

**OFFICE OF INTERNATIONAL SCIENCE AND ENGINEERING      \$34,510,000**

The FY 2006 Request for the Office of International Science and Engineering (OISE) is \$34.51 million, an increase of \$780,000, or 2.3 percent, over the FY 2005 Current Plan of \$33.73 million.

**Office of International Science and Engineering Funding**

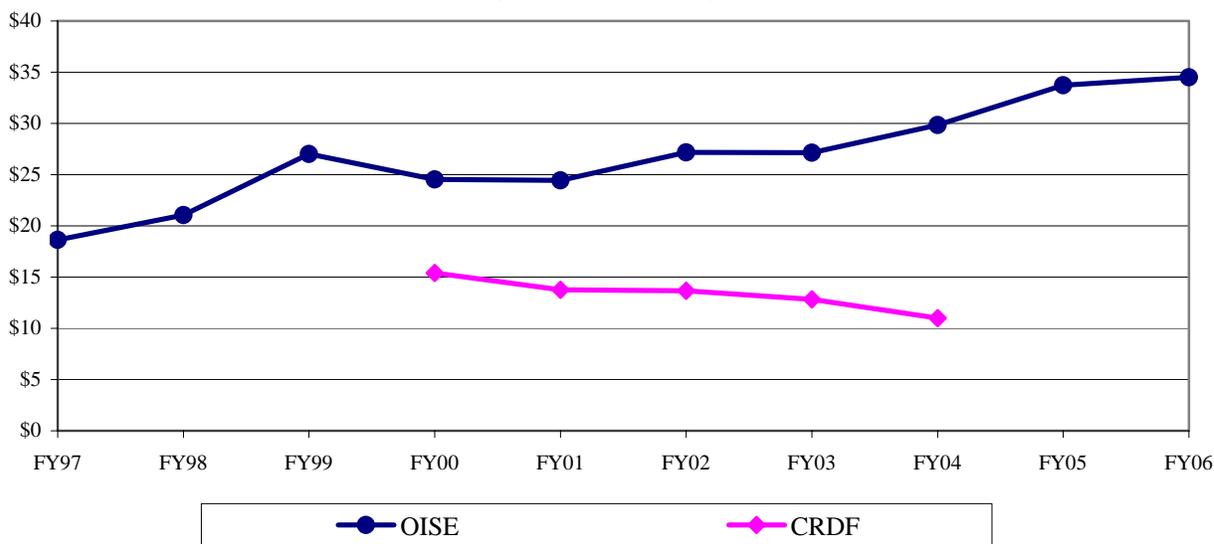
(Dollars in Millions)

	FY 2005		FY 2006 Request	Change over FY 2005	
	FY 2004 Actual	Current Plan		Amount	Percent
OISE	29.84	33.73	34.51	0.78	2.3%
U.S. Department of State transfer	10.99	0.00	0.00	0.00	0.0%
<b>Total, OISE</b>	<b>\$40.83</b>	<b>\$33.73</b>	<b>\$34.51</b>	<b>\$0.78</b>	<b>2.3%</b>

Funds provided by the U.S. Department of State were for an award to the U.S. Civilian Research and Development 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 interests. In November 2001, after an extensive examination of the international role of the Foundation and U.S. Government, the National Science Board (NSB) called on NSF to make international leadership a high priority with a much stronger programmatic focus both in core disciplines and in Foundation-wide activities. Consistent with the NSB's recommendation, OISE was moved in October 2004 from the Directorate for Social, Behavioral, and Economic Sciences to the Office of the Director.

**OISE 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), and FY 2004 (\$10.99 million).

## RELEVANCE

Science and engineering are, and will continue to be, international enterprises critical to American competitiveness and security. NSF – as the nation’s core source of academic support 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 are designed to complement and enhance the Foundation’s broader 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 maintains a range of activities that enables researchers to experience and engage in international research throughout their training. Bold exploration at the frontiers of science and engineering requires international partnerships. The Office carries out its functions by working closely with the other NSF Directorates and Offices as well as through its own program activities.

