

COMPUTER AND INFORMATION SCIENCE AND ENGINEERING **\$526,690,000**

The FY 2007 Budget Request for the Computer and Information Science and Engineering (CISE) Directorate is \$526.69 million, an increase of \$30.28 million, or 6.1 percent, over the FY 2006 Current Plan of \$496.41 million.

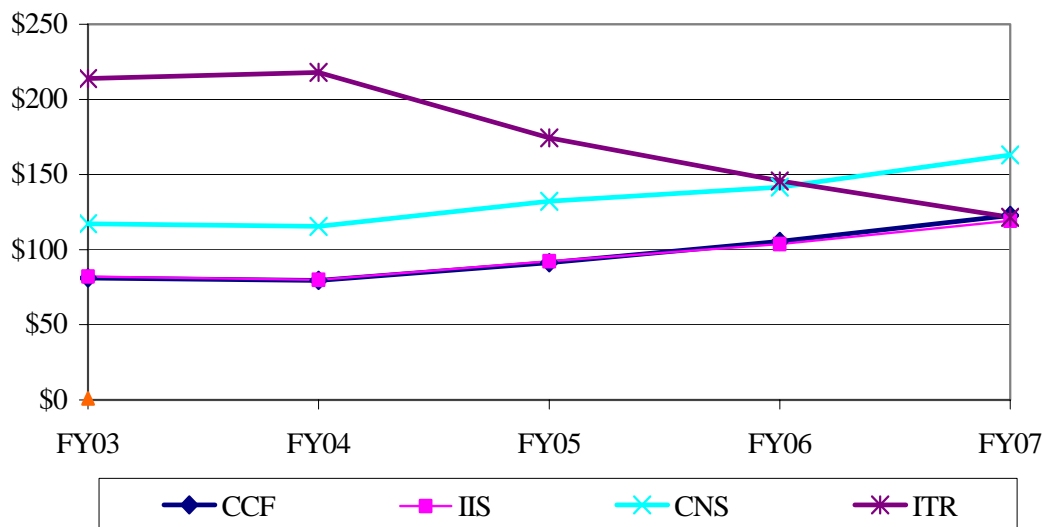
Computer and Information Science and Engineering Funding
(Dollars in Millions)

	FY 2005 Actual	FY 2006		Change over FY 2006	
		Current Plan	FY 2007 Request	Amount	Percent
Computing and Communication Foundations (CCF)	\$91.29	\$105.46	\$122.82	\$17.36	16.5%
Computer and Network Systems (CNS)	132.17	141.53	162.98	21.45	15.2%
Information and Intelligent Systems (IIS)	92.31	103.62	119.30	15.68	15.1%
Information Technology Research (ITR)	174.43	145.80	121.59	-24.21	-16.6%
Total, CISE	\$490.20	\$496.41	\$526.69	\$30.28	6.1%

Totals may not add due to rounding.

The CISE Directorate supports investigator-initiated research in all areas of computer science and engineering and related fields and contributes to the education and training of future generations of computing professionals, ensuring a supply of qualified technical personnel commensurate with national needs. CISE's Division of Shared Cyberinfrastructure was transferred to the Office of the Director in FY 2005, and renamed the Office of Cyberinfrastructure. The CISE budget has been rebased to reflect this organizational realignment. The CISE mission has been rescoped to focus on fundamental research and education in computing.

CISE Subactivity Funding
(Dollars in Millions)

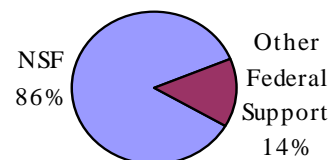


Note: The chart indicates that, with the completion of the ITR priority area, CISE ITR investments are being redirected to prominent IT research challenges and opportunities in core CISE activities in CCF, CNS and IIS.

RELEVANCE

CISE is the principal source of federal funding for university-based basic research in computer science, providing the vast majority – 86 percent – of total federal support in this area. The CISE Directorate also plays a leadership role in the multi-agency Subcommittee on Networking and Information Technology Research and Development (NITRD), co-chaired by the CISE Assistant Director. NITRD coordinating groups (CGs) that promote interagency coordination are co-chaired by CISE scientific officers.

Federal Support for Basic Research in Computer & Information Science & Engineering at Academic Institutions



Essentially, all practical applications of computing technology are ultimately based on ideas and concepts that have emerged at some point – often some years ago – from one or more basic research projects in computer science and engineering. These fundamental ideas and concepts have then enabled innovative product and application developments that now permeate essentially all areas of modern life. In turn, these practical innovations in computing-based technology not only form a sizeable portion of the economy in their own right, but are essential to innovation and effectiveness in many areas, including advanced scientific research, medical care, national and homeland defense, organizational competitiveness, and governmental efficiency.

Consistent with the Administration’s NITRD priority, in FY 2007 CISE will continue to advance the frontiers of information technology (IT) by supporting innovative research and education activities, and promoting advances in new software, hardware, systems, and algorithms. These investments include: research on new high performance computing (HPC) hardware and software architectures; homeland security areas such as cybersecurity, machine translation, artificial intelligence, computer vision, and technologies for collaboration and information retrieval; and nanotechnology via exploratory and interdisciplinary work on novel nano-based devices and architectures that promise to form the basis of future computing and communication systems.

