CISE Research Expansion
Landscape and Opportunities

Subrata Acharya
Lead CISE Research Expansion

National Science Foundation's Mission

"To promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense..."

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

29%
Funding rate

1,847
Awards made

371
Institutions supported

6,647
Grad students

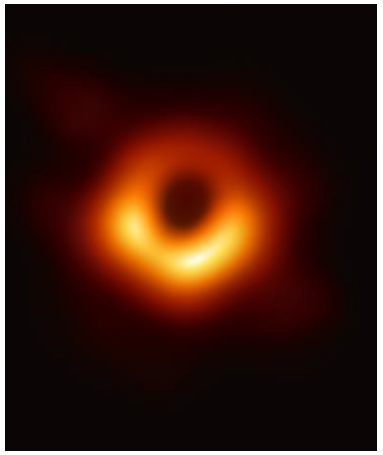
21, 623
Individuals from senior researchers to undergrads

48 states
+ D.C.
+ 1 territory

89
Minority-serving Institutions

62
Institutions funded in EPSCoR states

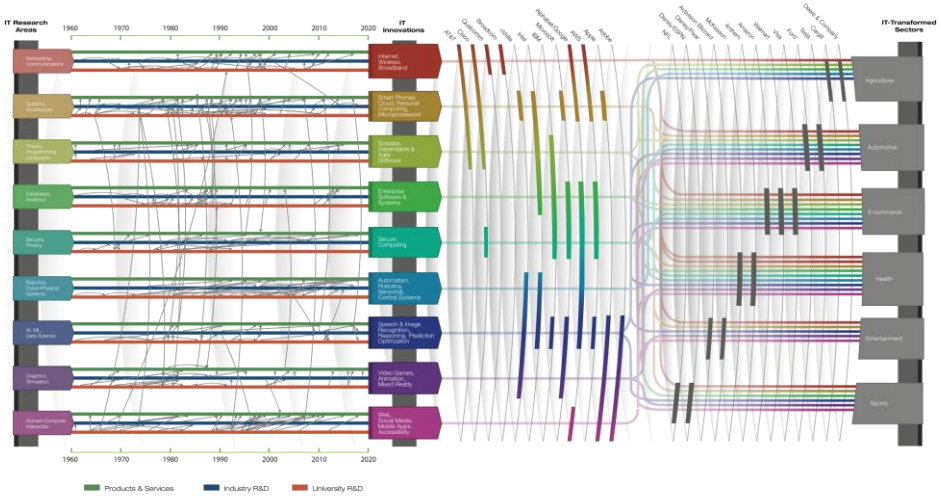
NSF-funded Foundational, Translational, Societal Impacts



Foundational

CISE-funded research has led the world in fundamental work on how information is gathered, analyzed, and communicated.

***44 of the 72** Turing Awardees have received NSF funding*



Translational

CISE-funded research has changed how the world computes and communicates.

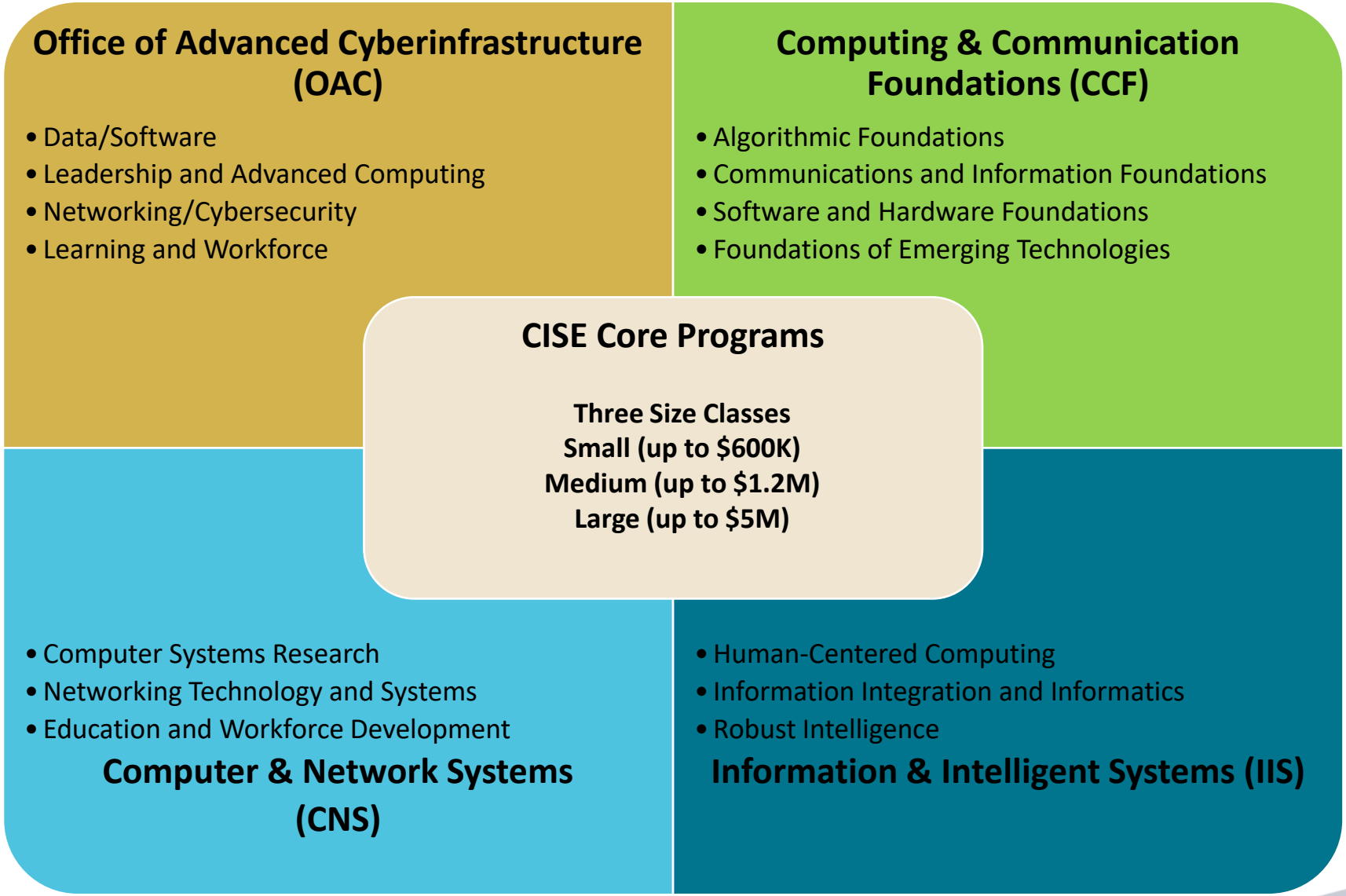
***>$1Trillion** of economic impact via the IT sector and beyond.*

