

# **Fostering Young Researchers and Technology Transfer in ICT: Case Study in Smart and Connected Communities**

**JST-NSF International Joint Symposium  
Challenge for the Future – The Frontier of Diverse AI Research**

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National Science Foundation



# US National Science Foundation

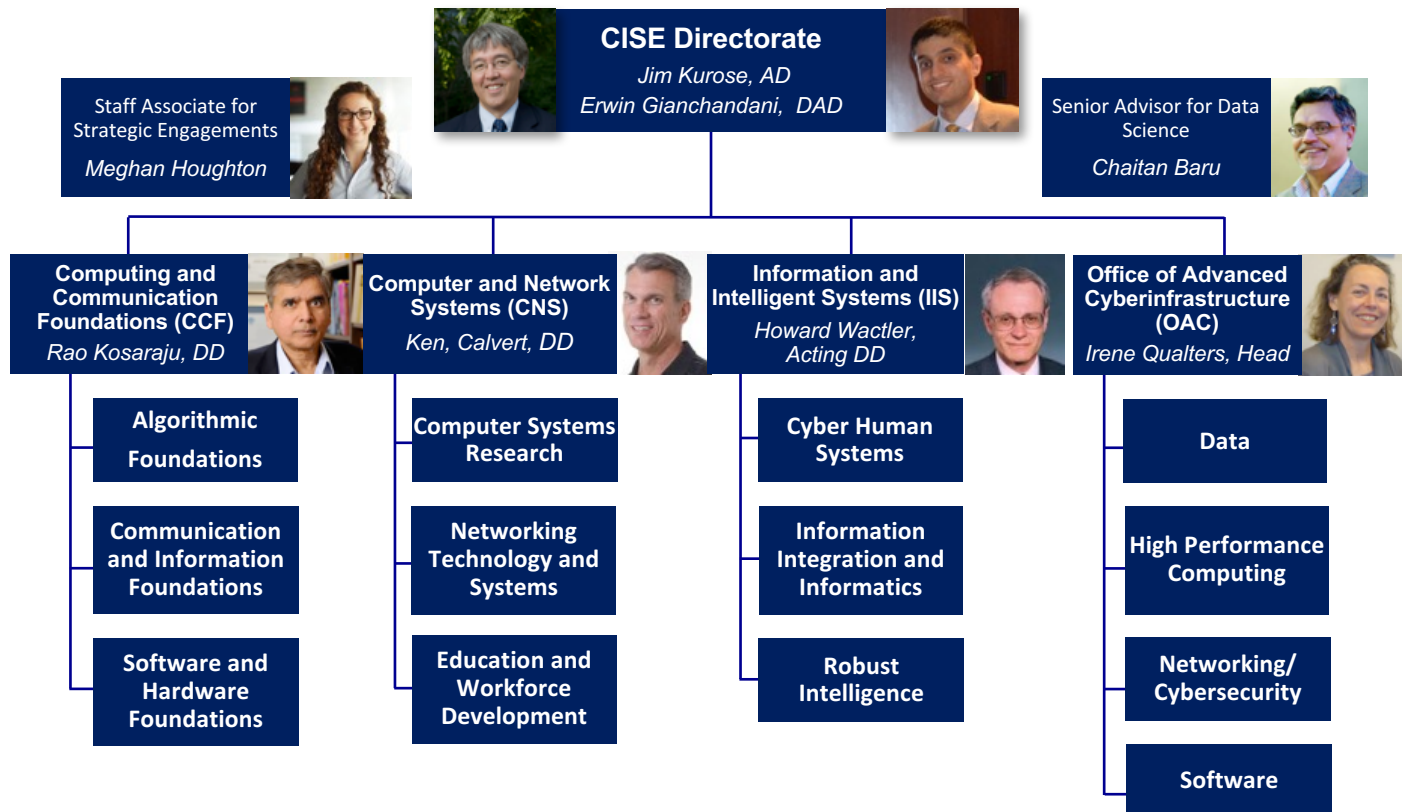
*The NSF Act of 1950: “To promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense...”*



# Overview

- Fostering CS Education and Promoting Young Researchers
- Technology Transfer and Industry Collaboration
- NSF's Smart and Connected Communities Program

# CISE Organization



# Accelerating Access to Computer Science in K-12 Classrooms: Advanced Placement® Computer Science Principles Course

- 8 years of NSF-funded development and piloting involving 100s of teachers and university faculty.
- First official AP® courses ran in 2016-17.
- Emphasis on the interests of students and applications for computer science.
- **Largest launch of an AP® course with 2,700 teachers & 51,000 test takers.**
- CSP improved on diversity over the existing AP CS exam with women, African Americans, and Hispanic students.

