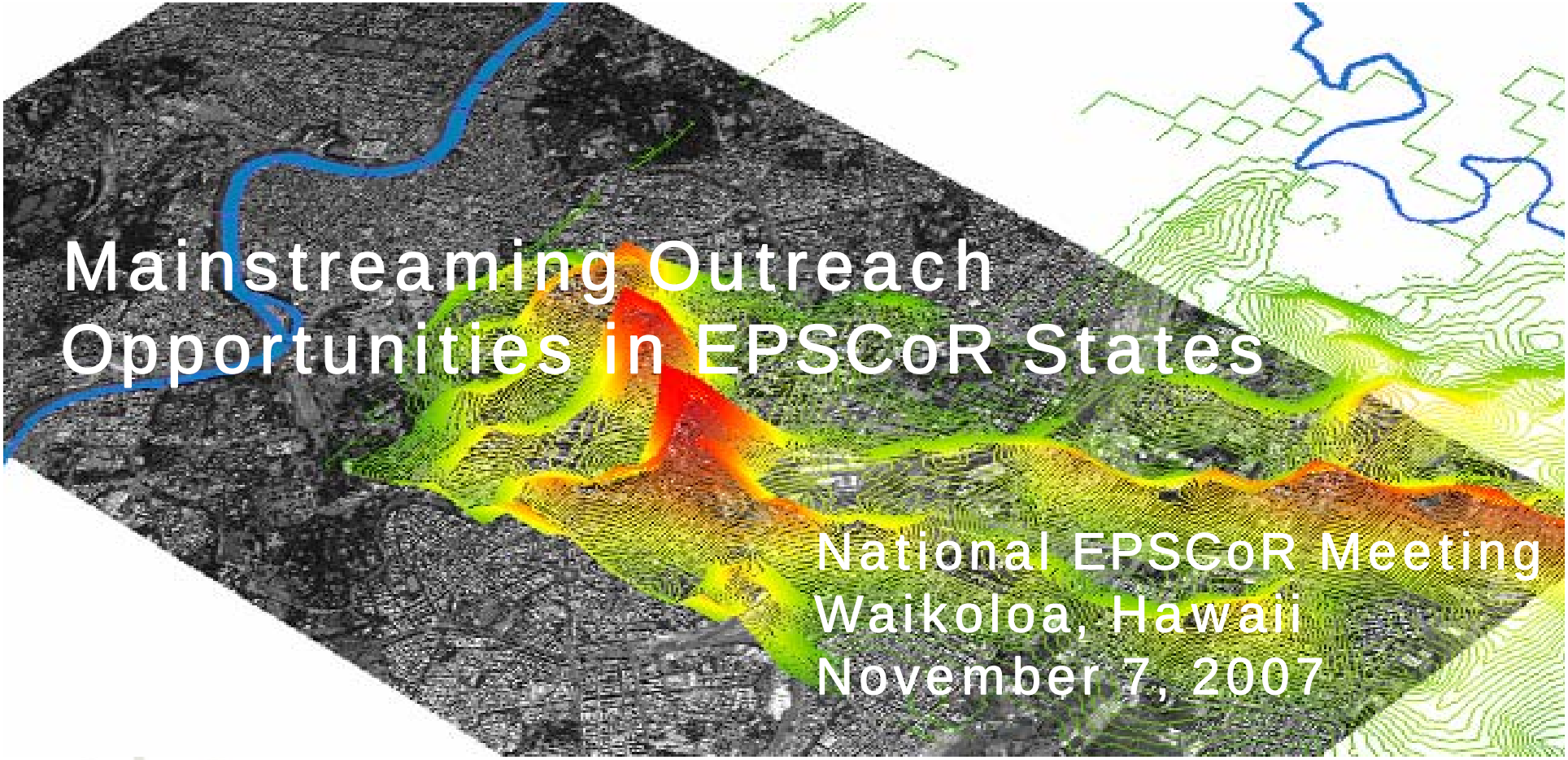


Mainstreaming Outreach Opportunities in EPSCoR States

National EPSCoR Meeting
Waikoloa, Hawaii
November 7, 2007

National Science Foundation
Directorate for Engineering

Richard O. Buckius
Assistant Director

National EPSCoR Meeting

Panel 3 Agenda—1:50 to 3:15 pm

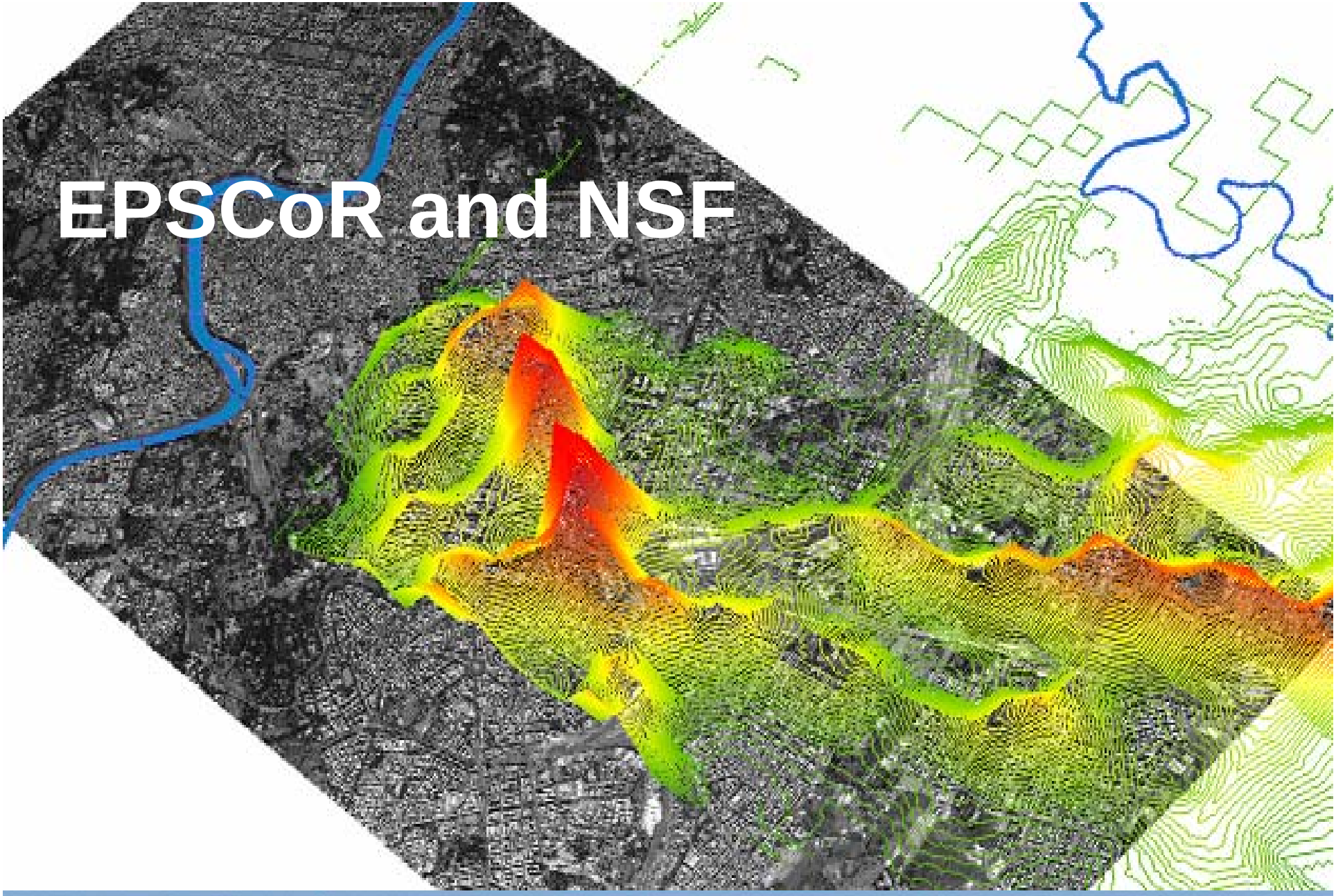
- **Session Goal—EPSCoR program will achieve a seamless level of interaction within the Foundation with a better understanding of the Foundation and its programs.**
  - **Richard Buckius**
    - **Assistant Director, Directorate for Engineering**
    - **Mainstreaming EPSCoR**
    - **Engineering and National Priorities**
  - **Peter March**
    - **Division Director, Division for Mathematical Sciences**
    - **Mathematical Sciences: discovery, connections, community**
  - **Christine Boesz**
    - **Inspector General, NSF**
    - **Accountability and Compliance Challenges**

EPSCoR and National Priorities

Topics

- EPSCoR and NSF
  - Goals
  - Current status
- EPSCoR in Context
  - National priorities
  - NSF priorities
- ENG and National Priorities
- Current solicitations

EPSCoR and NSF



EPSCoR and NSF

EPSCoR Mission and Goals

- **Mission: To assist the National Science Foundation in its statutory function "to strengthen research and education in science and engineering throughout the United States and to avoid undue concentration of such research and education."**
- **Goals:**
  - **Provide strategic programs and opportunities for EPSCoR participants that stimulate sustainable improvements in their R&D capacity and competitiveness.**
  - **Advance science and engineering capabilities in EPSCoR jurisdictions for discovery, innovation and overall knowledge-based prosperity.**

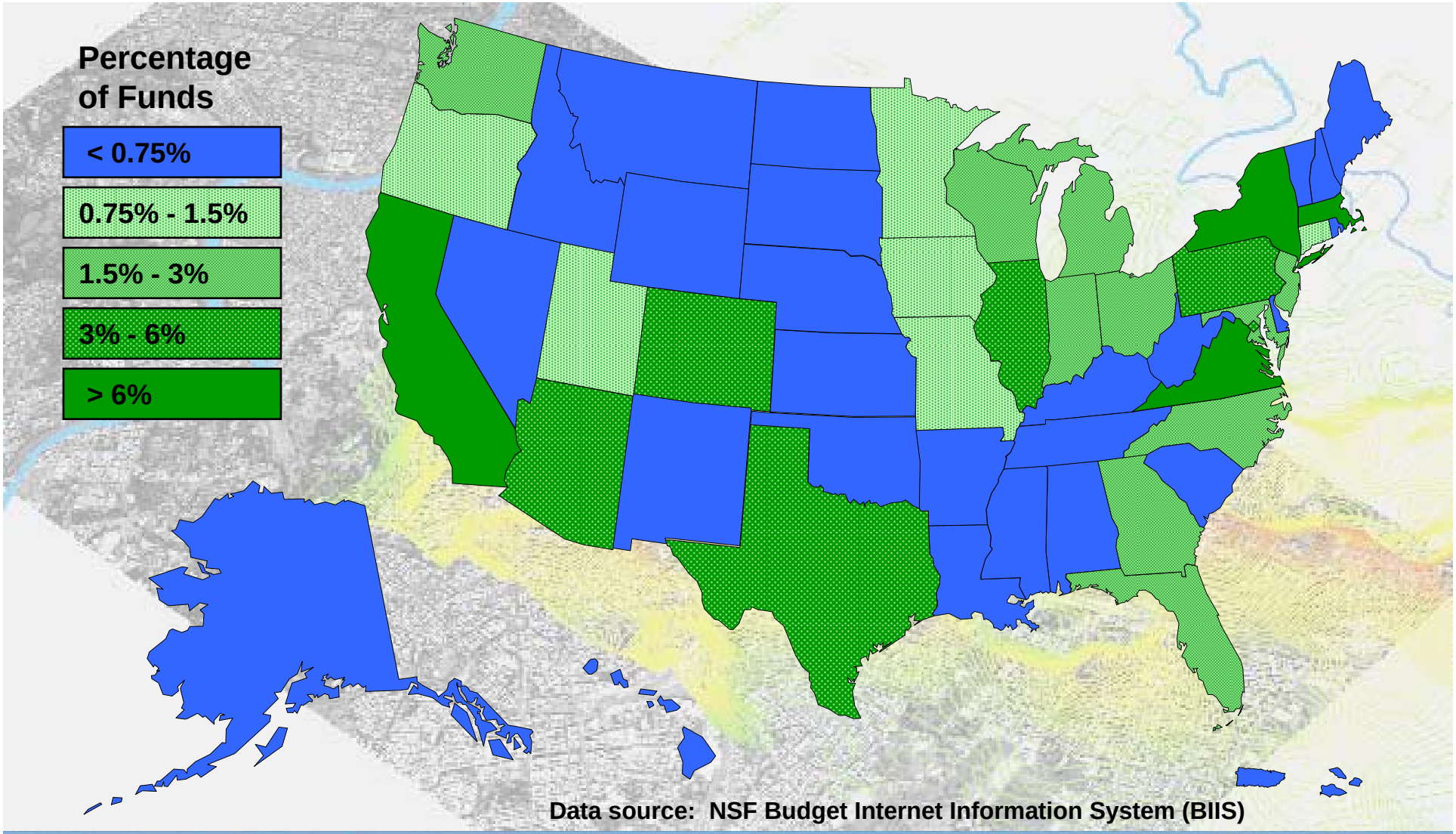
EPSCoR and NSF

EPSCoR Mission and Goals

- **EPSCoR and Innovation (from the recent EPSCoR RII solicitation):**
  - **EPSCoR meant to stimulate "research that is fully competitive in the disciplinary and multidisciplinary research programs of the National Science Foundation" and thus**
  - **"bolster the capacity of jurisdictions to "facilitate knowledge generation leading to economic development [and] develop the diverse, well-prepared, internationally competent and globally engaged STEM workforce necessary to sustain the nation's competitive edge."**
- **National priorities and the goals for EPSCoR states are intertwined.**

