



Computer and Information Science and Engineering (CISE)

Exploring the frontiers of computing



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

January 2016



CISE's Economic and Societal Context

- CISE is at the center of an ongoing, long-term societal transformation
- Advances in computing, communications, information technologies, cyberinfrastructure:
 - underpin economic prosperity, national security
 - drive U.S. competitiveness and sustainable economic growth
 - accelerate the pace of discovery and innovation
 - are crucial to achieving national and societal priorities



CISE and National Priorities



**Understanding
the Brain**



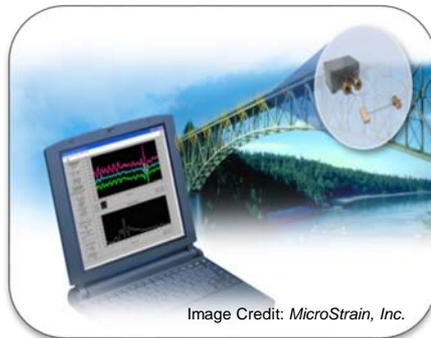
**Risk &
Resilience**



**Food-Energy-
Water Systems**



**Health &
Wellbeing**



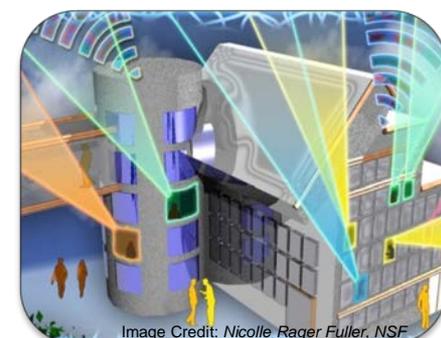
**Manufacturing,
Robotics, &
Smart Systems**



**Secure
Cyberspace**



**Education and
Workforce
Development**



**Broadband &
Universal
Connectivity**



CISE Mission

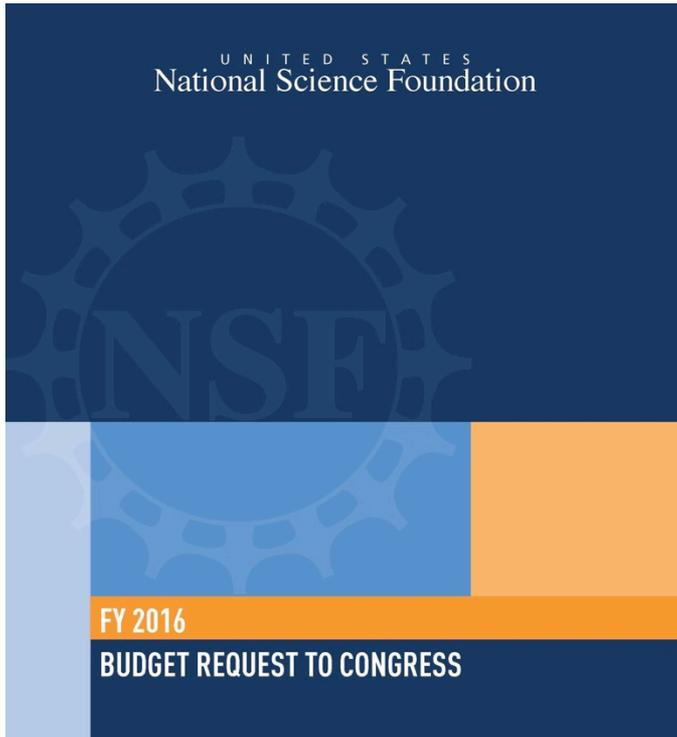
Exploring the frontiers of computing

- Promote progress of computer and information science and engineering research and education, and advance the development and use of cyberinfrastructure in the age of big data
- Promote understanding of the principles and uses of advanced computer, communications, information, and intelligent 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.



