

**Engineering
Education &
Centers:
An Integrative
Role for the ENG
Directorate**

Spring 2014
ENG Advisory
Committee Meeting



Theresa A. Maldonado
Division Director
Engineering Education &
Centers

Engineering Education & Centers: An Integrative Role



- All Engineering disciplines
- ENG-wide roles (annual solicitations and program descriptions):
 - Engineering Education Research
 - Broadening Participation in Engineering
 - Research Experiences for Undergraduates
 - Research Experiences for Teachers



EEC Program Clusters



Centers & Networks

Engineering Education Research


Engineering Workforce Development




Division of Engineering Education and Centers



Theresa Maldonado Division
Director
Executive IPA



Bradley Clements Science
Assistant



Deputy Division Director
(VACANT)



Brooke Coley,
Science Assistant



Alisha Lynn
Williams
Operations
Specialist


Centers Misawa, (Acting) Lead




Eduardo Misawa
ERC



Deborah Jackson
ERC



Carmina Londoño
ERC



Carole Read
ERC, NSEC



Keith Roper IPA
ERC, NSEC

ENG Education Riley, Lead




Donna Riley
IPA
Engineering
Education


Fellows



Dr. Dorothy Jones-Davis
AAAS Fellow




Dr. Laurie Stepanek
AAAS Fellow



Kathy Hoppe,
Einstein Fellow


ENG Workforce Watford, Lead



Bevelee Watford,
IPA
Broadening
Participation



Esther Bolding
REU



Mary Poats
RET, NUE


Administrative Staff



Marshall Horner
Program Specialist
ERC



LaTanya
Sanders-Peak
Program Specialist
Division Secretary
REU, CAREER



Shalika Walton
Program Specialist
RET, NUE



Susan Watson
Program Specialist
REE, RIGEE



Marcia Rawlings
IT Specialist



CENTERS AND NETWORKS





Engineering Research Centers

LINKING DISCOVERY TO INNOVATION



[HOME](#) ▾ [ERC PROGRAM](#) ▾ [CENTERS](#) ▾ [ACHIEVEMENTS](#) ▾ [RESEARCH](#) ▾ [INNOVATION ECOSYSTEM](#) ▾ [EDUCATION PROGRAMS](#) ▾

[BEST PRACTICES MANUAL](#) ▾

HIGH-IMPACT ACHIEVEMENTS

ADDRESSING NATIONAL PRIORITIES

Chief Architect of the ERC Program, Lynn Preston Retires

[Full Story](#)

Lynn Preston
Guest Book

<http://erc-assoc.org/>

History: 1985 National Academies charged federal agencies to...

- **Focus on fields to strengthen US competitiveness**
- **Increase engineering faculty committed to cross-disciplinary teams**
- **Focus on engineered systems**
- **Prepare creative, innovative engineers to influence US productivity**
- **Include industrial engineers as partners to stimulate technology transfer**

NSF Response: Create the Engineering Research Centers program with the GOAL...

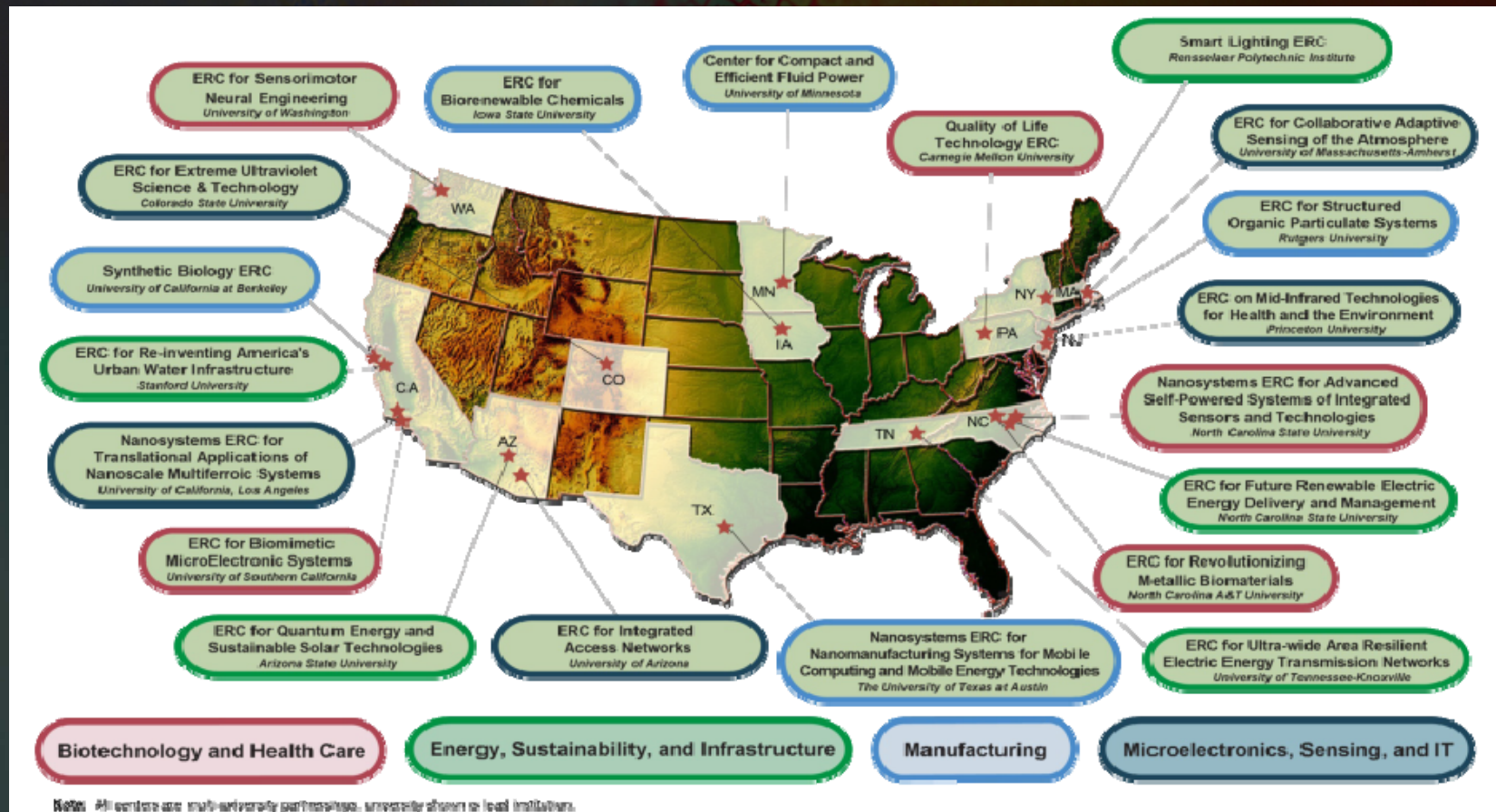
to “further the development of fundamental knowledge in engineering fields that will

