



Computer and Information Science and Engineering (CISE)

Exploring the frontiers of computing



<http://www.nsf.gov/dir/index.jsp?org=CISE>

June 2015



National Science Foundation's Mission

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

NATIONAL SCIENCE FOUNDATION

NSF by the Numbers



Other than the FY 2015 appropriation, numbers shown are based on FY 2014 activities.





NATIONAL SCIENCE FOUNDATION

NATIONAL SCIENCE BOARD (NSB)

Dan E. Arvizu
Chair

Kelvin K. Droegelemer
Vice Chair

703.292.7000

NATIONAL SCIENCE BOARD OFFICE

Michael Van Woert
Executive Officer

703.292.7000

OFFICE OF INSPECTOR GENERAL (OIG)

Allison C. Lerner, Inspector General

703.292.7100

Richard Buckius
Chief Operating Officer

OFFICE OF THE DIRECTOR
703.292.8000

France A. Córdova
Director

Vacant
Deputy Director

OFFICE OF DIVERSITY & INCLUSION (ODI)

Vacant, Head

703.292.8020

OFFICE OF THE GENERAL COUNSEL (OGC)

Lawrence Rudolph, General Counsel

Peggy Hoyle, Deputy GC

703.292.8060

OFFICE OF INTERNATIONAL & INTEGRATIVE ACTIVITIES (OIIA)

Wanda Ward, Head

703.292.8040

OFFICE OF LEGISLATIVE & PUBLIC AFFAIRS (OLPA)

Dana Toupousis, Acting Head

703.292.8070

DIRECTORATE FOR BIOLOGICAL SCIENCES (BIO)

James L. Oids, Assistant Director

Jane Sylvethorne, Deputy AD

703.292.8400

DIRECTORATE FOR COMPUTER & INFORMATION SCIENCE & ENGINEERING (CISE)

James F. Kurose, Assistant Director

Suzanne Jacobs, Deputy AD

703.292.8900

DIRECTORATE FOR EDUCATION & HUMAN RESOURCES (EHR)

Joan Ferris-Mundy, Assistant Director

James V. Lewis, Deputy AD

703.292.8600

DIRECTORATE FOR ENGINEERING (ENG)

Prasad P. Khargonekar, Assistant Director

Grace Wang, Deputy AD

Joselyn Light, Division Director

703.292.8300

DIRECTORATE FOR GEOSCIENCES (GEO)

Roger Vitek, Assistant Director

Margaret Cavannah, Deputy AD

703.292.8300

DIRECTORATE FOR MATHEMATICAL & PHYSICAL SCIENCES (MPS)

Fleming Oim, Assistant Director

Dezade M. Reinhart, Deputy AD

703.292.8300

DIRECTORATE FOR SOCIAL, BEHAVIORAL, & ECONOMIC SCIENCES (SBE)

Fay L. Cook, Assistant Director

Clifford Gabriel, Deputy AD (Acting)

703.292.8700

OFFICE OF BUDGET, FINANCE, & AWARD MANAGEMENT (BFA)

Martha A. Rubenstein, Head, Chief Financial Officer

Joanna E. Rom, Deputy Head

703.292.8200

OFFICE OF INFORMATION & RE SOURCE MANAGEMENT (OIRM)

Joanne S. Tarrow, Head & Chief Human Capital Officer

Amy Northcutt, Chief Information Officer

703.292.8100

DIVISION OF BIOLOGICAL INFRASTRUCTURE (DBI)

Scott Edwards, Division Director

703.292.8470

DIVISION OF COMPUTER & NETWORK SYSTEMS (CNS)

Kath Metzullo, Division Director

703.292.8960

DIVISION OF GRADUATE EDUCATION (DGE)

Valerie Wilson, Acting Division Director

703.292.8630

DIVISION OF CHEMICAL, BIOENGINEERING, ENVIRONMENTAL, & TRANSPORT SYSTEMS (CBET)

Joselyn Light, Division Director

703.292.8320

DIVISION OF ATMOSPHERIC & GEOSPACE SCIENCES (AGS)

Paul S. Heegaan, Division Director

703.292.8620

DIVISION OF ASTROPHYSICAL SCIENCES (AST)

James Urry, Division Director

703.292.8620

DIVISION OF BEHAVIORAL & COGNITIVE SCIENCES (BCS)

Mark Valias, Division Director

703.292.8740

BUDGET DIVISION (BUD)

Michael Sawyer, Division Director

703.292.8200

DIVISION OF ADMINISTRATIVE SERVICES (DAS)

Marcos de Eugenio, Division Director

703.292.8190

DIVISION OF ENVIRONMENTAL BIOLOGY (EEB)

Alan Trevisan, Acting Division Director

703.292.8460

DIVISION OF COMPUTING & COMMUNICATION FOUNDATIONS (CCF)

Rao Kosara, Division Director

703.292.8910

DIVISION OF HUMAN RESOURCE DEVELOPMENT (HRD)

Sylvia James, Division Director

703.292.8650

DIVISION OF CIVIL, MECHANICAL, & MANUFACTURING INNOVATION (CMMI)

Deborah Goodridge, Acting Division Director

703.292.8360

DIVISION OF EARTH SCIENCES (EAR)

Carol Front, Division Director

703.292.8560

DIVISION OF CHEMISTRY (CHE)

Steven Benisek, Division Director

703.292.8640

DIVISION OF SOCIAL & ECONOMIC SCIENCES (SES)

Amy Mumpson, Division Director

703.292.8760

DIVISION OF ACQUISITION AND COOPERATIVE SUPPORT (DA-C)

Jeffrey Lipsitz, Division Director

703.292.8240

DIVISION OF INFORMATION TECHNOLOGY (DIT)

Dorothy Aronson, Division Director

703.292.8150

DIVISION OF INTEGRATIVE ORGANISMAL SYSTEMS (IOS)

William Zamer, Acting Division Director

703.292.8420

DIVISION OF ADVANCED CYBERINFRASTRUCTURE (ACI)

Wen Quian, Division Director

703.292.8970

DIVISION OF RESEARCH ON LEARNING IN FORMAL & INFORMAL SETTINGS (ORL)

Sarah McDonald, Acting Division Director

703.292.8620

DIVISION OF ELECTRICAL, COMMUNICATIONS & CYBER SYSTEMS (ECS)

Samir El-Ghazaly, Division Director

703.292.8330

DIVISION OF OCEAN SCIENCES (OCS)

Deborah Brink, Division Director

703.292.8580

DIVISION OF MATERIALS RESEARCH (DMR)

Mary Galloway-Douglass, Division Director

703.292.8510

NATIONAL CENTER FOR SCIENCE AND ENGINEERING STATISTICS (NCSES)

John Gavett, Division Director

703.292.8700

DIVISION OF FINANCIAL MANAGEMENT (DFM)

Shirley Ruffalo, Division Director

703.292.8200

DIVISION OF HUMAN RESOURCE MANAGEMENT (HRM)

Judy Hanley, Division Director

703.292.8190

DIVISION OF MOLECULAR & CELLULAR BIOCHEMISTRY (MBC)

Gregory Voth, Acting Division Director

703.292.8440

DIVISION OF INFORMATION & INTELLIGENT SYSTEMS (IIS)

Ly Ann E. Parker, Division Director

703.292.8930

DIVISION OF UNDERGRADUATE EDUCATION (DUE)

Susan Slinger, Division Director

703.292.8670

DIVISION OF ENGINEERING EDUCATION & CENTERS (EEC)

Don L. Millard, Acting Division Director

703.292.8360

DIVISION OF POLAR PROGRAMS (PLP)

Kathy Falkner, Division Director

703.292.8500

DIVISION OF MATHEMATICAL SCIENCES (DMS)

Michael Vogelius, Division Director

703.292.8570

DIVISION OF PHYSICS (PHY)

Denise Caldwell, Division Director

703.292.8680

DIVISION OF GRANTS & AGREEMENTS (DGA)

Karen Tipple, Division Director

703.292.8210

DIVISION OF HUMAN RESOURCE MANAGEMENT (HRM)

Judy Hanley, Division Director

703.292.8190

OFFICE OF EMERGING FRONTIERS (EF)

Christa Laverack, Acting Division Director

703.292.8550

DIVISION OF INFORMATION & INTELLIGENT SYSTEMS (IIS)

Ly Ann E. Parker, Division Director

703.292.8930

DIVISION OF UNDERGRADUATE EDUCATION (DUE)

Susan Slinger, Division Director

703.292.8670

DIVISION OF ENGINEERING EDUCATION & CENTERS (EEC)

Don L. Millard, Acting Division Director

703.292.8360

DIVISION OF POLAR PROGRAMS (PLP)

Kathy Falkner, Division Director

703.292.8500

DIVISION OF MATHEMATICAL SCIENCES (DMS)

Michael Vogelius, Division Director

703.292.8570

DIVISION OF PHYSICS (PHY)

Denise Caldwell, Division Director

703.292.8680

DIVISION OF GRANTS & AGREEMENTS (DGA)

Karen Tipple, Division Director

703.292.8210

DIVISION OF HUMAN RESOURCE MANAGEMENT (HRM)

Judy Hanley, Division Director

703.292.8190

OFFICE OF EMERGING FRONTIERS IN RESEARCH & INNOVATION (EFRI)

Soni Raftoyiorgis, Senior Advisor

703.292.8520

DIVISION OF INFORMATION & INTELLIGENT SYSTEMS (IIS)

Ly Ann E. Parker, Division Director

703.292.8930

DIVISION OF UNDERGRADUATE EDUCATION (DUE)

Susan Slinger, Division Director

703.292.8670

DIVISION OF ENGINEERING EDUCATION & CENTERS (EEC)

Don L. Millard, Acting Division Director

703.292.8360

DIVISION OF POLAR PROGRAMS (PLP)

Kathy Falkner, Division Director

703.292.8500

OFFICE OF MULTIDISCIPLINARY ACTIVITIES (OMA)

