



Our World is **ENGINEERED**

Broadening Participation in Engineering

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Director of Diversity and Outreach
NSF Directorate for Engineering
Mentoring and Networking workshop for
Junior women faculty in Big 10, April 1-3/10
<http://www.nsf.gov/eng>



Directorate for Engineering (ENG)





NSF Role in Renewable Energy Technologies

NSF Mission

To promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense

The National Science Foundation Act of 1950 (Public Law 81-507)





Potentially Transformative Research

- ◎ A range of endeavors that promise extraordinary outcomes such as:
 - > revolutionizing entire disciplines,
 - > creating entirely new fields, or
 - > disrupting accepted theories and perspectives.
- ◎ These endeavors have the potential to change the way we address challenges in science and engineering and also provide grist for the innovation mill.



Renewable Energy Emphasis Areas



**Biomass Conversion,
Biofuels & Bio-Energy**



Renewable Natural Resources

**Renewable
Energy Technologies**



**Wind & Wave
Power**



**Solar Photovoltaic
Power & Fuels**

*Environmentally Benign
Materials & Processes*



NAE Grand Challenges

- Make solar energy economical
- Provide energy from fusion
- Develop carbon sequestration methods
- Manage the nitrogen cycle
- Provide access to clean water
- Restore and improve urban infrastructure
- Advance health informatics
- Engineer better medicines
- Reverse-engineer the brain
- Prevent nuclear terror
- Secure cyberspace
- Enhance virtual reality
- Advance personalized learning
- Engineer the tools of scientific discovery





ENG Research and Education Themes

- ◉ Cognitive engineering: Intersection of engineering and cognitive sciences
- ◉ Competitive manufacturing and service enterprises
- ◉ Complexity in engineered and natural systems
- ◉ Energy, water, and the environment
- ◉ Systems nanotechnology





NSF Plan for Broadening Participation

- ◉ Prepare a diverse globally engaged STEM workforce.
- ◉ Expand efforts to broaden participation from underrepresented groups and diverse institutions in all NSF activities.
- ◉ Integrate research with education, and building capacity.
- ◉ Improve processes to recruit and select highly qualified panel reviewers.



What Do Underrepresented Groups Bring?

- ◉ Talents and skills
- ◉ Unique experiences
- ◉ Invaluable research approaches
- ◉ Creativity and innovation
- ◉ Excellence in diversity





