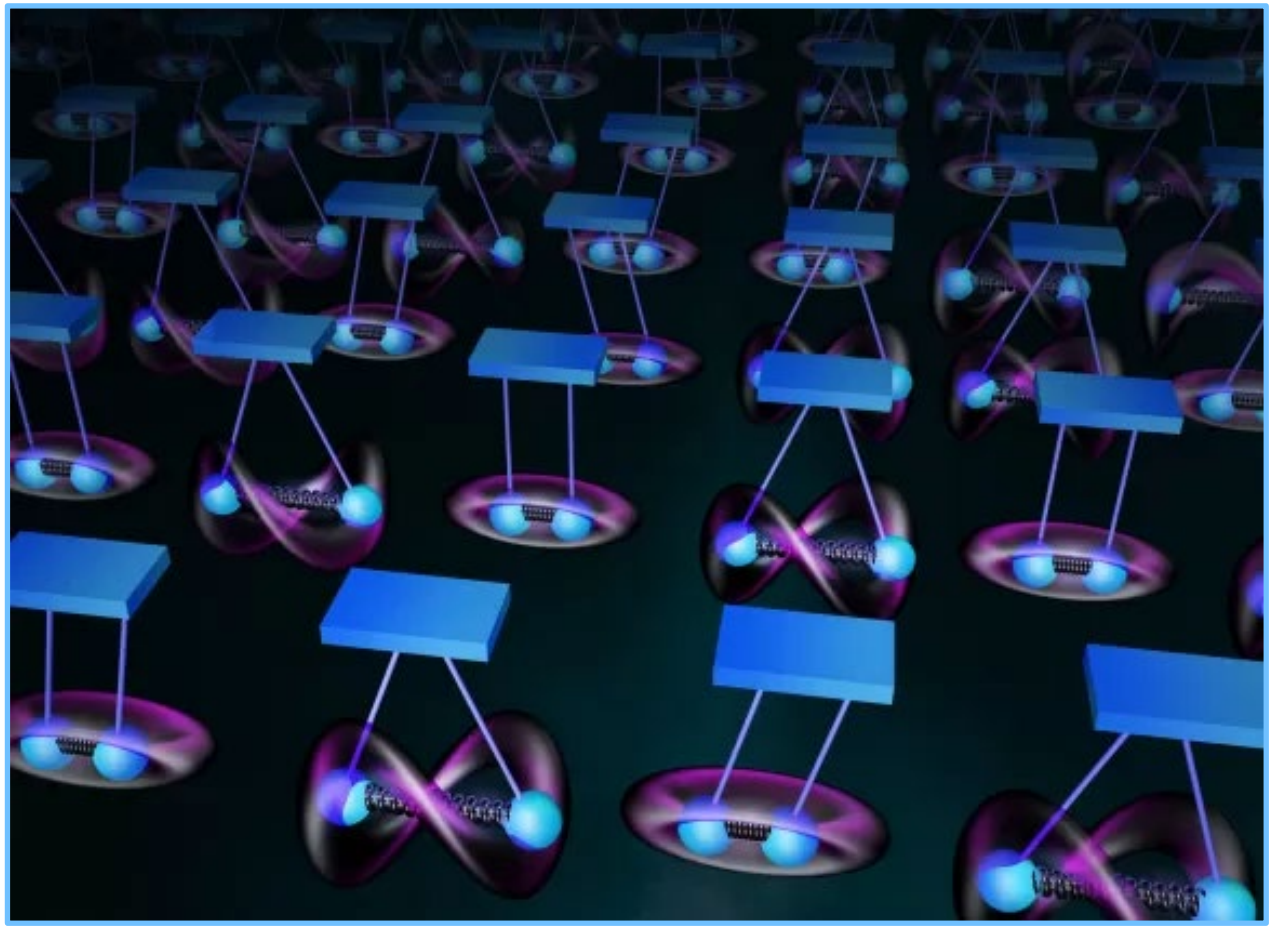
Michael Littman
Division Director

Behrooz Shirazi
Deputy Division
Director

Wendy Nilsen
Deputy Division
Director

Division of Computing and Communication Foundations (CCF) Overview

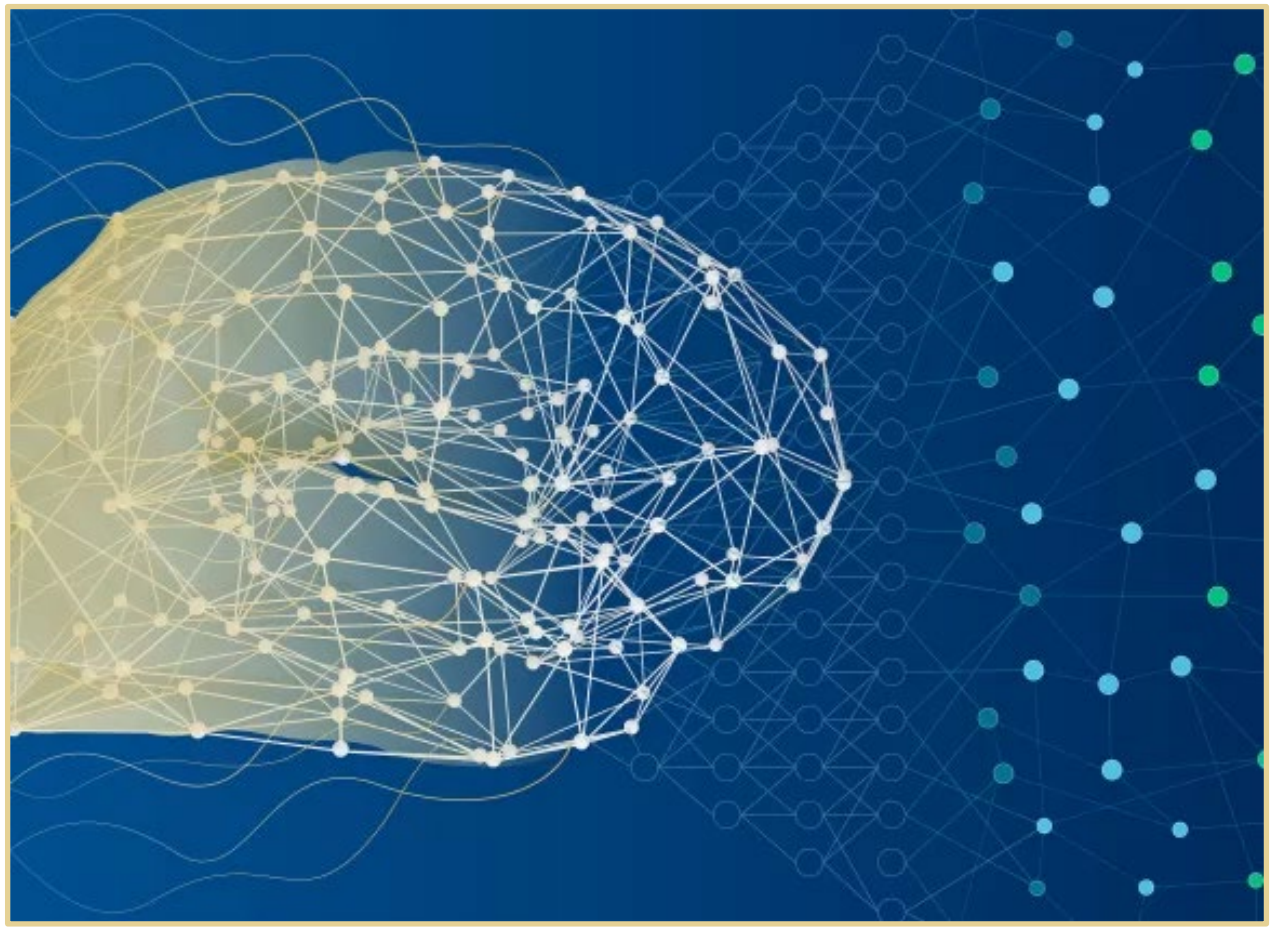
Supports research and education on the foundations of computing, communication, hardware, software and emerging technologies such as quantum information science and bio-inspired systems.



MIT researchers found a way to store quantum information in the vibrational motion of atom pairs, similar to the swinging motion of two pendula, connected by a spring. The quantum system contains hundreds of