

Overview of NSF Centers

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Conference on Developing National Science Foundation Centers



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Overview of NSF Centers

- NSF supports a variety of individual centers programs that contribute to NSF's investment in ideas.
- The centers play a key role in furthering the advancement of science and engineering in the U.S., particularly through their encouragement of interdisciplinary research and the integration of research and education.



Common Commitment--I

While the NSF centers programs are diverse, the centers generally share a common commitment in three areas:

- (1) Addressing scientific and engineering questions with a long-term, coordinated research effort. Center programs involve a number of scientists and engineers working together on fundamental research (often high-risk) addressing the many facets of complex problems (often interdisciplinary)



Common Commitment--II

- (2) Including a strong educational component that establishes a team-based cross-disciplinary research and education culture to train the Nation's next generation of scientists and engineers to be leaders in academe, industry, and government
- (3) Developing partnerships with industry that help to ensure that research is relevant to national needs and that knowledge migrates into innovations in the private sector



Common Commitment--III

Many of the NSF centers have large pieces of research equipment, but their funding is for research and education, not as user facilities



NSF Support for Centers

In FY-1999, NSF awarded a total of

- **\$1.849 billion** for research activities of which
- **\$242 million** (approximately **13.0%**) was invested in
- **196** university-based centers

In FY-2001, the center investment is

- **\$334 million** (approximately **13.8%**)



Center Management

- Highly decentralized
- Each disciplinary area of NSF selects the best way to use the center mode of support
 - ◆ e.g., the expectations for industrial involvement, interdisciplinarity, and educational activities vary across the disciplinary units within NSF



Center Configuration

- Most centers are located on one university campus, but:
- Some centers consist of one lead university with a small number of core partners
- Some centers are consortia led by a team in one university with nodes at other universities, companies, government labs, schools or school districts, and non-profit organizations
- Some consortia are tightly integrated among sites and linked by Internet, videoconferencing, or other electronic networks to become “virtual centers” or “centers without walls”



Center Support Features

- Most centers have the potential for 10 years of NSF support and some may extend this period through competitive renewal to 20 years or more
- Most initial awards are for 5 years with the possibility of a renewal, but some center programs limit the number of renewals to one or two



Center Review Features

- Extensive merit review by peer evaluators is universal, both prior to the initial award and for renewal of support
- Centers are usually reviewed by teams of on-site visitors annually, or at least once every three years
- Some centers have been refused renewal of support and others have been terminated during an award due to poor performance
- NSF programs that support centers undergo periodic evaluation



NSF Center Program Types

- Some NSF programs support centers from a **variety** of science and engineering disciplines:
 - ◆ e.g., STCs, ERCs, I/UCRCs, S/I/UCRCs, CRESTs
- Some NSF programs support centers from **specific disciplines** of science and engineering:
 - ◆ e.g., MRSECs, Chemistry Centers, Institute for Theoretical Physics, Physics Frontiers Centers, Mathematical Science Research Institutes, Plant Genome Virtual Centers, LTERs, Center for Ecological Analysis and Synthesis, ITR Centers, Nanoscale Science and Engineering Centers, Children's Research Initiative Centers, Science of Learning Centers



NSF Center Programs--I

- 1973 Industry/University Cooperative Research Centers
- 1979 Institute for Theoretical Physics
- 1980 Long-Term Ecological Research Program
- 1982 Mathematical Science Research Institutes
- 1985 Engineering Research Centers and Groups
- 1987 Science and Technology Centers
- 1987 Centers of Research Excellence in Science & Technology
- 1988 Earthquake Engineering Research Centers
- 1988 National Center for Geographical Information & Analysis
- 1991 State/University/Industry Cooperative Research Centers
- 1994 Materials Research Science and Engineering Centers



NSF Center Programs--II

- 1995 Center for Ecological Analysis and Synthesis
- 1995 Research Centers on Human Dimensions of Global Change
- 1995 National Consortium on Violence Research
- 1998 Plant Genome Virtual Centers
- 1998 Chemistry Centers
- 2000 Information Technology Research Centers
- 2000 Centers for Learning and Teaching
- 2001 Physics Frontiers Centers
- 2001 Nanoscale Science and Engineering Centers
- 2001 Children's Research Initiative Centers
- 2002 Science of Learning Centers



