Engineering Directorate @ NSF
Budget and Priorities

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Presentation ASEE
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Directorate for Engineering

Fundamental

EFRI

CBET

- Chemical, Biochemical, and Biotechnology Systems
- Biomedical Engineering and Engineering Healthcare
- Environmental Engineering and Sustainability
- Transport and Thermal Fluids Phenomena

CMMI

- Advanced Manufacturing
- Mechanics and Engineering Materials
- Resilient and Sustainable Infrastructure
- Systems Engineering and Design

ECCS

- Electronics, Photonics, and Magnetic Devices
- Communications, Circuits, and Sensing Systems
- Energy, Power, and Adaptive Systems

EEC

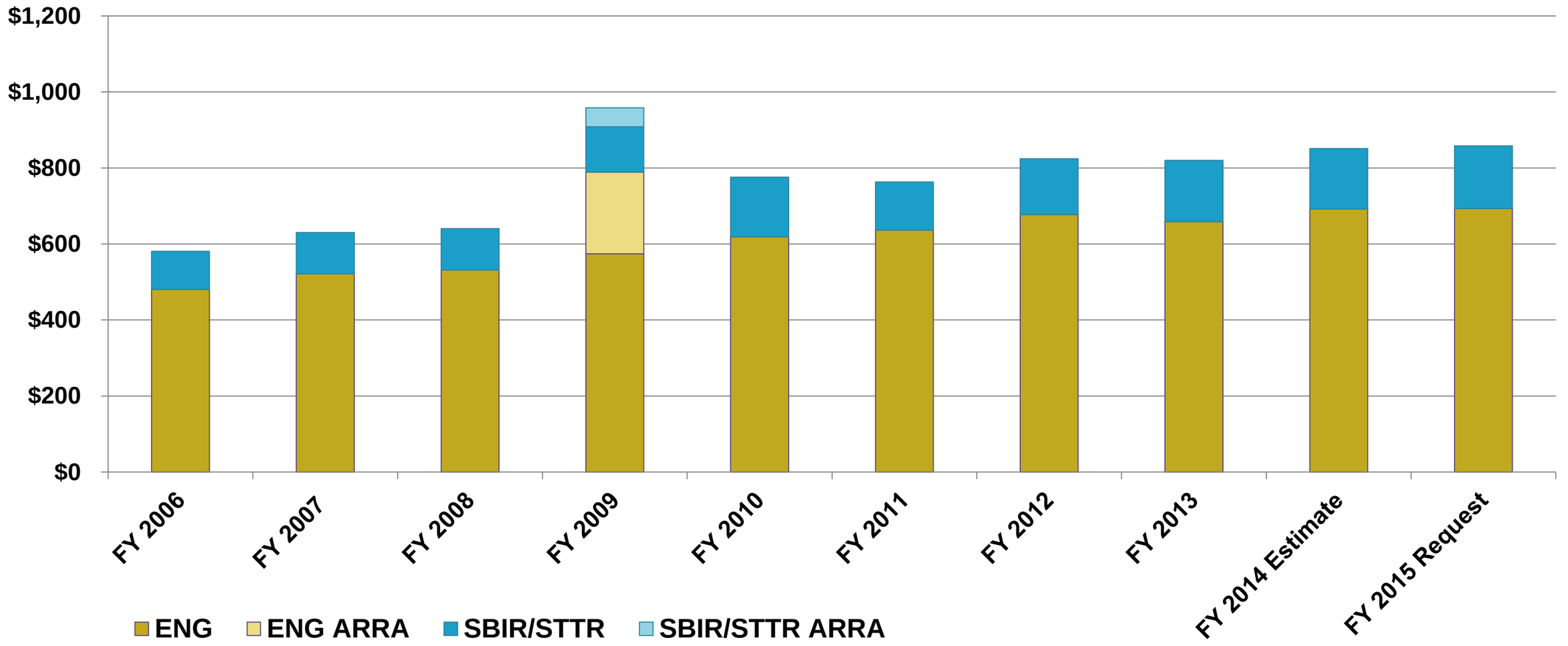
- Engineering Research Centers
- Engineering Education
- Engineering Workforce

Translational

IIP

- Academic Partnerships
- Small Business Partnerships

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



ENG R&RA Budget ($M)

