



# **ENG Strategic Planning Report**

John McGrath

ENG Advisory Committee Meeting

October 20, 2010



# Working Groups:

- STWG- Sohi Rastegar, Chair
  - Maria Burka, Darren Dutterer, Samir El-Ghazaly, Cecile Gonzalez, Barb Kenny, John McGrath, Steve McKnight, Dwayne Mitchell, Kesh Narayanan, Betty Person, Mike Roco, Al Soyster, Bob Trew
- EEWG - Al Soyster, Chair
- ASWG - Mike Reischman, Chair
- AEWG - Steve McKnight, Chair
- PUEWG - Bob Trew, Chair



# Input Gathered:

- General Approach:
  - Review Status of 2005 Strategic Plan
  - Identify Any New Strategic Directions
  - Recommend Overarching Goals
- Weekly Meetings (Since Oct 2009)
- Rastegar Met with NSF Strategic Coordinator
- Rastegar Visited Divisions, WGs, Other Directorates
- Survey on ENG Reorganization (Jan 2010)
- Half-Day Global Engineering Workshop (Feb 2010)
- Two All-Hands Meetings (Feb and Sept 2010)
- Ad Com Preliminary Input (April 2010)



# Response to AdCom Input

- **Revisit Strategic Goals in light of draft NSF Strategic Plan**

<b>NSF Goal One</b>	“Transform the Frontiers” emphasizes the seamless integration of research and education as well as the close coupling of research infrastructure and discovery.
<b>ENG Goal One: Frontier Research</b>	Lead in Frontier Engineering Research



# Response to AdCom Input

- **Revisit Strategic Goals in light of draft NSF Strategic Plan**

<b>NSF Goal Two</b>	“Innovate for Society” points to the tight linkage between NSF programs and societal challenges, and it highlights the role that new knowledge and creativity play in economic prosperity and society’s general welfare.
<b>ENG Goal Two: Innovation Ecosystem</b>	Cultivate an Innovation Ecosystem



# Response to AdCom Input

- **Revisit Strategic Goals in light of draft NSF Strategic Plan**

<p><b>NSF Goal Three</b></p>	<p>“Perform as a Model Organization” emphasizes the importance of NSF as an exemplar of an agency that expects to attain excellence in all operational aspects.</p>
<p><b>ENG Goal Four: Organizational Excellence</b></p>	<p>Strive for Excellence in ENG Organization</p>

<p><b>ENG Goal Three: Future Engineer</b></p>	<p>Develop the Next-Generation Engineer</p>
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# Response to AdCom Input

- Explicitly recognize broader context within which NSF operates and identify activities for which ENG plays a key role
- Focus on ENG-unique roles/strength/areas where ENG can make greatest contribution
- Identify clearly areas in which ENG expects to play a leadership role



# Response to AdCom Input



## FLAGSHIP ROLE (Goal 1 & Part of Goal 2)

- Frontier Research (Integrated with education) (Goal 1)
- Cultivate Innovation Ecosystem - for Academics (Goal 2)  
[ERCs, early, no product]



## BEACON ROLE (Part of Goal 2 & Goal 3)

- Cultivate Innovation Ecosystem (Goal 2) - Commerce, Industry, VCs [PFI, GOALI, SBIR, etc] - How far to go?
- Develop Next Generation Engineer (Goal 3) - Universities (State and Private) [BRIGE, REU, PUE, etc]



# Response to AdCom Input

- **Revisit Strategic Goals in light of changing global context**
  - Recommended to Emphasize Potentially Transformative Research and Innovation
  - Defined Engineering Grand Challenges (NAE report) and aligning funding with these areas (and others) in EFRI and Core programs
  - Held Global Engineering Workshop
  - Recommended to form ENG International Collaborations WG



# Response to AdCom Input

- **Address lack of diversity in ENG senior management**
  - Next DD of EEC will be Theresa Maldonado
  - Reach out to a wide pool of diverse applicants both internally and externally for all positions, particularly for senior leadership positions
  - Communicate regularly and openly on the interview process within ENG



