

Directorate for Engineering Update



Pramod Khargonekar
Assistant Director, Directorate for Engineering
Spring Advisory Committee Meeting
April 18, 2013



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ENG applauds Director Subra Suresh

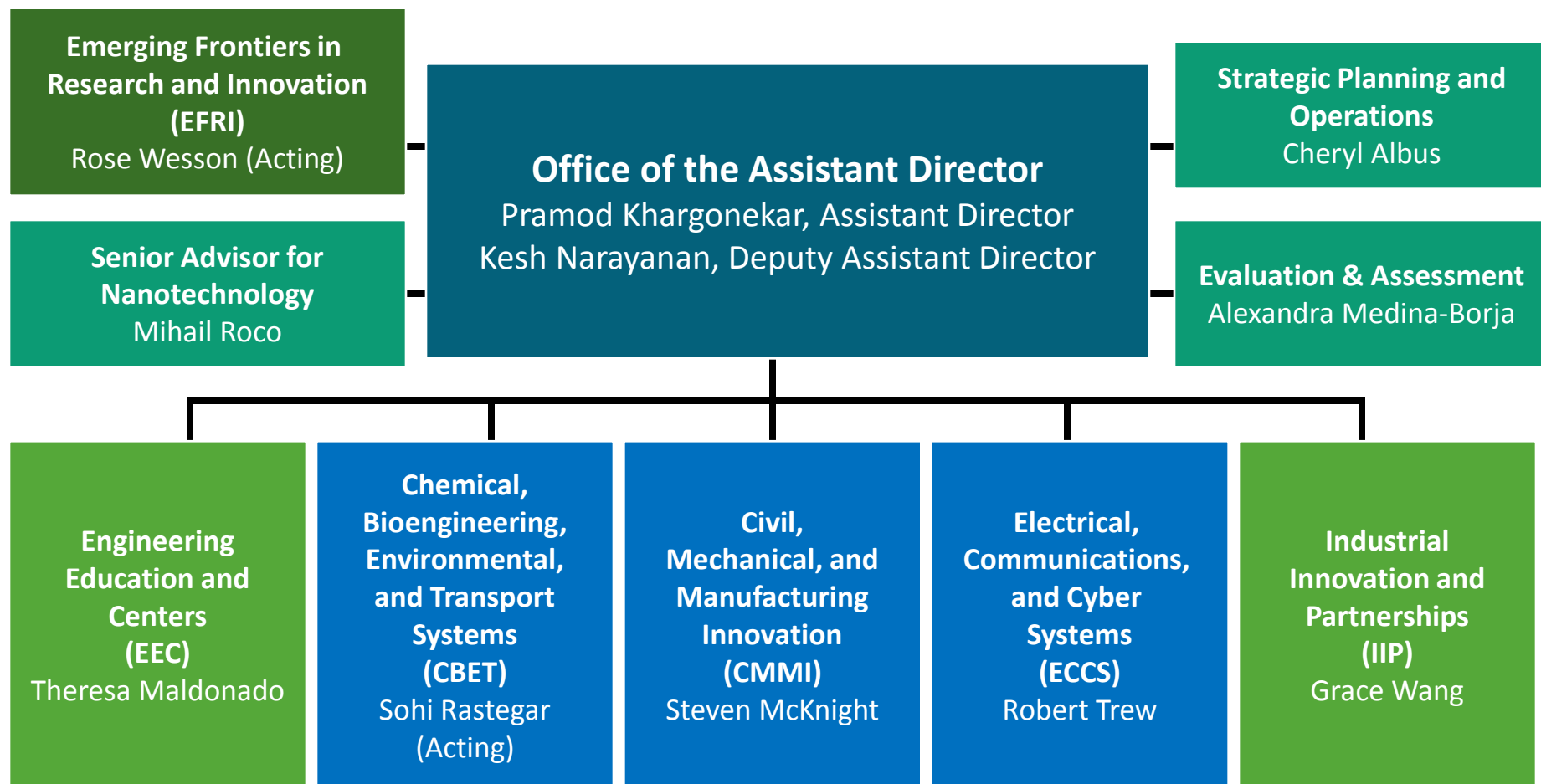
- New models for global engagement
- Principled commitment to human capital development and broadening participation
- Addressing national priorities and global challenges
- Nurturing and expanding the innovation ecosystem
- OneNSF philosophy and new paradigms for cross-disciplinary interactions



