Expeditions in Computing
PI Meeting

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CISE Directorate
National Science Foundation

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Image Credit: Exploratorium.
Pervasive Impact

- CISE is at the center of an ongoing societal transformation and will be for decades to come.
- Advances in computing, communications and information technologies:
  - underpin our economic prosperity and national security;
  - are key drivers of U.S. competitiveness and sustainable economic growth in an increasingly global market;
  - accelerate the pace of discovery and innovation in nearly all other fields of inquiry; and
  - are crucial to achieving our national and societal priorities.
“Recent technological and societal trends place the further advancement and application of networking and information technology squarely at the center of our Nation’s ability to achieve essentially all of our priorities and to address essentially all of our challenges.”

CISE and National Priorities

- Broadband & Universal Connectivity
- Environment & Sustainability
- Emergency Response & Disaster Resiliency
- Health & Wellbeing
- Manufacturing, Robotics, & Smart Systems
- Secure Cyberspace
- Transportation & Energy
- Education and Workforce Development

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Who is the CISE community?

PI and Co-PI Departments for FY 2012 Awarded by NSF CISE

- Computer Science & Information Science & Computer Engineering (CISE), 60%
- Engineering (excluding Computer Engineering), 12%
- Interdisciplinary Centers, 4%
- Sciences & Humanities, 24%

PI and Co-PI Departments for FY 2012 Awarded by NSF CISE
### Snapshot of CISE FY 2012 Activities

<table>
<thead>
<tr>
<th>Category</th>
<th>CISE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research Budget</td>
<td>$865M</td>
</tr>
<tr>
<td>Number of Proposals</td>
<td>7,695</td>
</tr>
<tr>
<td>Number of Awards</td>
<td>1,741</td>
</tr>
<tr>
<td>Success Rate</td>
<td>~22%</td>
</tr>
<tr>
<td>Average Annualized Award Size</td>
<td>$200K</td>
</tr>
<tr>
<td>Number of Panels Held</td>
<td>316</td>
</tr>
<tr>
<td>Number of People Supported</td>
<td>18,460</td>
</tr>
</tbody>
</table>

**Support Details:**

<table>
<thead>
<tr>
<th>Category</th>
<th>CISE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Senior Researchers</td>
<td>8,417</td>
</tr>
<tr>
<td>Other Professionals</td>
<td>943</td>
</tr>
<tr>
<td>Postdoctoral Associates</td>
<td>371</td>
</tr>
<tr>
<td>Graduate Students</td>
<td>6,131</td>
</tr>
<tr>
<td>Undergraduate Students</td>
<td>2,513</td>
</tr>
</tbody>
</table>
Budget Process Brief Overview

Community Input
- Societies and Academies
- CCC and CRA visioning activities
  - CSTB Studies
- CISE Advisory Committee and Industry
- Workshops and direct engagement of PIs

Internal Deliberation and Negotiation
- within directorate
- cross-foundation
- cross-agency

Administration Priorities
- Office of Science and Technology Policy (OSTP)
- Office of Management and Budget (OMB)
Budget Process (Brief) Overview
FY 2014 Budget Request

- **NSF**
  - FY 2014 Budget Request -- $7,625.78M
  - Increase over FY 2012 Enacted -- $592.69M or 8.4%

- **CISE**
  - FY 2014 Budget Request -- $950.25M
    - Increase over FY 2012 Enacted -- $85.02M or 9.8%

- CISE FY 2014 request is shaped by investments in core research, education, and infrastructure programs as well as investments in NSF cross-foundation priorities and programs
Emerging Frontiers