- Enhance the competitiveness of the U.S. and
- Prepare engineers to contribute through better engineering practice.”

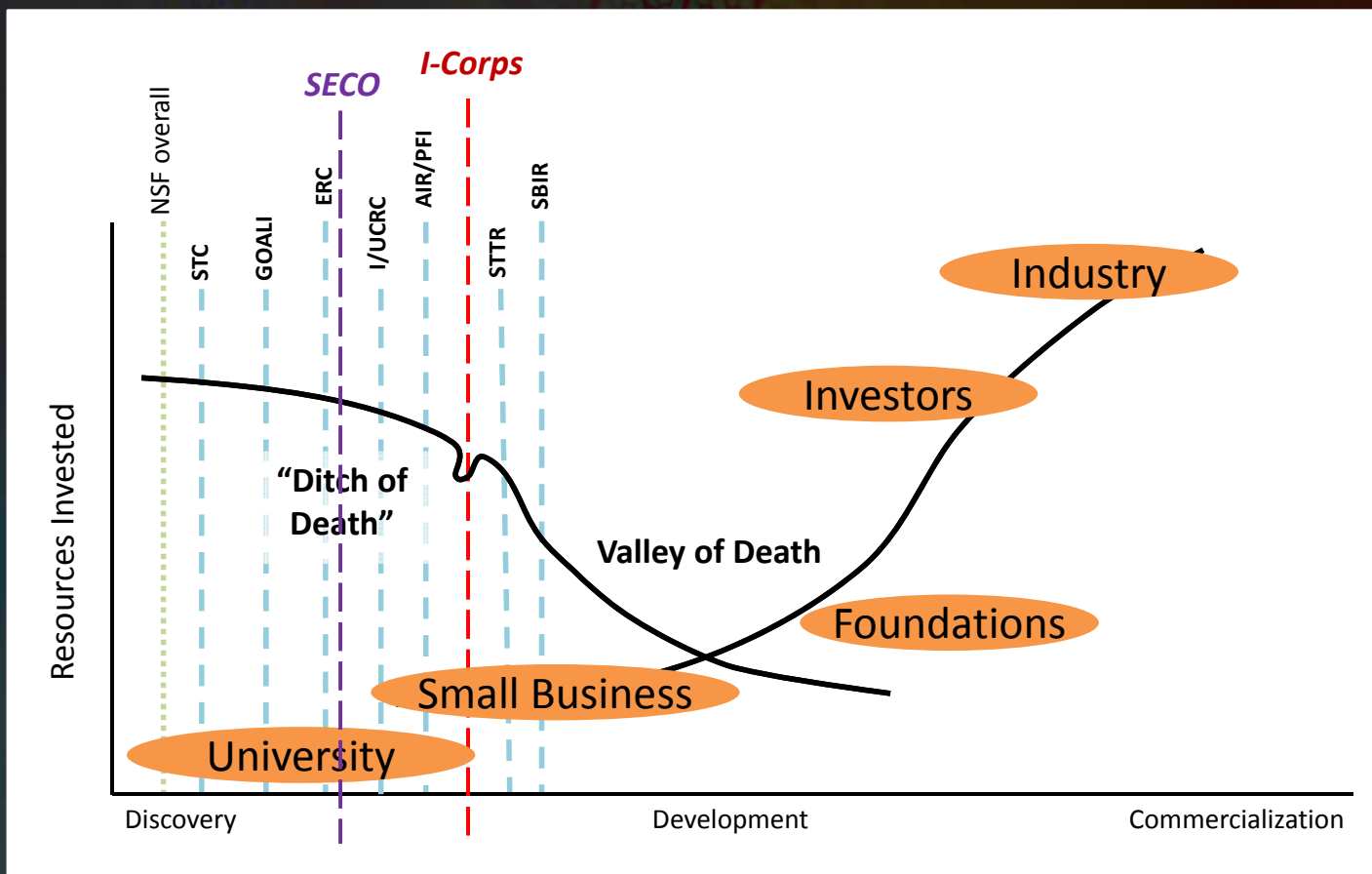
The ERC core elements have been sustained over time through three generations of the program.