*Summary of Major Changes by Office-Wide Investments* *(Dollars in Millions)*

**OISE FY 2005 Current Plan** .....\$33.73

### *Research and Education*

**Broadening Participation** +\$1.00

Funding will support initiatives to enhance collaboration, particularly to encourage women and underrepresented groups to enter graduate programs, complete advanced degrees, and incorporate international experiences in their academic careers.

**Disciplinary and Interdisciplinary Research** -\$0.22

A decrease will result in slightly fewer workshops, planning visits, and co-funding activities with the NSF research Directorates. The reduction compensates for other priorities described above.

Subtotal, Changes \$0.78

**OISE FY 2006 Request**..... \$34.51

### *Specific NSF-Wide Investments*

**Human and Social Dynamics** +\$0.50

The Human and Social Dynamics area is becoming increasingly international. The program has demonstrated the U.S. research community’s interest in tackling complex human and social problems in partnership with international scientists with strong social science expertise and with nations sharing common concerns. The increase provides added support to international collaborative efforts.

**Nanoscale Science and Engineering** -\$0.26

OISE has supported nanosciences for the past seven years. This area has an established record of international partnership. FY 2006 will be its last year as an NSF priority area. OISE will continue to pursue opportunities to support nanosciences through other programs.

**Biocomplexity in the Environment**

-\$0.25

OISE has contributed to the Biocomplexity priority area since FY 2001. Funding is reduced in order to shift investments to the newer HSD priority. OISE will continue to pursue opportunities to support Biocomplexity through other program activities.

**OISE Priorities for FY 2006:**

During the past two years, OISE has been shifting its portfolio to better define its priorities. The Office implemented changes to better link OISE to overall NSF goals and to move toward larger, more innovative and more competitive awards. In addition, OISE developed approaches to facilitate co-funding partnerships with the research Directorates. As a result, two key themes emerged for FY 2006:

- promoting research excellence through international collaboration; and
- providing U.S. students 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 strongly engage 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 programs managed by OISE and investments made in partnership with other NSF Directorate programs. In general, 40 percent of OISE's portfolio is available for new awards and activities. The remaining 60 percent funds awards made in previous years.

Specific emphases in FY 2006 are to:

- Continue major investments to promote research excellence through international collaboration. In FY 2005, OISE launched a pilot program – **Partnerships for International Research and Education**. This program builds international collaborative research projects that link institutions and provide support for U.S. researchers and students to engage in longer-term international projects. In FY 2006, OISE will fund the second year of the five-year Partnership for International Research and Education awards which total approximately \$5.0 million per year. OISE will also invest \$1.0 million in cyberinfrastructure research. Other OISE investments to advance research excellence include supporting workshops and planning visits to explore and develop collaborative efforts as well as fellowships for international research and education at the graduate and postdoctoral level.
- Support U.S. students and junior faculty **international research and education experiences**. This includes the East Asia and Pacific Summer Institutes, assistance to postdoctoral fellows and students in international collaborative activities, ongoing awards for the five-year Partnerships for International Research and Education, and co-funding and supplemental funding to highly competitive NSF awards in international work.
- Provide U.S. Government support to key **multilateral organizations**, 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 Science, and International Institute for Applied Systems Analysis.
- Continue efforts to develop greater collaboration with **developing countries**.

## PRIORITY AREAS

OISE will shift its investments in priority areas in FY 2006. OISE will fund \$500,000 for Human and Social Dynamics research where the potential for international collaboration is rapidly expanding. OISE will discontinue dedicated funding for Nanoscale Science and Engineering, which is in its last year as an NSF priority area. Support to Biocomplexity in the Environment will be reduced from \$500,000 to \$250,000. OISE's investments in the priority areas are used in a catalytic fashion to ensure that the international dimensions of these important research areas are highlighted and developed.

### OISE Investments in NSF Priority Areas

(Dollars in Millions)

	FY 2004	FY 2005	FY 2006	Change Over	
	Actual	Current Plan	Request	Amount	Percentage
Biocomplexity in the Environment	\$0.50	\$0.50	\$0.25	-\$0.25	-50.0%
Nanoscale Science and Engineering	\$0.00	\$0.26	\$0.00	-\$0.26	-100.0%
Human and Social Dynamics	\$0.15	\$0.00	\$0.50	\$0.50	-

## QUALITY

The Office of International Science and Engineering maximizes the quality of the R&D 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 45 percent in FY 2004 and is estimated at 45 percent in both FY 2005 and FY 2006. The majority of projects that did not undergo external merit review were supplements that added an international dimension to projects already reviewed and funded in Foundation disciplinary research programs.

