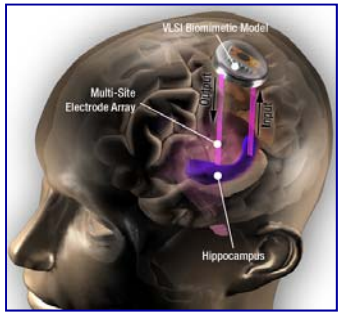
Engineering at NSF



Cheryl Albus

National Science Foundation

Directorate for Engineering

ENG 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

ENG Organization

Assistant Director for Engineering
Thomas Peterson
Deputy Assistant Director
Kesh Narayanan

Program Director for Diversity
Richard Smith

Senior Advisor for Nanotechnology
Mihail Roco

Program Director for Strategic Operations
Cheryl Albus

Emerging Frontiers of Research and Innovation (EFRI)
Rose Wesson
(Acting)

Engineering Education and Centers (EEC)
Theresa Maldonado

Chemical, Bioengineering, Environmental, and Transport Systems (CBET)
Sohi Rastegar (Acting)

Civil, Mechanical, and Manufacturing Innovation (CMMI)
Steven McKnight

Electrical, Communications, and Cyber Systems (ECCS)
Robert Trew

Industrial Innovation and Partnerships (IIP)
Grace Wang

Outline

- ENG Research Divisions
  - CBET – CMII – ECCS
- Exploratory Research
- Engineering Education and Centers
- Industrial Innovation and Partnerships
- Broadening participation
- Crosscutting and NSF-wide programs

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

Deputy Division Director
Bob Wellek

Division Director
Sohi Rastegar (Acting)

Chemical, Biochemical, and Biotechnology Systems

- Biotechnology, Biochemical, and Biomass Engineering — Friedrich Srienc
- Catalysis and Biocatalysis — George Antos
- Chemical and Biological Separations — Rose Wesson
- Process and Reaction Engineering — Luke Achenie

Biomedical Engineering and Engineering Healthcare

- Biomedical Engineering — Kaiming Ye
- Biophotonics — Leon Esterowitz
- Biosensing — Aleksandr Simonian
- General and Age-Related Disabilities Engineering — Ted Conway

Environmental Engineering and Sustainability

- Energy for Sustainability — Ram Gupta
- Environmental Engineering — Debra Reinhart
- Environmental Health and Safety of Nanotechnology — Barbara Karn
- Environmental Sustainability — Bruce Hamilton

Transport and Thermal Fluids Phenomena

- Combustion, Fire, and Plasma Systems — Ray Chen
- Fluid Dynamics — Henning Winter
- Interfacial Processes and Thermodynamics — Bob Wellek
- Particulate and Multiphase Processes — Ashok Sangani
- Thermal Transport Processes — Sumanta Acharya

CBET Areas of Interest

- **Chemical, biochemical, and biotechnology:** processing and manufacture of products by effectively utilizing chemical and renewable resources,
- **Biomedical engineering and engineering healthcare:** to integrate engineering and life science to solve biomedical problems
- **Environmental engineering and sustainability:** to reduce adverse effects of solid, liquid, and gaseous discharges into land, water, and air that result from human activity and impair the ecological value of those resources
- **Transport and thermal fluids phenomena:** thermal, mass, and momentum transport that enable new technological solutions to understand pressing issues in energy, environment, manufacturing, health care, and other fields

ONE submission deadline per year: Sept. or Feb. , depending on the program

Civil, Mechanical, and Manufacturing Innovation (CMMI)

Senior Advisor
Bruce Kramer

Division Director
Steven McKnight

Deputy Director
George Hazelrigg

Advanced Manufacturing

- **Manufacturing Machines and Equipment** — ZJ Pei
- **Manufacturing Enterprise Systems** — Edwin Romeijn
- **Materials Processing and Manufacturing** — Mary Toney
- **Nano Manufacturing** — Bruce Kramer

