Directorate for Engineering

Current State and Future Directions

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Div. Bioengineering & Environmental Systems

REGIONAL GRANTS CONDERENCE

University of California

- April 2005 -

NSF Support for Engineering

ENGINEERING ACIVITY

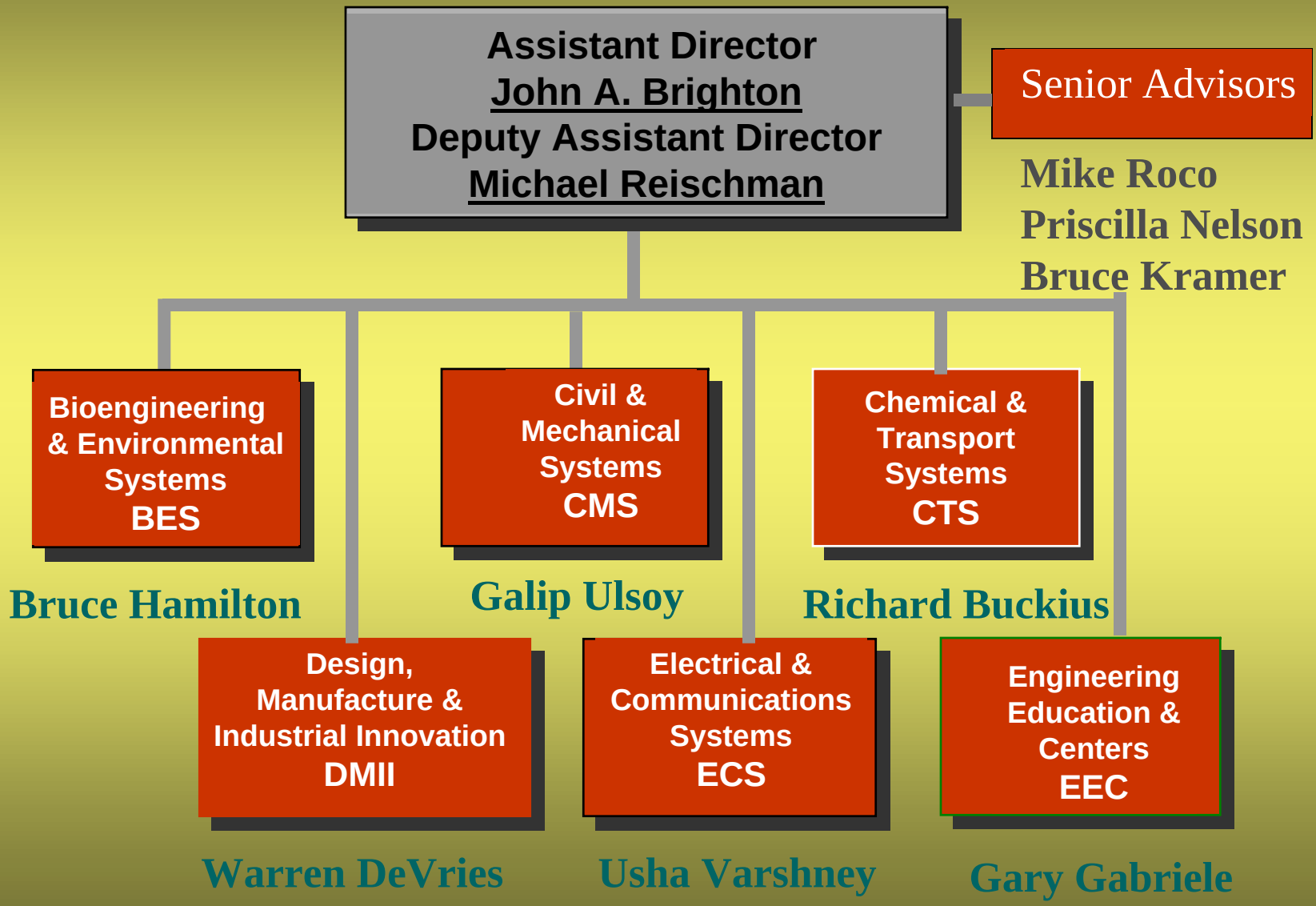
NSF supports fundamental research on engineering systems, devices and materials and their underpinning processes and methodologies.

