Funding Opportunities in NSF’s CISE Directorate and the Foundations of Computing Processes and Artifacts Cluster

*Timothy M. Pinkston*

Program Director

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Outline

- **Overview of NSF and CISE**
  - Origins, Mission, and Organization
  - Budgets and Funding Rates

- **CPA Cluster**
  - CPA 2006 Solicitation
  - CPA Research Areas and Topics of Interest

- **Funding Opportunities across CISE & NSF**
  - CSR and CRI (CNS Division)
  - CISE Emphasis Areas
  - NSF Cross-Directorate Programs

- **Proposal Preparation and Review Process**

- **Closing Remarks and Q&A**
NSF in a Nutshell

- Independent federal agency under the Executive Branch
- Supports basic research & education
- Uses grant mechanism
- Discipline-based structure
- Cross-disciplinary mechanisms
- ~ 50% Program Managers are Rotators/IPAs
- Oversight by the National Science Board
NSF’s Origin, Mission & Goal

- Established in 1950 by the NSF Act
- Only federal agency authorized to provide funding for research across all S&E disciplines
- “To Promote Progress of Science” and “Advance National Health, Prosperity & Welfare by Supporting Research & Education in S&E”
- NSF’s goal is to fund meritorious and broadly impacting S&E proposals
NSF’s Target Audience*

- U.S. Universities and Colleges
- U.S. Nonprofit, Nonacademic Organizations
- U.S. For-Profit Organizations
- State/Local Educational Organizations
- Unaffiliated U.S. Scientists, Engineers, Educators, & Citizens
  - NSF Rarely Supports Foreign Organizations or Other Federal Agencies

* Program Solicitations may establish more restrictive eligibility
NSF Sponsors Research in All Fields of Science and Engineering

SCIENCES
- Astronomy
- Atmospheric Sciences
- Behavioral Sciences
- Biological Sciences
- Computer Science
- Earth Sciences
- Materials Research
- Mathematical Sciences
- Oceanography

ENGINEERING
- Physical Sciences
- Research on Learning
- Social Sciences
- Aeronautical/Mechanical
- Chemical
- Civil
- Electrical
- Etc.
NSF’s Share of Total Federal Support for Basic Research at Academic Institutions

- Computer sciences: 86%
- Mathematics: 59%
- Social sciences: 48%
- Environmental sciences: 44%
- Engineering: 42%
- Physical sciences: 35%
- Biological sciences (non-medical): 9%
- Psychology: 1%
- Medical sciences: 0%
NSF Project Funding Profile

- Administration & Management: 5%
- Education & Training: 18%
- Research Projects: 52%
- Research Facilities: 19%
- Research Centers: 6%
NFS Appropriations
FY 1998 - 2006

62% Increase, 1998 – 2004
NSF Proposal Statistics
(FY 2005)

• 41,751 proposal actions
• ~ 254,000 reviews
• ~ 58,000 reviewers
• 9,784 awards
• 23.0% funding rate
NSF Research Grant Profile (FY 2005)

- Competitive awards: 9,794
- Average annual award: $155,280
- Median annual award: $97,065
- Average duration (research): 2.9 years
Number of FY 2003 Proposals: 29,164 Declines, 10,791 Awards (37% success)
Directorate for Computer and Information Science and Engineering (CISE)
CISE’s Mission

- CISE has three goals:
  - to enable the United States to remain competitive in computing, communications, and information science and engineering
  - to promote understanding of the principles and uses of advanced computing, communications, and information systems in service to society
  - to contribute to universal, transparent, and affordable participation in an information-based society

- CISE provides > 85% of all Federal support for computer science research
CISE Organization

Office of the Director

Office of the Assistant Director for CISE

CCF
Computing and Communications Foundations
- Clusters
  - EMT
  - CPA
  - TF

CNS
Computer and Network Systems
- Clusters
  - NeTS
  - CSR
  - CRI

IIS
Information and Intelligent Systems
- Clusters
  - HCC
  - III
  - RI

OCI
Office of Cyberinfrastructure
(formerly SCI, now an NSF-wide mission, reporting to Director of NSF since 2006)

Crosscutting CISE Emphasis Areas
- CT
- SoD
- BPC
- CPATH
Computing and Communication Foundations Division (CCF)

• **Emerging Models and Technologies for Computation (EMT)**
  - Computational biology; quantum computing; nano-scale computing; biologically-inspired computing

