

OFFICE OF INTERNATIONAL SCIENCE AND ENGINEERING \$45,000,000

The FY 2008 Budget Request for the Office of International Science and Engineering (OISE) is \$45.0 million, an increase of \$4.39 million, or 10.8 percent, over the FY 2007 Request of \$40.61 million.

Office of International Science and Engineering Funding

(Dollars in Millions)

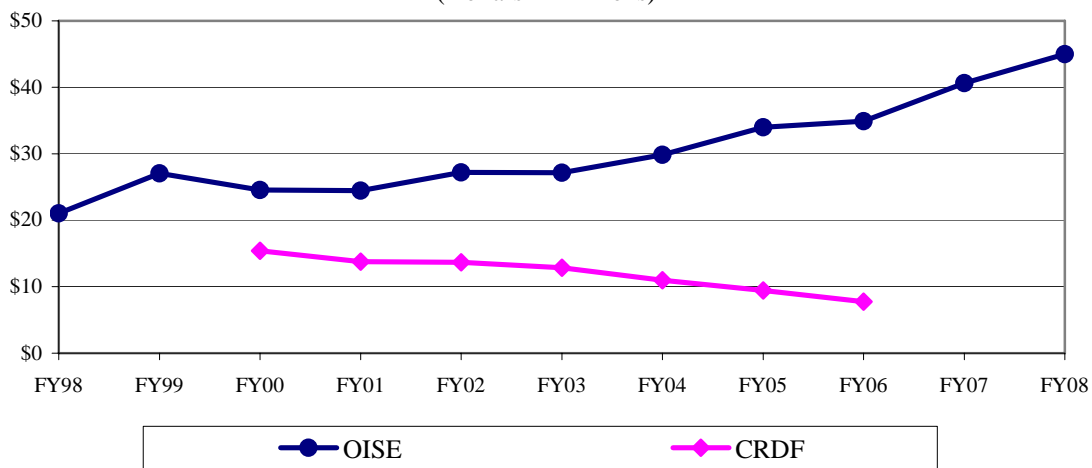
	FY 2006 Actual ¹	FY 2007 Request	FY 2008 Request	Change over FY 2007 Request	
				Amount	Percent
Office of International Science and Engineering	\$42.61	\$40.61	\$45.00	\$4.39	10.8%

¹ FY 2006 Actual includes \$7.73 million in additional funds provided by the U.S. Department of State for an award to the U.S. Civilian Research and Development Foundation (CRDF).

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) and FY 2006 (\$7.73 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 mathematical sciences and education. The office 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 2007 Request, OISE..... \$40.61

Discovery Research for Innovation+\$\$.79

- *Disciplinary and Interdisciplinary Research (\$500,000)*. OISE will invest \$500,000 in new funding for highly meritorious research activities that, due to the critical and integral role of foreign research partners, present unique risks and offer potentially high payoff.
- *Cyber-enabled Discovery and Innovation (\$290,000)*. Cyberinfrastructure and computational capabilities play a key role in fostering new scientific and engineering discoveries – whether domestically or through international partnerships. OISE will commit \$290,000 in new funding for Cyber-enabled Discovery and Innovation (CDI).

Preparing the Workforce of the 21st Century+\$3.60

OISE makes significant investments in building and strengthening the current and future pool of scientists and engineers by providing research and education opportunities where early-career researchers can develop the needed skills to operate effectively at the international level. In FY 2008, OISE will invest new funding to augment OISE-managed and other NSF programs in order to provide international research experiences for students, researchers, and teachers – specifically:

- *International Research Experiences for Students (\$650,000)*. Expand in FY 2008 OISE’s investment by \$650,000 to \$2.65 million. This increase will support approximately 100 more U.S. undergraduate and graduate students by providing early-career growth

opportunities through international cooperative research training and networking and mentoring.

- *International Research Fellowship Program (\$600,000)*. Augment funding by \$600,000 to bring the program’s annual investment total to \$4.10 million. The additional funding will support approximately 4 to 5 more post-doctorate students.
- *East Asia and Pacific Summer Institute Program (\$1,550,000)*. Increase funding by \$1.55 million to total \$2.70 million, to expand the program on three fronts. First, OISE will enlarge the number of students accepted into the program; secondly, the number of participating partner host countries will increase to a total of seven in FY 2008; finally, OISE will raise the program’s per student stipend to a level commensurate with other NSF stipends.
- *Dissertation Enhancements (\$300,000)*. Expand OISE’s investment by \$300,000 for a total annual investment for dissertation enhancements to \$350,000. This increase will provide approximately 10 to 15 dissertation enhancements and supplements to enable graduate students to gain first-hand experience conducting research overseas.
- *Research Experiences for Teachers (\$500,000)*. Allocate \$500,000 in new funding to provide international research experiences for approximately 50 K-12 science and math teachers.