# Response to AdCom Input

- **Consider emphasizing Innovation and Sustainability as areas of ENG leadership**
  - Innovation - discussed above
  - Sustainability
    - Tom Peterson: One of the leads in NSF SEES initiative
    - EFRI (14 new awards/\$28M in SEED and RESTOR)
    - “Energy for Sustainability” and “Environmental Sustainability” programs created in CBET (~\$14M/yr)



# Key Features of the Strategy

- Maintain the core of 2005 Strategic Plan, which remains valid
- Build on the Innovation Concept identified in 2005 Strategic Plan
- Incorporate assessment and evaluation into decision-making and planning at all levels



# Goal One

## Lead in Frontier Engineering Research

John McGrath

ENG Advisory Committee  
Meeting

October 20, 2010



# Goal One

ENG will invest in frontier fundamental engineering research, integrated with education, that addresses grand challenges for engineering and national and societal needs.



# Goal One

## Recommendation 1A

**FUNDAMENTAL ENGINEERING RESEARCH:** Sustain and expand the core research programs to have a balanced and thriving portfolio of research projects, groups, and centers that lead the frontiers of fundamental engineering research.

- **Examine and take into account potential impact of new initiatives and programs on core programs**
- **Evolve existing core programs continually as evidenced by workshops, external evaluation and open benchmarking**
- **Examine research portfolios periodically to assure balance and strategic development (senior management)**



# Goal One

## Recommendation 1B

**POTENTIALLY TRANSFORMATIVE RESEARCH:** Maintain a specific focus on funding potentially transformative (high-risk, high-reward) research across all ENG programs.

- Continue to fund Potentially Transformative Research (PTR) through EFRI
- Increase the amount of funding distributed through formal mechanisms such as EAGER and RAPID



# Goal One

## Recommendation 1C

**INTERDISCIPLINARY TEAM RESEARCH:** Promote interdisciplinary [and] team research, and ensure appropriate resources for such projects.

- Evaluate effectiveness of current IDR system over next two years and develop new strategy if found to be ineffective
- Consider recommendations of NSB Task Force on Mid-scale Research on the effects of larger project budget size



# Goal One

## Recommendation 1D

**INTERNATIONAL COLLABORATIONS:** Promote, facilitate, and provide the resources for mutually beneficial international collaborations between researchers funded by ENG in the United States and researchers in foreign nations.

- **Establish an International Collaborations Working Group (ICWG)**



# **ENG Goal 2**

## **Innovation Ecosystem**

***STG Working Group***



# Context of Innovation Goal

1. A Strategy for American Innovation: Driving Towards Sustainable Growth and Quality Jobs, September 2009
  - <http://www.whitehouse.gov/administration/eop/nec/StrategyforAmericanInnovation/>
2. The Role of the National Science Foundation in the Innovation Ecosystem, August 2010
  - <http://www.nsf.gov/eng/iip/innovation.pdf>
3. ENG Strategic Thinking
  - Strategic Thinking Working Group Report, October 2010



EXECUTIVE OFFICE  
OF THE PRESIDENT  
NATIONAL  
ECONOMIC  
COUNCIL  
OFFICE OF SCIENCE  
AND TECHNOLOGY  
POLICY : Sept 2009

**Innovation for Sustainable Growth and Quality Jobs**



**Catalyze  
Breakthroughs for  
National Priorities**

- Unleash a clean energy revolution
- Support advanced vehicle technology
- Drive breakthroughs in health IT
- Address the "grand challenges" of the 21<sup>st</sup> century

Energy, Health

**Promote Competitive Markets that Spur  
Productive Entrepreneurship**

- Promote American exports
- Support open capital markets that allocate resources to the most promising ideas
- Encourage high-growth and innovation-based entrepreneurship
- Improve public sector innovation and support community innovation

Innovation-Based  
Entrepreneurship

**Invest in the Building Blocks of American Innovation**

- Restore American leadership in fundamental research
- Educate the next generation with 21<sup>st</sup> century knowledge and skills while creating a world-class workforce
- Build a leading physical infrastructure
- Develop an advanced information technology ecosystem