1999 Data for Selected Centers

	# Centers	# Partic. Institut.	# Partners	NSF Support	Leveraged Support	# Participants
ERCs & Groups	18	126	505	\$57M	\$111M	8,700
STCs	23	72	340	\$51M	\$ 97M	3,910
I/UCRCs & S/IUCRCs	58	98	902	\$ 7M	\$ 72M	2,550
CRESTs	10	10	70	\$ 9M	\$ 9M	2,900
Plant Genome Centers	23	50	27	\$31M	\$ 3M	2,800
MRSECs	28	75	275	\$48M	\$ 53M	5,500
LTERs	21	153	106	\$16M	\$ 27M	2,290
Earthquake Eng. RCs	3	39	105	\$ 6M	\$ 11M	382
Chemistry Centers	4	8	12	\$ 7M	\$ 10M	350



1999 Data for Selected Centers

Definitions

Number of Participating Institutions = all academic institutions that participate in activities at the centers

Number of Partners = the total number of non-academic participants, including industry, states, and other federal agencies at the centers

Total Leveraged Support = funding for centers from sources other than NSF

Number of Participants = the total number of people who utilize center facilities; not just persons directly supported by NSF



NSF Center Programs



1973

Industry/University Cooperative Research Centers

- Stimulate industry/university interaction in industrially relevant research
- NSF provides seed funding with majority of support from industrial partners
- Goal to speed technology transfer and develop graduates familiar with industrial practice
- 52 Centers in FY-1999
- \$5 million in FY-2001



1979

Institute for Theoretical Physics

- The general purpose of the Institute is to contribute to the progress of theoretical physics, especially in areas overlapping the traditional subfields, in ways which are not easily realized in existing institutions.
- The Institute provides an environment for the conduct of interactive research by both resident and visiting senior scientists, as well as younger postdoctoral members.
- Located at University of California at Santa Barbara
- \$17 million for 5 years support beginning in FY-1999



1980

Long-Term Ecological Research Program

- LTERs are field research sites in diverse habitat types in which long-term research projects are supported in ecology, ecosystem studies, population biology, and other areas of environmental biology
- LTER Network enables the integration of data and analysis among individual sites
- 21 LTERs in FY-1999
- \$17 million in FY-2001



1982

Mathematical Science Research Institutes

- Institutes serve a variety of functions:
 - ◆ collaborative research in emerging problems
 - ◆ collaborative research between mathematicians and scientists from other disciplines
 - ◆ post-doc training
 - ◆ workshops
- 3 Institutes in FY-1999, but several new competitions may increase number to 7
- \$9 million in FY-2001



1985

Engineering Research Centers and Groups

- Cross-disciplinary university-based centers
- Centers focus on long-term research and education in next-generation engineered systems
- Centers partner with industry and others
- Groups are small cross-disciplinary teams of faculty who pursue high-risk, nascent technologies that might lead to future centers
- 18 Centers in FY-1999
- \$69 million in FY-2001



1987

Science and Technology Centers

- University-based centers with research, education, and knowledge- and technology-transfer activities
- Diverse partners in public and private sectors
- 23 Centers in FY-1999
- 5 new Centers in FY-2000; older Centers phasing out
- \$44 million in FY-2001



1987

Centers of Research Excellence in Science and Technology

- Awards to universities with high minority enrollments expand their capabilities for research and research training
- Some have long-term partnerships with selected Engineering Research Centers to foster collaboration among faculty and students
- 10 Centers in FY-1999
- \$ 9 million in FY-2001



1988

Earthquake Engineering Research Centers

- Conduct & coordinate earthquake engineering research & education for the nation, using a team approach to draw on experts in a range of fields including engineering, geology, geophysics & the social sciences
- Significant cooperation with industry and government organizations that are key stakeholders in reducing earthquake hazards.
- Centers match the federal funds, dollar-for-dollar, with funds from non-federal sources
- 3 Centers in FY-1999
- \$6 million in FY-2001



1988

National Center for Geographical Information and Analysis

- Started in 1988 with NSF support at \$9 million for 10 years
- Today, an independent consortium specializing in research, education, and outreach in geographic information science and its related technologies
- Center is based at three sites: SUNY-Buffalo, University of California at Santa Barbara, & at University of Maine



