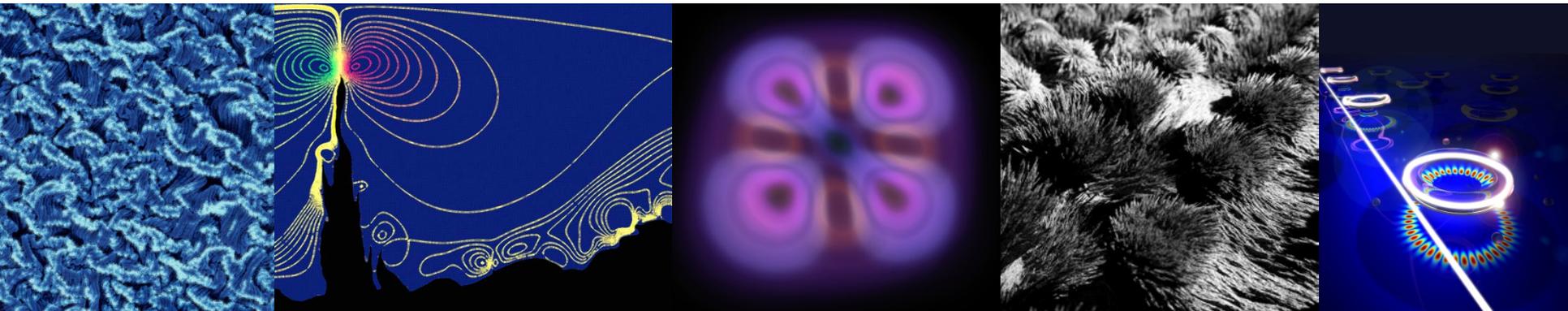
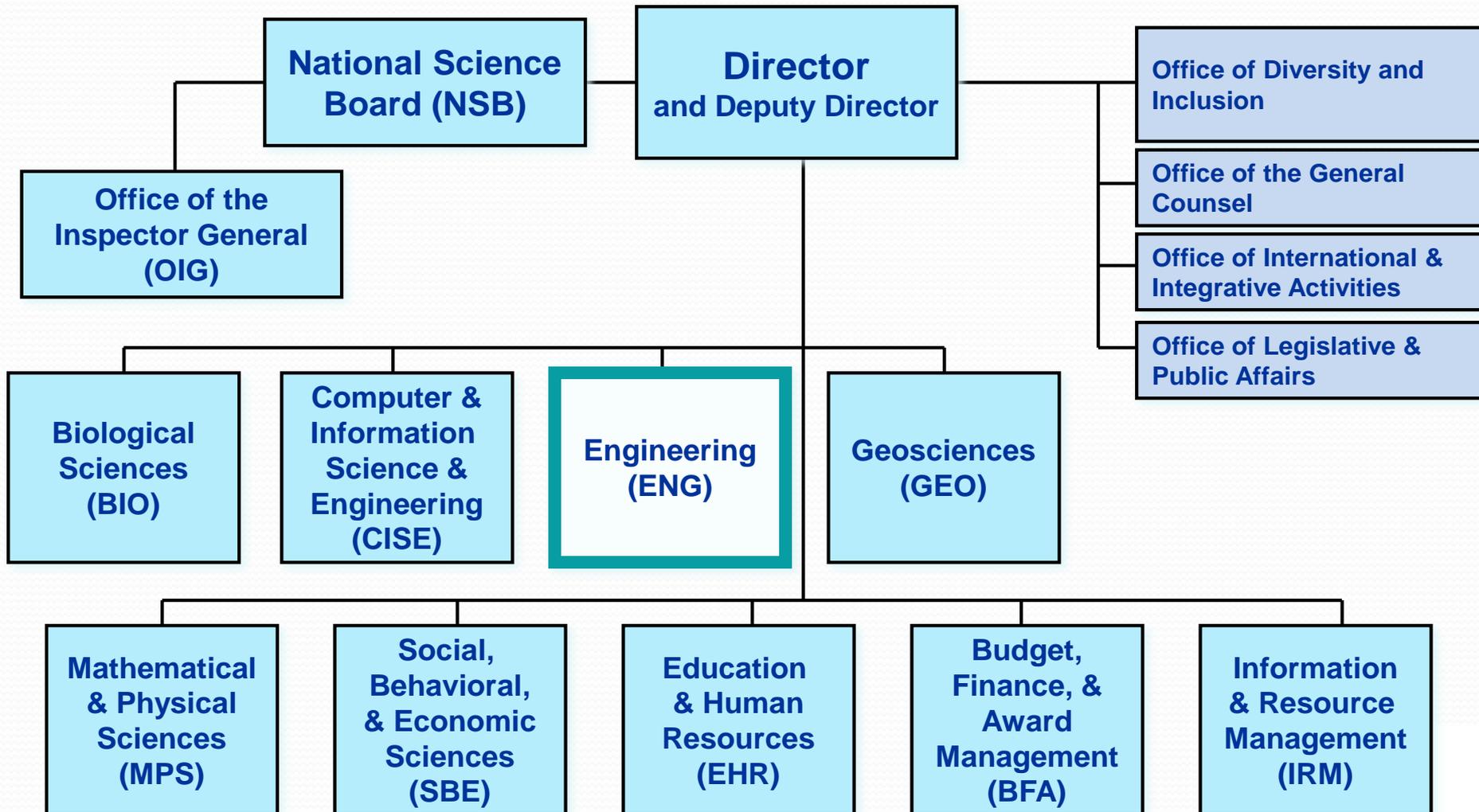


