

# **Opportunities in NSF's Directorate for Computer and Information Science & Engineering (CISE)**

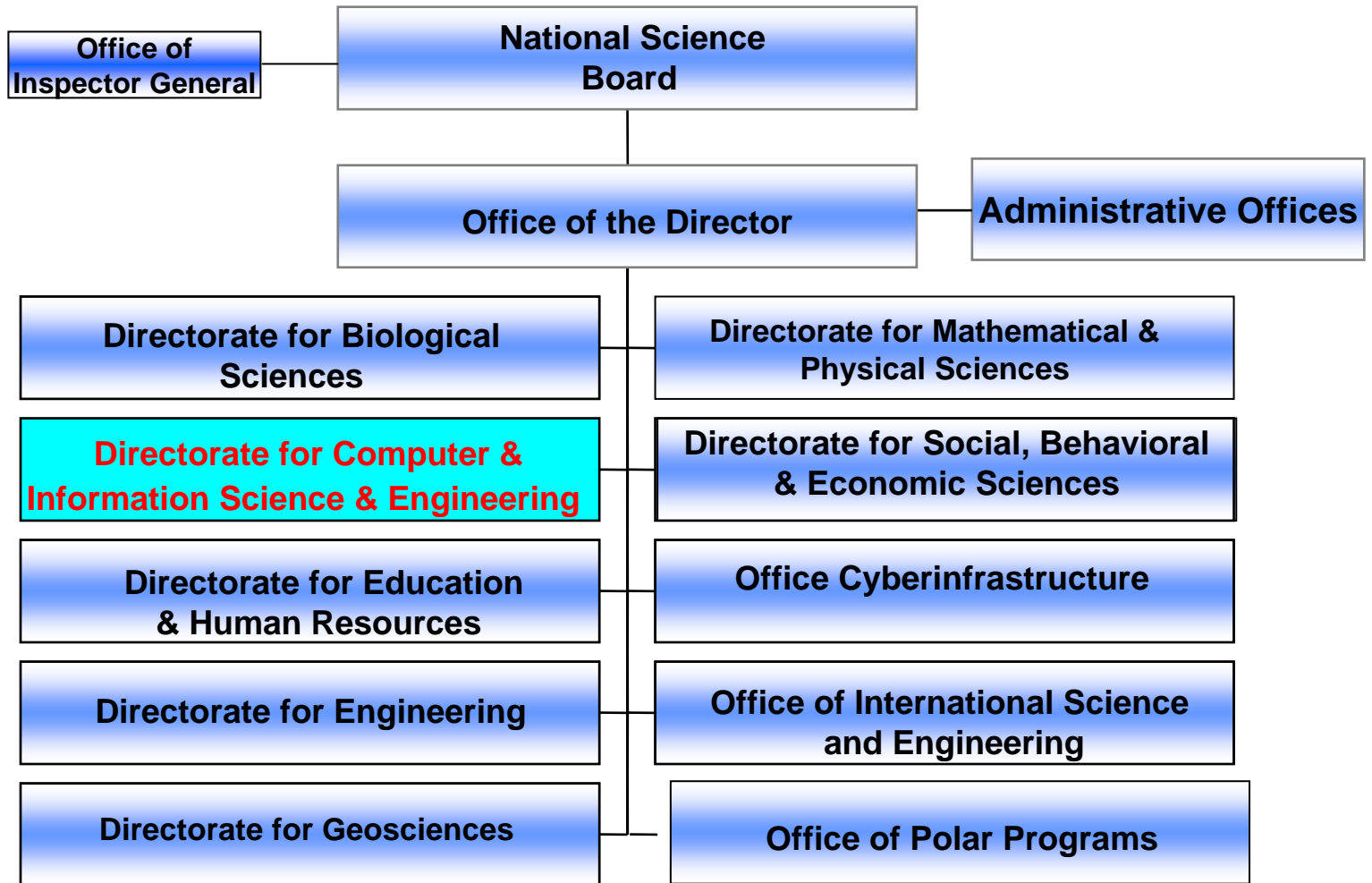
***Douglas H. Fisher***  
**Program Director**  
**National Science Foundation**  
**[dfisher@nsf.gov](mailto:dfisher@nsf.gov)**



# Outline

- **Overview of NSF and CISE**
  - Mission, Organization, Budgets, Funding
- **CCF Division**
  - Research Areas & Topics of Interest
- **CNS Division**
  - Research Areas & Topics of Interest
- **IIS Division**
  - Research Areas & Topics of Interest
- **Funding Opportunities across CISE & NSF**
  - CISE Cross-Division Programs
  - NSF Cross-Directorate Programs
- **Resources at Your Disposal**
- **Closing Remarks and Q&A**

