TAMEST The Academy of Medicine, Engineering & Science of Texas

INNOVATING TEXAS

TAMEST ★ 2020 Annual Conference

RESEARCH TO COMMERCIALIZATION

#TAMEST2020 TAMEST.ORG/2020

The Relevance of the NAE to Innovation

John L. Anderson
National Academy of Engineering
January 8, 2020

Mission of the NAE

- Advance the well-being of the nation by:

  1. promoting a vibrant engineering profession
  2. marshalling the expertise and insights of eminent engineers to provide independent advice to the federal government on matters involving engineering and technology

The NAE is a service organization.

About the NAE

- Not a government org – we are 501 (c3) nonprofit, 35 staff
- 2300 Members (US), and 270 International Members
- First **woman** elected in 1965 (Lilian Gilbreth); second in 1973.

  25% of Members elected 2016-19 are women
- Lagging on membership of underrepresented minorities

  7% of Members elected 2016-19 are minorities

About the NAE - continued

- 31% of our Members were born outside the US

  26% for NAS

- 58% of “active” Members participated in NAE/NRC activities in 2018
- 50% of Members elected 2016-19 are from **business**

  Challenge: Engage business community

National Research Council (NASEM)

- Operating arm - to serve the government
- 1000+ employees
- Presidents of 3 Academies are Chairs/Vice Chairs
- 7 Divisions
- 80% funding from US government
- “Transformation” study + Strategic Planning

What is "engineering"

"A scientist studies what is, whereas an engineer creates what never was."

~ Theodore von Kármán

What is "engineering"

"We use the term 'engineering' in a very broad sense to mean any engagement in a systematic practice of design to achieve solutions to particular human problems."

> ~ *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas* (NASEM, 2012; p. 11)

What is "engineering"

"Engineering is the act of creating artifacts, processes, or systems that advance technology and address human needs using principles of the sciences, mathematics, computing, and operations."

~ Suggestion of *The Bridge* (winter 2019)

What is "innovation"?

- More than a good idea
- More than solving existing (identified) problems
- More than just making money (e.g., in education)
- Affects the way we communicate/work/play/think
- Spurs R&D

"The Gift of Doubt" by Malcolm Gadwell
Albert O. Hirschman, *The New Yorker*, June 24, 2013

Hirschman was a planner who saw virtue in the fact that nothing went as planned. Illustration by Ricardo Martinez.

"Creativity always comes as a surprise to us; therefore we can never count on it and we dare not believe in it until it has happened. Hence, the only way in which we can bring our creative resources fully into play is by misjudging the nature of the task ……. undemanding of the creativity than it will turn out to need."

NAE's relevance to innovation?

- Get out of Washington - Listen
- Highlight/recognize engineering accomplishments (NSF study)
- Trace important patents/start-ups to financial support
- Recognize innovative engineers with membership in NAE

Relevant programs of the NAE

- Frontiers of Engineering (FOE)
- Grand Challenges
- Systems Focus
- EngineerGirl

US-FOE at Boeing factory 2019

2019 EU-US Frontiers of Engineering Symposium

Overview | Program 30 | Participants 61

At-a-Glance

The 2019 EU-US Frontiers of Engineering symposium was held November 18 - 20 in Stockholm, Sweden. About 60 outstanding engineers under the age of 45 met for an intensive 2-1/2 day symposium to discuss cutting-edge developments in four areas: 5G and Internet of Things, Materials Engineering Enabled by Advances in Imaging, Systems Approaches to a Clean Environment, and Smart Manufacturing. The event facilitates international and cross-disciplinary research collaboration, promotes the transfer of new techniques and approaches across disparate engineering fields, and encourages the creation of a transatlantic network of world-class engineers.

The symposium was hosted in partnership with the European Council of Academies of Applied Sciences, Technologies, and Engineering. The Royal Swedish Academy of Engineering Sciences (IVA) is serving as the administrator and organizer for the European side of the event.

Details

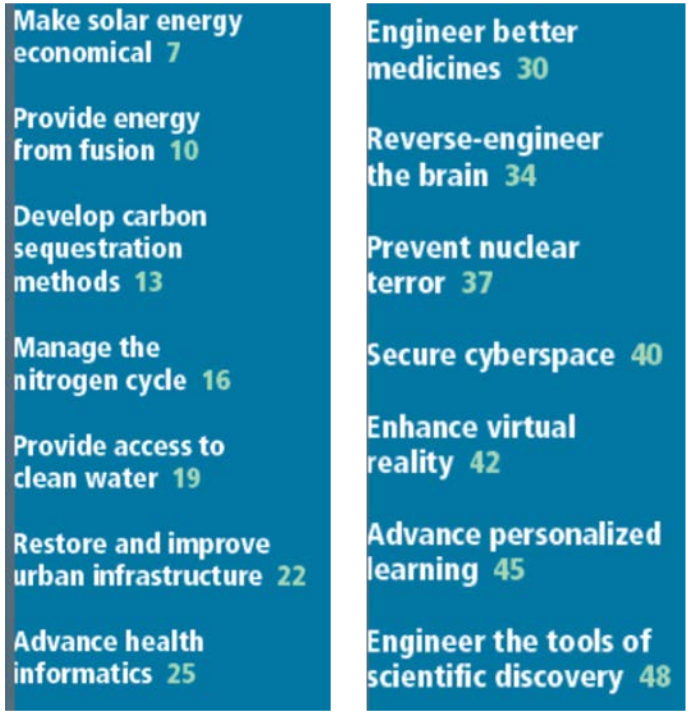
NOVEMBER 18 2019 TO NOVEMBER 20 2019

LAST UPDATED

January 06, 2020 AT 06:55 AM

LOCATION

Global Grand Challenges for Engineering



- ~ 5 relate to climate change
- ~ 5 relate to biomedical systems
- Leverage these & relate to innovation
- Grand Challenges Scholars Program

