

OFFICE OF INTERNATIONAL SCIENCE AND ENGINEERING \$47,440,000

The FY 2009 Budget Request for the Office of International Science and Engineering (OISE) is \$47.44 million, an increase of \$6.10 million, or 14.8 percent, over the FY 2008 Estimate of \$41.34 million.

Office of International Science and Engineering Funding

(Dollars in Millions)

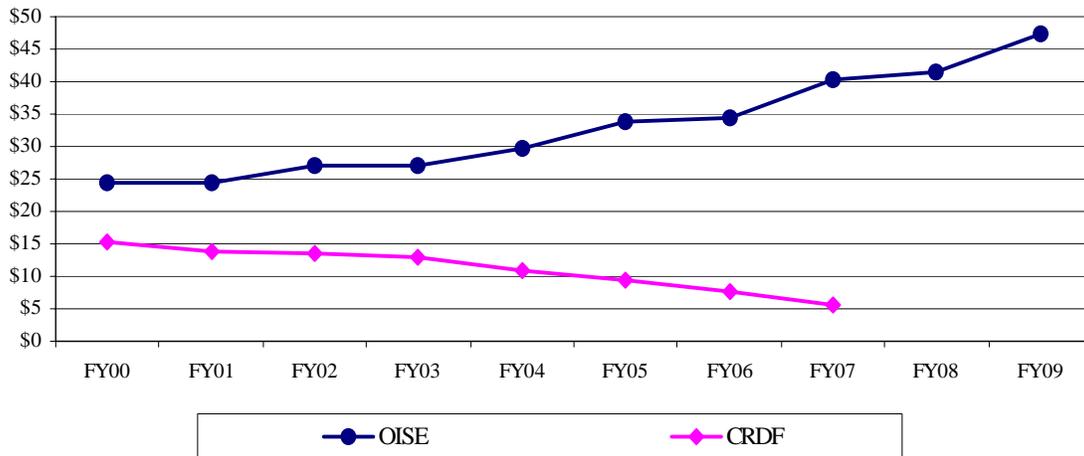
	FY 2007 Actual ¹	FY 2008 Estimate	FY 2009 Request	Change over FY 2008 Estimate	
				Amount	Percent
OISE	\$40.36	\$41.34	\$47.44	\$6.10	14.8%

¹ FY 2007 Actual excludes \$5.46 million in funds provided by the U.S. Department of State for an award to the US Civilian Research Foundation.

The Office of International Science and Engineering serves as the focal point, both inside and outside NSF, for international science and engineering activities. OISE promotes the development of an integrated, Foundation-wide international strategy, and manages international programs that are innovative, catalytic, and responsive to a broad range of NSF and national interests. Recognizing that scientific discovery is a global enterprise, OISE supports U.S. scientists and engineers engaged in international research and education activities in all NSF-supported disciplines involving any region of the world.

OISE Subactivity Funding

(Dollars in Millions)



The bottom line shows additional funds provided by the U.S. Department of State for an award to the U.S. Civilian Research and Development Foundation (CRDF) in FY 2000 (\$15.40 million), FY 2001 (\$13.75 million), FY 2002 (\$13.66 million), FY 2003 (\$12.83 million), FY 2004 (\$10.99 million), FY 2005 (\$9.42 million), FY 2006 (\$7.73 million), and FY 2007 (\$5.46 million).

RELEVANCE

Science and engineering are international enterprises critical to American competitiveness and security. Bold exploration at the frontiers of science and engineering increasingly requires international partnerships. NSF – as the Nation’s principal source of support to U.S. universities for fundamental science, mathematics, and engineering research and education – plays a unique role in leading the worldwide efforts of the U.S. science, engineering, and education communities.