• **Foundations of Computing Processes and Artifacts (CPA)**
  - Advanced computation research; compilers; computer architecture; design automation (micro/nano); graphics & visualization; software engineering & languages

• **Theoretical Foundations (TF)**
  - Computer science and communication theory; numeric symbolic/graphic computation; theory of computing; computational algebra and geometry; signal processing
Computer and Network Systems Division (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

- **Cross-Directorate Emphasis Areas & Activities**
  - Cybertrust (CT); Science of Design (SoD); Broadening Participation in Computing (BPC); IT workforce and special projects: REU sites, IGERT, ADVANCE, CPATH
Information and Intelligent Systems Division (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
## NSF & CISE Budget in $M FY’05 to FY’07 (Requested)

<table>
<thead>
<tr>
<th>CISE Divisions</th>
<th>FY’05</th>
<th>FY’06   (Change)</th>
<th>FY’07   (Change)</th>
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<tbody>
<tr>
<td>CNS</td>
<td>$132.39</td>
<td>$141.53 (+7%)</td>
<td>$162.98 (+15%)</td>
</tr>
<tr>
<td>CCF</td>
<td>$91.41</td>
<td>$105.46 (+15%)</td>
<td>$122.82 (+16%)</td>
</tr>
<tr>
<td>IIS</td>
<td>$92.54</td>
<td>$103.62 (+12%)</td>
<td>$119.30 (+15%)</td>
</tr>
<tr>
<td>ITR (across divisions)</td>
<td>$173.78</td>
<td>$145.80 (-16%)</td>
<td>$121.59 (-16%)</td>
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<td><strong>CISE Total</strong> <em>(Research)</em></td>
<td>$490.12</td>
<td>$496.41 (+1%)</td>
<td>$526.69 (+6%)</td>
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<td><strong>NSF Total</strong></td>
<td>$5,745</td>
<td>$5,605 (-2.4%)</td>
<td>$6,020 (+7.4%)</td>
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* Major Research Equipment and Facilities Construction (MREFC) since ’05: $165.6M add’l
The requested 6.1% increase includes $20M for cybersecurity and $10M for GENI.
CCF Budget
2003 – 2007

Dollars in Millions

Fiscal Year
Funding Rate for Competitive Awards in CCF

- Competitive Proposal Actions
- Competitive Awards
- Funding Rate
CCF Cluster Budgets
2004 - 2006

Diagram showing budget allocations for Cross, EMT, CPA, and TF clusters from 2004 to 2006.
Foundations of Computing
Processes and Artifacts
(CPA) Cluster
Foundations of Computing Processes and Artifacts (CPA)

The CPA Cluster supports basic research and education projects aimed at advancing formalisms and methods pertaining to processes and artifacts for designing and building computing and communication systems

- Processes and artifacts range from formalisms, models, algorithms, theories, design principles and languages to hardware/software architectures, technology components, and a variety of physical manifestations and implementations

- The CPA cluster funds a diverse portfolio of high-quality, high-payoff foundational research to meet the needs of the scientific and engineering community as well as society at large
Foundations of Computing Processes and Artifacts (CPA)

• Current CPA focus areas and Program Directors

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• Each focus area can have topics of specific interest, but clustering promotes cross-disciplinary research that may transcend programmatic/area boundaries
CPA Proposal Solicitation

• 2005 CPA competition
  – ~ 80 awards from ~ 530 proposals received (~ 15% success rate)
  – ~ $30,000,000 total funds, for ave. of ~ $125,000/yr over all awards

• 2006 CPA Solicitation 06-585
  – Proposal due date: October 10, 2006, 5pm local time
  – Anticipated funding, number, and size of awards:
    • $44,000,000 max. anticipated funds (could be much less)
    • 80 to 120 awards, averaging $125,000/year for 3 years
    • up to 5 awards of up to $500,000/year for 3 years for well-integrated projects of larger scope and magnitude
    • up to 2 collaborative multi-institutional awards of up to $250,000/year for 4 years for nanosystem topics having relevance to computing (i.e., NIRT-like awards)
  – Submission limitations:
    • Investigators may participate as PI, co-PI, or Senior Personnel on at most one proposal for this solicitation
    • PIs must come from US universities or colleges
### Foundations of Computing

**Processes and Artifacts (CPA)**

#### Current CPA focus areas and Program Directors

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Advanced Computation Research (ACR)

Hardware/software research and enabling technologies for advancing the state-of-the-art in computational science and engineering, developing efficient computational algorithms, high throughput input/output (I/O) capabilities, large data storage capacities, and tools for efficiently organizing, locating, and moving data produced by different applications in numerous locations and in various formats.