EPSCoR and NSF

Distribution of NSF Research Funds by State (FY 2004–2006)



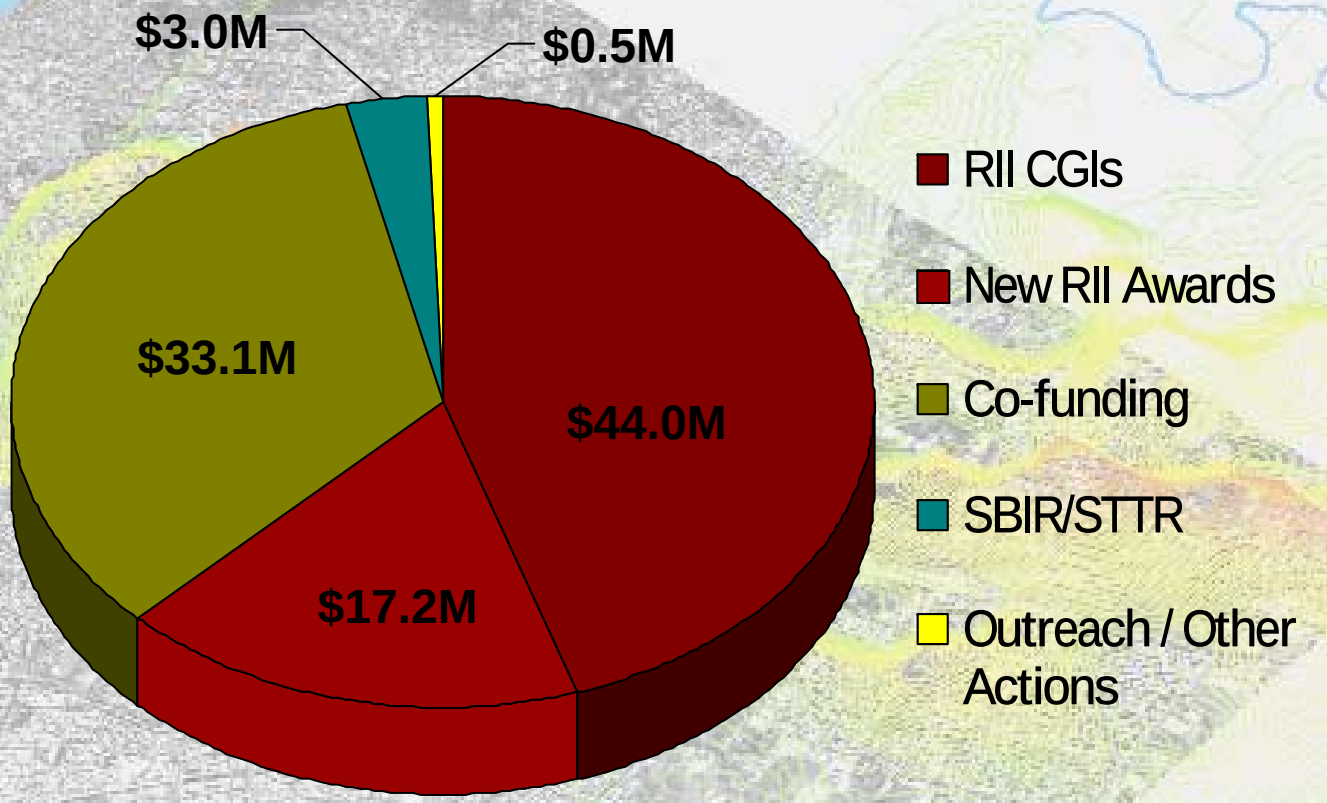
Data source: NSF Budget Internet Information System (BIIS)

EPSCoR and NSF

EPSCoR Funding Leveraged with NSF Directorate Funds

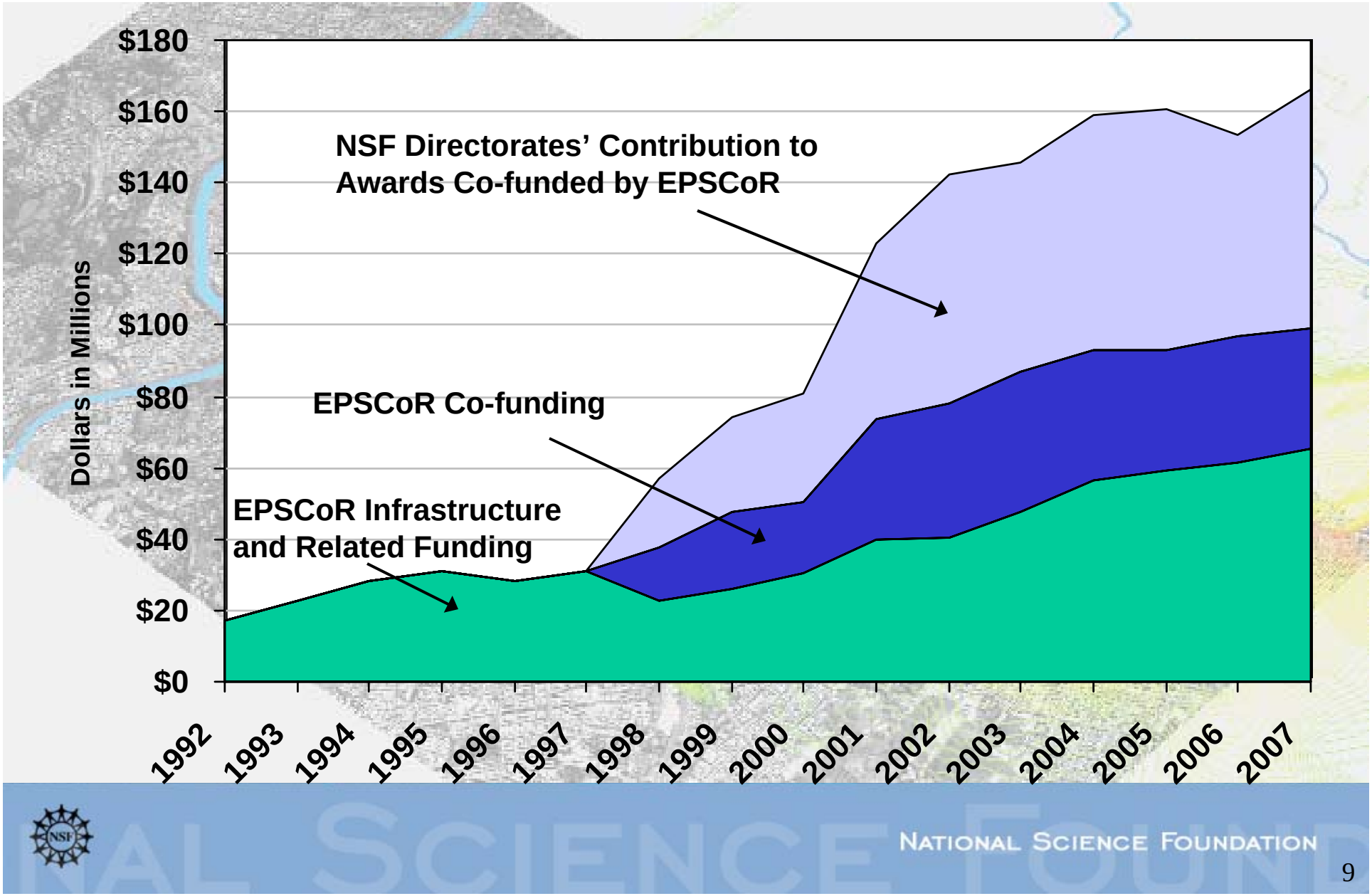
- **EPSCoR is meant to provide a foundation for merit-based, sustainable research.**

EPSCoR FY 2006 Allocation
Total: $97.8M



EPSCoR and NSF

EPSCoR Funding Leveraged with NSF Directorate Funds



EPSCoR and NSF

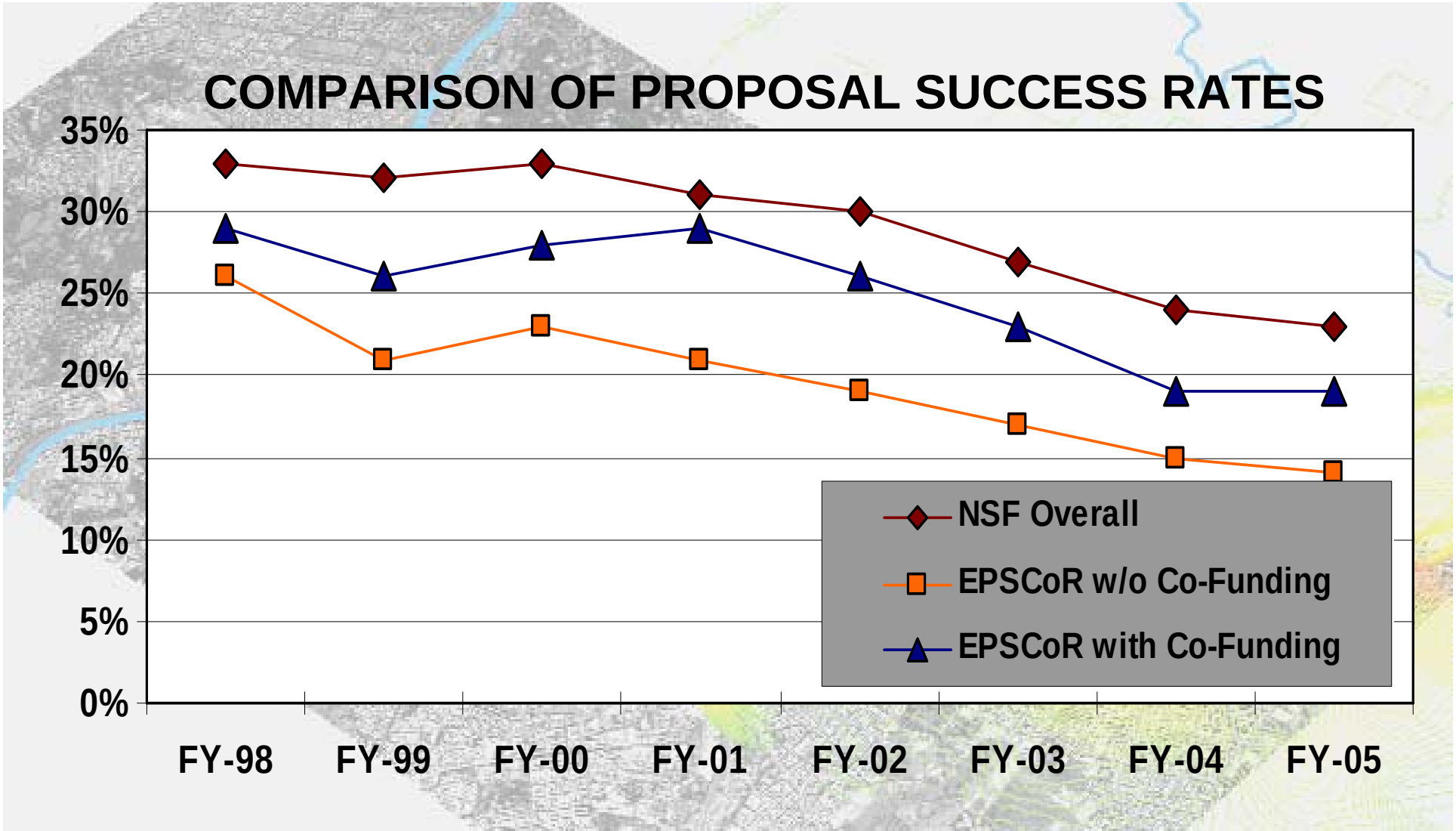
NSF is a Key Agency for EPSCoR Funding

	FY 2006 EPSCoR Budget	Estimated FY 2006 Total Research Budget
NSF	$97.8M	$4.3B
NIH	$222.0M	$20.2B
USDA	$18.6M	$2.8B
DOE	$7.3M	$3.6B
DOD	$9.2M	$6.3B
NASA	$4.6M	$5.2B
EPA	$0M	$0.7B
Total	$359.5M	$43.1B

EPSCoR Interagency Coordinating Committee (EICC): EPSCoR Budgets in Individual Agencies. Note that EPSCoR eligibility and funding mechanisms vary across agencies.