	CSP 2017	CSA 2017	CSA 2016
<b>Demographics</b>			
American Indian or Alaska Native	<1%	<1%	<1%
Asian (including Indian subcontinent and Philippines origin)	22%	34%	29%
Black or African American	7%	4%	4%
Hispanic or Latino (including Spanish origin)	19%	11%	12%
Native Hawaiian or Other Pacific Islander	<1%	<1%	<1%
No response	2%	2%	2%
Other	<1%	<1%	-
Two or more races, non- Hispanic	4%	4%	-
White (including Middle Eastern origin)	45%	45%	49%
Female	30%	24%	23%
Male	70%	76%	77%



# Graduate and Undergraduate Programs

## Graduate Research Fellowship Program

- To recognize and support individuals who have demonstrated the potential to be high achieving scientists and engineers, early in their careers.
- To broaden participation in science and engineering of underrepresented groups.

## Up to Five Year Award – \$138,000

- Three years of support
  - \$34,000 Stipend per year
  - \$12,000 Educational allowance



## Research Experiences for Undergraduates REU Sites

- Typically in summer; 8-10 students in a cohort environment.

## REU Supplements

- Support for 1-2 students to work on existing project.

Provides students with a research experience and a stipend.



# CISE Supports Early-Career Faculty through Multiple Mechanisms



## Faculty Early Career Development (CAREER) Program

*Integrating research and education efforts*

*One of NSF's most prestigious awards for faculty beginning their independent careers who exemplify the role of teacher-scholars.*

## CISE Research Initiation Initiative (CRII)

*Jumpstarting research independence*

*Open to faculty in first two years of an independent academic position to recruit and mentor undergraduate and graduate students, enabling a subsequent stream of discoveries and innovations. First awards in FY15.*



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

*Strengthening research and education activities through community*

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



# **NSF Programs Facilitate Academia-Industry Partnerships**

## **Driving Technology Transfer and Capacity Building**

- **Industry/University Cooperative Research Centers Program (IUCRC)**
  - Centers focused on specific research area provide a funding and IP framework
- **Grant Opportunities for Academic Liaison with Industry (GOALI)**
  - Faculty and student exchanges in industry setting, or vice-versa
- **Innovations Transitions (InTrans)**
  - Co-funding mechanism to transition successful, large-scale projects to industry support
- **Small Business Innovation Research (SBIR)**
  - Grants to support domestic small businesses to engage in R&D that has the potential for commercialization.





# NSF Innovation Corps (I-Corps™)

- Extends beyond technology transfer: **"Prepare scientists and engineers to expand their focus beyond the laboratory, into entrepreneurship and commercialization..."**
- Based on "Lean Startup" Curriculum, by Steve Blank
- Three award programs:
  - Nodes (NSF 17-533): Develop and teach standard curriculum
- 7-week intensive course focused on **customer discovery**
  - 8 Nodes around the country
  - Sites (NSF 16-547): Identify and develop teams
    - 80+ Sites around the country
  - Teams (NSF 17-559): Funded to attend the course
    - Team = PI + Tech Lead + Entrepreneurial Lead



# Direct Partnership Industry Partners:

## CISE and Intel Partnership

### Joint Solicitations:

- Cyber-Physical Systems Security and Privacy (CPS-Security)
- Visual and Experiential Computing (VEC)
- Computer-Assisted Programming for Heterogeneous Architectures (CAPA)
- Information-Centric Networking in Wireless Edge Networks (ICN-WEN)
- Foundational Microarchitecture Research (FoMR)