NSF Directorate for Engineering

Mary Toney
NSF Grants Conference
November 2-3, 2015



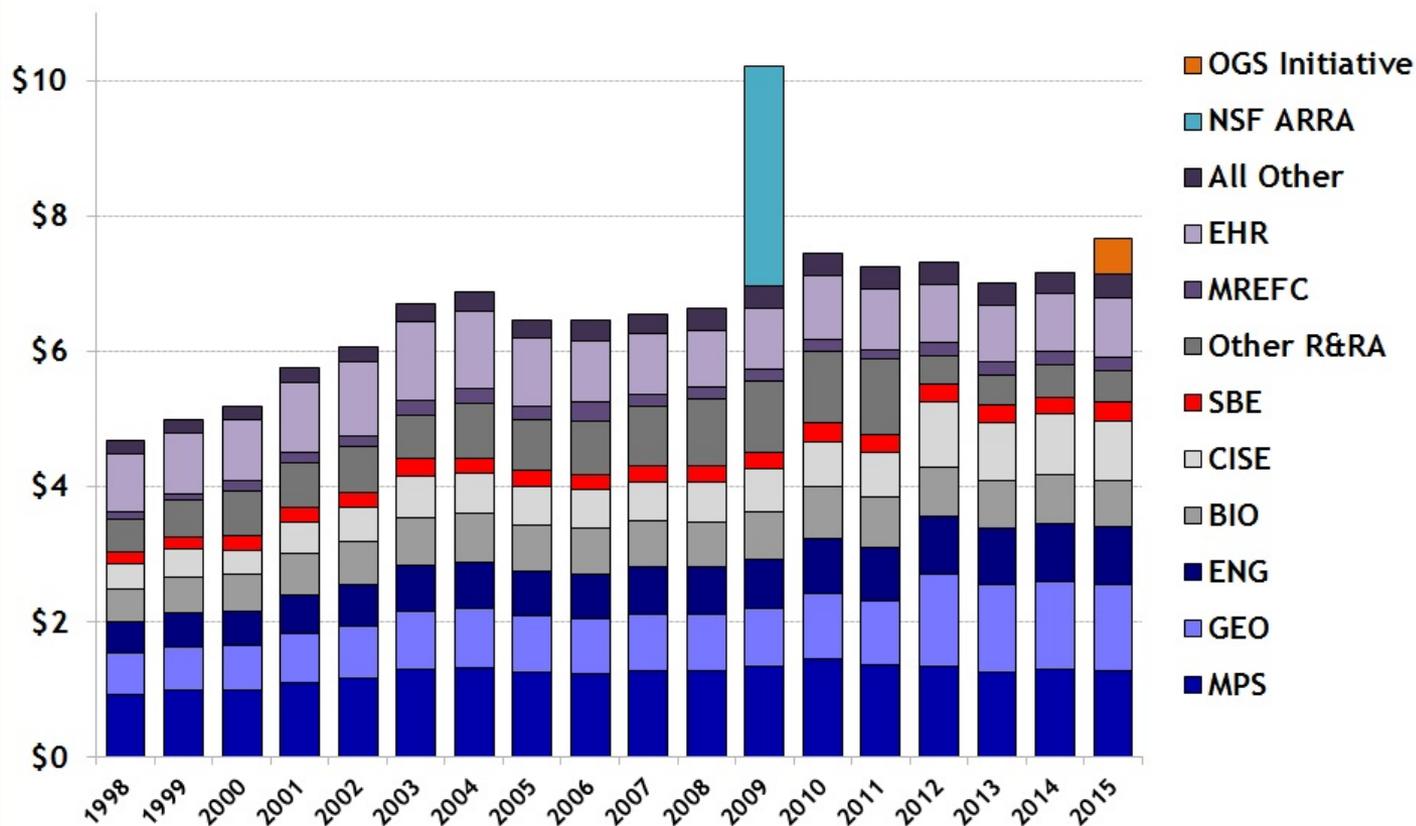
National Science Foundation



NSF – Budgets

National Science Foundation Budget

Budget Authority in billions of constant FY 2014 dollars



Source: NSF budget requests and AAAS R&D report series. FY 2014 figures are estimates, FY 2015 is the President's request. © 2014 AAAS



FY16 Investments

FY 2016 CROSS-FOUNDATION INVESTMENTS

Understanding the Brain (UtB)— Enable scientific understanding of the full complexity of the brain in action and in context. UtB encompasses NSF’s contributions to the Administration’s Brain Research through Advancing Innovation and Neurotechnologies (BRAIN) Initiative (\$144 million).

Risk and Resilience— Improve predictability and risk assessment and increase resilience to extreme natural events and man-made events in order to reduce their impact on the Nation’s quality of life, society, and economy (\$58 million).

Innovations at the Nexus of Food, Energy, and Water Systems (INFEWS)— Understand, design, and model the interconnected food, energy, and water system through an interdisciplinary research effort that incorporates all areas of science and engineering and addresses the natural, social, and human-built factors involved (\$75 million).

Inclusion across the Nation of Communities of Learners that have been Underrepresented for Diversity in Engineering and Science (NSF INCLUDES)— Develop a national scalable initiative to increase the preparation, participation, advancement, and potential contributions of those who have been traditionally underserved and/or underrepresented in the STEM enterprise (\$15 million).

NSF by the Numbers

NSF by the Numbers	
\$7.7 billion	FY 2016 Budget Request
1,826	Colleges, universities, and other institutions receiving NSF funding in FY 2014
48,100	Proposals evaluated in FY 2014 through a competitive merit review process
11,000	Competitive awards funded in FY 2014
225,800	Proposal reviews conducted in FY 2014
320,900	Estimated number of people NSF supported directly in FY 2014 (researchers, postdoctoral fellows, trainees, teachers, and students)
49,800	Students supported by NSF Graduate Research Fellowships since 1952