	FY 2013 Actual	FY 2014 Estimate	FY 2015 Request	Change over FY 2014 Estimate	
				Amount	Percent
CBET	$167.01	$173.00	$174.99	$1.99	1.2%
CMMI	200.81	209.20	210.40	1.20	0.6%
ECCS	104.58	110.06	110.41	0.35	0.3%
EEC	115.21	122.24	117.38	-4.86	-4.0%
IIP	202.41	205.97	213.69	7.72	3.8%
SBIR/STTR	*161.34*	*159.39*	*164.99*	*5.61*	*3.5%*
EFRI	30.16	30.60	31.30	0.70	2.3%
ENG TOTAL	$820.18	$851.07	$858.17	$7.10	0.8%

Engineering prioritizes research critical to the Nation's Challenges

- National Initiatives
  - Advanced Manufacturing
  - Clean Energy
  - National Nanotechnology Initiative
- NSF Cross-cutting Priorities
  - Cognitive Science and Neuroscience
  - Communications and Cyberinfrastructure
  - Cyber-Enabled Materials, Manufacturing, and Smart Systems (CEMMSS)
  - Science, Engineering, and Education for Sustainability (SEES)
  - Education and Career Development
  - Interdisciplinary Research
  - Research Centers
  - Innovation Corps

Advanced Manufacturing

$73M

- ENG will support system modeling, complex engineering systems design, biomanufacturing, and nanomanufacturing
  - Research to advance sensor- and model-based smart manufacturing, robotics, and materials
  - Research on cyber-physical systems to transform static manufacturing systems into “smart” systems that can sense and adapt to environmental change
  - Advanced semiconductor and optical device design, fabrication and processing, for use in biomedical, communications, computing, energy and sensing systems

Clean Energy

$134M

- ENG will invest significantly in fundamental research for clean energy
  - Conversion, storage and distribution of diverse power sources (including smart grids)
  - Renewable energy generation and storage
  - Research and engineering of energy materials, energy use, and energy efficiency; and the ways that people think about and use energy

National Nanotechnology Initiative

$166M

- The Directorate will continue support for nanomaterials and nanodevices; nanosystems; nanomanufacturing; and environment, health, and safety
  - Focus on composite nanomaterials, two-dimensional nanolayers, nano-electronic logic devices, metamaterials, plasmonics, and nanomedicine
- ENG will emphasize research for the Signature Initiatives
  - Nanoelectronics for 2020 and Beyond
  - Sustainable Nanomanufacturing
  - Nanotechnology for Solar Energy Collection and Conversion
  - Nanotechnology Knowledge Infrastructure
  - Nanotechnology for Sensors and Sensors for Nanotechnology

NSF Cross-cutting Priorities

- Cognitive Science and Neuroscience
- Communications and Cyberinfrastructure
- Cyber-Enabled Materials, Manufacturing, and Smart Systems
- Science, Engineering, and Education for Sustainability
- Education and Career Development
- Interdisciplinary Research
- Research Centers
- Innovation Corps

ENG will invest in Cognitive Science and Neuroscience

- ENG investments are critical to success of the BRAIN Initiative
  - ENG will drive integration across scales and across disciplines
  - ENG will accelerate the development of new experimental and analytical approaches, including computational and data-enabled modeling, and new neural engineering and technology research and development
  - ENG focus areas will include optogenetic mapping and stimulation of the brain, noninvasive or minimally invasive imaging technologies, and advanced neuroprosethetics for neuron repair or regeneration

$5M

ENG will support advances in Communications and Cyberinfrastructure

- Enhancing Access to the Radio Spectrum (EARS)
  ENG will prioritize research on more efficient radio spectrum use and energy-conserving device technologies
- Cyberinfrastructure for the 21st Century (CIF21)
  The ENG investment will focus on research platforms, engineering modeling and simulation, smart networks, and sensors
- Secure and Trustworthy Cyberspace (SaTC)
  ENG support will focus on the engineering aspects of the Networking and Information Technology Research and Development (NITRD) strategic plan

$8M for EARS

$10M for CIF21

$3M for SaTC

ENG will be a major contributor to Cyber-Enabled Materials, Manufacturing, and Smart Systems

- ENG will focus on breakthrough materials, advanced manufacturing, robotics, and cyber-physical systems
  - integrates materials discovery, property optimization, systems design and optimization, certification, manufacturing and deployment
  - integrates computational methods with data-enabled scientific discovery and innovative experimental techniques
  - includes the Critical Resilient Interdependent Infrastructure Systems and Processes (CRISP) focus area

$90M

ENG will continue support for Science, Engineering, and Education for Sustainability (SEES)

- ENG's investment will focus on sustainability research networks and sustainable chemistry, engineering, and materials
- ENG will continue funding for sustainable infrastructure and disaster-resilient systems
- ENG will promote sustainability research and education in the areas of the water/energy/food nexus