Mechanics and Engineering Materials

- **Biomechanics and Mechanobiology** — Dennis Carter
- **Geomechanics and Geomaterials** — Richard Fragaszy
- **Materials and Surface Engineering** — Clark Cooper
- **Mechanics of Materials** — Martin Dunn
- **Structural Materials and Mechanics** — Grace Hsuan

Resilient and Sustainable Infrastructures

- **Civil Infrastructure Systems** — Konstantinos Triantis
- **NEES Research** — Joy Pauschke
- **Geotechnical Engineering** — Richard Fragaszy
- **Hazard Mitigation and Structural Engineering** — Kishor Mehta
- **Infrastructure Mgmt. and Extreme Events** — Dennis Wenger

Systems Engineering and Design

- **Control Systems** — George Chiu
- **Dynamical Systems** — Eduardo Misawa
- **Engineering and Systems Design** — Paul Collopy
- **Operations Research** — Sheldon Jacobson
- **Sensors and Sensing Systems** — George Hazelrigg
- **Service Enterprise Systems** — Edwin Romeijn

CMMI Areas of Interest

- **Advanced manufacturing:** transformative advances in manufacturing and building technologies, with emphases on efficiency, economy, and sustainability
- **Mechanics and engineering materials:** advances in the transformation and use of engineering materials efficiently, economically, and sustainably
- **Resilient and sustainable infrastructures:** to advance fundamental knowledge and innovation for resilient and sustainable civil infrastructure and distributed infrastructure networks
- **Systems engineering and design:** decision-making aspects of engineering, including design, control, and optimization

Two submission deadlines each year: Oct. 1 and Feb. 15

Electrical, Communications, and Cyber Systems (ECCS)