To ensure the highest quality in processing and recommending proposals for awards, a Committee of Visitors, composed of qualified external experts, is reviewing OISE in FY 2005. 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.

Additionally, an interdisciplinary International Advisory Subcommittee, composed of members that represent the U.S. research and education community across disciplines, meets twice a year and advises the Office on its program and its broader coordination role across the Foundation. The Subcommittee includes a balanced representation of women, members of under-represented minorities and geographic regions.

**PERFORMANCE**

NSF's FY 2006 budget is also 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.

**By Strategic Outcome Goal and Investment Category**

(Dollars in Millions)

	FY 2004	FY 2005	FY 2006	Change over	
	Actual	Current Plan	Request	Amount	Percent
<b><i>People</i></b>					
Individuals	5.15	7.00	7.00	0.00	0.00
Institutions	-	-	-	-	-
Collaborations	-	-	1.00	1.00	-
	5.15	7.00	8.00	1.00	14.3%
<b><i>Ideas</i></b>					
Fundamental Science and Engineering <sup>1/</sup>	34.75	24.38	24.16	-0.22	-0.9%
Centers Programs	-	-	-	-	-
Capability Enhancement	-	-	-	-	-
	34.75	24.38	24.16	-0.22	-0.9%
<b><i>Tools</i></b>					
Facilities	-	-	-	-	-
Infrastructure and Instrumentation	-	-	-	-	-
Polar Tools, Facilities and Logistics	-	-	-	-	-
Federally-Funded R&D Centers	-	-	-	-	-
	-	-	-	-	-
<b><i>Organizational Excellence</i></b>					
	0.93	2.35	2.35	-	-
<b>Total, OISE</b>	<b>\$40.83</b>	<b>\$33.73</b>	<b>\$34.51</b>	<b>\$0.78</b>	<b>2.3%</b>

<sup>1/</sup> The FY 2004 total for Fundamental Science and Engineering includes \$10.99 million provided to NSF by the U.S. Department of State for an award to the U.S. Civilian Research and Development Foundation.

## Recent Research Highlights



Computer-generated image of a now extinct mammal found in Africa 24 million years ago next to a man.

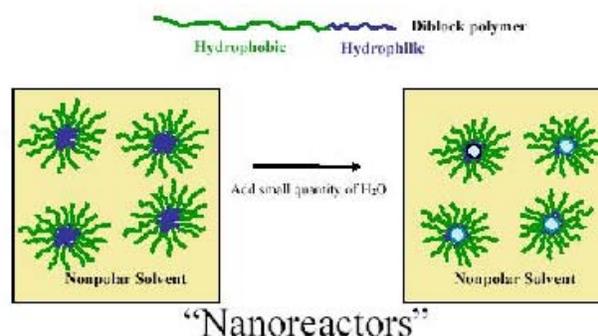
**Ethiopian Fossils Fill in Gaps.** An international team of researchers led by Dr. John Kappelman, a University of Texas paleontologist, has discovered new fossils from the highlands of Western Ethiopia that fill a long-standing gap in scientists' understanding of the evolution and distribution of African mammals. The period from 24 to 32 million years ago, when Africa and Arabia were still joined as a single continent that was isolated from the other landmasses, has long been one of the most poorly known for all of Africa and Arabia. Kappelman and his team of scientists from the University of Michigan, Washington University in Saint Louis, Addis Ababa University and the National Museum in Ethiopia, used high-resolution satellite imagery to identify potentially rich fossil beds, and then later recorded the position of the fossils with GPS technology. Several of the

newly discovered fossils mark the earliest evidence for some of today's African mammals, while others represent the last holdouts of species previously thought to be extinct long before this period. The team discovered that one group of proboscideans, distantly related to elephants, were living side by side with more advanced species that are the ancestors of today's elephants. The fossils also confirm the long-held conjecture that early elephant evolution and divergence occurred entirely in Africa. Perhaps the most unusual fossil mammal discovered is the arsiniothere, an animal larger than today's rhino with a pair of massive bony horns protruding sideways from its snout. The project, funded by NSF, the National Geographic Society, the Leakey Foundation, and the Ethiopian Ministry of Culture, was reported in *Nature* magazine.