Image Credit: CCC and SIGACT EATCS



Image Credit: NSF

### Typical model for each joint solicitation:

Total investments: \$6-8 million total

Funding ratio: 1:1 NSF:Intel

Awards: ~2-6 awards, \$500,000-\$3 million used over 3 years





# PAWR: Platforms for Advanced Wireless Research

- \$100M public-private investment for up to four city-scale testing platforms to accelerate fundamental wireless research that goes beyond 5G
  - \$50M NSF/CISE investment over 7 years
  - **\$50M cash and in-kind industry consortium investment ~30 companies: networking vendors, device manufacturers, and wireless carriers**
- To enable high-speed, high-capacity connectivity that underlies smart city solutions, including vehicle-to-vehicle and vehicle-to-infrastructure communication and disaster preparedness and response



# **The U.S. Smart and Connected Communities Landscape**

# Smart and Connected Communities

Activities Across the Federal Government Gain Momentum in 2015

## Smart Cities and Communities Task Force (SCC)

Smart Cities and Communities  
Federal Strategic Plan:  
Exploring Innovation Together

National Science and Technology Council

Networking and Information Technology Research and  
Development Subcommittee

Smart Cities and Communities Task Force

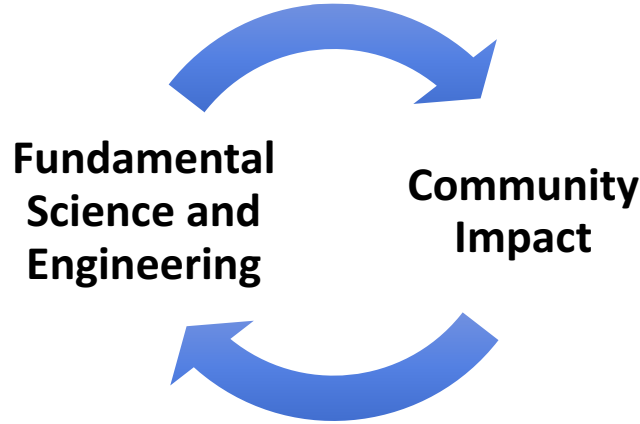


Coordination efforts began in June 2016



# Smart and Connected Communities (S&CC) Program

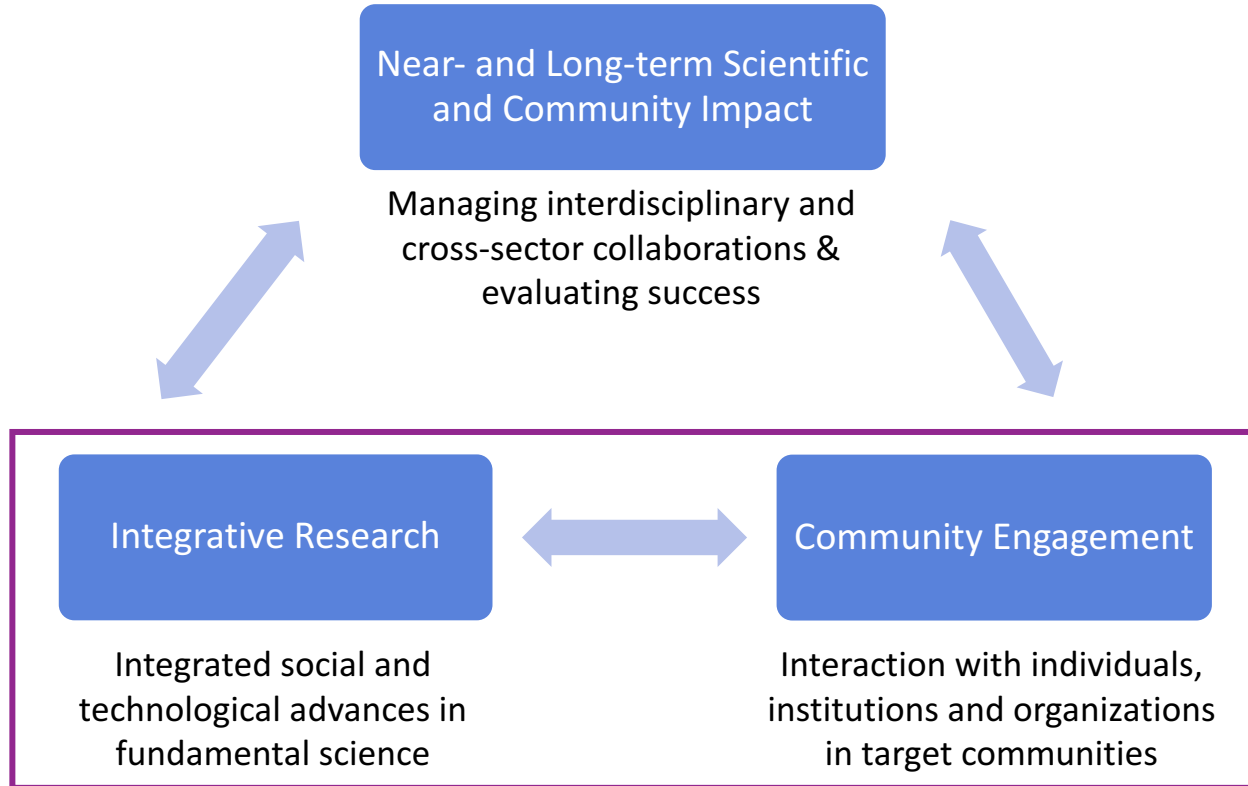
\$19.5M in FY 2017 and \$20.5M planned in FY 2018