ENG welcomes Acting Director Cora Marrett

- Served as NSF's acting Director, acting Deputy Director, and Senior Advisor, until her confirmation as Deputy Director in May 2011
- Previously served as Assistant Director for Education and Human Resources (EHR) and as the first Assistant Director for Social, Behavioral, and Economic Sciences (SBE)

NSF ENG Organization



CBET

- **Ruey-Hung (Ray) Chen,**
Program Director for Combustion
and Plasma Systems
(University of Central Florida)



- **Dimitrios Papavassiliou,** Program
Director for Fluid Mechanics
- **Alexander Revzin,**
Program Director for Nano-
Biosensing (UC Davis)

CMMI

- **Paul Collopy**, Program Director for Engineering and Systems Design and for Systems Science (University of Alabama in Huntsville)
- **Gary Fischman**, Expert Program Director for Materials and Surface Engineering
- **Demitris Kouris**, Expert
- **Wayne Plummer**, Program Support Manager
- **Timothy Sauer**, Expert

EEC

- **Bradley Clements,**
Science Assistant



- **Carmiña Londoño,** Program
Director for Engineering
Research Centers (OISE)

EEC

- **Donna Riley**, Program Director for Engineering Education Research (Smith College)



- **Alisha Lynn Williams**, Operations Specialist

- **Gracie Narcho**, Staff Associate



- **Shashank Priya**, Program Director for Industry/University Cooperative Research Centers (Virginia Tech)

EFRI and OAD

- **Rob Gordon**, EFRI intern
(Georgia Tech)



- **Grace Yuan**, Associate Program Director (Booz Allen and Semper Paratus)

FY 2013 Budget

- The Consolidated and Further Continuing Appropriations Act of 2013, signed March 26, funds the government for the remainder of FY 2013
- Sequestration remains in effect
- NSF Current Plan for FY 2013 is due to Congress May 10