NSF Support for Engineering

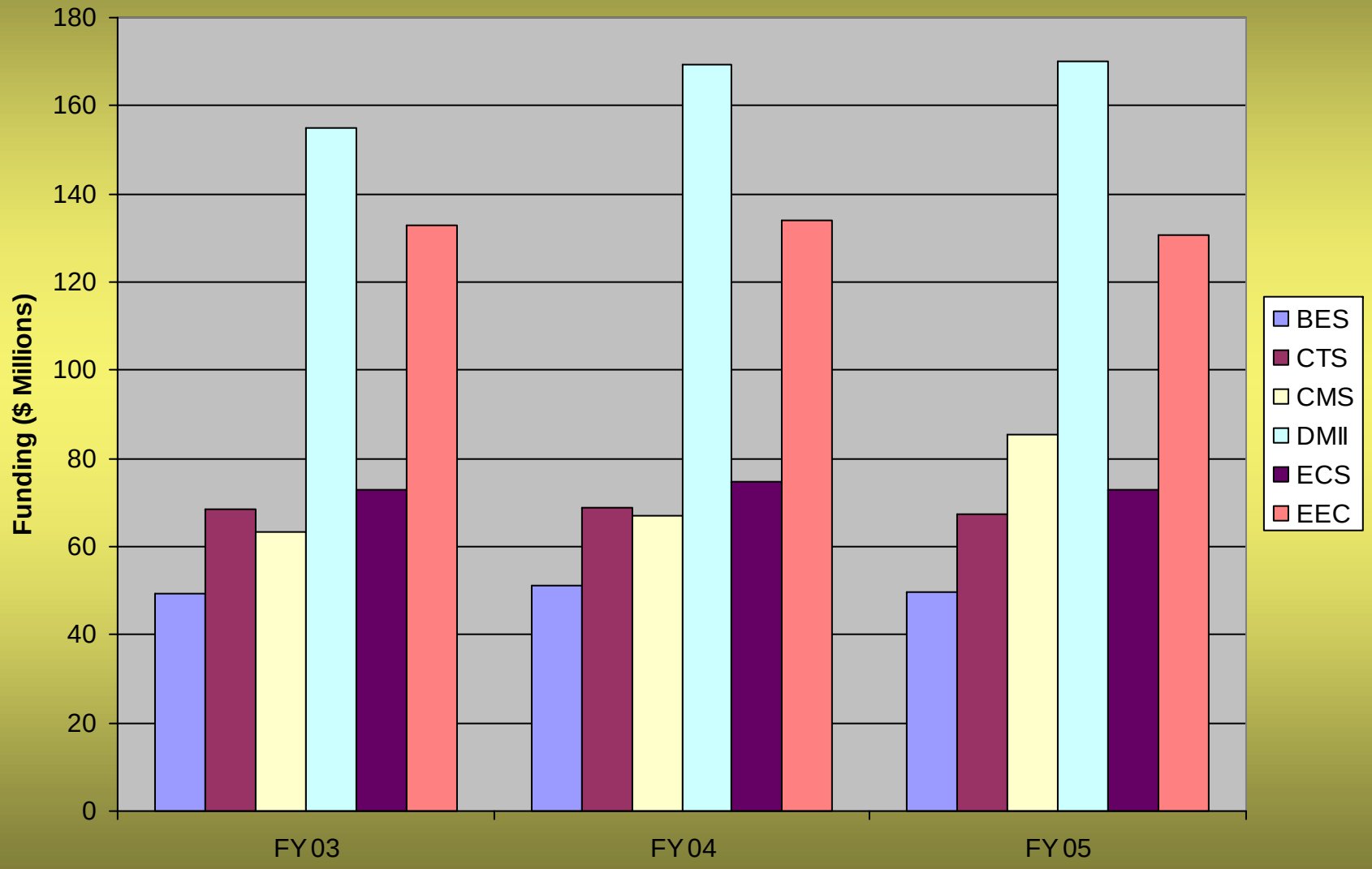
RELEVANCE

NSF is the principal source of federal funding for university based fundamental engineering research, providing over 42% of the total federal support in this area.