Topics of interest include:

- Design of multi-level (hierarchical, layered) parallel algorithms and libraries
- Scalable and latency tolerant computational/numeric algorithms
- Performance modeling of scalable algorithms
- Management of large-scale distributed file systems and data
- Novel storage devices, architectures, and middleware for high-throughput I/O
- Software and hardware processes and artifacts for design, simulation, benchmarking, tracing, performance measurement, and tuning of I/O, file, and storage systems in high-performance computing environments.
Foundations of Computing Processes and Artifacts (CPA)

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Compilers & HP Software (CHS)

Foundations in compilers research and education for enabling automatic algorithm mapping, code and data transformation, translation to hardware description language (for reconfigurable architectures), advanced analysis to verify program correctness and improve programmer productivity, compiler support for automating the exploitation of parallelism (i.e., parallelizing compilers for single-threaded and multi-threaded programs for multicore & multiprocessor systems)

Topics of interest include:

- Parallelizing compilers and infrastructure for optimizing compilers for multiple platforms
- Parallelization techniques for exploiting parallelism at multiple levels applicable to multiple programming models
- Software and compiler support for mapping and scheduling multiple threads on (possibly heterogeneous) multicore and multiprocessor systems
- Software and compiler techniques for managing on-chip communication, power consumption, temperature, and fault tolerance
- Compiler techniques to guarantee safety from potential deadlocks, memory leaks, race conditions, and other forms of correctness in parallel programs
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Computer System Architecture (CSA)

Foundations in computer system architecture research and education for facilitating and enabling scalable performance, power and thermal management, reliability (soft and hard error detection and recovery), dynamic adaptation, real-time computation, security, reduced design complexity, programmability, and other enhanced functionalities.

Topics of interest include:

• Processor microarchitecture, memory, and interconnection networks: multithreaded, multicore, and multiprocessor architectures; distributed register and cache architectures; on-chip networks.
• Novel architectures and hardware primitives that facilitate concurrency and exploit parallelism at multiple levels and in multiple forms: fine-grained, instruction, data, thread, stream, task, and coarse-grained.
• Architectural techniques for managing on-chip communication, power consumption, temperature, operational variability, error/fault tolerance.
• Application-to-hardware mapping: application-specific processors, programmable accelerators, and reconfigurable computing.
• Design and analysis of computer systems: tools and methods for design space exploration; modeling, benchmarking, simulation, synthesis, and performance evaluation.
Foundations of Computing
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Design Automation for Micro and Nano Systems (DA)

Foundations in VLSI design automation in both CMOS silicon technology and future computing media (i.e., MEMs, 3-D, optical, molecular, and nano-scale technologies) to meet the needs of deep submicron VLSI computing and communication chips.

Topics of interest include:

- **Physical design:** routing & layout, power optimization, logic synthesis, on-chip communication, modeling & device simulation.

- **System-level design:** systems-on-a-chip, multicore, embedded, and application-specific processor design; hardware/software co-design.

- **Test and verification:** analog and digital mixed-signal systems, built-in self-test, design for testability, formal proof of correctness.

- **Nano-scale design related to the circuits/architecture interface:** novel approaches to parallelism suitable to nano-scale electronics, systems integration of nano-scale devices, design of reliable systems from unreliable components, defect/fault models, fundamental limits to such designs.
Foundations of Computing Processes and Artifacts (CPA)

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Graphics & Visualization (GV)

- Integrated research and education projects to advance the scientific foundations and engineering practices/education that underlie the ability to perform visual information transfer, address models of physical events, develop mechanisms for image production, and utilize visualization to represent and explore information.

- Focus is on the ability to model, render, and display data and to understand the forms of visualization that can best transfer particular types of information.

- Seek *fundamental* advances that will enhance the numerous activities that utilize computer graphics and visualization, including science, engineering, medicine, entertainment, education, commerce, and homeland security.

