

# U.S. COMPETITIVENESS AND WHY STEM MATTERS

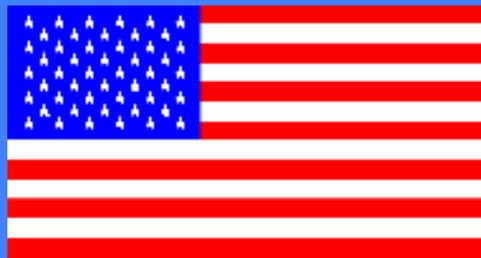
*Setting the Stage*

**Charles M. Vest**  
**President, National Academy of Engineering**  
**President *Emeritus*, MIT**

**THE NAVAL STEM FORUM**  
Alexandria, VA  
June 15, 2011

- A Changing World
- Category Five
- Grand Challenges
- Winnie

# We're Number 1!



**We're Number 1!**

**Get Real.**

**Actually ...**

**#6**

**#11**

**#16**

**#22**

**#24**

**#27**

**#48**

<b>Global Innovation-Based Competitiveness</b>	<b>#6</b>
<b>% Young Adults with High School Degrees</b>	<b>#11</b>
<b>College Completion Rate</b>	<b>#16</b>
<b>Broadband Internet Access</b>	<b>#22</b>
<b>Life Expectancy at Birth</b>	<b>#24</b>
<b>% College Graduates with S&amp;E Degrees</b>	<b>#27</b>
<b>Quality of K-12 Math &amp; Science Education</b>	<b>#48</b>

Sources: World Economic Forum, OECD, Information Technology and Innovation Foundation

**But we are in control;  
We are at the Wheel.**



**WAKE UP!**

The World has



changed.

# Global R&D Investments



R&D Expenditures and Share of World Total







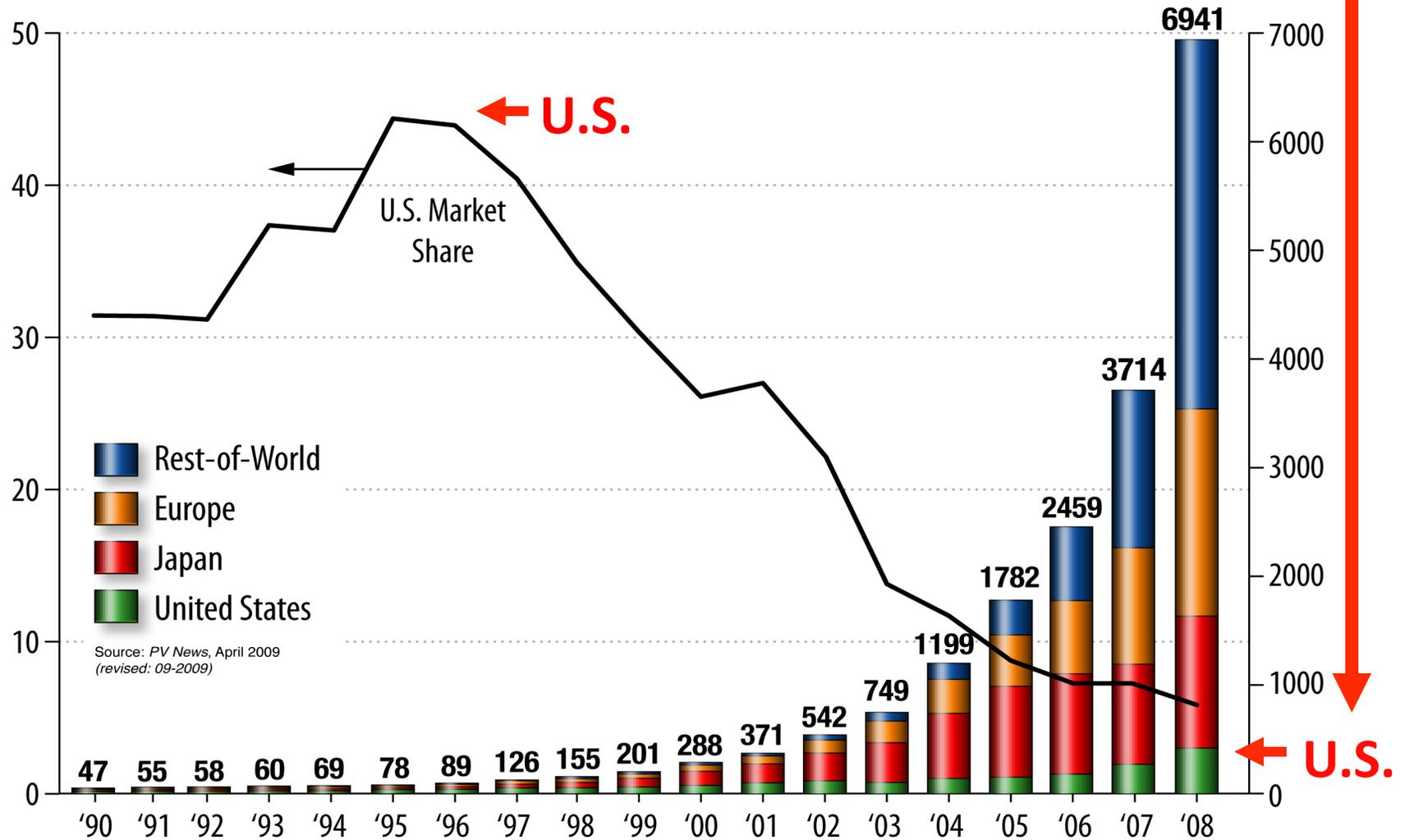


**Who made all these cells?**

**Not us.**

Not us.