Note: STEM—Science, Technology, Engineering, and Mathematics

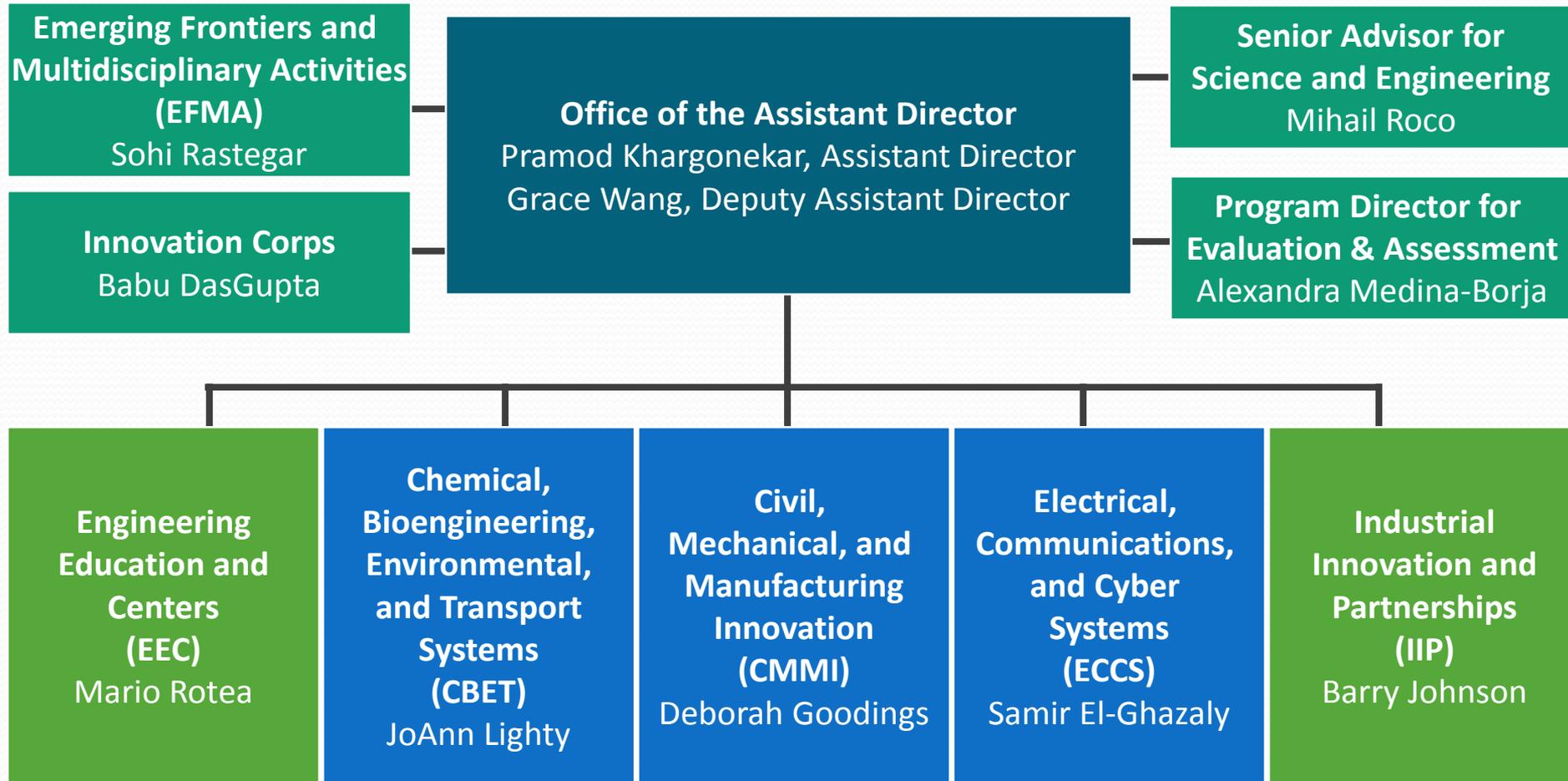


ENG Mission and Vision

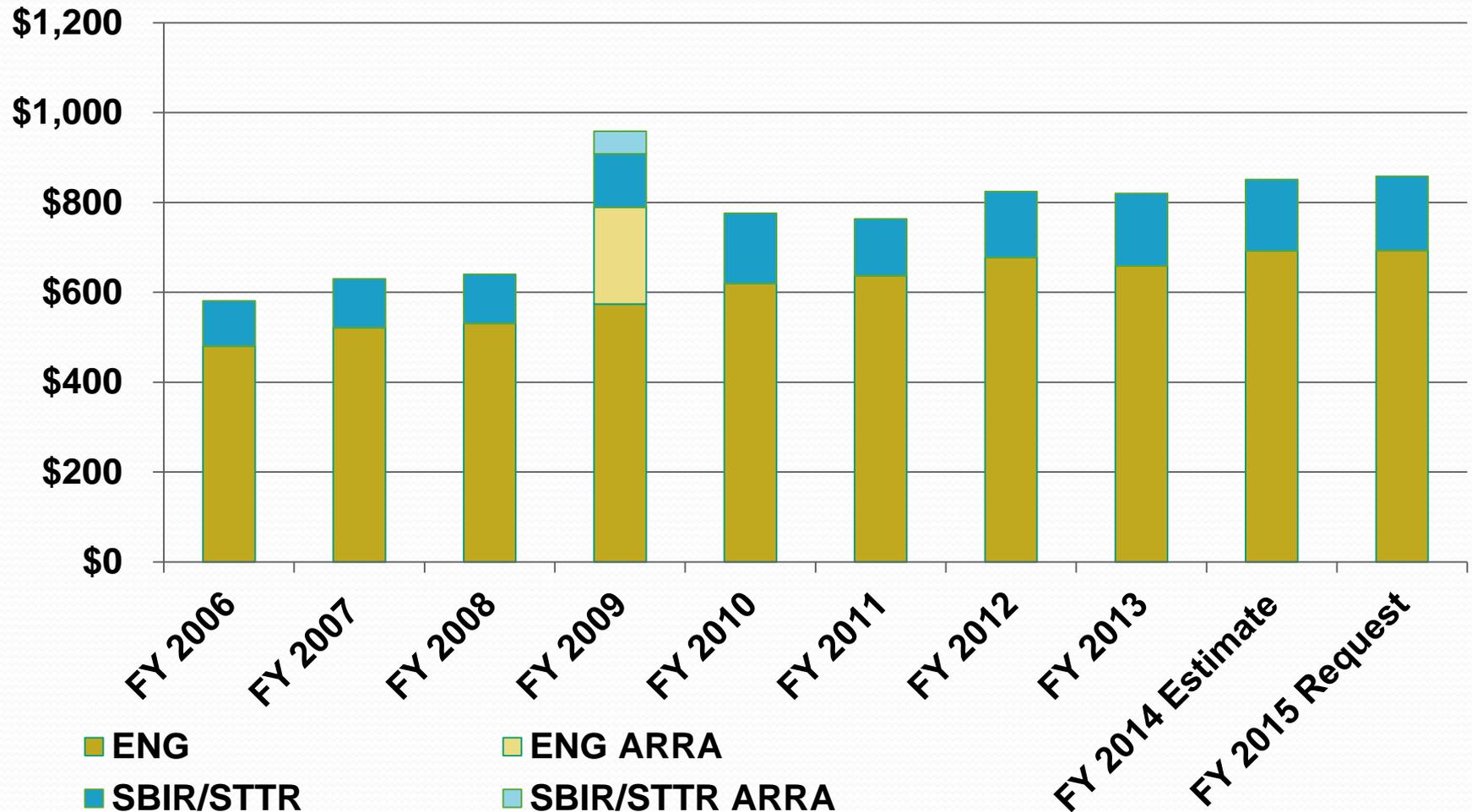
- **Mission:** To enable the engineering and scientific communities to advance the frontiers of engineering research, innovation, and education, in partnership with the engineering community, and in service to society and the nation.
- **Vision:** ENG will be a global leader in identifying and catalyzing fundamental engineering research, innovation, and education.



NSF Directorate for Engineering (ENG)

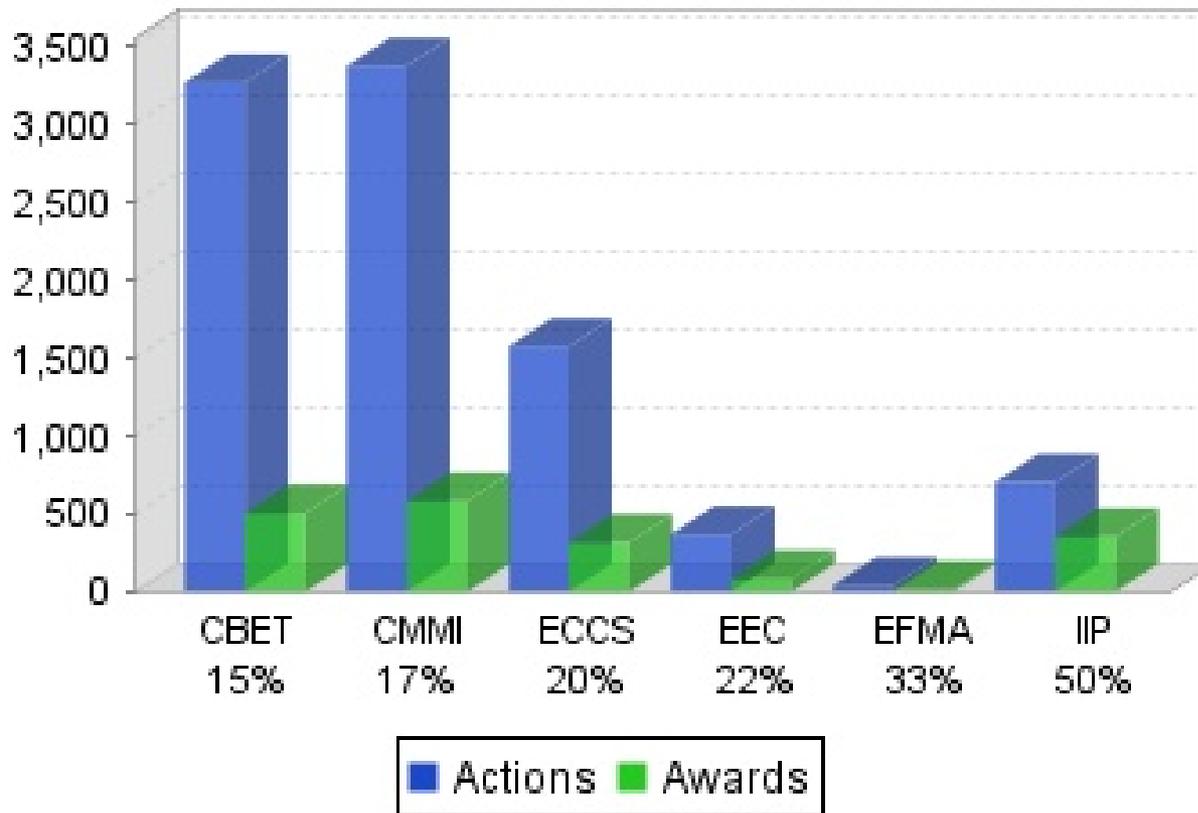


ENG and SBIR/STTR R&RA Budgets (\$M)



ENG Funding Rate

Overall FY 2015 ENG Funding Rate: 20%



NSF ENG Strategy

- **Attract, stimulate, catalyze and challenge research communities to think big, enable transformational advances, and expand national innovation capacity**
- **Portfolio balance between fundamental, applied and translational as well as small, medium and large projects**
- **New approaches to address engineering education challenges**
- **Collaborate and partner within and outside NSF to maximize opportunity for the engineering research and education community to address major national priorities**



Disciplines in a Multidisciplinary World

- **NSF ENG has a strong commitment to fundamental engineering research**
- **How should we think about discipline based fundamental research in the contemporary research environment?**
- **Think of disciplines as super-nodes in the knowledge network**
- **Major opportunity: robust, effective linkages among nodes to solve tomorrow's problems**