In FY 2007, CISE will continue to capitalize on the positive outcomes of the NSF-wide Information Technology Research (ITR) priority area that ended in FY 2004. ITR, an NSF-wide priority area from FY 2000 to FY 2004, spurred innovative research, permitted work on realistic-scale problems, and built strong bridges between computing and other fields. ITR outcomes have led to the emergence of a new CISE “core”, with a greater focus on inter- and cross-disciplinary research and education activities. In FY 2007, support will continue for projects that promise to advance the computing frontier of varying size and scope, from single investigators to center-scale activities, from very basic to highly interdisciplinary, and from very local to international partnerships.

As a result of the essential and growing role of computing in society, the number of new scientific opportunities and challenges presented by the field far exceeds CISE’s ability to fund them. While CISE has always received many more quality proposals than can be funded, proposal funding rates have declined dramatically since FY 2000 as a consequence of growth in the field. CISE was able to fund 32 percent of the proposals received in FY 2000; in FY 2005, only 21 percent could be supported.

Summary of Major Changes by Division

(Dollars in Millions)

CISE FY 2006 Current Plan..... \$496.41

Computing and Communication Foundations +\$17.36

Increased support will lead to the development of revolutionary software and hardware architectures that: improve the raw performance of computing systems, potentially by orders of magnitude; contribute to the improved security, reliability, and manageability of computing systems; and increase exploration of emerging computing paradigms including quantum and bio-computing. In addition, increased support will lead to new understanding of both the limits and optimal methods of computation and communication in our increasingly mobile and interconnected world.

Computer and Network Systems +\$21.45

Increased funding will support projects that promote the systematic re-design of current network systems, a pressing challenge since the existing network architecture is stressed and reaching the limits of its capabilities. CNS will also support the development of sensor systems that can greatly improve our ability to predict, detect and respond to natural disasters. In addition, CNS will increase support for projects aimed at making significant breakthroughs in the design and implementation of robust and secure systems software. Improving the security of computing and communications systems is of vital national importance and is an essential component in the division's programs.

Information and Intelligent Systems +\$15.68

Increased support will promote advances in Science and Engineering Informatics, informing the development of information tools and technologies that permit the effective collection, representation and analysis of very large collections of scientific data that further promotes discovery. Increased support is provided for Robust Intelligence and for Human-Centered Computing. IIS will build research capacity in areas foundational to homeland security such as machine translation, artificial intelligence, computer vision, and robotics.

Information Technology Research -\$24.21

Funds are redirected to prominent IT research challenges and emerging scientific opportunities in core CISE activities in CCF, CNS, and IIS. These funds will be used to support research on Cyber Trust and to support the broader category of cybersecurity research to address threats to this critical infrastructure. ITR funds also will be used to increase core funding rates in research on high-end computing, computational science, and broadening participation in computing.

Remaining ITR funds will be used for the design and pre-construction development associated with the Global Environment for Networking Innovations (GENI) program. GENI is a facility concept currently being explored by the computing community to permit a "clean-slate" reinvention of the Internet that builds in security and robustness and that creates new applications capabilities. If not addressed successfully, limits on the current Internet will severely impede innovation, defense, and economic activity within the next ten years. GENI builds on many years of research and practical experience as well as on FY 2005 planning activities. The GENI facility will enable experimental research in computing and networked systems at scale, and will support Homeland Security activities related to Critical Infrastructure Protection.

Subtotal, Changes	+\$30.28
FY 2007 Request, CISE.....	\$526.69

Summary of Major Changes in Directorate-wide Investments (Dollars in Millions)

CISE FY 2006 Current Plan.....	\$496.41
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Advancing the Frontier

Fundamental Computer Science and Engineering	+\$14.20
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Cybersecurity research and education increases by \$20.0 million of which \$10.0 million will increase support for the Cyber Trust program. Adjustments totaling \$5.80 million will be made in core CISE programs to accommodate the full increase for cybersecurity research.

Centers Programs	+\$0.08
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This increase restores both the Center for Embedded Networked Sensing and the Center for Ubiquitous Secure Technology to their full annual funding levels of \$4.0 million.

Capability Enhancement	+\$0.50
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Additional support of \$500,000, for a total of \$1.25 million, is provided for Industry/University Cooperative Research Centers (I/UCRCs) which support industry-university partnerships, speeding the transfer of basic research outcomes into products and services.

Education and Workforce Development

Individuals	+\$2.50
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CISE will provide additional support for the CAREER program to enhance opportunities for early career faculty. CISE also will provide additional support for students through the Research Experiences for Undergraduates (REU) program.

Institutions	+\$3.00
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CISE will provide additional support for education and workforce development activities to catalyze the development of both a new integration-oriented computing curriculum and the cross-campus integration of IT education and research.

Facilities and Infrastructure

Infrastructure and Instrumentation	+\$10.00
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An additional \$10.0 million will support the design and pre-construction development of the Global Environment for Networking Innovations (GENI). GENI is a facility concept currently being explored by the computing community to permit a "clean-slate" reinvention of the Internet that builds in security and robustness and that creates new applications capabilities. Once completed, the GENI facility will enable experimental research in computing and networked systems at scale, and will support Homeland Security activities related to Critical Infrastructure Protection.