### Synthesis of Novel Magnetic Nanoparticles.

Dr. Linda A. Harris, a synthetic polymer chemist from Virginia Tech and recipient of a prestigious NSF International Research Fellowship Program award funded by OISE, is working with physicist Dr. Tim St. Pierre, an expert in biomagnetics, and other researchers at the University of Western Australia to synthesize a series of organic polymers that will serve as nanoreactors for the controlled formation of iron oxide nanoparticles. Iron oxide nanoparticles are among a group of materials that exhibit magnetic properties only in the presence of a magnetic field. This interdisciplinary research collaboration could remove a major hurdle in understanding nanomagnetic behavior, and eventually lead to the development of a drug delivery system in which a magnetic field guides drugs through the body to a specific disease site. Drugs could be delivered directly to a cancerous tumor, for instance, and destroy cancer cells without harming other parts of the body, a side effect of most current anticancer treatments. The NSF International Research Fellowship Program provides opportunities for young investigators to work in collaboration with renowned researchers worldwide, providing them with access to the use of unique or complementary facilities, expertise and experimental conditions abroad.

### Polymer Templates for Iron Oxide Nanoparticle Formation



These images illustrate part of the method required to form novel nanoparticles that could eventually be used to deliver drugs to cancerous tumors.

**Engineering Historic Preservation.**

The Czech Republic has some of the richest and best documented cultural objects in the world, like the early 18<sup>th</sup> century grand Baroque Chateau of Veltrusy located north of Prague and pictured here. Many of the country's best scientists, engineers, and artisans — who have considerable experience with restoration of historic buildings — are part of an international collaborative research team that is tackling major challenges to preserving the Czech Republic's cultural heritage from the engineering viewpoint.



Exterior photo of Chateau Veltrusy

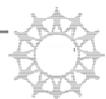
According to Dr. Bo Kasal, Professor of Wood Engineering and Mechanics at North Carolina State University, this project combines state-of-the-art technologies for in-situ evaluation of wood structures with development of new, sensitive preservation techniques aimed at conserving original structures able to survive natural and manmade threats. This project sparked added funding from the European Commission and Deutsche Forschungsgemeinschaft to extend the collaboration to additional Italian, German and Czech researchers working on earthquake resistant wood structures. A combination of high-strength composites such as glass, carbon and Kevlar materials with laminated wood has been investigated, and a series of shake table tests of wood frames were performed. American, Czech, and German students participating in the project take field measurements and gain unique first-hand experience in applying various state-of-the-art, non-destructive evaluation techniques to priceless structures. Many of the buildings are listed with UNESCO and the World Monument Fund. The U.S. students, both graduate and undergraduate, have the opportunity with NSF support to be a part of an international team of experienced researchers, designers, historians, and restorers, and to learn how to work in a multi-country research environment while performing highly specialized tasks in wood science and engineering. These NSF-supported students bring back to the United States critical knowledge and skills that will prove invaluable to efforts to restore and revitalize America's own historic sites.

**Process Chains for Replicating Complex Optical Components.** Imagine a world of manufacturing where extremely precise and complex optical elements for products ranging from camera lenses and eye glasses to solar panels and car dashboard displays can be mass-produced at low cost. A unique



Coating research with future potential applications for mass production of ultraprecision polymer and glass optics.

partnership between an America research group and a large German-funded research center is doing just that. This NSF-funded project enables Dr. Don Lucca and students from Oklahoma State University to engage in an extensive collaboration with the universities of Aachen and Bremen in Germany. The resulting U.S.-Germany Transregional Collaborative Research Center involves technical projects focused on the development of processes for the manufacture of complex, high-quality optical components for next generation applications in information technology and telecommunications, health care, the life sciences, sensing, lighting, and energy conversion. There are other projects in the areas of design, hard coatings, replication techniques, and measurement science and technology. The German center has a substantial



budget for leading-edge equipment, which is available to members of the U.S. group. Dr. Lucca's specific research is "High Resolution Surface Zone Analysis," the investigation of the near-surface mechanical nature of coatings, which will be used in the volume production of ultraprecision optics of polymers and glasses. Nanoindentation will be used to study the near-surface mechanical properties including elastic modulus and hardness, and the surface residual stress state of the hard coatings. One result of the collaborative research will be the development of molds capable of mass-producing surfaces at a level of precision only achievable on an individual, custom basis today. In the end, this Transregional Collaborative Research Center will help enable the mass production of extremely precise optical surfaces for defense, automotive, aerospace and communications uses.