Educate  
World-Class  
Workforce

Fundamental  
Research



## **Innovation Definition from 'A Strategy for American Innovation'**

**“Innovation is the development of novel products, services, and processes for the benefit of society”**

<http://www.whitehouse.gov/administration/eop/nec/StrategyforAmericanInnovation/>



# Role of NSF in the Innovation Ecosystem

- From Discovery to Innovation through Translation Research
  - research that moves an idea past the basic discovery stage
- Leads to technology platforms
- Requires the integration of multi-disciplines
- Is developed in collaboration with industry
- The innovation process is often non-linear

# Responding to Innovation Challenges



- Resources: Spur Translation of Fundamental Research
  - Enable academic researchers to take their fundamental research to the next phase via translational research opportunities
- Industry Engagement: Encourage Collaboration between Academia and Industry
  - Academia and industry collaborate through the sharing of ideas, infrastructure, and people
- Flow of Talent to Industry: Educate to Innovate
  - Prepare U.S. engineering students to be entrepreneurial



## ENG Goal 2: Cultivate an Innovation Ecosystem

ENG will play a leading role in enabling NSF to be the premier Federal agency for innovation, by supporting the innovation ecosystem and spawning innovation opportunities through partnerships among academic institutions, industry, not-for-profit organizations and foundations, private investors, and other agencies.



# ***Supporting the Innovation Ecosystem***

- Build on extensive ENG Investments in Innovation
- Create early Industry Linkage to Fundamental Engineering Research
- Expand partnerships between academic and small business programs
  - ERC
  - I/UCRC
  - PFI
  - GOALI
  - SBIR/STTR
  - NSEC
  - Nanoelectronics



# ***Spawning Innovation Opportunities through Partnerships***

- Establish new Interagency Partnerships
  - Healthcare IT with NIH, NIST
  - Sustainable Energy Systems with DOE
- Expand International Collaboration
  - Build on ERC Gen 3, I/UCRC, PIRE, & Others



# Recommendation 2A

## ACCELERATING INNOVATION:

- Catalyze interaction among academe, industry
- Facilitate strategic partnerships in innovation between U.S. and other countries.



# Recommendation 2B

## TRANSLATIONAL RESEARCH:

- Support translational research to move fundamental research toward commercialization