Computer-generated lighting effects using flash photography [Durand, MIT]

Multiresolution Subdivision Surfaces simplify the addition of sharp surface features onto surfaces [Zorin, NYU]
Topics of interest include:

• Mathematical models for representing geometric and non-geometric data
• Algorithms for the photorealistic and non-photorealistic rendering of geometry, lighting, and materials
• Physical-based modeling and graphical simulation
• Animation techniques
• Multi-resolution algorithms for graphics modeling and applications
• Visibility algorithms
• Scientific visualization algorithms and systems
• Visualization aspects of visual analytics
• Visualization aspects of location-aware computing
• Virtual and augmented reality
• Novel hardware for graphics processing
• Graphics issues in computational photography and video
• Innovative multidisciplinary proposals that join visualization with other computer-science domains

The nanoManipulator system enables scientists to directly see and touch nanometer-scale objects [Taylor et al., UNC]

The steps of the Virtual Colonoscopy: CT scan of patient’s abdomen; automatic segmentation and reconstruction; real-time volume rendering [Arie Kaufman, SUNYSB]
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Software Engineering and Languages (SEL)

- Integrated research and education projects to advance the scientific foundations and engineering practices/education that contribute to new understanding of software and software development issues with an objective of significantly increasing productivity of software development and attaining the highest quality software-based products and services.

- Relevant projects may concern any of the artifacts and processes involved in software engineering—including languages, theories, models, techniques, methods, tools and environments relating to requirements, specification, design, programming, verification, testing, maintenance, transformation, evolution and other activities of software development.

- Proposals should emphasize lasting principles, robust theories, high-leverage tools and novel approaches with plans for validation through proofs of concept, empirical evaluation and/or other scientific methods.
Software Engineering and Languages (SEL)

Topics of interests include:

• Programming language principles, design and implementation
  – PL semantics to elucidate new features, e.g., aspects
  – Advancing type theory to full theorem proving

• Software analysis and testing
  – Test-case generation, fault localization
  – Static and dynamic checking, model checking
  – Monitoring and continuous testing of distributed systems

• Formal methods for program development – components and composition
  – Assembling components to meet a specification, trusted components, behavioral interfaces

• Software development methodology
  – Informal methods, integrated environments, processes, requirements, architectures, dependability, scaling up
Related Programs

- CNS’s Computer Systems Research (CSR) Cluster
  - CSR next solicitation proposal deadline expected to be December 2006

- CISE’s Cyber Trust (CT) Emphasis Area Program
  - CT next solicitation proposal deadline expected to be March 2007

- CISE’s Science of Design (SoD) Emphasis Area Program
  - SoD next solicitation proposal deadline expected to be January 2007

- CISE’s Computing Research Infrastructure (CRI) Program
  - CRI next solicitation (06-597) proposal deadline is November 15, 2006

- Other NSF cross-cutting CISE related programs:
  - Major Research Instrumentation (MRI) Program
  - Industry University Cooperative Research (I/UCRC) Program
  - CAREER Program
  - IGERT, REU Sites, ADVANCE, GK-12, CPATH Programs
Components of CSR Program

- (EHS) Embedded and Hybrid Systems
  - (Helen Gill)
- (PDOS) Parallel and Distributed Operating Systems
  - (Brett Fleisch)
- (AES) Advanced Execution Systems
  - (Frederica Darema)
- (SMA) System Modeling and Analysis
  - (Frederica Darema)

Distributed Applications

- Advanced Execution Systems
  - Prog. Models
  - Compilers
  - Libraries
  - Tools
  - Visualization
  - Collaboration Environments

- Parallel and Distributed Operating Systems
  - Scalable I/O
  - Data Management
  - Archiving/Retrieval Services
  - Authentication
  - Authorization
  - Fault Recovery Services

Distributed Systems Management

- Distributed, Heterogeneous, Dynamic, Adaptive Computing Platforms and Networks

- Memory Technology
- CPU Technology
- Device Technology
- ...
CISE Computing Research Infrastructure (CRI)

- **Program Objectives:**
  - Infrastructure Acquisition and Development track; to support research and education of proposers; install & maintenance; requests for $50K to $2M
  - Community Resource Development track; to create resources that support research (and education) for a national community of researchers; requests for $300K to $2M
  - Planning track: up to $50K to plan for above
  - Supports infrastructure in all areas in which CISE supports research. CRI “complements” research program funding.
  - NSF -6-597; Deadline Nov. 15, 2006; 1st Tuesday, Aug. 2007
CISE Computing Research Infrastructure (CRI)

- Funds: upwards of $18.0M per year
- Success rates: about 30% of proposals receive funding. Thanks to funds from related research programs, about 20% of requested funds are awarded.
- Proposals: about 230 per year.

