CYBERINFRASTRUCTURE

Cyberinfrastructure Funding

(Dollars in Millions)

	FY 2004 Actual	FY 2005 Current Plan	FY 2006 Request	Change over FY 2005 Amount	Change over FY 2005 Percent
Biological Sciences	70.00	77.00	84.00	7.00	9.1%
Computer and Information Science and Engineering	141.13	168.60	181.56	12.96	7.7%
Engineering	45.00	52.00	52.00	0.00	0.0%
Geosciences	67.50	71.35	77.35	6.00	8.4%
Mathematical and Physical Sciences	21.20	37.40	51.20	13.80	36.9%
Social, Behavioral and Economic Sciences	20.40	20.39	20.54	0.15	0.7%
Office of International Science and Engineering	1.40	1.00	1.00	0.00	0.0%
Office of Polar Programs	25.00	25.00	26.50	1.50	6.0%
Subtotal, Research and Related Activities	391.63	452.74	494.15	41.41	9.1%
Education and Human Resources	18.00	20.40	15.00	-5.40	-26.5%
Total, Cyberinfrastructure Funding	$409.62	$473.14	$509.15	$36.01	7.6%

Totals may not add due to rounding.

The emergence of **cyberinfrastructure** – an infrastructure that harnesses the power and ubiquity of information technology – reflects some basic facts of life today: the Internet has become far more than an e-mail carrier; our workplaces, homes, cars and pockets are full of ever-shrinking computing devices; and data pile up far faster than anyone can make sense of it all. In fact, as described in the representative examples below, advances in information technologies are fueling the emergence of powerful NSF-supported research and education tools that enable discovery, learning and innovation across a range of science and engineering disciplines:

- Environmental scientists and engineers are drawing upon cyberinfrastructure to investigate the complexity of our environment, from the molecular to the planetary scale. This multidisciplinary work requires the collection and analysis of large volumes of data, it requires experiments with computer models that in many cases depend upon the world's most advanced supercomputers, and it relies upon the collaboration of scientists and engineers from a wide range of disciplines.
- Earthquake engineers are accessing shake tables, reaction wall facilities, geotechnical centrifuges, tsunami wave tanks and mobile field equipment that are integrated through a common cyberinfrastructure framework, allowing them to perform tele-observation and tele-operation of experiments; to publish to and make use of curated data repositories; to access computational resources and open-source analytical tools; and to use collaborative tools for experiment planning, execution, analysis, and publication.
- Plant biologists are using cyberinfrastructure tools developed to extract implicit genome information to reveal the structure and function of plant genes at levels from the molecular to the organismal. The new knowledge and insights gained from plant genomics will lead to new discoveries and conceptual advances in our understanding of the biology of plants, as well as to the broader impact of this new knowledge in applications relating to agriculture, natural resources, the environment, health, and plant-based industries.
- Computer scientists and engineers are conducting research on next-generation systems architectures that will enable future generations of cyberinfrastructure. Research advances will enable the

development of cyberinfrastructure systems that, for example, monitor and collect 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 a wide range of applications, cyberinfrastructure systems promise to reveal previously unobservable scientific phenomena.

NSF's current focus on the development of a *comprehensive* cyberinfrastructure, which integrates advanced computing engines, federated data archives and digital libraries, observing and sensor systems, and other research and education instrumentation into a common framework, builds on the agency's long history of leadership in this area. Our cyberinfrastructure investments are guided by three principles.

- *Science and engineering opportunities must drive cyberinfrastructure investments*. A rich mix of cyberinfrastructure projects supports communities who have been traditional users of extant cyberinfrastructure as well as those communities who are only now beginning to identify emerging cyberinfrastructure opportunities.
- *Development of intellectual capital to develop, sustain and effectively utilize cyberinfrastructure is critical.* Coordinated NSF action encourages the participation of a broad range of individuals, institutions, and stakeholder communities in cyberinfrastructure design, development, deployment and use. Multidisciplinary teams of computer scientists and engineers and domain scientists and engineers are key to the development of and sustained support for cyberinfrastructure.
- *Unwavering attention to interoperability and sustainability will provide economies of scale and scope and will guard against the balkanization of science.* Coordinated action and integrative planning and management approaches underscore the importance of interoperability across science and engineering fields and across organizational, cultural, regional, and national boundaries. Effective collaboration and development of a common vision enables a wide range of science and engineering research and education opportunities while ensuring that advances made in one domain rapidly migrate to others.

NSF's FY 2006 investments in cyberinfrastucture will continue to promote science and engineering advances enabled by cyberinfrastructure, and will foster the integration of a range of state-of-the-art heterogeneous research and education tools. The agency's FY 2006 investments include the following:

- Informed by the recent report of the High-End Computing Revitalization Task Force, funding for research on High-End Computing (HEC) architectures will be increased, and will leverage interagency coordination and collaboration activities.
- An agency-wide programmatic activity, CI-TEAM, aimed at preparing current and future generations of scientists and engineers to effectively use cyberinfrastructure will be strengthened.
- Continuing support will be provided for Protein Data Bank (PDB), the international repository and primary source for information about the structure of biological macromolecules, a key research resource and central component to our understanding of living systems.
- Support for the National Radio Astronomy Observatory and the National Optical Astronomy Observatory will include enhanced efforts to make available long-term data archives for astronomical research and education.
- Substantial investments will be made in major social and behavioral science data collections, and will address issues such as confidentiality protections and means for securing worldwide, user-friendly access.
- Continuing investments will be made in the National STEM Digital Library (NSDL) to support a national resource of high-quality Internet-based STEM educational content and services to support learners at all levels, and in the Digital Library for Earth Science Education (DLESE), a community effort involving educators, students, and scientists working together to improve the quality, quantity, and efficiency of teaching and learning about the Earth system at all levels.

- Projects that provide the nation's multidisciplinary computational science and engineering community with access to high-end computing and other cyberinfrastructure resources will be supported.
- Development of next-generation data management systems and tools will improve support of domain specific data types, such as sequences, pathways, and time series data.

Over time, NSF investments will contribute to the development of a powerful, stable, persistent, and widely accessible cyberinfrastructure to enable the work of science and engineering researchers and educators across the nation and around the world.