# National Science Foundation

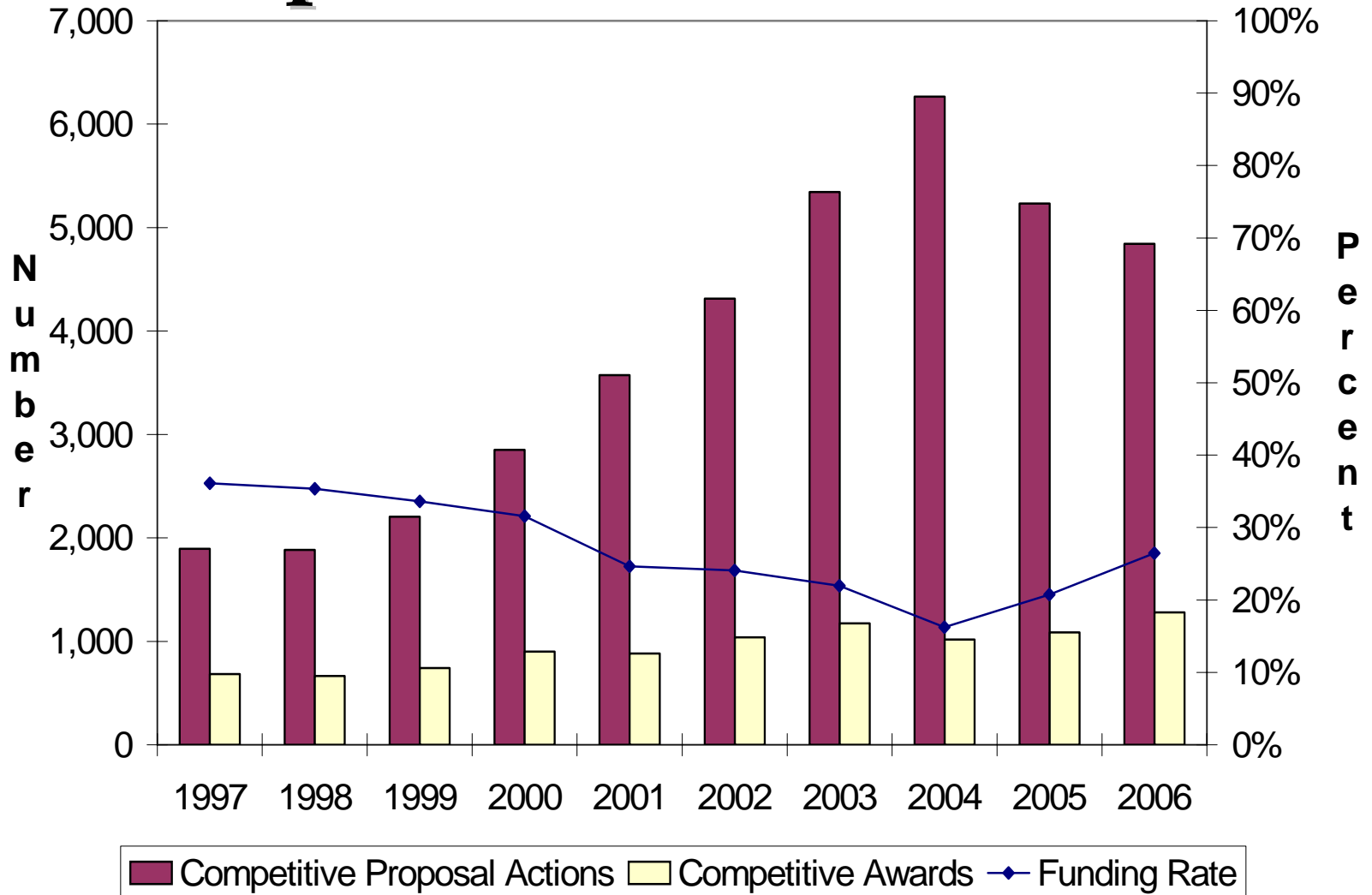


# NSF & CISE Budget in \$M

<b>CISE Divisions</b>	<b>FY'05</b>	<b>FY'06</b>	<b>FY'07</b>
<b>CNS</b>	<b>\$141.53</b>	<b>\$162.98</b> <b>(+15%)</b>	<b>\$191.98</b> <b>(+18%)</b>
<b>CCF</b>	<b>\$105.46</b>	<b>\$122.82</b> <b>(+16%)</b>	<b>\$149.15</b> <b>(+21%)</b>
<b>IIS</b>	<b>\$103.62</b>	<b>\$119.30</b> <b>(+15%)</b>	<b>\$154.63</b> <b>(+30%)</b>
<b>ITR (across divisions)</b>	<b>\$145.80</b>	<b>\$121.59</b> <b>(-16%)</b>	<b>\$78.24</b> <b>(-36%)</b>
<b>CISE Total * (Research)</b>	<b>\$496.41</b>	<b>\$526.69</b> <b>(+6%)</b>	<b>\$574.00</b> <b>(+9%)</b>
<b>NSF Total</b>	<b>\$5,605</b>	<b>\$6,020</b> <b>(+7.4%)</b>	<b>\$6,430</b> <b>(+6.8%)</b>

\* Major Research Equipment and Facilities Construction (MREFC) since '05: \$165.6M add'l

# Funding Rate for Competitive Awards in CISE



## **NSF Proposal Statistics (FY 2006)**

- **42,376 proposal actions**
- **~ 254,000 reviews**
- **~ 58,000 reviewers**
- **10,430 awards**
- **25.0% funding rate**  
**(research 21%)**

# ***NSF Research Grant Profile (FY 2006)***

- **Competitive awards (research): \$6,635**
- **Average annual award: \$134,800**
- **Median annual award: \$106,800**
- **Average duration (research): 2.92 years**

# NSF Award Statistics

**AWARDS** (<http://www.nsf.gov/awardsearch/>) =>

## More Options

- **Recent Awards**
  - Lists of Awards made during the five preceding weeks.
- **Funding Trends (BIIS)** ←
  - The Budget Internet Information System provides summaries of award amounts by:
    - state
    - awardee institution
    - **NSF Directorate**
- **Presidential and Honorary Awards**
  - Information about these award programs can be found on the Presidential and Honorary Awards page.



<http://dellweb.bfa.nsf.gov/>

## Budget Internet Information System

Providing Statistical and Funding Information

### [Award Summary: by State/Institution](#)

Shows the number of awards and the amount of funding by state and type of institution receiving an NSF award. The institutions are grouped into:

- Federal -- Government agency;
- Industry -- Large Corporation or business;
- Small Business; and
- University -- Academic institutions of higher education regardless of accreditation status, that offer at least two years of college-level studies in residence.

Click on a specific state to see a list of its awarded institutions. Click on a specific institution to see the list of awards. Click on an award to see the abstract and other information. Ten years of funding data is available and can be limited by NSF directorate or division.

### [Award Summary: by Top Institutions](#)

Provides the same information as above, but in order of those institutions receiving the largest portion of NSF Funding.

### [Summary Proposal and Award Information \(Funding Rate\) by State and Organization](#)

Provides information on the number of proposals and awards, Funding Rates, Average Decision Time, Mean Award Duration and Median Award Size. Average Decision Time measures the time from when NSF receives a proposal to when a final decision is made. Information is presented by NSF organization. To see the information by State, go to the "Data by" dropdown, select State and then press, "View Report". Ten years of data is available.



### [NSF Funding History -- Slides](#)

Shows NSF Funding graphically. (Requires Internet Explorer)

### [NSF Funding History by Account and FY](#)

Shows NSF Funding by Account since 1951 when the agency began.

### [NSF Funding History by Account and FY, Constant Dollars](#)

Shows NSF Funding by Account In constant dollars since 1951 when the agency began.

# NSF & CISE Awards


Funding Rate by State and Organization  
 from FY 2000 to 2006  
 for NSF

Org (Drill to Next Level)	FY	Number of Proposals	Number of Awards	Funding Rate	Average Decision Time (months)	Mean Award Duration (years)	Median Annual Size
NSF	2006	42,376	10,451	25%	5.52	2.59	\$98,209
	2005	41,723	9,772	23%	5.52	2.68	\$91,665
	2004	43,816	10,367	24%	5.43	2.77	\$88,235
	2003	40,084	10,798	27%	5.31	2.8	\$90,000
	2002	35,082	10,339	29%	5.65	2.87	\$75,333
	2001	31,846	9,834	31%	6.02	2.83	\$75,000
	2000	29,427	9,770	33%	6.23	2.72	\$69,246
	CISE	2006	4,844	1,281	26%	5.41	2.7
2005		5,233	1,086	21%	5.02	2.84	\$99,999
2004		6,266	1,017	16%	5.35	3.14	\$100,000
2003		5,344	1,174	22%	5.43	3.19	\$100,000
2002		4,314	1,038	24%	5.33	3.16	\$84,425
2001		3,575	881	25%	6.98	3.36	\$85,333
2000		2,850	900	32%	7.62	3.15	\$92,333