Released April 10, 2013

FY 2014 BUDGET REQUEST

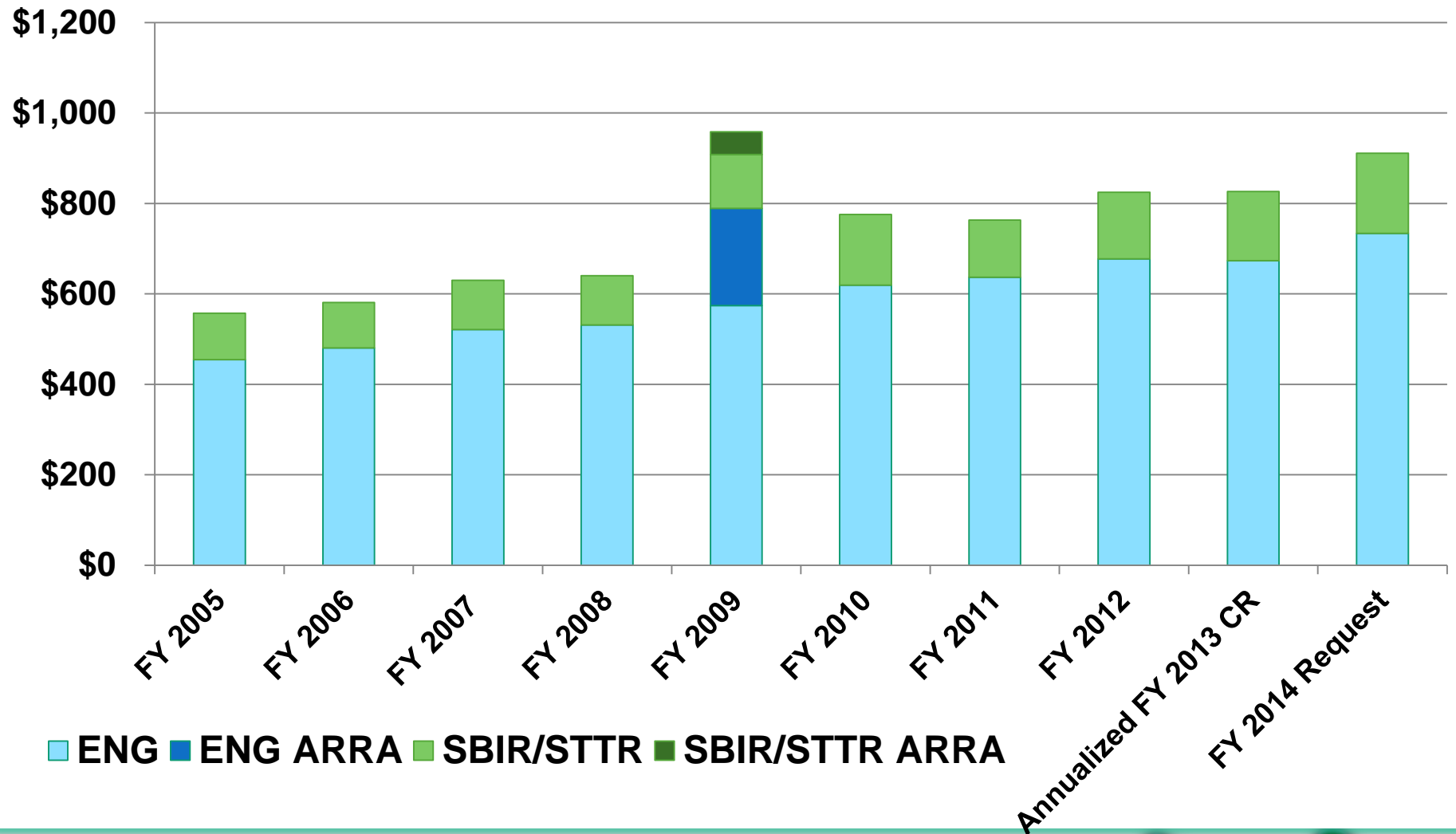


ENG R&RA Budget (\$M)

	FY 2012 Actual	FY 2013	FY 2014 Request	Change over FY 2012 Actual	
				Amount	Percent
CBET	\$171.51	TBD	\$185.30	\$13.79	8.0%
CMMI	203.59	TBD	224.02	20.43	10.0%
ECCS	106.74	TBD	117.90	11.16	10.5%
EEC	123.93	TBD	126.25	2.32	1.9%
IIP	187.79	TBD	225.45	37.66	20.1%
<i>SBIR/STTR</i>	<i>146.86</i>	<i>TBD</i>	<i>177.15</i>	<i>30.29</i>	<i>20.6%</i>
EFRI	30.99	TBD	32.20	1.21	3.9%
ENG TOTAL	\$824.55	TBD	\$911.12	\$86.57	10.5%



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



Engineering prioritizes research critical to the Nation's Challenges

- National Initiatives
 - Advanced Manufacturing
 - Clean Energy
 - National Nanotechnology Initiative (NNI)
 - National Robotics Initiative (NRI)
 - Brain Research through Advancing Innovative Neurotechnologies (BRAIN)
- NSF Cross-cutting Priorities
 - Cyber-Enabled Materials, Manufacturing, and Smart Systems
 - Communications and Cyberinfrastructure
 - Sustainability
 - Education and Career Development
 - Interdisciplinary Research
 - Research Centers
 - Innovation Ecosystem



Advanced Manufacturing

\$78 M

- ENG will support multi-scale modeling, complex engineering systems design, 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

\$130 M

- ENG will invest significantly in fundamental research for clean energy
 - Conversion, storage and distribution of diverse power sources (including smart grids)
 - Solar energy technologies, biofuels and bioenergy
 - Wind energy generation and renewable energy 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

\$175 M

- The directorate will continue support for nanomaterials and nanodevices; nanosystems; nanomanufacturing; and environment, health, and safety
- ENG will give additional funds to 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

National Robotics Initiative

\$10 M

- ENG will support
 - Assistive mechanisms for those with physical disabilities and/or cognitive impairments
 - Systems integration that enables ubiquitous, advanced robotics to be realized
 - Next-generation robotics for manufacturing, healthcare and rehabilitation, surveillance and security, education and training, and transportation

NSF Cross-cutting Priorities

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

ENG will contribute greatly 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, manufacturing and deployment
 - integrates advanced computational methods with data-enabled scientific discovery and innovative experimental techniques

**\$126 M for
CEMMSS**

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 cyber–physical systems, 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

**\$14 M for
EARS**

**\$12 M for
CIF21**

**\$4 M for
SaTC**



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

- ENG's investment will focus on sustainability research networks; sustainable energy pathways; and sustainable chemistry, engineering, and materials
- ENG will increase funding for sustainable infrastructure and disaster-resilient systems

**\$27 M for
SEES**

ENG will strategically invest in Education and Career Development

- The directorate emphasizes support for
 - CAREER awards
 - Engineering education research, in connection with Catalyzing Advances in Undergraduate STEM Education (CAUSE)
 - Activities that promote the entry and retention of veterans and other non-traditional students in engineering programs
 - Public-private partnerships, such as the STEP awards in the Graduate 10K+ focus area