Subtotal, Changes +\$4.39

FY 2008 Request, OISE..... \$45.00

OISE Priorities for FY 2008

During the past several years, OISE has implemented changes to define more clearly its programmatic priorities, to better link OISE to overall NSF goals, and to move toward larger, more innovative, and more competitive awards. OISE’s key programmatic themes for FY 2008 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 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 51 percent of OISE’s portfolio is available for all new awards each year while approximately 30 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 2008 are to:

- Continue major investments to promote research excellence through international collaboration. OISE will continue to invest in 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 support of the International Polar Year. OISE will maintain its overall investment in cyber-related research in order to enable U.S. scientists and engineers to benefit from leading experts, facilities, and data around the world. Other OISE investments to advance research excellence include: supporting workshops and planning visits to explore and develop collaborations; and providing supplemental and co-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. Supported programs and activities will include: the International Research Experiences for Students; the East Asia and Pacific Summer Institutes for U.S. Graduate Students; the Pan-American Advanced Studies Institutes; 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 increasing America's science and engineering talent pool by broadening participation of women and underrepresented groups in NSF-supported international research and education activities, and of K-12 students and teachers participating in science and engineering activities that have an international dimension.
- 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 of Scientific Unions, 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 2008, OISE will support research and education efforts related to broad, Foundation-wide investments.

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 initiatives, 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 2006 Actual	FY 2007 Request	FY 2008 Request	Change over FY 2007 Request	
				Amount	Percent
Biocomplexity in the Environment	\$0.20	\$0.13	-	-\$0.13	-100.0%
Cyber-enabled Discovery & Innovation	-	-	0.29	0.29	N/A
Cyberinfrastructure	1.00	1.05	0.75	-0.30	-28.6%
Human and Social Dynamics	0.50	0.50	0.50	-	-
International Polar Year	-	0.30	0.40	0.10	33.3%

Biocomplexity in the Environment: With the conclusion of this priority area in FY 2007, key components of investment in this area will be transferred to core programs for continued support.

Cyber-enabled Discovery and Innovation: OISE will maintain its investment in cyber-related research. In FY 2008, OISE will fund \$290,000 for Cyber-enabled Discovery and Innovation research.

Cyberinfrastructure: OISE will fund \$750,000 in cyberinfrastructure (a \$300,000 decrease from the \$1.05 million FY 2007 funding level). OISE will coordinate with NSF directorates and offices to ensure that the international dimensions of cyberinfrastructure are highlighted and developed.

Human and Social Dynamics: OISE will maintain its funding level of \$500,000 for this investment area where the potential for international collaboration is rapidly expanding.

International Polar Year: OISE will work closely with the Office of Polar Programs and participating directorates to ensure effective international partnering for research and education activities related to the International Polar Year (IPY) and will increase its investment for IPY-related programs to \$400,000 — an increase of \$100,000 from FY 2007.

Opportunities to support U.S. participation in international collaboration in the areas of the **nanotechnology, networking and information technology, climate change, and homeland security** have been targeted in the past. OISE will continue to consider funding new opportunities in these areas on the basis of proposals received.

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 52 percent in FY 2006 and is estimated at 60 percent in FY 2007 and 55 percent in FY 2008. The majority of projects that did not undergo external review were supplements that added an international dimension to projects already 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. These experts assess the integrity and efficiency of proposal review processes and provide a retrospective assessment of the quality of results of OISE's investments.

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 the Office on its programs and the integration of international activities across the Foundation. The Committee includes a balanced representation of women, under-represented minorities, and geographic regions.

PERFORMANCE

The FY 2008 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.

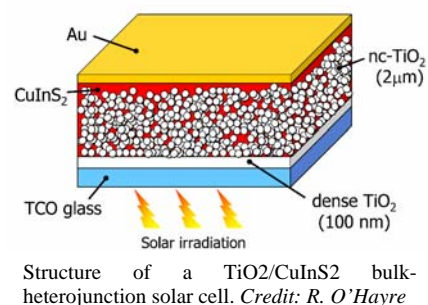
Office of International Science and Engineering By Strategic Outcome Goal (Dollars in Millions)

	FY 2006 Actual	FY 2007 Request	FY 2008 Request	Change over FY 2007 Request	
				Amount	Percent
Discovery	\$30.11	\$29.26	\$30.05	\$0.79	2.7%
Learning	9.91	9.00	12.60	3.60	40.0%
Research Infrastructure	0.59	-	-	-	N/A
Stewardship	2.00	2.35	2.35	-	-
Total, OISE	\$42.61	\$40.61	\$45.00	\$4.39	10.8%

Totals may not add due to rounding.