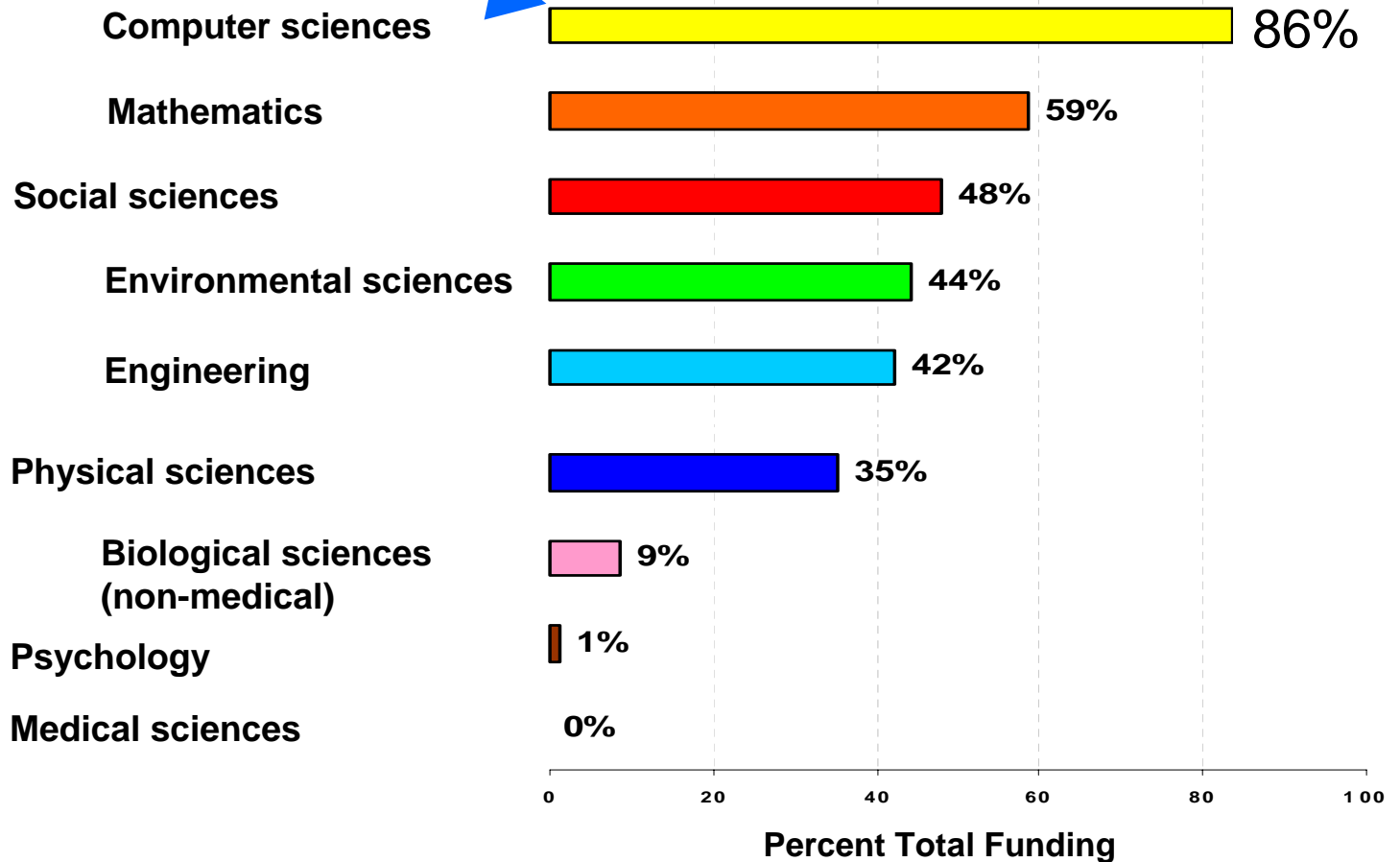
# CISE Awards

Funding Rate by State and Organization							
from FY 2004 to 2006							
for COMPUTER and INFO SCIE and ENGINR							
Org (Drill to Next Level)	FY	Number of Proposals	Number of Awards	Funding Rate	Average Decision Time (months)	Mean Award Duration (years)	Median Annual Size
<a href="#">CISE</a>	2006	4,844	1,281	26%	5.41	2.7	\$100,000
	2005	5,233	1,086	21%	5.02	2.84	\$99,999
	2004	6,266	1,017	16%	5.35	3.14	\$100,000
<a href="#">CCF</a>	2006	1,223	360	29%	5.94	2.87	\$100,000
	2005	1,299	327	25%	4.96	2.91	\$83,449
	2004	1,826	328	18%	5.39	3.15	\$82,000
<a href="#">CNS</a>	2006	2,347	553	24%	5.14	2.64	\$107,592
	2005	2,053	464	23%	5.55	2.81	\$102,479
	2004	2,068	376	18%	5.77	3.17	\$114,251
<a href="#">IIS</a>	2006	1,274	368	29%	5.4	2.62	\$102,600
	2005	1,881	295	16%	4.47	2.8	\$100,000
	2004	2,370	313	13%	4.95	3.09	\$106,326

# IIS Awards

Funding Rate by State and Organization from FY 2006 to 2006 for INFORMATION and INTELLIGENT SYST							
Org (Drill to Next Level)	FY	Number of Proposals	Number of Awards	Funding Rate	Average Decision Time (months)	Mean Award Duration (years)	Median Annual Size
	2006	1,274	368	29%	5.4	2.62	\$102,600
ADVANCED LEARNING TECHNOLOGIES	2006	96	5	5%	4.43	3.4	\$120,000
CISE EDUCAT RES & CURRIC DEVEL	2006	6	5	83%	5.24	2.66	\$83,063
CRCNS	2006	150	9	6%	4.3	3.22	\$135,341
HSD - AGENTS OF CHANGE	2006	2	2	100%	9.88	3	\$249,740
HSD - DYNAMICS OF HUMAN BEHAVI	2006	2	2	100%	8.83	3	\$245,773
HUMAN-CENTERED COMPUTING	2006	89	81	91%	2.04	2.37	\$100,181
IIS SPECIAL PROJECTS	2006	41	22	54%	2.49	1.55	\$83,249
INFO INTEGRATION & INFORMATICS	2006	136	122	90%	2.31	2.7	\$112,530
INFORMATION PRIVACY & SECURITY	2006	14	6	43%	6.1	3.5	\$87,940
ITR-SCIENCE OF DESIGN	2006	34	10	29%	5.23	2.44	\$157,095
ROBUST INTELLIGENCE	2006	104	98	94%	4.1	2.76	\$100,000
RSCH EXPER FOR UNDERGRAD SITES	2006	14	6	43%	4.13	3	\$97,348

# NSF's Share of Total Federal Support for Basic Research at Academic Institutions




# What do the numbers mean?

- **CISE is faring well at NSF**
- **CISE provides > 86% of all Federal support for computer science research in the USA**
- **CISE community is doing a super job!!!**

# CISE

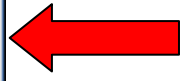
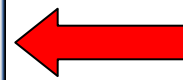
<http://www.nsf.gov/dir/index.jsp?org=CISE>

<a href="#">HOME</a>   <a href="#">FUNDING</a>   <a href="#">AWARDS</a>   <a href="#">DISCOVERIES</a>   <a href="#">NEWS</a>   <a href="#">PUBLICATIONS</a>   <a href="#">STATISTICS</a>   <a href="#">ABOUT</a>   <a href="#">FastLane</a>		
 National Science Foundation DIRECTORATE FOR Computer & Information Science & Engineering (CISE)		SEARCH <input type="text" value="NSF Web Site"/> <input type="button" value="v"/> <input type="text"/> <input type="button" value="→"/>
<a href="#">CISE Home</a>   <a href="#">CISE Funding</a>   <a href="#">CISE Awards</a>   <a href="#">CISE Discoveries</a>   <a href="#">CISE News</a>   <a href="#">About CISE</a>		
Exploring the frontiers of computing		
<b>CISE Organizations</b> <a href="#">Computing and Communication Foundations (CCF)</a> <a href="#">Computer and Network Systems (CNS)</a> <a href="#">Information &amp; Intelligent Systems (IIS)</a>	<b>Important Message from the CISE AD</b> I am delighted to share with the entire CISE community, for the first time in one place, a list of all research-focused program announcements and solicitations currently active or under development. <a href="#">Read More...</a>	<input type="checkbox"/> <a href="#">Get CISE Updates by Email</a> <b>Featured Programs</b> <a href="#">Expeditions in Computing</a> <a href="#">Software for Real-World Systems</a>
<b>About CISE</b> <a href="#">View CISE Staff Directory</a> Search CISE Staff Directory <input type="text"/> <input type="button" value="→"/> <a href="#">General Information About CISE</a> <a href="#">Career Opportunities</a> <a href="#">Advisory Committee</a> <a href="#">Budget Excerpt</a>	<b>Recently Announced Funding Opportunities</b> <a href="#">See All</a> <b>Human and Social Dynamics: Competition for FY 2008</b> (NSF 08-508) Posted November 16, 2007 <b>Major Research Instrumentation Program</b> (NSF 08-503) Posted October 24, 2007 <b>Cyber-Enabled Discovery and Innovation</b> (NSF 07-603) Posted September 28, 2007 <b>Sustainable Digital Data Preservation and Access Network Partners</b> (NSF 07-601) Posted September 28, 2007	<b>Additional CISE Resources</b> <a href="#">Subscribe to receive special CISE announcements</a> <a href="#">Assistant Director's Presentations</a> <a href="#">CISE Distinguished Lecture Series</a> <a href="#">Contact CISE OAD</a> <b>Publications</b> <a href="#">See All</a>

