



NATIONAL ACADEMY OF ENGINEERING

Fr: Continuation of Life on the Planet
To: The Grand Challenges for Engineering

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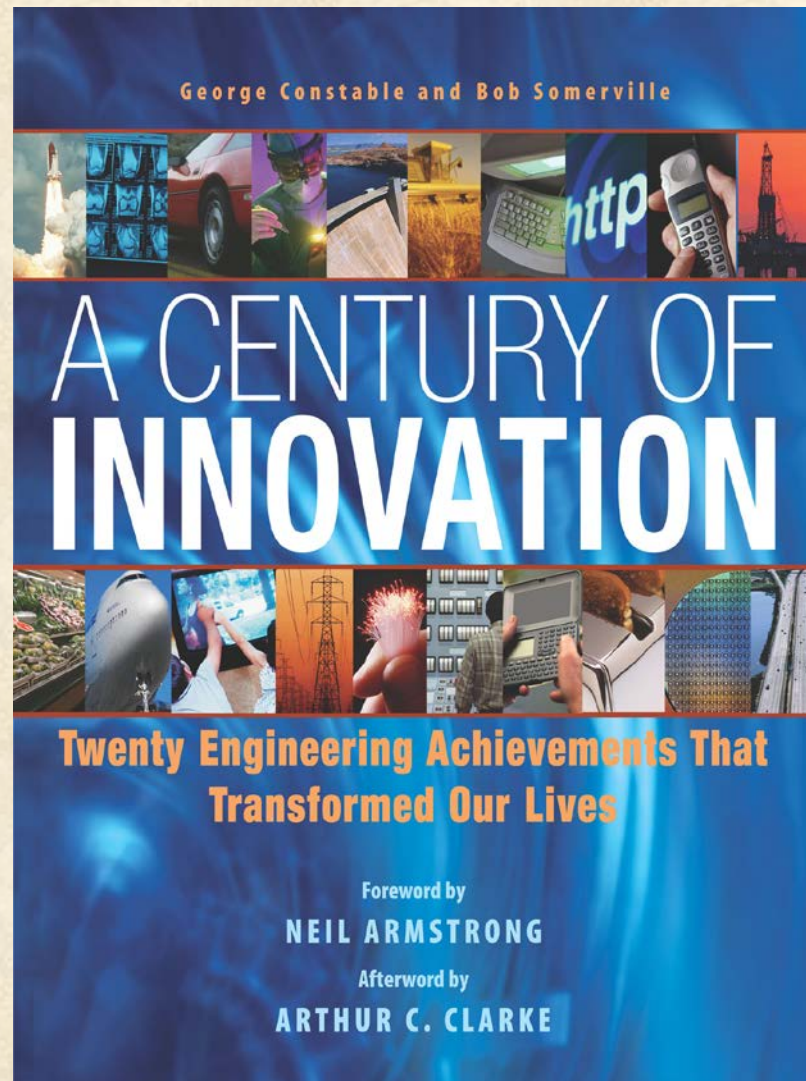
University of California, Irvine
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Today's Takeaways

1. National Academy of Engineering
 - what is it?
 - what does it do?
2. Grand Challenges for Engineering
 - where did they come from and why?
3. Grand Challenges Scholars Program
 - Educational platform to prepare students for global problems like the grand challenges

Engineering in the 20th Century



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20th Century Greatest Engineering Achievements

1. Electrification
2. Automobile
3. Airplane
4. Water supply and distribution
5. Electronics
6. Radio and television
7. Agricultural mechanization
8. Computers
9. Telephone
10. Air conditioning/refrigeration
11. Interstate highways
12. Space flight
13. Internet
14. Imaging
15. Household appliances
16. Health technologies
17. Petrochemical technology
18. Laser and fiber optics
19. Nuclear technologies
20. High-performance materials

21st Century Engineering Achievements

What will be the **engineering achievements**
in the 21st century?

Hmmm . . . not possible to predict, but a different question

What is a vision for **what engineering needs**
to achieve in the 21st century?

A vision may have promise . . . but to do what?

21st Century Engineering Vision

Vision : Continuation of life on the planet,
making our world more sustainable,
safe, healthy and joyful.