Funding Mechanisms

- Core/Unsolicited
 - Individual/small collaborative teams
- Solicitations
 - Special research call – DMREF, NRI, SNM
 - Early Career – CAREER
 - Instrumentation – MRI
 - Centers – ERC, STC
 - Small Business Innovation - SBIR, STTR
- International Collaborations
- Workshops/Conferences



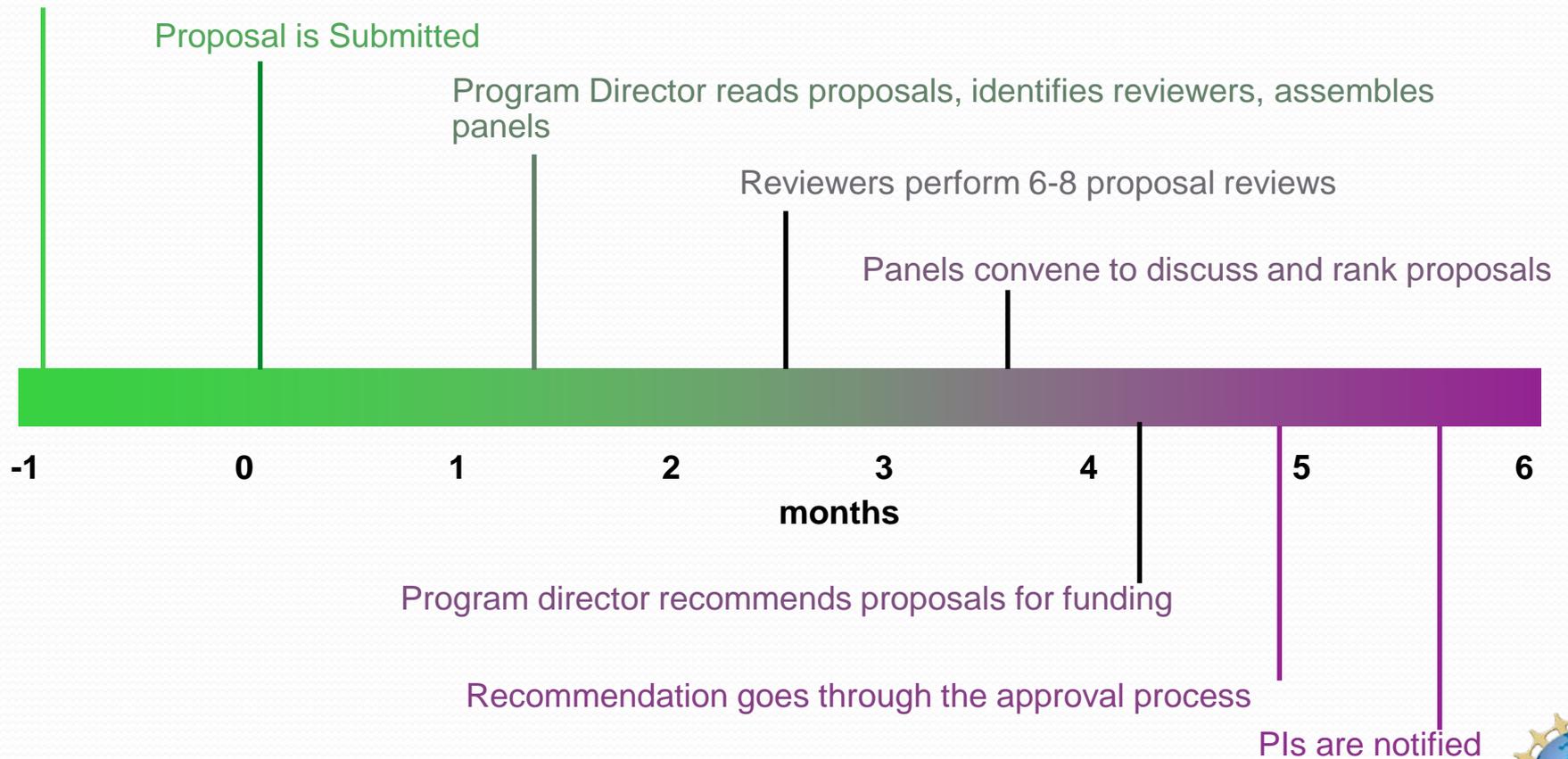
Proposal Review

- **Proposals must address NSF goals**
 - Transform the frontiers of science and engineering
 - Stimulate innovation and address societal needs through research and education
- **NSF merit review criteria**
 - Intellectual merit
 - Broader impacts

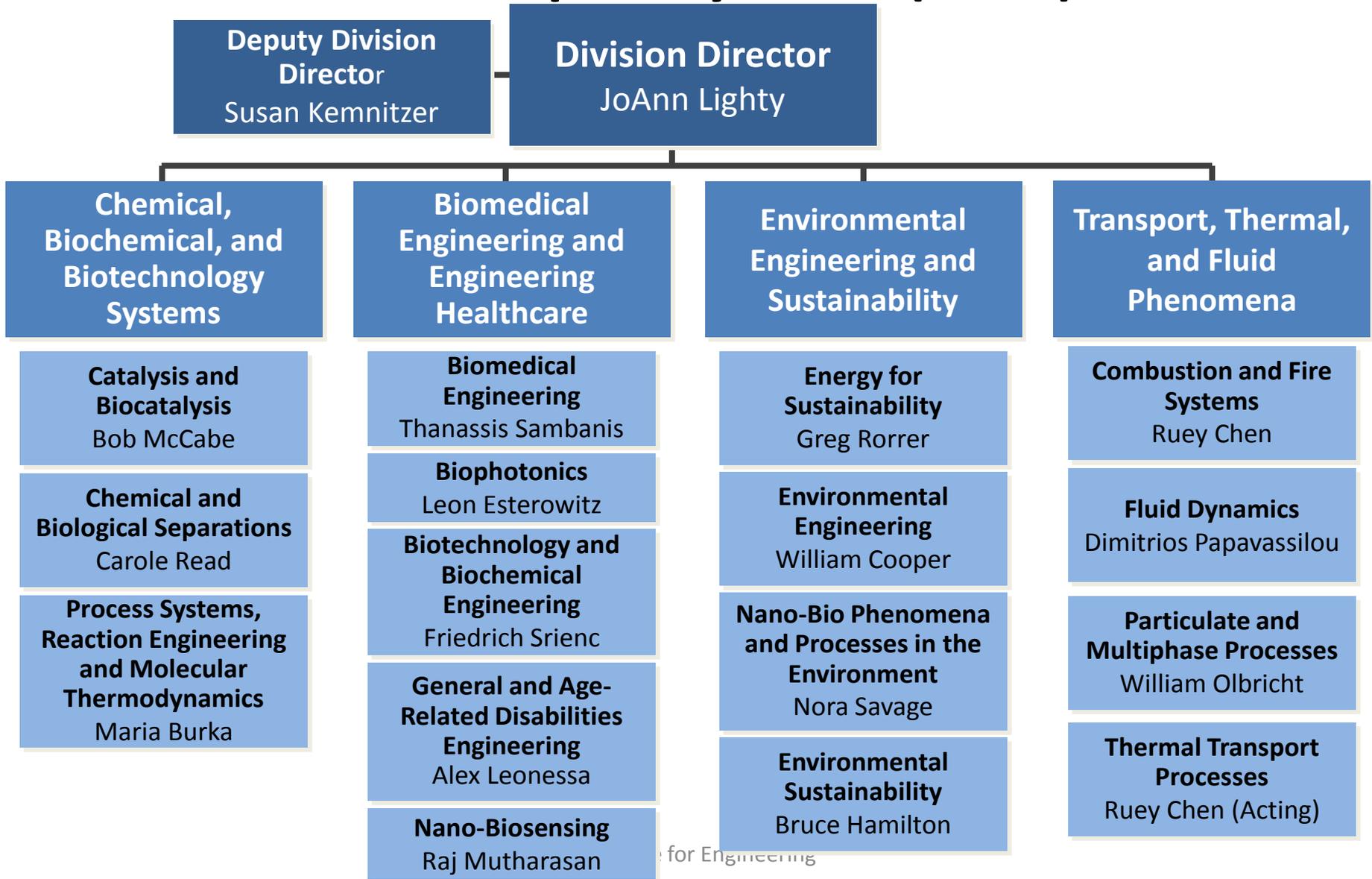


Review Timeline

PI communicates with Program Director to determine program fit



Chemical, Bioengineering, Environmental, and Transport Systems (CBET)