Directorate for Engineering



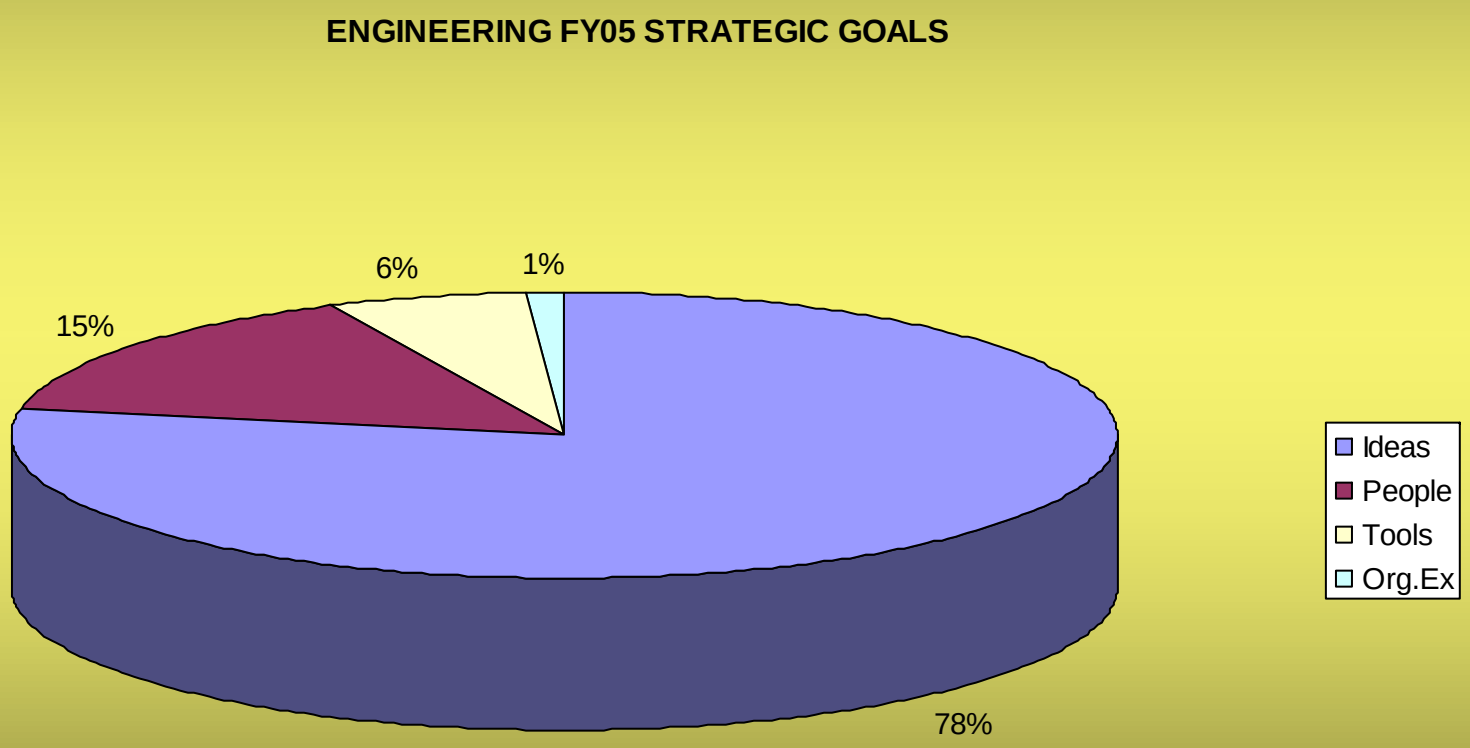
NSF Engineering Budget



Engineering Focus Areas

- **PEOPLE: Activities to Better Attract and Retain Engineering Graduates and to Ensure That They Receive a Quality Education.**
- **IDEAS: Advancement of Knowledge About Fundamental Engineering Research…..**
- **TOOLS: Enhancement of Infrastructure to Conduct Engineering Research……**
- **ORG.EXCELLENCE: Admin. Activities to Enable NSF to Achieve its Mission …**

Funding by Focus Area



Engineering Portfolio

Core Research

Funds broadly based engineering research and sustains the various engineering disciplines through grants for unsolicited proposals.

Priority Areas

Provide opportunities to connect to other disciplines and funding of teams or groups.

Review and management of interdisciplinary proposals are more complex.