pairs of vibrating quantum bits, or qubits, that researchers can coherently control for over 10 seconds.
Credit: Sampson Wilcox/RLE

Division of Information and Intelligent Systems (IIS) Overview

Supports research and education on the interrelated roles of people, computers and information to advance knowledge of artificial intelligence, data management, assistive technologies, and human-centered computing.



While a normal brain emits waves to signal function, an AI brain uses algorithms to execute functions.
Credit: Alice Kitterman/National Science Foundation

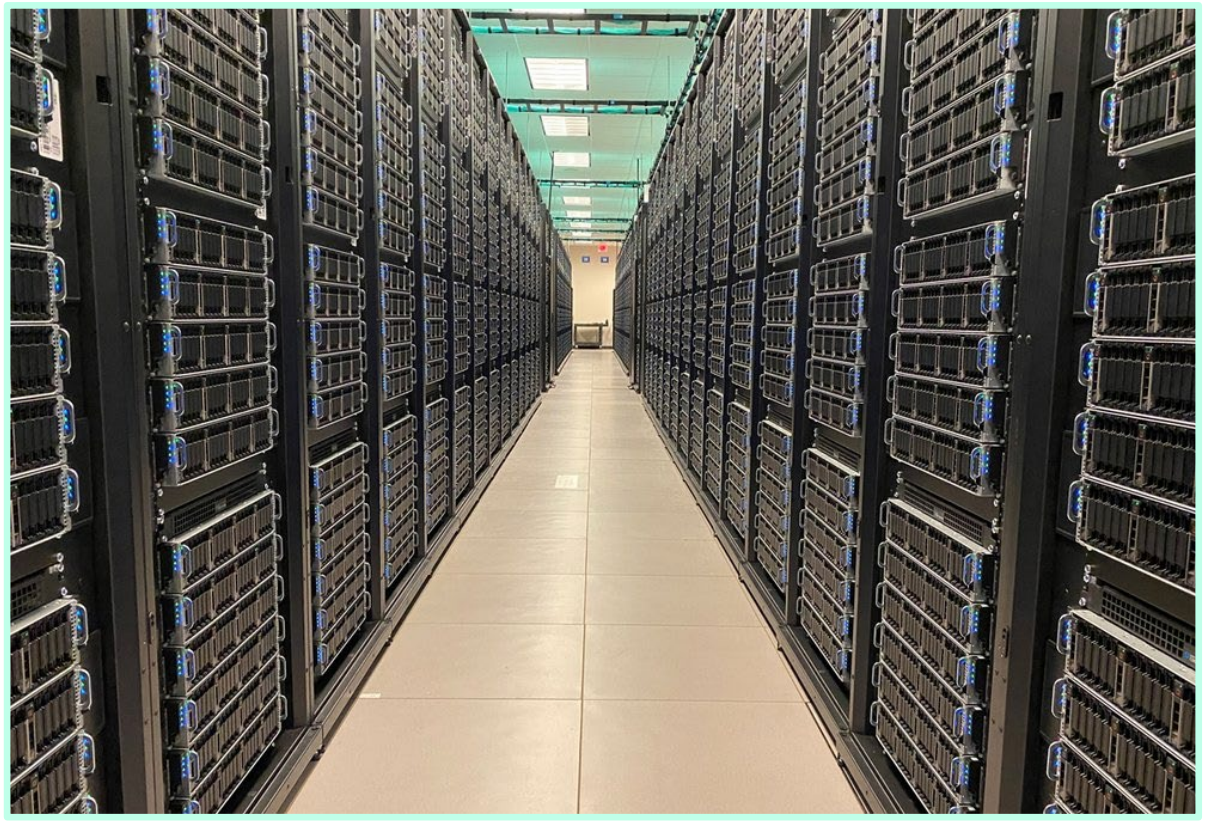
Division of Computer and Network Systems (CNS) Overview