1991

State/Industry/University Cooperative Research Centers

- Based on the I/UCRC model with added special focus on building partnerships with states to emphasize local economic development
- Established through an agreement between NSF and the National Governors Association
- Support in equal parts from NSF, the state government, and industrial partners
- Program is phasing down with no new proposals accepted
- 6 Centers in FY-1999
- \$1 million in FY-2001



1994

Materials Research Science and Engineering Centers (MRSEC)

- Antecedents were NSF's Materials Research Laboratories (MRLs) begun in the late 1960s
- MRSECs address problems beyond scope of traditional individual and group awards
- Educational and industrial components
- Many have advanced instrumentation and function in part as a user facility
 - ◆ See also National Facilities for Materials Research
- 28 Centers in FY-1999
- \$58 million in FY-2001



1995

Center for Ecological Analysis and Synthesis

- Established at University of California, Santa Barbara
- Brings together visiting researchers, post-doctoral fellows, and students for collaborative research on general ecological principles
- 1 Center in FY-1999
- \$2 million in FY-2001



1995

Research Centers on Human Dimensions of Global Change

- Goal is to discover ways to better predict the impact of changes on populations and their environment by combining research in the natural and the social sciences
- 6 Centers in FY-1995
- \$17.8 million in FY-1995



1995

National Consortium on Violence Research

- Multidisciplinary and multi-institutional consortium specializing in violence research and education
- Comprised of 66 active members affiliated with 40 institutions, across 23 states and in 4 countries
- Research participants are linked through a Data Center
- Funded in FY-1995 by a \$12.2 million grant from NSF in cooperation with HUD and the National Institute of Justice.



1998

Plant Genome Virtual Centers

- Part of National Plant Genome Research Initiative established by OSTP
- Collaborative research and infrastructure to understand structure, organization, and function of plant genomes
- 23 Centers in FY-1999
- \$31 million in FY-2001



1998

Chemistry Centers

- In partnership with DOE, NSF supports three Environmental Molecular Science Institutes for collaborative multidisciplinary research in chemistry and solving environmental problems
- A fourth NSF Center is devoted to fundamental processes in complex systems
- 4 Centers in FY-1999
- \$11 million in FY-2001



2000

Information Technology Research Centers

- As part of its Information Technology Research (ITR) Program Solicitation, NSF allows proposals for Information Technology Research Centers
- Part of a multi-agency ITR Initiative
- No ITR Center awards were made in FY-2000



2000

Centers for Learning and Teaching

- Comprehensive, research-based effort
- Creates innovative partnerships between universities, school districts and other educational partners
- Provides a rich environment that melds research, teacher professional development, and education practice
- Addresses critical issues in science, mathematics, engineering, and technology (SMET) education in K-12 classrooms and in universities
- Addresses national needs of the SMET instructional workforce
- Two CLTs created in FY-2000
- FY-2001 program solicitation
 - ◆ \$16 million for 7-9 new CLTs
 - ◆ \$2 million for developmental grants



2001

Physics Frontiers Centers

- University-based Centers to enable major advances at the intellectual frontiers of physics by providing needed resources not usually available to individual investigators or small groups
- Awards are expected to range in size between \$0.5 million/year and \$4 million/year, with an average award size of approximately \$2M/year
- Awards will be made for five years
- Number of awards in FY-2001 is expected to be in the range 3-5



2001

Nanoscale Science and Engineering Centers

- NSF plans to establish 6-10 NSECs in FY-2001
- Each NSEC award will be in the range from about \$1-\$4 million per year for five years, depending on the scope of the work proposed
- Centers will be eligible to compete for one further five-year renewal
- NSF expects to invest approximately \$20 million in this solicitation component from fiscal year 2001 funds



2001

Children's Research Initiative Centers

- Conduct multidisciplinary, integrative research on scales larger than would be possible through individual research projects
- Provide rich environments that combine research perspectives from multi-disciplinary areas related to children's research
- Proposals may request up to \$500,000 of NSF support annually for 3-5 years
- 3 awards estimated for FY-2001



2002

Science of Learning Centers

- Program under development
- Link research on learning with activities that have direct impact on society, education, and the U.S. workforce for the 21st Century
- Awards (up to 24 months) for transitional proof-of-concept research and collaborative activities
- Awards to support full-scale centers