## Worldwide shipments of Solar Photovoltaics— in Megawatts



Source: ARPA-E

Norman R. Augustine

Craig Barrett

Gail Cassell

Stephen P. Chu

Robert M. Gates

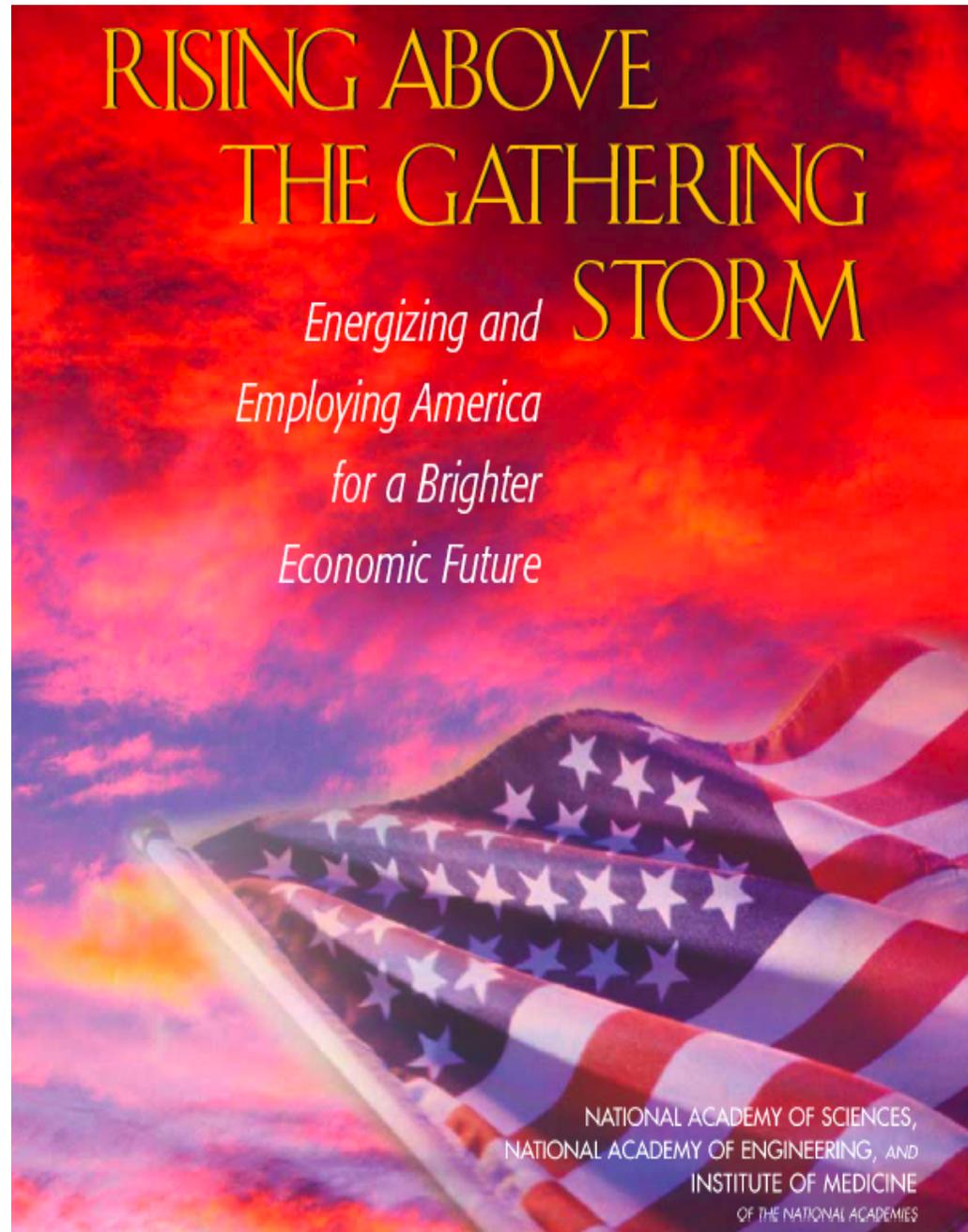
Nancy Grasmick

Charles Holliday, Jr

Shirley Ann Jackson

Anita K. Jones

Joshua Lederberg



Richard Levin

C. D. (Dan) Mote

Cherry Murray

Peter O'Donnell, Jr.

Lee R. Raymond

Robert C. Richardson

P. Roy Vagelos

Charles M. Vest

George M. Whitesides

Richard N. Zare

# RISING ABOVE

Move U.S. STEM K-12 Education to a leading position by Global Standards.

*Energizing and*

Double the Federal Investment in Basic Research in Physical Sciences and Engineering in 7 years.

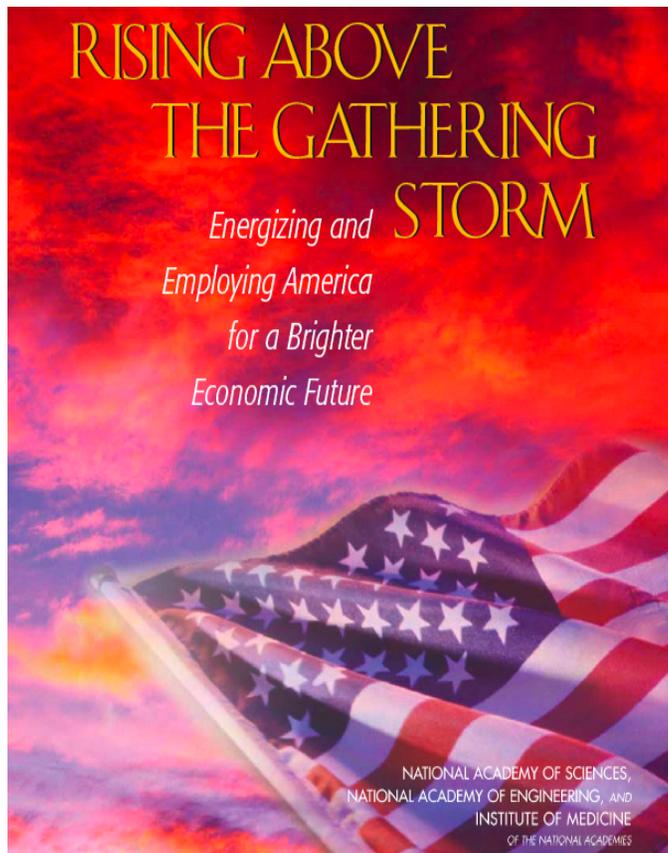
*Employing America*

*Economic Future*

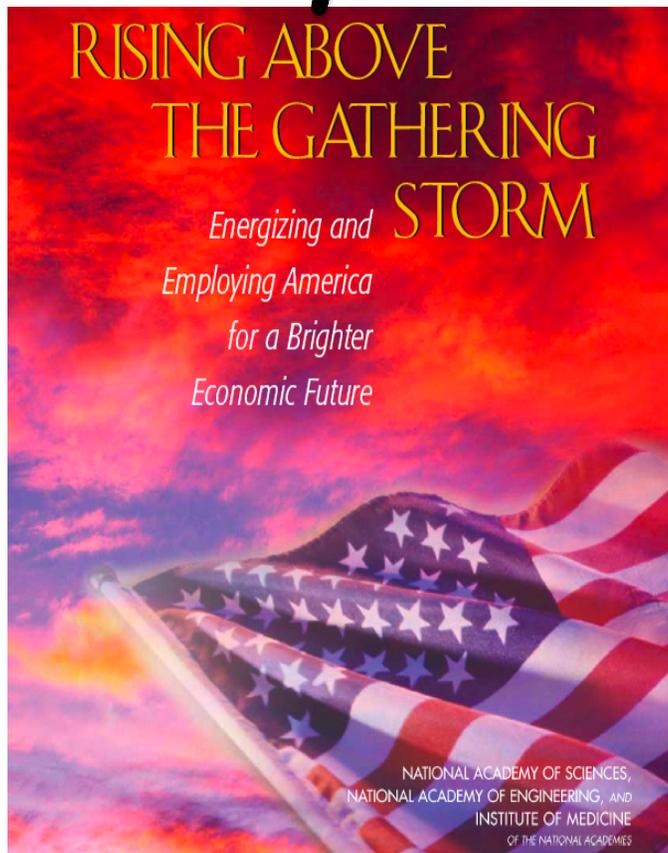
Encourage more U.S. citizens to pursue Science and Engineering.

Rebuild the Competitive Ecosystem through Reform in tax, patent, immigration, and litigation policies.

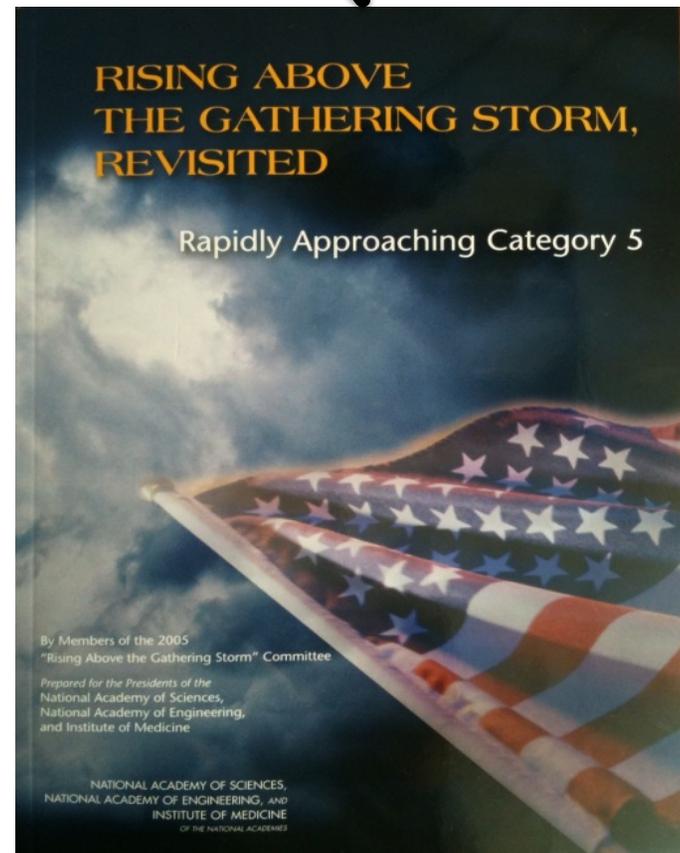
NATIONAL ACADEMY OF SCIENCES,  
NATIONAL ACADEMY OF ENGINEERING, AND  
INSTITUTE OF MEDICINE  
OF THE NATIONAL ACADEMIES