Clark Cooper, Chief, OMA

703.292.8600

DIVISION OF PHYSICS (PHY)

Denise Caldwell, Division Director

703.292.8680

DIVISION OF GRANTS & AGREEMENTS (DGA)

Karen Tipple, Division Director

703.292.8210

DIVISION OF HUMAN RESOURCE MANAGEMENT (HRM)

Judy Hanley, Division Director

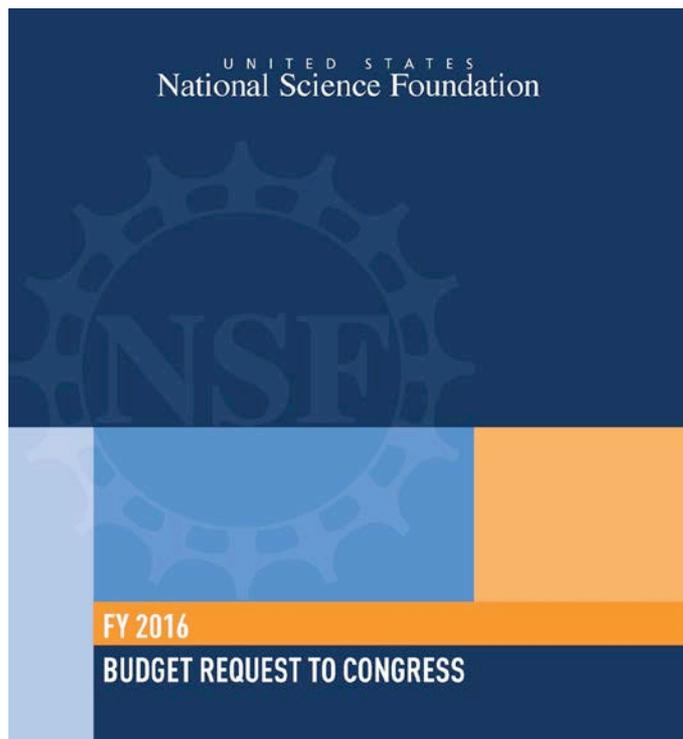
703.292.8190

National Science Foundation
4201 Wilson Boulevard
Arlington, Virginia 22230
TEL: 703.292.5111 | FIRS: 800.877.8339 | TDD: 800.281.8749

January 2015



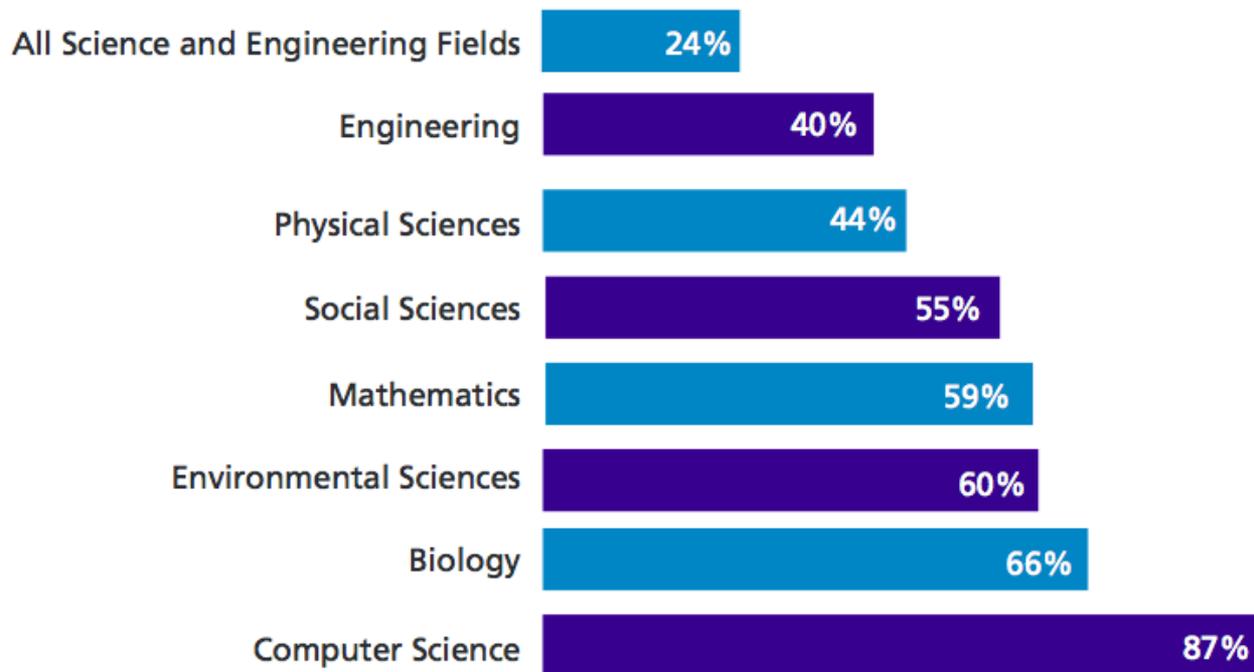
FY 2016 Budget Request



- **NSF**
 - FY 2016 Budget Request: \$7,723.55 Million
 - Increase over FY 2015 Est: \$379.34 Million, +5.2%
- **CISE**
 - FY 2016 Budget Request: \$954.41 Million
 - Increase over FY 2015 Est: \$32.68 Million, +3.5%
- CISE FY 2016 request is shaped by investments in ***core research, education, and infrastructure programs*** as well as critical investments ***in NSF cross-directorate priorities and programs***



NSF Support of Academic Basic Research in Selected Fields (as a percentage of total federal support)



Note: Biology includes Biological Sciences and Environmental Biology; excludes National Institutes of Health.

Source: NSF/National Center for Science and Engineering Statistics, Survey of Federal Funds for Research & Development, FY 2011



CISE Mission

Exploring the frontiers of computing

- Promote progress of computer and information science and engineering research and education, and advance the development and use of cyberinfrastructure.
- Promote understanding of the principles and uses of advanced computer, communications, and information systems in support of societal priorities.
- Contribute to universal, transparent and affordable participation in a knowledge-based society.

These frontiers have interfaces with all the sciences, engineering, education and humanities and a strong emphasis on innovation for society.



Snapshot of CISE FY 2014 Activities

Description	#
Research Budget	\$893M
Number of Proposals	7,436
Number of Awards	1,682
Success Rate	~23%
Average Annualized Award	\$199K
Number of Panels Held	302
Number of People Supported	16,774

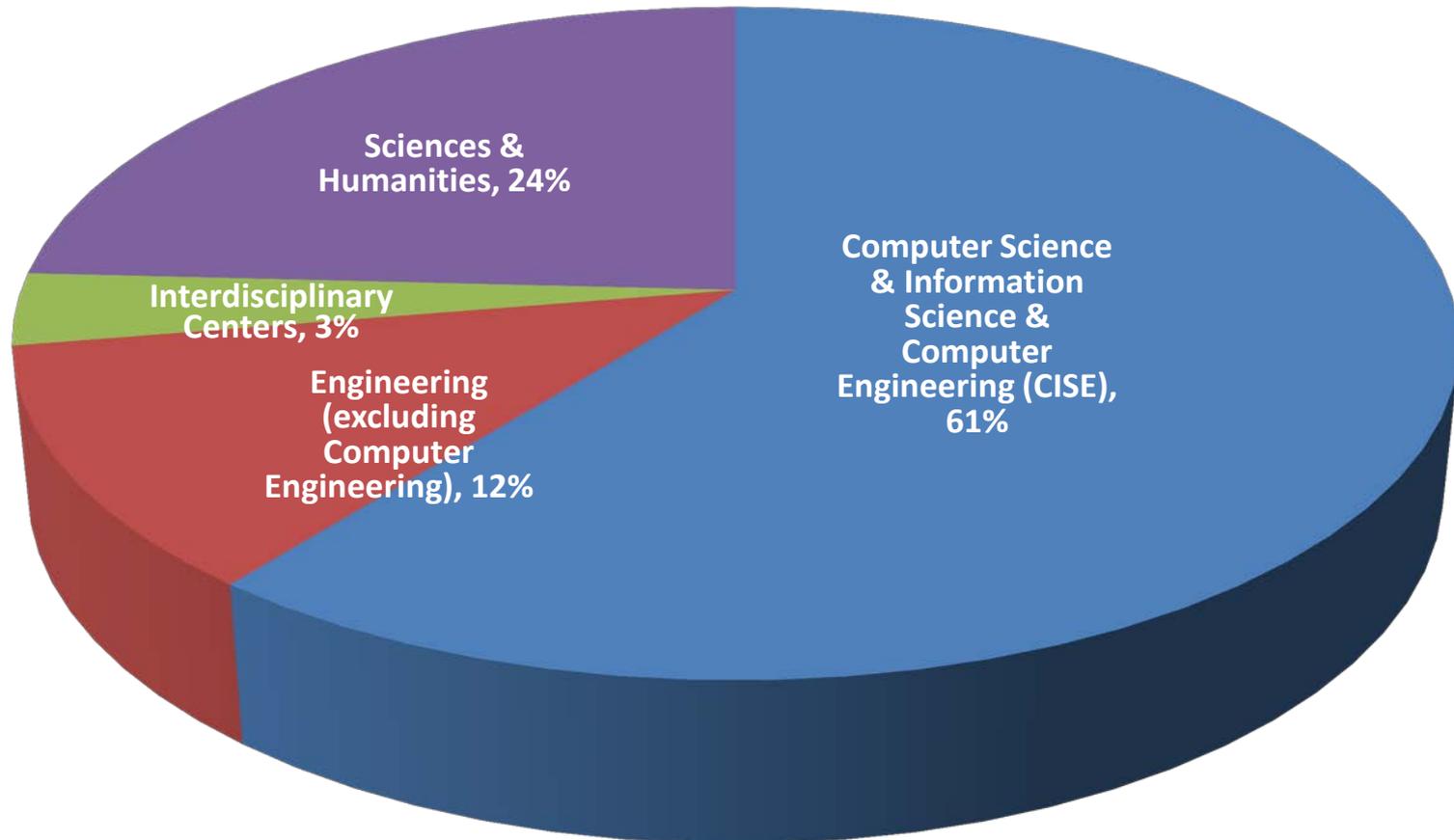


People Supported	#
Senior Researchers	6,663
Other Professionals	1,123
Postdoctoral Associates	491
Graduate Students	6,064
Undergraduate Students	2,433



Who is the CISE Community?