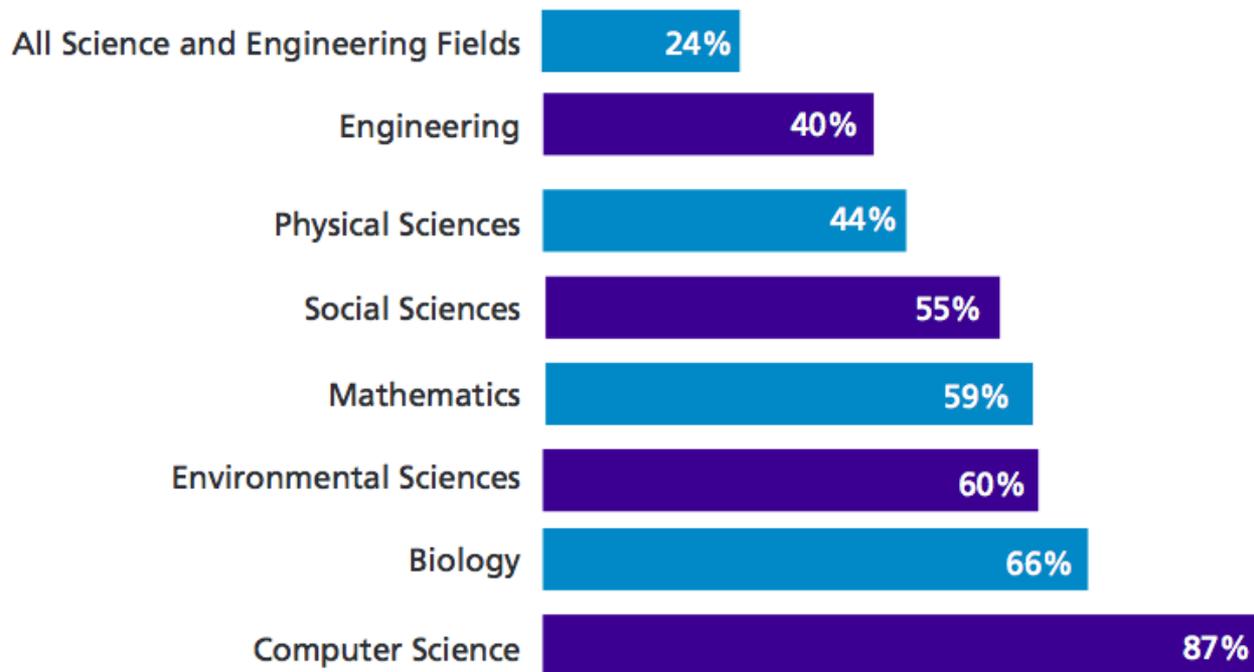
FY 2016 CISE Budget



- **CISE**
 - FY 2015 budget approx. \$922 mln, FY 2016 budget got an increase of 1.5%
- CISE FY 2016 request was higher and was 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



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 |

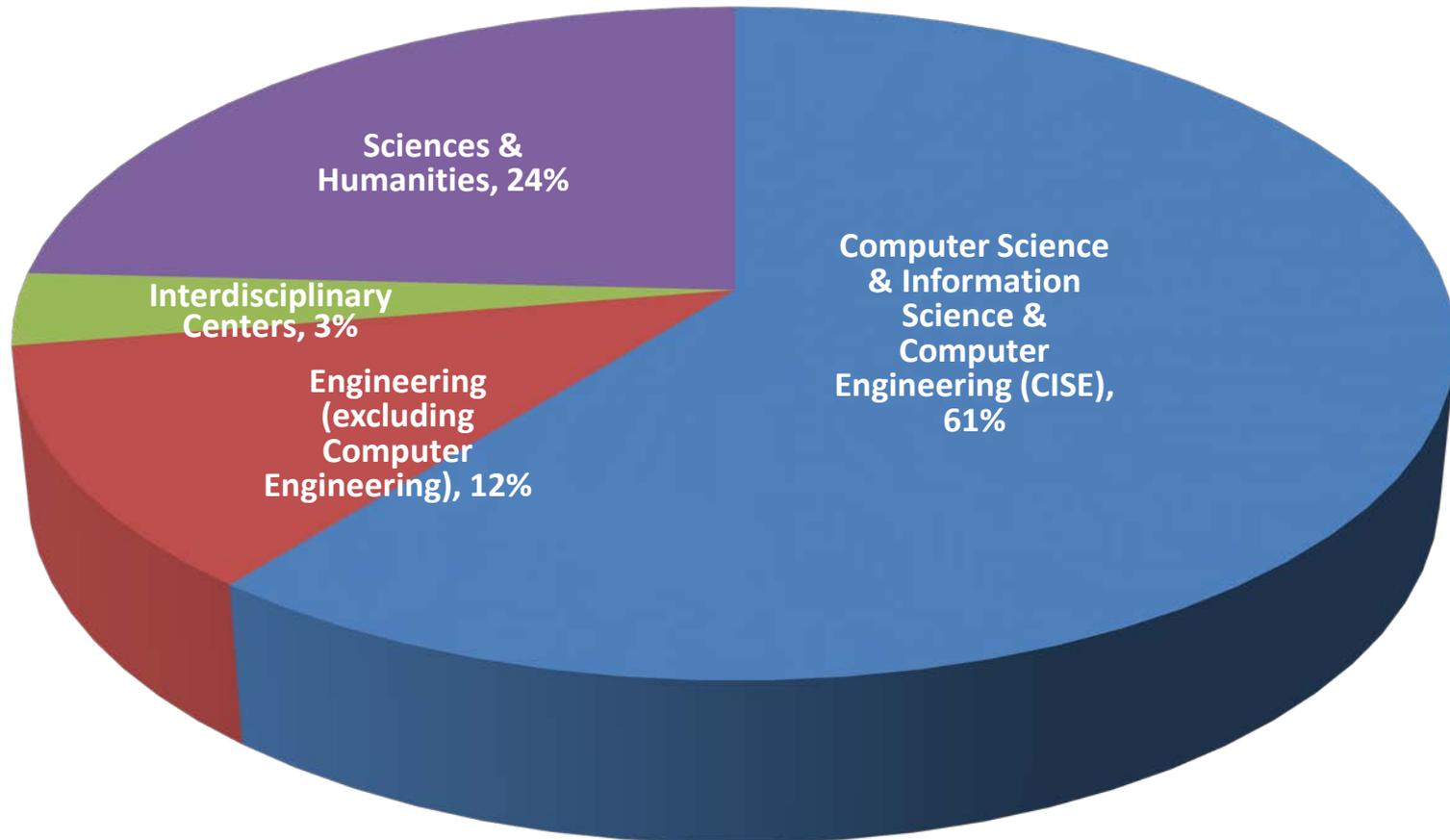


| People Supported | # |
|-------------------------|-------|
| Senior Researchers | 6,663 |
| Other Professionals | 1,123 |
| Postdoctoral Associates | 491 |
| Graduate Students | 6,064 |
| Undergraduate Students | 2,433 |