Supports research and education on the fundamental properties of computer systems and networks, cyber-physical systems, secure and trustworthy cyberspace, and new architectures for future-generation computing and communication systems.

Photo caption: Climate change could lead to higher power costs on the U.S. West Coast. Credit: David R. Tribble/Wikimedia Commons. From https://bit.ly/3xNNVEE

Office of Advanced Cyberinfrastructure (OAC) Overview

Supports the design, implementation and operation of research cyberinfrastructure essential for advancing research and education all areas of research and education in science and engineering.



https://tacc.utexas.edu/systems/frontera/

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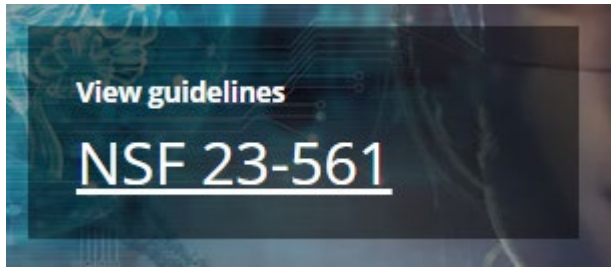
Selected Programs:

CISE Core Research Investments & Research and Education at All Levels

NSF CISE CORE PROGRAMS



IIS

Information and Intelligent Systems

- Human-Centered Computing
- Information Integration and Informatics
- Robust Intelligence

CCF

Computer and Communication Foundations

- Algorithmic Foundations
- Communications and Information Foundations
- Software and Hardware Foundations
- Foundations of Emerging Technologies

CNS

Computer and Network Systems

- Computer and Network Systems
- Education and Workforce Development

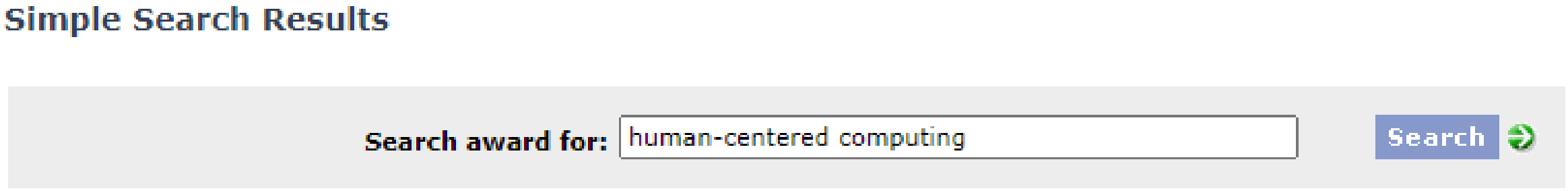
OAC

Office of Advanced Cyberinfrastructure

- OAC Core Research

How do I find my "home"?

1) Search nsf.gov/awardsearch to find an award relevant to your research:



2) Identify a program that looks close to your ideas and click on it.

3) Email the Program Manager to ask about fit to your ideas.

They may ask you to send them a 2-pager summary.

Computer and Information Science and Engineering (CISE): Core Programs

PROGRAM SOLICITATION
NSF 23-561

REPLACES DOCUMENT(S):
NSF 22-631

National Science Foundation

Directorate for Computer and Information Science and Engineering
Division of Computing and Communication Foundations
Division of Information and Intelligent Systems
Division of Computer and Network Systems
Office of Advanced Cyberinfrastructure

Full Proposal Deadline(s) (due by 5 p.m. submitter's local time):

Proposals Accepted Anytime

SMALL Projects

Submission Window Date(s) (due by 5 p.m. submitter's local time):

October 01, 2023 - October 23, 2023

October 1 - October 23, Annually Thereafter

MEDIUM Projects

October 01, 2023 - October 23, 2023

October 1 - October 23, Annually Thereafter

OAC Core Projects

Ref.: https://www.nsf.gov/pubs/2023/nsf23561/nsf23561.pdf

Proposers are invited to submit proposals in several project classes, which are defined as follows:

- Small Projects -- up to $600,000 total budget with durations up to three years: projects in this class may be submitted to CCF, CNS, and IIS only;
- Medium Projects -- $600,001 to $1,200,000 total budget with durations up to four years: projects in this class may be submitted to CCF, CNS, and IIS only; and
- OAC Core Projects -- up to $600,000 total budget with durations up to three years: projects in this class may be submitted to OAC only.

Eligibility Information

Who May Submit Proposals:

Proposals may only be submitted by the following:

- Institutions of Higher Education (IHEs) - Two- and four-year IHEs (including community colleges) accredited in, and having a campus located in the US, acting on behalf of their faculty members. Special Instructions for International Branch Campuses of US IHEs: If the proposal includes funding to be provided to an international branch campus of a US institution of higher education (including through use of subawards and consultant arrangements), the proposer must explain the benefit(s) to the project of performance at the international branch campus, and justify why the project activities cannot be performed at the US campus.
- Non-profit, non-academic organizations: Independent museums, observatories, research laboratories, professional societies and similar organizations located in the U.S. that are directly associated with educational or research activities.