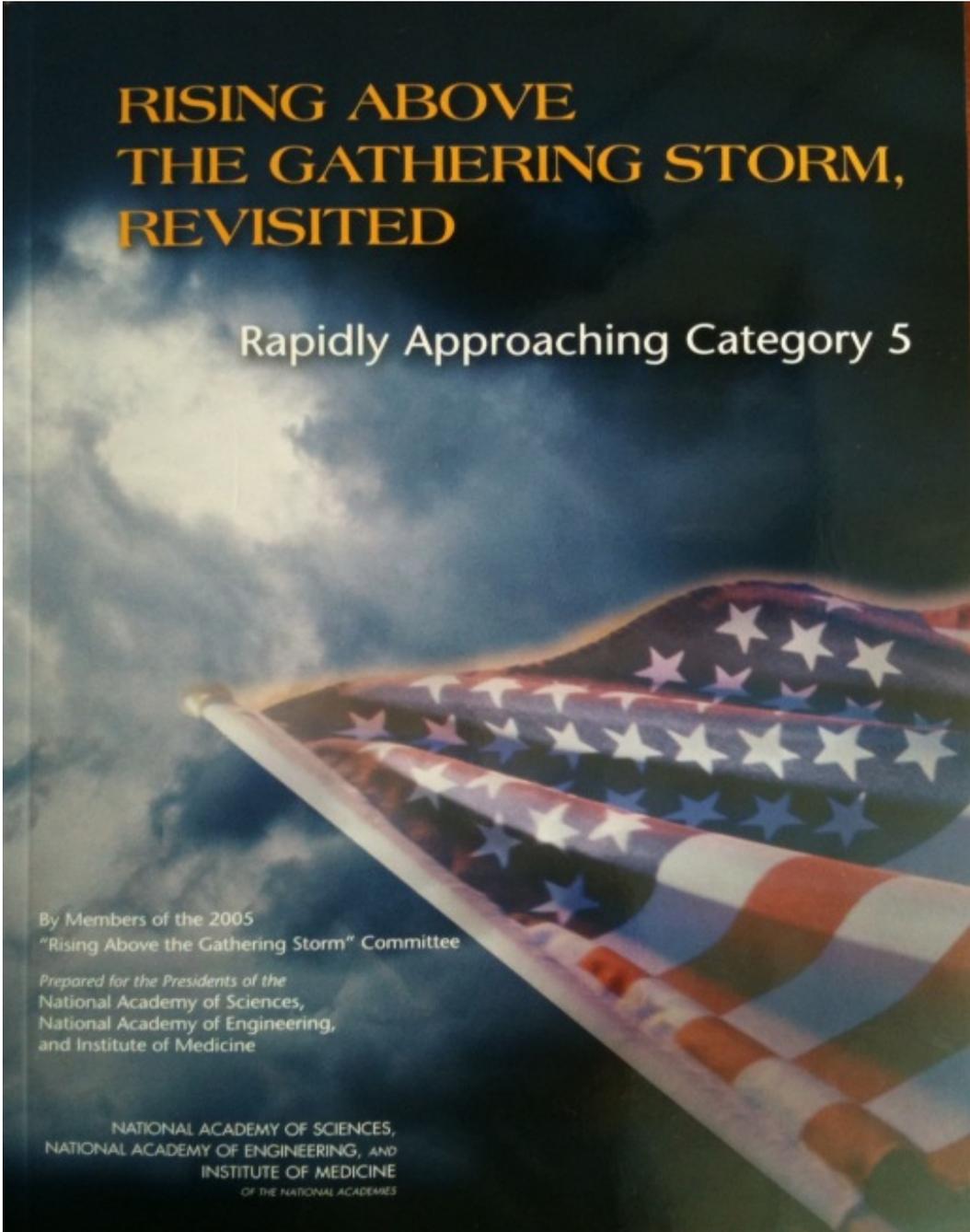
2005



2005



2010



**RISING ABOVE  
THE GATHERING STORM,  
REVISITED**

Rapidly Approaching Category 5

By Members of the 2005  
"Rising Above the Gathering Storm" Committee

*Prepared for the Presidents of the  
National Academy of Sciences,  
National Academy of Engineering,  
and Institute of Medicine*

NATIONAL ACADEMY OF SCIENCES,  
NATIONAL ACADEMY OF ENGINEERING, AND  
INSTITUTE OF MEDICINE  
OF THE NATIONAL ACADEMIES

**“Gentlemen, we have run out of money.  
It is time to start thinking.”**

*Sir Ernest Rutherford,  
Nobel Laureate (Chemistry)*

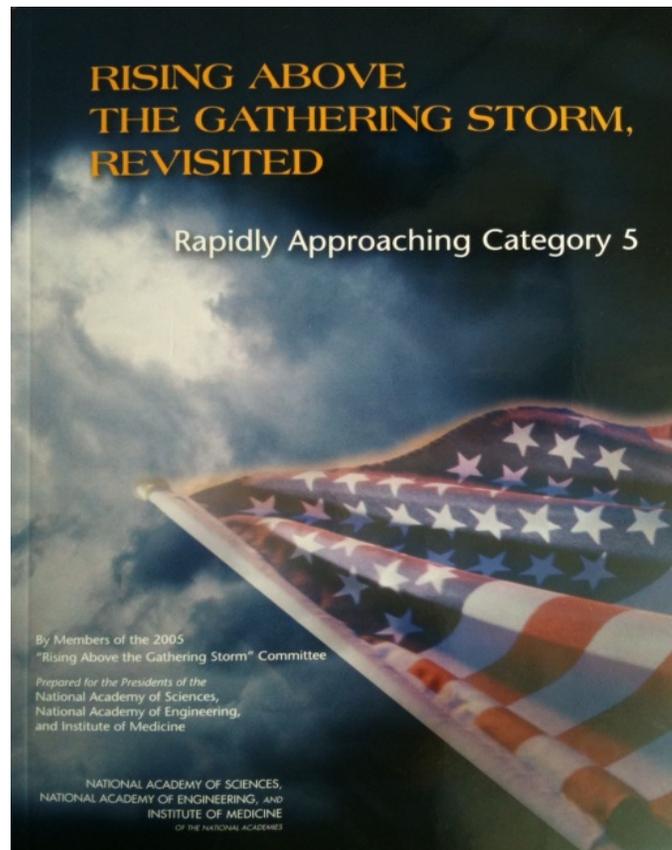
# Overall Assessment

*In balance, it would appear that overall the United States long-term competitiveness outlook (read jobs) has further deteriorated since the publication of the Gathering Storm report five years ago.*