# Where do I begin ?!?



<a href="#">CISE Home</a>   <a href="#">CISE Funding</a>   <a href="#">CISE Awards</a>   <a href="#">CISE Discoveries</a>   <a href="#">CISE News</a>   <a href="#">About CISE</a>		
<p>Exploring the frontiers of computing</p>		
<b>CISE Organizations</b> <a href="#">Computing and Communication Foundations (CCF)</a> <a href="#">Computer and Network Systems (CNS)</a> <a href="#">Information &amp; Intelligent Systems (IIS)</a>	<b>Important Message from the CISE AD</b> I am delighted to share with the entire CISE community, for the first time in one place, a list of all research-focused program announcements and solicitations currently active or under development. <a href="#">Read More...</a>	<a href="#">Get CISE Updates by Email</a>
<b>About CISE</b> <a href="#">View CISE Staff Directory</a> <a href="#">Search CISE Staff Directory</a> <input type="text"/> <a href="#">➔</a> <a href="#">General Information About CISE</a> <a href="#">Career Opportunities</a> <a href="#">Advisory Committee</a> <a href="#">Budget Excerpt</a>	<b>Recently Announced Funding Opportunities</b> <a href="#">See All</a> <a href="#">Human and Social Dynamics: Competition for FY 2008</a> (NSF 08-508) Posted November 16, 2007 <a href="#">Major Research Instrumentation Program</a> (NSF 08-503) Posted October 24, 2007 <a href="#">Cyber-Enabled Discovery and Innovation</a> (NSF 07-603) Posted September 28, 2007 <a href="#">Sustainable Digital Data Preservation and Access Network Partners</a> (NSF 07-601) Posted September 28, 2007	<b>Featured Programs</b> <a href="#">Expeditions in Computing</a> <a href="#">Software for Real-World Systems</a> <b>Additional CISE Resources</b> <a href="#">Subscribe to receive special CISE announcements</a> <a href="#">Assistant Director's Presentations</a> <a href="#">CISE Distinguished Lecture Series</a> <a href="#">Contact CISE OAD</a>
		<b>Publications</b> <a href="#">See All</a>





# CISE Goals

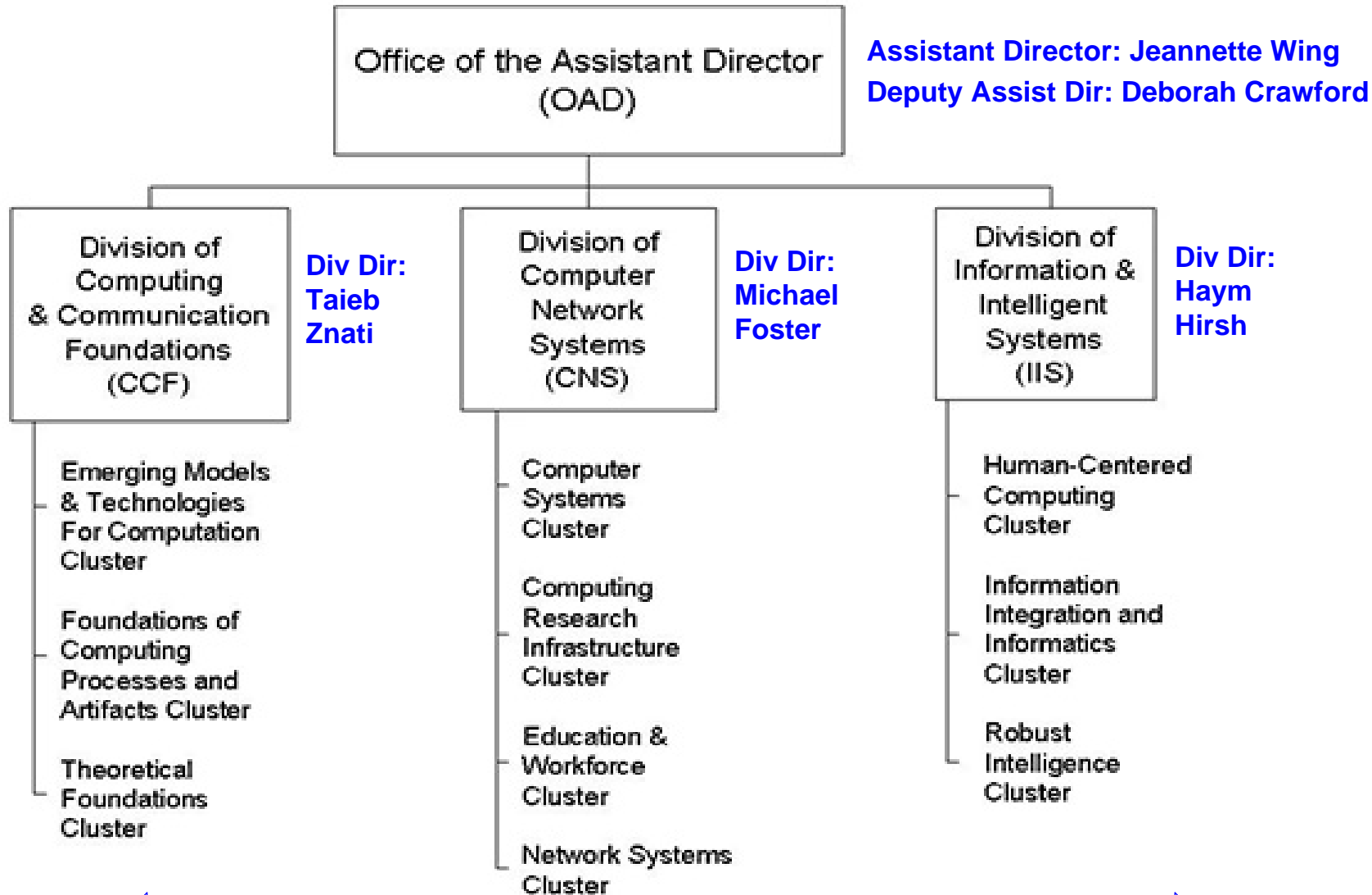
1. **Enable the United States to remain competitive in computing, communications, and information science and engineering**
2. **Promote understanding of the principles and uses of advanced computing, communications, and information systems in service to society**
3. **Contribute to universal, transparent, and affordable participation in an information-based society**

# Achieving CISE Goals

- **CISE supports investigator initiated research in all areas of computer and information science and engineering**
- **CISE helps develop and maintain cutting-edge national computing and information infrastructure for research and education**
- **CISE contributes to the education and training of the next generation of computer scientists and engineers.**

# CISE Organization

[http://www.nsf.gov/cise/about/org\\_chart.jsp](http://www.nsf.gov/cise/about/org_chart.jsp)



← Cross-Divisional Programs and CISE/NSF Emphasis Areas →

## More Information on CISE and CISE-relevant Programs

- **CCF, CNS, IIS Divisions Web sites**
  - Division, cluster information
  - Programs & Funding Opportunities
  - Division Staff
  - Division Awards
  - Division News, Events, Discoveries, ...
- **CISE-wide programs**
  - “Important Message from the CISE AD”
  - CISE Funding
- **CISE-relevant NSF programs**
  - NSF Funding (<http://www.nsf.gov/funding/>)
  - **Get NSF Updates by Email**

# CCF: Computing and Communication Foundations Division

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

- **Emerging Models and Technologies for Computation**
  - Computational biology; quantum computing; nano-scale computing; biologically-inspired computing
- **Foundations of Computing Processes and Artifacts**
  - Advanced computation research; compilers; computer architecture; design automation (micro/nano); graphics & visualization; software engineering & languages
- **Theoretical Foundations**
  - Computer science and communication theory; numeric symbolic/graphic computation; theory of computing; computational algebra and geometry; signal processing

# CNS: Computer and Network Systems Division

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

- **Computer Systems Research (CSR)**
  - Distributed systems; embedded and hybrid systems; next-generation software; parallel systems
- **Networking Technology and Systems (NeTS)**
  - Programmable wireless networks; networking of sensor systems; networking broadly defined; future internet design (GENI)
- **Computing Research Infrastructure (CRI)**
  - Equipment and infrastructure to advance computing research



# IIS: Information and Intelligent Systems Division

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

- **Human-Centered Computing (HCC)**
  - Digital society & technologies; human computer interaction; universal access; intelligent spaces (active displays, sensory devices, immersive experiences) and personal agents (feature-rich gadgets and appliances)
- **Information Integration and Informatics (III)**
  - Digital government; digital libraries & archives; information, data, and knowledge management; science & engineering information integration and informatics
- **Robust Intelligence (RI)**
  - Artificial intelligence & cognitive science; computational neuroscience; computer vision; human language & communication; robotics