- Strategic vision for transforming engineered systems
- Research
 - Systems-motivated, interdisciplinary, team-based
 - Societal-relevant, problem-focused
- Education
 - Interdisciplinary
 - Team-based
 - Global engagement
- Technology/knowledge transfer
 - Long-term university-industry-government partnerships
 - Mechanisms to accelerate innovation and technology transfer
- People
 - Community of scholar-educators
 - Diverse, globally competitive engineering workforce...

There are 17 active centers.



Gen-3 ERC: Small Business / ERC Collaborative Opportunity (SECO)



History of NSF funding from 1996 through to an ERC: USC – Biomimetic Microelectronic Systems ERC

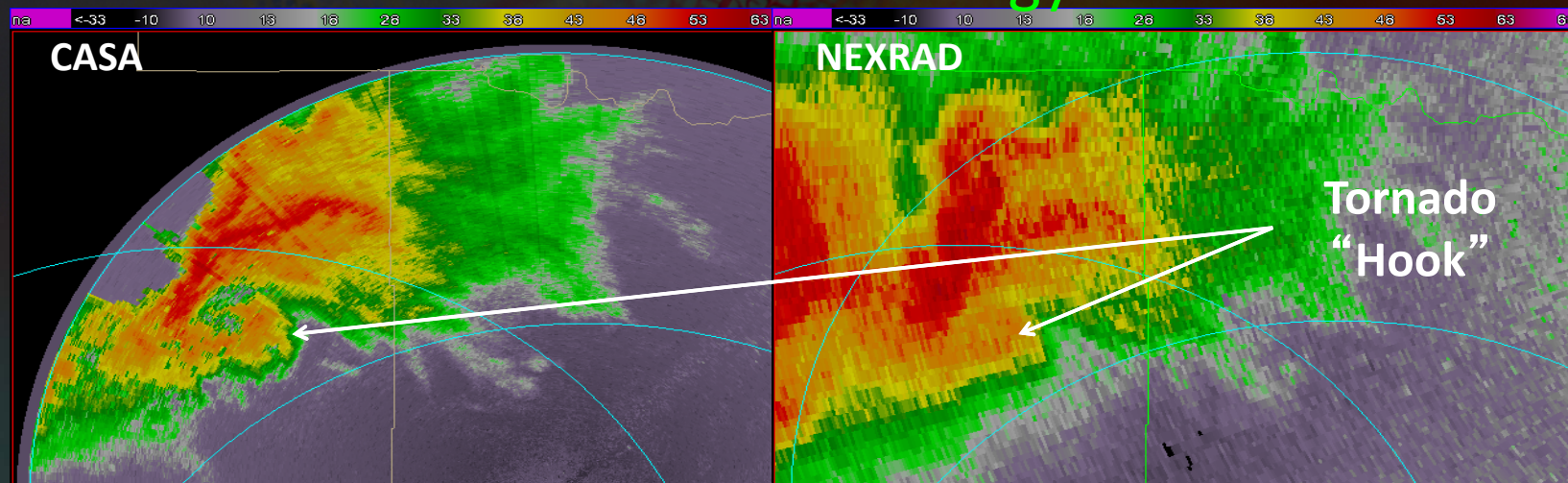


- An external camera sends images to a microelectronic implant in the eye
- The implant stimulates the retina of a blind person to provide a sense of vision
- The retinal implant is commercially available in Europe and the US (FDA approved for clinical use)
- Current implants – navigation and letter reading
- Future implants – face recognition

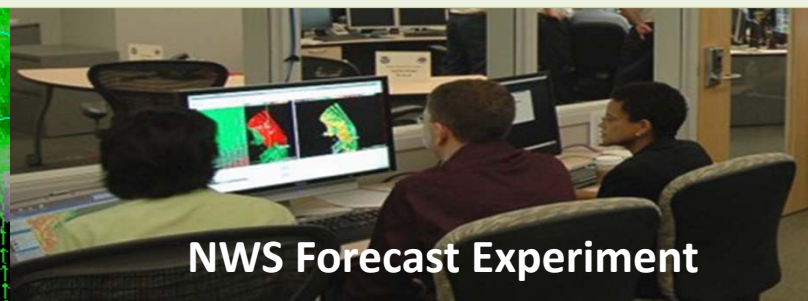
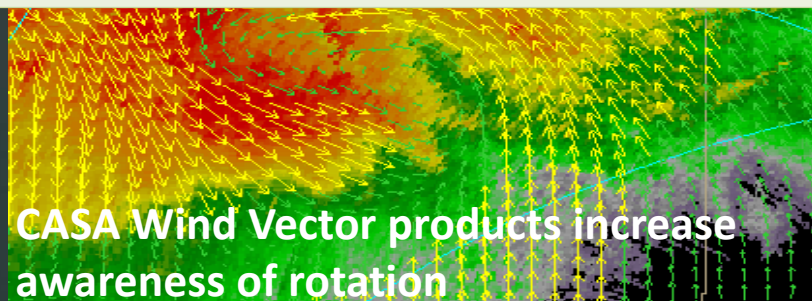
Intraocular Retinal Prosthesis



ERC value-added in research and technology



CASA Tornado Warning Issued
3 minutes before official warning (NWS)
Real Time Warning Experiment with Forecasters





CASA Value Chain: Practitioner Partner Program



Manufacturers

Integrators

Early Adopters

Customers

Antenna/ sensor manufacturers, Radar system manufacturers, end-to-end system integrators