Subtotal, Changes	+\$30.28
FY 2007 Request, CISE.....	\$526.69

NSF-WIDE INVESTMENTS

In FY 2007, the CISE Directorate will support research and education efforts related to broad, Foundation-wide investments in a number of areas, including NSF’s multidisciplinary priority areas and the Administration’s interagency R&D priorities.

CISE NSF-wide Investments
(Dollars in Millions)

	FY 2006			Change over	
	FY 2005	Current	FY 2007	FY 2006	
	Actual	Plan	Request	Amount	Percent
Biocomplexity in the Environment	8.00	3.00	-	-3.00	-100.0%
Cyberinfrastructure	45.32	63.00	68.00	5.00	7.9%
Human and Social Dynamics	3.00	3.00	5.00	2.00	66.7%
Mathematical Sciences	2.29	2.29	1.15	-1.14	-49.8%
National Nanotechnology Initiative	7.78	12.00	12.87	0.87	7.3%
Networking and Information Technology R&D	490.20	496.41	526.69	30.28	6.1%

Biocomplexity in the Environment: In FY 2007, BE activities are transitioned into core CISE activities.

Cyberinfrastructure: A total of \$68.0 million will support an increase in research on computing and communication techniques and systems that will form the cyberinfrastructure of the next decade. The challenges of scalability, security, reliability, and extensibility will be met with research and educational activities in architecture, software, networking, theory, and new underlying technologies.

Human and Social Dynamics: A total of \$5.0 million will expand research in areas such as augmented cognition and the exploration of new interfaces and tools that allow people to make informed and rational decisions in spite of human limitations and biases.

Mathematical Sciences: A total of \$1.15 million will emphasize interdisciplinary research and education bridging IT and mathematical disciplines, with focus on algebraic and geometric algorithms, algorithms for scalable scientific computations, and algorithms for visualization.

National Nanotechnology Initiative: A total of \$12.87 million will support research in areas such as fundamental nanoscale phenomena and processes; nanoscale devices and systems; nanomanufacturing; and research facilities and instrumentation. Within CISE, these general categories encompass architecture, design, and fabrication of information systems based on nanoelectronics, representation of quantum and classical information in nanostructures, and the national infrastructure needed to support such research.

Networking and Information Technology R&D: CISE's entire request of \$526.69 million is included in NITRD activities supporting fundamental research and related education in information technology and networking.

QUALITY

CISE optimizes the quality of the research it supports through the use of a competitive, merit-based review process. The percent of research funds that were allocated to projects that undergo external merit review was 97 percent in FY 2005, the last year for which complete data exist.

To ensure the highest quality in processing and recommending proposals for awards, CISE convenes Committees of Visitors (COVs), composed of qualified external evaluators, to review each program every three years. These experts assess the integrity and efficiency of the processes for proposal review and provide a retrospective assessment of the quality of results of NSF's investments. In December 2005, CISE convened a COV for the IIS Division. COVs also will be convened in FY 2006 for the CCF and CNS Divisions.

CISE also receives advice from the Advisory Committee for Computer and Information Science and Engineering (CISEAC) on such issues as: the mission, programs, and goals that can best serve the scientific community; the promotion of quality graduate and undergraduate education in the computer and information science and engineering sciences; and priority investment areas in computer and information science and engineering research. The CISEAC meets twice a year with members volunteering their time to serve on subcommittees for three additional days per year. Members from both academe and industry represent a cross section of the computer and information science and engineering field, with representatives from many different sub-disciplines within the field. The CISEAC includes a balanced representation of women, underrepresented minorities, and individuals from a range of geographic regions and institutions.

PERFORMANCE

NSF's FY 2007 budget is aligned to reflect funding levels associated with the Foundation's four strategic outcome goals and the ten investment categories highlighted in the FY 2003-2008 Strategic Plan. These categories were designed as a mechanism to better enable assessment of program performance and to facilitate budget and performance integration.

Computer and Information Science and Engineering
By Strategic Outcome Goal and Investment Category

(Dollars in Millions)