Division Director
Robert Trew
Deputy Director
Susan Kemnitzer

Operations Specialist
Crystal Aikens
Program Support Manager
Cynthia Greene

Senior Engineering Advisor
Lawrence Goldberg

Electronics, Photonics, and Magnetic Devices

Anupama Kaul
Usha Varshney
John Zavada
Dominique Dagenais

Communications, Circuits, and Sensing Systems

Zhi (Gerry) Tian
George Haddad
Massood Tabib-Azar

Energy, Power, and Adaptive Systems

Kishan Baheti
George Maracas
Paul Werbos

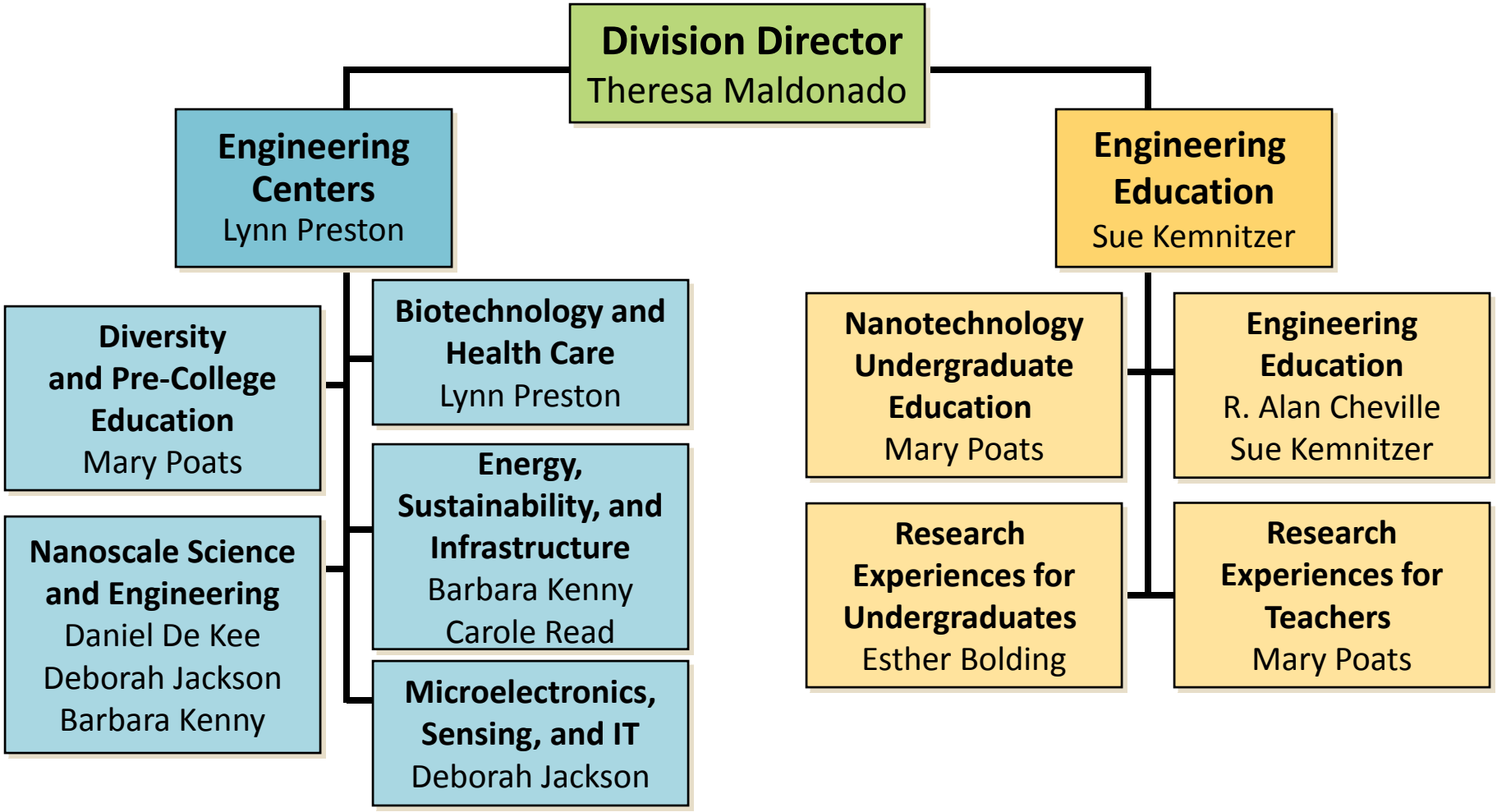
ECCS Areas of Interest

- Address fundamental research issues at the nano, micro, and macro scales underlying device and component technologies, energy and power, controls, networks, communications, computation, sensing and cyber systems
- Support integration of systems principles in complex engineering systems and networks for a variety of applications areas
- Ensure education of a diverse workforce to meet the technological challenges of a 21st century global economy

Exploratory Research

- Emerging Frontiers in Research and Innovation (EFRI)
  - Supports higher-risk, higher-payoff opportunities that:
    - Are potentially transformative
    - Address a national need or grand challenge
  - Topic areas for FY 2012 are:
    - Flexible Bioelectronics Systems (BioFlex)
    - Origami Design for the Integration of Self-assembling Systems for Engineering Innovation (ODISSEI)
    - Photosynthesis Biorefineries (PSBR)
  - $32M investment for 4-year awards at ~$500K per year
  - Invited full proposals due **February 8, 2013**

Engineering Education and Centers (EEC)



Engineering Research Centers

- Supports collaboration with industry to promote innovative research and education
- Engineering Research Centers
  - 17 in operation, including 4 new in 2011
    - Funding for 10 years
  - 2-year process from solicitation to funding
  - Competition underway for up to 3 Nanosystems ERCs to be established in FY 2012
- Nanoscale Science &Engineering Centers
  - First centers will graduate in 2011
  - 2007 solicitation established two Centers for the Environmental Implications of Nanotechnology

Engineering Education Research

- Seeks to enable a system of engineering education, equally open to all members of society, that dynamically and rapidly adapts to meet changing needs. Research areas include:
  - Increasing our understanding of how engineering students learn and the capacity that supports such discovery
  - Understanding how to increase the diffusion and impact of engineering education research
  - Understanding engineering education in broader frameworks such as sustainability
  - Diversifying pathways to and through engineering degree programs