# Recommendation 2C

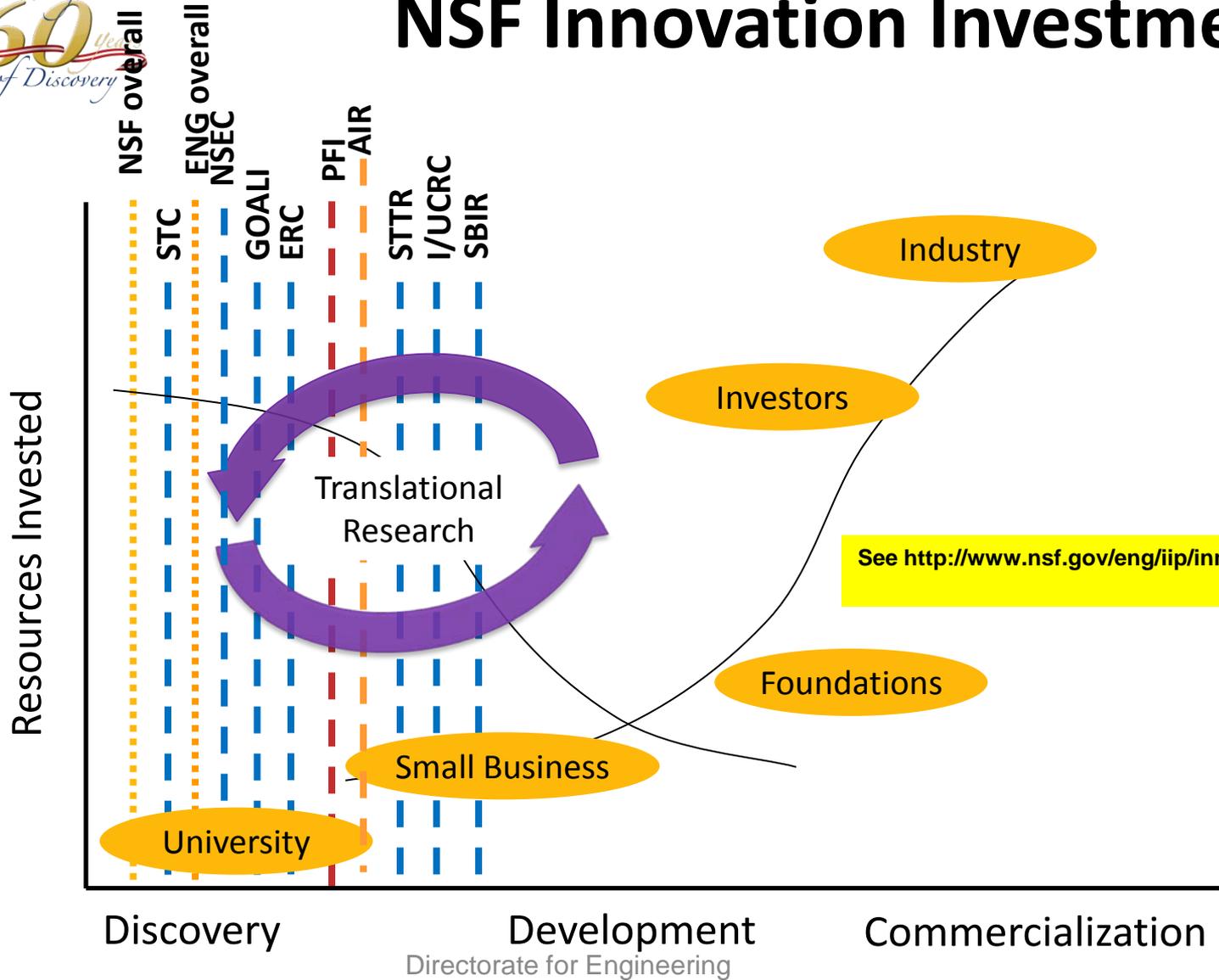
## INNOVATION ECOSYSTEM:

- Establish platforms that enable a **continuum** of research from discovery to proof of concept, prototypes, and beyond



Celebrating  
60 Years  
of Discovery

# NSF Innovation Investments





# Appendix



# White House focus on Innovation

- The Administration has set up series of working groups on the topic of Innovation
- These include commercialization of university research, proof of concept centers, regional innovation, manufacturing resurgence, and others



# ***Commercialization of University Research***

- **Tom Peterson testimony to Congress**
- **University Presidents invited to attend Four Regional Forums**
  - Organized by the Department of Commerce (DOC)
  - Led by Gary Lock, Secretary of Commerce
  - Tom Peterson, NSF Participated in several forums



# ***Commercialization of University Research***

- **Community Inputs (RFI)**
  - WH Request for Information (RFI)
  - OSTP, NEC, DOC, NSF,...
  - Al Soyster, NSF representative
  - received >200 proposals in Spring '10



# ***Commercialization of University Research***

- **Best Practices**

- Leadership from the top of University
- Deep collaboration with community, industry and investors
- Culture of Entrepreneurship and Commercialization
- Investment in Innovation Infrastructure

<http://www.eda.gov/commrfi-responses>



# Goal Three

Develop the Next-Generation  
Engineers

Sue Kemnitzer



## Goal Three

**ENG will continue to strive to develop the next-generation engineers and to provide the nation with an engineering workforce to be an engine of economic growth.**

### **Recommendation 3A**

- **ENGINEERS AS INNOVATORS:** Collaborate with engineering schools to produce innovative, entrepreneurial, and globally aware graduates.
  - Encourage faculty to take greater risks to utilize pedagogy which cultivates innovation skills in students
  - Provide global experiences for undergrad and grad students



## Goal Three

### Recommendation 3B

**ALTERNATIVE EDUCATION PATHWAYS:** Document and assess alternative and non-traditional pathways for diversifying engineering education.