PI and Co-PI Departments for FY 2013 Awards Funded by CISE



CISE and National Priorities



Image Credit: ThinkStock

**Understanding
the Brain**



Image Credits: Texas A&M University

Risk & Resilience



Image Credit: NASA

**Food-Energy-
Water Systems**



**Health &
Wellbeing**

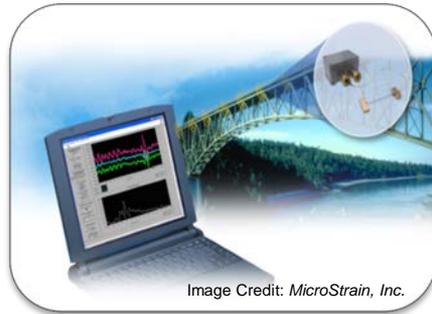


Image Credit: MicroStrain, Inc.

**Manufacturing,
Robotics, &
Smart Systems**



Image Credit: ThinkStock

**Secure
Cyberspace**



Image Credit: Georgia Computes! Georgia Tech

**Education and
Workforce
Development**

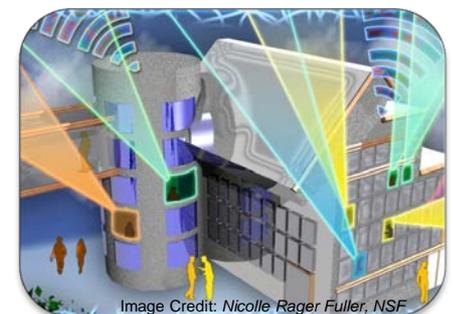


Image Credit: Nicolle Rager Fuller, NSF

**Broadband &
Universal
Connectivity**



CISE Organization

Office of the Assistant Director
Assistant Director: Dr. Jim Kurose
Deputy AD: Dr. Suzanne Iacono

**Advanced
Cyberinfrastructure
ACI**

Division Director
Ms. Irene Qualters

Acting Deputy DD:
Dr. Amy Friedlander

**Computing and
Communications
Foundations
CCF**

Division Director
Dr. Rao Kosaraju

Deputy DD:
Dr. James Donlon

**Computer and
Network
Systems
CNS**

Division Director
Dr. Keith Marzullo

Deputy DD:
Dr. Erwin Gianchandani

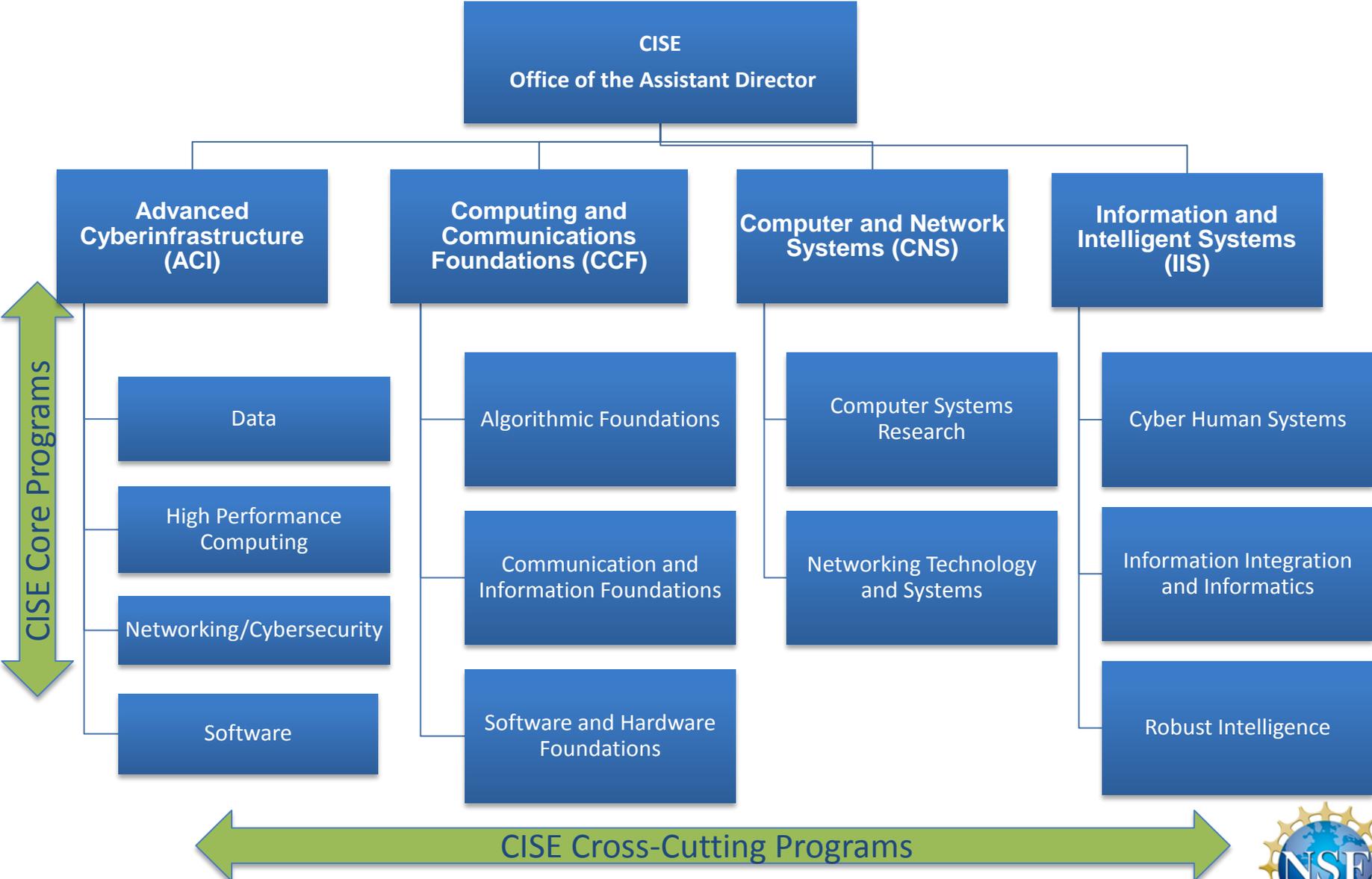
**Information and
Intelligent
Systems
IIS**

Division Director
Dr. Lynne Parker

Deputy DD:
Dr. Deborah Lockhart



CISE Organization and Core Research Programs



Advanced Cyberinfrastructure (ACI)

<http://www.nsf.gov/div/index.jsp?div=ACI>

Supports the acquisition, development, and provision of state-of-the-art cyberinfrastructure resources, tools, and services essential to the conduct of 21st century science and engineering research and education.

- *Data*: Support scientific communities in the sharing and archiving of, as well as computing with data by creating building blocks to address common community needs in data infrastructure.
- *High Performance Computing*: Enable petascale computing; provide open-science community with state-of-the-art HPC assets ranging from loosely coupled clusters to large scale instruments; develop an integrated scientific HPC environment.
- *Networking and Cybersecurity*: Invest in campus network improvements and re-engineering to support a range of activities in modern computational science. Support transition of cybersecurity research to practice.
- *Software*: Transform innovations in research and education into sustained software resources that are an integral part of cyberinfrastructure.



Computing & Communication Foundations (CCF)

<http://www.nsf.gov/div/index.jsp?org=CCF>

Supports research and education projects that explore the foundations of computing and communication devices.

- *Algorithmic Foundations (AF)*: Innovative research characterized by algorithmic thinking and algorithm design, accompanied by rigorous mathematical analysis.
- *Communications and Information Foundations (CIF)*: Transformative research addressing the theoretical underpinnings and current and future enabling technologies for information acquisition, transmission, and processing in communication and information networks.
- *Software and Hardware Foundations (SHF)*: Foundational research essential to advance the capability of computing systems, including software and hardware components, systems, and other artifacts.



Computer and Network Systems (CNS)

<http://www.nsf.gov/div/index.jsp?div=CNS>

Supports research and education activities inventing new computing and networking technologies and exploring new ways to make use of existing technologies.

- *Computer Systems Research (CSR)*: Transformative research on fundamental scientific and technological advances leading to the development of future generation computer systems, including new architectures; distributed real-time embedded devices; pervasive, ubiquitous and mobile computing; file and storage systems; operating systems; reliable, fault-tolerant and secure hard/middle/software.
- *Networking Technology and Systems (NeTS)*: Transformative research on fundamental scientific and technological advances leading to the understanding, development, engineering, and management of future-generation, high-performance computer networks.



Information and Intelligent Systems (IIS)

<http://www.nsf.gov/div/index.jsp?div=IIS>

Supports research and education activities that study the inter-related roles of people, computers, and information.

- *Cyber-Human Systems (CHS)*: Research to accelerate the creation and understanding of the complex and increasingly coupled relationships between humans and computing with the broad goal of advancing human capabilities: perceptual and cognitive, physical and virtual, social and societal.
- *Information Integration and Informatics (III)*: Information technology research on the processes and technologies involved in creating, managing, visualizing, and understanding diverse digital content in circumstances ranging from individuals through groups, organizations, and societies, and from individual devices to globally-distributed systems, and that can transform all stages of the knowledge life cycle.
- *Robust Intelligence (RI)*: Research that encompasses all aspects of the computational understanding and modeling of intelligence in complex, realistic contexts to advance and integrate the traditions of artificial intelligence, computer vision, human language research, robotics, machine learning, computational neuroscience, cognitive science, and related areas.