EPSCoR and NSF

Contribution of Co-Funding

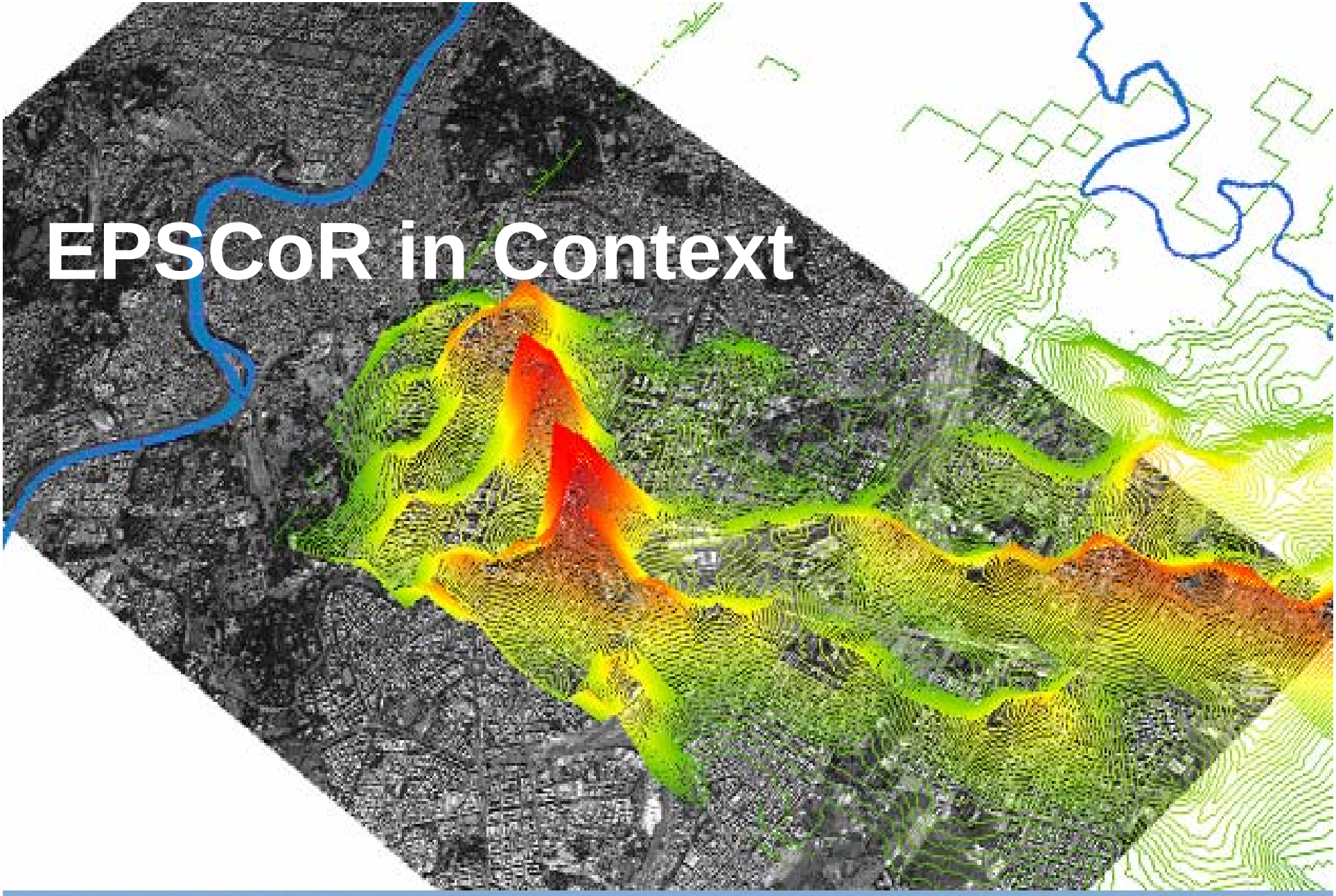


EPSCoR and NSF

Summary

- The EPSCoR mission is uniquely intertwined with national and NSF missions for innovation and for workforce development.
- EPSCoR should provide the foundation for mainstreaming EPSCoR states.
- An important EPSCoR goal is to stimulate research and education that is fully competitive in the programs throughout the Foundation.

EPSCoR in Context



EPSCoR in Context

National Priorities: America COMPETES

- America Creating Opportunities to Meaningfully Promote Excellence in Technology, Education and Science Act was passed in August 2007 by Congress and signed by President Bush.
- The Act states: “support and promote innovation research in the United States through high-risk, high-reward projects that meet fundamental scientific and technological challenges, involve multidisciplinary work, and involve a high degree of novelty."
- Outlines specific allocations for initiatives at NASA, NIST, NOAA, DOE, and NSF, with an emphasis on education and workforce development.

Development of a strong engineering workforce is a thread throughout America COMPETES. Pictured are two students at the University of Texas-El Paso. *Zubia, 0521650.*

EPSCoR in Context

National Priorities: America COMPETES

- Authorizes funding that would increase the NSF budget by 20 percent between FY 2007 and 2009.
  - $962.4 million for education and human resources programs (FY 2008)
  - $120 million for EPSCoR (FY 2008)

Development of a strong engineering workforce is a thread throughout America COMPETES. Pictured are two students at the University of Texas-El Paso. *Zubia, 0521650.*

- Calls on NSF to give priority in selecting awards that meet "critical national needs" in innovation, competitiveness, safety and security, physical and natural sciences, technology, engineering, social science and mathematics.

EPSCoR in Context

National Priorities: Innovation

- American Competitiveness Initiative: Leading the World in Innovation
- It states: "Keeping our competitive edge in the world economy requires focused policies that lay the groundwork for continued leadership in innovation, exploration, and ingenuity."

- Its centerpiece is to double the federal investment in key agencies that support basic research in physical sciences and engineering.
- The Federal agencies impacted over the next 10 years are NSF, DOE Science, and NIST.
- Three broad components:
  - Research in physical sciences and engineering
  - R&D tax incentives
  - Education and workforce

EPSCoR in Context

National Priorities: ACI Research Goals

➔ **NSF is tasked in 7 of the 12 ACI Goals:**

- **World-leading, high-end computing capability and capacity … to enable scientific advancement through modeling and simulation at unprecedented scale and complexity.**
- **Improvement of sensor and detection capabilities that will result in world-leading automation and control technologies.**

Simulation of the formation of an F3 tornado. National Center for Supercomputing Applications, UIUC

- **Overcoming technological barriers to the practical use of quantum information processing.**
- **Overcoming technological barriers to efficient and economic use of hydrogen, nuclear, and solar energy.**

EPSCoR in Context

National Priorities: ACI Research Goals

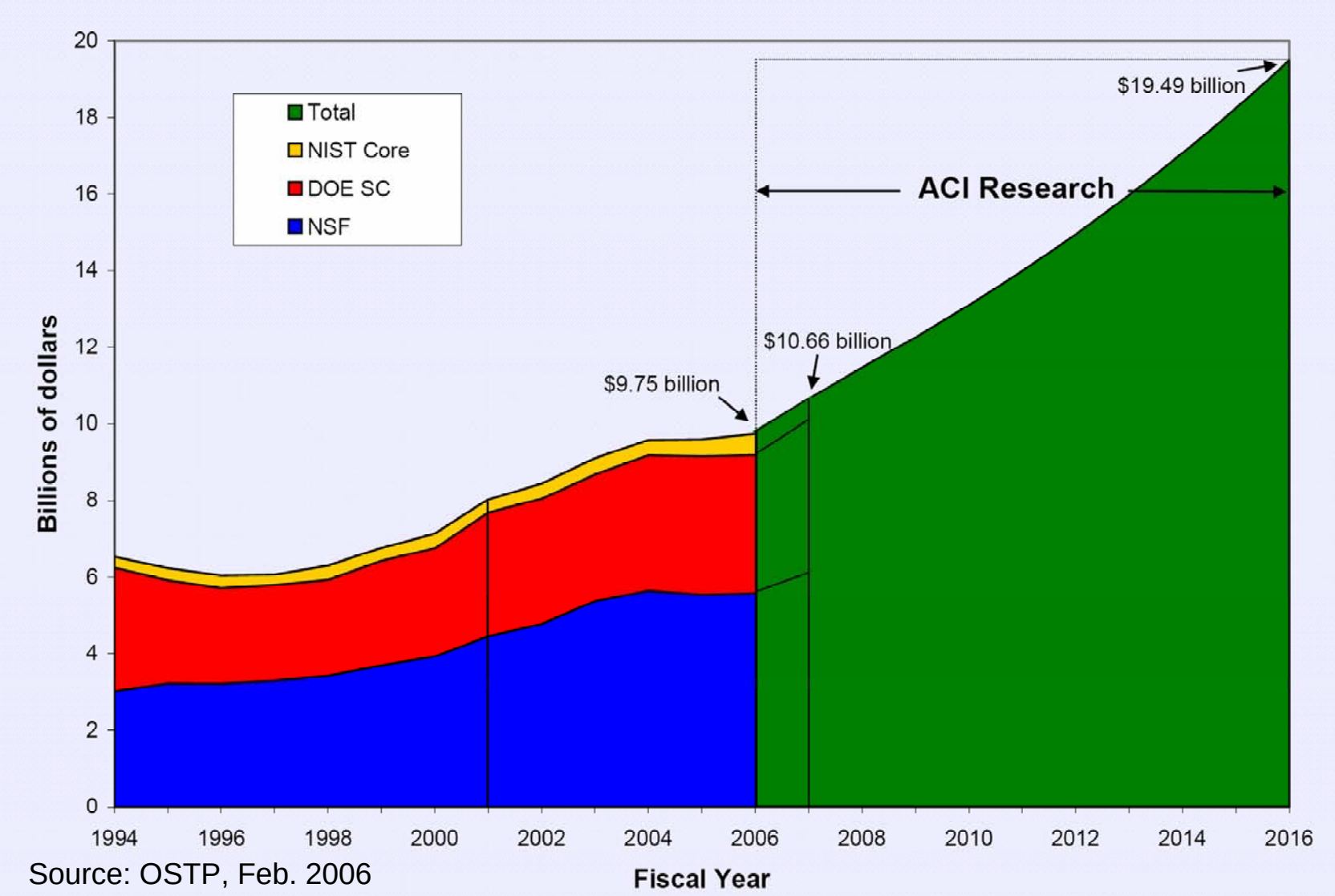
➔ **NSF is tasked in 7 of the 12 ACI Goals (continued):**

- **Addressing gaps and needs in cyber security and information assurance to protect our IT-dependent economy … and to lead the world in intellectual property protection and control.**
- **World-class capability and capacity in nanofabrication and nanomanufacturing.**
- **Advances in materials science and engineering to develop technologies and standards for improving structural performance during hazardous events such as earthquakes and hurricanes.**

Network for Earthquake Engineering Simulation, UCSD.

EPSCoR in Context

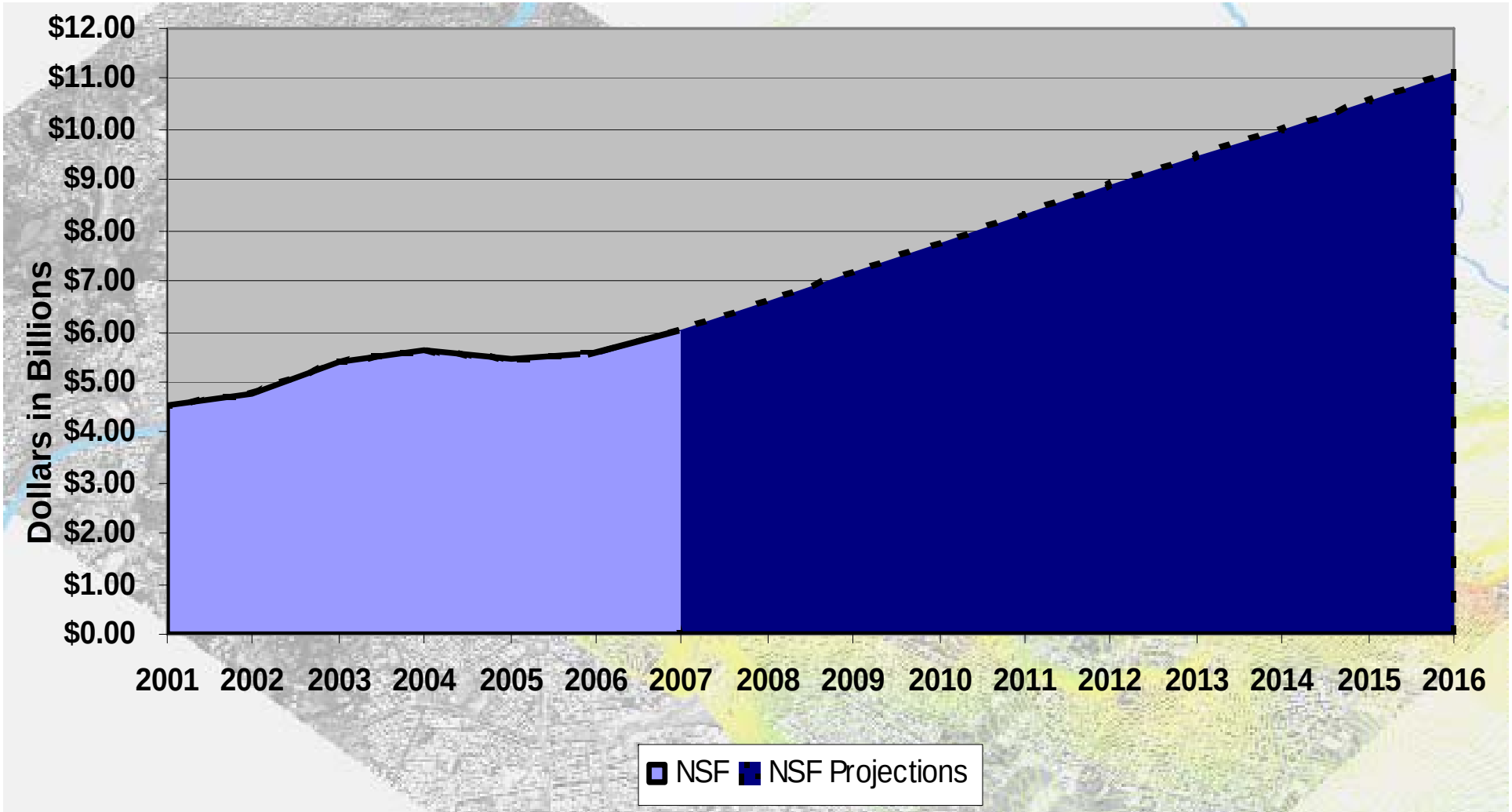
ACI: FY 2007–2016



Source: OSTP, Feb. 2006

EPSCoR in Context

ACI-Driven Budget Projections



FY 2006 through FY 2016 budgets are estimates based on White House data.