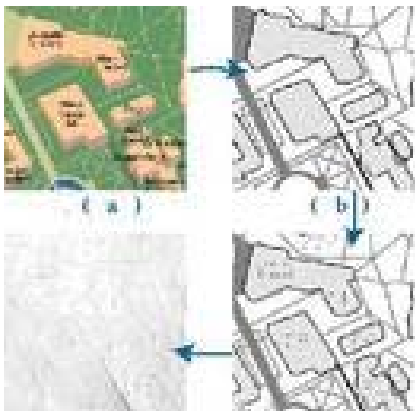
	FY 2006			Change over	
	FY 2005 Actual	Current Plan	FY 2007 Request	FY 2006 Amount	FY 2006 Percent
<i>Ideas</i>					
Fundamental Science and Engineering	\$400.71	\$389.52	\$403.72	\$14.20	3.6%
Centers Programs	6.03	9.92	10.00	0.08	0.8%
Capability Enhancement	0.55	0.75	1.25	0.50	66.7%
	407.29	400.19	414.97	14.78	3.7%
<i>Tools</i>					
Facilities	0.50	0.50	0.50	-	-
Infrastructure and Instrumentation	16.46	20.58	30.58	10.00	48.6%
Polar Tools, Facilities and Logistics	-	-	-	-	N/A
Federally-Funded R&D Centers	-	-	-	-	N/A
	16.96	21.08	31.08	10.00	47.4%
<i>People</i>					
Individuals	55.31	48.08	50.58	2.50	5.2%
Institutions	4.36	7.15	10.15	3.00	42.0%
Collaborations	-	14.00	14.00	-	-
	59.67	69.23	74.73	5.50	7.9%
<i>Organizational Excellence</i>					
	6.28	5.91	5.91	-	-
Total, CISE	\$490.20	\$496.41	\$526.69	\$30.28	6.1%

Totals may not add due to rounding.

CISE will continue its commitment to education, training, and increasing diversity within the computing field; the support for People reflects this commitment and represents CISE investments in the Broadening Participation in Computing (BPC) program, which encourages projects to work with local Centers of Research Excellence in Science and Technology (CREST), the Alliances for Graduate Education and Professoriate (AGEP) program, and the Louis Stokes Alliances for Minority Participation (LSAMP). Prominent IT research challenges and opportunities in the CISE Divisions of CCF, CNS and IIS are also targeted in FY 2007. At the same time, the FY 2007 request seeks to optimize funding rates and to emphasize crosscutting research and education opportunities in computing.

In FY 2007, CISE intends to launch a new education and workforce activity that will catalyze the development both of a new, integration-oriented computing curriculum and the cross-campus integration of IT education and research.

Recent Research Highlights



Four stages of producing a tactile image from an original image: (a) an original map, (b) a simplified map, (c) a simplified map with Braille inserted, and (d) a tactile map produced on a Tiger Embosser. Step (b) was completed automatically with our new color replacement algorithms and elementary edge detection. <http://tactilegraphics.ischool.washington.edu>

► **Automated Tactilization of Graphical Images: Full Access to Math, Science, and Engineering for Blind Students:** Understanding the work practices of people who create tactile graphics for the blind is crucial to developing an effective tool that will aid them in this very time- and labor-intensive work. Through a two-part study, NSF-supported researchers gained insight into how these specialists create diagrams, graphs, maps, and other tactile images for the blind in math, science, and engineering textbooks.

The research team developed image processing algorithms that automated various aspects of the image tactilization procedure, including color replacement and text identification. They then generated models to classify images by type (for example, bar charts or line graphs) so that the most appropriate image processing algorithms could be applied. The researchers will incorporate the image processing and classification algorithms into software: the Tactile Graphics Assistant. (IIS)

► **A “Natural” Robotic Hand Inspired by Biological Muscles:** An NSF-funded project is developing technology that allows a robot to have a “natural” hand with movement and features very similar to that of humans. The biologically inspired system uses multiple actuators, or devices that convert electrical control signals into physical actions, to coordinate both gross motion and fine movement with minimum architectural complexity. When applied to a five-fingered robotic hand, the novel system generated a variety of hand positions, some of which are illustrated. (IIS)

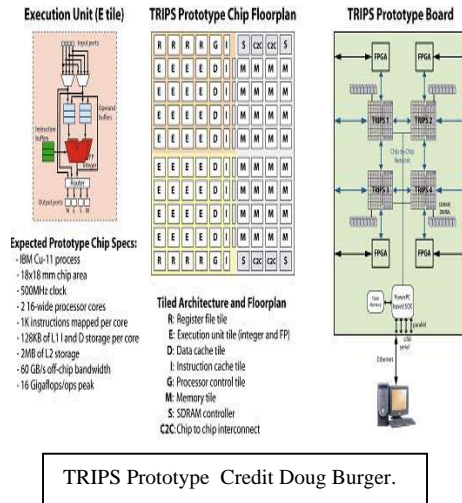


The left image shows an array of synthetic adhesive fibers 4mm in diameter that will be used to enhance the performance and robustness of climbing robots such as the ones shown in the center and right images climbing walls. *Credit: Carnegie Mellon University*

► **SGER: Biomimetic Wet Attachment Mechanism for Miniature Climbing Robots in Unstructured Environments:** A new, more efficient attachment mechanism has been developed for miniature climbing robots, enabling them to climb nearly vertical surfaces. The technology, based on methods used by beetles in nature, employs synthetic fibers to create an adhesive pad on the tread of the robot. The system generates high attachment forces with little energy input and requires only small amounts of power for detachment.