CBET Areas of Interest

Chemical, biochemical, and biotechnology

- processing and manufacturing of products with chemical and renewable resources

Biomedical engineering and engineering healthcare

- integration of engineering and life science to solve biomedical problems

Environmental engineering and sustainability

- reduction of adverse effects of solid, liquid, and gaseous discharges into land, waters, and air that result from human activity

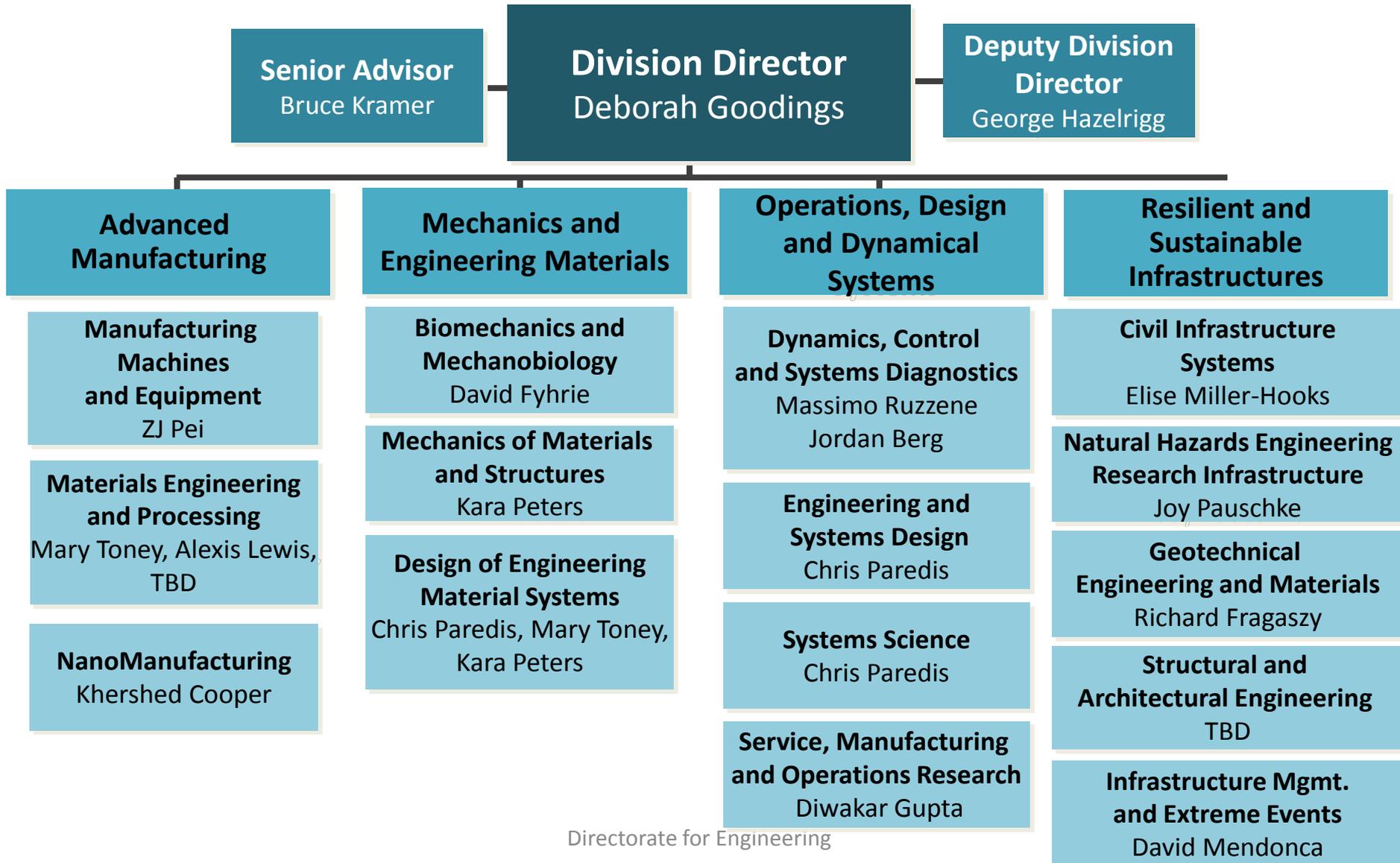
Transport and thermal fluids phenomena

- thermal, mass, and momentum transport that enable new technological solutions (energy, environment, manufacturing, health care, ...)

ONE submission deadline per year: October 1 - 20, 2015; October 1 - 20, Thereafter



Civil, Mechanical, and Manufacturing Innovation (CMMI)



CMMI Areas of Interest

Advanced Manufacturing

- transformative advances in manufacturing and materials processing, with emphases on efficiency, economy, sustainability and scalability

Mechanics and Engineering Materials

- understanding the properties and use of materials in engineered and natural systems

Resilient and Sustainable Infrastructures

- innovation to advance resilience and sustainability of civil infrastructure and distributed infrastructure networks