**\$55 M for
CAREER**

**\$13 M for
CAUSE**

ENG will continue its long-standing support for Interdisciplinary Research

- **INSPIRE (Integrated NSF Support Promoting Interdisciplinary Research and Education)**

ENG will support creative, important research collaborations between disciplines that may lead to new opportunities

**\$6 M for
INSPIRE**

- **Emerging Frontiers of Research and Innovation (EFRI)**

ENG will provide strategic support for fundamental research that may overcome scientific and/or national challenges and lead to breakthrough technologies

**\$32 M for
EFRI**



FY 2014 EFRI Topic

2D Materials Beyond Graphene



- Addresses fundamental challenges in the creation of 2D materials and their hybrids, scalable manufacturing strategies, characterization tools and methods, and novel devices
- May lead to transistors, memory, and solar cells, for example, that exploit the unique properties of stacked, heterogeneous layers
- Potential breakthroughs in energy, healthcare, and electronics beyond Moore's law

Image: Bulk MoS2 crystal

ENG will maintain support for integrative Research Centers

- Engineering Research Centers (ERCs)
 - First Nanosystems ERCs joined 17 other ERCs
- 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

**\$71 M for
ERCs**

**\$10 M for
STCs**

ENG will contribute strategically to the Innovation Ecosystem

- **Innovation Corps (I-Corps)**

Provides mentoring and resources to help determine the commercial readiness of technology built on NSF-funded basic research

**\$8 M for
I-Corps**

- **Partnerships for Innovation**

- Accelerating Innovation Research (AIR) fosters connections with existing NSF innovation research alliances
- Building Innovation Capacity (BIC) enables collaboration between academia and business to advance basic research for market-accepted innovations