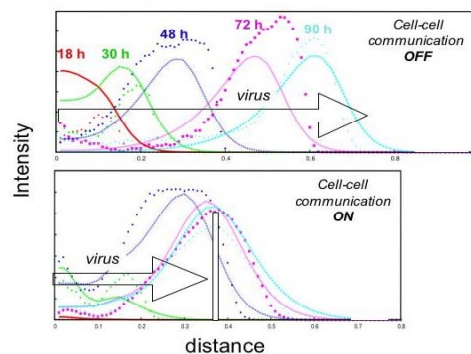
First tests demonstrated the feasibility of fabricating large areas of the synthetic fibers, and that the pads would allow a robot to climb surfaces with a 75° slope. In the near future, proposed synthetic micro/nano-structure manufacturing techniques could result in miniature climbing and walking robotic systems able to inspect bridges, buildings, nuclear facilities, and waste pipes and other hazardous or disaster-stricken areas. (IIS)

► **The Long-Term Effects of Technology on Microprocessors:** In a project co-funded by NSF and DARPA, researchers analyzed semiconductor technology trends over the next decade and designed new microprocessor architectures consistent with their findings. The team's TRIPS chip (Tera-op Reliable Intelligently-adaptive Processing System), which is now undergoing testing, is architecture that seeks to achieve significantly better performance — without the need for programmers to fine-tune the software — while using significantly less power. Two of the papers describing these ideas have received best paper awards; four others were selected for the “Top Picks in Computer Architecture” issue of *Institute of Electrical and Electronics Engineers Micro*, a journal that reaches an international audience of microcomputer and microprocessor designers, system integrators, and users. IBM Microelectronics is the fabrication partner on this project; working chips and boards are expected in early 2006. (CCF)



► **Preventing Pandemic Spread of Viruses by Cell-cell Communication:** Researchers have developed the first computational model that integrates information about virus growth and cell-cell signaling in order to understand how viral infections spread. Development of the model has been driven by a novel experimental system that enables visualization and analysis of spreading infections in a controlled laboratory setting.

Strategies to control viral diseases have focused on advancing vaccines or anti-viral drugs. Yet these approaches can fail due to the emergence of virus mutants that escape surveillance or develop drug resistance. One alternative is to utilize the innate immune response, a cellular response that up-regulates interferons (IFNs) in response to viral infections. IFNs are cell-cell signaling proteins that restrict the cellular resources needed by viruses for growth. While much is known about the molecular pathways of the IFN response, little is known about how IFN influences the dynamics of viral growth. Such advances in our quantitative understanding of innate cellular responses open opportunities for the design of new, robust anti-viral strategies. (CCF)



Other Performance Indicators

The tables below show the change in the number of people benefiting from CISE funding, and trends in the award size, duration, and number of awards.

Number of People Involved in CISE Activities			
	FY 2005	FY 2006	FY 2007
	Estimate	Estimate	Estimate
Senior Researchers	4,825	4,825	4,975
Other Professionals	597	597	615
Postdoctorates	322	322	330
Graduate Students	4,993	4,993	5,150
Undergraduate Students	731	731	755
Total Number of People	11,468	11,468	11,825

CISE Funding Profile			
	FY 2005	FY 2006	FY 2007
	Estimate	Estimate	Estimate
Statistics for Competitive Awards:			
Number	1,088	1,088	1,200
Funding Rate	21%	21%	21%
Statistics for Research Grants:			
Number of Research Grants	851	851	950
Funding Rate	17%	17%	18%
Median Annualized Award Size	\$112,000	\$116,000	\$116,000
Average Annualized Award Size	\$150,000	\$158,000	\$158,000
Average Award Duration, in years	3.0	3.0	3.0

COMPUTING AND COMMUNICATION FOUNDATIONS

\$122,820,000

The FY 2007 request for the Division of Computing and Communication Foundations (CCF) is \$122.82 million, an increase of \$17.36 million, or 16.5 percent, over the FY 2006 Current Plan of \$105.46 million.

Computing and Communication Foundations Funding

(Dollars in Millions)

	FY 2006		FY 2007 Request	Change over FY 2006	
	FY 2005	Current		Amount	Percent
	Actual	Plan			
Computing and Communication Foundations	\$91.29	\$105.46	\$122.82	\$17.36	16.5%
Major Components:					
Research & Education Grants	87.29	97.54	114.82	17.28	17.7%
Science and Technology Centers					
STC for Embedded Networked Systems	4.00	3.96	4.00	0.04	1.0%
STC for Ubiquitous Secure Technology	-	3.96	4.00	0.04	1.0%

About CCF:

CCF is organized into three clusters: Theoretical Foundations, Foundations of Computing Processes and Artifacts, and Emerging Models and Technologies. Within and across these clusters, CCF supports research and education activities that explore the foundations of computing and communication devices and their usage. Research and education projects supported promote advances in computing and communication theory, algorithms for computer and computational sciences, architecture and design of computers and software, and investigations of revolutionary computing paradigms such as bio-inspired computing. CCF projects also integrate education with research to prepare future generations of computer science and engineering professionals.

In FY 2005, the CCF Division received approximately 1,300 proposals, including more high quality proposals than could be funded. The CCF funding rate was 25 percent in FY 2005. Within the FY 2006 Current Plan, approximately 35 percent of CCF funding is already committed to grants made in previous years. A portfolio that includes a “mortgage” of approximately 35 percent for ongoing grants allows CCF to maintain a funding rate of 25 percent, and ensures that a sufficient level of CCF funds are available each fiscal year for new awards. This flexibility is particularly crucial in the computing field where the pace of technological innovation is rapid.