Challenges

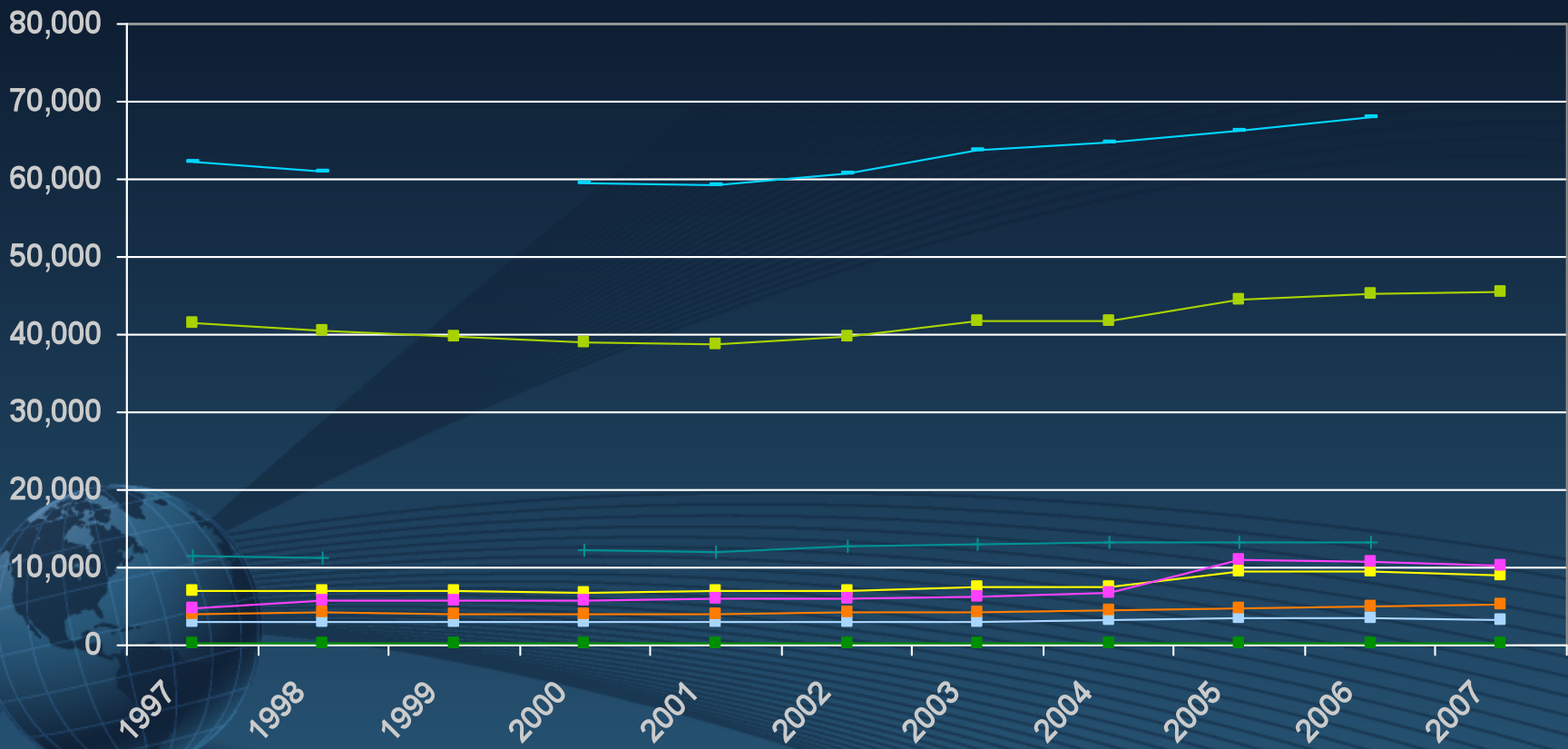
- Awareness
- Confidence and trust
- Cultural understanding
- Environment
- Facilities
- Opportunities
- Support