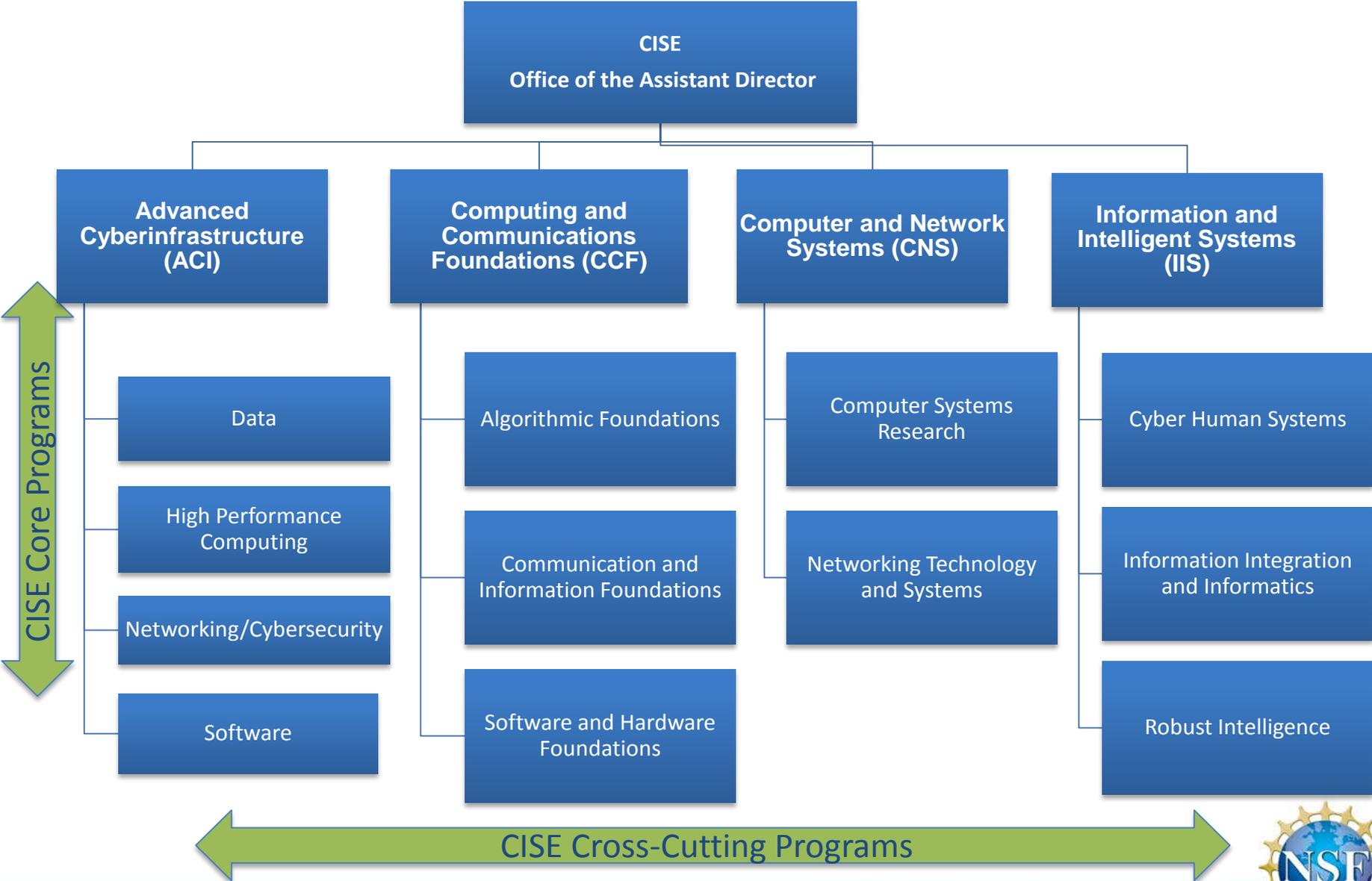


Who is the CISE Community?

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



CISE Organization and Core Research Programs



Advanced Cyberinfrastructure (ACI)

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

ACI Mission: To support advanced cyberinfrastructure to accelerate discovery and innovation across all disciplines

- **ACI supports** use-inspired cyberinfrastructure for research and education across science and engineering, including networking, security, software, data, advanced computing, learning and workforce development
- **ACI coordinates** cyberinfrastructure across NSF
- **ACI is inherently multidisciplinary** with strong ties to all disciplines/directorates, though individual projects may be domain-specific
- **ACI projects can build tools & capabilities for a single institution, multiple institutions, the country, the world**

***Comment.** A new version of a solicitation specifically addressing Campus Cyberinfrastructure (similar to archived solicitation 13-530 CC-NIE, Network Infrastructure and Engineering) is planned to be published soon, with a summer deadline*



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, computational cognition, and related areas.