Who May Serve as PI:

By the submission deadline, or for Small Projects, by the date of submission, any PI, co-PI, or other senior project personnel must hold either:

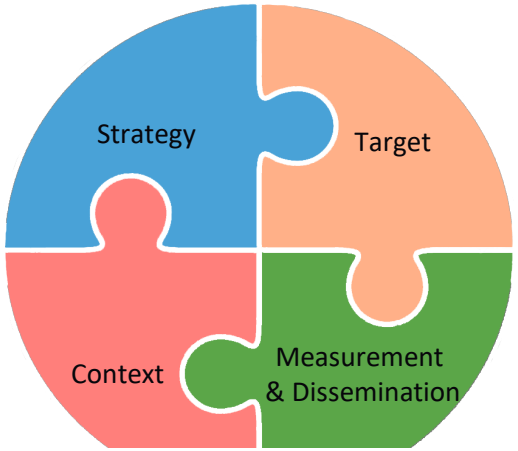
- a tenured or tenure-track position, *or*
- a primary, full-time, paid appointment in a research or teaching position

at a US-based campus of an organization eligible to submit to this solicitation (see above), with exceptions granted for family or medical leave, as determined by the submitting organization. Individuals with *primary* appointments at for-profit non-academic organizations or at overseas branch campuses of US IHEs are not eligible.

CISE Core Medium and Large Projects Broadening Participation in Computing (BPC) Plan

Increasing participation in computing and closely related disciplines by longstanding underrepresented groups and populations including women, Blacks and African Americans, Hispanics and Latinos, American Indians, Alaska Natives, Native Hawaiians, other Pacific Islanders, and persons with disabilities in computing and closely related disciplines. All levels within these groups are relevant, from K-12 to workforce

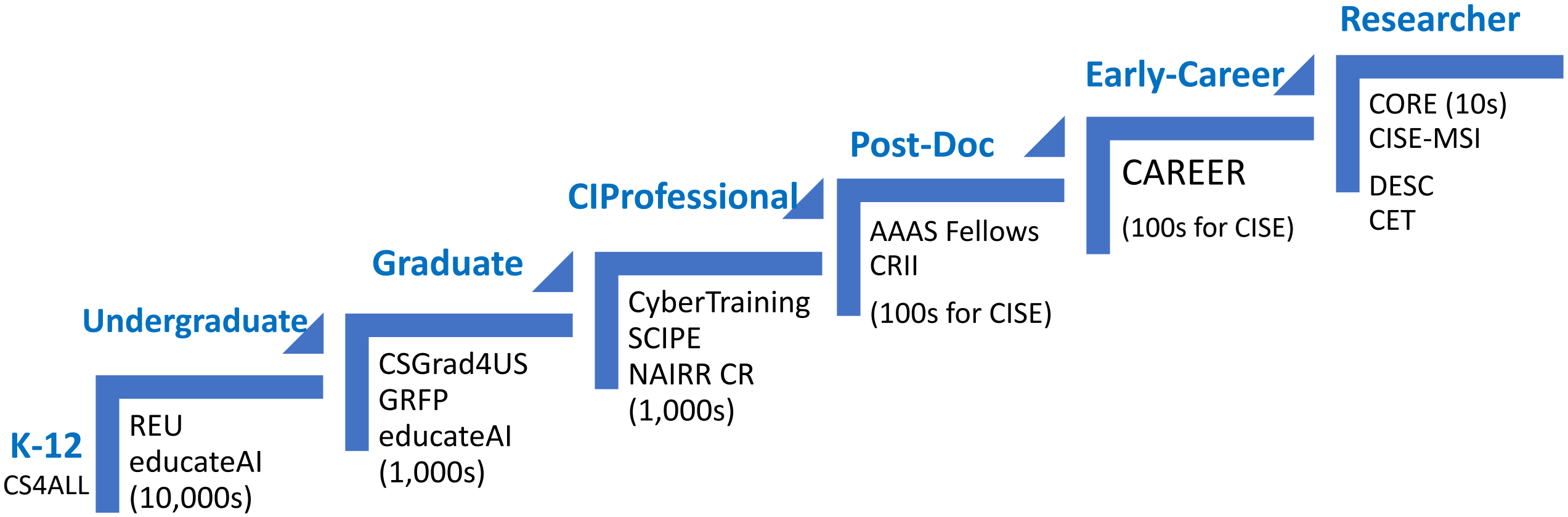
- CISE requires meaningful BPC activities in all Core research programs
- BPC Plan are included as a supplemental document in a proposal
- An approved BPC plan **must be** in place **at the time of award**



BPCnet RESOURCE PORTAL

Ref.: FAQ: https://www.nsf.gov/pubs/2022/nsf22125/nsf22125.jsp

Meeting Different Career Stages with Research & Education Programs



CISE Research Initiation Initiative (CRII)

Encouraging *research independence* immediately upon obtaining one's first academic position

- Hold a primary appointment (*for OAC, a full- or part-time appointment*) where the PI would normally submit proposals to CISE programs
- **Only open to faculty at non-R1 institutions**
- Be untenured
- Be in the first three years of a *tenure-track*, or *research science*, or *education* position (*or equivalent*) as of the submission deadline
- As of the submission deadline, the PI may not have received any other grants in the PI role from any institution or agency *excluding award as a co-PI on another's grant, workshop travel grants, Graduate Research Fellowship awards, non-NSF awards, …*