Grand Challenges Scholars Program (GCSP)

- Initiated by three universities in 2009
- Currently certificate programs at >80 engineering schools globally
- Biennial summits – US, UK, China

  → International teams of students

GCSP Desired Competencies:

1. Talent (project)
2. Multidisciplinary (systems)
3. Business/Entrepreneurship
4. Multicultural awareness
5. Social awareness

Global Grand Challenges for Engineering

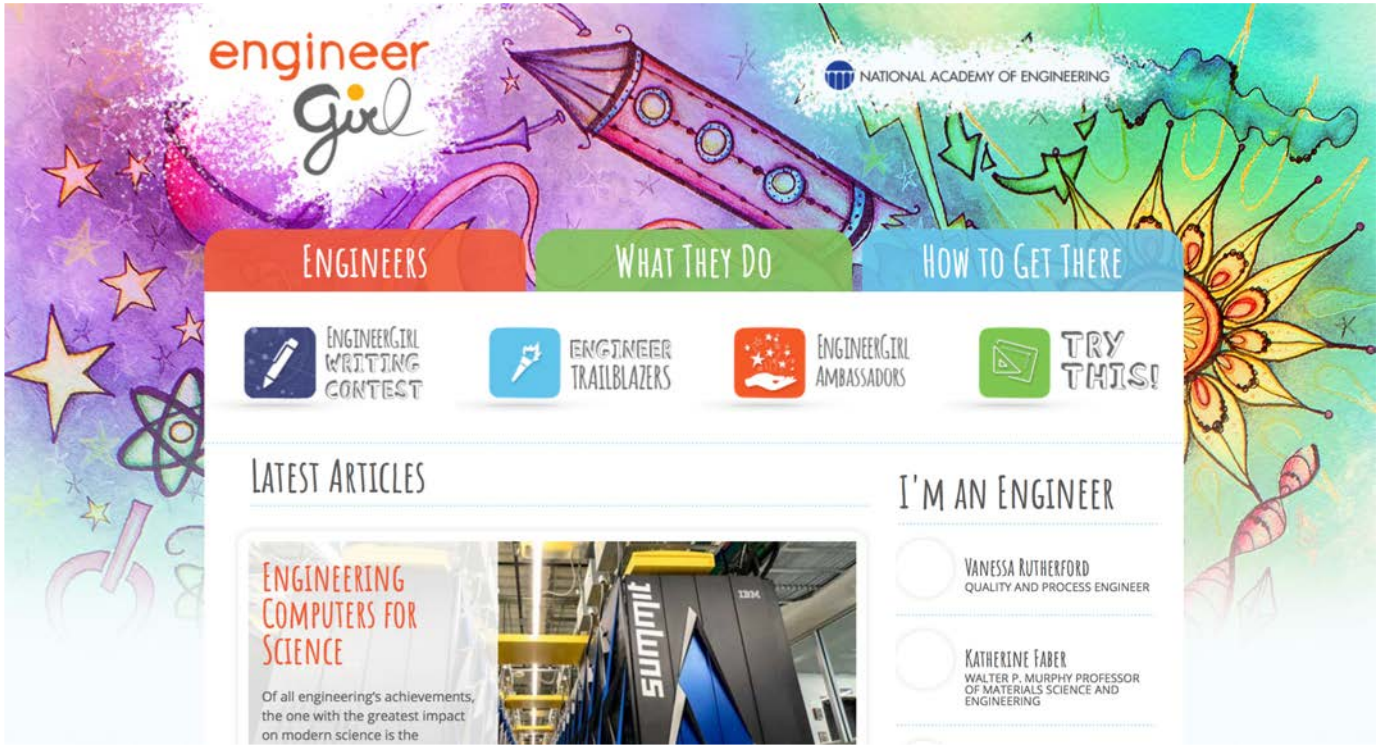
- "The Carbon Free Farm", Jay Schmuecker, *IEEE Spectrum*, Nov 2019, p. 30

CARBON-FREE FARMING: Creating fuel and fertilizer on the farm requires a lot of interconnected parts. Behind the solar panels, a long, squat building houses the tractor and control equipment; two small white huts house the ammonia generator and hydrogen pumps. The white tanks in front of them store the generated nitrogen and hydrogen, while the large gray tanks store additional hydrogen at high pressure. To the far right are the steps and railings of the tractor fueling dock.

Systems

- Climate
- Health and well-being
- Energy and power
- Mobility (including transportation)
- Information management and security
- Complex machinery (e.g., airplane)
- Education

Engineer Girl (https://www.engineergirl.org)



Final thoughts on Innovation

- If you're comfortable, you're not going fast enough.

Final thoughts on Innovation

- Change was realized by men and women who took the next step, not those who theorize about the 200th step.

Final thoughts on Innovation (and Research)

- Not everything that can be counted counts, and not everything that counts can be counted.