Applying to Core Programs

- Program Solicitations:
 - CCF: NSF 15-573
 - CNS: NSF 15-572
 - IIS: NSF 15-574
- } 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: September 18-24
 - Medium: September 10-16
 - Small: November 4-18
 - 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



CISE Cross-Division Programs

Cross-division refers to any program managed by more than one division

CISE Research Infrastructure (CRI)

Infrastructure and resources for research exclusively in computer science

- **NSFFutureCloud**

Enabling novel cloud architectures

- **Computing Research Initiation Initiative (CRII)**

Enabling early research independence

- **Algorithms in the Field (AitF)**

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

- **Big Data Regional Innovation Hubs**

Hub and Spoke”– A nation-wide network for data innovation

- **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



CISE Research Infrastructure (CRI)

Infrastructure and resources for research exclusively in computer science

Proposal types:

- **Institutional** Infrastructure: II-NEW, II-EN
- **Community** Infrastructure: CI-P, CI-NEW, CI-EN, CI-SUSTAIN

Solicitation 15-590

- Preliminary proposals obligatory: November 10, 2015; second Tuesday in November, Annually
- Full Proposals: January 20, 2016, third Wednesday in January, Annually
- Awards: CI-P up to \$100K, up to 18 months; CI up to \$2.5 mln; CI-SUSTAIN - \$1 mln up to 3 years



CISE Research Infrastructure: Mid-Scale Infrastructure - NSFFutureCloud

*Enabling novel cloud architectures,
DCL 15-081*

- 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



Computing Research Initiation Initiative (CRII)

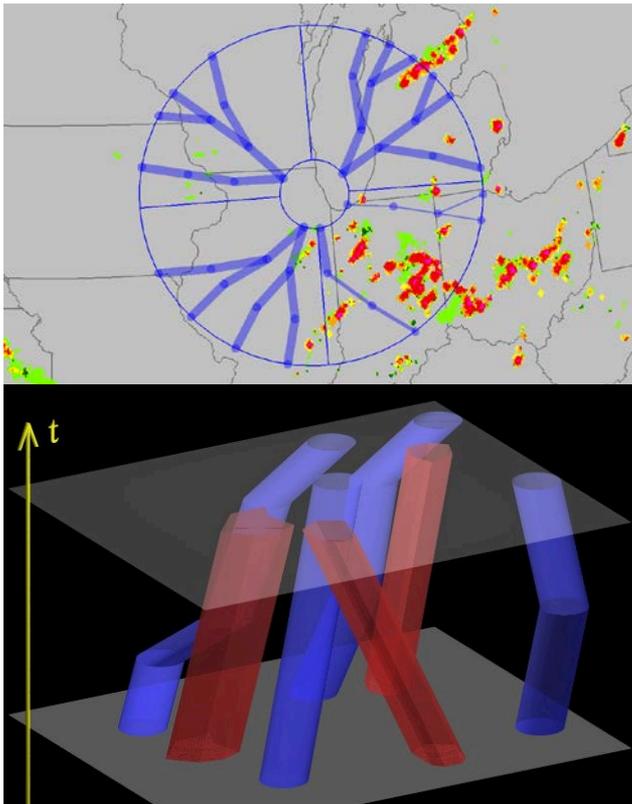
Enabling early research independence

- Aims to contribute to the growth and development of future generations of computer scientists and engineers who will dedicate their careers to advancing CISE research and education.
- Provides the opportunity for individuals who are in their first two years of an 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.
- Solicitation 15-569; Deadline: Last Wednesday in September Annually; pay close attention to the detailed eligibility requirements



Algorithms in the Field (AitF)

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



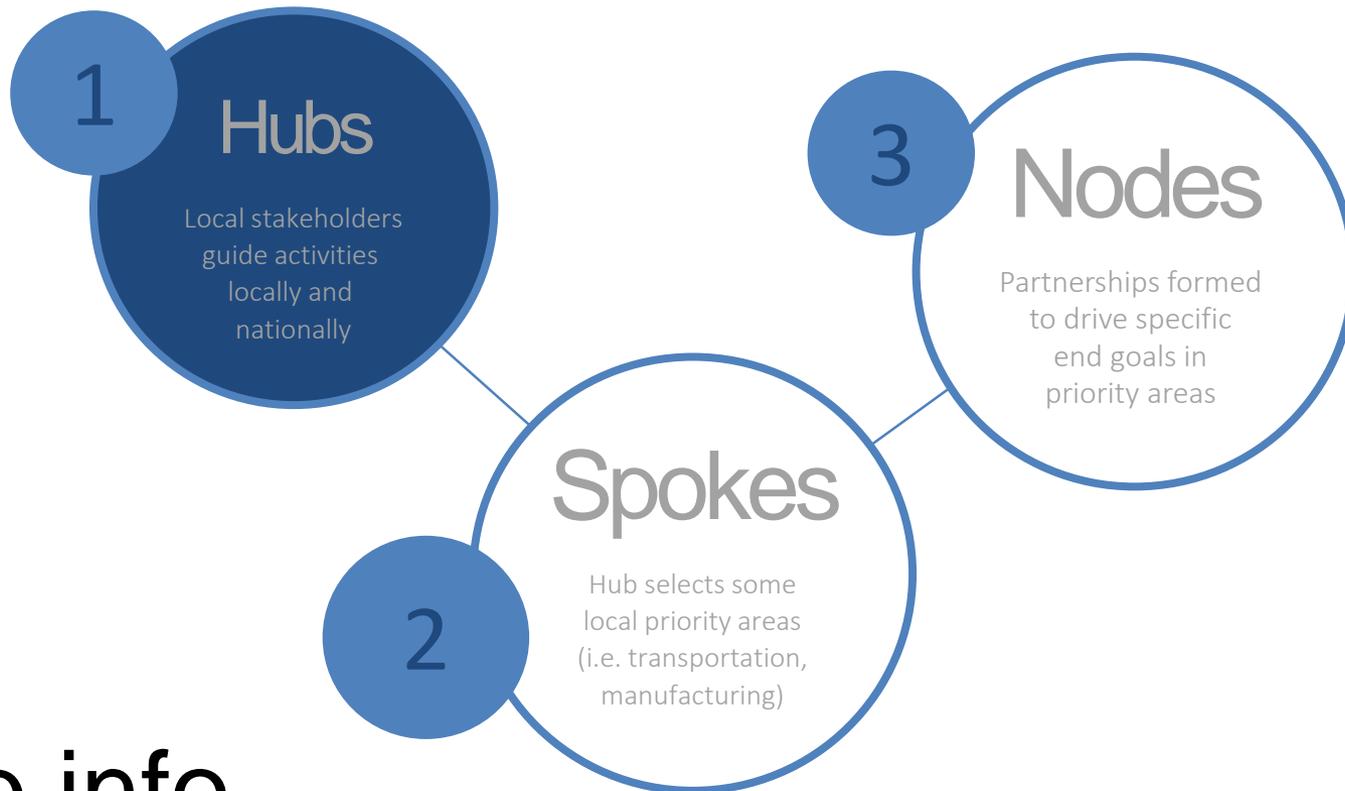
Images courtesy of Joseph Mitchell, SUNY at Stony Brook