Data Explosion

Smart Systems: Sensing, Analysis and Decision

Expanding the Limits of Computation

Secure Cyberspace

Universal Connectivity

Augmenting Human Capabilities
New Programs and Initiatives

- Big Data Initiative (NSF 12-499)
- Exploiting Parallelism and Scalability, XPS (NSF 13-507)
- CyberSEES (NSF 13-500)
- Hazards SEES (NSF 12-610)
- Campus Cyberinfrastructure – Network Infrastructure and Engineering Program, CCNIE (NSF 13-530) – 2nd year
- Failure-Resistant Systems, jointly with SRC (NSF 12-566)
- US Ignite
- Data Infrastructure Building Blocks (12-557)
- US-Finland Wireless Innovation
- United States-Israel Collaboration in Computer Science, USICCS (NSF 12-603)
- Future Internet Architectures – Next Phase, FIA-NP (NSF 13-538)
- Computing Education for the 21st Century, CE21 (NSF 12-609)
- National Robotics Initiative, NRI (NSF 12-607) – 2nd year
- Secure and Trustworthy Cyberspace, SaTC (NSF 12-596) – 2nd year
- CISE-MPS Interdisciplinary Faculty Program in Quantum Information Science (NSF 12-540)
Exploitations in Computing

• CISE’s largest, long-term research investments → up to $10 million over five years

• Promotes bold, ambitious, transformative research that promises to help define the future of computing

• Drives far-reaching research motivated by deep scientific questions
Expeditions in Computing

14 awards made so far (each award is for 5 years, $2M/year)

<table>
<thead>
<tr>
<th>Year</th>
<th>Awards</th>
<th>Pre-projects</th>
<th>PI, Co-PI &amp; SP</th>
<th>Institutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>4</td>
<td>75</td>
<td>1000</td>
<td>166</td>
</tr>
<tr>
<td>2009</td>
<td>3</td>
<td>48</td>
<td>650</td>
<td>161</td>
</tr>
<tr>
<td>2010</td>
<td>3</td>
<td>23</td>
<td>232</td>
<td>76</td>
</tr>
<tr>
<td>2012</td>
<td>4</td>
<td>36</td>
<td>328</td>
<td>69</td>
</tr>
</tbody>
</table>
### Expeditions in Computing

#### Beyond Moore’s Law
- **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

#### Wireless & Internet

#### Healthcare & Wellbeing
- **Socially Assistive Robots**, Yale, USC, MIT, Stanford, Willow Garage, 2011

#### Robotics
- **An Expedition in Computing for Compiling Printable Programmable Machines**, MIT, UPenn, Harvard, 2011

#### Limits of Computation
- **Understanding, Coping with, and Benefiting from Intractability**, Princeton, Rutgers, NYU, Institute for Advanced Study, 2008

#### Formal Modeling and Verification
- **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
- **Expeditions in Computer Augmented Program Engineering**, UPenn, UC Berkeley, UMD, Rice, Cornell, U of Michigan, U of Illinois-UC, UCLA, MIT, 2011

#### 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
The Future of the Expeditions Program: Roundtable Discussion Topics

1. CISE portfolio balance – small, medium, and large-scale awards

1. Project collaboration and coordination – incentives and best practices

2. Project self-assessment – what works and what doesn’t

3. Program assessment – ideas for improvement in NSF oversight

4. Life after Expeditions – follow-on programs and funding mechanisms
We need your help!

Nurture and Support a Culture of Engagement and Service
- Help shape the future directions of the field, priorities for the nation, and formulate a research and education agenda to address societal challenges.

Embrace a Collaborative Culture Enabled by Foundational Research
- Advances in CISE are pushed by long-term investment in foundational research and cross- and inter-disciplinary research and pulled by expanding complexity, scope, and scale of global priorities.

Educate and Empower the Next Generation
- Lead a cyber- and technology-enabled transformation in education and learning to develop the next generation IT workforce and contribute to universal, transparent, and affordable participation in a knowledge-based society.
The Growing Imperative of Research and Education in Computing

• Our investments in research and education have returned exceptional dividends to our nation.

• A thriving basic research community is the foundation for long-term discovery and innovation, economic prosperity, and national security.

• 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!

• To keep those benefits flowing, we need to constantly replenish the wellspring of new ideas and train new talent.
Thanks!

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