U.S. Demographic Data ENG BS Degrees Granted 1997-2007

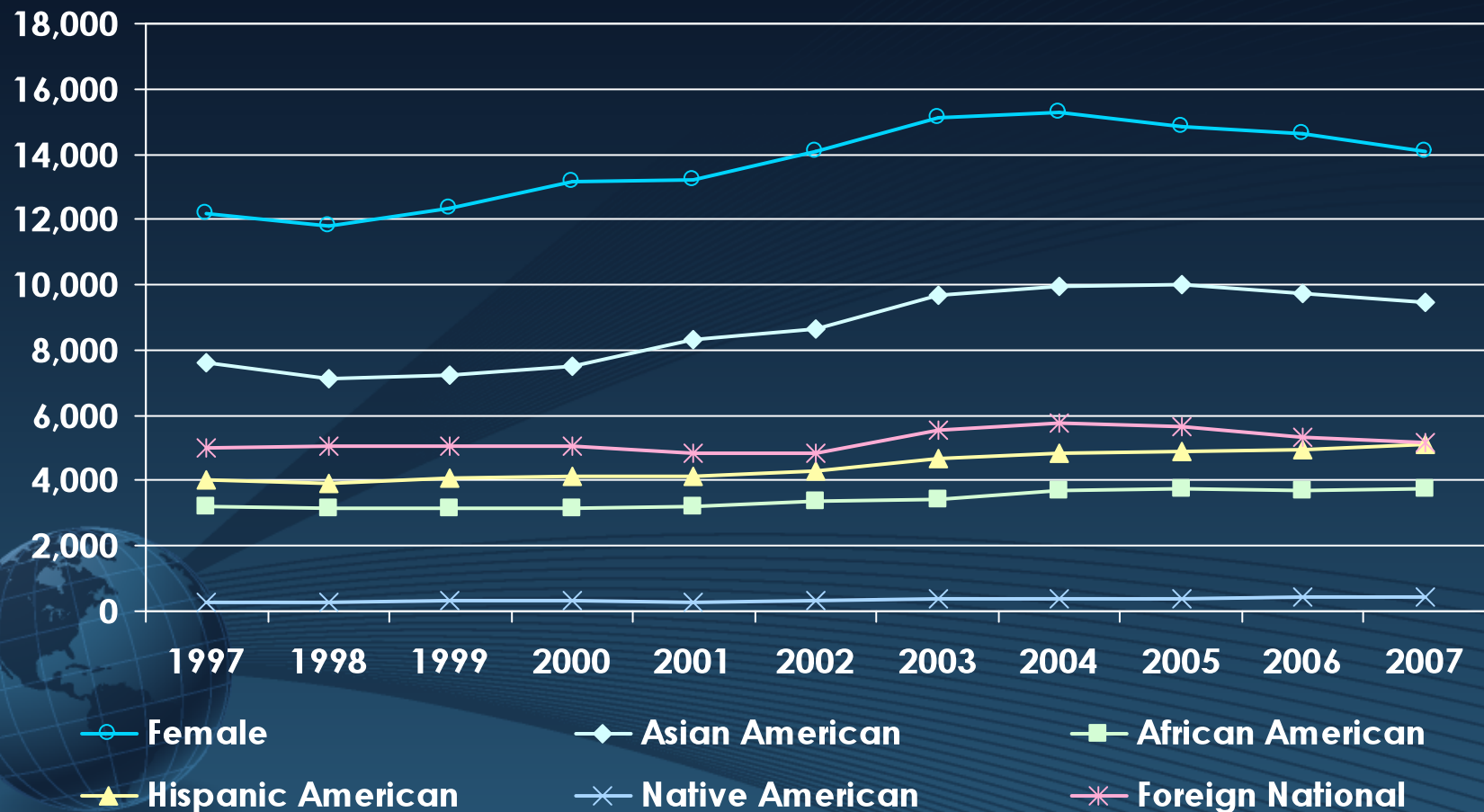
- African American
- Native American
- Women
- Asian American
- White, Non-Hispanic
- Line 8
- Hispanic
- Foreign National & Other
- All Degrees



Data: NSF Science & Engineering Indicators; DoEd National Center for Education Statistics



Bachelor's degrees awarded in Engineering, 1997–2007



Data: Engineering Workforce Commission, Engineering and Technology Degrees, 2007 (Washington, DC, 2008) ¹²



Average Participation in the Engineering Career Pipeline, 2001 to 2007 (%)





Opportunities: Broadening Participation in Engineering

- Broadening Participation Research Initiation Grants in Engineering (BRIGE)
- CAREER
- ADVANCE: Increasing the Participation and Advancement of Women in Academic Science and Engineering Careers
- Graduate Research Supplements (GRS)
- Graduate Research Fellowships (GRF) for Women
- Research Experience for Undergraduate (REU)
- Programs for Native Americans
- Engineering Research Center (ERC) Diversity Plan
- Research to Aid Persons with Disabilities (RAPD)
- Broadening Participation Workshops



Broadening Participation Research Initiation Grants in Engineering (BRIGE)

- Opportunity to increase the diversity of researchers through research support early in their careers
- Encourages support of under-represented groups, engineers at minority-serving institutions, and persons with disabilities



BRIGE awardee Stephanie Luster-Teasley (L) and NC A&T students Desiree Gordon and Patrick Onochie discuss preliminary research for the development of controlled-release polymers for environmental remediation.