- Encourages closer collaboration between theoretical computer science and applied researchers.
- Bridges gap between theory, practice in design, analysis, implementation, evaluation of algorithms.
- Solicitation 16-515
 - Proposals up to \$800,000 for up to 4 years.
 - Deadline February 18 – March 03, 2016



Big Data Regional Innovation Hubs (BD Hubs)

“Hub and Spoke” – A nation-wide network for data innovation; Hubs already awarded; Spokes solicitation 16-510



bdhub.info

a virtual forum for BDHubs



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.

- **Bi-annual solicitation, 14-519**
- **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: 16 awards to date

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

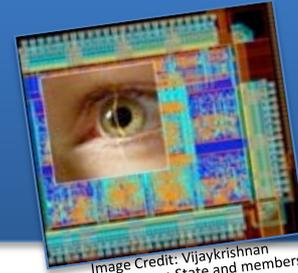


Image Credit: Vijaykrishnan Narayanan, Penn State and members of Visual Cortex on Silicon Team

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)



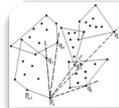
Image Credit: UC San Diego Jacobs School of Engineering



Exploiting Parallelism and Scalability (XPS)

Support groundbreaking research that will lead to a new era of parallel computing, solicitation 16-507

- 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 Cross-Directorate Programs

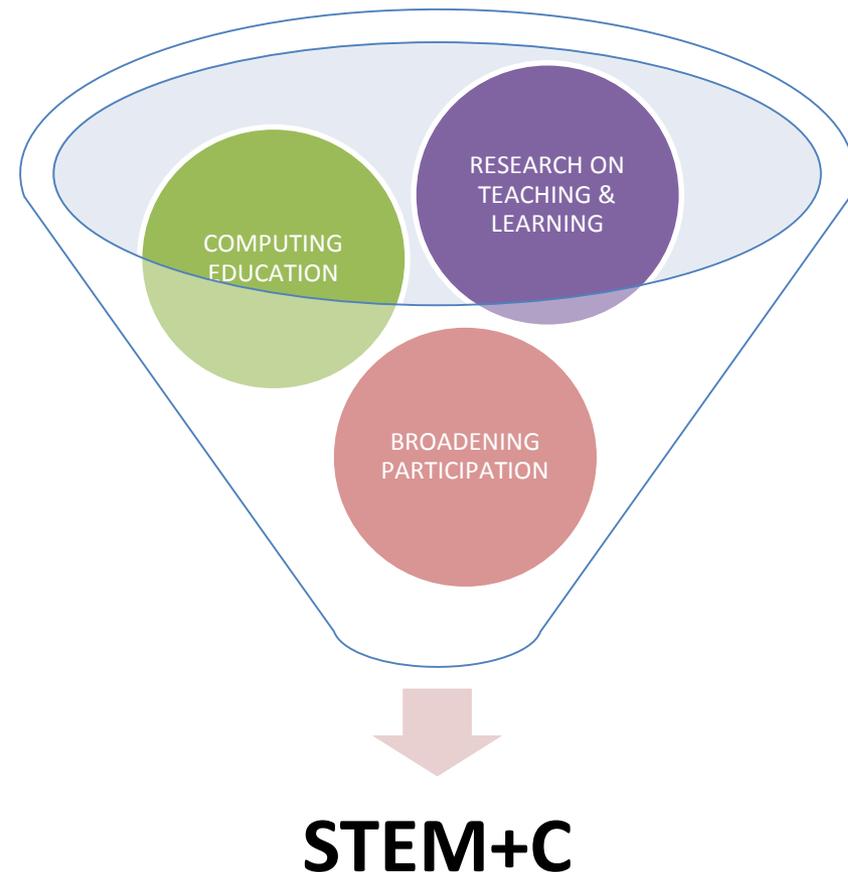
Cross-directorate refers to any program managed by more than one directorate.