# CCF: Emerging Models and Technologies for Computation (EMT)

**Cluster supports research in the following areas:**

- **Novel computing concepts**
  - Quantum
  - Nanoscale
  - Biology-inspired
- **Partnering essential - CS with Discipline X**
- **\$16M/Year**
- **New Program Announcement NSF 08-517**  
**Due Date March 13, 2008**

<http://www.nsf.gov/pubs/2008/nsf08517/nsf08517.htm>



# CCF: Foundations of Computing Processes and Artifacts (CPA)

Cluster supports research in the following areas:

- Design, verification, evaluation, utilization, and understanding of computing systems to meet the future computational needs of our society:
  - Formal Methods
  - Verification and synthesis
  - Programming languages
  - Compilers
  - Run-time support
  - Chips
  - Computer architectures
  - VLSI
  - Graphics and visualization
- \$40M/Year

# CPA Proposal Solicitation

- 2006 CPA Competition (NSF 06-585)
  - approx. 105 awards from 525 proposals (~20% success rate)
  - ~ \$38,000,000 total funds, ave. of ~ \$125,000/yr (all awards)
- 2007 CPA Solicitation (NSF 07-587)
  - Proposal due date: **December 7, 2007, 5pm local time**
  - Anticipated funding, number, and size of awards:
    - max. of \$42,000,000 anticipated funds (could be much less)
    - 70 to 95 awards of \$100K/year to \$125K/year for 3 years
    - 5 to 7 “team” awards of up to \$500,000/yr for 3 years
    - up to 2 “major team” awards of up to \$900K/yr for 3 or 4 yrs for well-integrated projects of larger scope, possibly cross-area
  - Submission limitations:
    - Investigators may participate as PI, co-PI, or Senior Personnel on at most two proposals; one having multiple PIs
    - PIs must come from US universities or colleges
  - See <http://nsf.gov/pubs/2007/nsf07587/nsf07587.htm>



# CCF: Theoretical Foundations (TF)

**Cluster supports research in the following areas:**

- Models of computation
- Computational complexity
- Parallel and distributed computation
- Random and approximate algorithms
- Algorithmic algebra, geometry, topology, and logic
- Computational optimization
- Techniques for representing, coding and transmitting information
- \$30M/Year
- **New TF Program Solicitation NSF 08-518**
  - **Due Date March 12, 2008 - March 19, 2008**
  - <http://www.nsf.gov/pubs/2008/nsf08518/nsf08518.htm>



# CNS: Computer Systems Research (CSR) NSF 07-504

- **Supporting innovative projects in the three areas:**
  - Distributed and Mobile Systems and Services
  - Parallel Systems, Computing and Execution
  - Embedded, Hybrid and Critical Systems
- **Three types of projects:**
  - Small (\$450K, 3yrs, 150K max per year)
  - Team (\$2M, 4yrs, \$500K max per year)
  - Other (e.g. planning grants, workshops, Small Grants for Exploratory Research (SGER) and other community building activities): **must get approval from a CRS Program Officer before submission**
- **Proposal Due Date: April 23, 2008**
- **Anticipated Funding Amount: \$37M**
- **Program Directors: David Du, Helen Gill, Anita J. LaSalle**

# CNS: Networking Technologies and Systems (NeTS)

- **NeTS Program Solicitation: NSF 08-524**
- <http://www.nsf.gov/pubs/2008/nsf08524/nsf08524.htm>
- **Four programmatic areas:**
  - **Future Internet Design (FIND)**—research toward a future internet with “clean-slate” design
  - **Wireless Networks (WN)**—all areas of wireless network research
  - **Networking of Sensor Systems (NOSS)**—all areas of sensor network research
  - **Networking Broadly Defined (NBD)**—all networking topics not part of the three previously described areas
- **Anticipated Funding Amount: \$40M**
- **Proposal due date: March 25, 2008**
- **Program Directors:**
  - **David Du, Darleen Fisher, Allison Mankin, Jie Wu**



# CNS: Computing Research Infrastructure (CRI)

- **Program Objectives (\$18M total funds):**
  - Supports infrastructure in all areas in which CISE supports research (CRI “complements” research funding)
  - *Infrastructure Acquisition and Development track:* to support research and education of proposers; install and maintenance--\$50K to \$2M awards
  - *Community Resource Development track:* to create resources that support research (and education) for a national community of researchers (e.g., testbed to evaluating research results)--\$300K to \$2M awards
  - *Planning grants:* up to \$50K awards to plan for above
  - Approximately 230 proposals/yr with~ 30% success rate
- **Proposal deadline: 1st Tuesday in August 2008**
- **Coordinating Program Directors:**
  - *Tanya Korelsky, Anita LaSalle, Rita Rodriguez, Joseph Urban*

# IIS: Information and Intelligent Systems: Advancing Human-Centered Computing, Information Integration and Informatics, and Robust Intelligence

- **Program Solicitation: NSF 07-577**  
<http://www.nsf.gov/pubs/2007/nsf07577/nsf07577.htm>
- **Human-Centered Computing**
- **Informatics and Information Integration**
- **Robust Intelligence**
- **FY 08 IIS Emphasis Areas (change every year)**
  - **Next Generation Networked Information**
  - **Integrative Intelligence**
- **Anticipated Funding Amount: \$55M**
- **Proposal due dates:**
  - **Medium Projects (up to \$900K total):** October 23, 2007
  - **Large Projects (up to \$3M total):** November 19, 2007
  - **Small Projects (up to \$450K total):** December 10, 2007
- **Similar deadlines are expected in FY09 (with different emphasis areas)**

# IIS: Human Centered Computing (HCC)

**HCC Cluster supports research in the following areas:**

- **Digital Society and Technologies**
- **Human-Computer Interaction**
- **Universal Access**

**HCC Program officers:**

**William Bainbridge (Lead)**

**Amy Baylor**

**Ephraim Glinert**

**Wayne Lutters**

**Mary Lou Maher**

# IIS: Information Integration and Informatics (III)

**III Cluster supports research in the following areas:**

- **Data Management Systems**
- **Digital Government**
- **Digital Libraries and Archives**
- **Information and Knowledge Management**
- **Science and Engineering Informatics**

**III Program officers:**

**Sylvia Spengler (Lead)**

**Larry Brandt**

**Jim French**

**Steve Griffin**

**Le Gruenwald,**

**Frank Olken**

**Maria Zemankova**

# RI: Robust Intelligence (RI)

**Cluster supports research in the following areas:**

- **Artificial Intelligence and Cognitive Science**
- **Computational Neuroscience**
- **Computer Vision**
- **Human Language and Communication**
- **Robotics**

**RI Program officers:**

**Kenneth C. Whang (Lead)**

**Daniel DeMenthon**

**Douglas H. Fisher**

**C.S. George Lee**

**Tanya Korelsky**

# CISE Crosscutting Programs

- **CISE Emphasis Areas:**
  - Data Preservation and Access
  - ALT - Advanced Learning Tech. (NSF EHR)
  - Computational Neuroscience (NIH)
  - Cyber-Enabled Discovery and Innovation
  - Data and Visual Analytics (DHS)
  - Community-Based Data Interop. Networks
  - Creative IT
  - High-end Computing Research
  - Math-CS Interfaces
- **Core Cross-Divisional Programs:**
  - Broadening Participation in Computing
  - CPATH
  - Cyber Trust
  - Expeditions in Computing
  - GENI Research Program
- **Many other cross-NSF programs**



Directorate for Computer &  
Information Science & Engineering

# **CISE Cross-Divisional Programs**

# CISE Crosscutting Programs

- **CISE Emphasis Areas: address scientific and national priorities, with specific durations**
  - **Cyber-Enabled Discovery and Innovation**
  - **Foundations of Data and Visual Analytics**
  - **Software for Real-World Systems**
- **Core Cross-Divisional Programs:**
  - **Broadening Participation in Computing**
  - **Creative IT**
  - **CPATH**
  - **Cyber Trust**
  - **Expeditions in Computing**
  - **GENI Research Program**