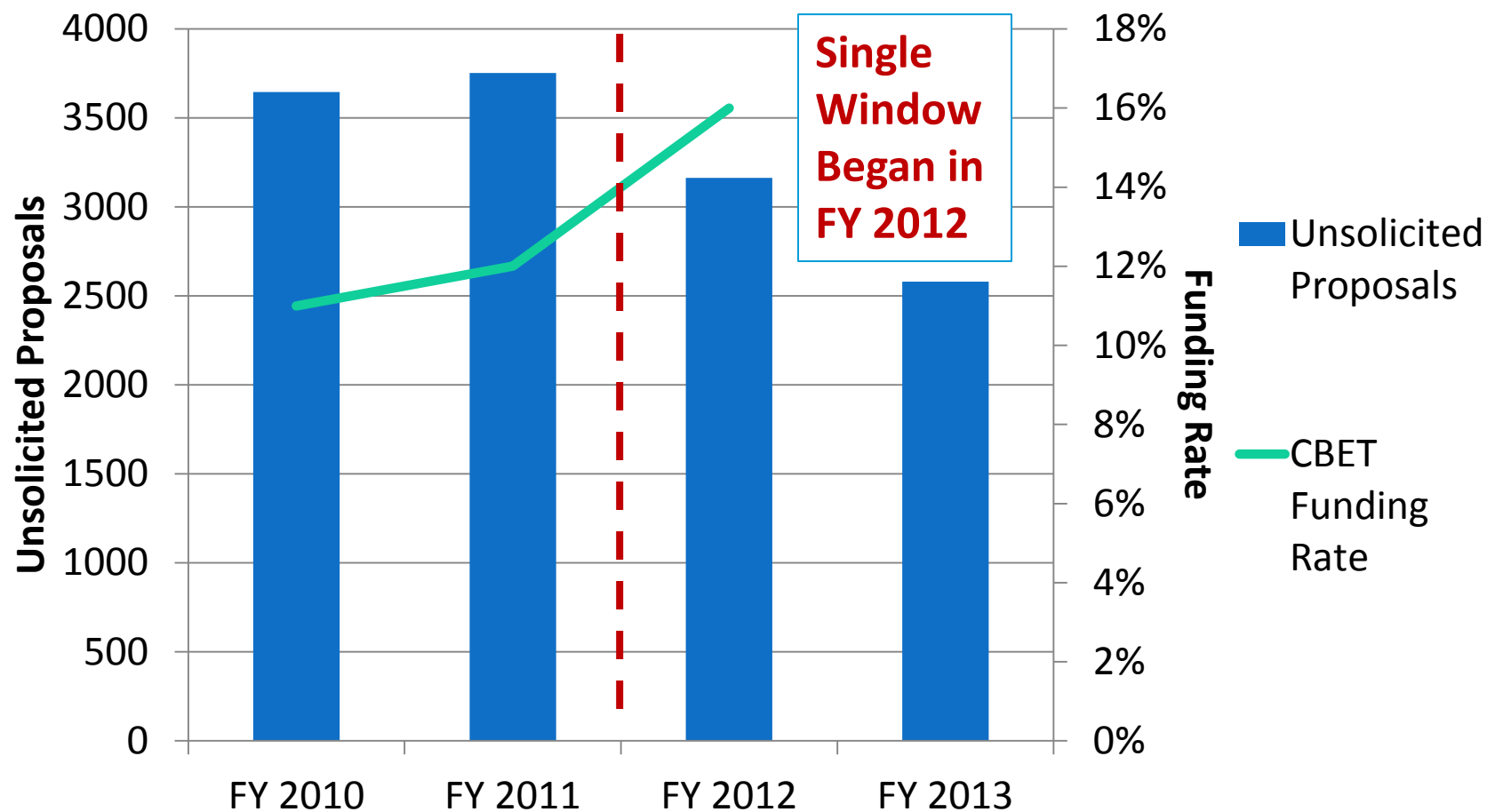
**\$22 M for
PFI**



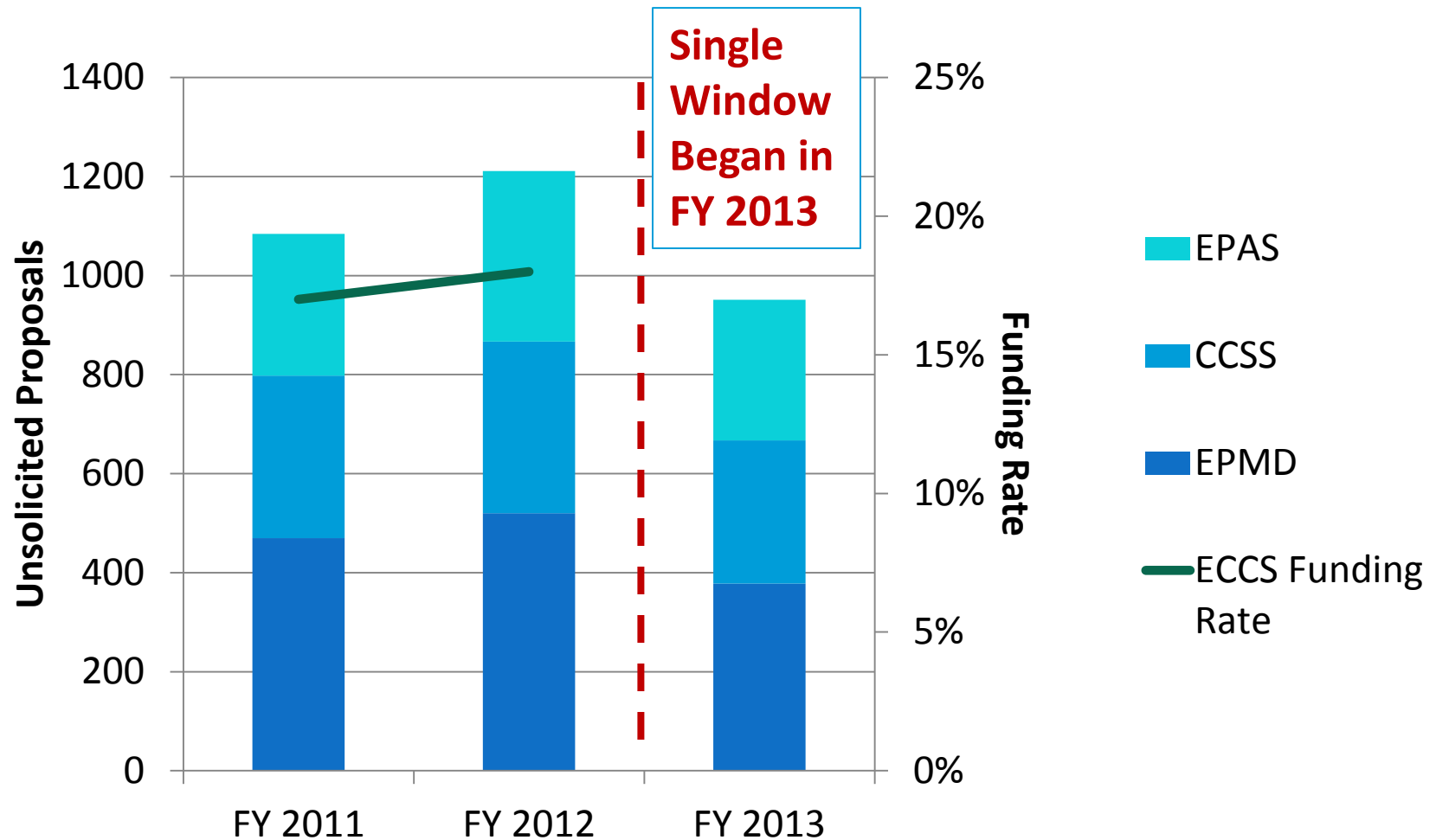
ENG OPERATIONS



Use of Single Window: CBET Unsolicited Proposals



Use of Single Window: ECCS Unsolicited Proposals



Hybrid and Virtual Panels: ENG Use Is Growing

ECCS	IN-PERSON	HYBRID	VIRTUAL	TOTAL
Unsolicited FY 2012	43	4	1	48
Unsolicited FY 2013	18	10	3	31

IIP	IN-PERSON	HYBRID	VIRTUAL	TOTAL
SBIR Summer 2012	54	0	22	76
SBIR/STTR Winter 2012	46	0	34	80

Hybrid and Virtual Panels: Lessons Learned

- More appropriate for some panels than others
 - Ideal for small panels (<8 reviewers) with few proposals
 - Challenging for complex proposals
- More appropriate for some panelists than others
 - Better for technically savvy, seasoned reviewers
 - Appreciated by reviewers for whom travel is problematic
- One technology solution does not fit all

New Travel and Conference Requirements

- OMB instructed NSF to reduce travel and conference spending
- Impacts on Post-award Management
 - NSF staff and site visitors all remote for Berkeley ERC visit
 - NSF staff and site visitors all remote for NCN visits with Purdue and UIUC
- Impacts on Conferences, Retreats, and Outreach
 - Staff conference and retreat attendance and grantee meeting spending is being tracked more closely

Reducing Administrative Burdens

- NSB created a Task Force on Administrative Burdens to
 - examine the administrative burden imposed on researchers and institutions
 - offer recommendations on relieving the administrative workload
- Community members may offer recommendations - formal *Request for Information* through May 24

Reducing Administrative Burdens: ERC Program

- Streamlined proposal process
 - Shorter preliminary proposal (from ~30 to ≤ 7 pp.)
 - Shorter proposal review time (from ~18 to ~15 mo.)
- Assessing ERC annual reporting guidelines to determine how to gain necessary, useful information while reducing the total burden of preparing the annual report