EPSCoR in Context

National Priorities: Research

- **Office of Management and Budget and the Office of Science and Technology Policy:**
  - **Homeland Security**
    - **Prevention, Detection, & Remediation of nuclear, chemical and biological threats**
    - **Medical Countermeasures and Biosurveillance Networks**
  - **Energy Security**
    - **Diversified Energy Sources and Renewables**
  - **Advanced Networking and High-End Computing**
    - **Supercomputing and Cyberinfrastructure**
  - **National Nanotechnology Initiative**
  - **Environment**
    - **Global Climate Change Science and Technology**
    - **Global Supply of Fresh Water**
  - **Understanding Complex Biological Systems**

***See www.ostp.gov/html/M-06-17.pdf**

EPSCoR in Context

NSF Budget by Research Directorate

Directorate	FY 2007 Plan (Dollars in millions)	FY 2008 Request (Dollars in millions)	FY 2008 Request	
			Change over FY 2007 Request	
			Amount (in millions)	Percent
BIO	$607.85	$633.00	$25.15	4.1%
CISE	526.69	574.00	47.31	9.0%
ENG *(less SBIR/STTR)*	519.67	566.89	47.22	9.1%
SBIR/STTR	*108.88*	*116.41*	*7.53*	*6.9%*
GEO	744.85	792.00	47.15	6.3%
MPS	1,150.30	1,253.00	102.70	8.9%
SBE	213.76	222.00	8.24	3.9%
Research and Related Activities across all NSF	$4,765.95	$5,131.69	$365.74	7.7%

EPSCoR in Context

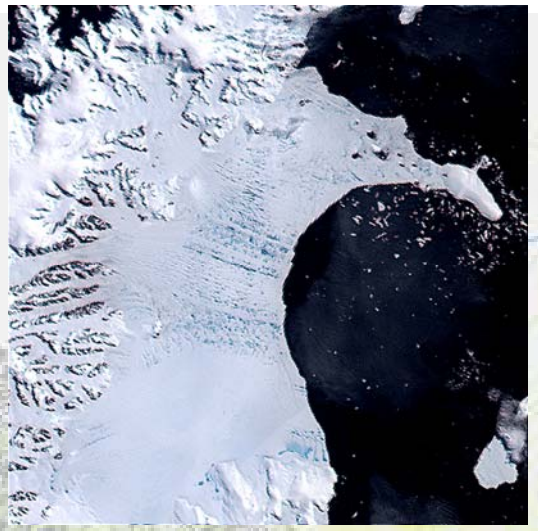
NSF Priority Area Investments

	FY 2006 Actual (in millions)	FY 2007 Request (in millions)	FY 2008 Request (in millions)	Change over FY 2006	
				Amount (in millions)	Percent
Climate Change Science Program	$196.88	$205.25	$208.25	$3.00	1.46%
Cyber-enabled Discovery and Innovation (CDI)	0.00	0.00	51.98	N/A	N/A
Cyberinfrastructure	520.50	597.31	644.09	46.78	7.83%
Human and Social Dynamics	39.47	41.45	37.95	-3.50	-8.44%
National Nanotechnology Initiative	359.71	373.18	389.90	16.72	4.48%
Networking and Information Technology R&D	811.53	903.74	993.69	89.95	9.95%

EPSCoR in Context

NSF Priority Areas

- **Climate Change Science Program** www.climatescience.gov
  - Across 13 federal agencies
  - NSF: system processes and consequences of change.
  - Also data acquisition and information management; efforts to mitigate and adapt to environmental change.
  - NSF enables synthesis of knowledge.



MODIS images from NASA's Terra satellite supplied by Dr. Ted Scambos; National Snow and Ice Data Center, University of Colorado, Boulder

Break-up of a massive portion of Antarctica's Larsen B ice shelf in 2002.

- **Cyber-Enabled Discovery and Innovation (CDI)**
  - Need a new generation of computationally based discovery concepts and tools.
  - Glean information from massive data flows and databases.
  - Remain competitive in an information economy.
  - Eliminate constraints for collaboration.
  - Integrate computation into experimentation.

EPSCoR in Context

NSF Priority Areas

➔ Cyberinfrastructure

- Cyberinfrastructure contributes to the development of a widely accessible information technology (IT) backbone that will ultimately enable innovative science and engineering research and education as well as next-generation IT capabilities.

Linking radio telescopes for Very Long Baseline Interferometry studies: These networks can be established and ended in seconds as needed. A key tool is GMPLS, generalized multiprotocol label switching.

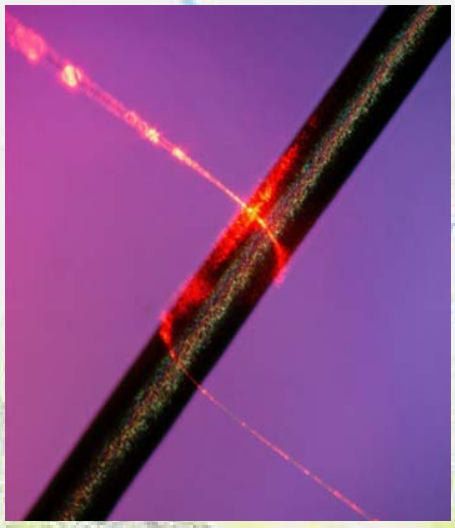
➔ Human and Social Dynamics

- Human and Social Dynamics research fosters breakthroughs in understanding human action and development, and generates knowledge about organizational, cultural and societal adaptation and change.

EPSCoR in Context

NSF Priority Areas

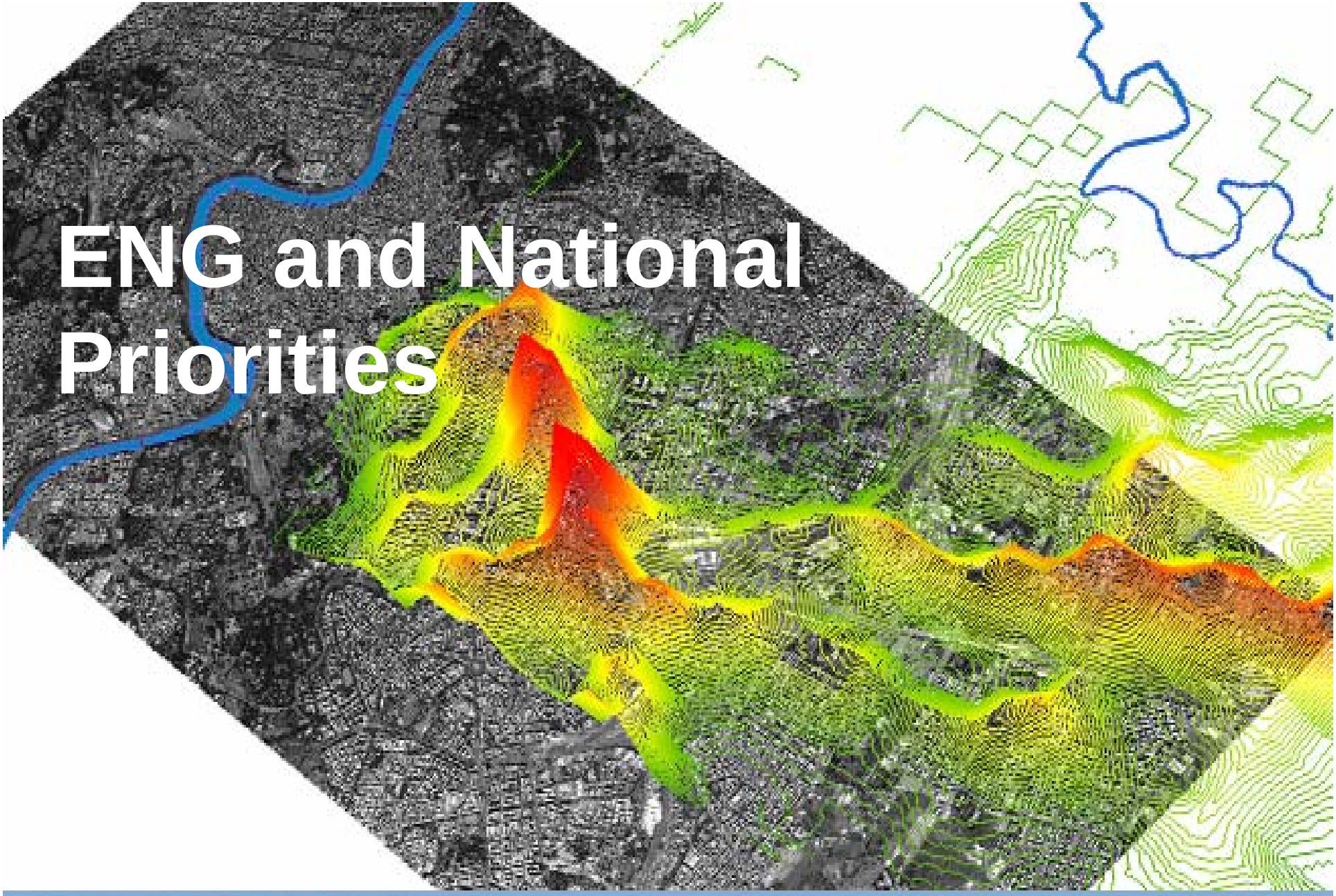
- **National Nanotechnology Initiative**
  - Nanoscale science and engineering research promises a better understanding of nature, the development of novel products, improved efficiency in manufacturing, means for sustainable development, better healthcare and improved human performance.



Light moves along a nanowire, pictured here wrapped around a human hair. ***Mazur, 0601520***.

- **Networking and Information Technology R&D**
  - NSF participates in this federal multiagency program, which explores new concepts and tools at the intersection of the computation and physical/biological worlds.
  - www.nitrd.gov

ENG and National Priorities

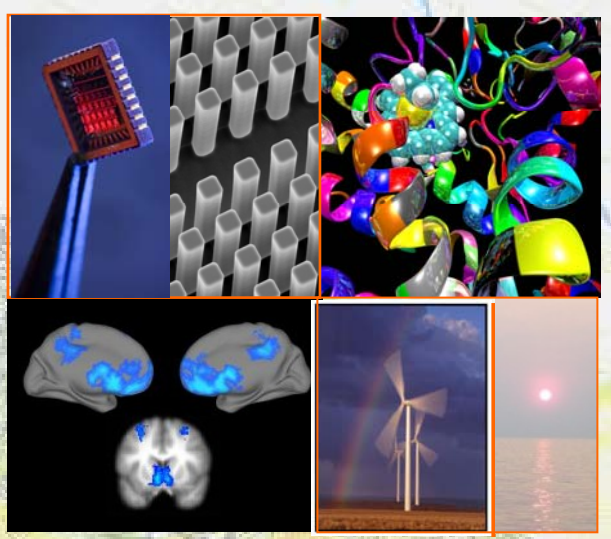


ENG and National Priorities

Engineering Topics

Engineering research spans the frontiers

- To more effectively support fundamental research and education, ENG identifies research and education topics.
- The topics represent a convergence of fields, disciplines, and frontier opportunities that crosscut divisions, and give general guidance on the potential future directions of engineering research.



Engineering contributes at all scales. Examples are nanotechnology, computational simulation, health, and alternative energy.

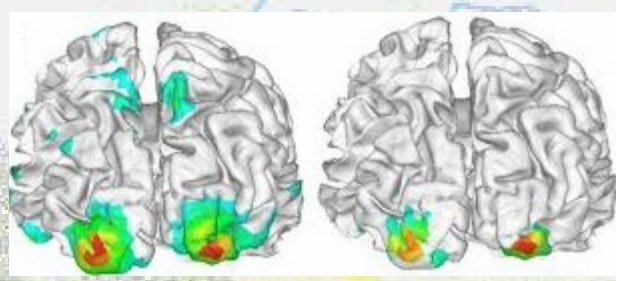
- Topic designations will evolve over time, reflecting the maturation of certain fields, the emergence of new fields, and the shift in demand from society for significant progress on grand challenges.

ENG and National Priorities

Engineering Topics

Cognitive Engineering: Intersection of Engineering and Cognitive Sciences

- Supports engineering methods and systems for improving understanding of brain and nervous system.
- Enables research on how to mimic nervous system processes to engineer better systems, machines and technologies.
- Provides a foundation for competitive innovations—such as intelligent machines that analyze and adapt—called for in national agendas.



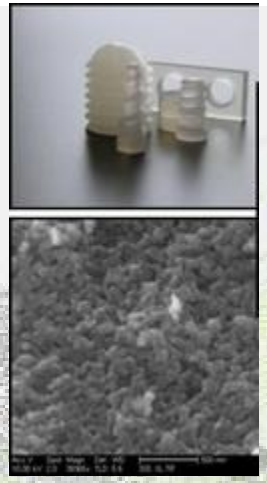
Combining EEG with functional MRI data (left image is EEG, right image shows both) enables precise mapping of brain activity. ***He, 0411898.***

ENG and National Priorities

Engineering Topics

Competitive Manufacturing and Service Enterprises

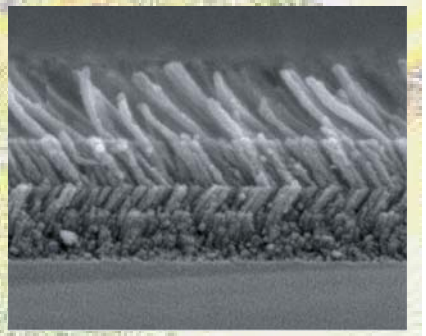
- Research supports innovation for understanding and thus specifying how materials are made at many scales.
- Development of efficient systems provides foundation for better delivery of services, such as making health care and health information more accessible.
- Meets ACI goal of advancing materials science and engineering; and to create world-class capacity in nanomanufacturing.



Groza, 0523063.