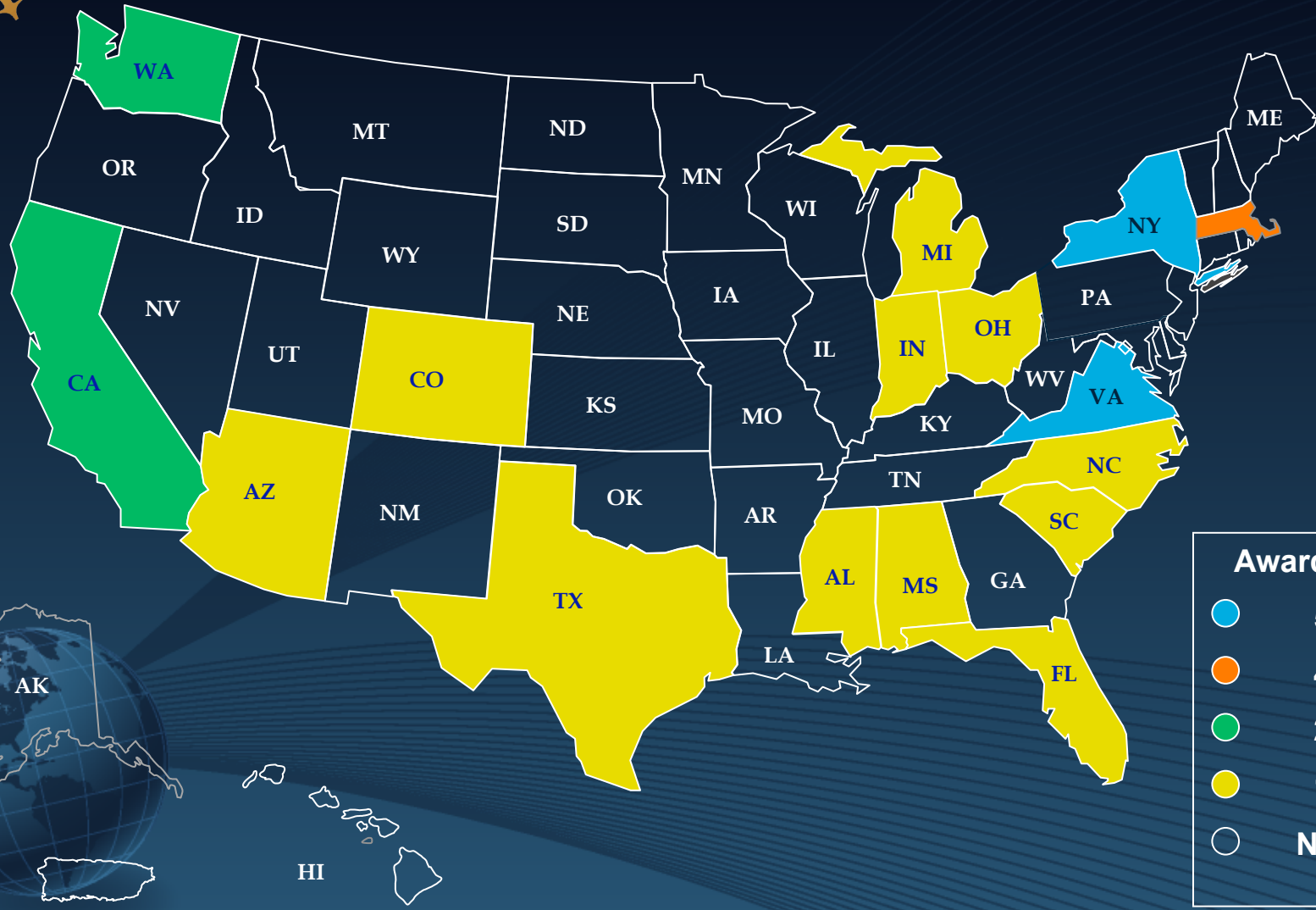


BRIGE Program (continued)