Applying to Core Programs

- Program Solicitations:
 - CCF: NSF 14-598
 - CNS: NSF 14-597
 - IIS: NSF 14-596
- } Coordinated Solicitations
- Project Types:
 - Large: \$1,200,001 to \$3,000,000; up to 5 years, collaborative teams
 - Medium: \$500,001 to \$1,200,000; up to 4 years, multi-investigator teams
 - Small: Up to \$500,000; up to 3 years, one or two investigators
 - CISE-wide Submission Windows:
 - Large: November 12 - 20
 - Medium: October 27 – November 10
 - Small: January 2 – 14
 - PI Limit:
 - Participate in no more than 2 “core” proposals/year

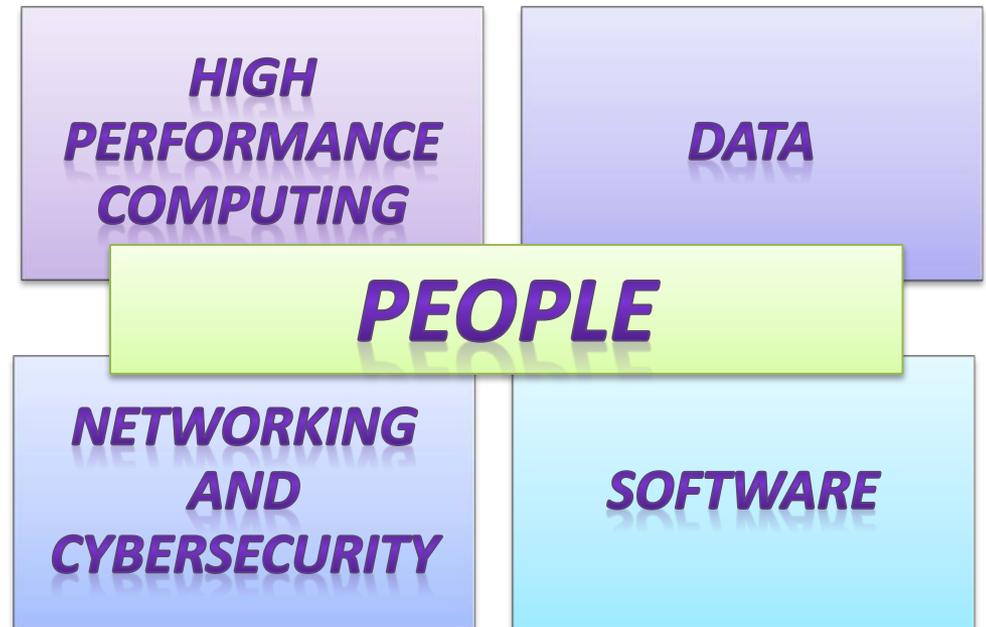
For a comprehensive list of CISE funding opportunities, visit:
http://www.nsf.gov/funding/pgm_list.jsp?org=CISE



NSF Advanced Cyberinfrastructure

Connecting scientific communities with computational resources and services at all scales

- Advanced cyberinfrastructure accelerates the pace of discovery, innovation across the entire spectrum of science, engineering, and education.
- Rich ecosystem of diverse and innovative national scale shared resources, outreach and education complementing campus and other national investments.



CISE/ACI Network Infrastructure Programs

- **CC*DNI – Campus Cyberinfrastructure – Data, Networking and Innovation Program**
 - Integrates data and network infrastructure activities, while maintaining areas of direct investment in campus networking infrastructure and innovation.
 - Enables higher levels of performance, reliability and predictability for science applications and distributed research projects on campuses across the U.S.
- **IRNC – International Research Network Connections**
 - Continues NSF's ~20 year commitment to support high performance network connectivity required by international science and engineering research and education collaborations.



Other ACI-Led Programs

- **Software Infrastructure for Sustained Innovation (SI²)**
 - Transforms innovations in research and education into sustained software resources that are an integral part of cyberinfrastructure.
 - SI² awards develop and maintain sustainable software infrastructure that enhance productivity and accelerate innovation in science and engineering.
- **Computational & Data-Enabled Science & Engineering (CDS&E)**
 - A virtual program with participation of most of NSF's Directorates intended to identify and capitalize on opportunities for major scientific and engineering breakthroughs through new computational and data analysis approaches.
- **Data Infrastructure Building Blocks (DIBBS)**
 - Encourages development of robust and shared data-centric cyberinfrastructure capabilities to accelerate interdisciplinary and collaborative research in areas of inquiry stimulated by data.



Sample of CISE Cross-Cutting Programs

For a comprehensive list of CISE funding opportunities, visit:

http://www.nsf.gov/funding/pgm_list.jsp?org=CISE

Cross-Division

- Algorithms in the Field (AitF)

Advancing algorithmic design and the application area to which the algorithms are being deployed

- Expeditions in Computing

Exploring new frontiers in computing and information science

- Exploiting Parallelism and Scalability (XPS)

Supporting groundbreaking research that will lead to a new era of parallel computing

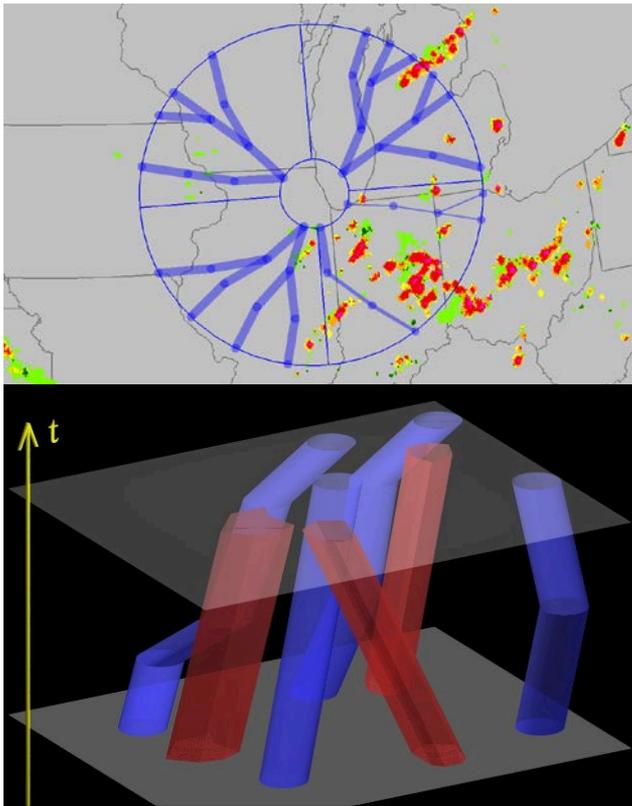
- NSF Cloud

Enabling novel cloud architectures



Algorithms in the Field (AitF)

Advancing algorithmic design and the application area to which the algorithms are being deployed



Images courtesy of Joseph Mitchell, SUNY at Stony Brook

- Encourages closer collaboration between theoretical computer science and applied researchers.
- Bridges gap between theory, practice in design, analysis, implementation, evaluation of algorithms.
- Project classes:
 - FULL-SIZE up to \$800,000 for up to 4 years.
 - EXPLORATORY up to \$400,000 for up to 3 years.
- Proposal Deadline: Feb 9, 2015



Expeditions-in-Computing

Exploring scientific frontiers that promise transformative innovations in computing

- Provides the CISE community an opportunity to pursue ambitious, fundamental research agendas that promise to define the future of computing and information.
- Successful projects bring together teams of investigators with diverse expertise within or across departments or institutions to identify compelling, transformative research agendas that seek disruptive innovations in CISE.

- **Funding:**
up to \$2,000,000 per year
for up to five years
- **Limit:**
1 Expeditions Proposal per individual
- **Deadlines:**
Preliminary Proposal (required): March 9, 2016
Full Proposal: December 14, 2016



Expeditions-in-Computing

Beyond Moore's Law

- *The Molecular Programming Project*, CalTech, U Washington, 2008; & Harvard, UCSF, 2013
- *Variability-aware Software for Efficient Computing with Nanoscale Devices*, UCSD, UCLA, UIUC, Stanford, Michigan, 2010
- *Customizable Domain-Specific Computing*, UCLA, UCSB, Rice, Ohio State, 2009

Sustainability & Environment

- *Understanding Climate Change: A Data Driven Approach* – Minnesota, Northwestern, NC State, NC A&T State, 2010
- *Computational Sustainability: Computational Methods for a Sustainable Environment, Economy, and Society* – Cornell, Oregon State, Bowdoin, 2008

Wireless & Internet

- *Open Programmable Mobile Internet 2020*, Stanford, 2008

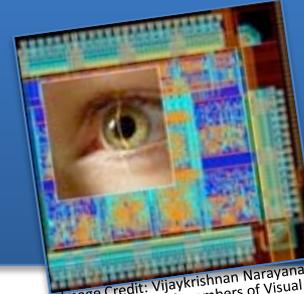


Image Credit: Vijaykrishnan Narayanan, Penn State and members of Visual Cortex on Silicon Team

Healthcare & Wellbeing

- *Socially Assistive Robots*, Yale, USC, MIT, Stanford, Willow Garage, 2011
- *Computational Behavioral Science: Modeling, Analysis, and Visualization of Social and Communicative Behavior*, Georgia Tech, MIT, Boston U, UIUC, USC, Carnegie Mellon, 2010

Robotics and Vision

- *Visual Cortex on Silicon*, Penn State, USC, Stanford, York College, UCSD, UCLA, Pitt, MIT, 2013
- *An Expedition in Computing for Compiling Printable Programmable Machines*, MIT, U Penn, Harvard, 2011
- *RoboBees: A Convergence of Body, Brain and Colony* – Harvard, Northeastern, 2009



Image Credit: Harvard University

Limits of Computation

- *Understanding, Coping with, and Benefiting from Intractability* – Princeton, Rutgers, NYU, Institute for Advanced Study, 2008



Image Credit: UC San Diego Jacobs School of Engineering

Formal Modeling and Verification

- *Expeditions in Computer Augmented Program Engineering*, U Penn, UC Berkeley, UMD, Rice, Cornell, U of Michigan, U of Illinois-UC, UCLA, MIT, 2011
- *Next-Generation Model Checking and Abstract Interpretation with a Focus on Embedded Control and Systems Biology*, Carnegie Mellon, Stony Brook, NYU, UMD, Pitt, Lehman College, JPL, 2009

Big Data

- *Algorithms, Machines, and People*, UC Berkeley, UC San Francisco, 2011
- *(Understanding Climate Change: A Data Driven Approach* – Minnesota, Northwestern, NC State, NC A&T State, 2010)



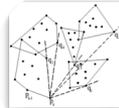
Image Credit: UC San Diego Jacobs School of Engineering



Exploiting Parallelism and Scalability (XPS)

Support groundbreaking research that will lead to a new era of parallel computing

- Aims to establish *new* collaborations combining expertise cutting across abstraction, software, hardware layers.
- Invests in foundational research advancing parallel and scalable computing, challenging validity of traditional computer hardware and software stack for heterogeneous parallel systems.
- Focuses on new principles and cross-layer approaches that integrate both software and hardware through new programming languages, models, algorithms, compilers, runtime systems, and architectures.