Nanoparticles compose a lightweight biocompatible material for bone implants (left); or they enhance the efficiency of a flexible solar cell (middle). Nanorods can be layered as a coating (bottom) that reflects almost no light and could potentially increase solar cell efficiency.

Konarka Technologies Inc., 0450532.



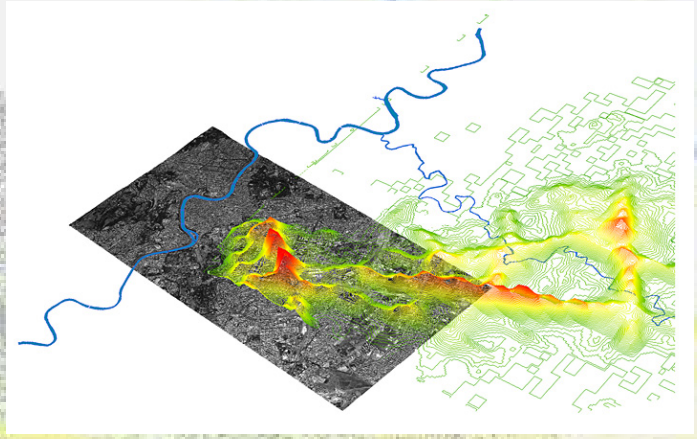
Schubert, 0725615.

ENG and National Priorities

Engineering Topics

Complexity in Engineered and Natural Systems

- Addresses unifying principles that enable modeling, prediction, and control of emergent behavior in complex systems.
- Impacts specific national research goals, including materials for improving structural performances during natural disasters, overcoming barriers to quantum information processing, and world-leading automation and control technologies.
- This research enhances our ability to understand natural systems, engineered systems, and interface of natural and engineered systems.



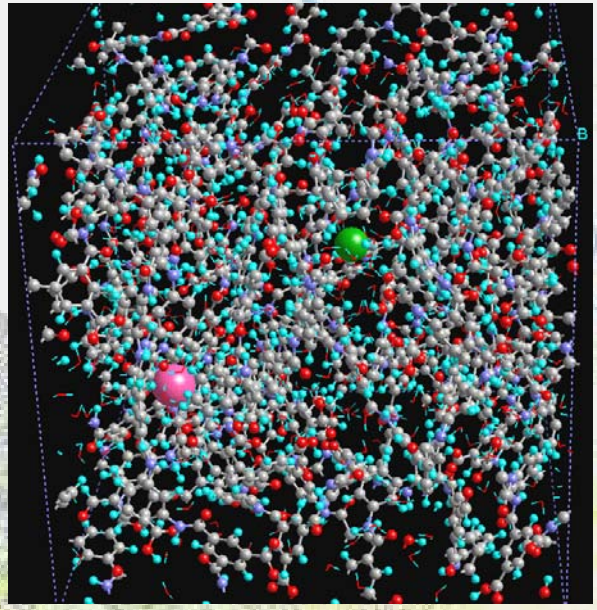
Combining maps (gray square) and density of cell-phone usage (shown as red and yellow 3-D peaks) can yield knowledge about how complex system respond to unplanned events. ***Dahleh, 0735956*** .

ENG and National Priorities

Engineering Topics

Energy, Water and the Environment

- Enables breakthroughs essential to harness, efficiently store, and economically distribute energy from alternative sources.
- Fosters research on materials and methods for assuring a supply of clean water.
- Develops new technologies needed to make energy use more efficient and thus to lessen energy demand.
- Meets the ACI goal of efficient, economic and sustainable use of energy.



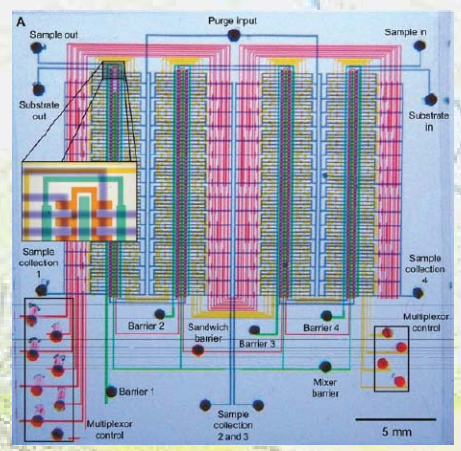
Advanced water purification and desalinization begins with a detailed understanding of how ions in water interact with purification membranes. This dynamic computer simulation shows sodium (pink) and chlorine (green) ions inside a polyamide membrane. *Shannon, 0120978.*

ENG and National Priorities

Engineering Topics

Systems Nanotechnology

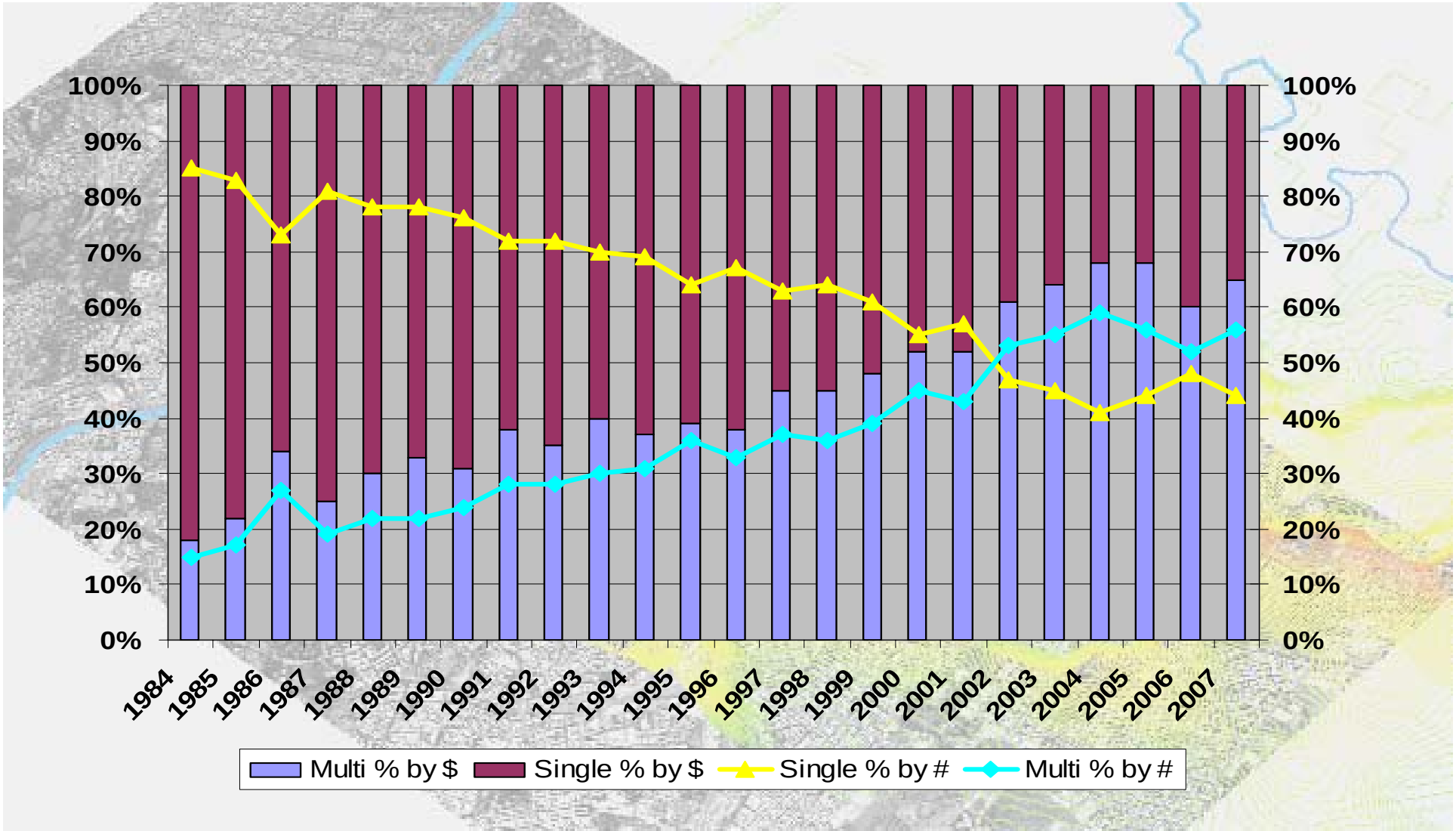
- Next frontier: create controllable systems built from nanoscale components.
- Wide application: new materials, petascale computing, organ regeneration, biological sensors for health monitoring, high-specificity sensors for national security.
- Meets the ACI goal for nanomanufacturing, as well as for developing high-end computing capability; overcoming technological barriers to efficient and economic use of energy; and improvement of sensor detection capabilities.



Integrated circuits that are smaller and faster are possible with microfluidics systems built from or incorporating nanocomponents. *Ferreira, 0328162.*