Various users and beachhead customers

Economic customers (buyers) including federal agencies, foreign met. offices, municipalities

- SECO Award #1246469 \$200K
- AIR Award #1237767 \$1.3M
- CASA
- Stormwater Mgmt. Div City of Ft. Worth-\$300K
- Nat. Weather Service-\$275K
- Ft Worth Weather Forecast Office
- N. Central TX Council of Governments-\$60K
- Ridgeline Instruments-\$75K
- Ft Worth Emergency Mgmt. Operations-\$56K
- UTexas-Arlington
- U North Texas





Nanoscale Science & Engineering Centers (NSEC) Awards

5-year awards via NSF-wide competition
renewable for further 5 years

2001 NSECs

Cornell (CNS-IT)
Columbia (CETMN)
Harvard (SNS-DA)
Northwestern (CINDT)
Rensselaer (C-DAN)
Rice (CBEN)

2004 NSECs

Northeastern (CHN)
Ohio State (CANPBD)
Penn (N/BI)
Stanford (CPN)
UC-Berkeley (COINS)
Wisconsin (TSAN)

2003 NSECs - Manufacturing

UC Berkeley (SINAM)
Illinois (Nano-CEMMS)

2004- Nanoscale Center for Learning and Teaching

NWU and partner institutions

2005 - Nanotechnology in Society

Arizona State (CNS)
UCSB (CNS)

2006 Manufacturing UMass (CHM)

2008 Environmental Implications – Duke and UCLA

NanoSystems ERCs

ASSIST: NC State, lead
Penn State, FIU, UVA,
UNC-Chapel Hill

NASCENT: UT Austin, lead
UC Berkeley, UNM

TANMS: UCLA, lead
Cornell, UC Berkeley,
Cal State Northridge

NNI is a national multi-agency initiative and an NSF-wide priority area.
About a dozen NSF Divisions co-fund and co-manage NSECs.

New ERC competition is underway...



Interdisciplinary
Research

Engineered
Systems Vision

Education

Innovation
Ecosystem

Infrastructure

- 188 pre-proposals received
- 18 invited for full proposals
- Deadline: June 2014
- Awards in FY15

What will the future of the program look like? What role will it serve?

July 16, 2014

16



The Network for Computational Nanotechnology (NCN) is a powerful platform for nanoscale modeling and simulation research and education.



"nanoHUB builds an extraordinary community among different disciplines and industries involved in nanotechnology and allows them to collaborate more efficiently. It's a virtual community that shows there are more solutions than there are problems."

-Jack Ullrich
Author of "The Next Big Thing is Really Small"

> 260K users globally

Re-competed in 2012

– Cyberplatform

– Two content nodes:

- NEEDS (Nano-SPICE)
- Nano-Bio

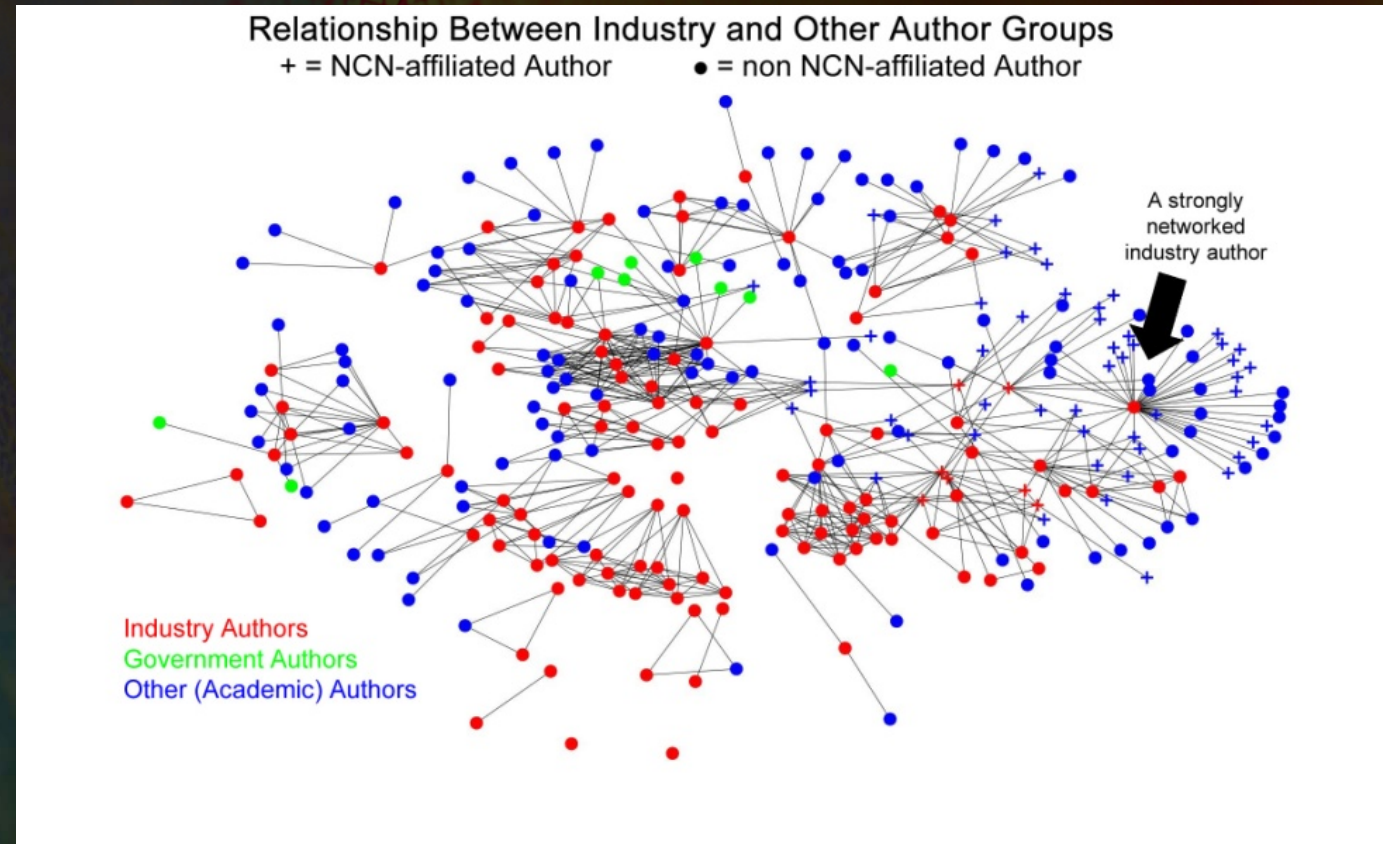
nanoHUB cited in 1,000+ papers (682 papers in North America)