- Proposals (<= $175,000 for exactly 2 years)

Ref.: https://www.nsf.gov/pubs/2023/nsf23576/nsf23576.htm

Faculty Early Career Development (CAREER) Program

- CAREER is a foundation-wide activity
- NSF's most prestigious awards in support of junior faculty who exemplify the role of teacher-scholars through:
  - Outstanding research and Excellent education
  - Integration of education and research within the context of the mission of their organizations
- Since its inception in 1996:
  - > 200 programs have reviewed CAREER proposals
  - > 7,000 awards
- PIs are allowed only one submission per competition and three attempts total
- *CISE CAREER Proposal Writing Workshops held each Spring*
- Proposal deadline is fourth Wednesday in July, Annually

https://new.nsf.gov/funding/opportunities/faculty-early-career-development-program-career/nsf22-586/solicitation

Proposal Writing Workshops, Aspiring PI Meetings, and Early-career Workshops

Strengthening research and education activities through community

Introduces early-career faculty to NSF, merit review process, and peers and senior researchers in their field.

2024 Workshop was April 29-30. Look for another in 2025!

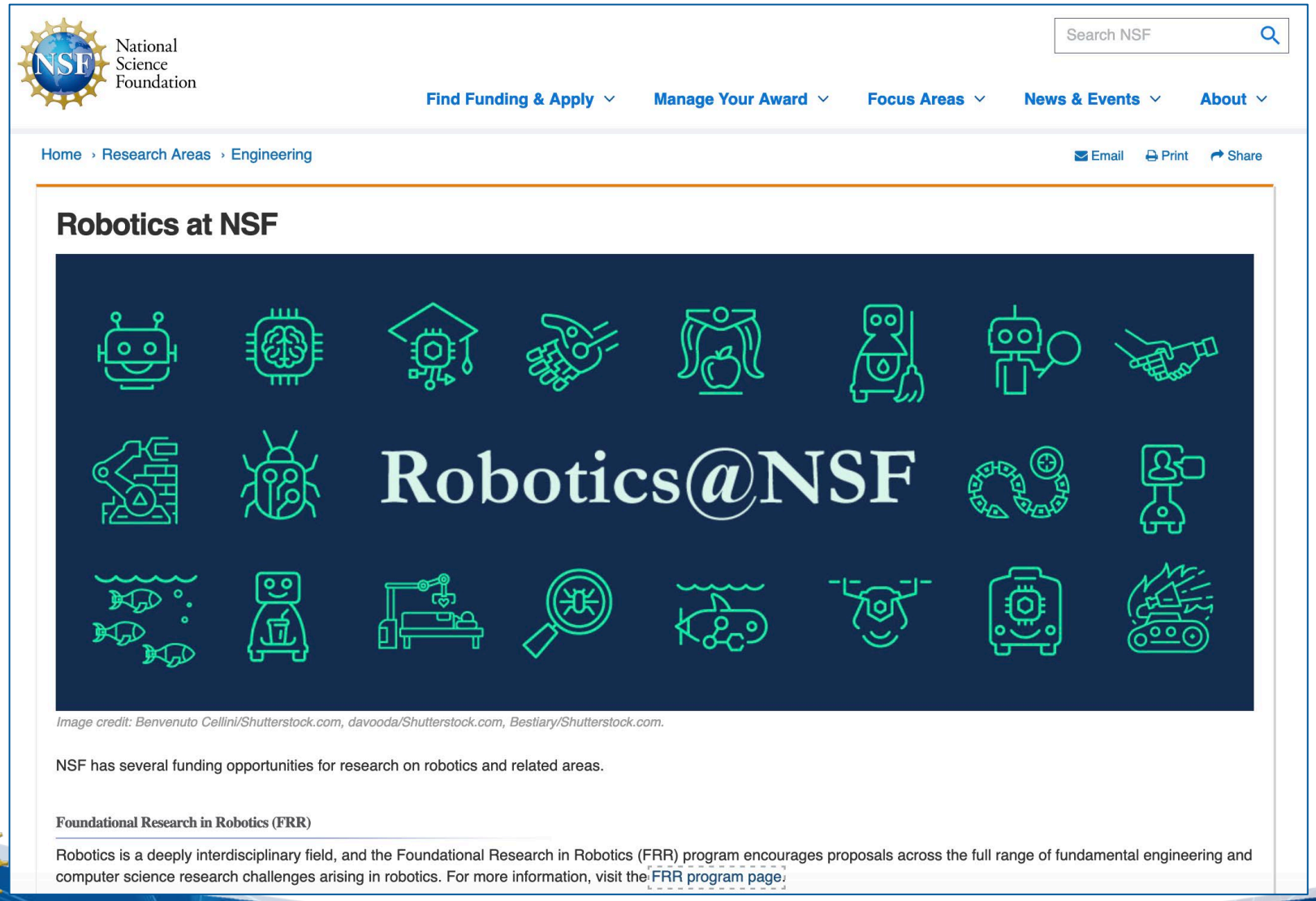
https://new.nsf.gov/events/2024-cise-career-workshop

Credit: NeTS Early Career Workshop

Selected Programs:

Cross-Directorate and Partnership Research Programs

CISE-ENG Foundational Research in Robotics (FRR)



NSF funding opportunities for robotics related research: nsf.gov/robotics

FRR proposals accepted anytime

Cyber-Physical Systems (CPS)