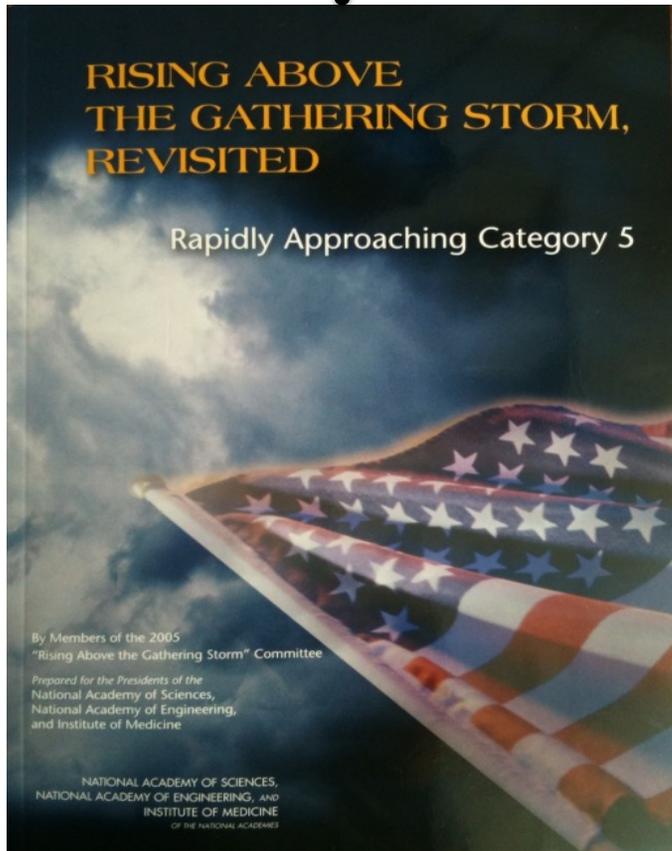
**We know what the problems are.**

**We know what most of the solutions are.**

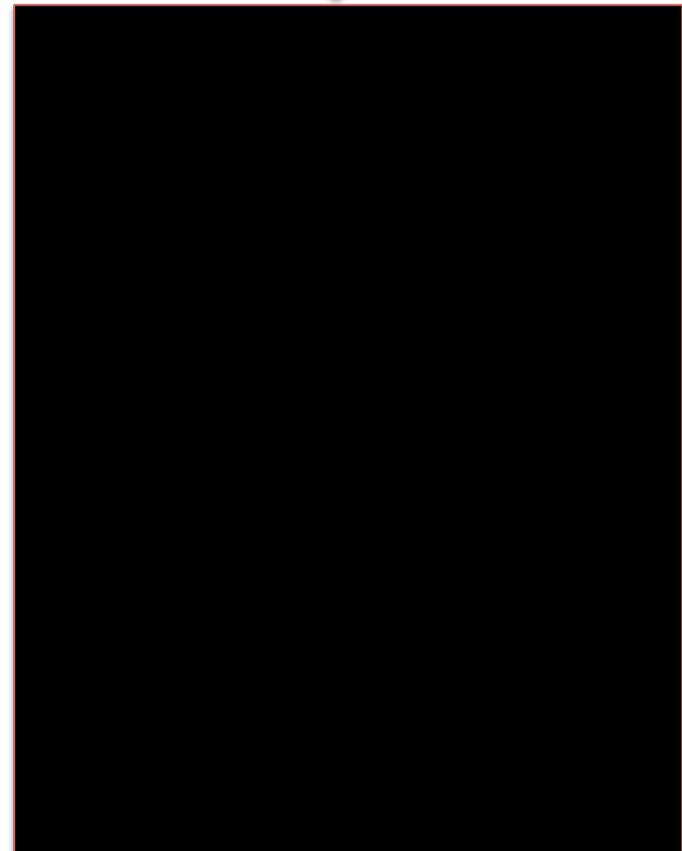
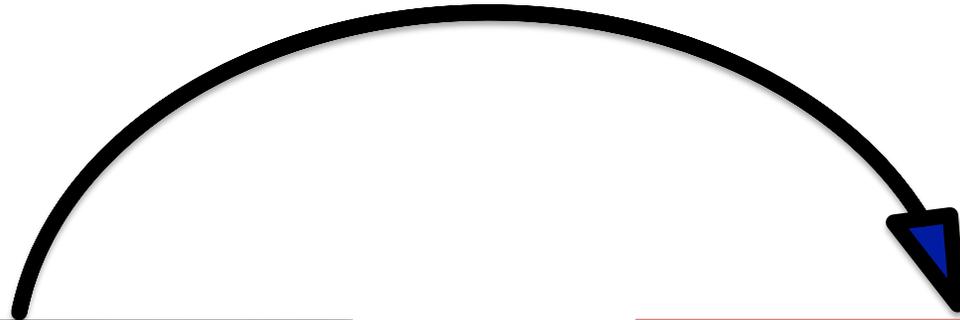
**The political will must be established.**



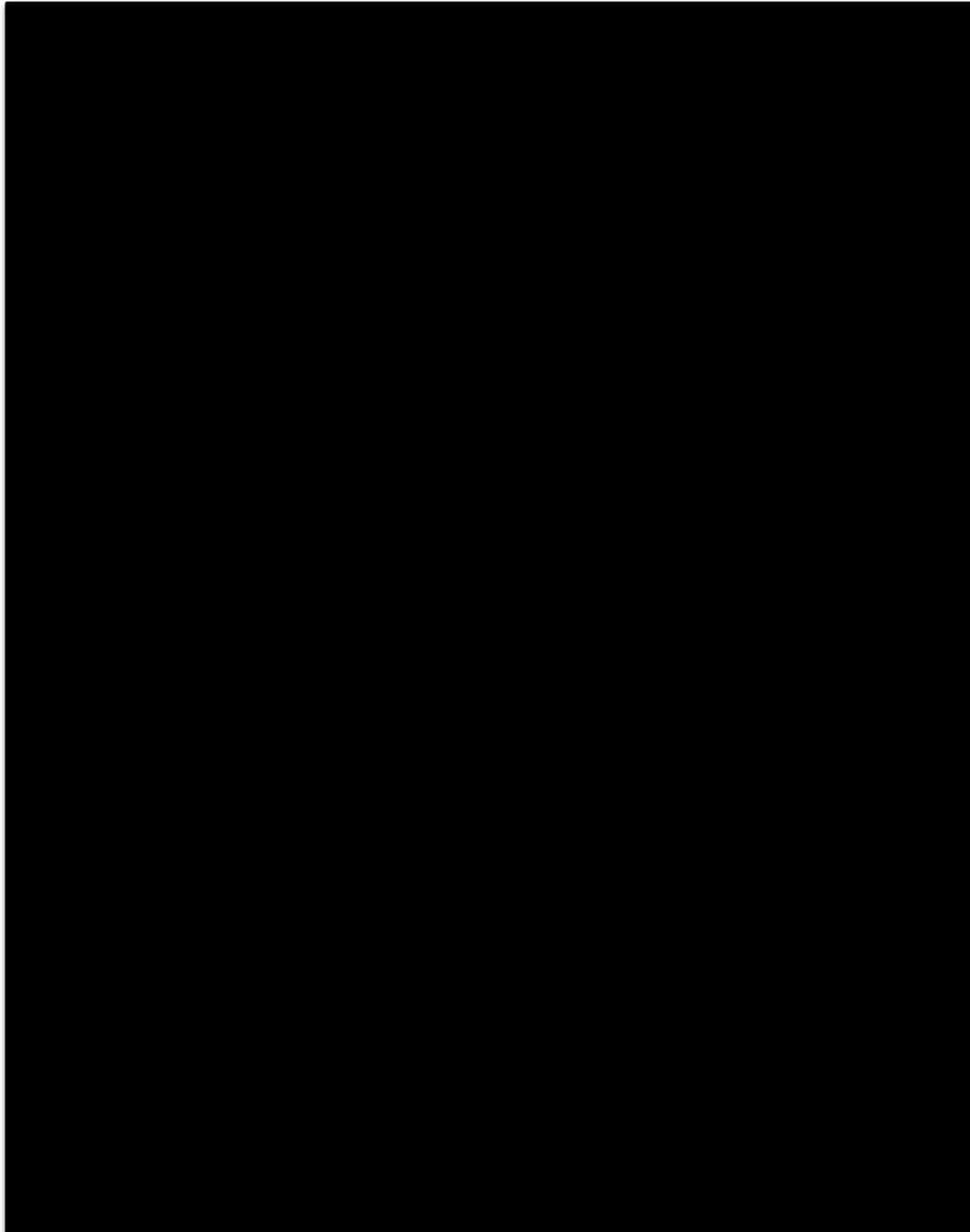
2010



2010



2015



**“Gentlemen, we have run out of money.  
It is time to start drinking.”**

*Dr. John Holdren,  
Presidential S&T Advisor*

# Some Major Responses

New S&T university with \$10 billion endowment has been established.

>200,000 students will study abroad.

A new Innovation City is being built for 40,000 people.

Create a global nanotechnology hub with 14 “world class universities.”