- Faculty must be a new investigator who has not previously served as PI or CO-PI on research grant more than \$50K.
- Must provide a section on how to Broaden Participation of women and underrepresented groups.
- Funding up to \$175K is available for two years
- Granted 28 awards in FY 2008 and 39 awards in FY 2009
- Success rate is 25% for FY 2008 and 31% for FY 2009



FY 2008 BRIGE Awards





Growth in ENG Research Support to Broaden Participation

◎ Broadening Participation Research Initiation Grants in Engineering (BRIGE)

- > Increased the number of awards due to ARRA funds:
- > 38 total BRIGE awards in FY 2009 (28 regular appropriation + 10 ARRA (28 total in FY 2008))
- > Reaching out to 9 new states and Puerto Rico

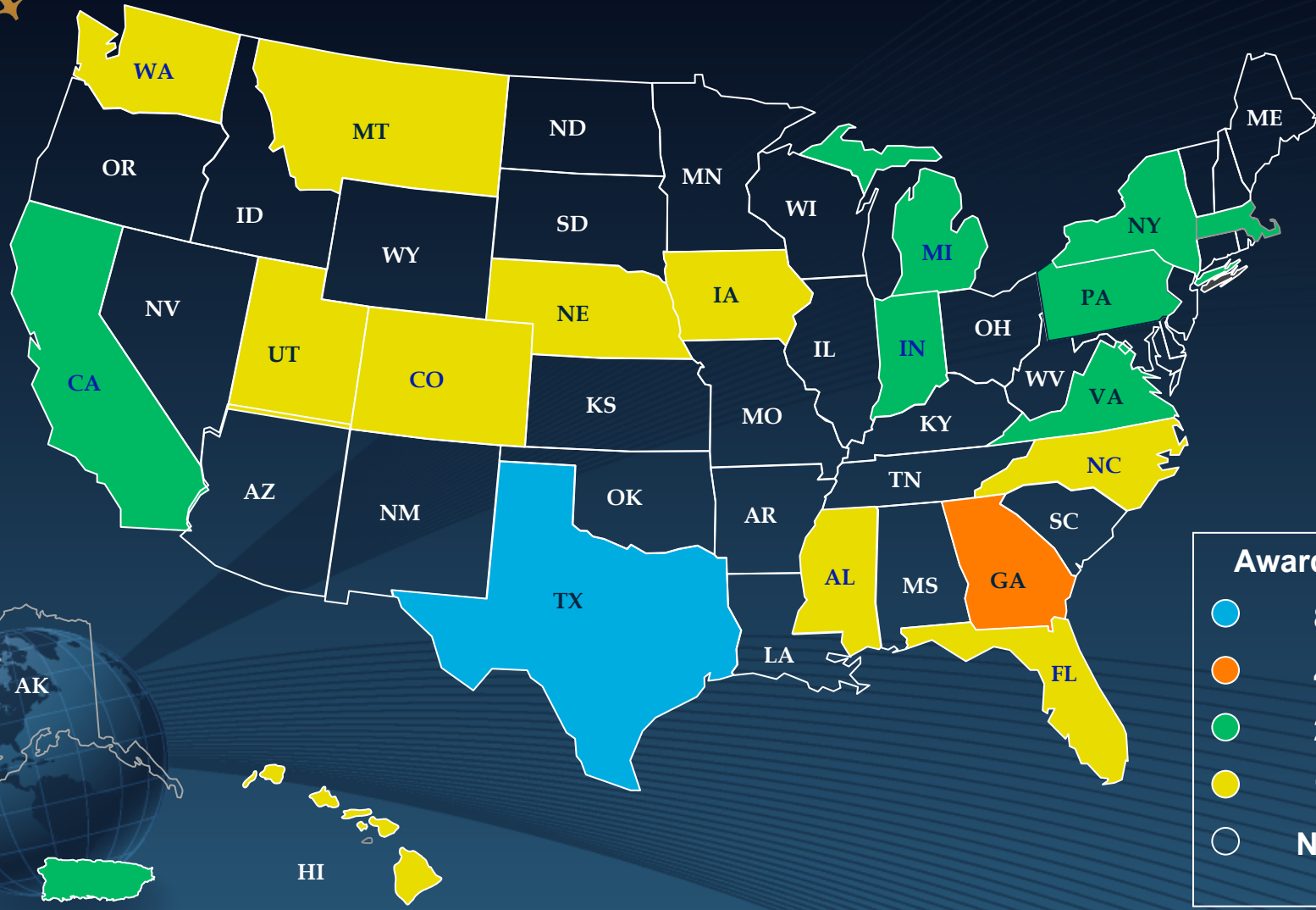
◎ Graduate Research Supplements (GRS)

