Grand Challenges and Engineering Systems

Inspiring and Educating the Next Generation

Charles M. Vest
President, National Academy of Engineering

Council of Engineering Systems Universities
MIT
June 15, 2009
Why aren’t more kids inspired to study Engineering?
Reason #1

The Amazing Disappearing Word
ENGINEER
We need to get it back into the vernacular.
Perception

All the jobs are going overseas.
For the second year in a row, engineer is the hardest job to fill in America.

-- Forbes
June 4, 2009
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Employers … want one engineer who is trained in several areas.

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The Obama administration's pledge to rebuild America's infrastructure is increasing the need for talented engineers.

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Perception

Why aren’t you studying Engineering?
Because I want to go into a field where I can make People’s lives better.
How we teach Engineering
What is important in Engineering Education

*Making universities and engineering schools exciting, creative, adventurous, rigorous, demanding, and empowering environments is more important than specifying curricular details.*

That’s what I learned at MIT.
Frontiers of Engineering Education

Goal:

Identify, recognize, and promulgate advances and innovations in 21st century Engineering Education
Reason #5

Generation Gap
QuickTime™ and a decompressor are needed to see this picture.
Why aren’t more kids inspired to study Engineering?
Why aren’t more kids Inspired to study Engineering?
Inspired
to Rebuild
a Real Economy
Doom and Gloom!

Global Economic Crisis

Bear Sterns
Unemployment
TARP

Dow Jones

General Motors

Global Warming

Toxic Mortgages
Rebuilding a Real Economy

Based on **Real Engineering** Innovation

to produce

**Real Products and Services**

that

Add **Real Value**
Inspired
to work at the
Frontiers of Technology
Engineering Frontiers

TINY SYSTEMS
- Bio
- Info
- Nano

MACRO SYSTEMS
- Energy
- Environment
- Health Care
- Manufacturing
- Communications
- Logistics …

Smaller and Smaller
Faster and Faster
More and More Complex
Engineering Frontiers

TINY SYSTEMS
Bio
Info
Nano

MACRO SYSTEMS
Energy
Environment
Health Care
Manufacturing
Communications
Logistics …

Larger and Larger
More and More Complex
Great Societal Importance
Frontiers and Synergies

Science and Engineering Are Merging.
Frontiers and Synergies

These engineering systems need social science, management, and Art, humanities / communications.

TINY SYSTEMS

Bio
Info
Nano

MACRO SYSTEMS

Energy
Environment
Health Care
Manufacturing
Communications
Logistics...

Social Science
Frontiers and Synergies

MACRO SYSTEMS
- Energy
- Environment
- Health Care
- Manufacturing
- Communications
- Logistics
...

TINY SYSTEMS
- Natural Science
  - Bio
  - Info
  - Nano

Social Science
Inspired to meet Grand Challenges
“Make no small plans because they have no power to stir the soul.”

Niccolo Machiavelli
“Make no small plans because they have no power to stir the soul.”

So, ...
Engineering Grand Challenges

Stirring our Souls
Grand Challenges for Engineering

• Proposed by a committee of amazingly accomplished and innovative people.

• Extremely challenging and important.

• Deemed to be doable in the next few decades.
Grand Challenges Committee

- Bill Perry, chair
- Sir Alec Broers
- Farouk El-Baz
- Wes Harris
- Bernadine Healy
- Daniel Hillis
- Calestous Juma
- Dean Kamen
- Ray Kurzweil
- Bob Langer
- Jaime Lerner
- Bindu Lohani
- Jane Lubchenco
- Mario Molina
- Larry Page
- Rob Socolow
- Craig Venter
- Jackie Ying
Engineering 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 Healthcare 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
- Engineer the Tools of Scientific Discovery

NATIONAL ACADEMY OF ENGINEERING
OF THE NATIONAL ACADEMIES
Engineering Grand Challenges

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- Provide Energy from Fusion
- Develop Carbon Sequestration Methods
- Manage the Nitrogen Cycle
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- Engineer Better Medicines
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Engineering Grand Challenges

See the NAE website.

- Energy
- Environment
- Global Warming
- Sustainability

- Reducing Vulnerability to Human and Natural Threats

- Improve Medicine and Healthcare Delivery

- Expand and Enhance Human Capability And Joy
Engineering Grand Challenges

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INSPIRATION

EDUCATION
Engineering Grand Challenges

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NECESSITY

INSPIRATION

EDUCATION
Engineering Grand Challenges
See the NAE website.

- Energy Environment
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- Improve Medicine and Healthcare Delivery
- Expand and Enhance Human Capability And Joy

And …

INSPIRATION
NECESSITY
EDUCATION
Energy Flows in the U.S. Economy, 2007
Engineering Grand Challenges
See the NAE website.

Energy Environment Global Warming Sustainability

Reducing Vulnerability to Human and Natural Threats

Expand and Enhance Human Capability And Joy

Insipiration

NECESSITY

Education

Innovation & Action
Meeting the Grand Challenges

INNOVATION & ACTION

Industry
Media
Government
Meeting the Grand Challenges

- Universities
- Students
- Industry
- Media
- Government

INNOVATION & ACTION
Engineering Systems

Universities

Students

INNOVATION & ACTION

Industry

Media

Government
Thoughts about Engineering Systems

The Man at the end with a big rubber mallet

The whole is greater than the sum of its parts.

How a CEO reduced mortality rates in his hospital

What is the meaning of the Financial Implosion?

Is it smart to burn food in your car engine?
The Man at the end with a big rubber mallet
The whole is greater than the sum of its parts.
How a CEO reduced mortality rates in his hospital
What is the meaning of the financial implosion?
Is it smart to burn food in your car engine?
In closing, …

Engineering Systems

Inspire

Educate

Challenge
In closing, ...

Engineering Systems

We may succeed ...
June 14, 2009

"(IT'S MORE EXCITING THAN YOU THINK, ACTUALLY.)

*(IT'S MORE EXCITING THAN YOUR THINK, ACTUALLY.)*
Thank You.