High-level commission patterned on RAGS established to create jobs

# Some Major Responses

Saudi Arabia

China

Russia

India

United Kingdom

*“I firmly believe that science is the ultimate revolution.”*

-- Premier Wen Jaibao  
People's Republic of China

**GULP!**

Bottom Line:

We have a STEM Problem

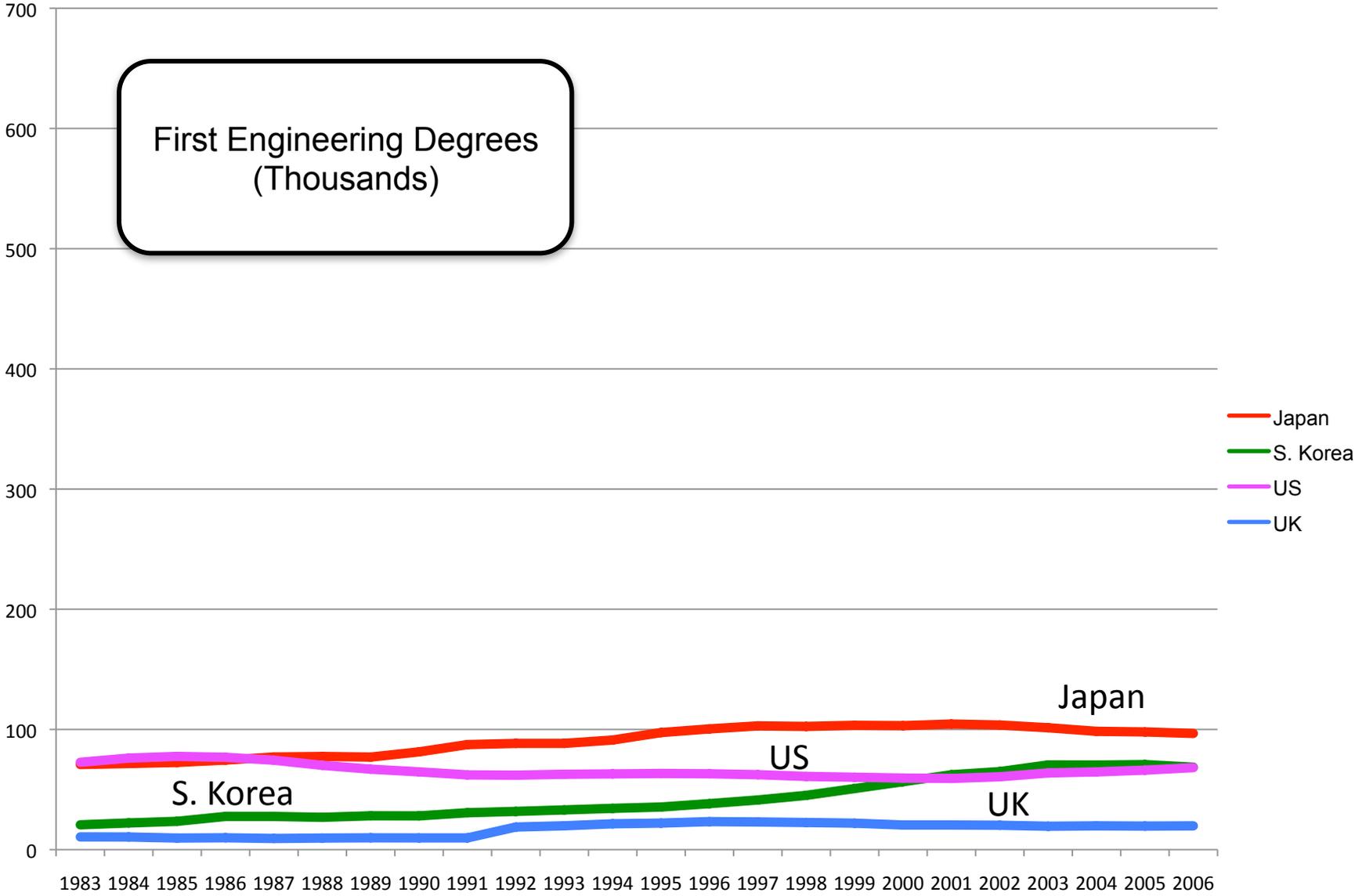
that We Must Address

Actually,

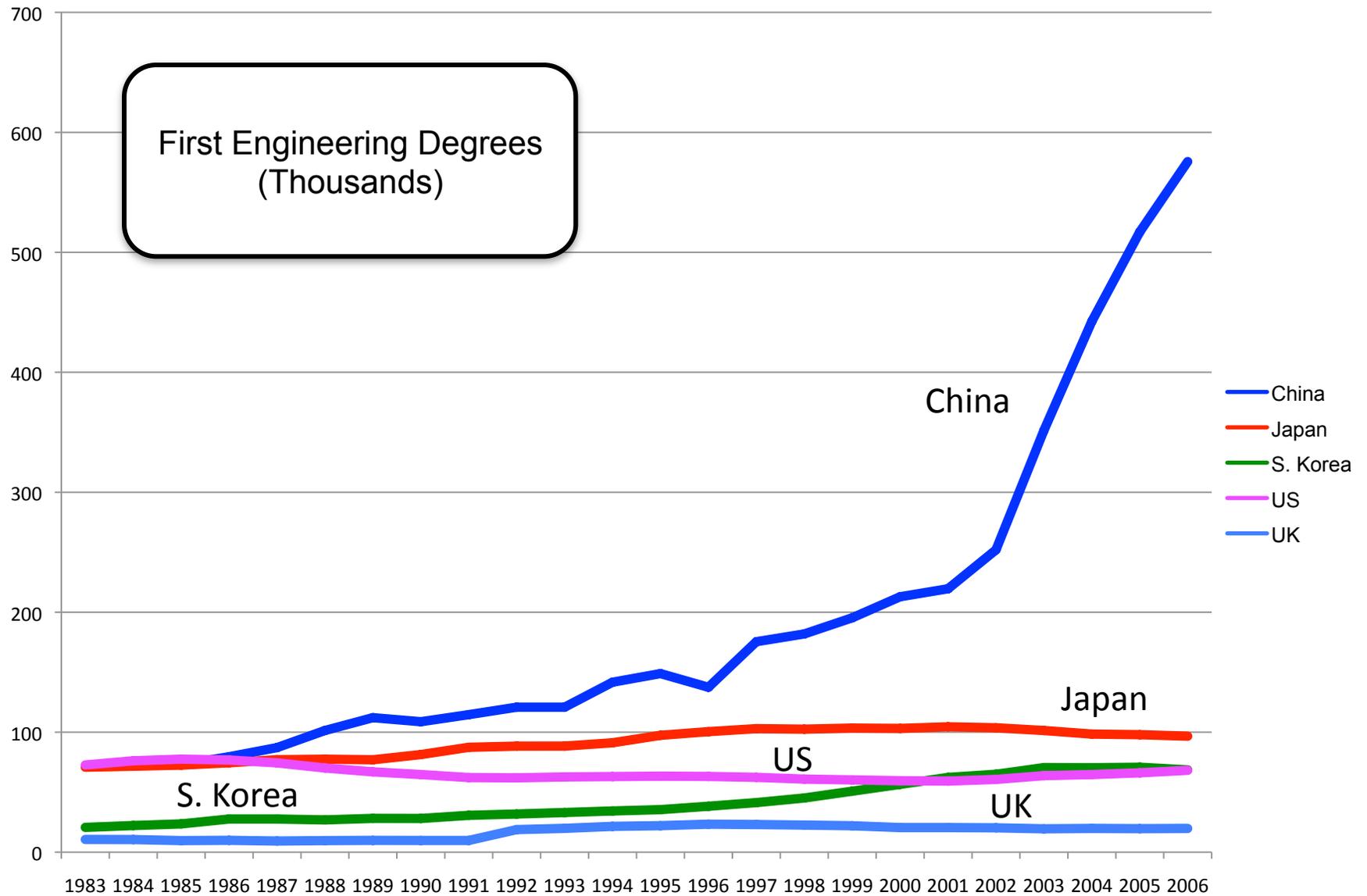
We have a stEm Problem

that We Must Address

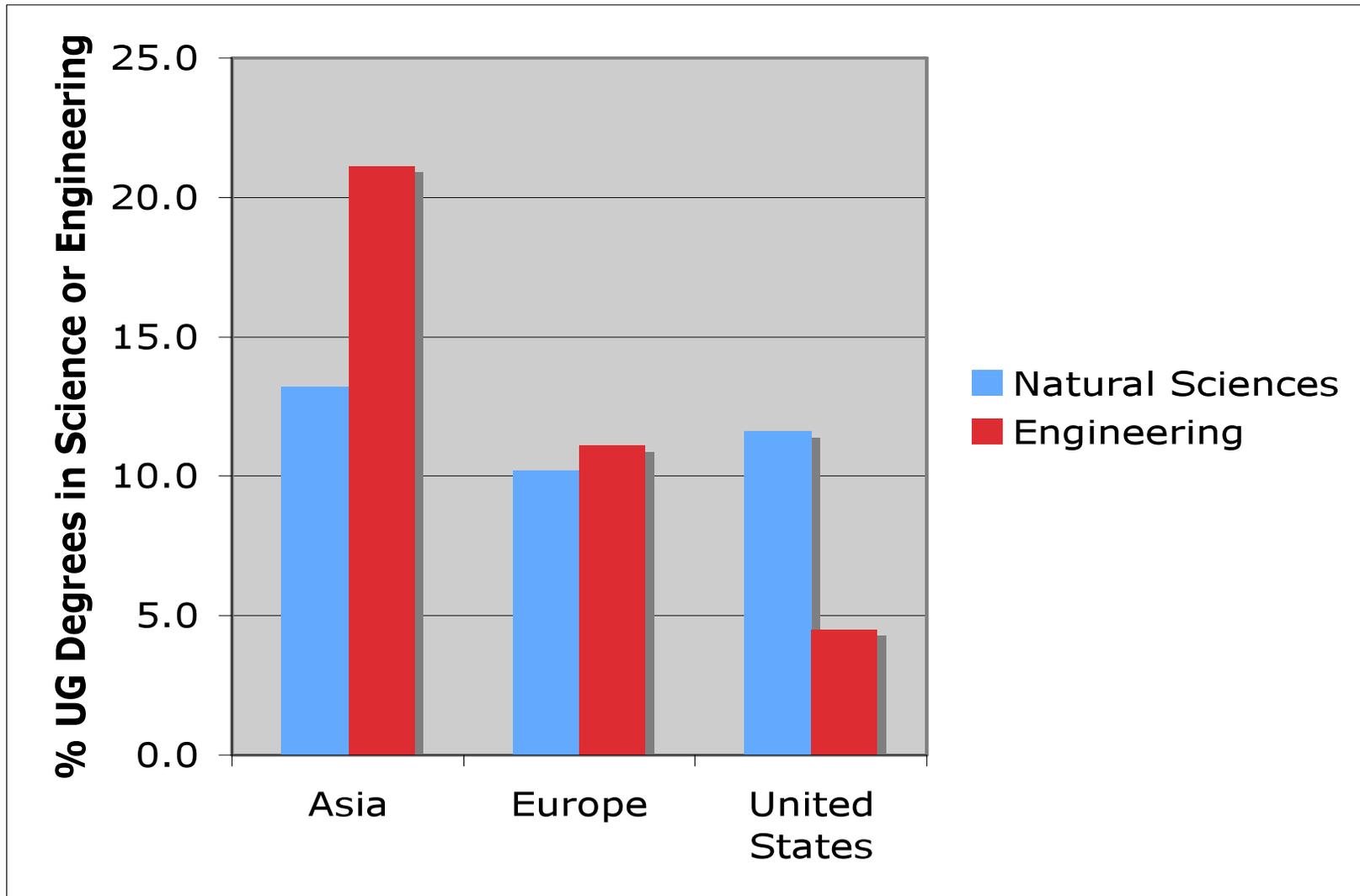
First Engineering Degrees  
(Thousands)