Foundational Principles

- New models guiding parallel algorithm design on diverse platforms
- Optimization for resources (energy, bandwidth, memory hierarchy)



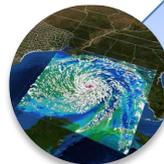
Cross-layer and Cross-cutting Approaches

- Re-thinking/re-designing the hardware and software stack
- Coordination across all layers



Scalable Distributed Architectures

- Highly scalable and parallel architectures for people and things connected everywhere
- Runtime platforms and virtualization tools



Domain-specific Design

- Exploiting domain knowledge to improve programmability and performance



CISE Research Infrastructure: Mid-Scale Infrastructure - NSFFutureCloud

Enabling novel cloud architectures

- Aims to support research infrastructure that enables the academic research community to develop and experiment with novel cloud architectures and applications.
- Builds upon existing investments, recent growth in cloud computing.
- Enables exploration of:
 - Resource sharing in clustered computing.
 - Virtualization with software-defined networking technologies.
 - Interplay between application and cloud computing architectures.



Images: Logos from the NSF Cloud projects funded in FY2014

Integrates key input from
CISE AC subcommittee and
CCC whitepapers



Sample of CISE Cross-Cutting Programs

For a comprehensive list of CISE funding opportunities, visit:

http://www.nsf.gov/funding/pgm_list.jsp?org=CISE

Cross-Directorate

- **Critical Resilient Interdependent Systems and Processes (CRISP)**
Creating new approaches and engineering solutions to make interdependent critical infrastructure systems resilient
- **Critical Techniques and Technologies for Advancing Big Data Science & Engineering (BIG DATA)**
Developing tools to manage and analyze data in order to extract knowledge from data
- **Science, Engineering and Education for Sustainability (SEES)**
Sustainability enabling by new advances in computing
- **Cyberlearning: Transforming Education (CTE)**
Designing and implementing technologies to aid and understand learning
- **Cyber-Physical Systems (CPS)**
Integrating computation, communication, and control into physical systems
- **Enhancing Access to the Radio Spectrum (EARS)**
Enhancing access to wireless service and/or efficiency with which radio spectrum is used
- **Secure and Trustworthy Cyberspace (SaTC)**
Securing our Nation's cyberspace, while preserving privacy and promoting usability



Critical Resilient Interdependent Systems and Processes (CRISP)

Creating new approaches and engineering solutions to make interdependent critical infrastructure systems resilient

- Aims to foster an ***interdisciplinary*** research community of engineers, computer and computational scientists and social and behavioral scientists to create new approaches and engineering solutions for the design and operation of infrastructures.
- Award types:
 - Type 1 Awards: Up to \$500,000 over 3 years.
 - Type 2 Awards: \$1 million to \$2.5 million over 3-4 years.
- Proposal deadline: March 20, 2015



Cross-Directorate Solicitation: CISE, ENG, and SBE



Critical Techniques and Technologies for Advancing Foundations and Applications of Big Data Science & Engineering (BIGDATA)

Developing techniques to manage and analyze data

- Two categories for submission:
 - **Foundations:** Encourages fundamental techniques, theories, methodologies, and technologies of broad applicability.
 - **Innovative Applications:** Encourages novel techniques, methodologies, and technologies of interest to at least one specific application (special requirements).
- Awards: Up to \$500K per year for up to 4 year.
- New solicitation coming soon.

Cross-Directorate Solicitation: CISE, BIO, EHR, ENG, and SBE

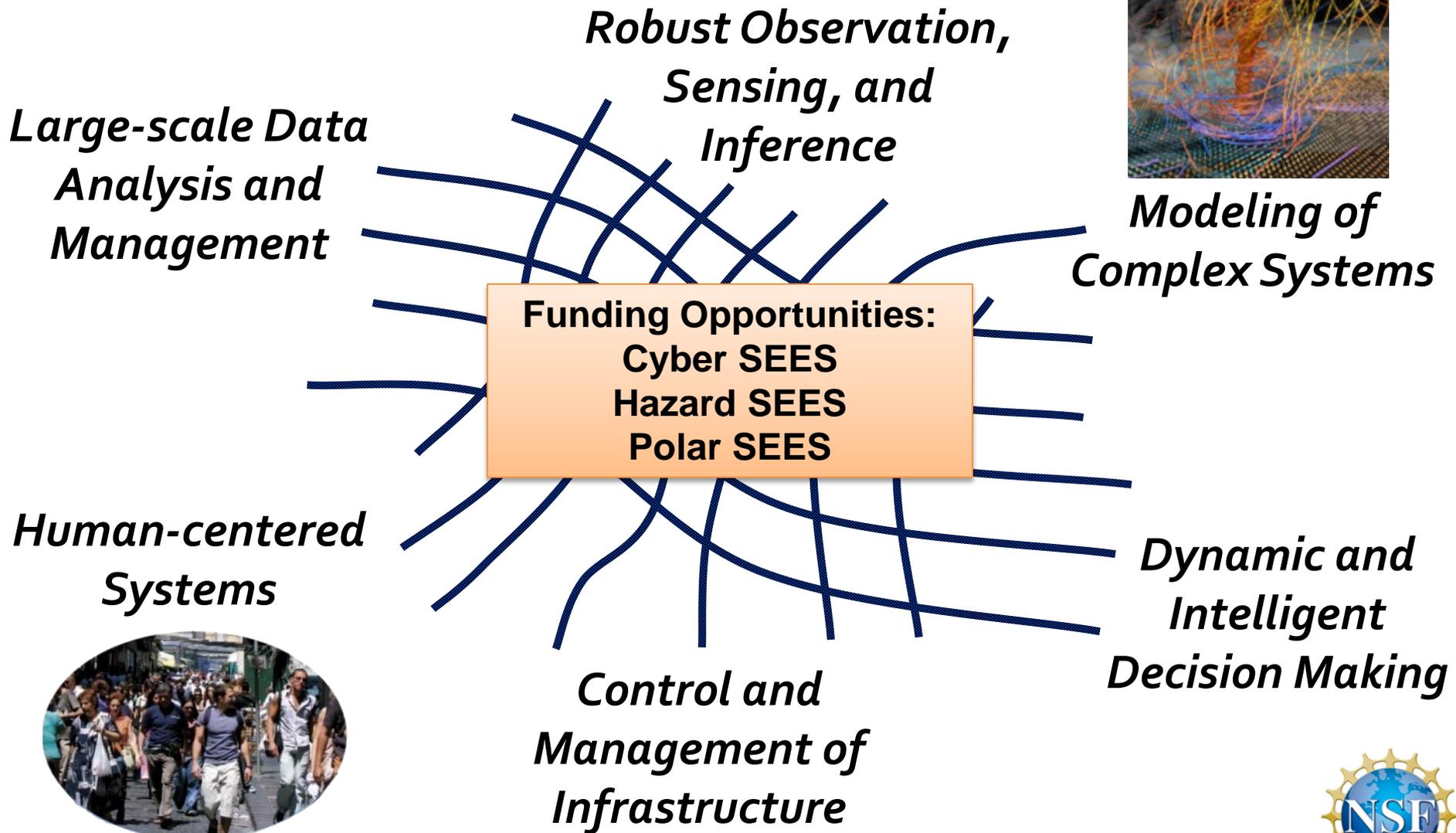


Federal Big Data R&D Initiative

- **Cross-agency “Big Data” Senior Steering Group** – chartered in spring 2011 by OSTP:
 - Co-chaired by NSF and NIH
 - Significant research community input
- **Launched** by OSTP on March 29, 2012
 - **Major Announcements:** NSF, NIH, USGS, DoD, DARPA, DOE
- **Data to Knowledge to Action** event hosted by OSTP November 12, 2013
 - Encouraging **public-private partnerships** across the country



Computational challenges are woven into many areas of sustainability research



Cyberlearning: Transforming Education

Improving learning by integrating emerging technologies with knowledge from research about how people learn

- Computer science is both the **enabling discipline** for the development of technologies that enhance learning and a discipline with an **immediate and critical need** for cyberlearning technologies as it aims to scale K-16 educational transformations at the national scale.

Research Thrusts:

- **Innovation:** Identifying new means of using technology for fostering and assessing learning;
- **Advancing understanding of how people learn in technology-rich learning environments:** Enhancing understanding of how people learn and how to better foster and assess learning; and
- **Promoting broad use and transferability of genres:** Extracting lessons from experiences with these technologies that can inform design and use.