ENG Awards

ENG: Percent of Single PI vs. Multiple Investigator Awards



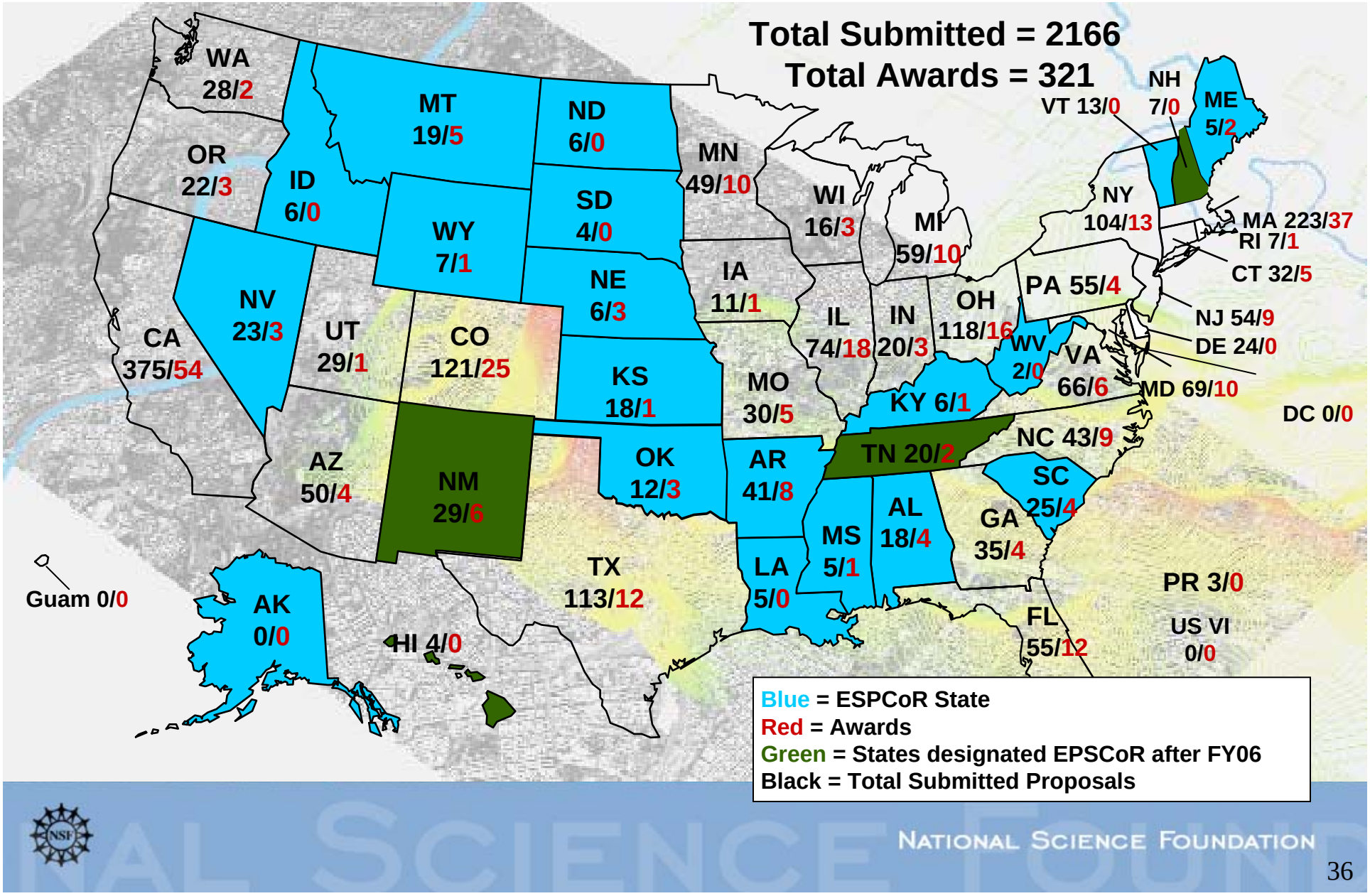
ENG and SBIR/STTR

Opportunities for Innovation

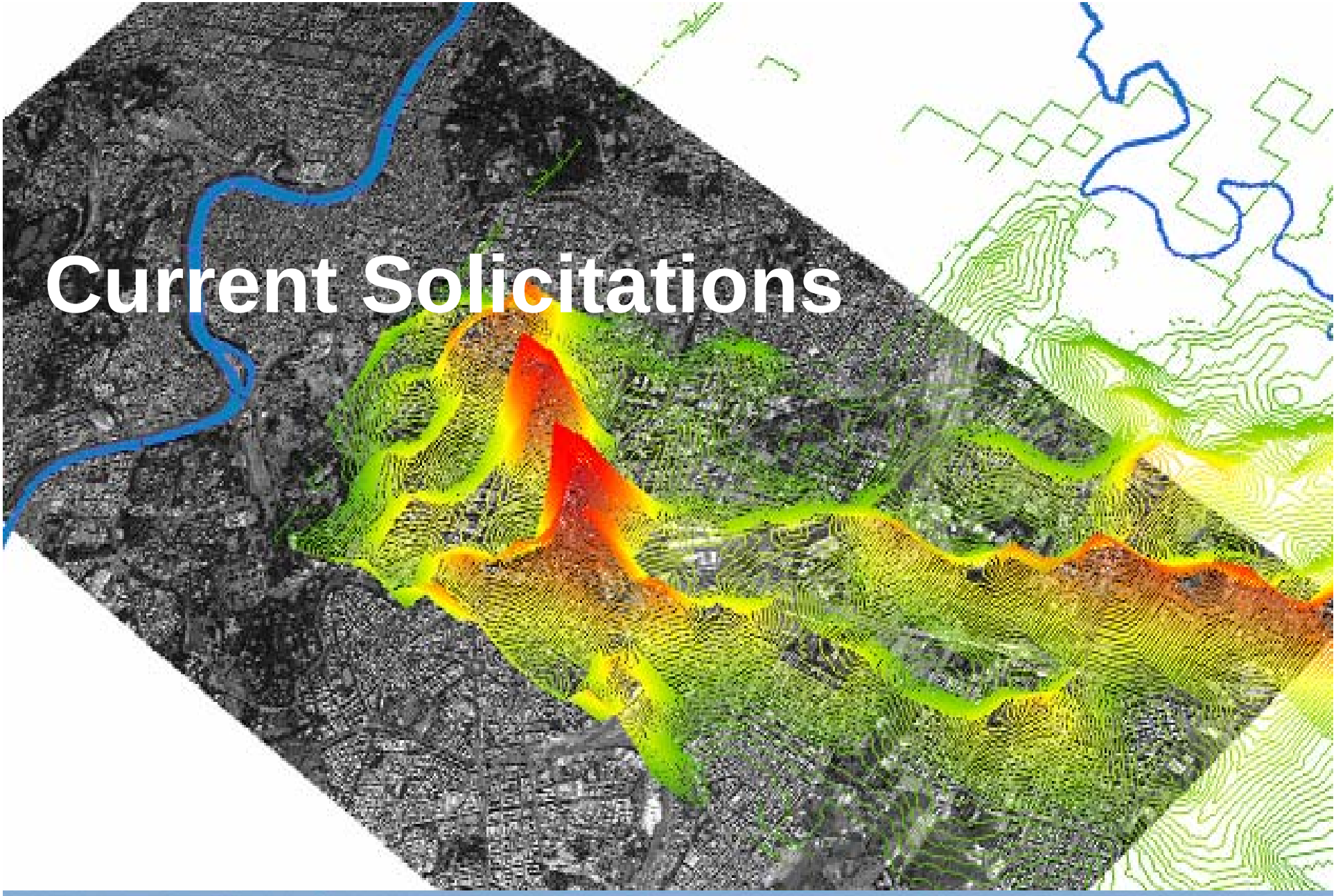
- ENG hosts Small Business Innovation and Research (SBIR) and Small Business Technology Transfer (STTR) programs for NSF.
- $107 million requested for FY 2008.
- SBIR and STTR programs catalyze technology transfer by enabling partnerships between universities and industry.

ENG and SBIR/STTR

SBIR Phase I Proposals and Awards—FY 2006



Current Solicitations



Cyber-Enabled Discovery & Innovation (CDI)

- Employ advances in computational concepts, methods, models, algorithms, and tools (computational thinking) for revolutionary science and for generating and applying new knowledge.
- CDI seeks ambitious, transformative, multidisciplinary research proposals within or across the following three thematic areas:
  - From Data to Knowledge
  - Understanding Complexity in Natural, Built, and Social Systems
  - Building Virtual Organizations
- Please note, CDI review criteria are fully compliant with the updated NSF review criteria, which can be found on: http://www.nsf.gov/pubs/2007/in130/in130.jsp

National Nanotechnology Initiative

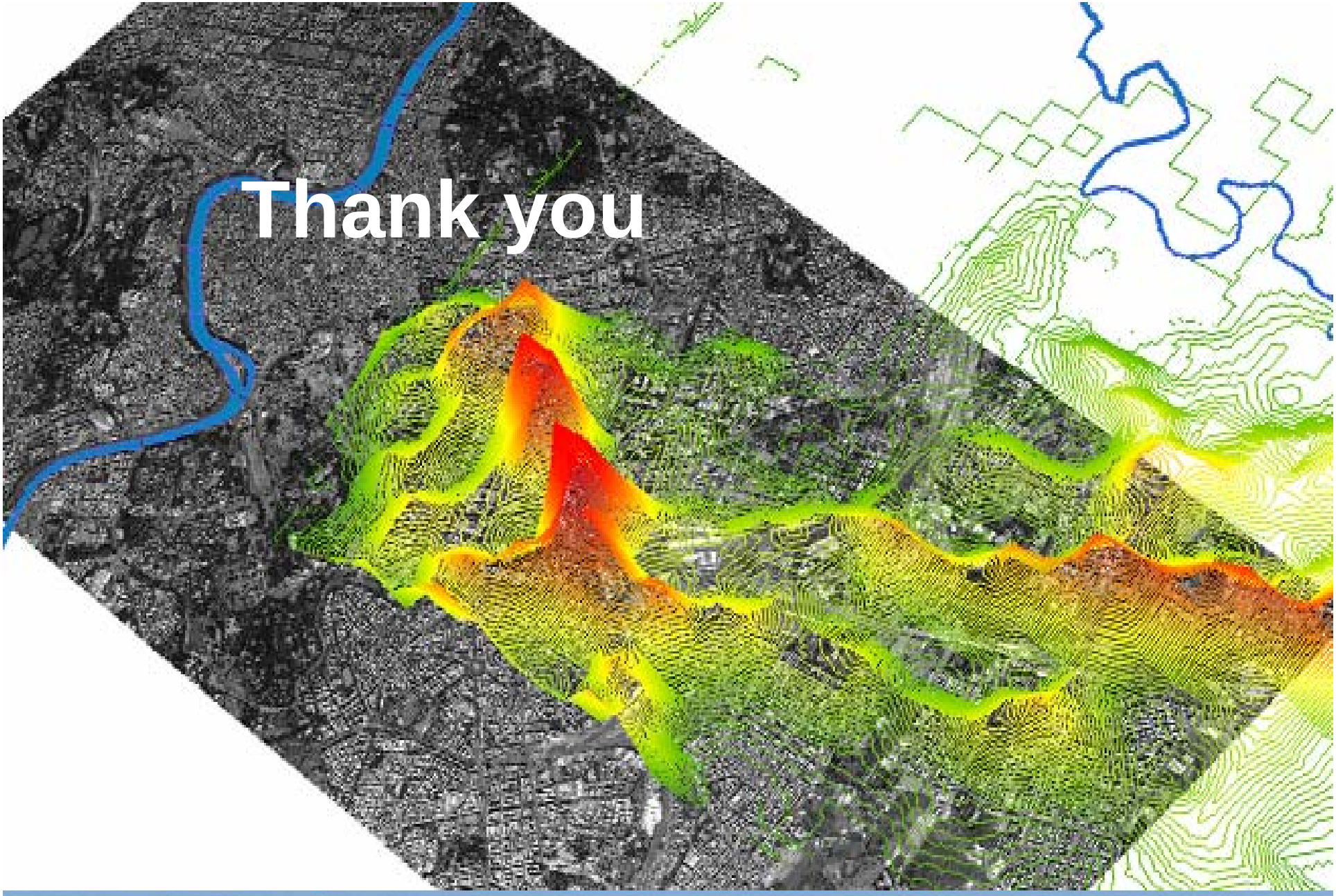
Funding Opportunities at NSF in FY 2008

www.nsf.gov/nano

- NSF supports nanoscale science and engineering in FY 2008 through:
  - Competitive awards in existing (core) programs, including interdisciplinary team research proposals.
  - Competitive awards via the FY 2008 "Center for the Environmental Implications of Nanotechnology (CEIN)" solicitation (NSF 07-590).
  - FY 2008 EPA-NSF-DOE research solicitation: "Nanotechnology Research Grants Investigating Fate, Transport, Transformation, and Exposure of Engineered Nanomaterials."
  - FY 2008 "NSF-SIA/NRI Graduate Student and Postdoctoral Fellow Supplements to NSF Centers in Nanoelectronics" (NSF 07-051).

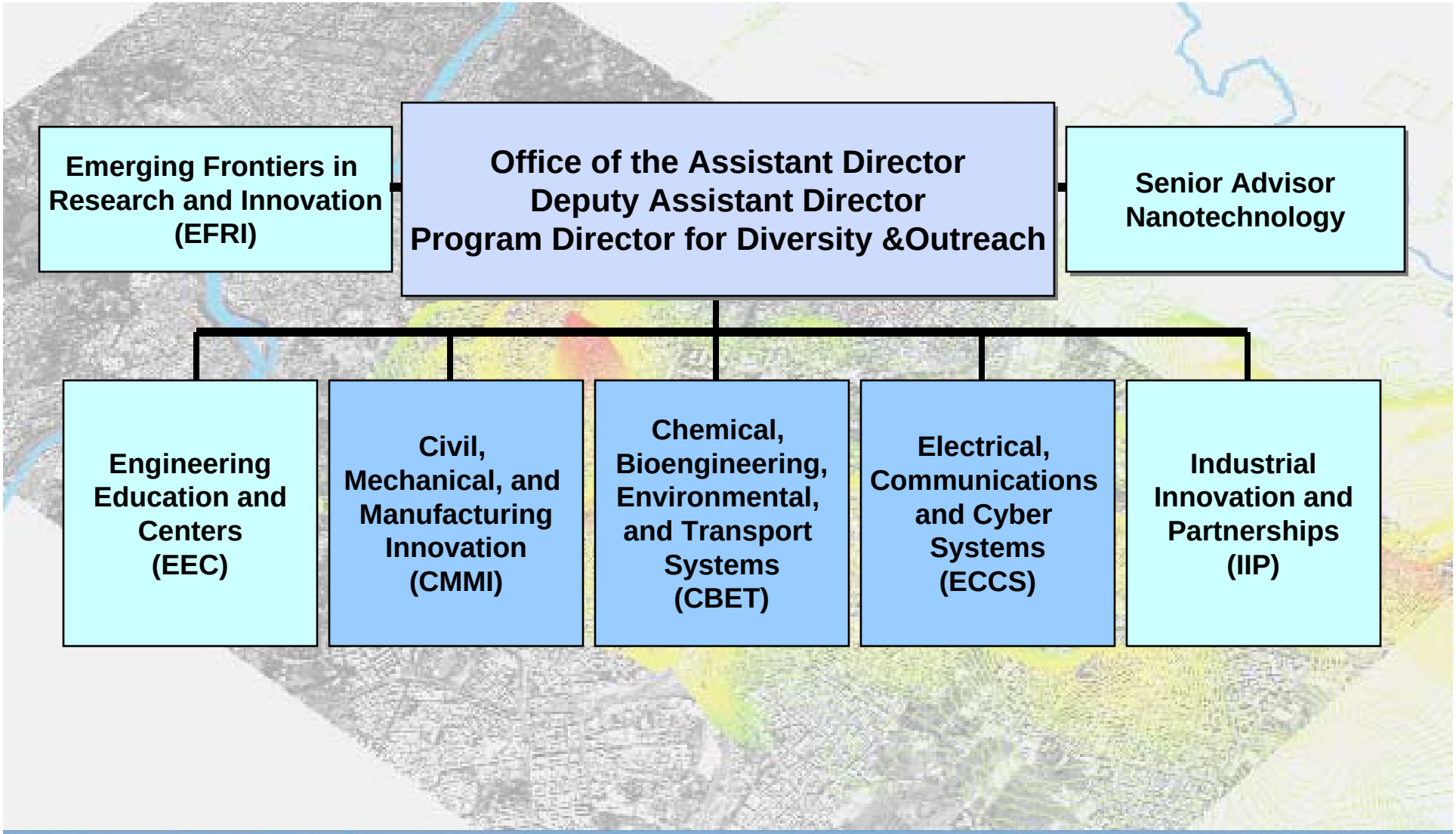
Recent Solicitations

- ADVANCE: Increasing the Participation of Women in Academic Science and Engineering Careers—NSF 07-582, Jan. 7, 2008
- ARI: Joint Domestic Nuclear Detection Office/National Science Foundation: Academic Research Initiative— NSF 07-545, first Wednesday in April, annually through 2011.
- BRIGE: Broadening Participation Research Initiation Grants in Engineering—NSF 07-589, Feb. 8, 2008.
- CEIN: Center for the Environmental Implications of Nanotechnology—NSF 07-590, Prelim. Proposals; March 17, 2008.
- CDI: Cyber-Enabled Discovery and Innovation—NSF 07-603, Letter of Intent Oct. 30, 2007–Nov. 30, 2007.
- GOALI: Grant Opportunities for Academic Liaison with Industry—NSF 07-522.
- RET and REU (Research Experiences for Teachers, Undergraduates)—NSF 07-557, NSF 07-569, Nov. 19, 2007; August 18, 2008.