- **STEM + Computing (STEM+C) Partnerships**
Integrating computing into STEM
- **Cyberlearning and Future Learning Technologies**
Designing and implementing technologies to aid and understand learning
- **Smart and Connected Communities (SS&CC)**
- **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
- **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
- **Software Infrastructure for Sustained Innovation (SI2)**
- **Designing Materials to Revolutionize and Engineer our Future (DMREF)**



STEM + Computing (STEM+C) Partnerships

Integrating computing into STEM



- Builds capacity in K-12 computing education
- Deep community partnerships
- Transforms the computing education pipeline
- Solicitation 16-527, deadline March 28, 2016
- Jointly managed by CISE and the Directorate for Education and Human Resources
- Two tracks:
 - *Track 1: Integration of Computing in STEM Education*
 - *Track 2: Computing Education Knowledge and Capacity Building*



STEM+C Track 2 Project Types

- **Research on Education and Broadening Participation Projects (EBP):** (up to \$600,000 maximum); duration three years.
 - *Focus on foundational research on the teaching and learning of computing in complex socio-cultural environments. These environments include large urban school districts and learning environments with increasing concentrations of poverty, and both rural and urban isolation*
- **CS 10K (CS10K):** (up to \$1,000,000); duration three years.
 - *CS 10K proposals focus on high school computer science teachers, providing pre-service and in-service teachers with courses, professional development opportunities, and long-term, ongoing support.*

Comment: *some community colleges might be interested in offering CS Principles course which could be a good general education course for many community college students and a good dual credit course for high school students. Please contact Dr. Janice Cuny, jcuny@nsf.gov if interested.*



Cyberlearning and Future Learning Technologies

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

- **Advancing the frontiers of learning** by developing and studying new categories of technologies for learning
- **Learning** in any discipline or area by any demographics
- **Multidisciplinary proposal teams:** technology researchers and learning researchers
- **Solicitation 14-526;** four types of awards: CAP, EXP, DIP, INT

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



Smart and Connected Communities

The White House
Office of the Press Secretary



For Immediate Release

September 14, 2015

FACT SHEET: Administration Announces New “Smart Cities” Initiative to Help Communities Tackle Local Challenges and Improve City Services

“Every community is different, with different needs and different approaches. But communities that are making the most progress on these issues have some things in common. They don’t look for a single silver bullet; instead they bring together local government and nonprofits and businesses and teachers and parents around a shared goal.” – **President Barack Obama**

“The National Science Foundation (NSF) has announced over \$35 million in Smart Cities-related grants and planning new investments in FY16... [to] bring academic researchers and community stakeholders together.

Health and wellness, energy efficiency, building automation, transportation, and public safety — research to integrate new digital tools and engineering solutions into the physical world.”

**DCL 15-120 : supplements to existing awards, EAGERs
Deadline March 1, 2016
CISE,EHR,ENG,GEO,SBE**



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 critical resilient interdependent infrastructures (e.g. power stations – fuel delivery – transportation)
- Award types:
 - Type 1 Awards: up to \$500,000 over 2 years.
 - Type 2 Awards: \$1 million to \$2.5 million over 3-4 years.
- Solicitation 16-519



Critical Techniques, Technologies, and Methodologies 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).
- Solicitation 16-512; awards: up to \$500K per year for up to 4 years, minimum \$400K

Cross-Directorate Solicitation: CISE, BIO, GEO, MPS, EHR, ENG, SBE



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

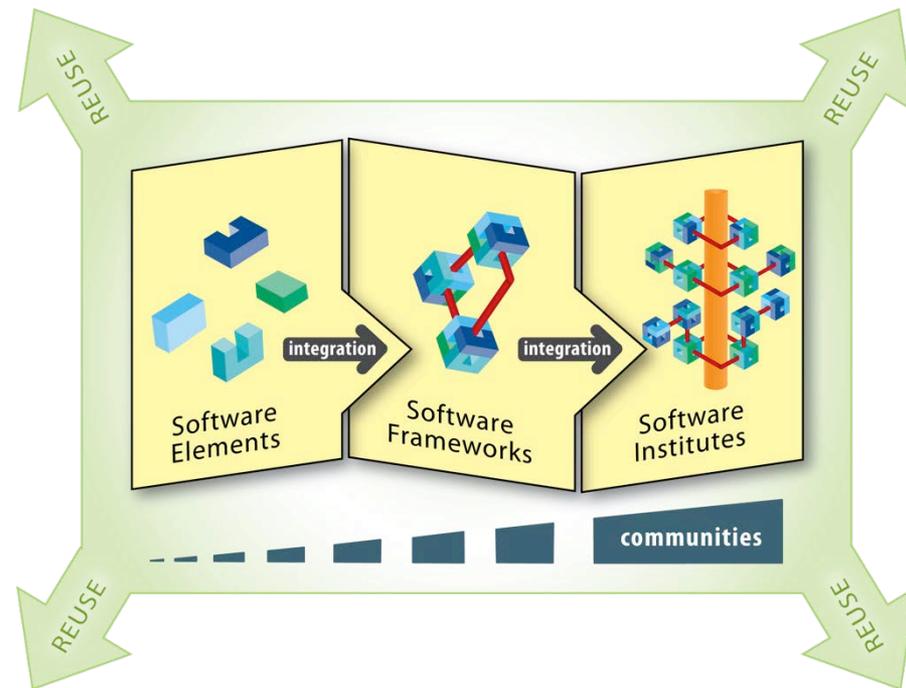
- Aims to strengthen U.S. leadership in the global wireless technology marketplace.
- Support for research in wireless communication, spectrum sharing, and mobile computing, as well as development of wireless and spectrum testbeds.
- Advance spectrum sensing techniques, explore machine learning and game theory for dynamic spectrum management, and understand incentive mechanisms.
- Former solicitation 15-550, the new one with substantial changes is upcoming with expected submission deadline in mid-April

Cross-Directorate Solicitation: CISE, ENG, and MPS



Software Infrastructure for Sustained Innovation (SI2) Program

- Aims to catalyze and nurture the interdisciplinary processes required to support the entire software lifecycle, resulting in sustainable community software elements and reusable components
- Addresses software in all aspects of cyberinfrastructure, from embedded sensor systems and instruments, to desktops and high-end data and computing systems, to major instruments and facilities
- Solicitation 15-553 S2I2 focused on **institutes**; conceptualization proposals accepted anytime; new solicitation is coming soon
- Awards at 3 levels from **elements** to **integration** to **institutes**