# FODAVA: Foundations of Data and Visual Analytics

- ***Problem:*** Those involved with science, engineering, commerce, health, and national security all increasingly face the challenge of synthesizing information and deriving insight from massive, dynamic, ambiguous and possibly conflicting digital data
- ***This program*** seeks the creation of the mathematical and computational sciences foundations required to transform data in ways that permit visual-based understanding
- **Research topics:**
  - Synergistic combinations of data transformation techniques to create more meaningful representations with semantic richness and validity
  - Approaches that will tightly couple novel data transformations with visualization systems, including methods to capture and represent information quality and uncertainty
  - Novel transformations to facilitate dynamic identification of new or unanticipated events which may also include measures of usefulness
  - Computational and mathematical algorithms that will enable the unified representation of dynamic data of multiple types and sources
  - Fundamentally new approaches to identifying changes in massive data sets

Full Proposals due, 2007 Nov. 20 (similar deadline expected in FY 09)

- See <http://nsf.gov/pubs/2007/nsf07583/nsf07583.htm>

## Software for Real-World Systems (SRS)

- *Motivation:* Software is a critical element of real-world systems, yet the science and engineering remain elusive and poorly understood for designing and building the software that will govern the essential behaviors and properties of real-world systems
- Program Goals: Support research on developing new scientific principles, engineering processes and methods, and educational pedagogy for the challenges inherent in real-world systems
  - *Design and evolution of large-scale, real-world systems with scalable, computational methods of composition*
  - *Monitoring, orchestration, and control of real-world system behaviors and interactions in dynamic, ever-changing conditions and operational environments*
  - *Amplification of human participation in the design and use of real-world systems*
- Consideration of emerging technologies (e.g., multicore systems) and innovative applications (e.g., pervasive health care computing) are encouraged, as are industrial partnerships with clearly stated research benefits
- Anticipated Funding Amount: \$10,000,000 for 12 to 20 awards
- Proposals due January 17, 2008
- See <http://www.nsf.gov/pubs/2007/nsf07599/nsf07599.htm>

# Broadening Participation in Computing (BPC)

- The Broadening Participation in Computing program aims to significantly increase the number of students who are U.S. citizens and permanent residents receiving post secondary degrees in the computing disciplines
- Emphasis will be on students from communities with longstanding under-representation in computing:
  - Women, persons with disabilities, and
  - Minorities: African Americans, Hispanics, American Indians, Alaska Natives, Native Hawaiians, Pacific Islanders
- Anticipated Funding Amount: \$14M
  - Proposal due date: **TBD, (likely May 2008)**
  - Check CISE web site concerning which proposals require a Letter of Intent and the due dates

# Cyber Trust (CT)

- **Vision: A society in which**
  - Computing systems operate securely, reliably, and predictably, as intended, in the presence of attacks
  - Computing systems are trusted to protect privacy of users and sensitive information
  - Systems are developed and operated by a well-trained and diverse workforce
- **Research on foundations, network security, systems software, and information systems**
  - Systems which have security as a design goal
- **Integrated education and workforce activities**
- **FY 2008 competition**
  - Solicitation due date **March 24, 2008**
  - **4 types of projects: Exploratory Research (2 yrs, \$200K); Single Investigators and Small Group (1-2 PIs, 3yrs, \$500K); Medium (2 or more PIs, 3 yrs, \$1.5M); Large (3yrs, \$3M)**
  - **Anticipated Funding Amount: \$34M**

# CISE Pathways to Revitalized Undergraduate Computing (CPATH)

- CPATH Solicitation NSF 08-516
- Vision: a U.S. workforce with the computing competencies and skills imperative to the Nation's health, security and prosperity in the 21st century.
- CPATH will support four *types* of projects:
  - Community Building (CB) Grants;
  - Evaluation, Adoption, and Extension (EAE) Grants;
  - Transformation (T) Grants; and
  - CISE Distinguished Education Fellow (CDEF) Grants.
- Proposal due date: **March 11, 2008**
- <http://www.nsf.gov/pubs/2008/nsf08516/nsf08516.htm>



# Expeditions in Computing NSF 07-592

Created to inspire bold, transformational research that explores new scientific frontiers that promise disruptive innovations in computing

- **Program Goals:**

- Catalyze far-reaching research in the computing and information fields motivated by hard, emerging problems and/or compelling applications
- Inspire current & future generations to pursue CISE careers
- Stimulate significant research and education outcomes that benefit society through effective knowledge transfer

- **Scope:** Research that cuts vertically or horizontally across CISE

- **Awards:** 3 anticipated, w/ budgets of \$2,000,000/yr for five years

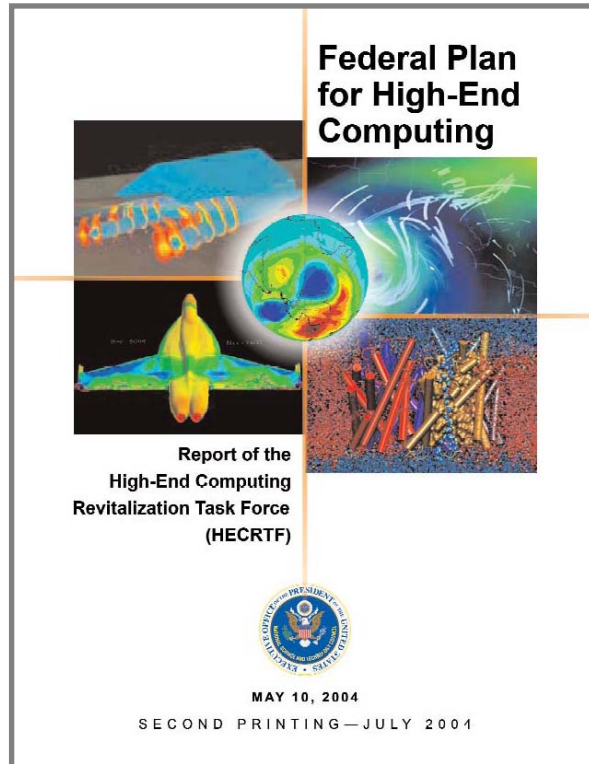
- **Submission Requirements and Deadlines:**

- Letter of Intent (required) due **November 5, 2007**
- Preliminary Proposal (required) due **December 30, 2007**
- Full Proposal (by invitation only) due **April 1, 2008**

- See <http://www.nsf.gov/pubs/2007/nsf07592/nsf07592.htm>

- ***Different dealines in FY09, FY10, FY11***

# High-End Computing University Research Activity (HECURA)



- HECURA FY 2006 Budget 14.5M
- NSF/DARPA/DOE/EPSCoR activity
  - Input/Output capabilities
  - File Systems
  - Storage Systems
- 62 proposals submitted in Feb. 2006
- Nineteen projects were awarded.
- HECURA FY 2008 Budget 10M
- NSF 08-531 activity is focused on
  - HEC Programming Models
  - HEC Languages
  - HEC Compilers
- <http://www.nsf.gov/pubs/2008/nsf08531/nsf08531.htm>
- **Deadline April 8, 2008**

## Global Environment for Networking Investigations Initiative (GENI)

- **The GENI Initiative envisions the creation of new networking and distributed system architectures that, for example:**
  - **Build in security and robustness;**
  - **Enable the vision of pervasive computing and bridge the gap between the physical and virtual worlds by including mobile, wireless and sensor networks;**
  - **Enable control and management of other critical infrastructures;**
  - **Include ease of operation and usability; and**
  - **Enable new classes of societal-level services and applications.**
- **Funding opportunities in future**



Directorate for Computer &  
Information Science & Engineering

# NSF-wide Crosscutting Programs

# Cross-Foundation Programs

- CAREER
  - RUI
  - IGERT
  - REU Sites
  - RET
  - ADVANCE
  - GK-12
  - MRI
  
  - I/UCRC
  - GOALI
  - SBIR
- OISE: Office of International Science & Engineering
  - OCI: Office of CyberInfrastructure
  