2,019 authors

NCN impacts industry collaborations.



Demonstrates how nanoHUB facilitates the building of networks both within and outside of the NCN



NCN Nano-Engineered Electronic Device Simulation (NEEDS) Node



NEEDS aims to create a complete model development environment (NEEDS-SPICE) to support the creation of high-quality compact models by technology developers and to provide designers with models that run robustly on both open source and commercial platforms.

Purdue University
MIT
UC-Berkeley
Stanford University (co-funded by SRC)



NCN nanoBIO Node



provide simulation building blocks and educational resources for use in nanoBIO device engineering. Building a new community which bridges engineering and biology through strategic partnerships and outreach activities.

University Illinois – Urbana Champaign
University California - Merced





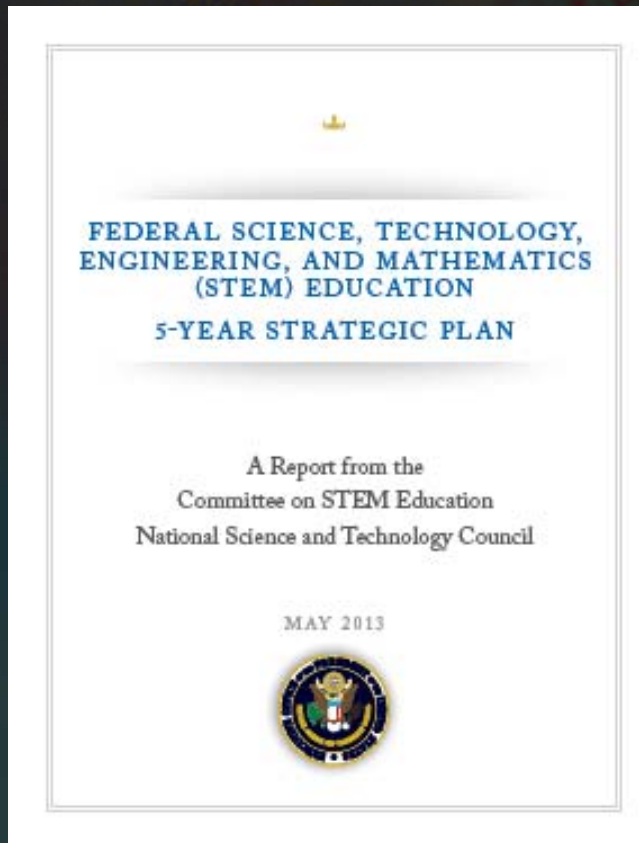
ENGINEERING EDUCATION RESEARCH



STEM

Critical thinking,
creativity,
leadership, etc.

Technical
Depth



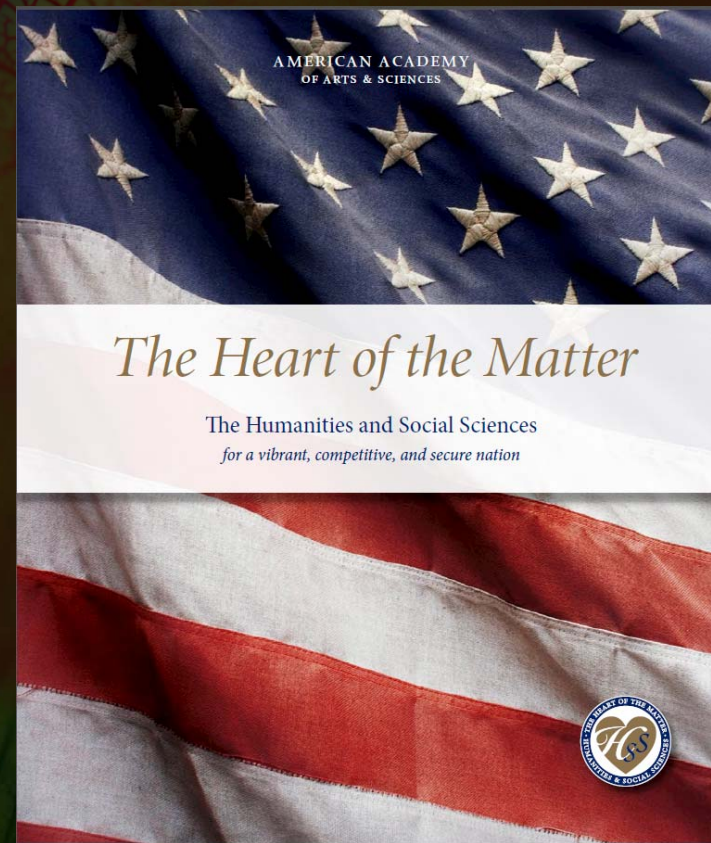
http://www.whitehouse.gov/sites/default/files/microsites/ostp/stem_stratplan_2013.pdf