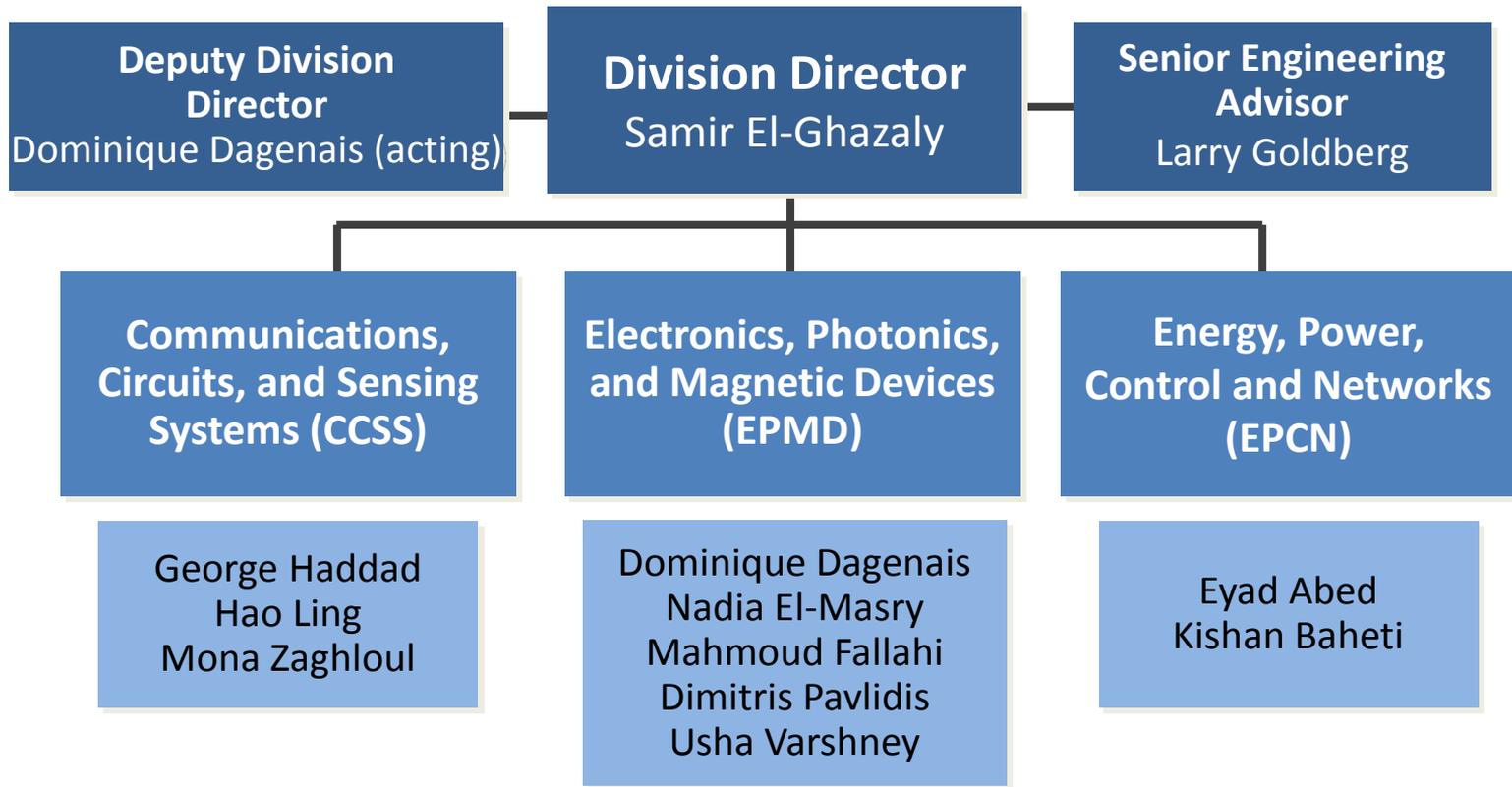
Operations, Design and Dynamic Systems

- decision-making aspects of engineering, including design, control, optimization and systems science

TWO submission deadlines : September 1-15, February 1-17



Electrical, Communications, and Cyber Systems (ECCS)



ECCS Areas of Interest

- Fundamental research issues underlying device and component technologies, power, controls, computation, networking, communications and cyber technologies
- The integration and networking of intelligent systems at the nano, micro and macro scales
 - for healthcare, homeland security, disaster mitigation, energy, telecommunications, environment, transportation, manufacturing, and other systems-related areas
- ONE submission deadline per year: Nov. 1



Emerging Frontiers in Research and Innovation (EFRI)

- **Supports higher-risk, higher-payoff opportunities that:**
 - Are potentially transformative
 - Address a national need or grand challenge
- **Recent topic areas:**
 - Flexible Bioelectronics Systems (BioFlex)
 - Origami Design for the Integration of Self-assembling Systems for Engineering Innovation (ODISSEI)
 - Photosynthetic Biorefineries (PSBR)
 - 2-D Atomic-layer Research and Engineering
- **New topic announced in October 2015:**
 - Advancing Communication Quantum Information Research in Engineering (ACQUIRE)
 - New Light and Acoustic Wave Propagation: Breaking Reciprocity and Time-Reversal Symmetry (NewLAW)
- **4-year awards at ~\$500K per year**
- **LOI due Nov 9**



Engineering Education and Centers

Division Director (Acting)

Mario Rotea

Deputy Division Director

Don Millard

Centers and Networks

Engineering Research Centers (ERC)

Keith Roper, Lead
Deborah Jackson
Carmiña Londoño
Mary Poats

Nanoscale Science & Engineering Centers (NSEC)

Keith Roper

Network for Computational Nanotechnology (NCN)

Keith Roper

Engineering Education

Research in Engineering Education (REE)

Research Initiation Grants in Engineering Education (RIGEE)

Ethics Education in Science and Engineering (EASE)

Elliot Douglas

Nanotechnology Undergraduate Education (NUE) in Engineering and Computer Science

Mary Poats

Engineering Workforce Development

Research Experiences for Undergraduates

Mary Poats

Research Experiences for Teachers

Mary Poats

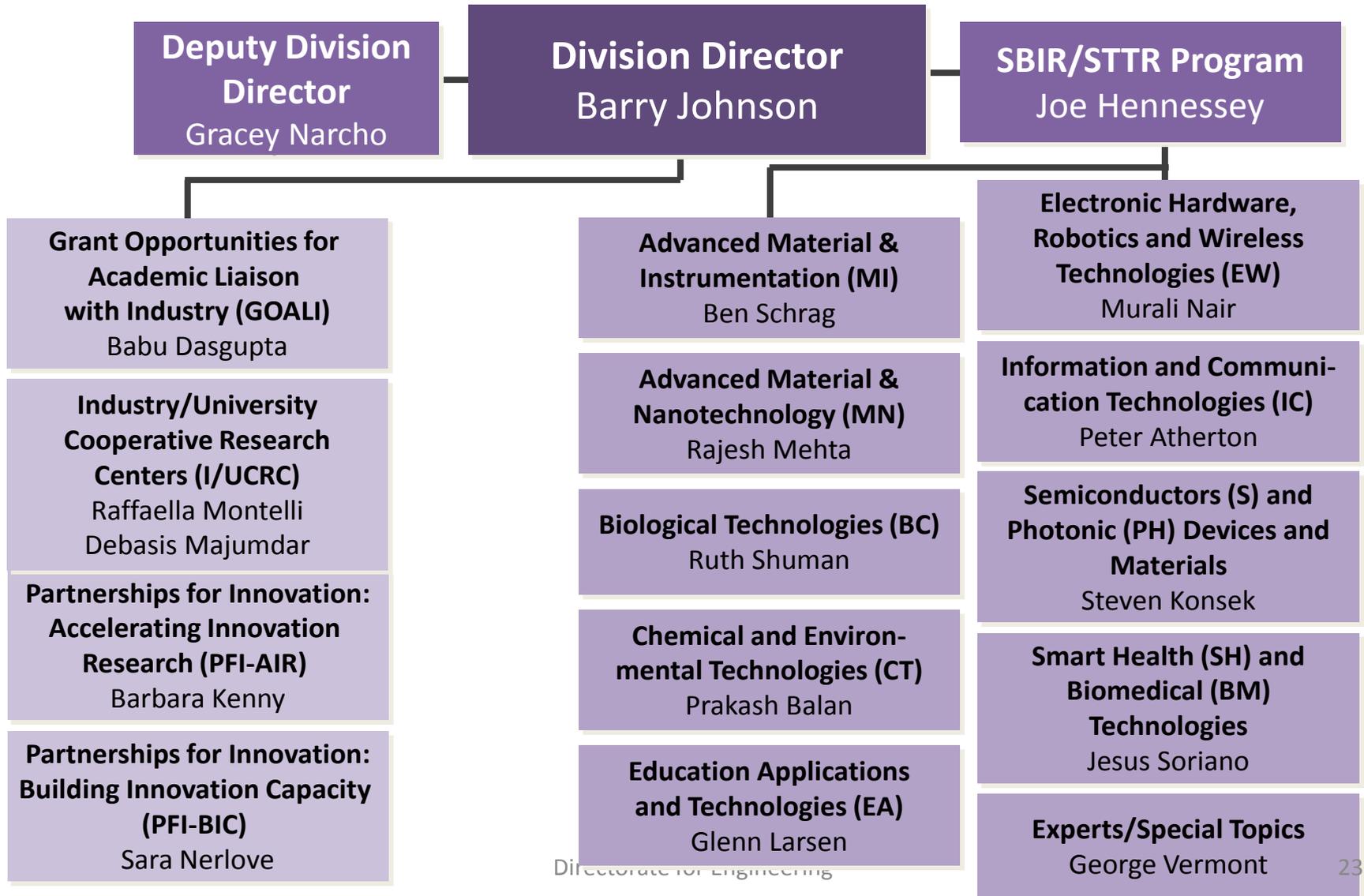
Broadening Participation in Engineering

Engineering Centers and Networks

- **Large-scale research investments in ENG**
- **Supports collaboration with industry and other stakeholders** to promote innovative research and education
- **Engineering Research Centers (ERC)**
 - Three generations (50 centers total) since 1985
 - New Nano-Systems ERCs (NERCs) in FY12
- **Nanoscale Science and Engineering Centers (NSEC)**
 - 19 NSECs since 2001
 - 3 graduated NSECs from FY01 class
- **Network for Computational Nanotechnology**
 - Cyber-resource for nanotechnology theory, modeling and simulation
 - nanoHUB.org gateway for nanotechnology research and education
 - > 180k users globally