Deeply integrating computation, communication, and control into physical systems

- Cyber-physical systems (CPS) are engineered systems that are built from, and depend upon, the seamless integration of computation and physical components.
- Aims to develop the core system science needed to engineer complex cyber-physical systems.
- Serves multiple key national priority sector areas.
- Includes *Transition to Practice (TTP)* option.
- Cross-Directorate and Cross-Agency Solicitation: NSF CISE and ENG with DHS, DOT/FHA, NIH, USDA.
- SMALL and MEDIUM Proposals are accepted anytime
- See NSF 21-551

Transportation

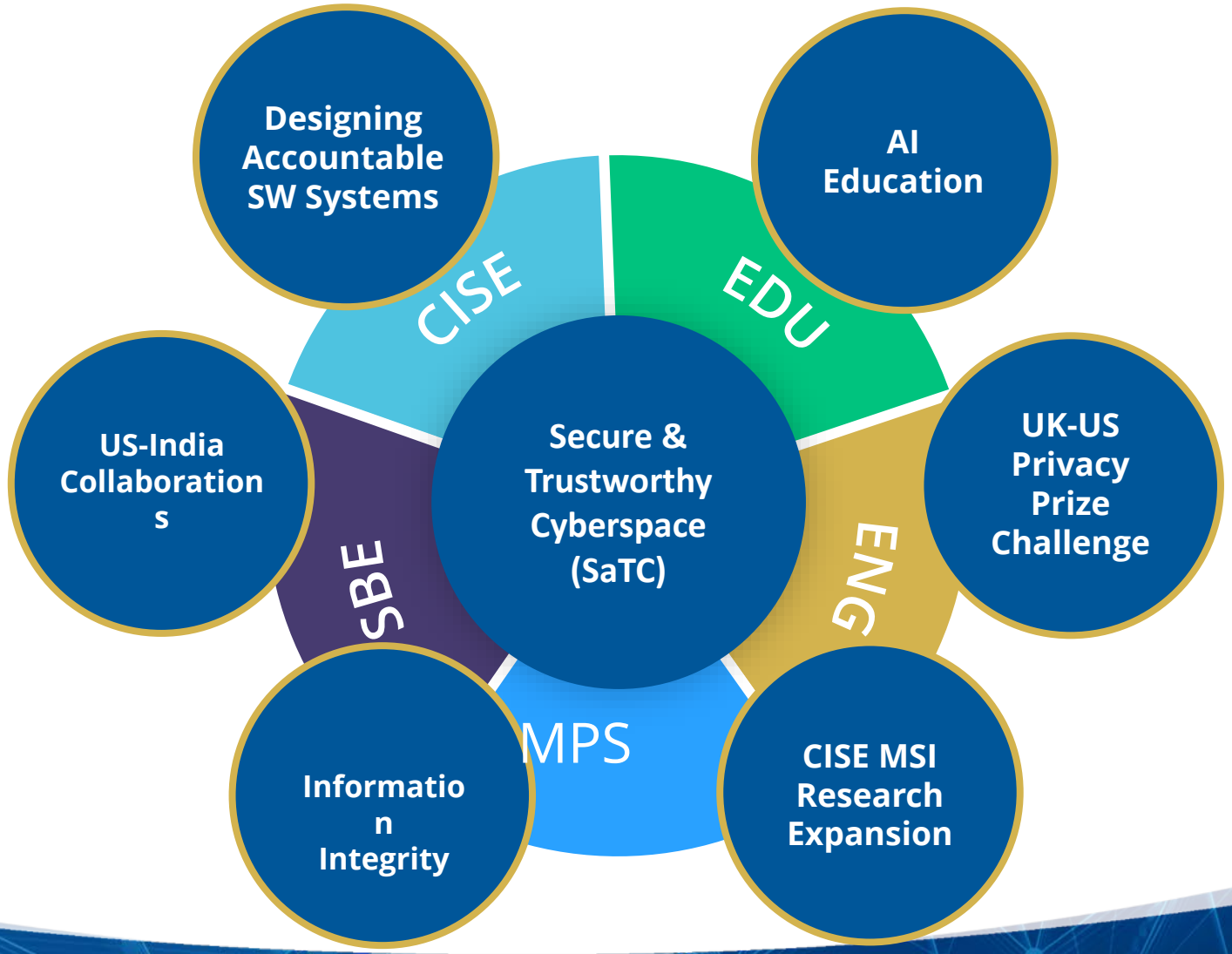
Energy

Healthcare

Critical Infrastructure

Secure and Trustworthy Cyberspace (SaTC)