OISE programs and activities are designed to complement and enhance the Foundation’s broad research and education portfolio and to overcome barriers involved in international collaboration. America’s next generation of scientists and engineers must be able to work effectively in the global arena and marketplace. OISE supports programs that enable students and researchers to experience and engage in international research and educational activities across such areas as cyberinfrastructure, complex biological systems, natural hazards prediction and mitigation, nanotechnology, water resources, and math and science education. OISE carries out its functions by working closely with the other NSF directorates and offices as well as through its own programs. Additionally, OISE manages NSF’s offices in Beijing, Paris, and Tokyo that report on and analyze in-country and regional science and technology developments and policies, promote greater collaboration between U.S. and foreign scientists and engineers, liaise with foreign counterpart agencies and research institutes, and facilitate coordination and implementation of NSF research and education programs.

Summary of Major Changes in Office-wide Investments

(Dollars in Millions)

FY 2008 Estimate, OISE..... \$41.34

Discovery

+ \$5.18

Disciplinary and Interdisciplinary Research (+\$5.18 million).

In FY 2005, OISE launched a pilot program: *Partnerships for International Research and Education (PIRE)*. This program funds innovative, international collaborative research projects that link U.S. institutions and researchers at all career levels with premier international collaborators to work at the most promising frontiers of new knowledge. In FY 2007, OISE held a second PIRE competition. More than 500 preliminary proposals were submitted, the largest response ever for an OISE program. Given the increasing importance of the U.S. scientific and engineering community having access to the best researchers and facilities around the world, OISE will build on the first two PIRE competitions by supporting a third solicitation in FY 2009. OISE will invest \$3.0 million in new funds in the FY 2009 PIRE competition resulting in a program total of \$15.0 million. For Cyber-enabled Discovery and Innovation (CDI), a \$500,000 investment is proposed for FY 2009. Working in partnership with the Directorate for Computer and Information Science and Engineering (CISE), OISE’s objective is to identify and link communities of researchers across international boundaries to facilitate communication and collaboration between the United States and the international scientific community. The remaining \$1.68 million in new funds will be used to augment other international collaborative research supported by OISE as well as international planning visits and workshops program.

Learning +\$0.65

OISE makes significant investments in developing and strengthening the current and future pool of scientists and engineers. In FY 2009, OISE will reallocate funding to augment OISE-managed programs in order to provide international experiences for students and researchers.

International Research Experiences for Students (+\$500,000).

This funding, coupled with other funding that OISE will make available, will expand OISE's investment by \$500,000 to \$3.15 million, thus enabling OISE to support a higher percentage of highly-rated projects. Awareness of this program has grown, and additional funding will support approximately 60 more U.S. undergraduate and graduate students (increasing the total to approximately 360 per year) by providing early-career growth opportunities through international cooperative research training and networking, and mentoring. This program was one of three new programs introduced by OISE in 2004 and will undergo review by the 2008 Committee of Visitors.

International Research Fellowship Program (+\$400,000).

In FY 2009, an increase of \$400,000 will bring the program total to \$4.50 million. The additional funding will support 2 to 3 additional postdoctoral fellows, which will result in 40+ international postdoctoral fellows supported under this program. The Committee of Visitors in 2005 recommended that OISE allocate additional resources to increase the funding rate of this highly subscribed and successful program. In response, OISE has incrementally increased program support each year since 2005.

Research Experiences for Teachers Program (-\$250,000).

As a primary focus of OISE programs is providing international research experiences for students, OISE will reduce the support for the Research Experiences for Teachers Program from \$500,000 to \$250,000 in FY2009.

Stewardship +\$0.27

A number of activities are funded directly from NSF's programs to advance NSF's Stewardship goal. These include Intergovernmental Personnel Act appointments, NSF-wide studies and evaluations, and mission-related information technology investments. As is discussed further in the Stewardship chapter of this Request, in FY 2009 NSF has realigned IT investments to tie mission-related activities more directly to NSF's programs.

Subtotal, Changes +\$6.10

FY 2009 Request, OISE **\$47.44**

OISE Priorities for FY 2009

During the past several years, OISE has implemented changes to define more clearly its programmatic priorities, to better link OISE to overall NSF goals, broaden the applicant pool and to move toward larger, more innovative awards. OISE's key programmatic themes for FY 2009 are:

- Promoting research excellence through international collaboration; and
- Providing U.S. students, postdoctoral researchers, and junior faculty with international research and education experiences.