- PD’s: Tanya Korelsky, Stephen Mahaney, Rita Rodriguez
CISE Computing Research Infrastructure (CRI)

- **Infrastructure Acquisition.** These awards have budgets up to $2,000,000.
- **Community Resource Development.** These awards have budgets from $300,000 to $2,000,000: medium from $300,000 to $800,000 and large over $800,000. Development projects create a resource for an entire CISE research community, such as a testbed for evaluating research results or a large data resource that contains problems a community is trying to solve (e.g., annotated speech data).
- **Planning.** These awards facilitate the preparation of a proposal for a medium or large infrastructure acquisition grant. They have budgets up to $50,000 for one institution or up to $100,000 if more than one institution is involved.
CISE Cross-Cutting Emphasis Areas

• **Characteristics**
  - cut across clusters and divisions (and directorates)
  - address scientific or national priority

• **FY 2006 Emphasis Areas**
  - Cyber Trust
  - Science of Design
  - Information Integration
  - Broadening Participation in Computing

• **FY 2007 Emphasis Areas**
  - Cyber Trust: December, 2006
  - Science of Design: January 17, 2007
  - Information Integration:
  - Broadening Participation:
CyberTrust

• **Vision: A society in which**
  - Computing systems operate securely, reliably, and predictably in presence of attacks
  - Computing systems protect 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**
Cyber Trust

- **FY 2006 competition**
  - ~ 425 proposals received in February 2006
  - 59 awards funded at $25M (~ 14% success rate)
    - 41 single PI awards totaling $12M
    - 10 team awards totaling $11M
    - 8 exploratory awards totaling $2M
    - excludes 8 CAREER awards totaling $3.2M

- **FY 2007 competition**
  - Solicitation expected in December 2006 (anticipated deadline of March 2007)
  - Anticipated Funding Amount: $30M
Science of Design (SoD)

- *About* Computing: computers, computation, information, communication
- *Not about*: buildings, bridges, airplane wings, traditional engineering design, nano, biotech, ..
- However: desirable to import design research from other fields
- How is “software” different from other materials from which artifacts are designed?
- How is design of (distributed, embedded, heterogeneous, ...) systems different or the same as design of other artifacts?
Science of Design (SoD)

- Focus—design of software-intensive systems
- Advance design research and education to meet critical software design challenges
- New paradigms, concepts, approaches, models, methods, and theories to build an intellectual foundation for software design to improve the processes of constructing, evaluating, and modifying software-intensive systems
- Research must be intellectually rigorous, formalized where appropriate, supported by empirical evidence, open to creative expression, and teachable.
SoD Program Objectives

• How to synthesize creative expression with scientific rigor in the design of software-intensive systems?
  – Import and adapt the creative thinking about design from other scientific, engineering, and artistic fields within context of the unique nature of software
  – Develop new, innovative constructs, models, methods, and tools to move software design into the next generation of complex, distributed computing environments
Science of Design

- **FY 2006 competition**
  - Proposals received in January 2006
  - Projects up to $300,000/year for 3 to 5 years
  - Received ~ 113 proposals (~90 projects)
  - Made 30 awards (many SGERs of up to $200K)
  - ~ $10 million invested

- **FY 2007 competition**
  - Anticipated proposals due date: January 17, 2007
  - Anticipated Funding Amount: ~ $10 million
Broadening Participation in Computing (BPC) Program

- The Broadening Participation in Computing (BPC) 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.
  - New Program FY05
  - Available Funds: 14 Million
  - Full Proposals due: April 5, 2006
  - Check CISE web site concerning which proposals require a Letter of Intent and due dates (Note: The Letter of Intent MUST be submitted via FastLane)
BPC Program

- Initial Emphasis will be on students from communities with longstanding under-representation in computing:
  - Women, persons with disabilities, and

- Develop and implement innovative methods to improve recruitment and retention of these students at the undergraduate and graduate levels.