**Land Use Implications of a Tropical Forest Ecosystem.** What role do tropical terrestrial ecosystems play in the global balance of carbon dioxide (CO<sub>2</sub>)? To answer that question, Dr. George Vourlitis, California State University, San Marcos, and Dr. Nicolau Priante Filho at Universidade Federal de Mato Grosso in Cuiaba, Brazil are working together to study the land use implications on the net ecosystem



A 40-meter tall research platform in the rain forest near Sinop Mato Grosso, Brazil, is used to study the role that tropical ecosystems play in the global balance of carbon dioxide (CO<sub>2</sub>).

production and energy balance of a Brazilian tropical forest ecosystem. U.S. researchers with NSF support, working with their Brazilian partners, measured the net ecosystem production (NEP) of an Amazonian tropical transitional forest. NEP is the forest assimilation of atmospheric carbon dioxide through gross primary production minus ecosystem CO<sub>2</sub> loss to the atmosphere by plant and soil respiration. In conjunction with other research conducted as part of the NASA-Instituto Nacional de Pesquisas Espaciais Large-scale Biosphere-Atmosphere Experiment in Amazonia, this project provides a much-needed set of observations for processes that occur in the transition region between the more heavily studied rain forest and savanna ecosystems. This region is currently within the so-called 'arc of deforestation,' and this research provides the framework to determine how land-cover change will alter these heavily impacted tropical ecosystems. The research has already added significantly to important regional syntheses, and will help provide a more comprehensive

understanding of how climatic gradients and land-cover change alter the structure and function of Amazon Basin. It fills a gap in our understanding of tropical ecosystem carbon cycling. The project has quantified the seasonal patterns of, and controls on, mass (CO<sub>2</sub> and water vapor) and energy exchange of an Amazonian transitional tropical forest. Thus, it significantly contributes to the scant body of knowledge on tropical forest function. This effort involved a diverse interdisciplinary team of researchers and students that benefited significantly from a constant 'cross-fertilization' of backgrounds and ideas in ecology, agronomy, micrometeorology, environmental physics, and climatology.

**Other Performance Indicators**

The first table below shows the number of individuals supported through research awards where stipend and salaries are provided. In addition, OISE funds other research activities for post-doctoral and graduate students through fellowships (not shown on chart). In FY 2004, awards funded solely by OISE supported a total of 445 postdoctorates, 703 graduate students, and 336 undergraduates. OISE’s East Asia Graduate Research Summer Institutes program alone placed 146 U.S. graduate students in research projects in Japan, Taiwan, Korea, China, and Australia, while the Office’s International Research Fellowship Program supported the research activities of 34 postdoctoral fellows from 17 states in 18 countries around the world.

**Number of People Involved in OISE Activities<sup>1/</sup>**

	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate
Senior Researchers	138	110	115
Other Professionals	28	25	25
Postdoctorates	10	35	35
Graduate Students	82	120	125
Undergraduate Students	27	50	56
<b>Total Number of People</b>	<b>285</b>	<b>340</b>	<b>356</b>

<sup>1/</sup> This table shows salary and stipend support awards only

The second table shows OISE’s funding profile. The funding rate in FY 2006 is estimated to decrease, chiefly due to plans to increase award size.

**OISE Funding Profile**

	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate
<b>Statistics for Competitive Awards:</b>			
Number	384	325	330
Funding Rate	45%	45%	35%
<b>Statistics for Research Grants:</b>			
Number of Research Grants	206	200	205
Funding Rate	45%	45%	35%
Median Annualized Award Size	\$10,000	\$15,000	\$25,000
Average Annualized Award Size	\$15,018	\$40,000	\$40,000
Average Award Duration, in years	2.3	2.8	2.8