These themes reflect the fact that the process of discovery and the scientific/engineering workforce are increasingly global. The United States needs to engage actively in the global research community through collaborative research and must ensure that its young scientists and engineers are capable of operating in an international research environment and a global market.

The OISE portfolio, which is primarily made up of awards to U.S. researchers and institutions, reflects both programs managed by OISE and investments made in partnership with other NSF directorates and offices. Approximately 54 percent of OISE's portfolio is available for all new awards each year while approximately 39 percent of OISE's portfolio is available for new research grants. The remainder is used primarily to fund awards made in previous years.

Specific emphases in FY 2009 are to:

- Continue major investments to promote research excellence through international collaboration. OISE will hold a third competition of the **Partnerships for International Research and Education** program. OISE will partner with other NSF research directorates and offices and foreign research organizations to catalyze research in NSF's **Cyber-enabled Discovery and Innovation** program. Other OISE investments to advance research excellence include: supporting workshops and planning visits to explore and develop collaborations; and co-funding and supplemental funding to highly competitive NSF awards that involve international work.
- Support **international research and education experiences** for U.S. early-career researchers, students, and teachers through OISE-managed and other NSF programs. This includes: the International Research Experiences for Students; the East Asia and Pacific Summer Institutes for U.S. Graduate Students; the Pan-American Advanced Studies Institute; the International Research Fellowship Program for postdoctoral researchers; funding for undergraduate and graduate students, postdoctoral researchers, and early-career faculty to engage in international collaborative activities; and opportunities for K-12 students and teachers.
- Promote increases in America's science and engineering talent pool by **broadening participation** of women and underrepresented groups in NSF-supported international research and education activities.
- Provide U.S. Government support to key **multilateral organizations**, thereby enabling U.S. scientists to participate in these global efforts. Multilateral groups expected to be funded include the Human Frontier Science Program, Global Biodiversity Information Facility, International Council for Science, International Neuroinformatics Coordinating Facility, and International Institute for Applied Systems Analysis.
- Continue efforts to expand networks between the U.S. research community and those in **developing countries** as well as to identify new opportunities for collaboration.

NSF-WIDE INVESTMENTS

In FY 2009, OISE will support research and education efforts related to broad, Foundation-wide investments in a number of areas including the Administration's interagency R&D priorities.

These investments are based on a highly-focused and strategic framework that simultaneously strengthens core research, enhances interdisciplinary collaborations, promotes the integration of research and education, and collectively benefits the U.S. economy and citizenry. Within OISE, funding will support/contribute to ensuring that U.S. research and education objectives in these important areas benefit

from international collaboration. OISE investments focus on innovative, catalytic activities, with the understanding that U.S. researchers with established international collaborations will seek funding directly from other NSF directorates/offices. OISE investments in these NSF-wide investment areas support planning visits, workshops, principal-investigator-led collaborative research, international research experiences for U.S. students and postdoctoral researchers, and other catalytic activities.

Office of International Science and Engineering NSF-wide Investments

(Dollars in Millions)

	FY 2007	FY 2008	FY 2009	Change over	
				FY 2008 Estimate	
				Actual	Estimate
Biocomplexity in the Environment	\$0.14	-	-	-	N/A
Cyber-enabled Discovery and Innovation	-	0.50	0.50	-	-
Cyberinfrastructure	1.30	0.75	0.75	-	-
Human and Social Dynamics	0.47	0.50	-	-0.50	-100.0%
International Polar Year	0.54	0.40	-	-0.40	-100.0%

Biocomplexity in the Environment and Human and Social Dynamics: With the conclusion of these priority areas in FY 2007 or FY 2008 (as noted in the table above), key components of these investments will be retained for core programs.

Cyber-enabled Discovery and Innovation: A \$500,000 investment for CDI is proposed for FY 2009. Working in partnership with CISE, OISE’s objective is to identify and link communities of researchers across international boundaries to facilitate communication and collaboration between the United States and the international scientific community.