Societal

CISE-funded research is benefitting American communities

Changing the face of computing and changing the world

CISE Core



Transition to CISE Core

2030 Vision

STRENGTHENING ESTABLISHED NSF

INSPIRING THE MISSING MILLIONS

ACCELERATING TECHNOLOGY AND INNOVATION

NSF's budget themes/priorities

Emerging Industries for Economic and National Security

Creating Opportunities Everywhere

Resilient Planet

Research Infrastructure

Research Expansion Efforts

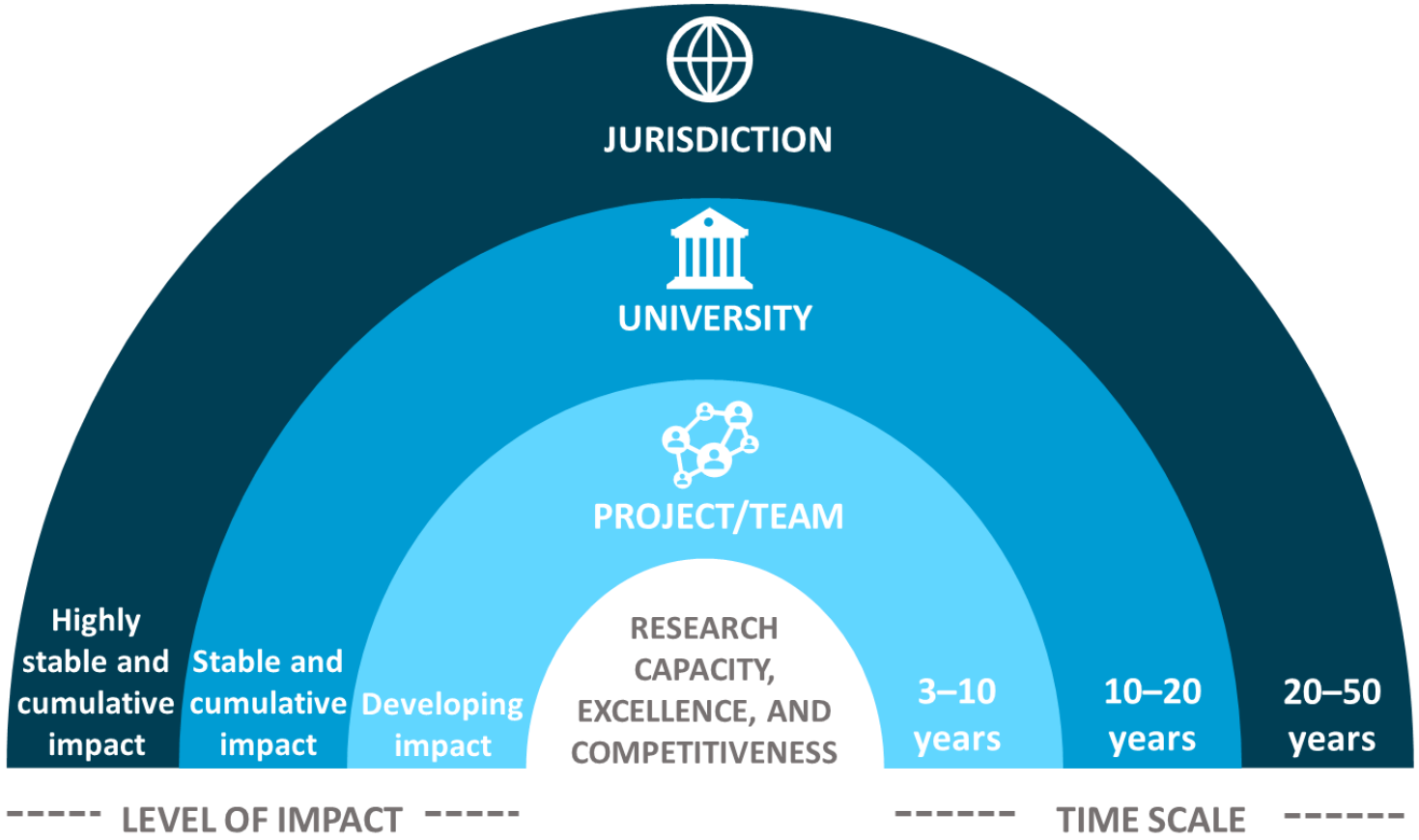
Infrastructure and desire already present in the Jurisdiction(s)/Team(s)/Individual(s)