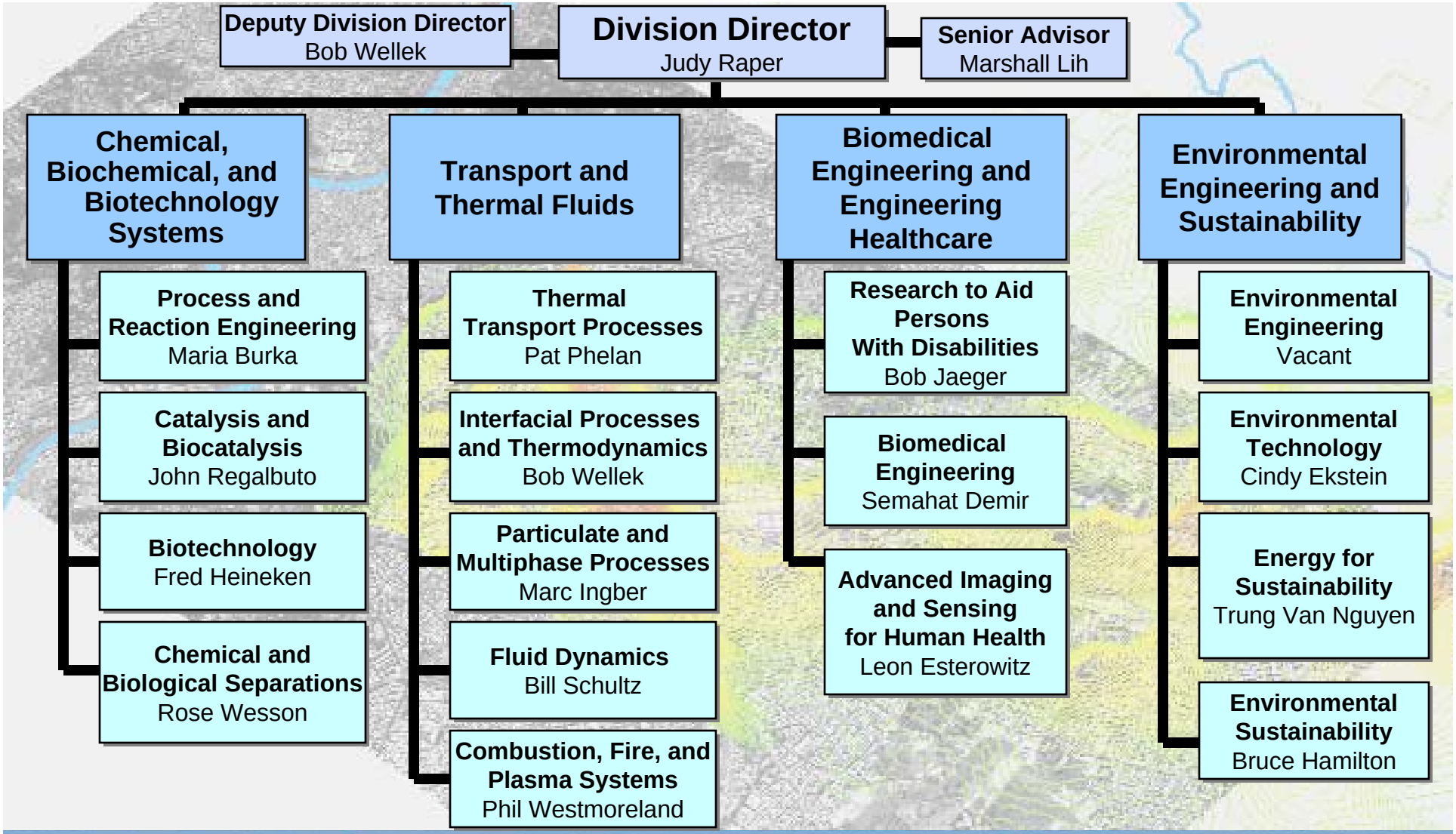

Thank you

Directorate for Engineering

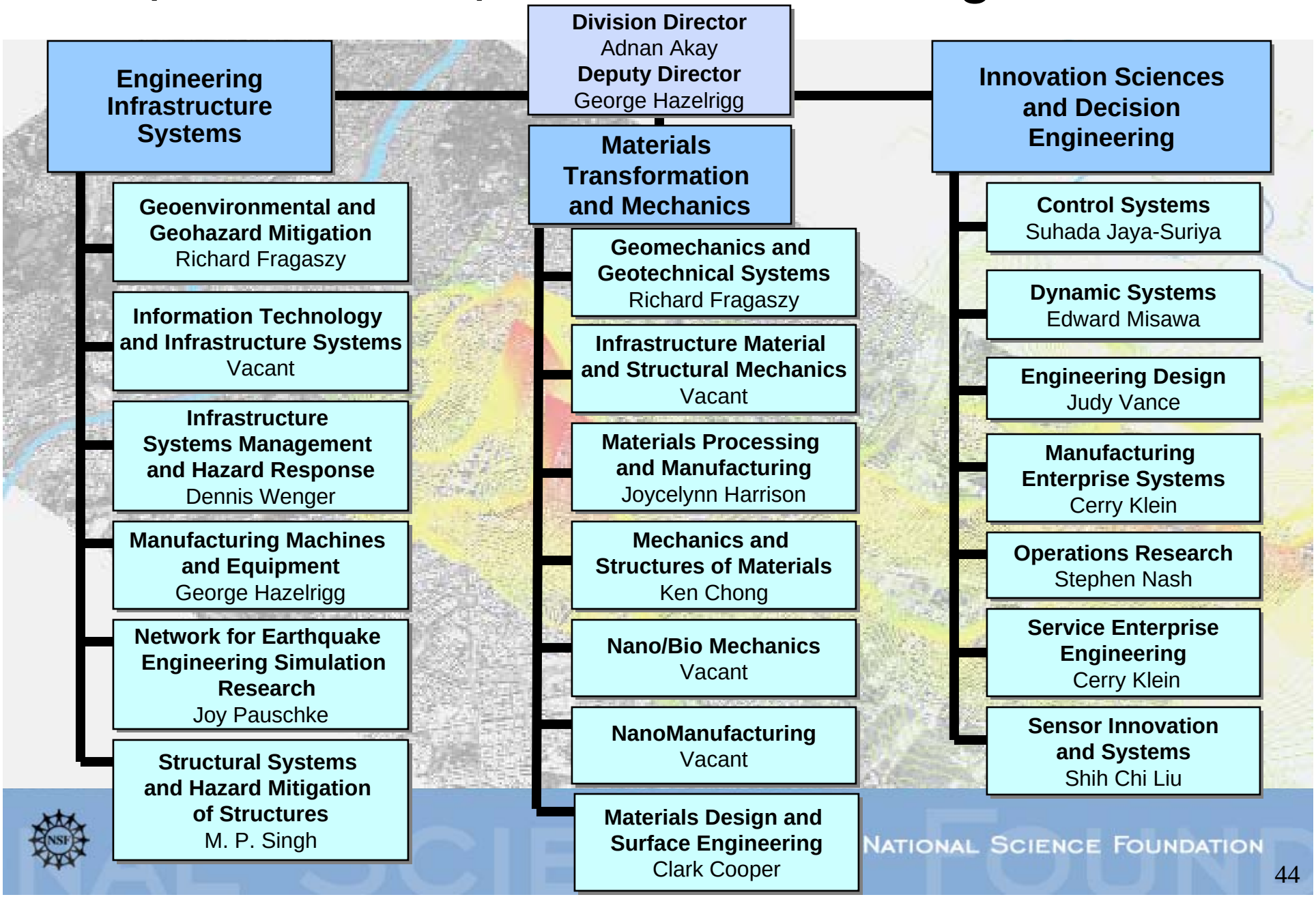
FY 2008



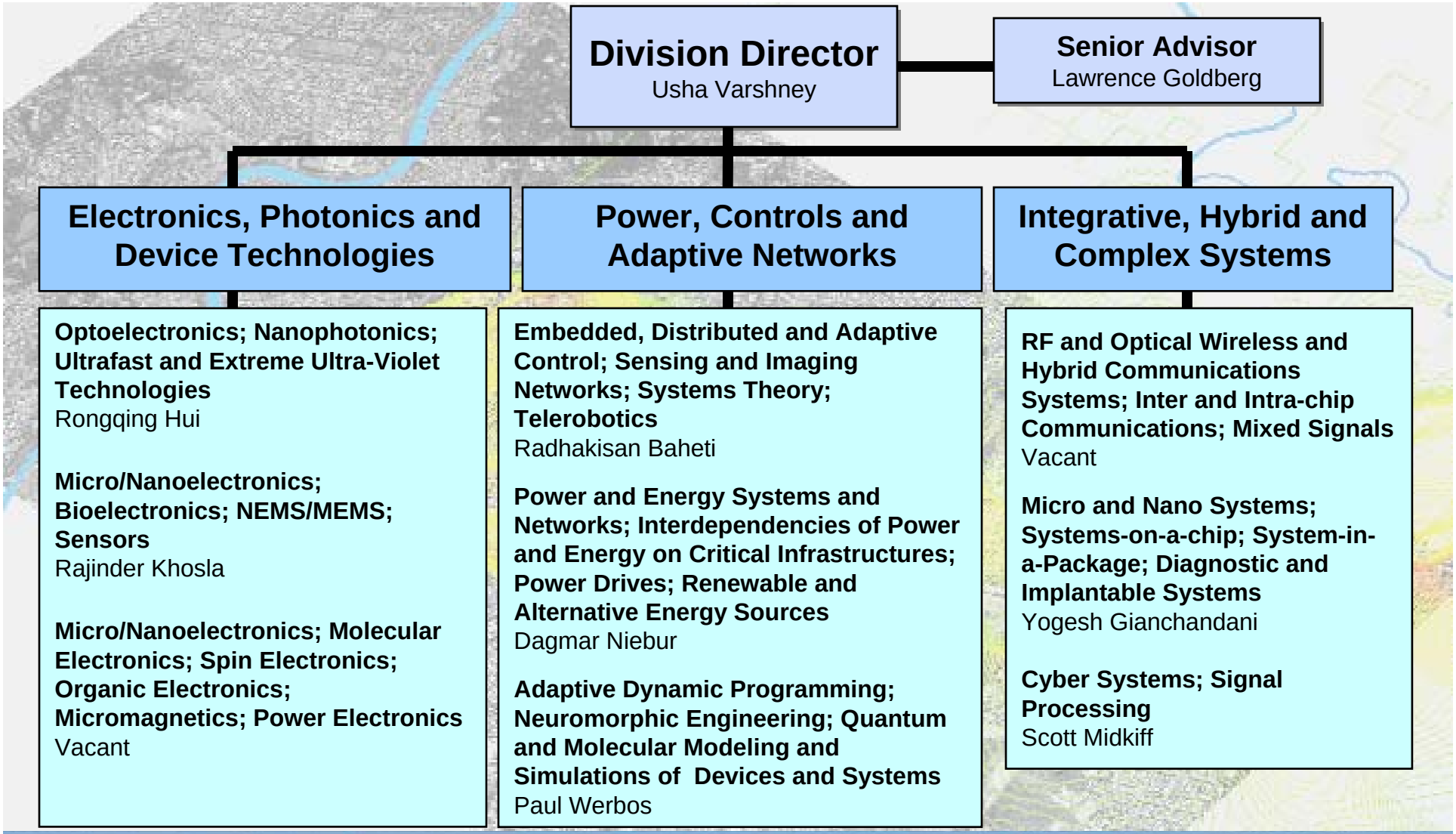
Chemical, Bioengineering, Environmental, and Transport Systems



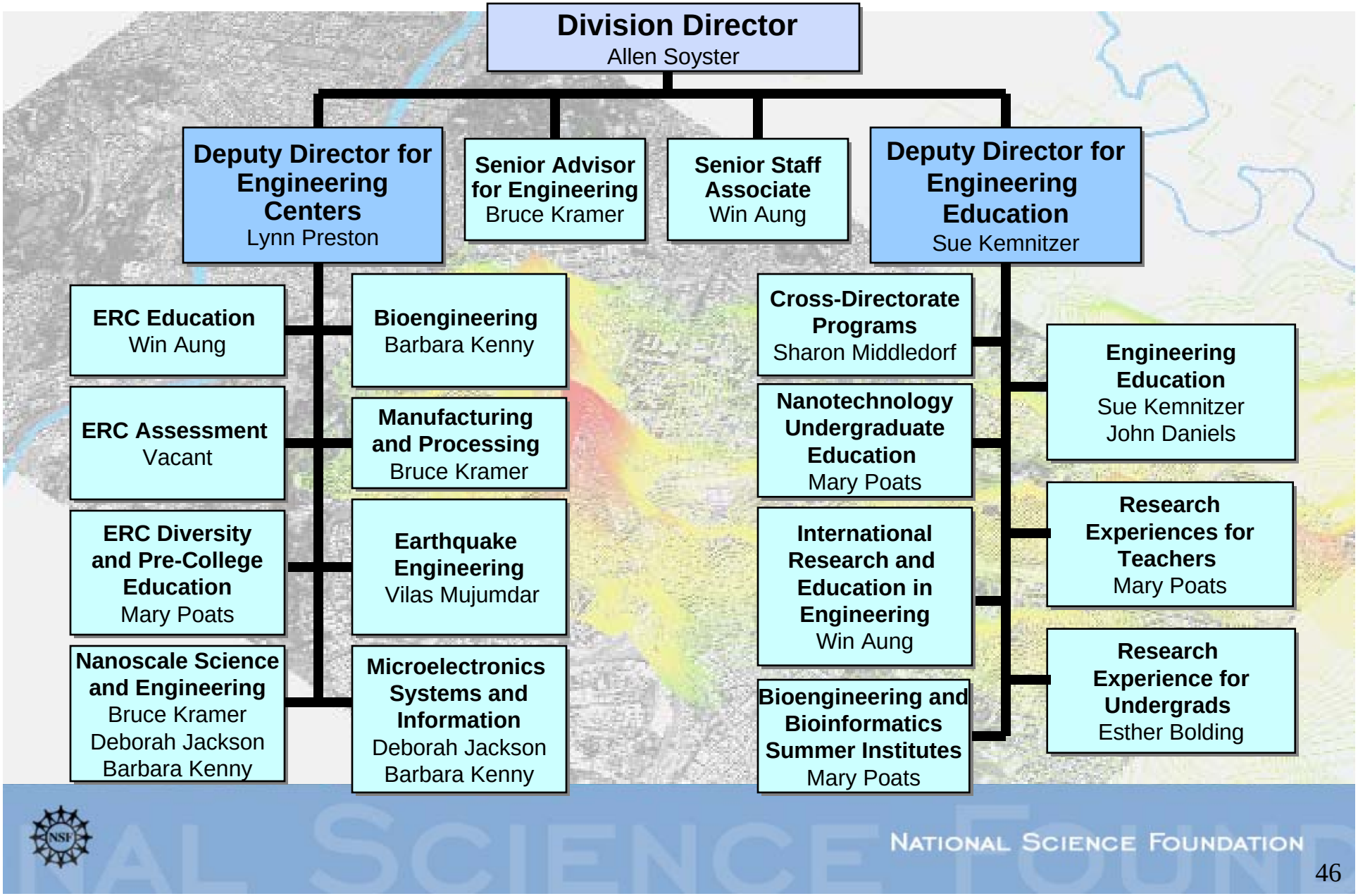
Civil, Mechanical, and Manufacturing Innovation