Engineering Priority Areas FY05

- **Biocomplexity in the Environment** **$6M**
- **Nanoscale Engineering** **$134M**
- **Mathematical Sciences** **$3M**
- **Human & Social Dynamics** **$2M**
- **Workforce for the 21st Century** **$1M**

Biocomplexity in the Environment

- **Engineering: $6.0M (FY04), $6.0M (FY05)**

- **Technological issues, such as process and product redesign and manufacturing, as well as behavioral factors, such as economic and other social forces that affect consumption and adoption of new technologies and materials. Materials Use: Science, Engineering and Society Program**

Nanoscale Science and Engineering

Engineering: $107M (FY04), $134M (FY05)

Four modes of support:

- **Nanoscale Interdisciplinary Research Teams (*Enhance funding rates to >10%)***
- **Nanoscale Exploratory Research (*Increase funding by $16M)***
- **Nanoscale Science and Engineering Centers and Infrastructure (*Increase funding for NNIN & NCN as well as Centers*)**
- **Nanotechnology Undergraduate Education (*Increase funding for K-12, and Societal Implications)***

Mathematical Sciences and Human & Social Dynamics

Engineering: $5M (FY04), $5M (FY05)

Support for Collaborations Between Mathematicians and Engineering Researchers.

Support for Studies on Security of Critical Infrastructure Networks, and Integration of Nanotechnology, Biotechnology etc. for Improving Human Abilities.

Engineering Pathways Strategy (21st Century Workforce)

- ⇨**Revitalize and update engineering curricula**
- ⇨**Integrate research and education**
- ⇨**Develop current and future faculty**

Information Technology Research

Engineering: $11.2M (FY04), Good Bye (FY05)

Information technology essential for solving critical national problems in areas such as fundamental science and engineering, the environment, health care, and government operations.

Engineering Working Groups & Themes

- **Sensors and Sensor Networks**
  (Partnership with CISE and others)
  Received 925 proposals in FY03, 600+ in FY04
- **Hydrogen Based Energy Research**
  (Fuel cells, hydrogen production)
- **Complex Environmental Systems**
- **Manufacturing Research**
- **Hazards and Disaster Mitigation**
- **CLEANER**

List of Educational Outreach Programs

- **RET: Research Experiences for Teachers**
- **BEE: Bridges for Engineering Education**
- **MSP: Math and Science Partnerships**
- **REU: Research Experiences for Undergraduates**
- **CLT: Centers for Learning and Teaching**
- **CAREER: Faculty Early Career Development**
- **PFF: Postdoctoral Faculty Fellowships**

Building Bridges Between Engineering and Education Faculty

- **Collaborations between Schools of Engineering and Education – BEE Planning Grants (NSF 02-092)(23 awards were made)**

Enable 2-way partnerships:

⇨**Develop technology-focused curricula with exciting engineering examples for in-service and pre-service teachers.**

⇨**Improve pedagogy in engineering schools.**

Revitalize and Update Engineering Curricula

- **Planning Grants for Department-level Reform of Undergraduate Engineering Curricula.**
  - **Integrate exciting research conducted at graduate level into undergraduate teaching materials (NSE, ITR, BE)**
  - **Expose students to the computational methods used by practicing engineers**
  - **Update instruction using mentoring, team-based and experience-based learning**

New Tools for Engineers

(Instruments and facilities similar to those of astronomers, physicists and oceanographers)

Distributed and networked multi-user research facilities e.g. NEES & NNIN

Network for Earthquake Engineering Simulation

Remote Users

Instrumented Structures and Sites

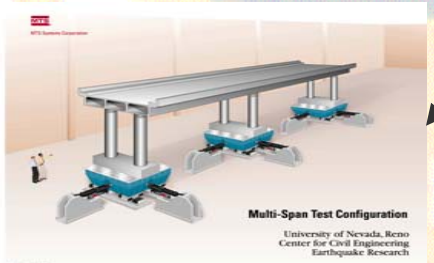
Laboratory Equipment

High-Performance Network(s)

Field Equipment

Curated Data Repository

Global Connections (fully developed FY 2005 – FY 2014)



Laboratory Equipment

Remote Users

Leading Edge Computation

National Nanotechnology Infrastructure Network (NNIN)

- **Facilities with diverse technical capabilities to enable nanoscale science and engineering research**
- **A network of geographically diverse facilities accessible to a broad range of users**
- **Sites of learning providing unique experiences for all levels of education**
- **Sites for engaging social scientists and addressing societal implications of nanotechnology**

Future Directions at NSF Engineering

Priority Areas in the next 2-8 years

- **Cyberinfrastructure.**
- **Converging Technologies (Nano-Bio-Info).**
- **Development of a Strong US Engineering Workforce.**
- **Distributed, Networked, Shared Laboratory Tools and Infrastructure.**