Research competitiveness

And "self actualization"

Comprehend *how to build research capacity across jurisdictions and to* ***enable*** *the necessary* ***interventions*** *for research competitiveness for an expanded CISE Core footprint.*

Academic Research Excellence and Competitiveness (AREC)



4 Levels of Analysis for the AREC Framework:

- JURISDICTION LEVEL
- UNIVERSITY LEVEL
- PROJECT/TEAM LEVEL
- INDIVIDUAL LEVEL

CISE Research Expansion Mission & Vision

To build research capacity and enhance institutional research infrastructure at MSIs in support of their transition into the CISE CORE programs.

To stimulate rigorous research advances at MSIs and thus address the challenges faced by the nation's STEM competitiveness.

To fill the gap in funding of MSIs, as they are central to promoting inclusive excellence, thus enabling CISE research access and inclusion.

CISE Research Expansion: CISE MSI

NSF 24-536

- Launched in 2020
  - Series of workshops took place in 2019 and 2020 involving MSI faculty to encourage collaborations, partnerships and ideation.

- Goal: Research expansion and institutional infrastructure support for Emerging Research Institutions (including MSIs)

CISE MSI outcomes: Over 135 CISE research capacity awards (and supplements),

~ $50M (2021-2024)

Transition to Core

CISE Research Expansion: CISE HBCU-EiR

NSF 23-598

Recommended and appropriated by Congress to "…provide opportunities for both public and private HBCUs,… in order to stimulate sustainable improvement in their research and development capacity. NSF is further encouraged to use research infrastructure improvement grants, co-funding programs, and other innovative mechanisms to achieve these goals."

- Goal: Research expansion and institutional infrastructure support for HBCUs, which are ERIs.
- Budget: No budget cap; Equipment: 30%.
- Deadlines: Required LOI due ~~July 11th, 2024~~; Full Proposals: Oct 15th, 2024

CISE EiR outcomes : Over 40 CISE research capacity awards (and additional supplements) totaling nearly $30M (2018-2024)

Transition to Core

Funding Opportunities within CISE (Research Capacity Building)

Multi-directorate Programs led by CISE

- Secure and Trustworthy Cyberspace
- Cyber-physical Systems
- National AI Research Institutes
- Expand AI
- Smart and Connected Health
- Smart and Connected Communities
- Civic Innovation Challenge (CIVIC)
- Research on Emerging Technologies for Teaching and Learning
- Collaborative Research on Computational Neuroscience
- Designing Accountable Software Systems

CISE Wide Programs

- CISE-MSI Research Expansion
- Principles and Practices of Scalable Systems
- Safe Learning-Enabled Systems
- Formal Methods in the Field
- Big Data Hubs (community resource)

Early-Career

- CAREER
- CISE Research Initiation Initiative (CRII)

Other cross-cutting programs

- HBCU –EiR (CISE) (NSF OIA lead)
- Designing Materials to Revolutionize and Engineer our Future
- Foundational Robotics
- Future of Work
- Future Manufacturing
- Future Semiconductors (FuSe)
- Spectrum Innovation Initiative
- Sustainable Regional Systems
- Neural and Cognitive Systems

Entrepreneurship and Translation

- Convergence Accelerator
- I-Corps, SBIR/STTR
- Industry/University Cooperative Research Centers (IUCRC)

Infrastructure

- Major Research Instrumentation
- Mid-Scale Research Infrastructure – Size classes 1 ($4-20M) and 2 ($20-100M)
- CIRC – Community Infrastructure for Research in CISE
- Cyberinfrastructure for Sustained Scientific Innovation (CSSI)
- Campus Cyberinfrastructure (CC*)

Education programs

- CSGrad4US
- Computer Science for All
- Computing in Undergraduate Education
- Broadening Participation in Computing Alliances

Transition to Core

National AI Strategy

- Sustained, long-term support
- Maintain and grow U.S. Leadership in AI
- Core missions:
  - advance fundamental knowledge of AI;
  - advance use-inspired work to solve real-world problems of importance to the U.S. economy
  - grow the U.S. AI workforce and build pathways for students from diverse backgrounds.
- NSF and USDA-NIFA - 25 AI Research Institutes funded as of May 2023
- Broad spectrum of AI research: foundational and use-inspired
- Critically important to US competitiveness, food security, public safety, education, etc.

