Integration of Research and Education

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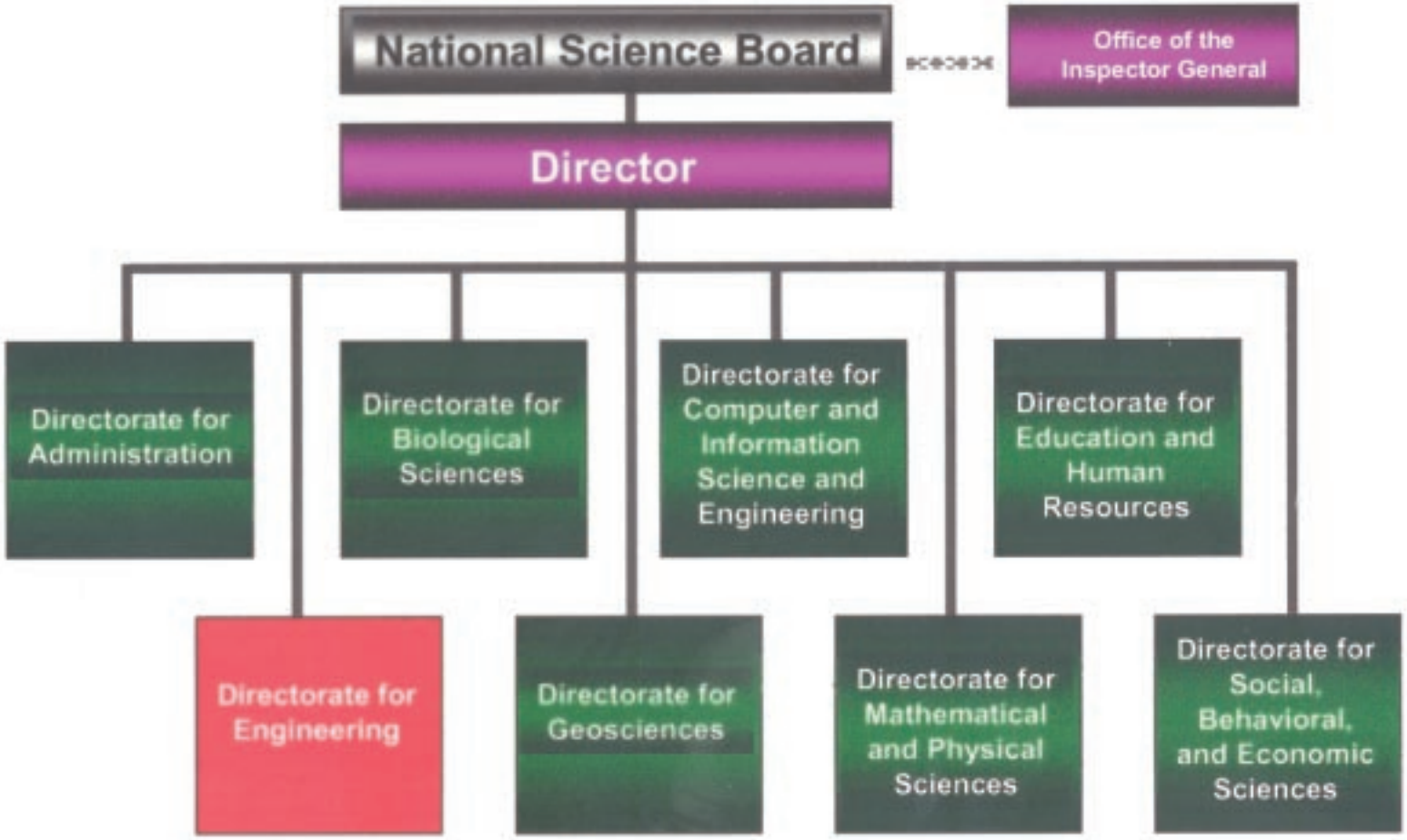
National Science Foundation



The NSF Vision

Enabling the Nation's future through discovery, learning, and innovation...

Strategic goals:

People: Diverse, internationally competitive and globally engaged S&E workforce

Ideas: Discovery across the frontiers of S&E, connected to learning, innovation and service to society