- Develop effective strategies for identifying and supporting members of the targeted groups who want to pursue academic careers in computing.
BPC Program Components

- **Alliances (up to $1M/year for up to 3 years)**
  - Comprehensive programs that address under-representation in the computing disciplines
  - Join academic institutions of higher learning with secondary schools, government, industry, professional societies, and other not-for-profit organizations

- **Demonstration Projects (average $200k/year for 2-3 yrs)**
  - Demonstration Projects (DPs) are smaller in scope and narrower in focus than Alliance projects.
  - DPs will be pilots that could be incorporated into the activities of an Alliance

- **Supplements**
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.
GENI Components

GENI Research Program

- Support research, design, and development of new networking and distributed systems
- Build on many years of knowledge and experience
- Encouraging researchers and designers to:
  
  • reexamine all networking assumptions
  • reinvent where needed
  • design for intended capabilities
  • deploy and validate architectures
  • build new services and applications
  • encourage users to participate in experimentation
  • take a system-wide approach to the synthesis of new architectures
GENI Components
(continued)

The GENI Facility will enable:

- Shared use through slicing and virtualization in time and space domains (i.e., where "slice" denotes the subset of resources bound to a particular experiment);
- Access to physical facilities through programmable platforms (e.g., via customized protocol stacks);
- Large-scale user participation by "user opt-in" and IP tunnels;
- Protection and collaboration among researchers by controlled isolation and connection among slices;
- A broad range of investigations using new classes of platforms and networks, a variety of access circuits and technologies, and global control and management software; and
- Interconnection of independent facilities via federated design.
GENI Outreach

- CISE has supported numerous community workshops in support of GENI
- CISE is supporting on-going planning efforts, including needs assessment and requirements for the GENI Facility.
- CISE will hold town meetings and continue to support future workshops to broaden community participation.
- CISE will work with industry, other US agencies, and international groups to broaden participation in GENI beyond NSF and the US government.
NSF-wide Crosscutting Programs
Major Research Instrumentation Program (MRI)

FY2006 budget $90M

The Major Research Instrumentation Program (MRI) is designed to increase access to scientific and engineering equipment for research and research training in our Nation's organizations of higher education, research museums and non-profit research organizations. This program seeks to improve the quality and expand the scope of research and research training in science and engineering, and to foster the integration of research and education by providing instrumentation for research-intensive learning environments. The MRI program encourages the development and acquisition of research instrumentation for shared inter- and/or intra-organizational use and in concert with private sector partners.
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.
Office of CyberInfrastructure (OCI)

- New Office of CyberInfrastructure (OCI) created in the Office of the Director
  - Division of Shared CyberInfrastructure (SCI) in CISE no longer exists
- NSF’s plans for CyberInfrastructure may be found in: NSF’s Cyberinfrastructure Vision for 21st Century Discovery
  - Consists of four chapters covering the period (2006-2010):
    - Strategic plan for High Performance Computing
    - Strategic plan for Data, Analysis and Visualization
    - Strategic plan for Collaboratories, Observatories and Virtual Organizations
    - Strategic plan for Education and the Workforce
Cross-Foundational Programs

- IGERT
- REU Sites
- ADVANCE
- GK-12
- CAREER
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
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
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
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
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
Resources at your Disposal
Keeping Aware

- Funding Opportunities Calendar at NSF
- Guide to Programs/Browsing of Funding Opportunities at NSF Web site
- Funding Search Engine
- Upcoming Due dates
Observations on Proposal Preparation
Proposal Preparation

- Grant Proposal Guide
- Frequently Ask Questions
- Regional Grants Conferences
- Funding Opportunities Calendar at NSF
- Guide to Programs/Browsing of Funding Opportunities at NSF Web site
- Funding Search Engine
- Keep Aware of Upcoming Due Dates
NSF Merit Review Process

- Electronic Receipt of Proposal
- NSF Program Officer
- Peer Review
  - Ad Hoc
  - Panel
  - Combination
- Program Officer Recommendation (Award/Decline)
- Merit Review Criteria
  - Intellectual Merit
  - Broader Impacts

Awards and declines are determined based on reviews and recommendations.
NSF Review Criteria

Criteria include:

- What is the *intellectual merit* and quality of the proposed activity?

- What are the *broader impacts* of the proposed activity?
Intellectual Merit

Potential Considerations:

- How **important** is the proposed activity to *advancing knowledge and understanding* within its own field or across different fields?
  - *Significance of expected results*: incremental? high impact? high-risk, high-gain?
- How well **qualified** is the proposer (individual or team) to conduct the research?
  - Not necessarily track record in the specific field, but *quality of prior work* can be a consideration, as can *preliminary results*
- How creative, **original** are the concepts and **ideas**?
  - Should be *ground-breaking* in some aspect(s)
- How well conceived, **organized** is the proposed activity?
  - *Well-articulated problem* and well-structured research plan
- Is there sufficient **access to resources**?
  - Ownership is not necessary, only **access** to equipment, facilities, etc.
Intellectual Merit