- > 29 total in FY 2009 (12 CBET, 9 CMMI, 5 ECCS, 2 EEC, and 1 EFRI)





FY 2009 BRIGE Awards



NSF Directorate for Engineering



Growth in ENG Outreach to Broaden Participation

- National and International Workshops
 - > Address topics of community importance (e.g., renewable energy and other grand challenges, best practices in education)
 - > Involve students, faculty, and top administration from academe
 - > Provide global workshops in collaboration with OISE
 - > Leverage NSF support in partnership with others
- Collaboration with Professional Organizations
 - > Provide a strong presence at annual conferences
 - > Engage students, faculty, and community members
 - > Disseminate resources and develop curricula



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
- \$80M invested each year for 425 new awards
- ENG awards are ~\$400K for 5 years
- Deadlines vary by directorate;
ENG proposals due July 21, 2010

ENG Contact
Sharon Middledorf



ADVANCE: Increasing the Participation and Advancement of Women in Academic Science and Engineering Careers

ADVANCE supports three types of activities:

- ◎ **Partnerships for Adaptation, Implementation, and Dissemination (PAID)**

- > the adaptation, implementation, dissemination, and diffusion of effective materials and practices; and to advance understanding of gender in the STEM academic workforce (PAID-Research)
- > Letters of Intent due Jan. 20, 2009; full proposals due Feb. 24, 2009

- ◎ **Institutional Transformation (IT)**

- > Systemic organizational approaches for institution-wide change
- > Letters of Intent due Aug. 4, 2009; full proposals due Nov. 12, 2009

- ◎ **Institutional Transformation Catalyst (IT-Catalyst)**

- > institutional self-assessment activities to identify specific issues in the recruitment, retention, and promotion of women faculty in STEM academics
- > Letters of Intent due Aug. 4, 2009; full proposals due Nov. 12, 2009



Graduate Research Supplement (GRS)

- Provides one year of support (up to three times) (~\$41K/year) for graduate study leading to research-based doctoral degrees
- Encourages women, members of under-represented minority groups, and persons with disabilities to apply
- Faculty request GRS via their existing grants
- ENG invests ~\$2M for ~50 awards per year
- ENG requests (see Dear Colleague Letter) due May of each year

GRS Contact
Omnia El-Hakim



Graduate Research Fellowship (GRF) Program

- Provides up to three years of support (~\$40K/year) for graduate study leading to research-based master's or doctoral degrees
- Encourages women, members of under-represented minority groups, and persons with disabilities to apply
- NSF invests ~\$67M each year for ~1650 new awards
- ENG makes an additional 80 awards to women
- Deadlines vary by directorate;
ENG proposals due Nov. 12, 2009

GRF Contact
Gisele Muller-Parker



Innovations in Engineering Education, Curriculum, and Infrastructure

- ◉ Supports focused efforts that integrate research into advances in undergraduate and PhD engineering education, and partner with K–12 pipeline innovators
- ◉ FY 2010 awards will be made in the following areas:
 - > Innovations in Teaching and Learning
 - > Translation of Engineering Education Research into our Classrooms
 - > Implementation of Programs for Students Supported by the GI Bill
- ◉ ~\$8.5M for 35–40 awards