  - Current/New:
    - HSD: Human and Social Dynamics
    - INTEROP: Community-based Data Interoperability Networks
    - EPSCoR Research Infrastructure Improvement Grant Program
    - ...
    - CDI: Cyber-Enabled Discovery and Innovation

# CAREER Program

- **Foundation-wide activity that offers the National Science Foundation's most prestigious awards for new faculty**
- **NSF supports the early career development activities of those faculty members who are most likely to become the academic leaders of the 21st century**
- **CAREER awards have a 5-year duration**
- **In FY'06, the minimum CAREER award (including indirect costs) is \$400,000 for all NSF directorates**



# Research in Undergraduate Institutions (RUI)

- **Predominantly undergrad, no more than 10 Sci/Eng PhD/yr**
- **Addition 5-page impact for institution**
- **Same review as standard proposal**
- **Look at Research Opportunity Awards (ROA) for supplements to existing NSF grants for RUI collaborators**
- **NSF 00-144, funds from disciplinary programs**



# **Integrative Graduate Education and Research Traineeship (IGERT)**

- **Intended to meet the challenges of educating U.S. Ph.D. scientists, engineers, and educators**
- **Intended to catalyze a cultural change in graduate education – for students, faculty, and institutions – by establishing innovative new models for graduate education and training**
- **Intended to facilitate greater diversity in student participation and preparation, and to contribute to the development of a diverse globally-engaged science and engineering workforce**

# Research Experiences for Undergraduates (REU) Sites

- **Enables a cohort experience for students**
- **Projects may be based in a single discipline or academic department, or on interdisciplinary or multi-departmental research opportunities with a coherent intellectual theme**
- **REU Sites are encouraged to involve students in research who might not otherwise have the opportunity, particularly those from academic institutions where research programs are limited**

# Research Experiences for Teachers (RET)

- **K-12 teachers of science and math and the NSF research community**
- **REU supplements**
  - **For teachers, up to 10K/year, 1 year supplement**
- **Site Program**
  - **From ENG, 3 years, includes community college faculty**



# ADVANCE

- **Increase the representation and advancement of women in academic science and engineering careers**
- **Increase the diversity of the science and engineering workforce**
- **Increase the number of underrepresented minority groups and individuals with disabilities**

# **NSF Graduate Teaching Fellows in K-12 Education (GK-12)**

- **Provides fellowships and training in STEM disciplines**
- **Provides institutions of higher education with an opportunity to make a permanent change in their graduate programs by including partnerships with K-12 schools**
- **Provides educational opportunities for Graduate Students**

# **Industry University Cooperative Research Program (I/UCRC)**

- **Partnering Industries and Universities to Innovate.**
- **I/UCRCs stimulate highly leveraged industry/university cooperation by focusing on fundamental research recommended by Industrial Advisory Boards.**
- **I/UCRC develops long-term partnerships among industry, academic institutions, and government.**
- **The centers are catalyzed by a small investment from the National Science Foundation (NSF) and are primarily supported by center members, with NSF taking a supporting role in their development and evolution.**



# Grant Opportunities for Academic Liaison with Industry (GOALI)

- **Aims to synergize university-industry partnerships by making project funds or fellowships/traineeships available to support an eclectic mix of industry-university linkages:**
  - **Faculty, postdoctoral fellows, and students to conduct research and gain experience in an industrial setting;**
  - **Industrial scientists and engineers to bring industry's perspective and integrative skills to academe; and**
  - **Interdisciplinary university-industry teams to conduct research projects.**
- **Proposal submissions follow established discipline deadlines**

# NSF-wide CISE-relevant Programs

- **Advanced Learning Technologies**
  - April 25, 2008
- **Community-Based Data Interoperability Networks**
  - July 23, 2008
- **Sustainable Digital Data Preservation and Access Network Partners (DataNet)**
  - Preliminary Proposals: January 7, 2008
  - Full Proposals: March 21, 2008
- **Mathematical Sciences: Innovations at the Interface with Computer Sciences**
  - Spring 2008
- **Partnerships for International Research and Education (PIRE)**
  - Planned for 2009
- **Etc.**



# Cyber-Enabled Discovery and Innovation (CDI)

National Science Foundation



# Cyber-Enabled Discovery and Innovation

- **Multi-disciplinary research seeking contributions to more than one area of science or engineering, by innovation in, or innovative use of **computational thinking****
- **Computational thinking refers to computational...**
  - ...**Concepts**
  - ...**Methods**
  - ...**Models**
  - ...**Algorithms**
  - ...**Tools**

# CDI is Unique within NSF

- **five-year initiative**
- **to create *revolutionary* science and engineering research outcomes**
- **made possible by innovations and advances in computational thinking**
- **emphasis on bold, multidisciplinary activities**
- **radical, paradigm-changing science and engineering outcomes through computational thinking**



# Transformative Research

## NEW in NSF Review Criteria:

- To what extent does the proposed activity suggest and explore creative, original, or **potentially transformative** concepts?

## ADDITIONAL CDI REVIEW CRITERIA:

- The proposal should define a bold multidisciplinary research agenda that, through computational thinking, promises paradigm-shifting outcomes in more than one field of science and engineering.
- The proposal should provide a clear and compelling rationale that describes how innovations in, and/or innovative use of, computational thinking will lead to the desired project outcomes.
- The proposal should draw on productive intellectual partnerships that capitalize upon knowledge and expertise synergies in multiple fields or sub-fields in science or engineering and/or in multiple types of organizations.
- potential for extraordinary outcomes, such as,
  - revolutionizing entire disciplines,
  - creating entirely new fields, or
  - disrupting accepted theories and perspectives... as a result of taking a fresh, multi-disciplinary approach.

**Special emphasis will be placed on proposals that promise to enhance competitiveness, innovation, or safety and security in the United States.**

# Long-term Funding for Cyber-enabled Discovery and Innovation

**All NSF directorates are participating  
in this activity (*subject to budget  
approval*)**

<b>Request FY 2008</b>	<b>FY 2009</b>	<b>FY 2010</b>	<b>FY 2011</b>	<b>FY 2012</b>
<b>\$52M</b> \$26M in the Solicitation;	<b>\$100M</b>	<b>\$150M</b>	<b>\$200M</b>	<b>\$250M</b>

# Three CDI Themes

**CDI seeks transformative research in the following general themes, via innovations in, and/or innovative use of, computational thinking:**

- **From Data to Knowledge:** deriving new science and engineering knowledge and enhanced human cognition from the growing abundance of digital data;
- **Understanding Complexity in Natural, Built, and Social Systems:** insights on systems of many interacting elements throughout science and engineering;
- **Virtual Organizations:** research via cyber-enabled virtual organizations that bring people and resources together across institutional, geographical, and cultural boundaries.