Recent Research Highlights

► **Improving Solar Cell Performance:** Modern science is increasingly a global endeavor, and sometimes U.S. researchers need to go abroad to pursue a unique line of research. Recently, for example, NSF's International Research Fellowship Program gave Stanford graduate student Ryan P. O'Hayre a chance to follow his interests to the Technical University of Delft in the Netherlands, where scientists were investigating a novel type of solar cell that promises far lower cost than traditional silicon-based alternatives. The Dutch lab was working on problems with "bulk-heterojunction" solar cells that generate electric current from the energy of sunlight. These devices are made from inexpensive materials using comparatively low-cost fabrication methods. But these methods typically tend to produce defective, low quality films, thus reducing the cell's efficiency. At Delft, O'Hayre's research focused on cells using titanium dioxide – a workhorse compound found in light-sensitive applications from house paint to sunscreen. O'Hayre's group found that cells made from larger TiO₂ particles outperformed cells made from smaller particles. This discovery, along with recent results from other researchers, suggests that design changes could improve bulk-heterojunction solar cell performance, dramatically improving efficiency. O'Hayre and colleagues published multiple papers on their findings. O'Hayre earned his doctorate and took a position at the Colorado School of Mines, in order to work closely with the National Renewable Energy Laboratory and the Colorado Fuel Cell Center.





Andy Klein, a Cornell University doctoral student, works with Pierre Duhamel of Supélec in Paris on overcoming wireless communication problems. *Credit: Andy Klein*

► **U.S. - France Collaboration Sparks Multiple Successes:**

International research collaboration can improve communications in more ways than one. Andy Klein's experience is a case in point. As a graduate student at Cornell, an NSF grant enabled him to participate in a research project between Cornell University and two French institutions: the French National Institute for Telecommunications and Supélec. At the French institutes, Klein was immersed in cutting-edge research focused on some of the most difficult problems in wireless communications – extending range and reliability. In particular, he worked on ways to counteract the "multipath" distortion that results when electromagnetic waves reflect off different surfaces. That phenomenon is perhaps most familiar as the cause of "ghost" images

on TV sets with antennas. Klein and colleagues published jointly submitted papers, and Klein soon earned his doctorate. The work will allow portable, personal communication devices to communicate successfully in a wider range of environments and permit longer battery life. The experience produced ideas that Klein used in his thesis; however it also created another kind of communication: "The non-technical aspects of the collaboration were perhaps even more rewarding," Klein says, "since I was presented with a fresh perspective on how research can be conducted, from funding issues to topic selection. This alternate perspective gave me a reference point through which to better judge aspects of the American research system – a system for which I now have even more appreciation."

► **Imaging the African Superplume while building U.S.-African partnerships and enhancing diversity in geosciences:**

U.S. scientists and students have partnered with African colleagues to examine the Earth's mantle below Africa, where it forms a structure known as the African Superplume. As part of a broad initiative called "AfricaArray," the group is imaging the African Superplume to provide insights into how it formed. This region in the African lower mantle may hold the key to unraveling the dynamics of mantle convection, which brings warm material to the surface and sends cooler material to the interior. The project, which is in its initial year, is funded through NSF's Partnership for International Research and Education program, and supports researchers from Pennsylvania State University and North Carolina A&T University to work with scientists in Botswana, Ethiopia, Kenya, Namibia, South Africa, Tanzania, Uganda, Zambia, and Zimbabwe. The program has a unique model for graduate education, which requires students to take a foreign language, spend one semester at a university in Africa, undertake international field research, and develop tutorials of introductory geophysics topics for undergraduates. The participants are also developing new e-education courses for U.S. and African students. The program has run its first workshop for North Carolina high school teachers, providing them with information and educational materials about seismology, earth structure, plate tectonics, and African geology.



Students (U.S.-left; African-right) working on an electrical resistivity survey during a summer geophysics field course in Africa. *Credit: Paul Dirks*

Other Performance Indicators

OISE funding supports a significant number of individuals with a focus on early-career researchers. In FY 2006, awards managed by OISE supported estimated totals of 445 postdoctoral researchers, 1022 graduate students, and 539 undergraduates. OISE's East Asia and Pacific Summer Institutes program alone placed 143 U.S. graduate students in research projects in Australia, China, Japan, Korea and Taiwan, while the Office's International Research Fellowship Program supported the research activities of 38 postdoctoral fellows from 18 states in 23 countries around the world. The table below shows the number of individuals supported through research awards where stipend and salaries are provided.

Number of People Involved in OISE Activities¹

	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate
Senior Researchers	259	245	250
Other Professionals	31	40	75
Postdoctorates	65	80	70
Graduate Students	86	110	110
Undergraduate Students	37	70	45
Total Number of People	478	545	550

¹ This table shows salary and stipend support awards managed by OISE only. People supported through co-funded awards that are managed by other directorates are not included in the above numbers but rather in respective directorate figures.

The funding rate for competitive awards in FY 2008 is estimated to remain relatively unchanged.

OISE Funding Profile

	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate
Statistics for Competitive Awards:			
Number	320	310	350
Funding Rate	45%	40%	40%
Statistics for Research Grants:			
Number of Research Grants	83	85	90
Funding Rate	27%	25%	20%
Median Annualized Award Size	\$32,500	\$35,000	\$30,000
Average Annualized Award Size	\$57,787	\$100,000	\$50,000
Average Award Duration, in years	2.1	2.4	2.6

NOTE: The spike in the average annualized award size in FY 2007 is due to the Partnerships for International Research and Education competition in that year.