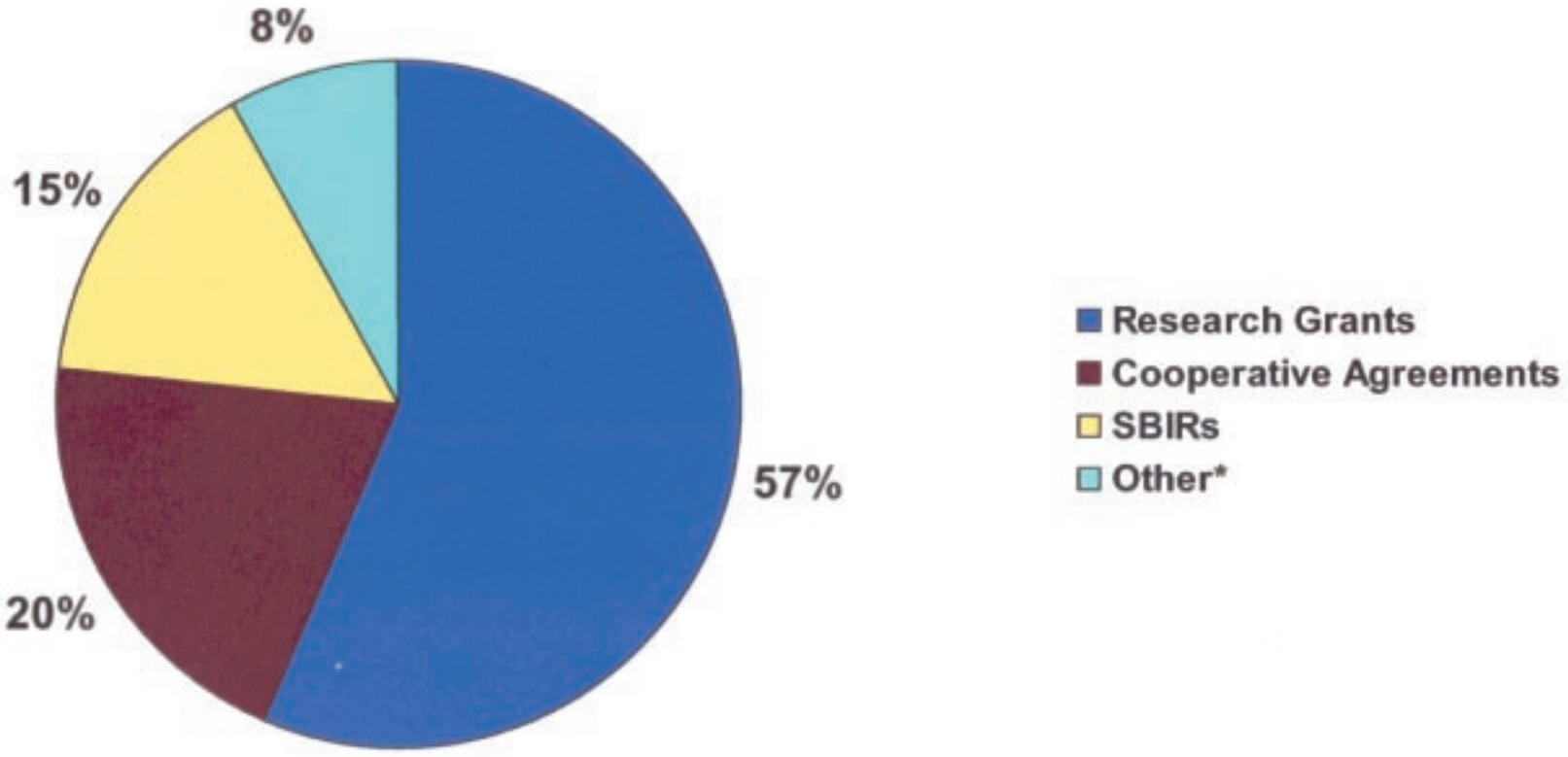
Tools: Accessible, state-of-the-art, and shared research and education tools

NSF FY 2003 Budget Request

- Total NSF: $5.036 billion
- Increase: $247 million
  5.1% over current year

- ENG: $487.98 million (9.7% of NSF)
- Increase: $15.66 million
  3.3% over current year

FY 2001 Engineering R&RA Obligations



* Note: The Other category is comprised primarily of contracts, equipment, fellowships, small travel and symposia grants, and IPA costs.

Current NSF-Wide Priorities

- Information Technology Research ($286M)
- Biocomplexity in the Environment ($ 79M)
- Nanoscale Science and Engineering ($221M)
- Learning for the 21st Century Workforce ($185M)
- Mathematical Sciences ($ 60M)
- Social, Behavioral and Economic Sciences ($ 10M)

ENG Award Size & Duration

Annual mean award size in ENG was $88K in 2000....goal is $100K by 2004

Mean duration, was 2.6 yrs in 2000, due to a substantial number of new, high-risk, short-duration, exploratory awards

The concept of “high risk” has many facets

Investments in People

- ENG invests heavily in CAREER (Faculty Early Career Development).
  - » Typically 30% of all CAREER awards at NSF.
- ENG launched Research Experiences for Teachers (RET) in FY 2001.
  - » $3+ million in FY 2003.
- ENG continues to invest in Research Experience for Undergraduates (REU).
  - » 2000 students, Sites $7 million, Supplements $3+ million in FY 2003
- Engineering Curriculum Change
  - » Departmental-Level Reform
  - » Bridges between Schools of Engineering & Education
  - » Math and Science Partnership (NSF 02-190)