National AI R&D Strategic Plan

AIFS AI INSTITUTE FOOD SYSTEMS · IFML · MOLECULE MAKER LAB INSTITUTE · NSF · AIIRA AI Institute for Resilient Agriculture · AIFARMS · USDA · IES · ISAT NSF AI Institute for Student-AI Teaming · AI Institute in Dynamic Systems · AgAID · NIST · AI CARING · ALOE INSTITUTE · ICICLE Intelligent CyberInfrastructure with Computational Learning in the Environment · AI Institute for Engaged Learning · ATHENA · AI EDGE Institute · AI Institute for Advances in Optimization · accenture · IAIFI · Google · IBM · intel · amazon

AI Institutes Virtual Organization (aiinstitutes.org)

ExpandAI Program Overview

Diversify participation in AI research, education, and workforce development through (1) Capacity Building and (2) Partnerships with the National AI Research Institutes

- NSF supports growth of interdisciplinary research by diverse community for advancement of AI-driven innovation
- MSIs are source of untapped talent critical to future AI innovation/responsible AI research
- Many minority-serving institutions (MSIs) are not yet significantly engaged in AI research and education. However, there is enormous potential to develop talent through federally supported AI research that is critical to future AI innovation and responsible AI research
- ExpandAI promotes capacity development for new AI programs at Minority Serving Institutions (MSIs), as well as partnerships between MSIs and AI Institutes

Capacity

Build AI capacity

MSI-specific goals
Institutional Change
Potential Path
to Partnership

Partnership

Leverage AI Institutes

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

Approach

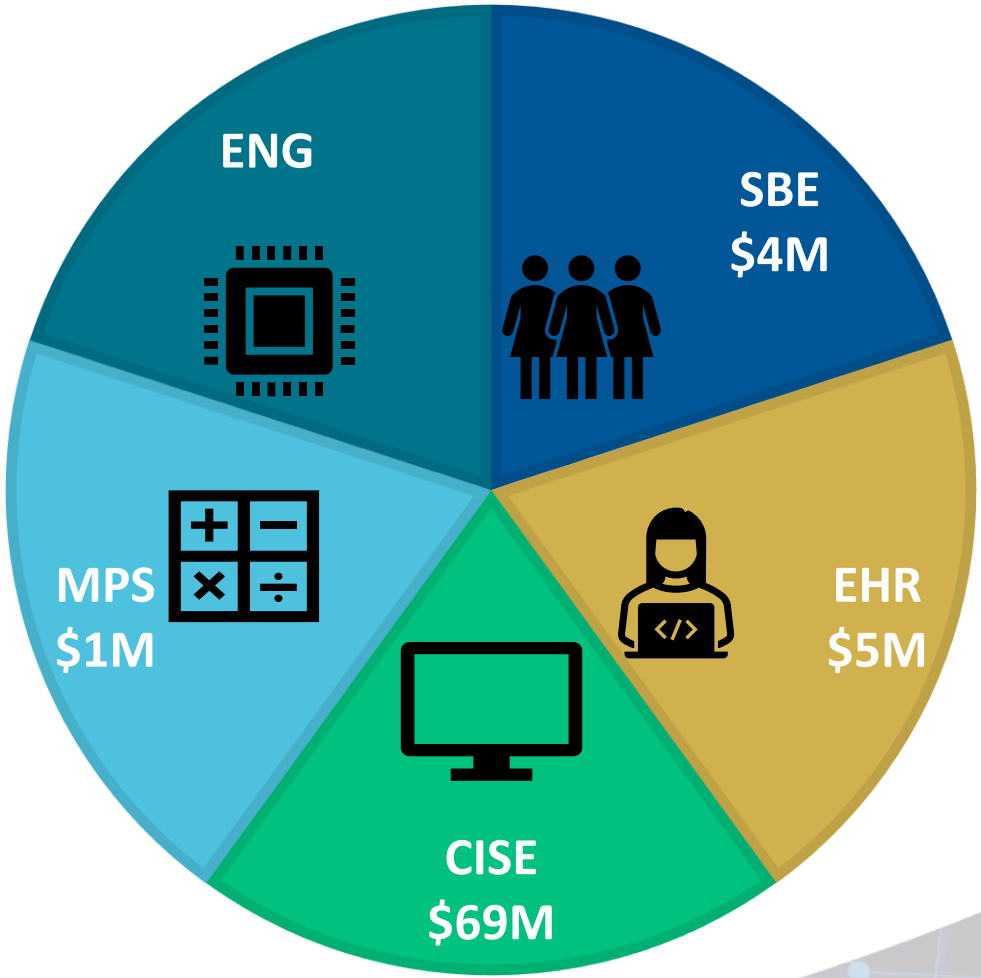
Lower barriers to success

Concept outlines
Submission windows
Flexible submissions

https://new.nsf.gov/funding/opportunities/expanding-ai-innovation-through-capacity-building/nsf23-506/solicitation

Secure and Trustworthy Cyberspace (NSF SaTC)