CCF supports the Science and Technology Center for Embedded Networked Sensing (CENS) at the University of California at Los Angeles. CENS is exploring embedded networked sensing systems, large-scale, distributed systems, composed of smart sensors and actuators embedded in the physical world. These systems promise to form a critical infrastructure resource, monitoring and collecting information on such diverse subjects as plankton colonies, endangered species, soil and air contaminants, medical patients, and buildings, bridges, and other man-made structures. Across this wide range of applications, embedded networked sensing systems promise to reveal previously unobservable phenomena.

Beginning in FY 2006, CCF supports the Science and Technology Center for Ubiquitous Secure Technology at the University of California at Berkeley (TRUST). TRUST will address a parallel and accelerating trend of the past decade--the integration of secure, robust computing and communications capabilities across critical infrastructures, in areas such as telecommunications, finance, energy

distribution, and transportation. The center will lead development of new technologies based on findings from studies of software and network security, trusted platforms, and applied cryptographic protocols. The center will also explore cybersecurity systems challenges through modeling and analysis, development of secure embedded systems, and integration of trusted components and secure information management software. These efforts will be merged with investigations of social science questions on economics, public policy and societal challenges, human-computer interfaces and privacy, and other issues.

CCF Priorities for FY 2007

The longer-term context of the FY 2007 request is focused on strengthening and integrating the core of computer science. All three CCF clusters, Theoretical Foundations, Foundations of Computing Processes and Artifacts, and Emerging Models and Technologies for Computation, will address the interoperability of complex systems and the need to design systems for the context in which they are used.

Strengthening the Role of Theory:

A variety of activities will be carried out that strengthen the role of theory as an incubator for new areas of computing and communications. These activities range from continued support of individual researchers through the application of theory to the foundations of connectivity and interoperability in wired and wireless networks.

Computing Processes and Artifacts:

Research will increase the robustness of hardware and software systems, supporting projects investigating architectural issues that affect performance of IT systems in real-world tasks. One such issue is interoperability: the ability of systems to share information and operate together. Other such issues are reliability, energy use, programmer productivity, and maintainability. All of these properties of hardware or software are affected by system architecture. Activities flowing from the Science of Design emphasis area will also be supported.

Emerging Models and Technologies:

Research will explore algorithms and models of computation for revolutionary technologies such as quantum information science or three-dimensional fabrication. Emphasis will continue on fabrication techniques and tools for emerging technologies. These activities will provide the basis for new computing technologies that promise computing performance improvements at the pace of Moore's Law. Moore's Law states that the number of transistors per integrated circuit will double every 18 months but this growth is expected to level off in the near future.

Cybersecurity:

Cybersecurity research will build on emphasis areas focused on software requirements for data security, new technologies for secure communication, and mathematical ways of controlling access to information.

Other Activities:

CCF will support a CISE-wide series of educational demonstration projects that will integrate IT across campuses; work on logical formalisms and algorithms for information integration; and broaden participation in computing.

Changes from FY 2006:

The FY 2007 request for CCF includes an increase of \$17.36 million directed toward core research and education. Disciplinary and interdisciplinary research in the CCF core will be allocated to activities like those described above and will help maintain a proposal funding rate of 25 percent.

COMPUTER AND NETWORK SYSTEMS

\$162,980,000

The FY 2007 request for the Division of Computer and Network Systems (CNS) is \$162.98 million, an increase of \$21.45 million, or 15.2 percent, over the FY 2006 Current Plan of \$141.53 million.

Computer and Network Systems Funding

(Dollars in Millions)

	FY 2006			Change over	
	FY 2005	Current	FY 2007	FY 2006	
	Actual	Plan	Request	Amount	Percent
Computer and Network Systems	\$132.17	\$141.53	\$162.98	\$21.45	15.2%
Major Components:					
Research & Education Grants	118.38	120.95	132.40	11.45	9.5%
Computing Research Resources	13.79	20.58	30.58	10.00	48.6%

About CNS:

The CNS Division is organized into four clusters: Computer Systems, Network Systems, Computing Research Infrastructure, and Education and Workforce. Organization into clusters minimizes stove-piping within the subdisciplines that CNS supports and allows changes in support patterns dependent on the scientific opportunities and needs of the subdisciplines represented in this division. Within and across these clusters, CNS supports research and education activities that invent new computing and networking technologies and that explore new ways to make use of existing technologies. The division seeks to develop a better understanding of the fundamental properties of computer and network systems through analysis, prototyping, and experimentation, and to create better abstractions and tools for designing, building, analyzing, and measuring future systems. The division also supports the computing infrastructure that is required to enable state-of-the-art computer science research and education, and it coordinates cross-divisional activities that foster the integration of research, education, and workforce development to develop future generations of computer science and engineering professionals.

In FY 2005, the CNS Division received over 2,100 proposals, more quality proposals than could be funded. The CNS funding rate was 20 percent in FY 2005. Within the FY 2006 Current Plan, approximately 35 percent of CNS funding is already committed towards awards made in prior years. A portfolio that includes a "mortgage" of approximately 35 percent for ongoing grants allows CNS to maintain a funding rate of 20 to 25 percent and ensures that a sufficient level of CNS funds are available each fiscal year for new awards. This flexibility is particularly crucial in the computing field where the pace of technological innovation is rapid.