Research Initiation Grants in Engineering Education

- Enables engineering faculty who are renowned for teaching, mentoring, or leading educational reform efforts to initiate collaborations with colleagues in the learning and cognitive sciences to address difficult, boundary-spanning problems in engineering education
- ~$3M for 20 awards
- Proposals due the last Thursday in March

Industrial Innovation and Partnerships (IIP)

Division Director
Grace Wang

Academic Partnerships
Donald Senich

- **Grant Opportunities for Academic Liaison with Industry**
  Donald Senich
- **Industry/University Cooperative Research Centers**
  Rathindra DasGupta
  Larry Hornak
- Partnerships for Innovation
  Don Senich
  - **Accelerating Innovation Research (AIR)**
    Karlene Hoo
  - **Building Innovation Capacity**
    Sara Nerlove

Small Business Partnerships
Joe Hennessey

- **Nanotechnology, Advanced Materials and Manufacturing**
  Ben Schrag, Rajesh Mehta
- **Biotechnology and Chemical Technology**
  Prakash Balan, Ruth Shuman, Jesus Soriano
- **Information and Communications Technology**
  Juan Figueroa, Murali Nair, Steven Konsek
- **Expert/Special Topics**
  George Vermont
- **Education Applications**
  Glenn Larsen

Grant Opportunities for Academic Liaison with Industry (GOALI)

- Effectively promotes the transfer of knowledge between academe and industry, student education, and the exchange of culture
- Supports:
  - Faculty and students in industry (≤ 1 year)
  - Industry engineers/scientists in academe (≤ 1 year)
  - Industry-university collaborative projects (≤ 3 years)
- $5M available for co-funding with all NSF Directorates
- Proposals accepted anytime or windows for the unsolicited proposals; ~70 awards each year

Industry/University Cooperative Research Center (I/UCRC) Program

- Promotes long-term partnerships among industry, academe, and government
- Centers are catalyzed by a small investment from NSF and are primarily supported by industry center members during their development and evolution
- ~$10M for 2-8 full center awards
  ($55-80K/year for up to 5 years) and
  4-12 planning grant awards ($10K for 1 year)
- Two windows per year:
  Letters of Intent due in Jan. and June;
  Full proposals due in March and Sept.

Partnerships for Innovation: Building Innovation Capacity (BIC)

