NETWORKING AND INFORMATION TECHNOLOGY R&D

The National Science Foundation is a primary federal agency supporting the Networking and Information Technology Research and Development (NITRD) program. NSF's NITRD portfolio includes all funding in the Directorate for Computer and Information Science and Engineering (CISE) and the Office of Cyberinfrastructure (OCI), and contributions from all of the agency's other directorates. NSF makes research, education, or research infrastructure investments in every NITRD Program Component Area (PCA). NSF's Assistant Director for CISE is co-chair of the NITRD Subcommittee of the National Science and Technology Council's Committee on Technology and OCI provides NSF representation to the subcommittee. In addition, NSF works in close collaboration with other NITRD agencies and participates at the co-chair level in five of the seven PCA Coordinating Groups.

NSF's FY 2012 Request continues strong support for NITRD at a level of $1.258 billion, a 15.3 percent increase over the FY 2010 Enacted level. NITRD activities represent approximately 16 percent of NSF's FY 2012 budget. CISE and OCI's combined support comprises 77 percent of NSF's NITRD activities.

Several NSF-wide investments, both new and continuing, are reflected in various NITRD PCAs:

- Cyberinfrastructure Framework for the 21st Century (CIF21), designed to develop and deploy comprehensive, integrated, sustainable, and secure cyberinfrastructure to accelerate research and new functional capabilities in computational and data-intensive science and engineering, primarily supports investments in five program component areas: Large Scale Networking; High End Computing Research and Development (R&D); High End Computing Infrastructure and Applications; Human-Computer Interaction and Information Management; and Social/Economic/Workforce Implications of IT and IT Workforce Development.

- The Science, Engineering, and Education for Sustainability (SEES) cross-Foundation investment supports activities in Large Scale Networking as well as in Software Design and Productivity and Social/Economic/Workforce Implications of IT and IT Workforce Development.

- The National Robotics Initiative (NRI), a new cross-agency initiative engaging four U.S. agencies (NSF, NASA, NIH and USDA) in a concerted program to provide U.S. leadership in science and engineering research and education aimed at the development of next generation robotics, supports activities in Human-Computer Interaction and Information Management, High Confidence Software and Systems, and Social/Economic/Workforce Implications of IT and IT Workforce Development.

- Advanced Manufacturing investments encompass research in nanotechnology and cyber-physical systems, as well as expanded industry/university cooperation. Activities are supported in High End Computing R&D, High End Computing Infrastructure and Applications, and High Confidence Software and Systems.

- Enhancing Access to the Radio Spectrum (EARS), which supports basic research on new and innovative ways to use the spectrum more efficiently, supports activities in Large Scale Networking.

- The Comprehensive National Cybersecurity Initiative (CNCI) supports activities in Cybersecurity and Information Assurance.

Networking and Information Technology Research and Development Funding
(Dollars in Millions)

	FY 2010 Omnibus Actual	FY 2010 Enacted/ Annualized FY 2011 CR	FY 2012 Request
Biological Sciences	$93.00	$93.00	$99.00
Computer and Information Science and Engineering	618.71	618.83	728.42
Engineering	23.70	23.70	23.70
Geosciences	22.98	22.98	22.98
Mathematical and Physical Sciences	97.24	85.39	91.75
Social, Behavioral, and Economic Sciences	25.71	22.80	46.30
Office of Cyberinfrastructure	214.72	214.28	236.02
Subtotal, Research and Related Activities	$1,096.06	$1,080.98	$1,248.17
Education and Human Resources	9.50	9.50	9.50
Total, NITRD	**$1,105.56**	**$1,090.48**	**$1,257.67**

Totals may not add due to rounding.

FY 2012 NSF Investments by Program Component Area
The following information focuses on FY 2012 NSF-wide investments, both new and continuing, by PCA.

Large Scale Networking ($132.56 million) CISE will support the basic research that underpins Enhancing Access to the Radio Spectrum (EARS). The recent NSF workshop report, *Enhancing Access to the Radio Spectrum*, outlines the need for research on new and innovative ways to use the spectrum more efficiently. A portion of NSF's new investment in CIF21 will address broadband applications and research on end-to-end performance from the desktop to major scientific and computational facilities.

Cybersecurity and Information Assurance ($94.72 million) Support for the Comprehensive National Cybersecurity Initiative (CNCI) is increased by $10.0 million above the FY 2010 Enacted level to a total of $65.0 million for CNCI activities. A realignment of the funding allocation within CNCI provides $37.0 million for CISE to focus on the development of a Science of Cybersecurity as well as three research themes – Moving Target Defense, Tailored Trustworthy Spaces, and Cyber Economic Incentives. OCI will provide $16.0 million to (1) early deployment and testing of cybersecurity prototypes, and experimental approaches, (2) development of cybersecurity in advanced compute environments and leading-edge IT services, and (3) support research on virtual organization and coordination. SBE will provide $12.0 million, working in partnership with CISE, to support research at the interstices of the economic and computer sciences to achieve secure practices through the development of market forces that incentivize good behavior.