- Support large scale survey of the **Community College** role in educating engineers
- Support innovative approaches to support **Veterans'** pathways

### Recommendation 3C

**VALUE OF ENGINEERING EDUCATION:** Assess the value of an engineering education

- Collaborate with **SRS** to support a large survey of engineering career tracks



## Goal Three

### Recommendation 3D

**EVALUTE ENGINEERING EXPENDITURES IN STUDENTS:** Evaluate the engineering directorate's investments in students and align with strategic goals.

- Identify the demographic characteristics of students supported on ENG research grants, and track their career paths.

### Recommendation 3E

**STRENGTHEN ENG BROADENING PARTICIPATION:** Prioritize and implement the ENG Broadening Participation plan and take strong measures to attract and bring the best talent from the diverse talent pools of America into engineering.

- Continue supporting Broadening Participation Research Initiation Grants (BRIGE).
- Continue Tribal College Pre-Engineering Education Collaborative (PEEC).



# Goal Three

## Recommendation 3F

**SUSTAIN REU AND RET:** Continue support of the Research Experiences for Undergraduates (REU) and Research Experiences for Teachers (RET) programs.

- Increase the Research Assistantships for High School Students (RAHSS)
- Include innovation as a component of REU and RET
- Encourage more community college professors in RET

## Recommendation 3G

**PUBLIC UNDERSTANDING OF ENGINEERING:** Expand and strengthen public information, outreach, and broader impact activities for better understanding of engineering by the public.

- Build strategic partnerships to leverage public understanding activities
- Create and support engineering ambassadors to communicate with the public