Cross-Directorate Solicitation: CISE, EHR, and ENG



Enhancing Access to the Radio Spectrum (EARS)

*Enhancing access to wireless service and/or efficiency with
which radio spectrum is used*



Credit: Nicolle Rager Fuller, National Science Foundation

- Aims to strengthen U.S. leadership in the global wireless technology marketplace.
- Support for research in wireless communication, spectrum sharing, and mobile computing, as well as development of wireless and spectrum testbeds.
- Advance spectrum sensing techniques, explore machine learning and game theory for dynamic spectrum management, and understand incentive mechanisms.

Cross-Directorate Solicitation: CISE, ENG, and MPS



Secure and Trustworthy Cyberspace (SaTC)

Securing our Nation's cyberspace

- Aims to support fundamental scientific advances and technologies to protect cyber-systems from malicious behavior, while preserving privacy and promoting usability.
- Proposals must address cybersecurity from one or more perspectives:
 - Trustworthy Computing Systems.
 - Social, Behavioral and Economic Sciences.
 - Secure, Trustworthy, Assured and Resilient Semiconductors and Systems (STARSS), jointly offered with the Semiconductor Research Corporation (special requirements).
 - Cybersecurity Education (special requirements).
- Transition to Practice option.

Project type	Submission window	Award size
Small	January 2-14 annually	up to \$500,000 Up to 3 years
Medium	October 27 – November 10 September 2-19 annually thereafter	\$500,001 to \$1,200,000 Up to 4 years
Large	November 12-20 November 4-19 annually thereafter	\$1,200,001 to \$3,000,000 Up to 5 years
Cybersecurity Education	December 4-19 annually	Up to \$300,000 Up to 2 years



Sample of CISE Cross-Cutting Programs

For a comprehensive list of CISE funding opportunities, visit:

http://www.nsf.gov/funding/pgm_list.jsp?org=CISE

Cross-Agency

- BRAIN

Improving understanding of the brain

- Cyber-Physical Systems

Deeply integrating computation, communication, and control into physical systems

- Materials Genome Initiative

Decreasing the time-to-market by 50%

- National Robotics Initiative (NRI)

Developing and using robots that work alongside, or cooperatively with, people

- Smart and Connected Health (SCH)

Transforming healthcare knowledge and delivery, and improving quality of life through IT



BRAIN: Brain Research through Advancing Innovative Neurotechnologies

Improving understanding of the brain

- White House BRAIN Initiative launched in April 2013 (NSF, NIH, DARPA).
- Addresses critical challenge of research integration across multiple scales ranging from molecular to behavioral levels with the ultimate goal of understanding the brain.
- Builds on ongoing NSF investments:
 - Collaborative Research in Computational Neuroscience (CRCNS) in collaboration with NIH, Germany, France, and Israel;
 - Integrative Strategies for Understanding Neural and Cognitive Systems;
 - Robust Intelligence Core Research; and
 - MIT STC: Center for Brains, Minds and Machines: The Science and the Technology for Intelligence.



More at:

http://www.nsf.gov/news/special_reports/brain/



Cyber-Physical Systems (CPS)

Deeply integrating computation, communication, and control into physical systems

- Aims to develop the core system science needed to engineer complex “smart” cyber-physical systems.
- Serves multiple key national priorities.
- Deadline: April 20 - May 4

Project Types:

- **Breakthrough Projects**
up to \$500,000
up to 3 years
- **Synergy Projects**
\$500,001 to \$1,000,000
over 3-4 years
- **Frontiers Projects**
\$1,000,001 to \$7,000,000
over 4-5 years



Transportation

- Faster and safer aircraft
- Improved use of airspace
- Safer, more efficient cars



Energy and Industrial Automation

- Homes and offices that are more energy efficient and cheaper to operate
- Distributed micro-generation for the grid



Healthcare and Biomedical

- Increased use of effective in-home care
- More capable devices for diagnosis
- New internal and external prosthetics



Critical Infrastructure

- More reliable power grid
- Highways that allow denser traffic with increased safety

Cross-Directorate Solicitation: CISE and ENG

Multi-agency Commitment: NSF, DHS, DoT, NASA, and NIH



Materials Genome Initiative

Aiming to decrease the time-to-market by 50%



To help businesses discover, develop, and deploy new materials twice as fast, we're launching what we call the Materials Genome Initiative. The invention of silicon circuits and lithium ion batteries made computers and iPods and iPads possible, but it took years to get those technologies from the drawing board to the market place. We can do it faster.

-President Obama, Carnegie Mellon University, June 2011

Goals:

- Develop a Materials Innovation Infrastructure
- Achieve National goals in energy, security, and human welfare with advanced materials
- Equip the next generation materials workforce

Themes

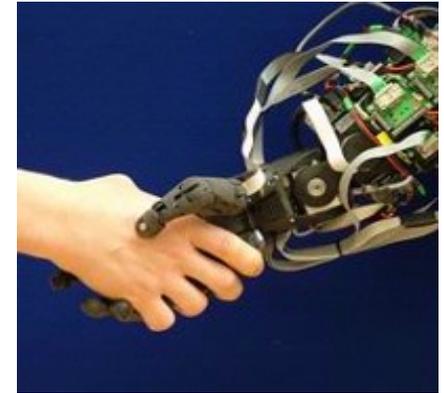
- Incentivizing open paradigms of sharing & access of tools
- Facilitating the development of innovation ecosystems & access to all stakeholders
- Driving innovative techniques across computation, informatics & experimentation
- Catalyzing shift in culture across the entire materials continuum & scaling the movement



National Robotics Initiative (NRI)

Developing the next generation of collaborative robots to enhance personal safety, health, and productivity

- A nationally concerted cross-agency program to provide U.S. leadership in science and engineering research and education aimed at the development and use of cooperative robots that work alongside people across many sectors.
- Deadlines:
 - January 14, 2015
 - December 3, 2015



Credit: Bristol Robotics Lab

Research Thrusts

- **Fundamental research in robotics science & engineering**
- **Understanding the long term social, behavioral, and economic implications across all areas of human activity**
- **Use of robotics to facilitate and motivate STEM learning across the K-16 continuum**

Cross-Directorate Solicitation: CISE, EHR, ENG, and SBE

Multi-agency Commitment: NSF, DOD/DARPA, NASA, NIH, and USDA



Smart & Connected Health (SCH)

Transforming healthcare knowledge, delivery, and quality of life through IT

- Address fundamental technical and scientific issues to support the transformation of healthcare from reactive and hospital-centered to preventive, proactive, evidence-based, person-centered and focused on wellbeing rather than disease.
- Must relate to a key health problem and must make a fundamental contribution to ENG, CISE, or SBE domains.

Project Types:

- **Type I: Exploratory**
Up to \$250,000 / year
for 1-3 years
Next Deadline: Oct 10, 2014
- **Type II: Integrative**
Up to \$500,000 / year
for up to 4 years
Next Deadline: Dec 10, 2013

Research Thrusts

**Digital Health
Information
Infrastructure**

*Informatics and
Infrastructure*

**Data to Knowledge to
Decision**

*Reasoning under
uncertainty*

Empowering Individuals

*Energized, enabled,
educated*

**Sensors, Devices, and
Robotics**

Sensor-based actuation

Cross-Directorate Solicitation: CISE, ENG, and SBE

Multi-agency Commitment: NSF and NIH



Sample of Programs to Support CS Students, Teachers, and Early-Career Researchers

For a comprehensive list of CISE funding opportunities, visit:

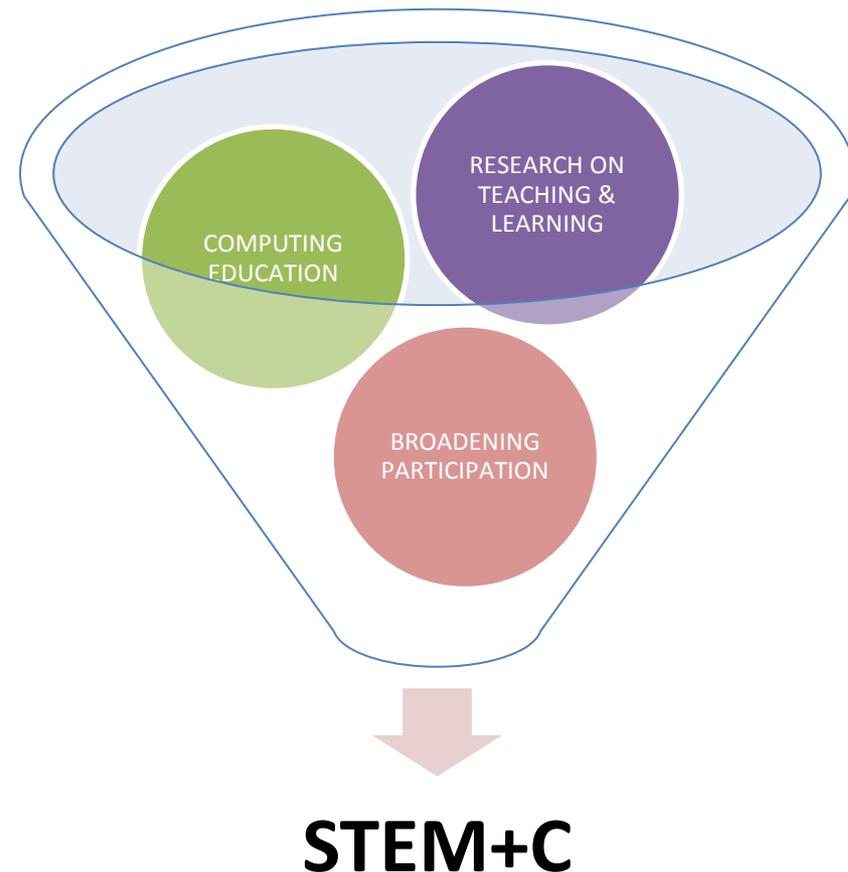
http://www.nsf.gov/funding/pgm_list.jsp?org=CISE