21st Century Engineering Vision

Vision : Continuation of life on the planet,
making our world more sustainable,
safe, healthy and joyful.

Goals: Grand Challenges for Engineering

Satisfying the goals (GC) will deliver
the Vision

Goals: 14 Grand Challenges for Engineering

1. Make solar energy economical
2. Provide energy from fusion
3. Develop carbon sequestration methods
4. Manage the nitrogen cycle
5. Provide access to clean water
6. Restore and improve urban infrastructure
7. Advance health informatics
8. Engineer better medicines
9. Reverse-engineer the brain
10. Prevent nuclear terror
11. Secure cyberspace
12. Enhance virtual reality
13. Advance personalized learning
14. Engineer the tools of scientific discovery

Grand Challenges : Vision for the Planet

Vision : Continuation of life on the planet,
making our world more sustainable,
safe, healthy and joyful

Goals: 14 Grand Challenges for Engineering

Objectives: Solutions that deliver each Goal
(the hard part)

NAE Convening Role on GCSP

Vision : Continuation of life on the planet, making our world more sustainable, safe, healthy and joyful.

Goals: 14 Grand Challenges for Engineering

Grand Challenges Scholars Program:

Prepare students for problems like GC.

Grand Challenges Scholars Program

- Program and ***experiences*** that prepare students (and others) for problems like the Grand Challenges
- Students earn a certificate in the GCSP while earning their degrees
- **5 “competencies” of GCSP program:**
 - **Research/creative** project experience on GC like topic
 - **Multidisciplinarity** – through hands-on experience
 - **Business/entrepreneurship** – viable business model for implementation
 - **Multicultural** understanding from global experience
 - **Social consciousness** through service learning

NAE Grand Challenges Scholars Program



In 2015 120+ Deans of Engineering (~ 1/3 U.S. deans) committed to graduating more than 20,000 Grand Challenge Scholars over next decade.

- **Research/creative** project experience on GC topic
- **Multidisciplinarity** – through hands-on experience
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Global Grand Challenge Activity

- Australia
- Botswana
- China
- Egypt
- Hong Kong
- India
- Kuwait
- Malaysia
- Singapore
- U.K.
- U.S.

Global Grand Challenges Summits

- London, March 12-13, 2013
- Beijing, September 14-16, 2015
- Washington D.C. July 18-20, 2017

GGCS 2015 – Beijing – U.S. Speakers

- | | |
|---------------------|------------------|
| ● Robert Socolow | ● Will.i.am |
| ● Dean Kamen | ● Doris Sung |
| ● Molly Coye | ● Arun Majumdar |
| ● Roderic Pettigrew | ● Richard Miller |
| ● Wayne Clough | ● Marcia McNutt |



Points to Note

- i. This is the 1st Engineering Vision for the planet in history
- ii. The Grand Challenges are the best description of Engineering for the public.

Illustrates the answers to two important questions:

- What is **Engineering**?
- How does **Engineering serve people and society**?

Points to Note

- iii. Global Vision mandating global solutions to reach the Goals
 - Solutions depend on locale
 - “We” are all in these Challenges together
- iv. Students are inspired by the Challenges
 - Preparing talent for global challenges is essential
 - National Academy of Engineering priority
 - Grand Challenge Scholars Program focus
 - Over 50% GCSP students are females and minorities

"Grand Challenges of Engineering"

adapted from

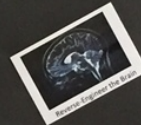
National Academy of Engineering



Make Solar Energy Affordable

Prevent Nuclear Terror

Energy from Fusion



Understand How the Brain Works

Carbon Sequestration Clean Air

Secure Cyberspace



Manage Nitrogen Cycle



Enhance Virtual Reality



Restore and Improve Infrastructure



Develop Tools of Scientific Discovery

Access to Clean Water



Advance Personalized Learning



Advance Health Information Systems



Create Better Medicines



GRAND CHALLENGES
FOR ENGINEERING



Points to Note

Closing Point:

- Come join with the NAE to inspire the preparation of young engineers and others for global problems of our time, problems like the Grand Challenges for Engineering and the Vision that inspired them.
- Together “we” can lead this ***movement*** for the betterment of the world.
- What could be better?



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