CNS Priorities for FY 2007

The focus of the FY 2007 request for CNS is strengthening existing programs as well as initiating new and emerging research areas in computer and network systems, computing education, and IT workforce development.

Network Systems:

CNS supports a range of research and education activities in networking technology and systems to create next-generation networks while addressing the limitations of existing networks. The FY 2007 request

will focus on networking projects that will (1) exploit the capabilities of programmable radios to make more effective use of the frequency spectrum and to improve wireless network connectivity; (2) create architectures, tools, algorithms, and systems that make it easy to assemble and configure networks of sensor systems; and (3) expand our understanding of large, complex, heterogeneous networks, design of access and core networks based on emerging wireless and optical technologies, and continue the evolution of the Internet.

Computer Systems Research:

This cluster focuses on a variety of complex computing systems including distributed, mobile, and embedded systems, sensing and control systems, dynamically configured, multiple-component systems, and parallel systems. The FY 2007 request will continue to focus on supporting basic research in a number of important emerging areas, including high confidence system software that will control and manage computer systems so that system behavior is more predictable and analyzable, and consequently, more manageable. Another emerging area is effective system support software for large-scale, distributed dynamic applications. Effective system support will reduce the cost of system design, construction, and maintenance while increasing system performance.

Cybersecurity:

Computers reside at the heart of systems on which people rely, both in critical national infrastructures and in their homes, cars, and offices. Many of these systems are far too vulnerable to cyber attacks that can inhibit their operation, corrupt valuable data, or expose private information. Cybersecurity research will continue to address threats to this critical infrastructure. Within this effort, research in Cyber Trust supports a vision of a society in which networked computer systems are more predictable, more accountable, and less vulnerable to attack and abuse; are developed, configured, operated and evaluated by a well-trained and diverse workforce; and used by a public educated in their secure and ethical operation. In FY 2007, additional funds will be used to augment investments in the Cyber Trust program and in the broader category of cybersecurity research.

Education and Workforce Development:

In FY 2007, CISE intends to launch a new education and workforce activity that builds on a series of workshops to be held in FY 2006. These workshops bring together leading educators and researchers along with representatives from industry and professional organizations to discuss the requirements of the IT workforce of the next decade. The FY 2007 education and workforce activity will catalyze the development both of a new, integration-oriented computing curriculum and the cross-campus integration of IT education and research.

Changes from FY 2006:

The FY 2007 request for CNS includes an increase of \$21.45 million that will be directed toward the following areas:

Core Research and Education: +\$15.45

Disciplinary and interdisciplinary research in the CNS core will increase by \$15.45 millions, including Cyber Trust. This additional support will be allocated to research priorities as described above and will help improve the funding rate in CNS.

Other Institutions Support: +\$ 6.00

Funding for Other Institutions Support is increased by \$6.0 million in FY 2007 for improvements in computing curriculum and integration of IT education.

INFORMATION AND INTELLIGENT SYSTEMS

\$119,300,000

The FY 2007 request for the Division of Information and Intelligent Systems (IIS) is \$119.30 million, an increase of \$15.68 million, or 15.1 percent, over the FY 2006 Current Plan of \$103.62 million.

Information and Intelligent Systems Funding
(Dollars in Millions)

	FY 2006		FY 2007 Request	Change over FY 2006	
	FY 2005 Actual	Current Plan		Amount	Percent
	Information and Intelligent Systems	\$92.31		\$103.62	\$119.30
Major Component:					
Research & Education Grants	92.31	103.62	119.30	15.68	15.1%

About IIS:

The Division of Information and Intelligent Systems (IIS) supports research and education that 1) increases the capabilities of human beings and machines to create, discover and reason with knowledge; 2) advances knowledge about how computer systems perform tasks autonomously, robustly, and flexibly; 3) advances the state of the art in the application of IT to science and engineering problems; and 4) develops new knowledge about the integration of social and technical systems and capabilities. The division is organized into three clusters: Robust Intelligence, Human-Centered Computing, and Science and Engineering Information Integration Informatics. By organizing the division into clusters, stove-piping within IIS subdisciplines is minimized and flexibility in supporting emerging scientific opportunities is maximized. IIS activities also focus on the integration of research and education to prepare future generations of computer science and engineering professionals.

In FY 2005, the IIS Division received close to 1,900 proposals, including many more high quality proposals than could be funded. The overall IIS success rate was 16 percent, seven percent below the NSF average. Within the FY 2006 Current Plan, approximately 30 percent of funding is committed to continuing grant increments. Despite modest commitment to ongoing grants, IIS expects to maintain a funding rate of 16 percent across its programs.

IIS Priorities for FY 2007

The focus of the FY 2007 request for IIS is strengthening existing programs as well as initiating new and emerging research areas in information and intelligent systems. Support of research in areas such as Science of Design and Human and Social Dynamics will continue as well as participation in cybersecurity activities relating to information privacy and security.