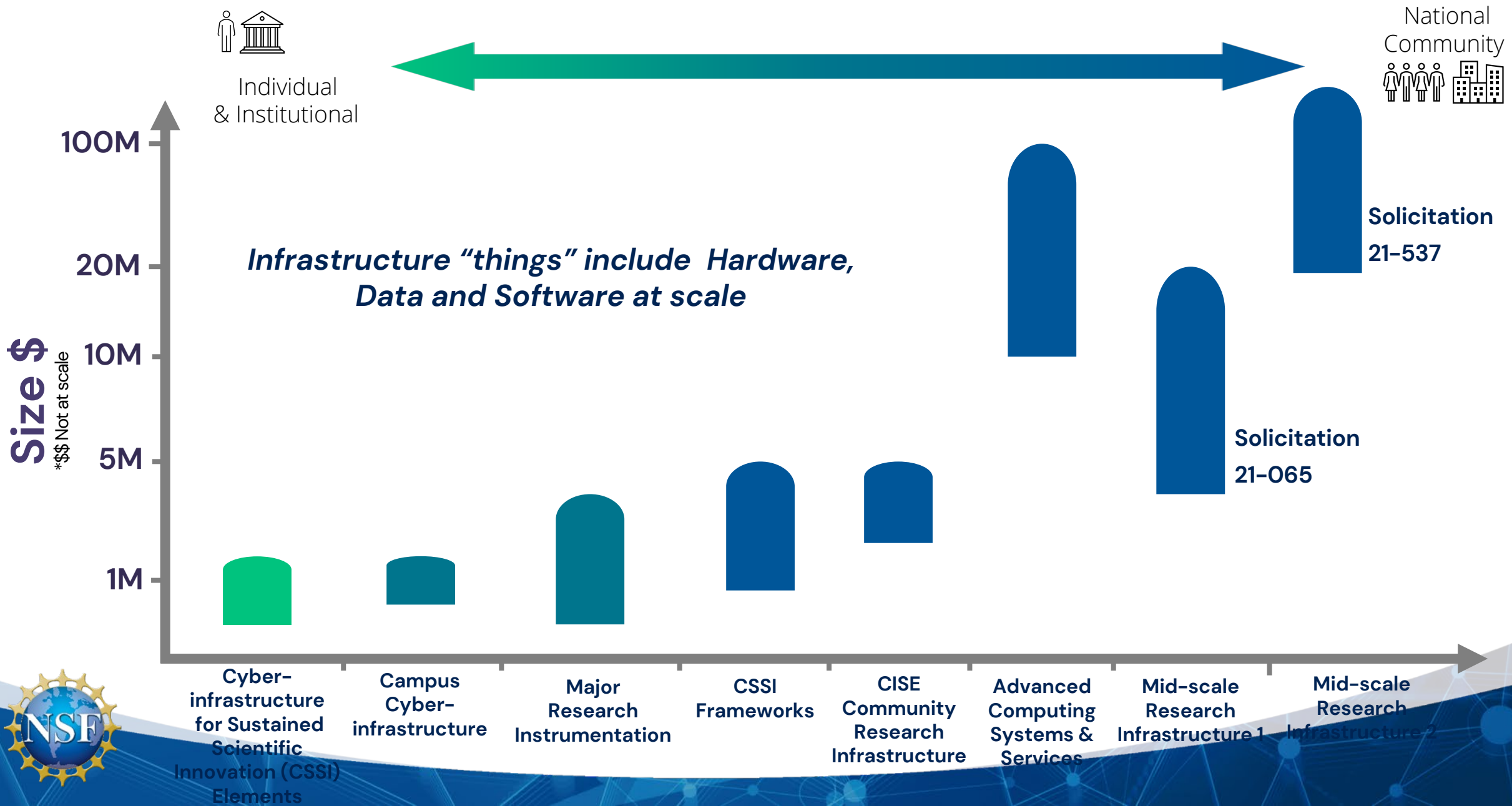
https://new.nsf.gov/funding/opportunities/secure-trustworthy-cyberspace-satc



Selected Programs:

Funding for Cyberinfrastructure and Access to Existing Cyberinfrastructure

A Sketch of NSF and CISE Infrastructure Programs (for things)



Campus Cyberinfrastructure (CC*)

Must be SCIENCE DRIVEN
Must have a campus Cyberinfrastructure Plan (except Strategy awards)
Seek to create partnerships – researchers, educators, IT organization

Area 1: Data Driven Networking Infrastructure

Campus up to $700K
Region up to $1.4M

Technical solution; network management plan and diagram; leverage community

Area 2: Computing and the Computing Continuum

Campus up to $700K
Region up to $1.4M

Multiple science drivers and needs; architecture; 20% is shared, typically through PATh

Area 3: Network Integration and Applied Innovation

Small up to $500K
Large up to $1M

Networking R&D applied to the campus network with graduate student involvement

Area 4: Data Storage and Digital Archives

Campus up to $700K
Region up to $1.4M

Multiple science drivers and needs; architecture; 20% is shared, typically through OSDF

Area 5: Strategy

Campus up to $100K
Region up to $200K

A grant to help teams plan for a full proposal! No CI plan; Funds community building activities; No hardware

See NSF 24-530 for details. Deadline is October 15, 2024.

Program Officers: Amy Apon, awapon@nsf.gov and Kevin Thompson, kthompso@nsf.gov
Office of Advanced Cyberinfrastructure

NSF OAC funds many resources and services!

Incomplete Summary

Democratized access to advanced computing

ACCESS Advancing Innovation
ALLOCATIONS SUPPORT OPERATIONS METRICS

PATh PARTNERSHIP to ADVANCE THROUGHPUT COMPUTING
High Throughput Computing

SGX3
Science Gateways expertise

Advanced Computing Resources

- Leadership-Class Computing Facility (LCCF) advancing to FDR and construction
- National Artificial Intelligence Research Resource (NAIRR) pilot moving forward in FY24

Community and workforce development

ms-cc.org in partnership with INTERNET2
Minority Serving CI Consortium (MS-CC)

RCD Nexus The CaRCC Resource and Career Center
CaRCC Campus Research Computing Consortium
CyberTraining & SCIPE
CI Workforce Development

Portals:

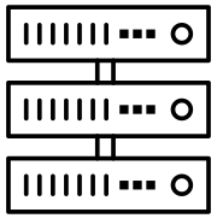
- ACCESS: https://access-ci.org/
- LCCF: https://lccf.tacc.utexas.edu/
- PaTh: https://path-cc.io/
- SGX3: https://sciencegateways.org/
- MSCC: https://www.ms-cc.org/
- RCD Nexus: https://rcd-nexus.org/
- CaRCC: https://carcc.org/
- Trusted CI: https://www.trustedci.org/
- Research SOC: https://omnisoc.iu.edu/services/researchsoc/
- CI Compass: https://ci-compass.org/