- Launched in 2011
  - Over 2800 awards, $1.15B to date [3300+ / $1.3B incl prior programs]
  - Awards range from <$300K - $10M
- Broad and inter-disciplinary focus from the beginning
  - A socio-technical lens
  - DCLs, PI meetings to build interdisciplinary communities
- Holistic approach
  - Research + Education + Transition to Practice + RCNs
- Partnerships
  - Interagency (leadership in NITRD IWGs)
  - International collaborations



NSF SaTC Impact Advances

Privacy Enhancing Technologies

- Privacy Preserving Machine Learning
- Secure Multi Party Computation
- Advertisement Tracking

End to End Security

- Trusted Execution Environments
- Physically Unclonable Functions
- Provable security

Secure Infrastructure

- Cyber Physical Systems
- Securing SW/HW supply chains
- NextG Wireless

Emerging Technologies

- Post Quantum Crypto
- AI for cybersecurity
- Biometric authentication

Trust

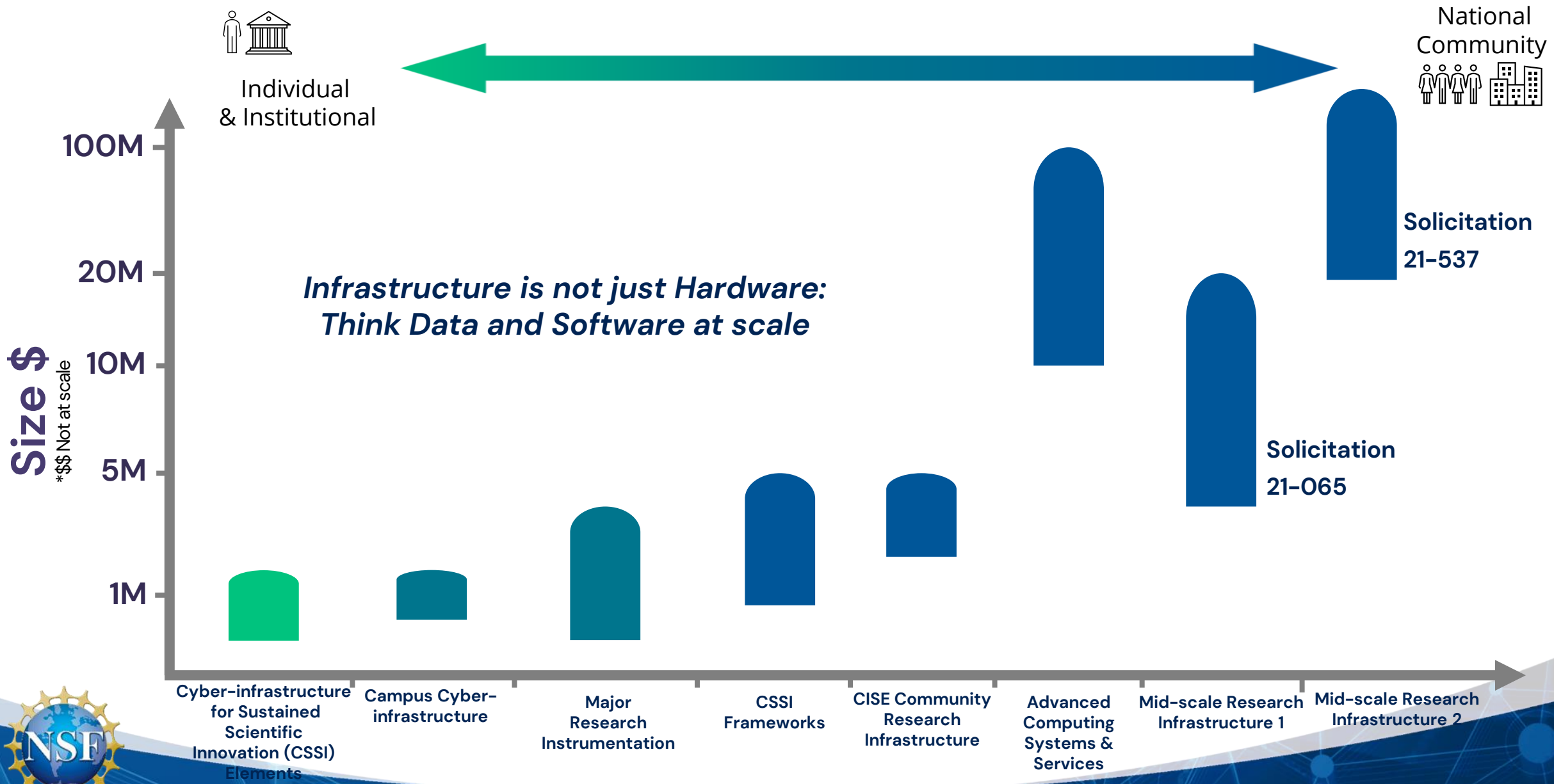
- Psychology of risk and vigilance
- User-focused privacy interfaces
- (Personalized) cybersecurity education

Understanding security behaviors

- Game theoretic attacker models
- Online threat intelligence and harms
- Modeling misinformation behaviors

https://new.nsf.gov/funding/opportunities/secure-trustworthy-cyberspace-satc/nsf24-504/solicitation

NSF and CISE Infrastructure Programs (for things)



NSF Major Research Instrumentation (MRI)

The NSF MRI Program serves to increase access to multi-user scientific and engineering instrumentation for research and research training.