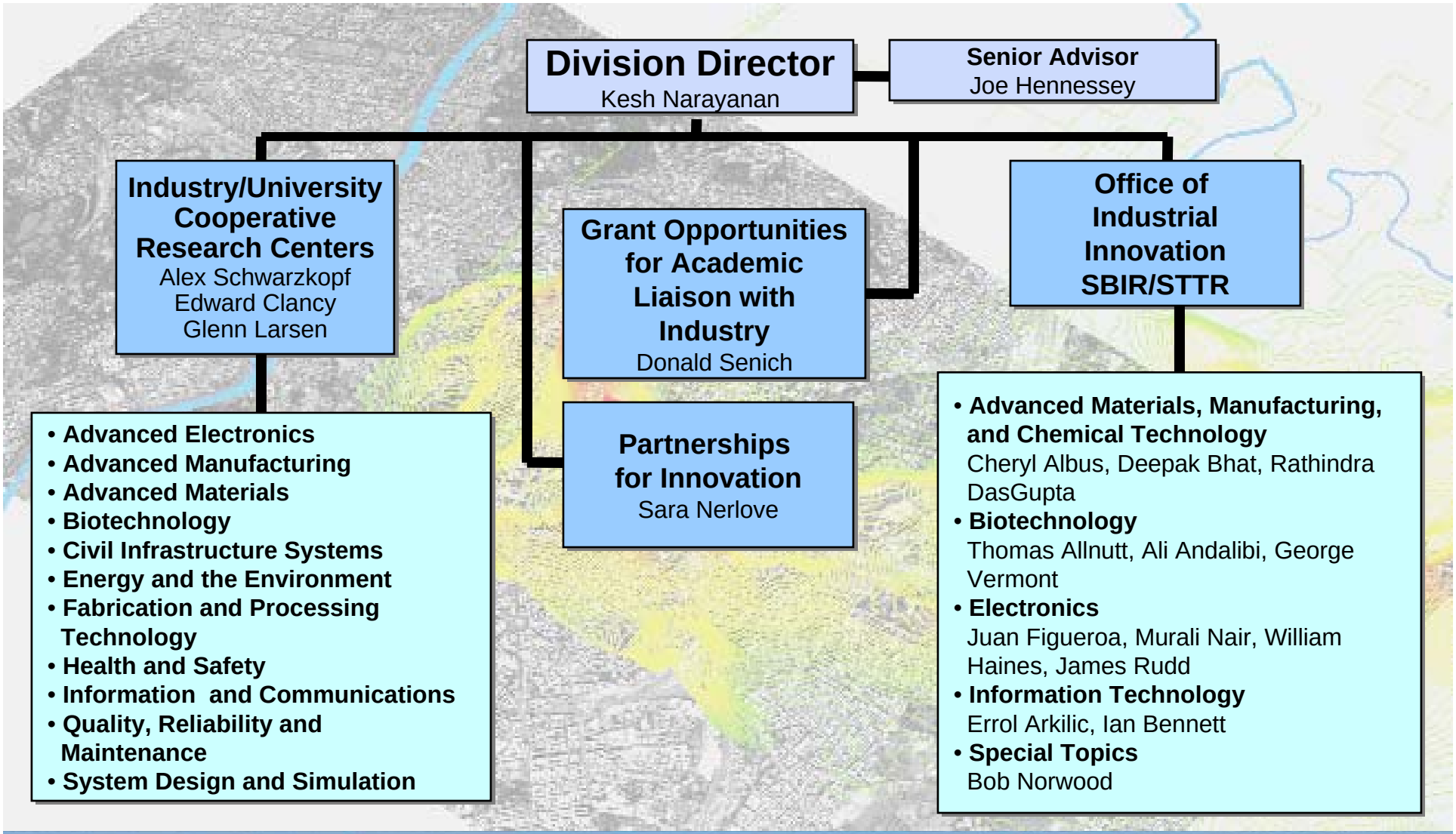
Electrical, Communications and Cyber Systems



Engineering Education and Centers



Industrial Innovation and Partnerships

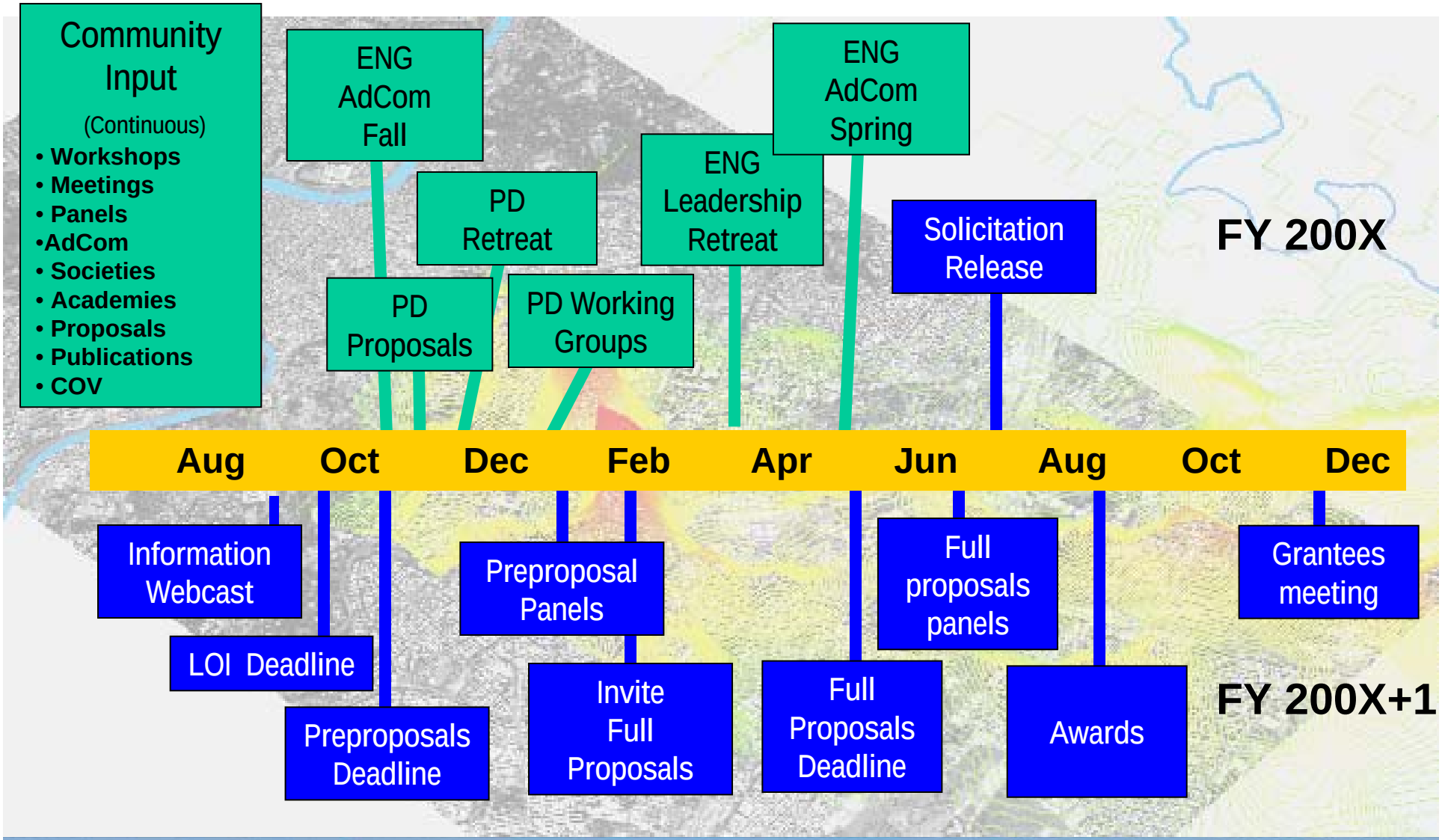


EFRI Office

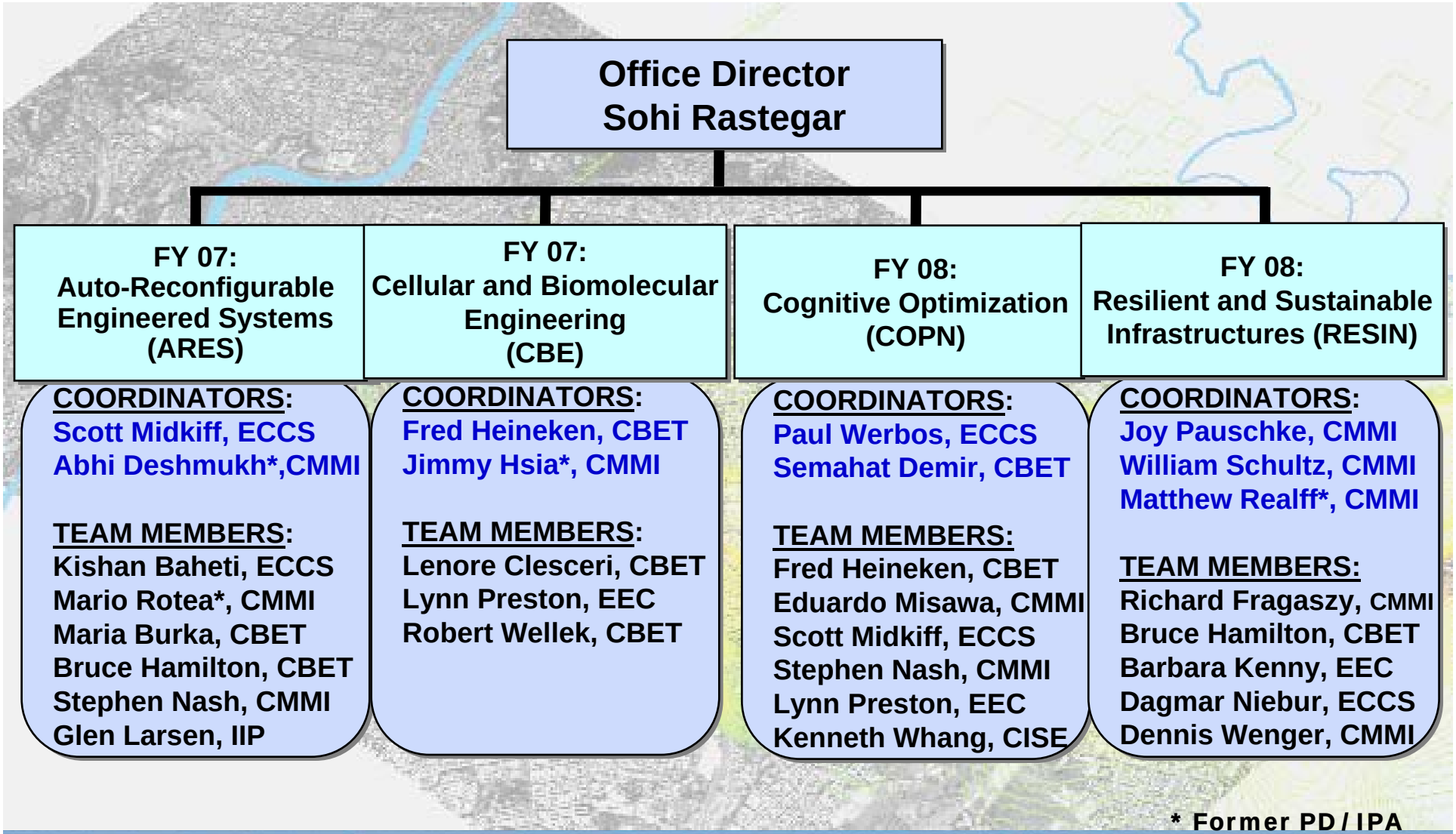
Emerging Frontiers in Research and Innovation

- EFRI will support higher risk, higher payoff opportunities leading to:
  - new research areas for NSF, ENG, and other agencies
  - new industries/capabilities resulting in a leadership position
  - significant progress on advancing a “grand challenge”
- Successful topics would likely require:
  - small- to medium-sized interdisciplinary teams
  - the necessary time to demonstrate substantial progress and evidence for follow-on funding through other established mechanisms
- The current investment for EFRI totals $25 million for 4-year awards at $500k per year.

EFRI Timeline



Emerging Frontiers in Research and Innovation



* Former PD / IPA