# From Data to Knowledge

**Extracting useful information and deriving new knowledge from data efficiently, while accounting for the presence of uncertainty and dependency, leads to several sub-themes in which transformative ideas are needed:**

- **Modeling**
- **Operations on data**
- **Algorithms**
- **Human interaction with data**



# From Data to Knowledge

- **In many science and engineering applications...the ability to gather, organize, analyze, model, and visualize large, multi-scale, heterogeneous data sets...is often crucial.**
- **New methods are required that create knowledge and understanding from an abundance of digital data...and that accelerate the transformation of knowledge into new products and services...Driven by compelling science and engineering research and education opportunities, new efforts to support the complex tasks of data analysis and discover must be explored.**
- **New visualization methods can enhance human cognition, allowing scientists, engineers, researchers, educators, and students to detect and comprehend previously indiscernible abstract concepts, patterns and important exceptions amidst vast data.**

# From Data to Knowledge

- **...CDI seeks proposals for multidisciplinary efforts focused on the development of and evaluation of new approaches to data mining, data federation, knowledge extraction and knowledge representation, and visualization in demanding scientific and engineering applications.**

# Understanding Complexity in Natural, Built, and Social Systems

- **Identifying general principles and laws that characterize complexity and capture the essence of complex systems is one of the major challenges of 21st century science. Attaining the breakthroughs, to overcome these challenges, requires transformative ideas in the following areas:**
  - **Simulation and Computational Experiments**
  - **Methods, Algorithms, and Tools**



# Virtual Organizations (VOs)

- **Advances in VOs bring together domain needs with algorithm development, systems operations, organizational studies, social computing, and interactive design. VOs provide flexible boundaries, memberships, and lifecycles, which can be tailored to particular research problems, users and learner needs or tasks of any community. VOs provide opportunities for:**
  - **Remote access**
  - **Collaboration**
  - **Education and training**

# Virtual Organizations (VOs)

- **Beyond computational, simulation, and visualization skills, 21st century scientists, engineers, and technicians working in cyber-enabled environments will need experiential training in new modes of distributed communication, collaboration and cognition.**

# CDI Philosophy

- **Contributions to more than one area of science or engineering, by development or innovative use of computational thinking**
  - **Multidisciplinary projects stimulating advances in computational concepts, methods, models, algorithms, and tools**
- **“Business as usual” need not apply**
  - ***“Projects that make straightforward use of existing computational concepts, methods, models, algorithms and tools to significantly advance only one discipline should be submitted to an appropriate program in that field instead of to CDI.”***
- **No place for incremental research**
- **Nontraditional approaches and collaborations welcome**

# Types of Projects

- **CDI defines research modalities**
- **Project size not measured by \$\$**
- **Projects classified by magnitude of effort**
- **Three types are defined: Types I, II, and III.**
- **Type III, center-scale efforts, will not be supported in the first year of CDI**

# Type I Projects

- **focused aims that tackle discrete, high-risk problems that, once resolved, may enable transformative breakthroughs in multiple fields of science or engineering through computational thinking**
- **research and education efforts roughly comparable to that of up to two investigators with summer support, two graduate students, and their research needs (e.g., materials, supplies, travel), for a duration of three years**



## Type II Projects



- multiple major aims that tackle complementary facets of complex solutions for advancing multiple fields of science and engineering through computational thinking.
- several intellectual leaders, multidisciplinary teams
- significant education component
- likely to be distributed collaborative projects with more extensive project coordination needs
- greater effort than in Type I, and, for example, roughly comparable to that of up to three investigators with summer support, three graduate students, one or two other senior personnel (post-doctoral researchers, staff), and their research needs (e.g., materials, supplies, travel), for a duration of four years

# Type III Projects

- collaborative research, potentially distributed across several institutions
- may involve center-type activities, demanding substantial coordination efforts
- greater effort than in Type II in terms of scope and in the order of magnitude of expected outcomes
- **Type III projects will not be supported in FY08, but in the future years, subject to the availability of funds**





# Broadening Participation

- **diversity of sciences and engineering, academic departments**
- **underrepresented minorities in STEM**
- **collaborations with **industry** in order to match**
  - **scientific insights with**
  - **technical insights**



# International Collaborations

- involve true intellectual partnership in which successful outcomes depend on the unique contributions of all partners, U.S. and foreign
- engage junior researchers and students in the collaboration, taking advantage of cyber environments to prepare a globally-engaged workforce
- in conducting research in all of the major components of the CDI
- create more systematic knowledge about the intertwined social and technical issues of effective VOs, changing both the practice and the outcomes of science and engineering research and education.



NSF awards are, in principle, limited to support of the U.S. side of an international collaboration. In almost all cases, international partners should obtain their own funding for participation.

# Key Dates:

- Letters of Intent (required) due: Nov 30, 2007
- Preliminary Proposals due: Jan 8, 2008
- Full proposals due: April 29, 2008
  - Full proposals by invitation only!
- Awards: Planned for no later than October 2008
  
- Next Round:
- Letter of Intent: September 30, 2008
- Preliminary Proposal: November 4, 2008
- Full proposals due: February 27, 2009
  - Full proposals by invitation only!
  
- Annually Thereafter: FY10, FY11, FY12



# Resources at your Disposal to Keep Aware

- **Funding Opportunities Calendar at NSF**
- **Guide to Programs**
- **Browsing of Funding Opportunities at NSF Web site**
- **FUNDING Search Engine**
- **Upcoming Due dates**
- **NSF Updates by Email**

# Key On-line Documents

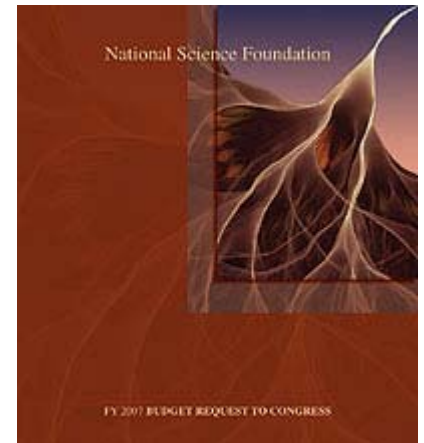
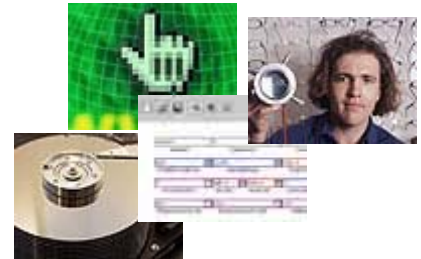
- **FY 2008 NSF Budget Request**
  - <http://www.nsf.gov/about/budget/fy2008>
- **Current Grant Proposal Guide (GPG) (NSF 07-140)**
  - [http://www.nsf.gov/publications/pub\\_summ.jsp?ods\\_key=gpg07140&org=NSF](http://www.nsf.gov/publications/pub_summ.jsp?ods_key=gpg07140&org=NSF)
- **New Proposal and Award Policies and Procedures Guide (includes GPG), NSF 08-1, Effective 01/05/2008**
  - [http://www.nsf.gov/publications/pub\\_summ.jsp?ods\\_key=gpg](http://www.nsf.gov/publications/pub_summ.jsp?ods_key=gpg)
- **General Information**
  - <http://www.nsf.gov/>

# Your Role in CISE's Success

- **Send your best ideas to NSF**
  - Consistent with focus & goals of the program
  - We want high risk / high reward proposals
- **Suggest and encourage good panelists who can do justice to the proposals and our focus**
- **Volunteer to be a reviewer and panelist**
- **Participate in the process**
- **Keep us informed of your accomplishments**
- **Work within your institutions to support collaborative, interdisciplinary research**
- **Call our attention to things that need improvement**
- **Suggest transition strategies from basic research to prototyping and production**
- **Serve as a program officer (“Rotator” or “IPA”)**

# Highlights, Discoveries, News

- **Convince the US public that research is worth paying for**
- **Succinct, interesting vignettes**
  - Show a result, not an expense
  - Layman's language
  - Graphics if possible
- **NSF Uses the best ones**
  - Budget requests
  - Performance reports
  - Public relations
- **See**
  - <http://www.nsf.gov/discoveries/>
  - <http://www.nsf.gov/news/>



# NSF CISE Career Opportunities

- **Program Directors are sought for one-year terms to four-year terms or for permanent positions in CNS, CCF, and IIS Divisions of CISE**
- **Information about positions found at [http://www.nsf.gov/publications/vacancy.jsp?org=CISE&nsf\\_org=CISE](http://www.nsf.gov/publications/vacancy.jsp?org=CISE&nsf_org=CISE)**

# Concluding Remarks

- **NSF's role is fundamental to all areas of our society - the most basic future investment**
- **Computer science and related disciplines are very important in their own right and essential to advancement in all areas of S&E**
- **NSF and our field are facing unprecedented pressures that can only be overcome by concerted, cooperative action**



**Thanks for your attention**

**Questions?**

**Douglas H. Fisher**

**Program Director**

**National Science Foundation**

**Computer & Information Science & Engineering  
Directorate**

**Division of Information and Intelligent Systems  
dfisher@nsf.gov**