- Current Solicitation: NSF 23-519
- Submission Window: **October 15, 2024 - November 15, 2024**
- Two main categories: Acquisition & Development
- Two budget tracks:
- Track 1: $ 100,000 - $1,400,000
  - Track 2: $1,400,000 - $4,000,000
- NOTE: **No** cost-sharing (used to be required)

Campus Cyberinfrastructure (CC*)

Must be SCIENCE DRIVEN

Must have a campus CI plan (except strategic planning grants)

Seek to create partnerships – researchers, educators, IT organization

Network

Campus

Regional

Innovation

Technical solution; network management plan and diagram

Compute

Campus

Regional

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

Storage

Campus

Regional

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

NSF 24-530

https://new.nsf.gov/funding/opportunities/campus-cyberinfrastructure-cc/nsf24-530/solicitation


Computing
Campuses contribute core hours to researchers via the OSPool, a compute resource accessible to any researcher affiliated with a US academic institution. These contributions support more than 230 research groups, campuses, multi-campus collaborations, and gateways, and in fields of study ranging from the medicine to economics, and from genomics to physics.
PATh
PARTNERSHIP to ADVANCE THROUGHPUT COMPUTING
https://osg-htc.org/campus-cyberinfrastructure
OSPool: Serving Open Science throughput computing
On October 28
705K jobs completed
Placed by 41 researchers
Triggering 6M file transfers
Consuming 1M core hours
The OSG Fabric of Services connects over 150 sites across the US and internationally, making compute and data resources available through their Access Points.
In the last 12 months, over 2.6B CPU hours were delivered by OSG services
CC* Site
52 Sites, 33 Institutions
Leaflet | Map data © OpenStreetMap contributors, Imagery © Mapbox

CISE Research Initiation Initiative (CRII) Program

- Aims to level the playing field by offering "startup package" opportunities to new Early-Career faculty in CISE-relevant topics at non-R1 institutions

- Deadline: September 18, 2024

  (Third Wednesday in September, Annually Thereafter)

https://new.nsf.gov/funding/opportunities/computer-information-science-engineering-research/nsf23-576/solicitation

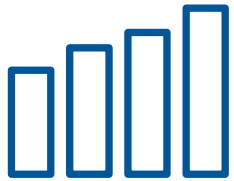
CloudBank Supplement DCL

Named in CISE Core solicitation, CISE-MSI, 10+ other solicitations and DCLS

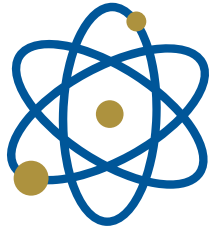
No Indirect Cost -- ~50-60% “discount”

Request NSF award supplements for CloudBank credits at any time, not just proposal time.

“CHIPS and Science” and NSF



Authorizes a doubling of the NSF budget over 5 years



Strengthens fundamental research

Establishes Technology, Innovation & Partnerships

Invests in STEM Education

Advances diversity in STEM

Addresses research security

Key EPSCoR Highlights from CHIPS & Science Act

- Prioritize funding and activities that enable sustainable growth in the competitiveness of EPSCoR jurisdictions, including—
  - (i) infrastructure investments to build research capacity in EPSCoR jurisdictions;
  - (ii) scholarships, fellowships, and traineeships within new and existing programs, to promote the development of sustainable research and academic personnel;
  - (iii) partnerships between eligible organizations in EPSCoR and non-EPSCoR jurisdictions, to develop administrative, grant management, and proposal writing capabilities in EPSCoR jurisdictions;
  - (iv) capacity building activities for ERIs, HBCUs, TCUs, and MSIs; and
  - (v) building sustainable innovation ecosystems in EPSCoR jurisdictions

Focus on ERIs for Research Capacity Building

- **Emerging Research Institution** (ERI)
  - Institutions of higher education with an established undergraduate or graduate program that has less than $50M in Federal research expenditures.

Over 500 ERIs in the U.S. and over 110 within EPSCoR jurisdictions

EPSCoR-CISE (Institutional Infrastucture & Research Capacity)

- CISE MSI Research Expansion
  - Broaden participation by increasing the number of CISE-funded research projects from MSIs and to develop research capacity toward successful submissions to core CISE programs.
- ExpandAI
  - Broaden participation of MSIs in AI research, education, and workforce development through capacity development projects and through partnerships within the National AI Research Institutes ecosystem.
- ExpandTRIPODS
  - Supports partnerships between non-R1 universities and current TRIPODS (Transdisciplinary Research In Principles Of Data Science) Phase II Institutes to broaden participation and diversity in data science research.
- CRII: CISE Research Initiation Initiative
  - Supports early-career scientists at non-Carnegie R1 institutions, enabling them to undertake exploratory research and develop collaborations and new approaches.
- Campus Cyberinfrastructure Program (CC*)
  - Supports coordinated campus-level networking and cyberinfrastructure improvements for science applications and distributed research projects.