# China Rises

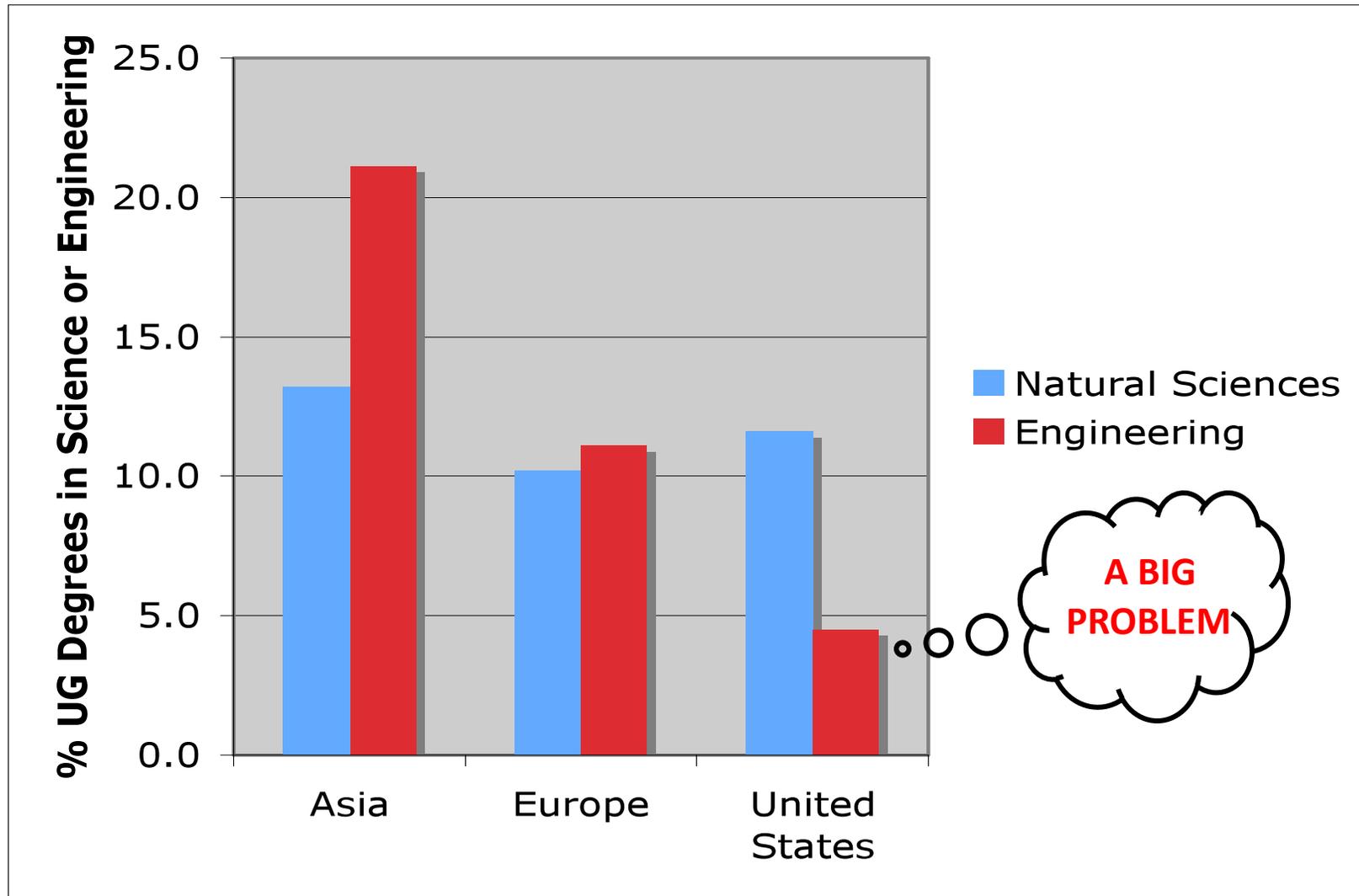


# How do we compare with the Rest of the World?



Source: NSF Science and Engineering Indicators 2010

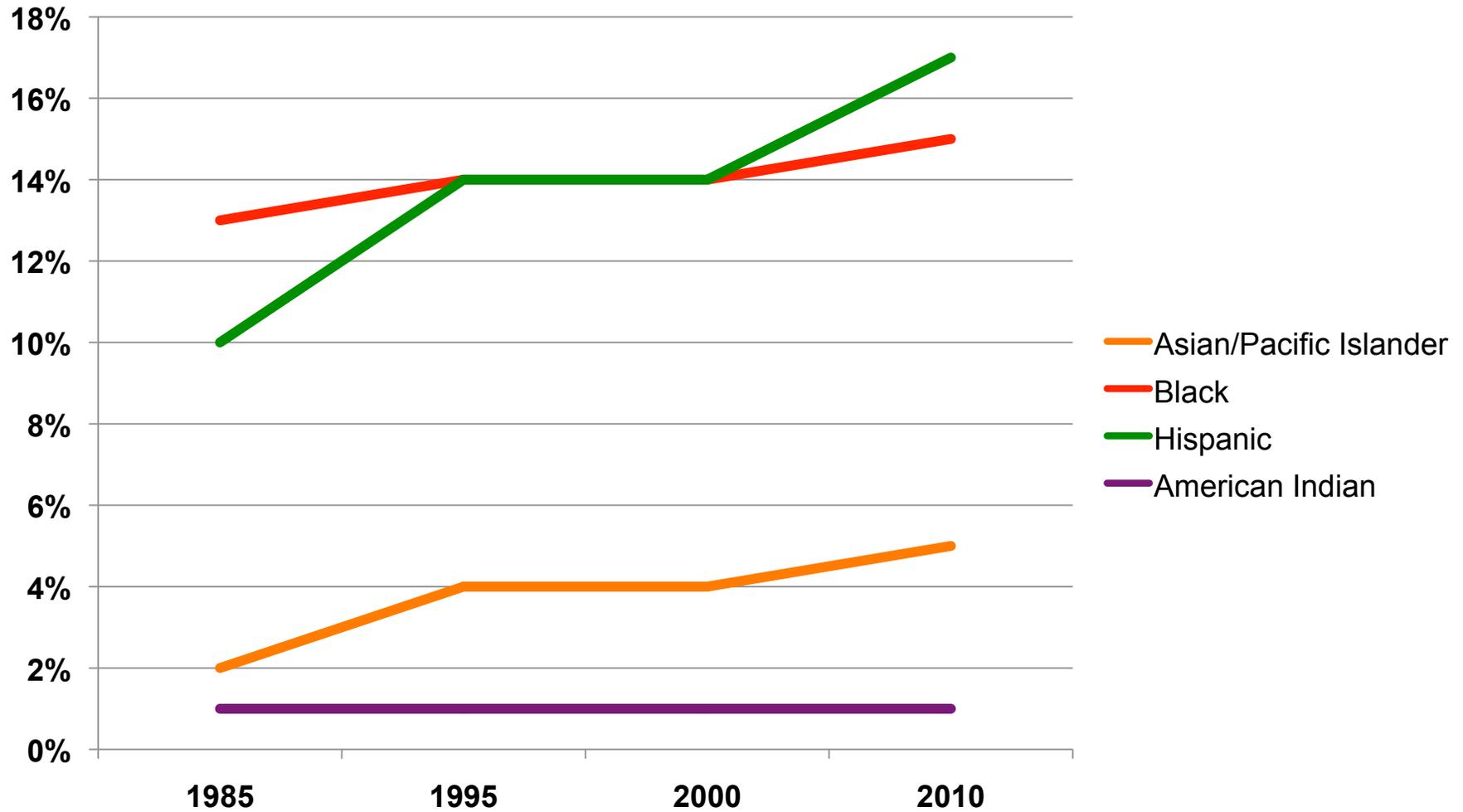
# How do we compare with the Rest of the World?