- STEM + Computing (STEM+C) Partnerships
Integrating computing into STEM
- NSF Research Traineeship (NRT)
Preparing professionals in emerging STEM fields vital to the nation
- Computing Research Initiation Initiative (CRII)
Enabling early research independence
- Faculty Early Career Development (CAREER) Program
- Graduate Research Fellowship Program (GRF)
- Research Experiences for Undergraduates (REU)



STEM + Computing (STEM+C) Partnerships

Integrating computing into STEM



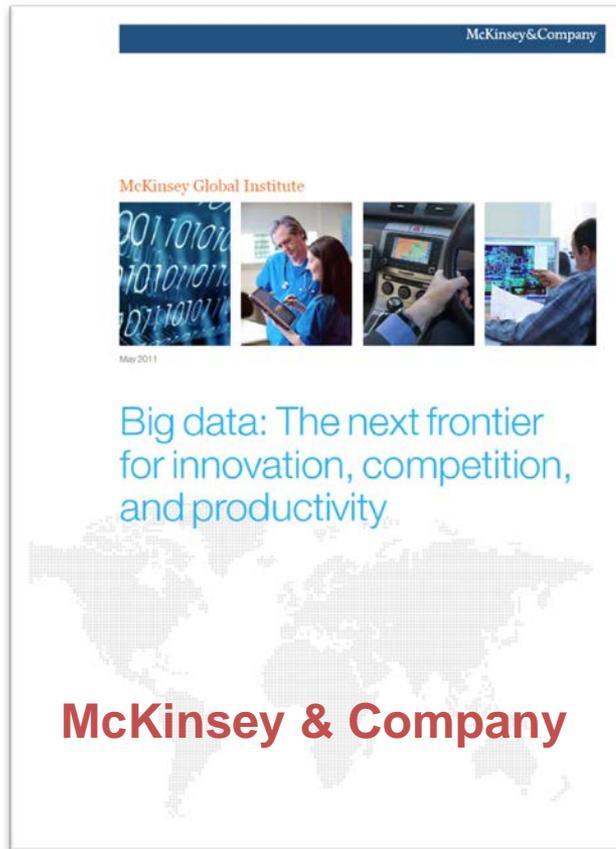
STEM+C

- Integrates computing into STEM disciplines and builds capacity in K-12 computing education.
- Deep community partnerships.
- Transforms the computing education pipeline through CS10K.
- Combines and replaces two earlier solicitations that focused on Science, Technology, Engineering and Mathematics (STEM), including Computing Partnerships: Math and Science Partnerships (STEM-CP: MSP) and STEM-CP: Computing Education for the 21st Century (STEM-CP: CE21).

Cross-Directorate Solicitation: CISE & EHR



Education, Learning, Workforce Development, Computational and Data-enabled Science



“By 2018 the United States alone faces a shortage of 140,000 to 190,000 people with analytical expertise and 1.5 million managers and analysts with the skills to understand and make decisions based on the analysis of big data.”¹

¹McKinsey&Company (May 2011), “Big data: The next frontier for innovation, competition, and productivity.” Available at: http://www.mckinsey.com/Insights/MGI/Research/Technology_and_Innovation/Big_data_The_next_frontier_for_innovation



NSF Research Traineeship (NRT)

Preparing professionals in emerging STEM fields vital to the nation

Priority research theme: Data-enabled science and engineering

- Aims to create and promote new, innovative, effective, and scalable models for STEM graduate student training and prepare scientists and engineers of the future, particularly in emerging STEM fields vital to the nation.
- A new NSF graduate education initiative to replace the Integrated Graduate Research Traineeship (IGERT) program.
- Award tracks:
 - NRT Traineeship: Up to \$3M up to 5 years.
 - NRT Innovations in Graduate Education: \$300K-\$500K over 2-3 years.
- Proposal deadlines: May 6, 2015 and February 22, 2016

NSF-wide Initiative



Computing Research Initiation Initiative (CRII)

Enabling early research independence

- Aims to contribute to the growth and development of future generations of scientists and engineers who will dedicate their careers to advancing CISE research and education.
- Provides the opportunity for individuals who are in their first academic position post-PhD to recruit and mentor their first graduate students.
 - Allows for a full budget for grad student salary only (and some travel, equipment) but no PI salary.
- Deadline: September 23, 2015 (Fourth Wed. in Sept. Annually)



Faculty Early Career Development (CAREER) Program

- The National Science Foundation's most prestigious awards in support of junior faculty who exemplify the role of teacher-scholars through:
 - outstanding research,
 - excellent education, and
 - the **integration of education and research** within the context of the mission of their organizations.
- Since its inception in 1996:
 - More than **200 programs** have reviewed CAREER proposals.
 - More than **7,000 awards**.
- PIs are allowed only one submission per competition.
- Deadline: July 21, 2014 (New solicitation expected)

CISE CAREER Proposal Writing Workshops

- 2015 Workshop in Arlington, VA: March 16
- Presentations from March 2014 available at <http://cs.gmu.edu/events/nsfcisecareer2014/>



Support for Graduate and Undergraduate Students

- ***Graduate Research Fellowship Program (GRF)***
 - Foundation-wide programs with substantial CISE participation.
 - Deadlines in mid-Nov but differ for each Directorate.
- ***Research Experiences for Undergraduates (REU)***
 - **REU Sites**
 - Typically in summer.
 - 8-10 students in a cohort environment.
 - Deadline in August.
 - **REU Supplements**
 - Support for 1-2 students to work on existing project.
 - Best to submit request by March but no strict deadline.



Other NSF-wide Opportunities for the CISE Community

- Innovation Corps (I-Corps)
- Grants for Rapid Response Research (RAPID)
- EARly-concept Grants for Exploratory Research (EAGER)
- Conferences, Summer Schools, and Workshops
- International Collaborations

For a comprehensive list of NSF funding opportunities, visit:

<http://www.nsf.gov/funding/>



Innovation Corps (I-Corps)

Accelerating innovations from the laboratory to the market

- Aims to develop and nurture a national innovation ecosystem that builds upon fundamental research to guide the output of scientific discoveries to the development of technologies, products and processes that benefit society.
- NSF-funded researchers are eligible to receive additional support in the form of mentoring and funding through I-Corps.
- **Must consult with a program director before submission.**



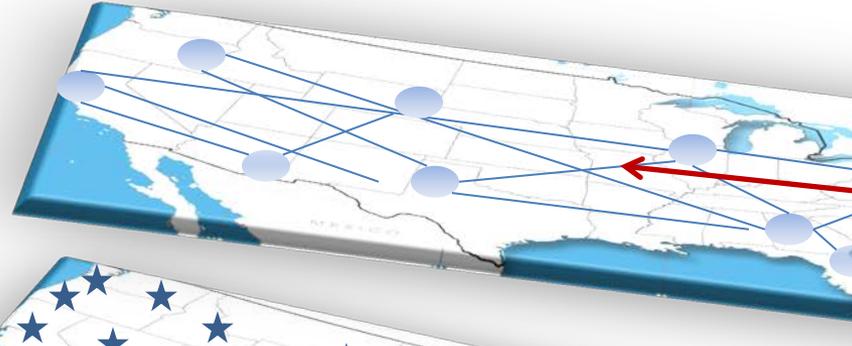
NSF-wide Initiative



Building the Nation's I-Corps "Fabric"

I-Corps Nodes

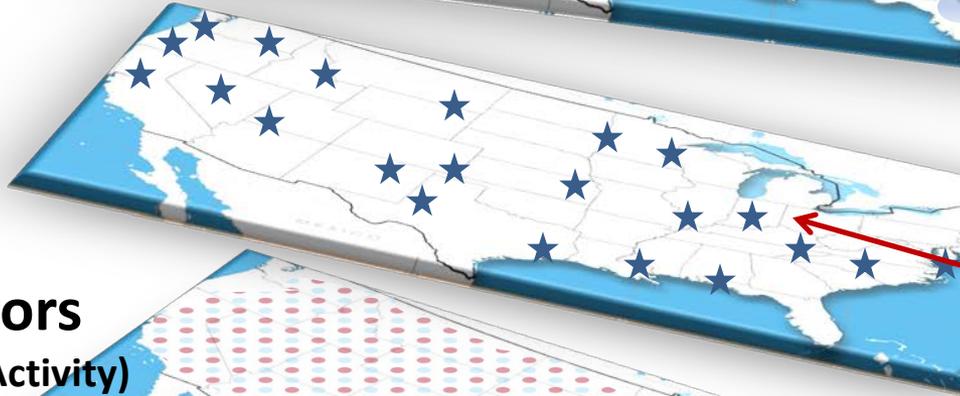
(NSF Program)



National Network of university collaborators – offer immersion curriculum and engage in research about commercialization

I-Corps Sites

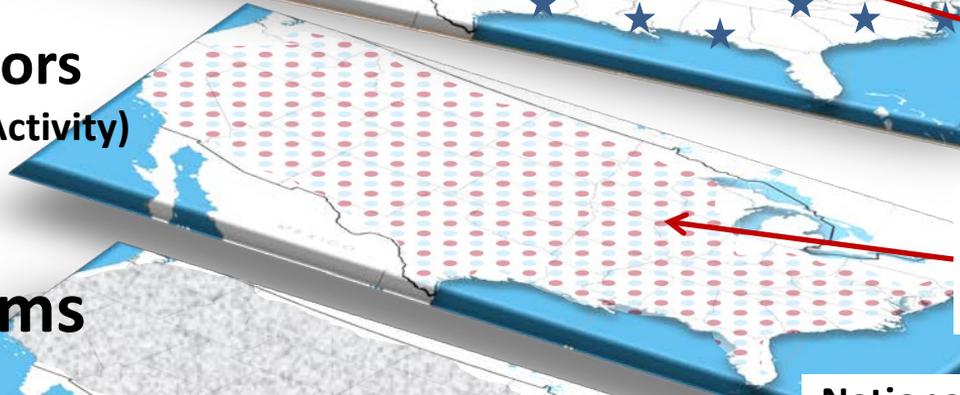
(NSF Program)