Cross-Directorate Solicitation: CISE/ACI, BIO, EHR, ENG, GEO, 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.
- **Solicitation 15-575:** 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
 - Transition to Practice
- Separate track for Cybersecurity Education

| Project type | Submission window | Award size |
|-------------------------|--------------------------|---|
| Small | November 4-18 annually | up to \$500,000 Up to 3 years |
| Medium | September 10-16 annually | \$500,001 to \$1,200,000 Up to 4 years |
| Large | September 18-24 annually | \$1,200,001 to \$3,000,000 Up to 5 years |
| Cybersecurity Education | December 3-16 annually | Up to \$300,000 Up to 2 years |



Designing Materials to Revolutionize and Engineer Our Future (DMREF) and Engineer NSF Solicitation 15-608 as part of Materials Genome Initiative



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

Participating directorates : ENG, CISE, MPS

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



CISE Cross-Agency Programs and Initiatives

Cross-agency refers to any program managed by more than one government agency

- BRAIN

Improving understanding of the brain

- Collaborative Research in Computational Neuroscience (CRCNS)

- 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

- Cyber-Physical Systems

Deeply integrating computation, communication, and control into physical systems



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/



Collaborative Research in Computational Neuroscience

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

- Computational neuroscience, inclusively defined encompassing many approaches and goals; related to biological processes; disease and normal function; theory, modeling, and analysis; implications for biological and engineered systems
- ***Innovative, collaborative, and interdisciplinary*** to make significant advances on important hard problems, and to develop new research capabilities

The program considers **Research Proposals** describing collaborative projects that bring together complementary expertise on interdisciplinary challenges; and **Data Sharing Proposals** to support preparation and deployment of data and other resources, in a manner that responds to the needs of a broad community.

Opportunities for ***parallel international funding*** (Germany, France, Israel).

Solicitation 15-595; upcoming solicitation expected to be similar

Participating agencies: NSF, NIH, ANR, BMBF, BSF



Integrative Strategies for Understanding Neural and Cognitive Systems

<http://www.nsf.gov/ncs/> (CISE, EHR, ENG, SBE)

Solicitation 16-508

Emphasis on *transformative, integrative approaches* to tackle previously intractable challenges. Integrative themes represent emerging foci where novel integrative strategies are expected to have significant impact:

*Neuroengineering
and Brain-Inspired
Concepts and
Designs*

*Individuality
and
Variation*

*Data-Intensive
Neuroscience and
Cognitive Science*

*Cognitive and
Neural Processes in
Realistic, Complex
Environments*

INTEGRATIVE FOUNDATIONS (500K-1M, 2-4 years); **CORE+ SUPPLEMENTS** (CISE, EHR, ENG) to connect new or existing projects to neural and cognitive systems

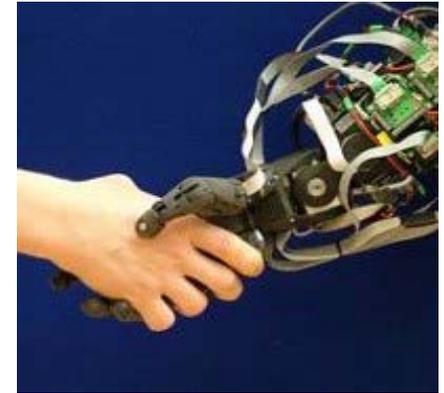
Questions? e-mail NCS@nsf.gov



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.
- **Solicitation 16-517**, deadlines March 7, 2016; January 12, 2017



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

Participating agencies: NSF, DOD, NASA, NIH, DOE, USDA



Smart & Connected Health (SCH)

Transforming health 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.
- Solicitation 13-543; EXP-October 10, INT-December 10 annually

Project Types:

- **Type I: Exploratory**
Up to \$250,000 / year
for 1-3 years
- **Type II: Integrative**
Up to \$500,000 / year
for up to 4 years

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

Participating agencies: NSF and NIH



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.

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

Participating directorates: CISE and ENG, solicitation 15-541, an updated solicitation is upcoming in 2016

Participating agencies: NSF, DHS, DoT, NASA, and NIH



NSF-wide Opportunities for the CISE Community

- Faculty Early Career Development (CAREER)
- National Research Traineeships (NRT)
- Graduate Research Fellowships (GRFP)
- Research Experiences for Undergraduates/Veterans/Teachers (REU/ VRS/ RET)
- Others...

For a comprehensive list of NSF funding opportunities, visit:

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



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.
- Awards: up to \$3M over 5 years.
- *No longer accepting proposals.*

NSF-wide Initiative



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

CISE CAREER Proposal Writing Workshops

- Generally held each Spring
- 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, but not strictly necessary
 - 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/>