Industrial Innovation and Partnerships(IIP)

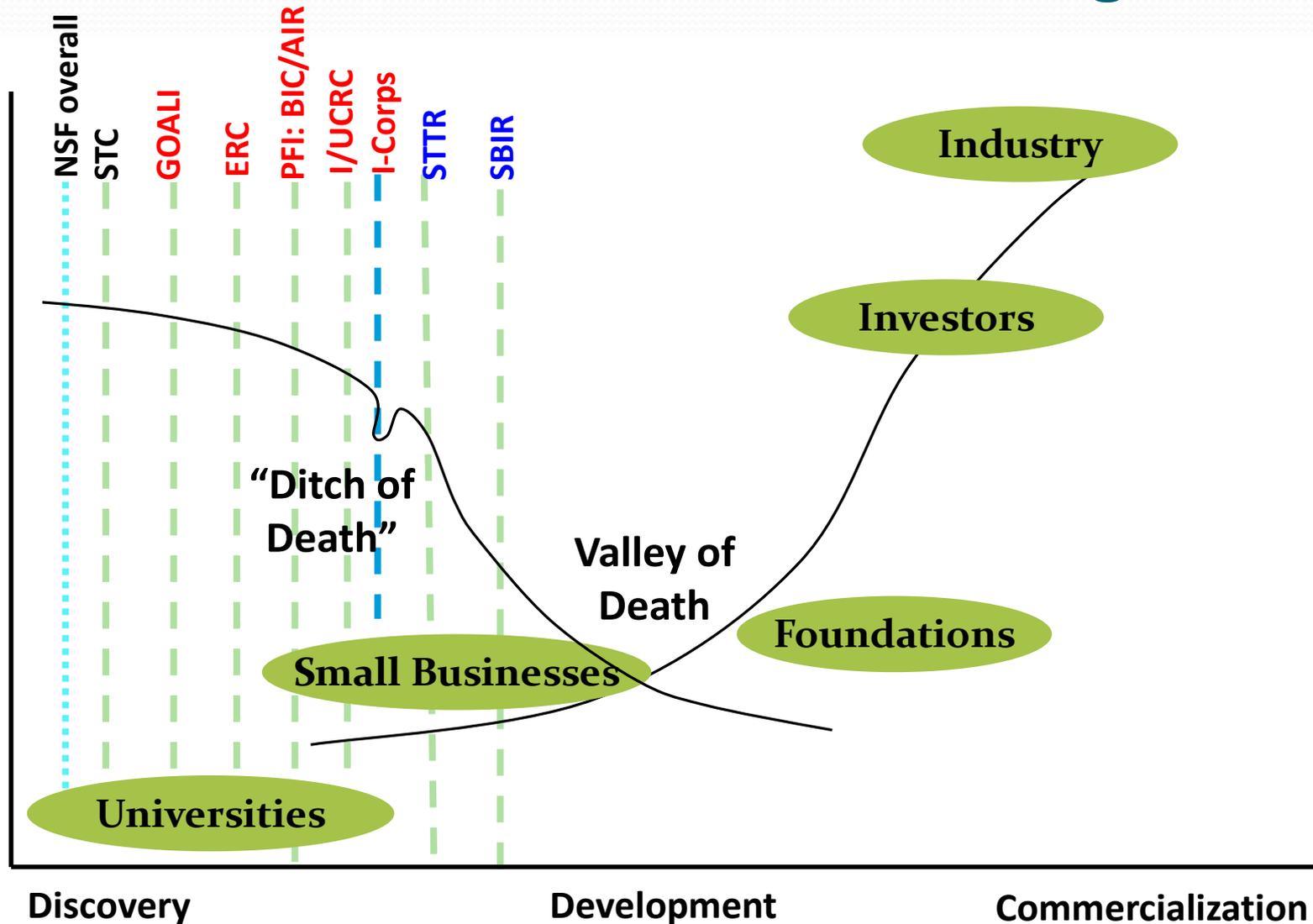


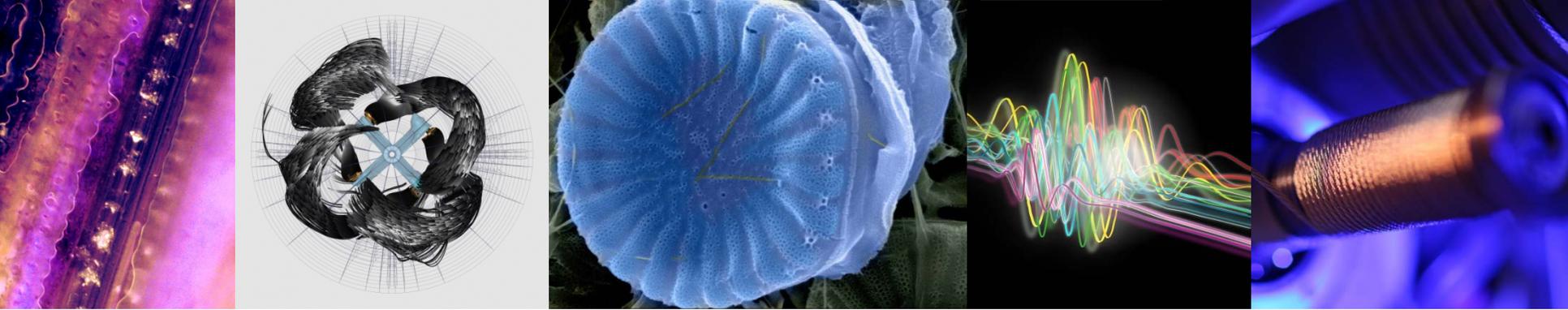
Industrial Innovation and Partnerships Division (IIP)

- fostering partnerships to advance technological innovation
- small business research proposals aimed at pursuing opportunities to commercialize products and services
- Solicitations only

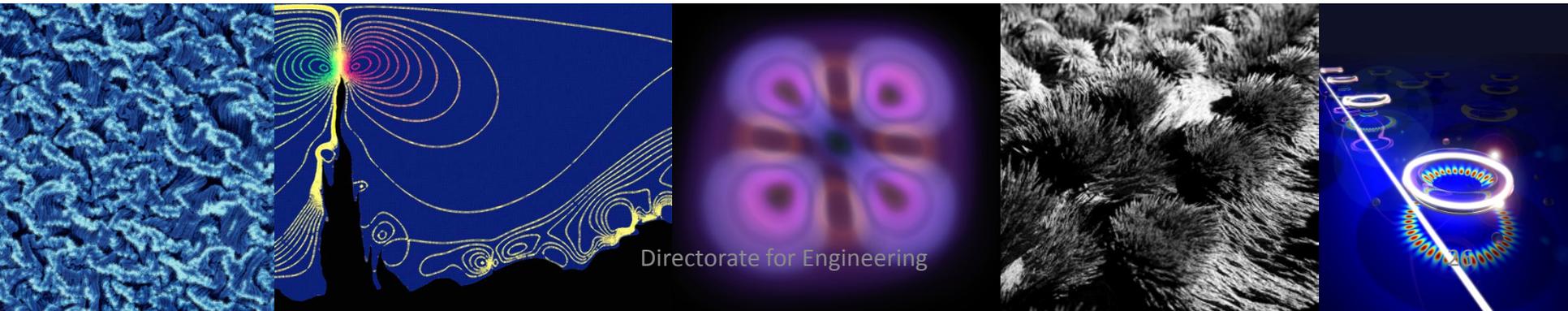


Research to Commercialization: Filling the Gap





ENG Investments and Crosscutting Programs



Crosscutting and NSF-wide Opportunities

- Faculty Early Career Development Program (CAREER)
- Critical Techniques and Technologies for Advancing Big Data Science & Engineering (BIGDATA)
- Cyber-enabled Sustainability Science and Engineering (CyberSEES)
- Cyber-Physical Systems (CPS)
- Innovation Corps (I-Corps)
- Integrative Strategies for Understanding Neural and Cognitive Systems (NSF-NCS)
- National Robotics Initiative (NRI)
- Pan-American Advanced Studies Institutes (PASI)
- Partnerships for International Research and Education (PIRE)
- Research Coordination Networks (RCN)
- Scalable Nanomanufacturing (SNM)
- Sustainability Research Networks (SRN)
- Sustainable Chemistry, Engineering, and Materials (SusChEM)
- Grant Opportunities for Academic Liaison with Industry (GOALI)