Possible Ways of Assessing:

- **High impact** means more than just good papers
  - Does it *change practice* for the better?
- Funding *is possible* for *high-risk, high-reward* projects
  - Even if *some may not succeed*
  - Even if the *“details” are not all worked out* in advance
- Funding is unlikely for *“flawless”* projects that would *“predictably”* lead to only *incremental results*
- It’s expected that *not all creative work is already done*
  - It’s okay if PI doesn’t know what the *final solutions will be*
- Reviewers and Program Manager look for
  - Exciting, bold *vision*
  - *Articulation* of challenging problem(s)
  - *Substantiated description and plan* of proposed approach/solution
  - *Reasonable chance* the PI can be successful with the requested funds
Broader Impacts

Potential Considerations:

• How well does the activity advance discovery and understanding while promoting teaching, training and learning?

• How well does the activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc.)?

• To what extent will it enhance the infrastructure for research and education, such as facilities, instrumentation, networks and partnerships?

• Will the results be disseminated broadly to enhance scientific and technological understanding?

• What may be the benefits of the proposed activity to other disciplines and society as a whole?
Panel and Ad Hoc Reviews

- A minimum of 3 reviews/proposal (typically at least 4)
  - A score of $E, V, G, F, P$ is given to a proposal by each reviewer
  - Comments on intellectual merit and broader impacts are given
  - Typically, a recommendation to fund (or not) is also given

- Panel Review:
  - Proposals are discussed and evaluated collectively
  - Proposal summary is written—couple of sentences
  - Intellectual merits are described: strengths and weaknesses
  - Broader impacts are described: strengths and weaknesses
  - Improvements may be suggested (optional)
  - Panel recommendation: Competitive or Not Competitive

- Comments are intended to help unsuccessful PIs improve their proposals for the next competition
Seven Deadly Sins of Proposal Writing

1. Failure to focus on the problems and payoffs
2. No persuasive structure: *poorly organized*
3. No clear differentiation: *competitive analysis*
4. Failure to offer a compelling value proposition: *potential impact*
5. Key points are buried: *no highlights, no impact*
6. Difficult to read: *full of jargon, too long, too technical*
7. Credibility killers: *misspellings, grammatical errors, wrong technical terms, inconsistent format, etc.*
Ingredients for a Good Proposal

Educate the reviewers and Program Director

• What problem(s) does your work address?
• Why is this problem important?
• What will you do to contribute to a solution?
• What unique ideas/approaches do you have? Put in context.
• Why are you the best person to do this work?
• How will you evaluate your results?
  – How will we know if you were successful or if you failed?
• How will you assure that the work has an impact?
Response from the Community

- 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”)
Nuggets

- 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
NSF CISE Career Opportunities

- Program Directors are sought for one- or two-year terms or for permanent positions in CNS, CCF, and IIS Divisions of CISE
- Currently available positions are in the CNS Division (call closes on 10/06/06):
  - Network Systems (Nets) Cluster
  - Computer System Research (CSR) Cluster
  - Education and Workforce (EWF) Cluster
- Information about positions can be found at 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
Contact Information

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(703) 292-8910

CISE Web Site:  http://www.nsf.gov/cise
2006 Proposal Solicitations

CCF Division’s CPA 2006 Solicitation 06-585

– *Proposal due date: October 10, 2006*

CNS Division’s CSR 2006 Solicitation

– *Proposal due date: Mid-December, 2006*

- *Research topics include (but are not limited to)*
  - **SW/HW systems**: reliable and high-performance computing, parallelizing compilers, programming models, and run-time support for efficient resource allocation and scheduling
  - **Computer system architecture**: processor architecture, memory, I/O subsystems, interconnection networks (including on-chip networks), reconfigurable and application-specific architectures; multicore, multithreaded, and SoC architectures
  - **SW/HW tools**: design, simulation, benchmarking, performance measurement, evaluation and tuning
## CISE Proposal/Award Statistics

<table>
<thead>
<tr>
<th>FY</th>
<th>Proposals</th>
<th>Awards</th>
<th>Funding Rate</th>
<th>CGIs</th>
<th>Supplements</th>
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<tr>
<td>2005</td>
<td>4,962</td>
<td>1,086</td>
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<tr>
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<td>1,017</td>
<td>16%</td>
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<td>2003</td>
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<td>1,023</td>
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<td>308</td>
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