NSF

Selected Programs for Artificial Intelligence Applications and Research

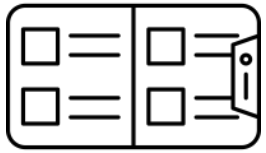
The National AI Research Resource (NAIRR)

A widely-accessible, national research infrastructure that will advance the U.S. AI R&D environment, discovery, and innovation by empowering a diverse set of users through access to:



Secure, high-performance, privacy-preserving **computing**

High-quality **datasets**



Catalogs of **testbeds** and **educational materials**

Training tools and **user support** mechanisms

Goals:

Spur **innovation**

Increase the **diversity** of talent in AI

Improve U.S. **capacity** for AI R&D

Advance **trustworthy AI**

NAIRR Pilot National Artificial Intelligence Research Resource Pilot

Current Opportunities | NAIRR Secure | Awarded Projects | About

https://nairrpilot.org/

The National Artificial Intelligence Research Resource (NAIRR) Pilot

Current Opportunities

CLASSROOM AND EDUCATOR RESOURCES

Request access to educational platforms (such as Juypter notebooks).

Apply

RESEARCHER RESOURCES

Request access to advanced computing, cloud computing, models, software, platforms, and collaborations.

Apply

OTHER RESOURCES

Additional government and government-funded resources that do not require an application (datasets, models, platforms).

View other resources

National AI Research Institutes

- NSF has funded **25 multi-organization AI Institutes**
- **~$500 million** investment to advance fundamental and use-inspired AI

LEAD ORGANIZATION

SUBAWARD

FEDERAL AGENCY AND INDUSTRY PARTNERS

amazon accenture Google intel IBM NIST USDA

EducateAI

EducateAI enables *educators* to make high-quality, audience-appropriate artificial intelligence educational experiences available nationwide to **K-12**, **community college, four-year college** and graduate students, as well as adults interested in formal training in AI.

Emerging Industries:
Advancing inclusive computing education to prepare all learners for the AI workforce.

Creating Opportunities Everywhere:
Focus on broadening participation of groups who are historically underrepresented and underserved by existing computing courses and careers

Research Infrastructure:
Leveraging the NAIRR Pilot to support AI-related computational, data, model or other resources, and associated workforce training through NAIRR Classroom.

PHASE 1: EducateAI DCL (24-025)

Invites submission of proposals that advance inclusive AI education for preK-12 and undergraduate students through **CSforAll** and **IUSE: Computing in Undergraduate Education**

ExpandAI program
Capacity building – MSI/Equity connectors

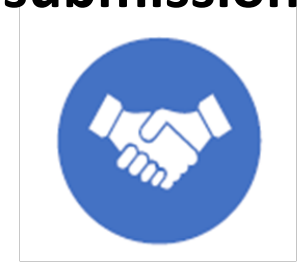
*Promoting **capacity development** in AI and **partnerships between MSIs and AI Institutes** to diversify and strengthen U.S. research, education pathways, and workforce-driven innovation, and enhance minority access to STEM careers.*

Many submission windows!

Capacity

Build AI capacity

MSI-specific goals
Institution support
Path to partnership



Partnership

Leverage AI Institutes

MSI-led awards
Institute subawards
Shared vision and goals
Institute integration plans

Policy

Lower barriers to success

Concept outlines
Submission windows
Flexible submissions

Ref.: https://www.nsf.gov/pubs/2023/nsf23506/nsf23506.htm

CISE Program Portfolio Snapshot

CISE Programs

- Principles and Practices of Scalable Systems
- CISE-MSI Research Expansion
- Expeditions in Computing
- Formal Methods in the Field
- Designing Accountable Software Systems.

Multi-Directorate Program Led by CISE

- Secure and Trustworthy Cyberspace
- Cyber-physical Systems
- National AI Research Institutes/ExpandAI.
- Cyberinfrastructure for Sustained Scientific Innovation (CSSI)
- Pathways to Enable Open-Source Ecosystems.
- Smart and Connected Health
- Smart and Connected Communities
- Civic Innovation Challenge (CIVIC)
- Foundational Research in Robotics
- Research on Emerging Technologies for Teaching and Learning.
- Internet Measurement Research

Early Career

- CAREER
- CISE Research Initiation Initiative (CRII)

Programs Led by Other Directorates with CISE Participation

- Designing Materials to Revolutionize and Engineer Our Future.
- Future Manufacturing.
- Spectrum Innovation Initiative.
- Neural and Cognitive Systems
- Mathematical and Scientific Foundations of Deep Learning and Related Areas MoDL+).
- ERCs (Eng Research Centers)
- . . . . .

Education Programs

- Computer Science for All
- Computing in Undergraduate Education.
- Louis Stokes Alliances for Minority Participation

Infrastructure

- Major research Instrumentation.
- Mid-Scale Research Infrastructure
- CCRI – CISE Community Research Infrastructure

NSF BIG IDEAS

- Future of Work
- Harnessing the Data Revolution
- Data Science Corps
- Quantum Leap
- Quantum Leap Faculty Fellows

Entrepreneurship and Translation

- Convergence Accelerator
- I-Corps, SBIR/STTR.
- Industry/University Cooperative Research Centers (IUCRC)
- CISE InTrans supplements
- CISE Transition-to-Practice supplements
- . . . . .

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Closing Thoughts

An amazing time to be in the CISE community !

Ubiquity

Computing is *everywhere* – across all of science and engineering, and all of society

Engagement

Computing intertwines with many *communities*

Urgency

Computing is *rapidly expanding and evolving*. There is tremendous opportunity … ***now!***

Q&A

Amy Apon, PhD, Program Director, NSF/CISE/OAC

awapon@nsf.gov