CAREER

- Foundation-wide activity that offers NSF's most prestigious awards for faculty members beginning their independent careers
- Provides stable support at a sufficient level and duration to enable awardees to develop careers as outstanding researchers and educators who effectively integrate teaching, learning, and discovery
- High priority for Engineering
- ENG award size increased to \$500,000
- *Note: the CAREER award is not just a research award, it is a career development award*



Proposal Submission

- The right program for a proposal depends on the research objective
- The research goal is to obtain a fundamental understanding of...
- The research objective is to test the hypothesis...
- Winning proposals need both a research objective and a plan to accomplish the objective



NSF Supports Basic Research

- Winning proposals focus on research, not development
- If the focus of the proposal is an artifact (a device, system, product, process,...), it's probably development
- If the focus of the proposal is knowledge (the truth of a hypothesis), it's probably research



Steps towards Successful Proposals

- Begin with
 - White paper
 - Dialog with program officer
 - Short biography
- Get involved with NSF reviews



Ethics

- Persons submitting proposals to the Federal government are held to high standards of conduct
- Misbehavior can be dealt with quite severely
 - PI barred from submission to NSF for up to 2 years
 - Permanently barred from proposal review
 - At least two cases of jail time (Grimes case, 42 months in Federal prison)
 - Maximum \$250,000 fine, 5 years in prison
- Institutions must train and verify



Major Forms of Misbehavior

- Plagiarism—uncited reproduction of the work of others
- Falsification—intentional misrepresentation of data or results (progress reports)
- Fabrication—making up data
- Double charges—billing the government twice for the same work



Closing Thoughts

- **NSF ENG is deeply committed to fundamental engineering research, education and people, and innovation for benefit to the nation**
- **We invite the engineering community to help us in embracing current opportunities and lay the foundations for a prosperous future for engineering**
- **This will require all of us to be creative, bold, collaborative, inclusive, and persistent**



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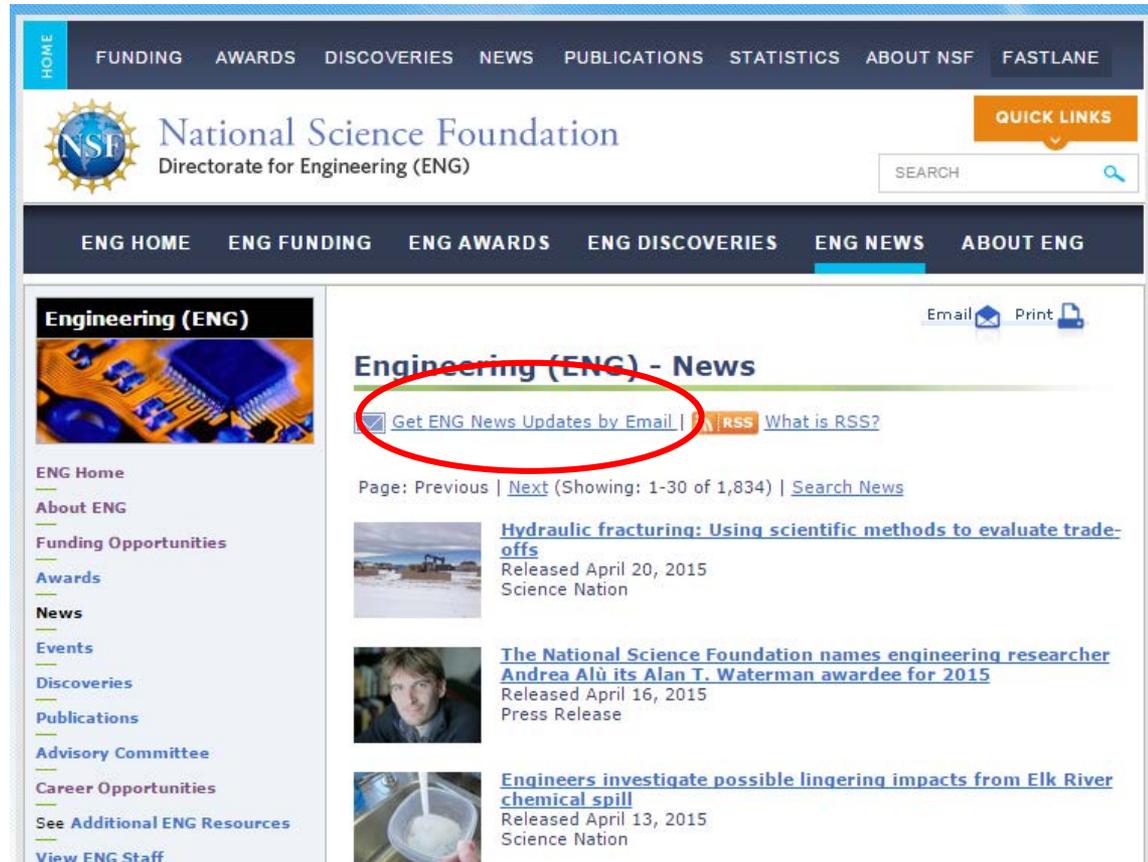
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<https://www.facebook.com/US.NSF>



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- Funding opportunities
- Due dates



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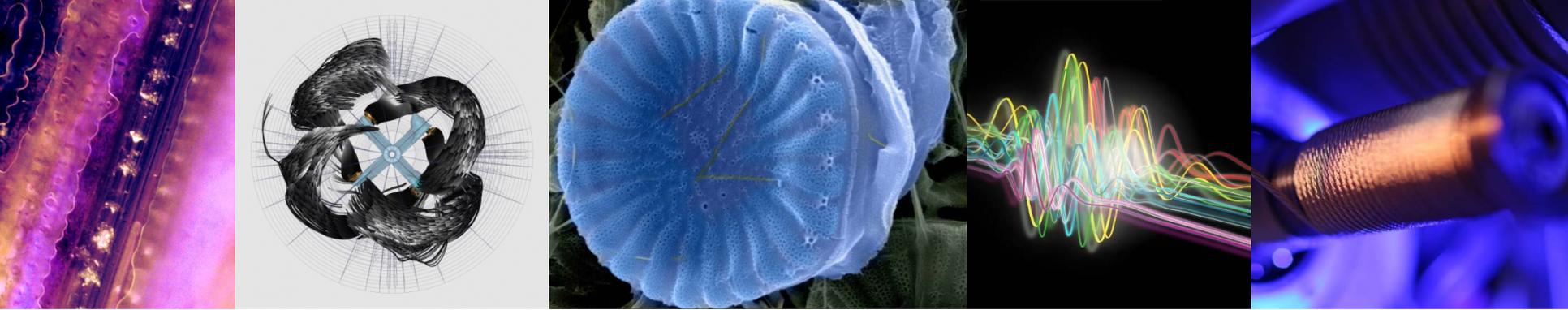
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