Humanities & Social Sciences



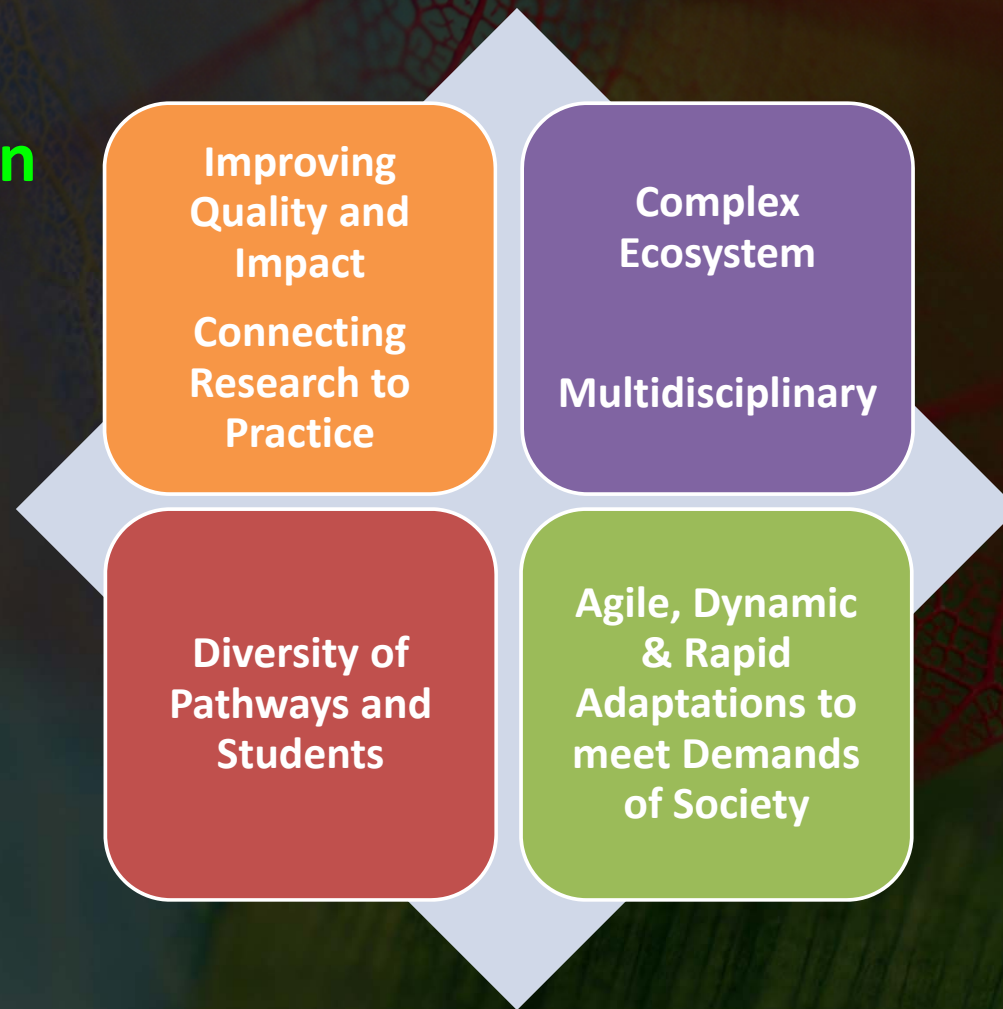
Principles of
STEM

Critical thinking,
leadership,
creativity, etc.



http://www.humanitiescommission.org/_pdf/hss_report.pdf

Engineering Education Vision





Engineering Education						
Program	Year	Number of Awards	Average Annual Amount	Maximum	Minimum	Average Award Duration (years)
REE	2011	16	\$284,884	\$1,793,272	\$16,525	2.42
	2012	22	\$309,009	\$769,110	\$49,556	2.54
RIGEE	2011	12	\$151,954	\$179,440	\$131,093	2.04
	2012	9	\$147,778	\$150,000	\$133,293	1.99
Workshops	2010	5	\$208,736	\$79,927	\$421,626	2.09
	2011	2	\$45,019	\$40,037	\$50,000	1.50
	2012	3	\$264,666	\$290,996	\$233,178	2.09
IEECI	2010	49	\$213,815	\$889,944	\$20,241	2.76
CAREER	2010	4	\$411,883	\$443,576	\$400,109	5.00
	2011	6	\$442,809	\$466,681	\$400,682	4.98
	2012	1	\$400,000	N/A	N/A	0.00
Innovation	2010	5	\$1,320,052	\$1,800,000	\$600,000	2.89
NUE	2010	14	\$200,698	\$210,000	\$199,868	2.62
	2011	13	\$188,691	\$226,250	\$50,000	2.00
	2012	11	\$199,818	\$200,000	\$199,018	1.99
IREE	2010	1	\$959,736	N/A	N/A	1.20



National Center for Engineering Pathways to Innovation

What is the Epicenter?

The Epicenter is dedicated to infusing entrepreneurship and innovation skills into undergraduate engineering in the United States.