CISE EPSCoR Response and Investment Strategies

- Outreach efforts to expand on CISE CORE footprint
  - Non-R1 institutions and ERIs, AI Institutes collaborations with ERIs, Expeditions, Frontiers, Large Core competition, and Infrastructure programs
- Leveraging existing key investment areas such as facilities and centers
  - Supplemental support for facilities/centers for R1-ERI institutional collaboration
- NSF CISE Targeted efforts for MSIs and ERIs
  - CISE EPSCoR DCL NSF 24-056
  - CISE-CREST Planning DCL NSF 24-089
  - CISE Large Planning DCL NSF 24-092
- Leverage inter agency and intra agency collaborative co-funding investment (NSF-TIP Regional Innovation Engines, NSF OIA EPSCoR, and other agencies - NIH, NASA, DoD-NSA, DARPA, DoE, etc.)

Regional CISE Research Expansion Aspiring Investigator Workshops

❑**Southwest Regional Workshop, December 4-5, 2023 (AI and Computer Engg.)**

- University of Arizona (NV, AZ, NM, CA)
- *Resource Link: https://tinyurl.com/join-cise-southwest"*

❑**Southeast Regional Workshop, April 8-9, 2024**

- University of Alabama (MS, AL)

❑**Pacific Regional Workshop, June 13-14, 2024 (TODAY)**

- University of Hawaii at Mānoa (HI, GU)

❑**Alaskan Regional Workshop, August 5-6, 2024**

- University of Alaska Anchorage (AK)

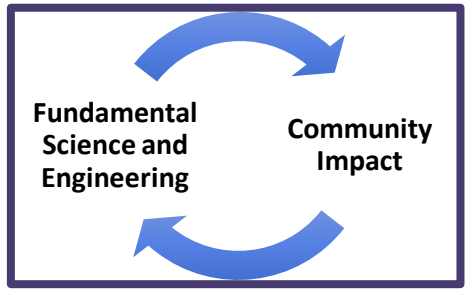
❑ **NSF TCU Regional Workshop, August 2025 (WY, MT, CO, UT)**

❑ **Southern Regional Workshop, Spring 2025, Fall 2026 (TX, FL, AL, LA, AR, MS, NM)**

SPEED AND SCALE

Smart and Connected Communities

NSF program on **use-inspired research** integrating intelligent technologies with the natural and built environments to address **social, economic, and environmental challenges facing communities**

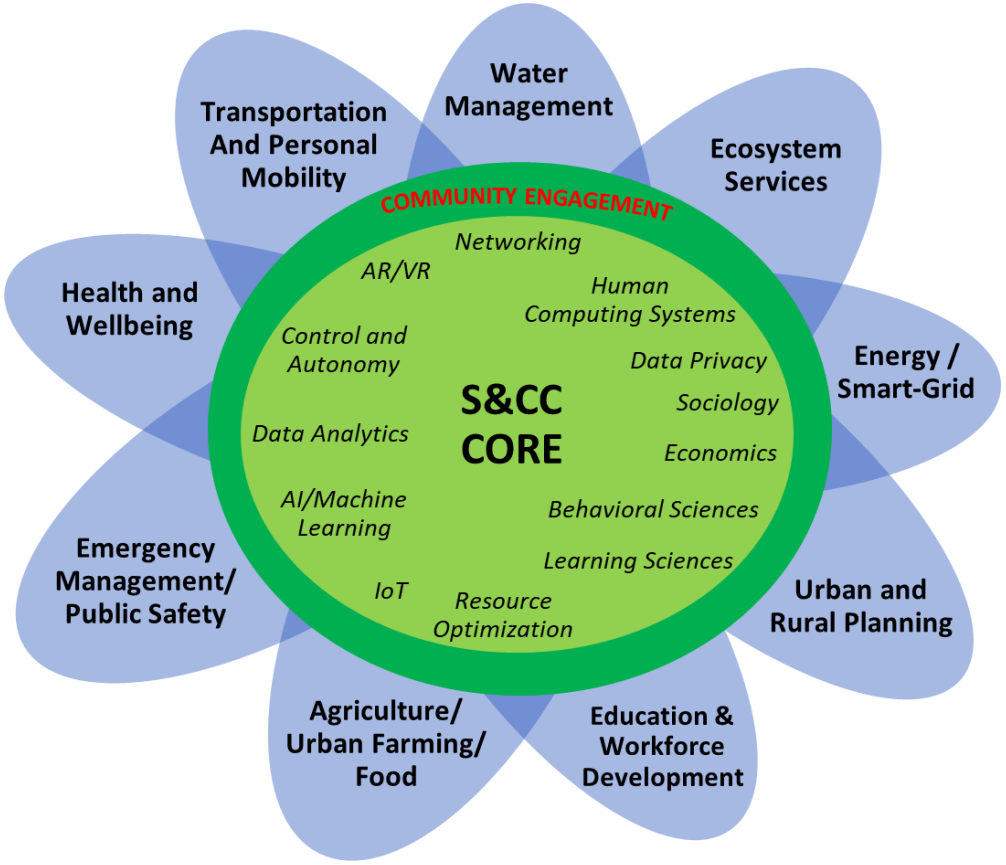


S&CC Program Goals

Community-inspired research and piloting addressing priority areas relevant to communities

Research focus on fundamental computing and engineering that pushes beyond the current state-of-the-art to enable new frontiers in smart communities

Key considerations for the program are **scalability and transferability** of research outcomes and their **sustainability** beyond the life of the NSF award.