Enabling Science and Engineering Informatics and Information Integration:

In FY 2007, IIS will support research enabling the effective management of science and engineering data that in turn leads to new discoveries in science and engineering. This topic was advocated by the National Research Council study that resulted in the book “Computing the Future” and argues that new core topics in computer science have promise for considerable impact outside of computer science. These topics include new methods of computational analysis of data such as that collected by observational sciences. IIS will also continue to focus on the challenge of providing a uniform view to a multitude of heterogeneous and independently developed data sources. This will free users from having to locate the data sources, interact with each data source in isolation, and manually combine data from multiple formats and multiple sources.

Enhancing Information Security and Privacy:

IIS participates in the Cyber Trust program. Continuing in FY 2007, IIS will support the area of Information Privacy and Security that is shared by the Robust Intelligence and Human-Centered Computing clusters. This area is exploring both technical and policy issues to insure that privacy is not compromised when data are shared and aggregated.

Promoting and Enhancing Collaboration:

In FY 2007, IIS research will focus on how collaborative research environments comprised of distributed experimental facilities and domain-specific research tools enable new scientific discoveries and education across disciplines and geography. IIS research will also continue to focus on how people, software agents, robots, and sensors contribute to collaborations that can self-organize for optimal concerted action, which is useful to society, for example, in responding to a crisis, performing surgery, or teaching children.

Technologies for Successful Aging:

In FY 2007, a focus will be on research that enables adults to remain involved and capable of living a longer independent life through the development of technologies and environments that automatically adapt to competencies and skills of the user.

Changes from FY 2006:

The FY 2007 request for IIS includes an increase of \$15.68 million directed toward core research and education in areas such as those highlighted previously. This funding increase will also help, at a minimum, to maintain the current funding rate.

INFORMATION TECHNOLOGY RESEARCH

\$121,590,000

The FY 2007 request for the Information Technology Research (ITR) Subactivity is \$121.59 million, a decrease of \$24.21 million, or 16.6 percent, below the FY 2006 Current Plan of \$145.80 million.

Information Technology Research Funding

(Dollars in Millions)

	FY 2006		FY 2007 Request	Change over FY 2006	
	FY 2005	Current		Amount	Percent
	Actual	Plan			
Information Technology Research	\$174.43	\$145.80	\$121.59	-\$24.21	-16.6%
Major Component:					
Research & Education Grants	174.43	145.80	121.59	-24.21	-16.6%

About ITR:

During FY 2000 - FY 2004, the ITR Subactivity provided for CISE investments in the agency-wide ITR priority area. It provided support for state-of-the-art IT research and related education activities; enhanced support for more focused research in areas of national importance such as cyber security, homeland security, and cyberinfrastructure; and permitted the funding of a larger number of complex, often interdisciplinary, projects.

In FY 2006, approximately 65 percent of ITR funds are committed to projects established in prior fiscal years. The remaining 35 percent of funds are available to make new awards in crosscutting areas in computing.

ITR Priorities for FY 2007

Funds available in the ITR Subactivity will be used to target IT priorities in the core CISE Subactivities of CCF, CNS, and IIS as well as prominent CISE-wide IT research and education priorities as described below.

Global Environment for Networking Innovations (GENI):

In FY 2007, ITR will support the design and pre-construction development associated with the Global Environment for Networking Innovations (GENI) program. GENI is a facility concept currently being explored by the computing community to permit a “clean-slate” reinvention of the Internet that builds in security and robustness and that creates new applications capabilities. If not addressed successfully, limits on the current Internet will severely impede innovation, defense, and economic activity within the next ten years. GENI builds on many years of research and practical experience as well as FY 2005 planning activities. The GENI facility will enable experimental research in computing and networked systems at scale, and will support Homeland Security activities related to Critical Infrastructure Protection.

Cybersecurity:

In FY 2007, ITR funds will be used to support cybersecurity research to address current and known threats to this critical infrastructure. Within this effort, research in Cyber Trust supports a vision of a society in which networked computer systems are more predictable, more accountable, and less vulnerable to attack and abuse; developed, configured, operated, and evaluated by a well-trained and

diverse workforce; and used by a public educated in their secure and ethical operation. In FY 2007, ITR funds will be used to support the Cyber Trust program and the broader category of cybersecurity research.

High-End Computing and Computational Science:

In FY 2007, ITR will continue to emphasize fundamental research on high-end software and hardware systems that are designed specifically to address important computation- and data-intensive science and engineering opportunities and challenges. Research activities will focus on building complex software and tools for high-end computing architectures; developing multi-scale analysis methods in computational science; and developing more sophisticated information management and data analysis tools and technologies to support the analysis of scientific data and information.

Broadening Participation in Computing:

The Broadening Participation in Computing (BPC) emphasis area aims to significantly increase the number of domestic students receiving postsecondary degrees in the computing disciplines. CISE will continue to support BPC projects in FY 2007 with ITR funds.

Changes from FY 2006:

In FY 2007, CISE will redirect \$24.21 million from the broad category of IT Research to IT priorities in the core CISE Subactivities of CCF, CNS, and IIS. With funds available in the ITR Subactivity, CISE will fund the research, education, and workforce preparation priorities described above.