Funded by the National Science Foundation and directed by the [Stanford Technology Ventures Program](#), the Epicenter is an education, research and outreach hub for the creation and sharing



**\$10M for five years
EHR/DUE and ENG/EEC**

Get Epicenter Updates

* indicates required

Email Address

First Name

Last Name

Who are you? Check all that apply.



**STEP Center
Joint EHR/ENG**

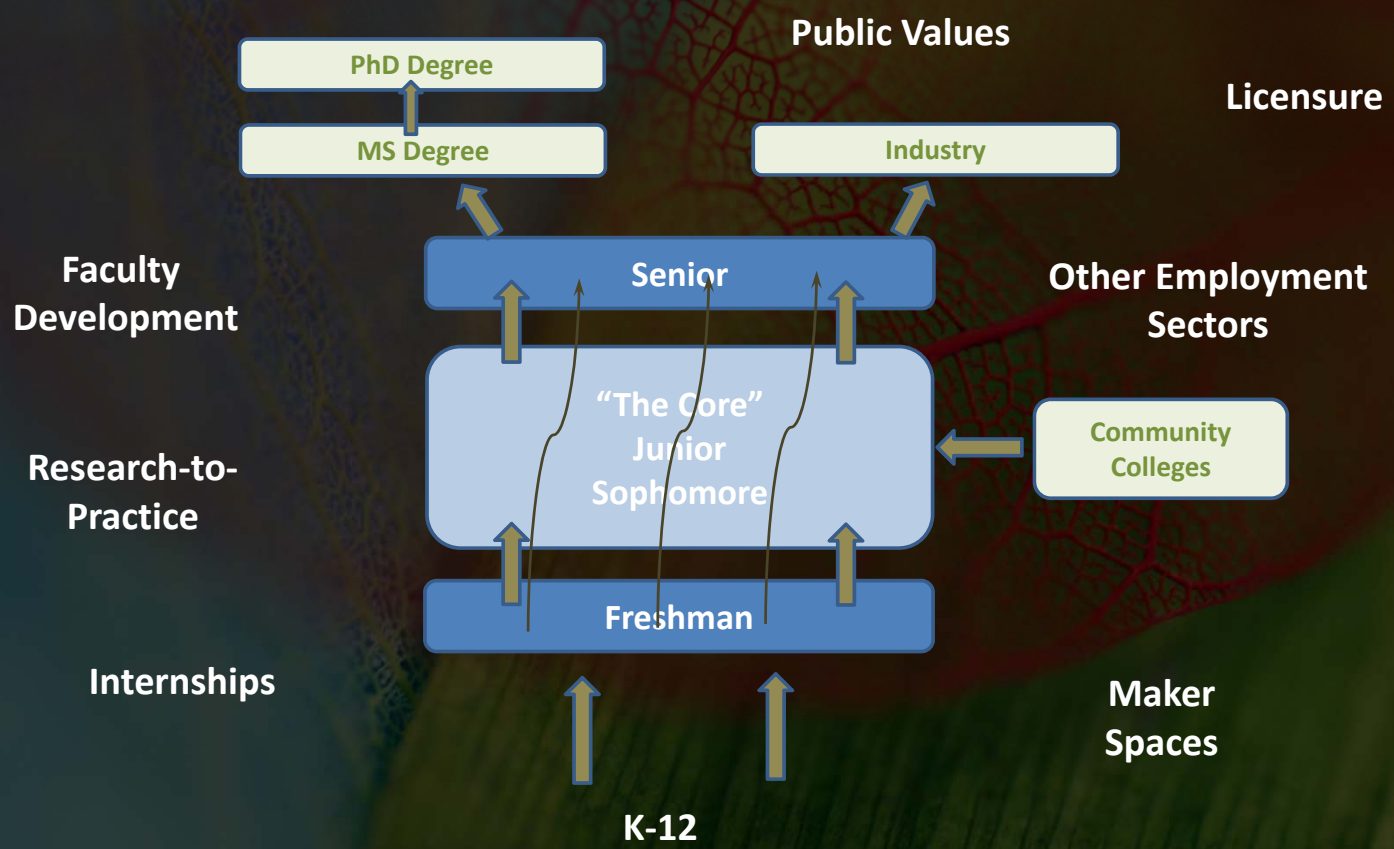
\$2M/yr for 5 years



Epicenter: <http://epicenter.stanford.edu/>

National Collegiate Inventors and Innovators Alliance: <http://nciia.org/>

Professional Formation of Engineers





Are we approaching this complex adaptive engineering education system correctly when > 73% of ALL students enrolled in UG programs in the U.S. are non-traditional?*

*Nontraditional Student

- Delays enrollment
- Attends part time for at least part of the year
- Works 35 hrs. or more per week while enrolled
- Is considered financially independent (i.e., when determining financial aid)
- Has dependents other than a spouse
- Completed secondary education with GED or other certificate or did not finish high school

<http://www.ere.net/2012/06/13/recruiting-the-73-nontraditional-students-must-be-part-of-your-plan/>



ENGINEERING WORKFORCE DEVELOPMENT





The minority is becoming/has become the majority.