$12M

ENG will strategically invest in Education and Career Development

- The Directorate emphasizes support for
  - CAREER awards
  - NSF Research Traineeship (NRT) and Integrative Graduate Education and Research Traineeships (IGERT) programs
  - Exploring new approaches to address engineering education challenges, in connection with Improving Undergraduate STEM Education (IUSE)
  - Broadening participation at all levels

$43M for CAREER

$4M for NRT

$6M for IUSE

ENG will continue its support for Emerging Frontiers of Research and Innovation

- The ENG investment in EFRI provides strategic support for fundamental research that may overcome scientific and/or national challenges and lead to breakthrough technologies
  - FY 2014 topics: Two-Dimensional Atomic-layer Research and Engineering (2-DARE) and Resilient Interdependent Infrastructure Processes and Systems (RIPS)
  - FY 2015 topics: Two-Dimensional Atomic-layer Research and Engineering (2-DARE) and other(s) in development

$31M for EFRI

ENG will maintain support for integrative Research Centers

- Engineering Research Centers (ERCs)
  - 17 active centers, competition underway
- Science and Technology Centers (STCs)
  - CBET will continue supporting the Center on Emergent Behaviors of Integrated Cellular Systems
  - ECCS will continue supporting the Center for Energy Efficient Electronics Science

$64 M for ERCs

$10 M for STCs

ENG will continue to strengthen Innovation Corps

- The NSF investment will provide mentoring and resources to help determine the commercial readiness of technology built on NSF-funded basic research
- ENG will continue to support I-Corps Teams, Sites, and Nodes to further build, utilize, and sustain a national innovation ecosystem
- NSF FY 2015 plans include approximately 189 new Teams, 15 new Sites, and 2 new Nodes

$25M from NSF

$11M from ENG

President's Opportunity, Growth & Security Initiative

$552 million

Research in a Broader Context

How do we leverage research for larger societal benefits?

Merit Review Criterion: *Broader Impacts*

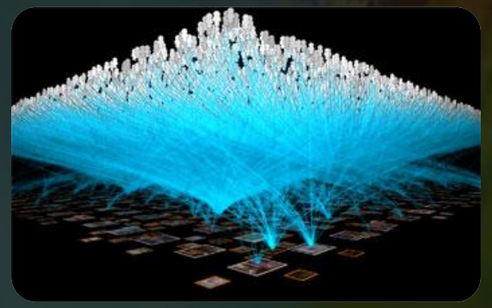
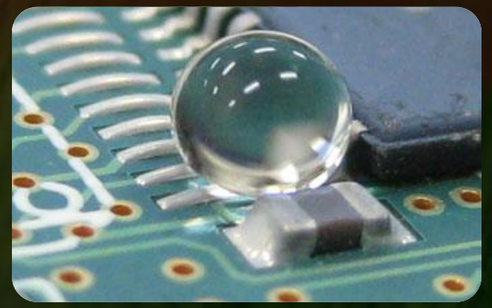
- The Broader Impacts criterion encompasses the potential to benefit society and contribute to achieving specific, desired societal outcomes, including:
  - increased participation of women, persons with disabilities, and underrepresented minorities in science, technology, engineering, and mathematics (STEM);
  - improved STEM education at all levels;
  - increased public scientific literacy and public engagement with science and technology; improved well-being of individuals in society;
  - development of a globally competitive STEM workforce;
  - increased partnerships between academia, industry, and others;
  - increased national security;
  - increased economic competitiveness of the United States;
  - and enhanced infrastructure for research and education.

NSB Recommendation

- "Just as institutions play an important role in facilitating research-related activities of their investigators, often in ways that align with strategic departmental and institutional (and possibly state-wide, regional, or national) priorities and investments, such a role can extend to activities directed toward the broader impacts of the project as well."
- "… such efforts might be more effective if coordinated appropriately in ways that leverage particular institutional assets or strategic directions and even link investigators from multiple projects."
- *NSF should encourage institutions to pursue such cooperative possibilities, which have the dual benefit of retaining the contributions of individual investigators while addressing national goals and yielding benefits broader than those within a given project.*
- *How can engineering colleges and departments respond to this opportunity?*

The Directorate for Engineering

- Empowers research in frontiers of engineering
- Builds an innovation economy
- Prepares today's students for tomorrow's challenges and opportunities

Credits, from left: Electronic Visualization Laboratory, University of Illinois at Chicago; Philip DeCamp and Deb Roy; Integrated Surface Technologies, Menlo Park, CA; NSF; Erik Demaine and Martin Demaine, MIT