Human Resource Development

- Research Experiences for Undergraduates (REU)
 - > Supports the involvement undergraduates in meaningful ways in ongoing research programs or in research projects specifically-designed for the REU program
 - > \$10M/year available for engineering
 - > Deadline for site proposals in Aug. each year
- Research Experiences for Teachers (RET) in Engineering
 - > Supports the active involvement of K-12 teachers and community college faculty in engineering research in order to bring knowledge of engineering and technological innovation into their classrooms
 - > \$4M/year available
 - > Deadline in Nov. each year





Tribal College Initiative

- ◎ **Goal:** To expand the engineering and pre-engineering capacities of tribal colleges and universities (TCUs) through curriculum development and partnerships.
- ◎ **Approach:** Develop a 3-year pre-engineering curriculum based on success-oriented student cohorts, distance education, relevant coursework and projects, and mainstream university participation.





Programs for Native Americans

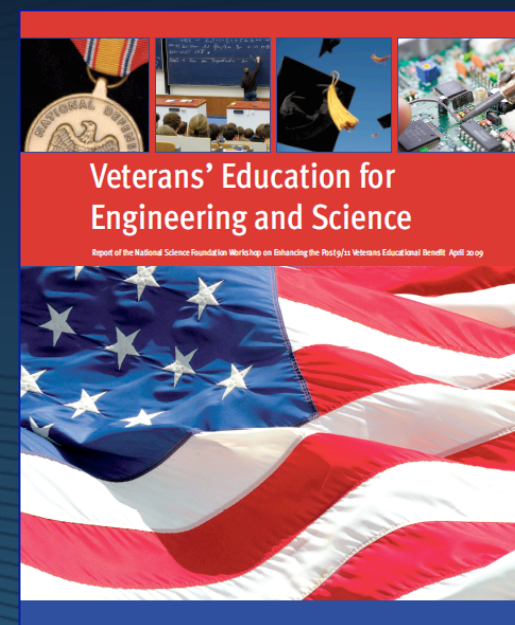
TCUP and PEEC

- Tribal Colleges and Universities Programs (TCUP) aims to enhance the quality of STEM instructional and outreach programs at Tribal Colleges and Universities, Alaska Native-serving institutions, and Native Hawaiian-serving institutions.
- Pre-engineering Education Collaboratives (PEEC) – new Implementation track supported by EHR/ENG
- PEEC supports pilot efforts in TCUP institutions to:
 - > Develop and/or enhance pre-engineering curricula
 - > Provide pathways from 2-yr colleges to 4-yr universities
 - > Provide internships, research experiences, and extramural learning opportunities; and faculty development
- 2–3 awards for up to \$1M per year (\$250K/institution) for up to five years



Innovations in Engineering Education, Curriculum, and Infrastructure

- ◉ Recruiting, transitioning, and supporting Veterans who pursue STEM education
- ◉ FY 2009:
 - > workshop report “Veterans’ Education for Engineering and Science”
 - > 7 planning grants
- ◉ FY 2010 Solicitation area “Implementation of Programs for Students Supported by the GI Bill”





Engineering Research Centers

- ERC Core Objectives
 - > Create and sustain an integrated, interdisciplinary research environment to advance fundamental engineering knowledge and engineered systems
 - > Educate a globally competitive and diverse engineering workforce from K-12 on
 - > Join academe and industry in partnership to achieve these goals
- Currently 15 funded ERCs in 3 technology clusters
 - > Biotechnology and health care (5)
 - > Energy, sustainability and infrastructure (4)
 - > Microelectronics, sensing and information technology (6)



Research to Aid Persons with Disabilities (RAPD)