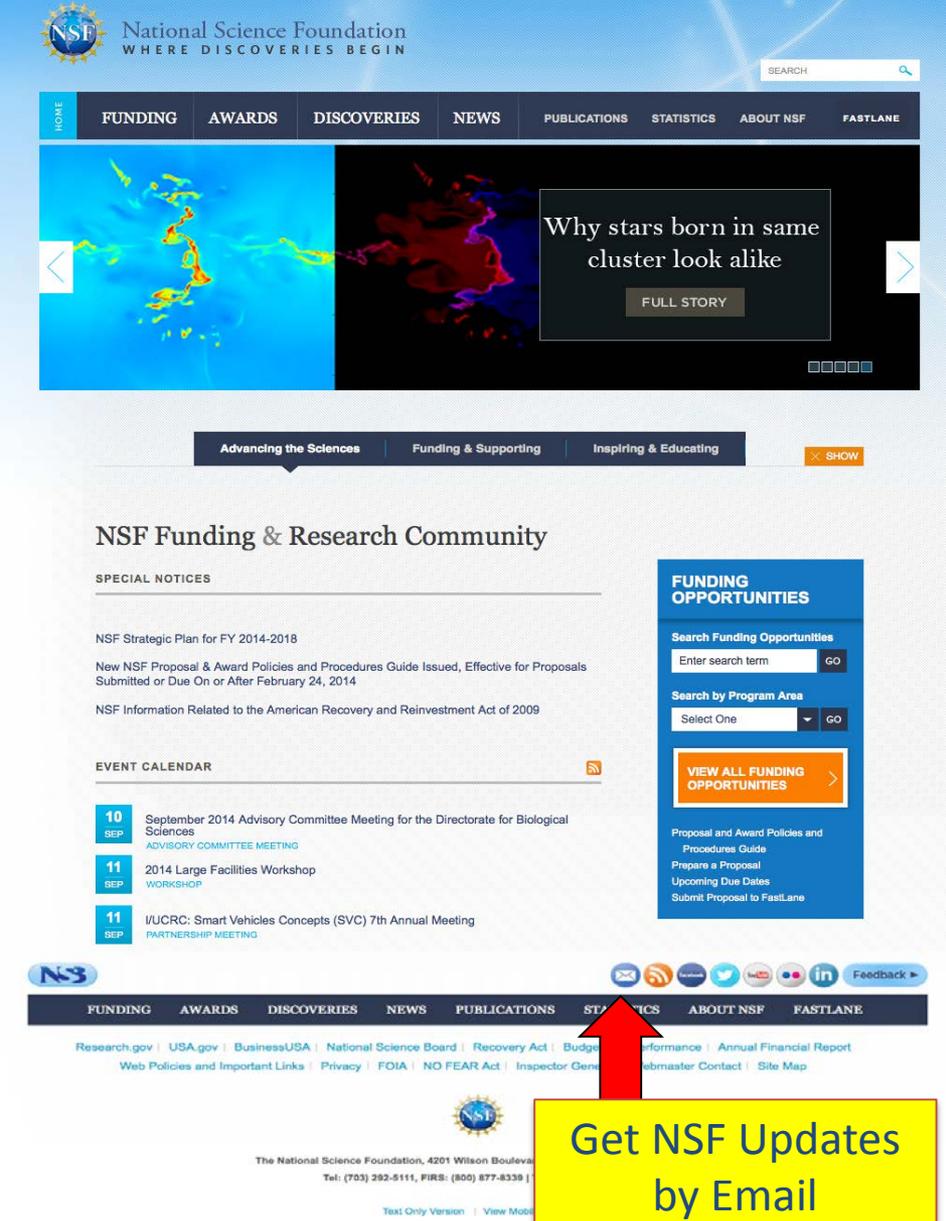
Commitment to Research and Education in CISE

- 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 menu with links for HOME, 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 image of a star cluster with a text overlay that reads "Why stars born in same cluster look alike" and a "FULL STORY" button. Below this, there are three tabs: "Advancing the Sciences", "Funding & Supporting", and "Inspiring & Educating". The "Funding & Supporting" tab is active, showing the "NSF Funding & Research Community" section. This section includes "SPECIAL NOTICES" with links to the NSF Strategic Plan for FY 2014-2018, New NSF Proposal & Award Policies and Procedures Guide, and NSF Information Related to the American Recovery and Reinvestment Act of 2009. It also features an "EVENT CALENDAR" with three events: a September 10th meeting for the Directorate for Biological Sciences, a September 11th Large Facilities Workshop, and a September 11th IUCRC Smart Vehicles Concepts (SVC) 7th Annual Meeting. On the right side, there is a "FUNDING OPPORTUNITIES" sidebar with a search box, a "Search by Program Area" dropdown, 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 "STATISTICS" link in the navigation menu, and a yellow box with the text "Get NSF Updates by Email" is overlaid on the bottom right corner.

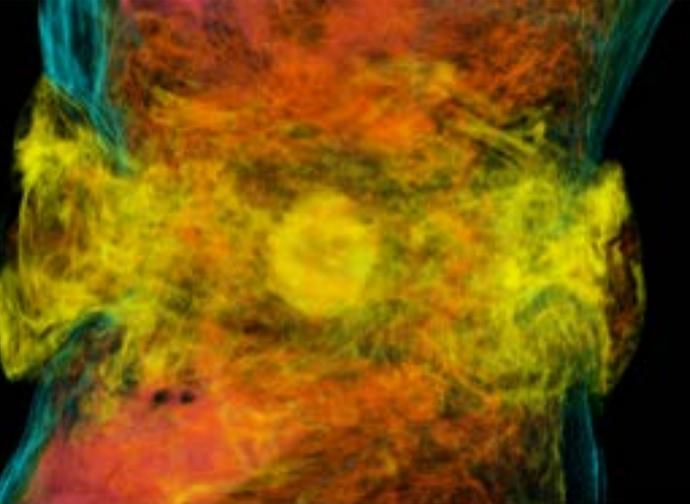
Get Involved

- 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.



Thanks!

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