States with the most minorities under age 1, 2011*

By percentage (actual number of minorities)



* The District of Columbia is 67.7% (6,041)

Source: U.S. Census Bureau

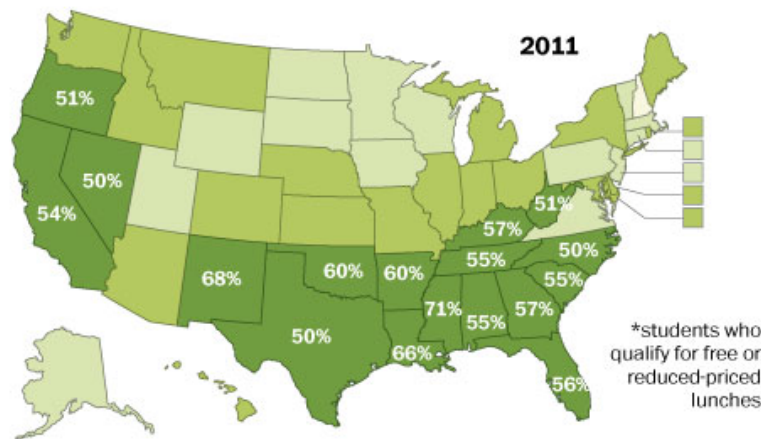
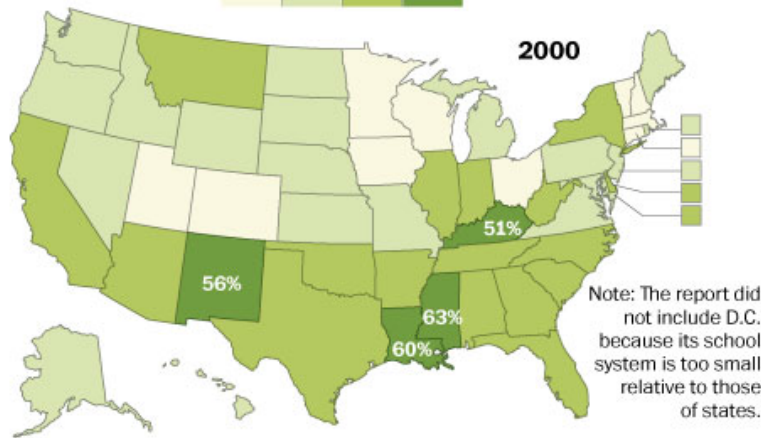
Robert Calzada/American-Statesman

<http://www.statesman.com/news/local/in-texas-7-in-10-children-under-age-2360672.html#.T-psxHtnYtg.email>



Percentage of low-income students*

30% 40 50%



Poverty increasing in public schools

Low-income students made up at least half the public school student population in 17 states in 2011, a marked increase from 2000, when four states topped 50 percent.

Washington Post, 10/16/2013

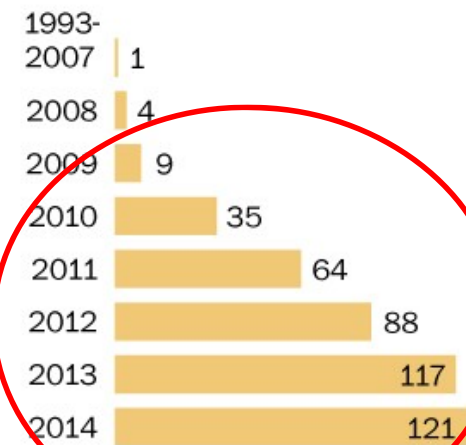
“More college students battle hunger as education and living costs rise”

Washington Post, 4/9/2014

Growth in college food banks

The number of food pantries on college campuses has increased rapidly in the past six years — especially at colleges with a lot of low-income or first-generation students.

Number of college campuses that have started food banks after consulting with MSUSFB



Source: Michigan State University Student Food Bank

The Washington Post

http://www.washingtonpost.com/local/more-college-students-battle-hunger-as-education-and-living-costs-rise/2014/04/09/60208db6-bb63-11e3-9a05-c739f29ccb08_story.html



U.S. demographics are experiencing accelerated shifts. Are we cognizant of these shifts as we focus on (meaningful and realistic) societal impact of research and education innovations supported by the Engineering Directorate?





Research Experiences for Undergraduates (REU)

*...has inspired many students to
continue their studies in Engineering
and other STEM-related disciplines.*

Research Experiences for Teachers (RET)

*...has inspired many teachers to
continue their professional development
in STEM and make an impact in
their classrooms.*



Engineering Workforce Development



	Number of Awards	Reviewed by Panel	Reviewed Ad-Hoc	Percentage of Ad-Hoc reviews
REU	77	77	0	0%
RET	26	23	0	0%
BRIGE*	4	1	3	75%

* BRIGE ENG-wide
FY08-FY12: 153 awards
Award: \$175K for 2 yrs.





ENG Broadening Participation

- Broadening Participation Program: May 1
- NSF Community
 - NSF employees
 - Panelists
- PI Community
 - Education
 - Building Relationships
- ERC
 - Formal review for education, diversity and outreach
- Social inequality (IUSE Ideas Labs)
- Engineering Databook



Dr. Bev Watford





Internal strategy: Minimizing implicit bias in proposal evaluation

- What is *implicit bias*?
 - Hypotheses/stereotypes about a group, often about competence, may be implicit or unconscious
 - Accumulation of disadvantage
 - Small bias in same direction has large effect over time
 - Very small differences in treatment can have major consequences in salary, promotion, and prestige (*Valian, 1998*)
- Launched in EEC and a few programs elsewhere
- Will use for CAREER and other programs in ENG



The ERCs engage diverse leaders and teams.



*What can we learn
about the culture of
centers that may
positively impact diverse
engagement and
productivity in engineering
research, education, and
innovation?*





EEC = The Integrator

- Education
- Research
- People
- Knowledge transfer and partnerships