S&CC Program Priorities

Foundational Research Advancements in Computing, Engineering, and Social Sciences

Projects that work with Communities to Addresses Challenges and Create New Capabilities

Training of Students in Sociotechnical Research and Community-Engagement

Life Beyond the NSF Award; Scaling Sustaining, and Transferring of Outcomes

https://www.nsf.gov/pubs/2022/nsf22529/nsf22529.htm

Civic Innovation Challenge (CIVIC)

A research and action competition driven by community priorities

U.S. Department of Agriculture
Co-Lead and Co-Funder

U.S. Department of Energy
Co-Lead and Co-Funder

National Science Foundation
Challenge Lead and Funder

U.S. Department of Homeland Security
Co-Lead and Co-Funder

METROLAB NETWORK
Community-of-Practice Builder and Communications Lead

RAPID.
LOCAL.
CO-CREATED.
IMPACTFUL.

CIVIC INNOVATION CHALLENGE

Program Goals

Accelerate transition to practice of foundational research and emerging technologies **into local government and community organizations**

Address local priorities and challenges through research-based pilot projects

Pilot projects must be co-created and executed as partnerships between researchers and a range of stakeholders on the front lines of their community challenge

Projects outcomes must have potential to be **scaled and sustained** in the pilot communities**,** with **transferability across the US**

Website: https://nsfcivicinnovation.org/

RAPID. LOCAL. CO-CREATED. IMPACTFUL.

CIVIC INNOVATION CHALLENGE

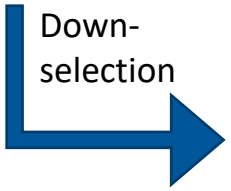
Program Structure

Focused track themes, developed with input from local government and community organizations and the priority areas of the co-funding federal agencies

Broad outreach to solicit project proposals with a focus on outreach to local government, community organizations, and minority serving institutions

Project selection through NSF merit review involving civic and academic reviewers

Stage 1 Planning Grant Awards
($50K for 6-month awards, for team capacity building and to refine pilot project ideas)



Stage 2 Pilot Awards
($1M for 12-month awards, to execute fast-paced pilot project)

Community of Practice to facilitate knowledge sharing, training, and networking between CIVIC teams

METROLAB NETWORK

NSF USDA

BRAIDED Food Security (St. Paul Island, Alaska)

Building Research Aligned with Tribal Self-Determination, Equity, and Decision-making

Lead PI: A. Bishop, University of Alaska Anchorage

Pending CIVIC Award from USDA/NIFA

Project Challenge

Access to ***healthy, safe food resources*** is challenging for coastal Alaskan communities.

Community needs: Braid together the cultural and nutritional dimensions of traditional foods, Indigenous Sovereignty, and subsistence resource monitoring data to enhance resilience.

Technology needs: reduce delay and uncertainty between data collection and dissemination on safety of locally harvested foods

Project Approach

A community-university partnership that anchors the analytical, personnel, and data infrastructures required to monitor the safety of traditionally harvested foods **within the community.**

Enhance on-site capacity for ecosystem monitoring and place-based decision making processes.

Project Innovation

Pilot a shift from data-contributory model of citizen science to a **Tribally-led Research Center**, situated in the Aleut Community of St. Paul Island Tribal government.

Evaluate components of the framework that are effective, transferrable, and sustainable to enhance resilience and facilitate rapid responses to changes in vital natural resources.

CIVIC-FA Track B: Bridging the Rural Justice Gap: Innovating & Scaling Up Civil Access to Justice in Alaska (Alaska)

Lead PI: Michele Statz, PhD, University of Minnesota Medical School

NSF Award ID: 2321920

Alaska Legal Services Corporation

MEDICAL SCHOOL
UNIVERSITY OF MINNESOTA

AMERICAN BAR FOUNDATION

Project Challenge

An astounding 92% of low-income people in the U.S. have limited or no access to legal help with urgent civil legal issues like evictions, domestic violence, and illegal debt collection. In Alaska, the rurality of the population, and particularly of Alaska Native communities, only compounds these service delivery challenges. Through an innovative "hub and spoke" model, the Community Justice Worker (CJW) Program trains and supervises qualified, culturally and linguistically responsive non-lawyer advocates to provide meaningful access to justice in rural Alaska.

Project Approach

Leveraging scientific and policy insights and local relationships, we are: 1) Developing a training and credentialing process; 2) Growing best practices for recruitment and retention; 3) Testing scalability and sustainability models; and 4) Creating a framework for evaluation and evidence-based practices via the development of a new CJW Resource Center.

Project Innovation

The project seeks to scale and sustain a culturally-appropriate, spatially-responsive, and people-centered model of non-lawyer legal service delivery to meaningfully increase access to justice for low-income and rural Alaskans through targeted technological, policy and programmatic innovations.

NSF USDA