Cyberinfrastructure: OISE will maintain its funding level of \$750,000 for Cyberinfrastructure. OISE will coordinate with NSF directorates and offices to ensure that the international dimensions of cyberinfrastructure are highlighted and developed.

International Polar Year: With the conclusion of IPY in March 2009, key components of this investment will be retained for core programs.

QUALITY

OISE maximizes the quality of research and education activities it supports through the use of a competitive, merit-based review process. Within the existing portfolio, the percentage of funds allocated to projects that undergo merit review was 69 percent in FY 2007 and is estimated at 65 percent in FY 2008 and 70 percent in FY 2009. The majority of projects that did not undergo external review were supplements that added an international dimension to projects already merit reviewed and funded by NSF disciplinary programs.

To ensure the highest quality in processing and recommending proposals for awards, a Committee of Visitors composed of external experts reviewed OISE in FY 2005 and affirmed the high quality of funded projects, of OISE’s program portfolio management, and of OISE’s unique enabling role within NSF regarding international activities and issues. The Committee of Visitors’ 2005 report stated that the new OISE program, Partnerships for International Research and Education (PIRE), was a bold new program.

The Committee of Visitors meeting planned for Spring of 2008 will, *inter alia*, review the results of the first two PIRE competitions and will make recommendations for future PIRE competitions.

Additionally, the Advisory Committee for International Science and Engineering, composed of members representing the U.S. research and education community across disciplines, was established in June 2005. The committee meets twice a year and advises OISE on its programs and the integration of international activities across the Foundation. The committee includes a balanced representation of women, members of under-represented minorities, and geographic regions.

PERFORMANCE

The FY 2009 Budget Request is aligned to reflect funding levels associated with the Foundation's four strategic outcome goals stated in the FY 2006-2011 Strategic Plan. These goals provide an overarching framework for progress in fundamental research and education and facilitate budget and performance integration.

Office of International Science and Engineering By Strategic Outcome Goal

(Dollars in Millions)

	FY 2007 Actual	FY 2008 Estimate	FY 2009 Request	Change over FY 2008 Estimate	
				Amount	Percent
Discovery	\$27.45	\$26.39	\$31.57	\$5.18	19.6%
Learning	11.95	12.60	13.25	0.65	5.2%
Research Infrastructure	-	-	-	-	N/A
Stewardship	0.96	2.35	2.62	0.27	11.5%
Total, OISE	\$40.36	\$41.34	\$47.44	\$6.10	14.8%

Totals may not add due to rounding.

Recent Research Highlights



Large tanker vessels pose a risk in the Bosphorus Strait due to the narrowness of the waterway and the high volume of ship traffic. *Credit: Tayfur Altioek.*

► **Reducing Accident Risks in Narrow Waterways:** A team at Rutgers University has developed a computer-based risk model that can improve vessel traffic management in narrow waterway passages while also mitigating risks to the local environment and population. The Rutgers team collaborated with Bosphorus University in Istanbul to develop a high-fidelity simulation model that replicates maritime operations in the Istanbul Strait. The Strait is among the world's busiest and most accident-prone waterways. The risk model computes the probabilities of potential accidents, instigator probabilities, accident probabilities, and consequences. The mathematical risk model is

superimposed onto a simulation model and then analyzed in order to find ways to mitigate the risks involved. U.S. waterway managers recognize that these important modeling/risk insights can be applied with significant benefit to narrow waterway passages in the U.S.

► **U.S. and Austria Collaborate to Solve Computational Problems in Science and Mathematics:**

Computer science researchers at the University of Kentucky, Johannes Kepler University of Linz, Austria, and the Karl-Franzens University of Graz, Austria are collaborating to develop tools to hasten from six to 12 months to a few days the identification of algorithms capable of solving industrial-quality computations. New research developments in algebraic multigrid have enabled the U.S. and Austrian teams to produce an open-source, community resource to develop an expert system for more swiftly choosing algorithms capable of solving complex, industrial-quality computational problems. Potential applications of the work include producing useful software and new methods for determining how injected drugs spread throughout the body and how they might be directed to specific locations. The participation of students is crucial to the success of the research.