National network of universities that can enable their local teams

I-Corps Mentors

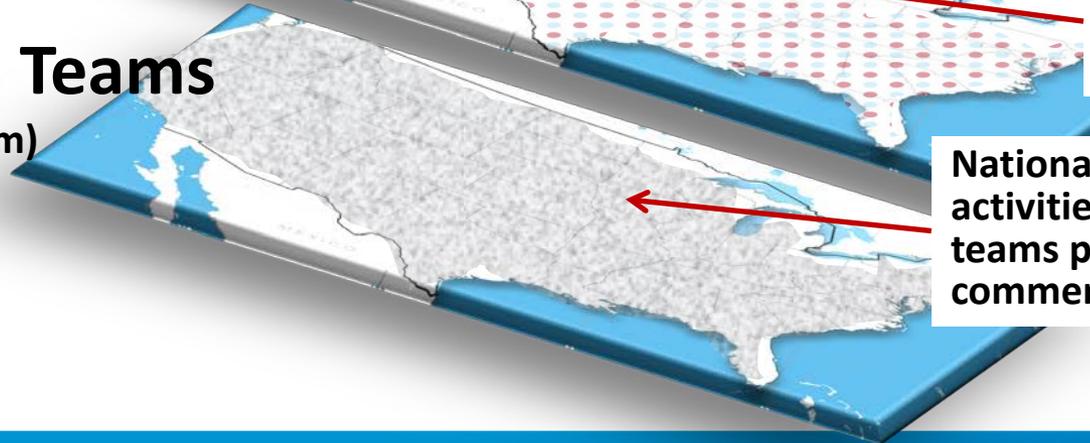
(External Partners Activity)



National network of serial-entrepreneurs who Mentor I-Corps Teams

I-Corps Teams

(NSF Program)



National network of "Grass-Roots" activities by NSF PIs – individual teams pursue I-Corps Curriculum and commercialization



RAPID and EAGER Proposals

- ***Grants for Rapid Response Research (RAPID):***
 - Supports quick-response research on natural or anthropogenic disasters and similar unanticipated events.
 - Up to \$200K and one year duration.
 - Project descriptions are expected to be brief (two to five pages) and include clear statements as to why the proposed research is of an urgent nature.
- ***EARLY-concept Grants for Exploratory Research (EAGER):***
 - Supports high-risk, exploratory and potentially transformative research.
 - Up to \$300K and two years duration.
 - Project description is expected to be brief (five to eight pages) and include clear statements as to why this project is appropriate for EAGER funding.



Conferences, Summer Schools, and Workshops

- ***Conferences***
 - Student Travel Support
 - Doctoral Consortia
- ***Summer Schools***
 - Intensive program for doctoral students on emerging research topics.
 - Require faculty expertise not available at any single institution.
- ***Workshops***
 - Bring the community together to reflect on, and identify emerging research opportunities and challenges.

Must consult with a program director before submission.



International Collaborations

- ***Supplements*** to existing projects to allow U.S. researchers to engage in collaborative activities with international partners:
 - True intellectual collaboration with foreign research partner;
 - New international collaborations;
 - Clear benefit to U.S. science/engineering community from expertise, facilities, or resources of the foreign collaborator; and
 - Active research engagement of U.S. students and junior researchers at the foreign site.
- ***East Asia and Pacific Summer Institutes for U.S. Graduate Students (EAPSI)***
- ***Pan-American Advanced Studies Institutes Program (PASI)***
- ***International Research Fellowship Program (IRFP)***
- If what you have in mind does not fit one of the existing programs, get in touch with the PD responsible for the country, or region of interest in the NSF Office of International Science and Engineering.



Commitment to Research and Education in CISE

- As a field of inquiry, computer, communication and information science and engineering has a **rich intellectual agenda** – highly creative, highly interactive, with enormous possibilities for changing the world!
- A thriving basic research community is the foundation for long-term **discovery** and **innovation, economic prosperity, and national security.**
- Our investments in **research and education** have returned exceptional dividends to our nation.



Stay Informed

- Subscribe to get NSF updates by email at www.nsf.gov.
- Subscribe to receive special CISE announcements:
 - Send a message to: join-cise-announce@lists.nsf.gov with no text in the subject or message body.
- Visit the CISE website often: <http://www.nsf.gov/dir/index.jsp?org=CISE>.
- Talk to Program Directors: http://www.nsf.gov/staff/staff_list.jsp?org=CISE&from_org=CISE.
- Follow us on Twitter [@NSF_CISE](https://twitter.com/NSF_CISE).

The image shows a screenshot of the National Science Foundation (NSF) website. At the top, the NSF logo and tagline 'WHERE DISCOVERIES BEGIN' are visible. Below the logo is a navigation bar with links for FUNDING, AWARDS, DISCOVERIES, NEWS, PUBLICATIONS, STATISTICS, ABOUT NSF, and FASTLANE. A search bar is located in the top right corner. The main content area features a large banner with the text 'Why stars born in same cluster look alike' and a 'FULL STORY' button. Below the banner is a section titled 'NSF Funding & Research Community' with sub-sections for 'SPECIAL NOTICES' and 'EVENT CALENDAR'. On the right side, there is a 'FUNDING OPPORTUNITIES' sidebar with a search form and a 'VIEW ALL FUNDING OPPORTUNITIES' button. At the bottom of the page, there is a footer with various links and contact information. A red arrow points to the 'STAY INFORMED' link in the top navigation bar. A yellow box with a red arrow pointing to it contains the text 'Get NSF Updates by Email'.



Get Involved

- Volunteer to be a reviewer.
- Visit NSF, get to know your program(s) and program director(s).
- Develop transformational ideas and send your best ideas to NSF.
- Participate in NSF-funded and hosted activities (e.g., workshops, COVs, ACs).
- Participate in the CCC/CRA visioning activities.
- Develop transitional ideas for how to move from ideas and prototypes to systems deployed on testbeds to technology transfer.
- Work within your institution to support and reward interdisciplinary research.
- Work within your institution to support service to the larger computing community around the globe.
- Send us your accomplishments; advertise your research to other citizens through local radio or TV, blogs, newspaper articles, etc.
- Join NSF to serve as program officers or division directors.



CISE Needs Good People

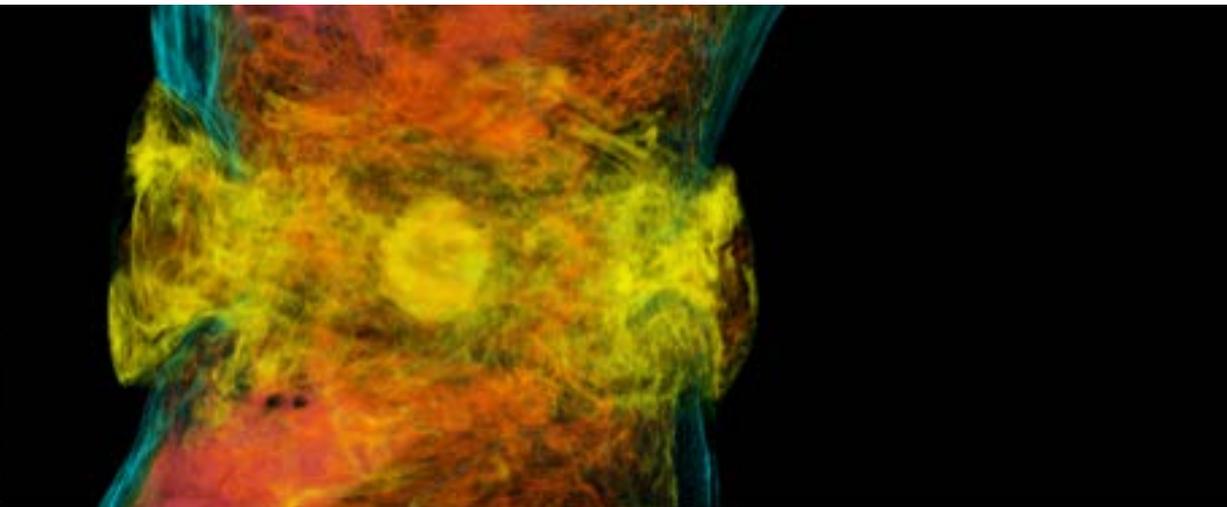
Quality of program directors:

- ✓ Affects quality of reviewers chosen for panels and ad hoc reviews.
- ✓ Affects quality of reviews PIs receive.
- ✓ Affects funding decisions.
- ✓ Affects the nature and content of our research.
- ✓ Affects the frontiers of our discipline.



Thanks!

Follow us on Twitter
[@NSF_CISE](#)



TWEETS 1,075 FOLLOWING 27 FOLLOWERS 2,050

 [Following](#)

NSF Comp & Info
@NSF_CISE

Exploring the frontiers of computing

Arlington, Virginia · nsf.gov/dir/index.jsp?...



Credits

- Copyrighted material used under Fair Use. If you are the copyright holder and believe your material has been used unfairly, or if you have any suggestions, feedback, or support, please contact: ciseitsupport@nsf.gov.
- Except where otherwise indicated, permission is granted to copy, distribute, and/or modify all images in this document under the terms of the GNU Free Documentation license, Version 1.2 or any later version published by the Free Software Foundation; with no Invariant Sections, no Front-Cover Texts, and no Back-Cover Texts. A copy of the license is included in the section entitled “GNU Free Documentation license”
- ([http://commons.wikimedia.org/wiki/Commons:GNU Free Documentation License](http://commons.wikimedia.org/wiki/Commons:GNU_Free_Documentation_License)).
- The inclusion of a logo does not express or imply the endorsement by NSF of the entities' products, services, or enterprises.