EARLY PERSPECTIVE



ENG Current State

ENG core mission to support:

- Fundamental research
 - Advancing research frontiers
 - Use inspired basic research
- Translational research
 - Driven by innovation
- Human capital development
 - Student talent pool
 - Junior faculty
 - Broadening participation at all levels

Excellent organization – people and structure



Major challenges and opportunities

- Multitude of directions for interdisciplinary research addressing societal needs
- Growing complexity and cost of research
- Global context and competition
- Undergraduate education – retention, globalization, innovation, pathways into engineering
- Graduate education – domestic student interest in doctoral research, curriculum & internships to meet needs of interdisciplinary research and long term career development
- Broadening participation

ENG Strategic Questions

- NSF ENG: Limited funding vis-à-vis broad mandate to support the engineering community
- How do we best invest our precious resources to fulfill the NSF ENG core missions?
 - Are we sowing the seeds for the next major engineering/technological revolutions?
 - How do we balance among competing priorities?

ENG Strategic Questions

- How do we ensure that the core programs are truly advancing the disciplines?
- How do we balance investments in cross-cutting initiatives vs needs of the core programs?
- How do we increase synergies between the EEC and IIP activities and the disciplines based programs in CBET, CMMI, and ECCS?
- How do we balance the need to focus and having critical mass vs. broad coverage of engineering disciplines?

ENG AdCom Questions

- How can AdCom help us in making the best decisions for the engineering community?
- Which areas are most suitable for AdCom to engage with the NSF ENG team?
- What new mechanisms should we explore for AdCom-ENG engagement?
- How can we make AdCom service valuable to AdCom members?

Questions?