An example of computational modeling of head tissues. Credit: Craig Douglas.



Shown here is Mr. Andrew Marchesseault, in the clean room facility at the Technical University of Braunschweig, inspecting visually a micro-sensor that he fabricated in the laboratory. Mr. Marchesseault is a dual-degree master's student at the University of Rhode Island. Credit: Andrew Marchesseault.

► **U.S. – German Team Investigating Faster, More Accurate Method for Detecting Viruses Using Mass Measurement:**

U.S. and German researchers have made discoveries that can speed up and improve the sensitivity of detection of disease-causing viruses using rapid mass measurements. Currently, the improved production speed and quality of manufactured viruses is a major component in engineering research. The quality of viruses is important in both vaccine productions as well as for gene therapy, and speed can be a major factor during flu seasons since viruses mutate very quickly and time between vaccine discovery and distribution is limited. The researchers are part of a collaboration funded through the Partnerships for International Research and Education program supported by NSF's Office of International Science and Engineering and the Division of Chemical, Bioengineering, Environmental, and Transport Systems.

► **Graduate Students Study Links Between African and U. S. Weather Systems:**

Graduate students worked with American and international researchers on a project called the African Monsoon Multidisciplinary Analysis. The NSF-funded graduate research team, based in the West African region, focused on studying storms and weather systems at their source. In Cape Verde, they investigated easterly waves, developing tropical cyclones, Saharan dust outbreaks, convection, and cloud microphysics. In Senegal, they used advanced equipment to track precipitation, predict rainfall, and measure air pressure. Their findings contributed to the understanding of the effects of African weather systems on the U.S., particularly how land storms become ocean storms and then make their way west to U.S. and Caribbean waters.



Graduate students study African storms onboard a DC-8 airplane to understand links to U.S. storms. Credit: Dr. Gregory Jenkins, Howard University.

► **Reconnaissance Survey of a Major Landslide in the Philippines:**

Following a major landslide – one of the largest recorded in recent history – in Leyte, Philippines in February 2006, NSF-supported researchers at Virginia Polytechnic Institute and Iowa State University visited the area to immediately collect evidence and data of possible causes before debris was removed and rebuilding of the city began. The U.S. researchers, who collaborated with Philippine counterparts, used their extensive experience in geotechnical engineering and post-failure investigation to study the cut made by the landslide on the surface of the mountain. The study resulted in a better understanding of the geological effects of severe weather due to global warming and established long-term collaboration on geohazards research.



Student performing field geological mapping at the foot of the scarp. *Credit: Dr. Marte Gutierrez.*

Other Performance Indicators

Number of People Involved in OISE Activities

	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
Senior Researchers	1,023	1,035	1,210
Other Professionals	29	33	40
Postdoctorates	647	660	765
Graduate Students	1,412	1,430	1,670
Undergraduate Students	1,043	1,070	1,235
Total Number of People	4,154	4,228	4,920

The funding rate for competitive awards in FY 2009 is estimated to remain relatively unchanged. In years when PIRE competitions are held (FY 2005, 2007, 2009), the average award size increases significantly. This is due to the size and number of the average PIRE award (\$500,000 per year multiplied by 20 awards in FY 2007) in comparison to the average non-PIRE award (\$50,000 per year) managed by OISE.

OISE Funding Profile

	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
Statistics for Competitive Awards:			
Number	355	350	370
Funding Rate	46%	40%	40%
Statistics for Research Grants:			
Number of Research Grants	82	90	100
Funding Rate	22%	20%	20%
Median Annualized Award Size	\$46,800	\$30,000	\$50,000
Average Annualized Award Size	\$156,673	\$50,000	\$175,000
Average Award Duration, in years	2.4	2.6	3.0

NOTE: The spike in the average annualized award size in FY 2007 and 2009 is due to the PIRE competition for those years.