- What are the fundamental science and engineering **research questions** that must be addressed within and **across disciplines**, for **community impact**?
- How do partnerships enable **piloting, testing, and future research** in communities to improve community functioning and quality of life?

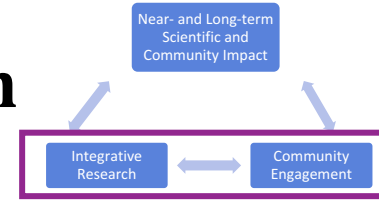


# S&CC Program: Conceptual Framework





# Successful Dimensions of S&CC Research



- Interdisciplinary Research that Advances Fundamental Science:  
*Research that integrates and advances social, behavioral, and economic sciences, policy and implementation, and technical disciplines*
- Community Engagement with Iteration and Piloting:  
*Research questions inspired by community needs and iterative cycle of conducting research, and piloting and improving the innovations in the community*
- Team and Project Management and Evaluation of Impact:  
*Management across disciplines, institutions, and community partners, demonstrating a shared vision, and evaluate success in near and long-term through a range of methods.*
- Diversity of Communities:  
*Inclusivity of all types of geographic communities (e.g., rural, tribal, urban, suburban), including a range of populations sizes.*



# NSF/CISE – Japan Science and Technology Agency Collaboration History

- Researcher exchanges at NSF- and JST-Sponsored PI Meetings
- JST-NSF International Joint Symposium on Big Data, AI, IoT and Cybersecurity for a New Society, 2016, Tokyo, Japan
- US-Japan Workshop Enabling Global Collaborations in Big Data Research, 2017, Atlanta, GA, US
- Joint Research Solicitations
  - NSF-JST: US-Japan Big Data and Disaster Research (BDD)
- NSF and JST support for travel to build partnerships based on existing grants
- JST-NSF International Joint Symposium: Challenges for the Future – The Frontier of Diverse AI Research

# Summary

1. NSF's CISE Directorate is committed to K-12 education, undergraduate and graduate students, and early career researchers.
2. Technology transfer is an important component of NSF's portfolio and is supported through a number of mechanisms.
3. NSF's Smart and Connected Communities program is focused on fundamental science and engineering research, with strong socio-technical dimensions and community engagement. Fostering young researchers and technology transfer are both important to its success.
4. Partnerships are key to the success and impact of NSF/CISE research, including with JST, and we look forward to the progress of the ongoing collaborations.

# Questions?



# Thank you!

For more information on S&CC, please visit [NSF.gov/SCC](https://www.nsf.gov/SCC)  
[mehought@nsf.gov](mailto:mehought@nsf.gov)

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