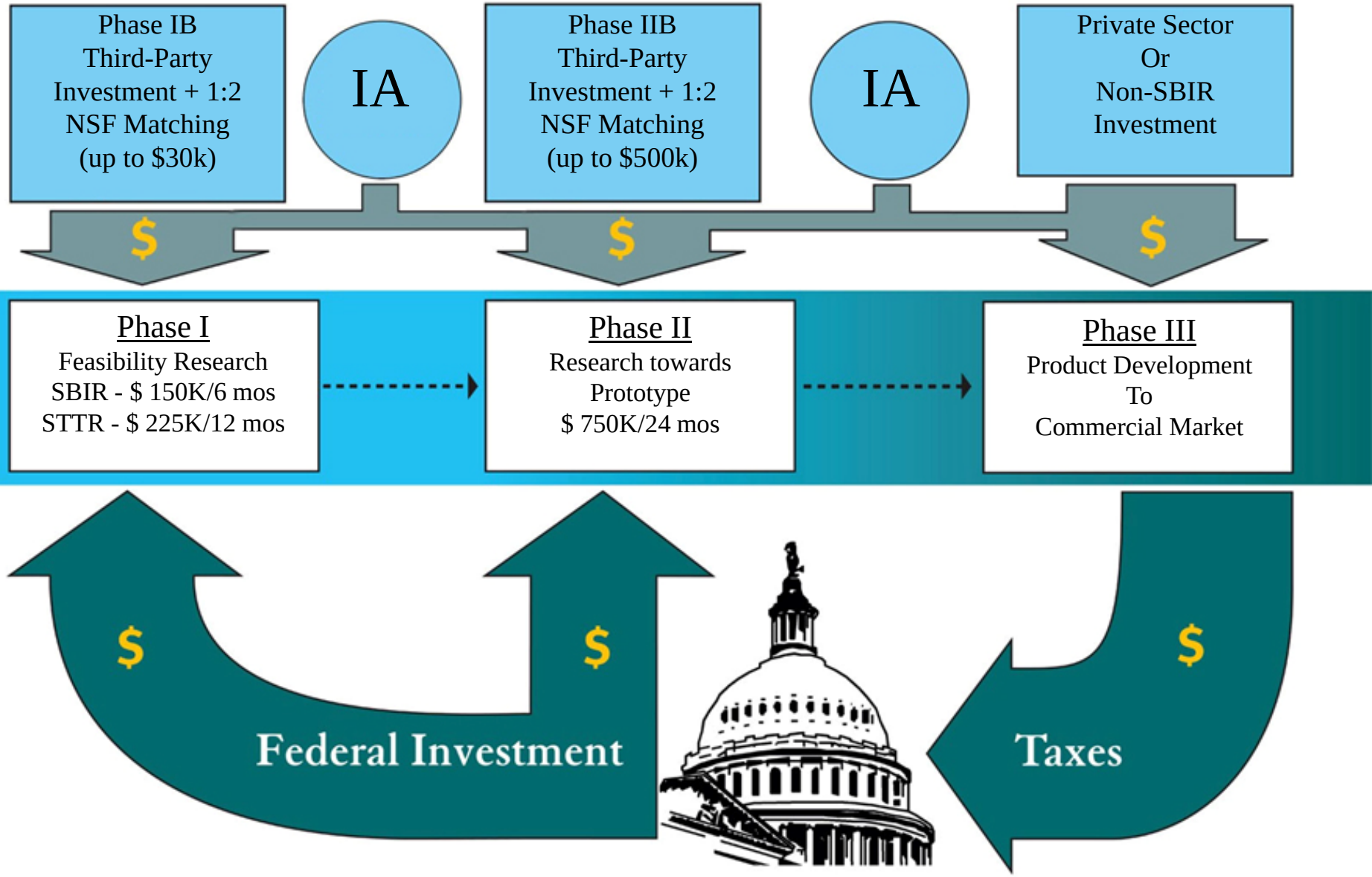
- The primary activities of this partnership are:
  1. To build the innovation capacity of the individual participants from academe and from business
  2. To increase the viability of the small business concerns
  3. To develop the next-generation workforce by providing opportunities for students at different levels to effectively learn from, participate in, and be profoundly changed by exposure to the process of building innovation capacity that occurs in BIC projects
- Academic Lead and a minimum of 2 small businesses
- Anticipated funding amount for FY 2013 = $8M
- Awards amount up to $600K for up to 2 years

Partnerships for Innovation (PFI)

Accelerating Innovation Research (AIR)

- **Motivate the translation and transfer of fundamental research discoveries, to encourage synergistic public-private partnerships between academia and industry, and to educate and train students to understand the innovation and entrepreneurial processes.**
- **Two options:**
  - **AIR Technology Translation – supports innovative ideas in the translation of fundamental science and engineering discoveries into market-valued solutions.**
    - **Award Amount: $150K**
    - **Award Duration: 18 months**
  - **AIR Research Alliance – promotes collaborations between existing NSF-funded research alliance and at least one other research partner to form synergistic relationship**
    - **Award Amount: $800K**
    - **Award Duration: 24 months**
    - **Third Party Investment required**

NSF SBIR/STTR Innovation Model



Broadening Participation Research Initiation Grants in Engineering (BRIGE)

- Funding opportunity intended to increase the diversity of researchers through research program support early in their careers
- Encourages support of under-represented groups, engineers at minority serving institutions, and persons with disabilities
- ~$5M investment for 25–30 awards
- Up to $175,000 over two years
- New solicitation is currently under development

Faculty Early Career Development (CAREER) Program

- Supports junior faculty who exemplify the role of teacher-scholars through
  - outstanding research
  - excellent education
  - integration of education and research
- Encourages women, members of under-represented minority groups, and persons with disabilities to apply
- ENG awards are ~$400K for 5 years

ENG proposals due July 2013

QUESTIONS