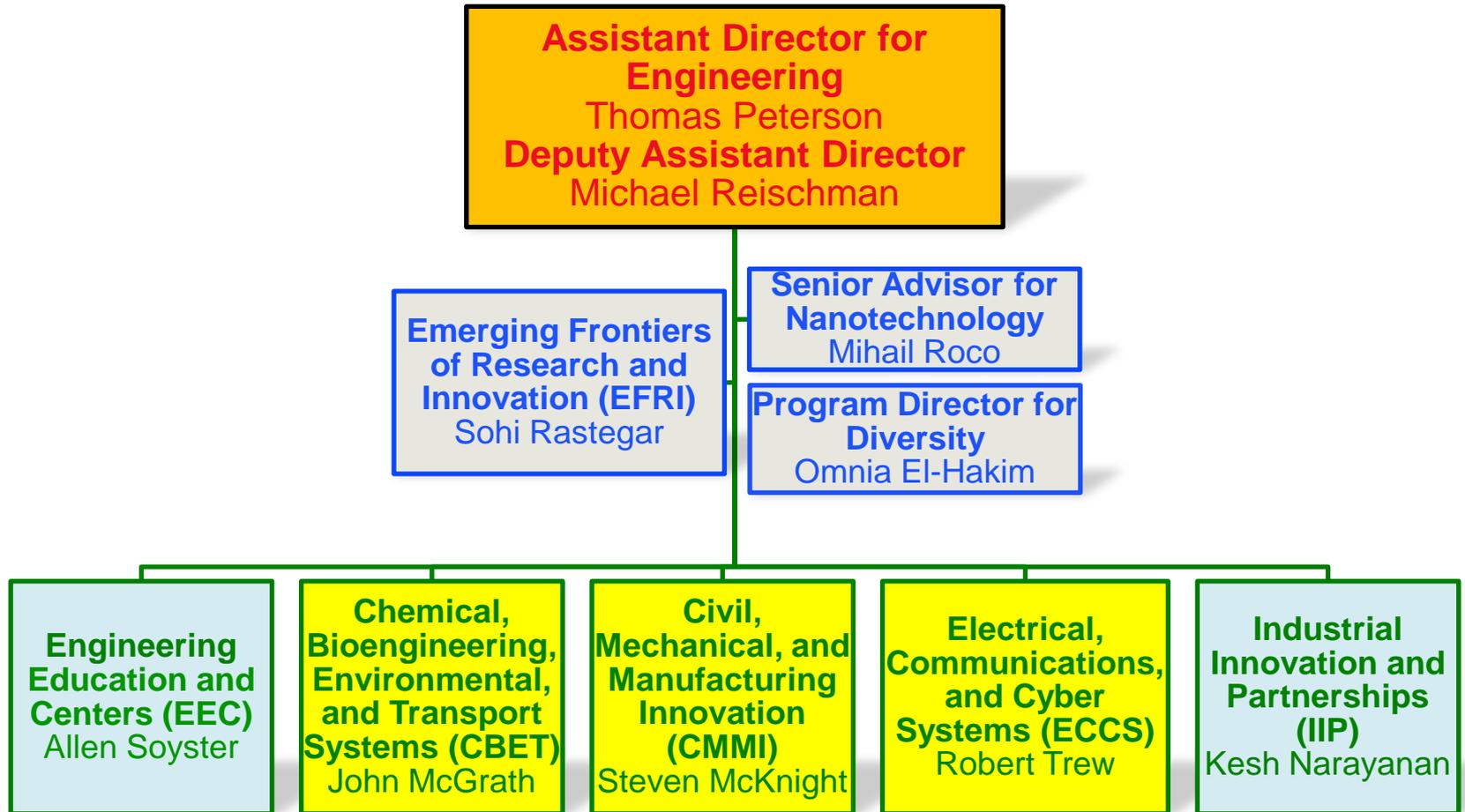
# Goal Four

ENG will effectively organize to provide agile, multidisciplinary leadership in engineering research, innovation, and education.



# ENG Organization

Established from Reorganization in 2006





# Overview

- **Goals Derived from Findings in Three Areas Across Working Groups**
  - Organizational Structure
  - Awards and Solicitation
  - Assessment and Evaluation
- **Recommendations in Six (6) Categories**
  - 4A: ASSESSMENT AND EVALUATION
  - 4B: DIRECTORATE STRUCTURE AND MANAGEMENT
  - 4C: DIVERSITY STRATEGY
  - 4D: MANAGE FUNDING RATE:
  - 4E: COMMUNICATION AND COORDINATION
  - 4F: INTERNAL AND EXTERNAL TRAINING



# Key Points

## Recommendation 4A

- **ASSESSMENT AND EVALUATION:** Organically incorporate assessment and evaluation into ENG processes
- How?:
  - Establish ENG A/E standing working group for ENG policy / oversight
  - Recruit and hire ENG A/E professional (New Slot)
  - Create detailed BPE and associated A/E framework processes
  - Develop requirements and implement ENG knowledge management system
  - Implement expanded COV role in ENG A/E activities
  - Engage in NSF and Interagency Basic Research A/E activities



# Key Points

## Recommendation 4B

- **DIRECTORATE STRUCTURE AND MANAGEMENT:**

Optimize the structure and management of the disciplinary divisions within ENG in relation to other NSF directorates.

- Imbalance in division size does not merit further reorganization at this time
- Program support managers in CBET and CMMI work load -> consider alternative management structures
- Intellectual content -> consider fragmentation of programs between ECCS, DMR and CISE



# Key Points

## Recommendation 4C

- **DIVERSITY STRATEGY:** Develop and implement a clear strategy to increase diversity, particularly in the Directorate's senior leadership positions.
  - Specific attention in recruiting and outreach to candidates
  - Theresa Maldonado incoming EEC DD



# Key Points

## Recommendation 4D

- **MANAGE FUNDING RATE:** Manage funding rate through management of proposal-generating documents and proposal submission limits.
  - Continue to limit proposal-generating documents
    - 5–6 ENG-only and 2–3 inter-directorate solicitations per year
  - Limits on proposal submission
    - 2 / year per applicant as PI, co-PI, or Senior Personnel
    - one-year wait on submitting substantially revised proposals



# Key Points

## Recommendation 4E

- **COMMUNICATION AND COORDINATION:**
  - Strategic PD working groups
  - Strategic NSF DD retreats
    - (topic driven, linked to initiatives and budget preparation)
  - Periodic dissemination of information
    - Electronic News Letters
    - ENG Town-Halls
  - Team-building and social activities to build comradeship



# Key Points

## Recommendation 4F

- **INTERNAL AND EXTERNAL TRAINING:**

- Internal

- ENG training in addition to NSF Academy for IPAs
- Plans and resource for staff professional development

- External

- Proposal writing for PI community
- ENG/NSF “Road Map” tools for PIs