Investments in Ideas

- Sensors and Sensor Networks (NSF 03-512)
  - » Joint with CISE
- Nanoscale Science & Engineering (NSE, NSF 02-148) - $86.3 million in FY 2002 for ENG
  - » ENG leads NSE priority area
- Information Technology Research (ITR, NSF 02-168) - $11.22 million in FY 2002 for ENG
  - » CISE leads priority area
- Biocomplexity in the Environment (BE, NSF 02-167) - $3.7 million in FY 2002 for ENG
  - » BIO leads priority area

Criteria 1 & 2

- **Criterion 1 - What is the intellectual merit of the proposed activity?**
  - **This criterion addresses the overall quality of the proposed activity to advance science and engineering through research and education.**

- **Criterion 2 - What are the broader impacts of the proposed activity?**
  - **This criterion addresses the overall impact of the proposed activity.**

Controls, Networks, and Computational Intelligence (CNCI)

OUTLINE

- Program Goals and Research Areas
- Integration of Research and Education
- Reaching the Customer

CNCI Program Goals

- Methods and tools for analysis, design, and optimization of both engineered and natural systems
  - » Complex systems with both symbolic and continuous dynamics – Hybrid Systems

    (0099824 Varaiya, UC Berkeley; 0115694 Hollwoway, U. Kentucky; 0093762 Hespanha, USC)

Examples of Research Areas

- Distributed, asynchronous, networked control

  (0098089 Chong, Purdue; 0097447 Kushner, Brown)

- Micro and bio systems modeling and control

  (0119815 Messner, CMU; 0123496 Khamash, Iowa State)

- High performance Intelligent systems

  (0122412 Spong, U. Illinois, 9983954 D'Andrea, Cornell)

Systems and Control Programs

- Control, Networks, and Computational Intelligence, ECS/ENG
- Embedded and Hybrid Systems, CCR/CISE
- Dynamic Systems and Control, CMS/ENG
- Applied Mathematics, DMS/MPS
- Process and Reaction Engineering, CTS/ENG
- Manufacturing Machines and Equipments, DMII/ENG

Grant Opportunities for Academic Liaison with Industry (GOALI)

- **Goals:**
  - **Catalyze industry-university partnerships**
  - **Encourage innovative application of academe's intellectual capabilities**
  - **Bring industry's perspective and integrative skills to academe**
  - **Promote high quality research and broaden educational experiences in industrial settings**

Reaching the High School Teachers

Ideas and Technology of Control Systems

ECS-0126318

- NSF/CSS/AACC Joint Sponsors
- Held on June 27, 2000 at ACC
- 50 High School Teachers of mathematics and science representing many school districts
- Follow-up at 2003 ACC and CDC

Research Experience for Teachers (NSF 02-078)

RET-Supplement

- Build long term collaborative relationship between K-12 Teachers and NSF Research Community
- Encourage active participation of Teachers in on-going NSF projects
- Three Participating NSF Directorates
  - » Engineering,
  - » Biological Sciences
  - » Computer Science and Engineering

Research Experience for Teachers

- Examples of collaboration
  - » Design of new experiments, modeling and simulations, algorithms and software development, analysis of data, ...
  - » Encourage transfer of new knowledge to classroom activities
- Supplement to current awards
  - » $10,000 per teacher up to 2 teachers

Reaching Out to Teachers in Science and Mathematics

- Regional RET workshops
  - » NSF-JHU-Howard Community College
  - » 200 teachers and 40 NSF researchers from Virginia, DC, and Maryland
- NSF-IEEE CSS Workshop at the American Control Conference
- Nanotechnology workshop at Penn State for Virginia Teachers

Nanotechnology Undergraduate Education

- NSF received 70 proposals under the Nanoscale Science and Engineering Initiative (NSF 02-148)
- 40 awards for $100K each for one year duration
- Longer duration awards in the next competition

NSF Cross-cutting Programs

www.nsf.gov/home/crssprgm/

- ADVANCE: Increasing the Participation and Advancement of Women in Academic Science and Engineering Careers
- CAREER: Faculty Early Career Development Program
- EGB: Environmental Geochemistry and Biogeochemistry
- EPSCoR: Experimental Program to Stimulate Competitive Research
- ERE: Environmental Research and Education
- ESH: Earth System History
- GK-12: NSF Graduate Teaching Fellows in K-12 Education
- GOALI: Grant Opportunities for Academic Liaison with Industry

NSF Cross-cutting Programs
(continued)

- IGERT: Integrative Graduate Education and Research Traineeship
- IOC: Innovation and Organizational Change
- ITR: Information Technology Research
- ITW: Information Technology Workforce
- LExEn: Life in Extreme Environments
- Minority Research Planning Grants and Career Advancement Awards
- MRI: Major Research Instrumentation Program

NSF Cross-cutting Programs
(continued)

- NANO: Partnership in Nanotechnology
- Partnerships for Innovation (PFI)
- PECASE: Presidential Early Career Awards for Scientists and Engineers
- REU: Research Experiences for Undergraduates
- RUI/ROA: Research in Undergraduate Institutions and Research Opportunity Awards
- SBIR: Small Business Innovation Research
- Science and Technology Centers (STC): Integrative Partnerships
- TCW: Transitions from Childhood to the Workforce