High-End Computing R&D ($123.82 million) Additional support is provided for CISE's nanotechnology research, including participation in the National Nanotechnology Initiative Signature Initiative: Nanoelectronics for 2020 and Beyond. NSF supports this effort in partnership with other federal agencies. NSF's investment in Science, Engineering, and Education for Sustainability (SEES) is increased and a portion of NSF's investment in CIF21 is included here.

High-End Computing Infrastructure and Applications ($308.11 million) NSF's investment in CIF21 is reflected here as well as increased investments in innovative partnerships and collaborations between

universities and industries, including the Industry/University Cooperative Research Centers program (I/UCRC). OCI's Track 1 and Track 2 high performance computing activities are reduced. MPS will continue to invest in new computational methods, algorithms, robust software and other computational tools to support researchers in the mathematical and physical sciences.

High Confidence Software and Systems ($91.76 million) CISE will support the National Robotics Initiative and continue investments in smart health and wellbeing. As development of the next generation of robotics proceeds, complete confidence in the systems supporting robots that work beside, or cooperatively with, people in areas such as manufacturing, space and undersea exploration must be assured. High confidence surgical robots and medical devices are central to high quality healthcare and building trust in robotic aids. CISE and ENG will support advanced manufacturing technologies research in cyber-physical systems such as smart infrastructure that will blend traditional concrete-and-steel physical infrastructure systems with cyber-infrastructure systems such as computers, networks, and sensors.

Human Computer Interaction and Information Management ($329.95 million) CISE support for the National Robotics Initiative is included here as well as support for smart health and wellbeing. As part of the next generation of robotics, co-robot systems will be characterized by their flexibility and resourcefulness. They will use of a variety of modeling or reasoning approaches, and use real-world data in real time, demonstrating a level of intelligence and adaptability seen in humans and animals. Research in smart health and wellbeing will focus on human-centered intelligent information systems and tools that collect, mine, synthesize, protect and share appropriate data and knowledge with healthcare organizations, practitioners, caregivers and individuals to enable effective, safe and well-informed decision-making by all stakeholders. NSF investments in CIF21 also are reflected. BIO will continue investments to facilitate discovery through tools that integrate the published literature with the expanding universe of digital data collections, expand capacity for understanding through virtual environments, and make it practical for scientists to search vast collections of biological images simply and quickly.

Software Design and Productivity ($78.79 million) Software centers are added to the Software Infrastructure for Sustained Innovation program (OCI). NSF investments in CIF21 and SEES also are included.

Social, Economic and Workforce (SEW) Implications of IT and IT Workforce Development ($97.96 million) CISE support for the National Robotics Initiative is reflected here. SEW research will focus on human robot interaction, a critical component in achieving effective human robot partnerships in manufacturing, education, space exploration, etc. In addition, CISE's continued emphasis on smart health and wellbeing focuses on, for example, assistive technologies and quality of life aids. EHR will continue to study the impact of information and communication technology on educational practice, new approaches to using technology in education, application and adaptation of technologies to promote learning in a variety of fields and settings, the effects of technology of learning, and efforts that advance teaching and learning opportunities utilizing cyberinfrastructure. These efforts also will support science, technology, engineering and mathematics education for the cyber-workforce through workforce programs and research and development in learning sciences. In FY 2012, EHR will fund research that highlights the educational use of information tools that operate seamlessly across formal and informal learning environments and across traditional computers, mobile devices, and newly emerging information and communications.

NITRD by Program Component Area

(Dollars in Millions)

	FY 2010 Omnibus Actual	FY 2010 Enacted/ Annualized FY 2011 CR	FY 2012 Request
Large Scale Networking	$120.96	$107.18	$132.56
Cybersecurity and Information Assurance	72.74	71.36	94.72
High End Computing R&D	89.06	98.54	123.82
High End Computing Infrastructure and Applications	325.24	310.87	308.11
High Confidence Software and Systems	74.25	73.08	91.76
Human-Computer Interaction and Info Management	269.81	280.70	329.95
Software Design and Productivity	54.35	57.58	78.79
Social/Economic/Workforce	99.15	91.17	97.96
Total, NITRD	**$1,105.56**	**$1,090.48**	**$1,257.67**

Totals may not add due to rounding.