- RAPD supports research that will lead to the development of new technologies, devices, or software for persons with disabilities
- Award size: \$80K/year for up to three years
- Undergraduate Engineering Design Projects are also supported, especially those that provide prototype "custom-designed" devices or software for persons with disabilities (\$25K/year for up to five years)
- Proposals due Sept. 17, 2009 and March 3, 2010

RAPD Contact
Ted A. Conway



U.S. Workshops

- Effective negotiation skills, San Diego, CA, August 2009.
- Recruitment and Transition of Community College Students to Four Year Institutions, Birmingham, AL, October 2009 (Collaboration with LSAMP).
- Enabling participation of Hispanic students in SHPE activities, National SHPE, DC, October 2009.
- Mentoring workshop for undergraduates who are from underrepresented groups or have a disability, Baltimore, MD, November 2009.
- Problem Solvers Conference: for engineering students with disabilities to share best practices & associated technological needs for success in academia and the professional environment, DC, November 2009.



U.S. Workshops (continued)

- Creating Partnerships and Pathways among Faculty and the Hispanic Community, UTEP, El-Paso, February 2010.

Other Workshop Ideas under Consideration:

- Diversity and outreach in SBIR/STTR programs
- Big 10 for Junior Women ENG Faculty
- Seamless Admission Summer ENG BRIGE program for underrepresented minority students
- Women and women minorities in nanoscience and engineering



Global Collaboration

(via NSF Office of International Science and Engineering)

- Explore global activities and international workshops to involve women and minorities.
- Inform current PIs about opportunities for supplements to support international activities.
- International Planning Visits: travel to plan collaborative research with prospective foreign partners.
- International Workshops: hold meetings to identify common priorities and approaches for collaboration on specific, well-defined research areas.



WIRES: Women International Research Engineering Summit

- ⦿ Venue: Barcelona, Spain. June 2-4, 2009
- ⦿ Theme: Enable sustainable research exchanges among female engineers in the world!





WIRES Summit

- Provide forum for women engineering researchers around the world to spark innovative research topics.
- Promote international partnerships and enable sustainable research exchanges in ENG disciplines.
- Understand how engineering research is conducted in many countries, sharing best practices and learning about different research approaches.
- Identify methods of securing funding from international sources, private sectors, and governmental agencies.



WIRES Outcomes

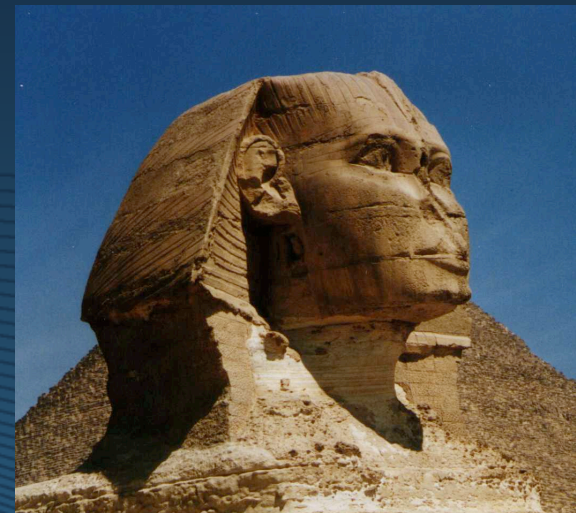
- 105 researchers from 23 countries (50 from U.S.) attended and showed posters
- Formed organizing committee for WIRES 2 Summit
- Several countries offered to host WIRES 2 Summit in 2011





Future International Workshops

- ◉ Sustainable energy workshop in Turkey in 2010
- ◉ Wind engineering workshop in Egypt in 2010





Resources

- ◉ Directorate for Engineering:
 - > <http://www.nsf.gov/eng>
- ◉ Funding Opportunities:
 - > <http://www.nsf.gov/funding/>
- ◉ E-mail
 - > aelhakim@nsf.gov
- ◉ Phone
 - > (703) 292-8300