Source: NSF Science and Engineering Indicators 2010

# Our Minority Population is Growing

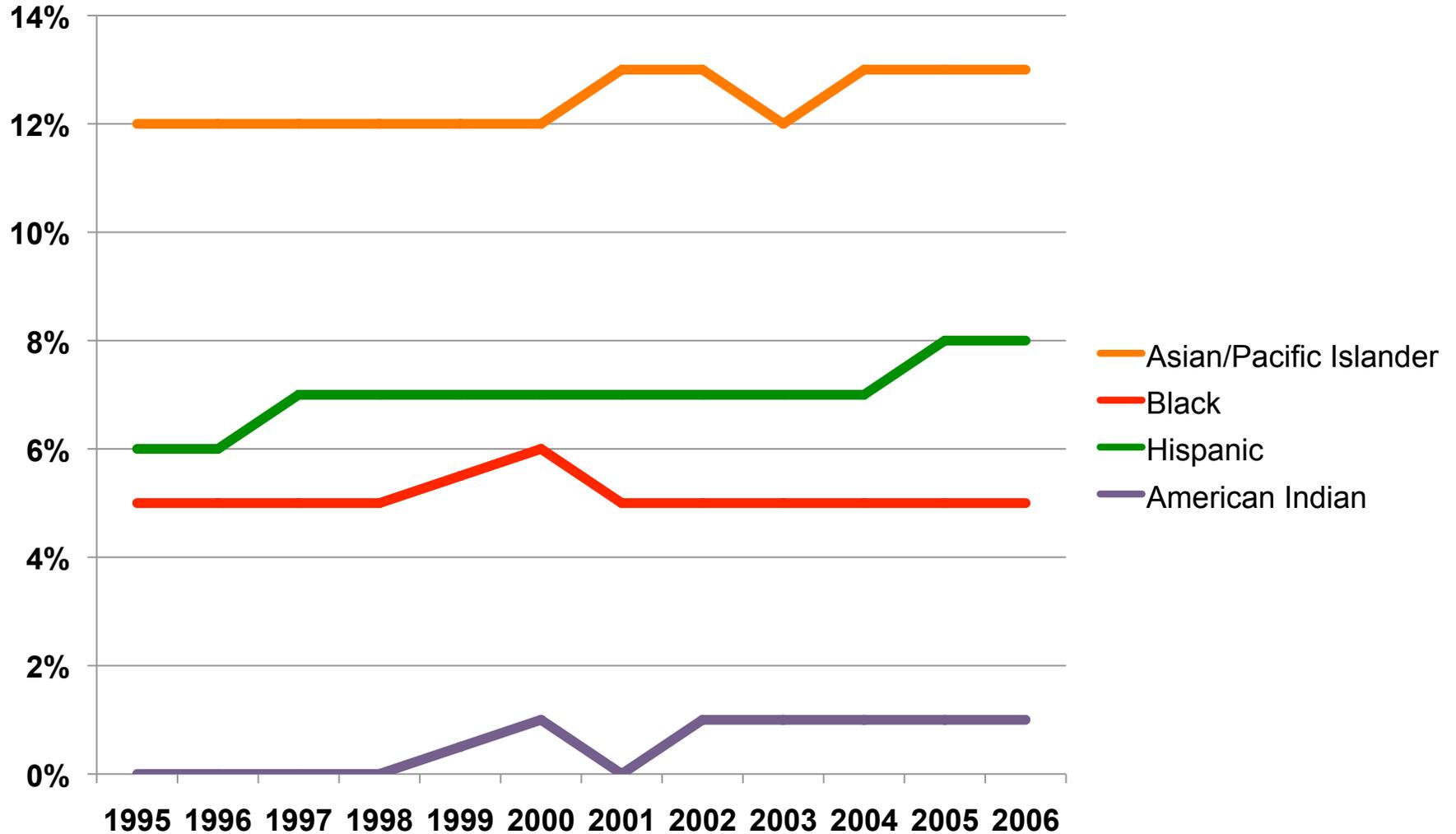
## U.S. Population Aged 18-23



Source: U.S. Census Bureau, 2011

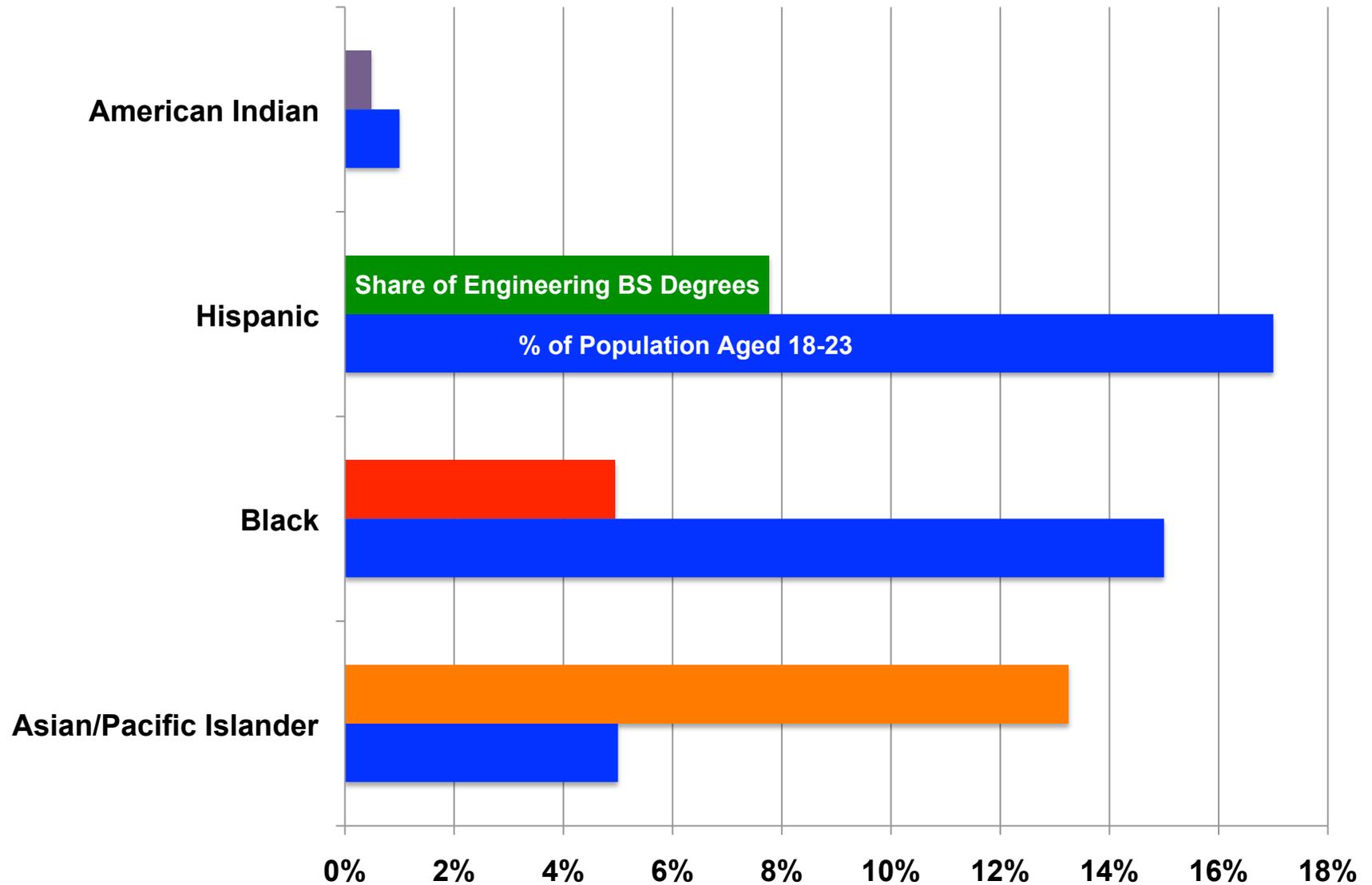
# But the Minority Share of Engineering Degrees is Nearly Constant

Share of Engineering Bachelors Degrees by Race



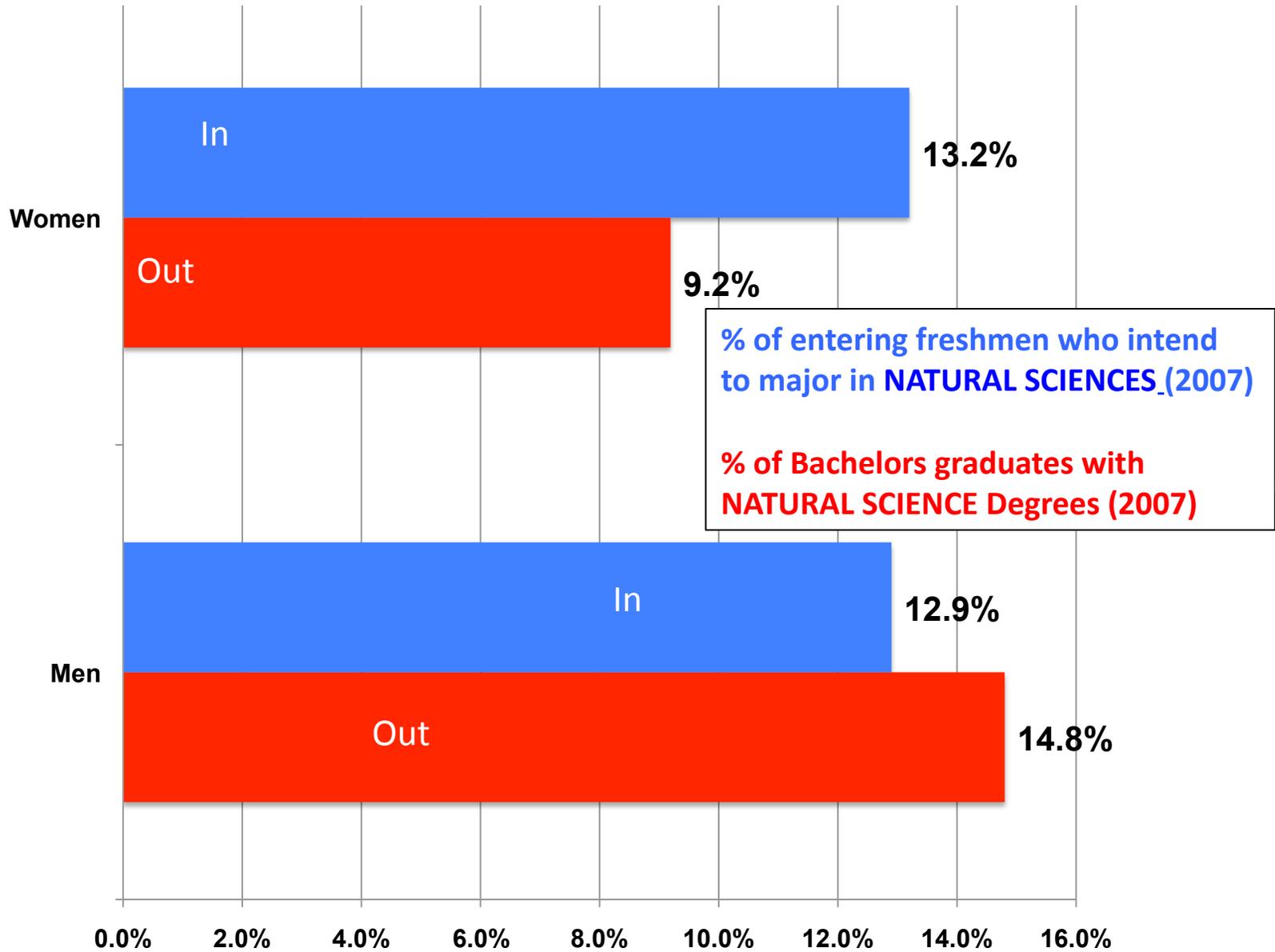
Source: NSF Science and Engineering Indicators, 2010

# This is a Workforce Train Wreck.



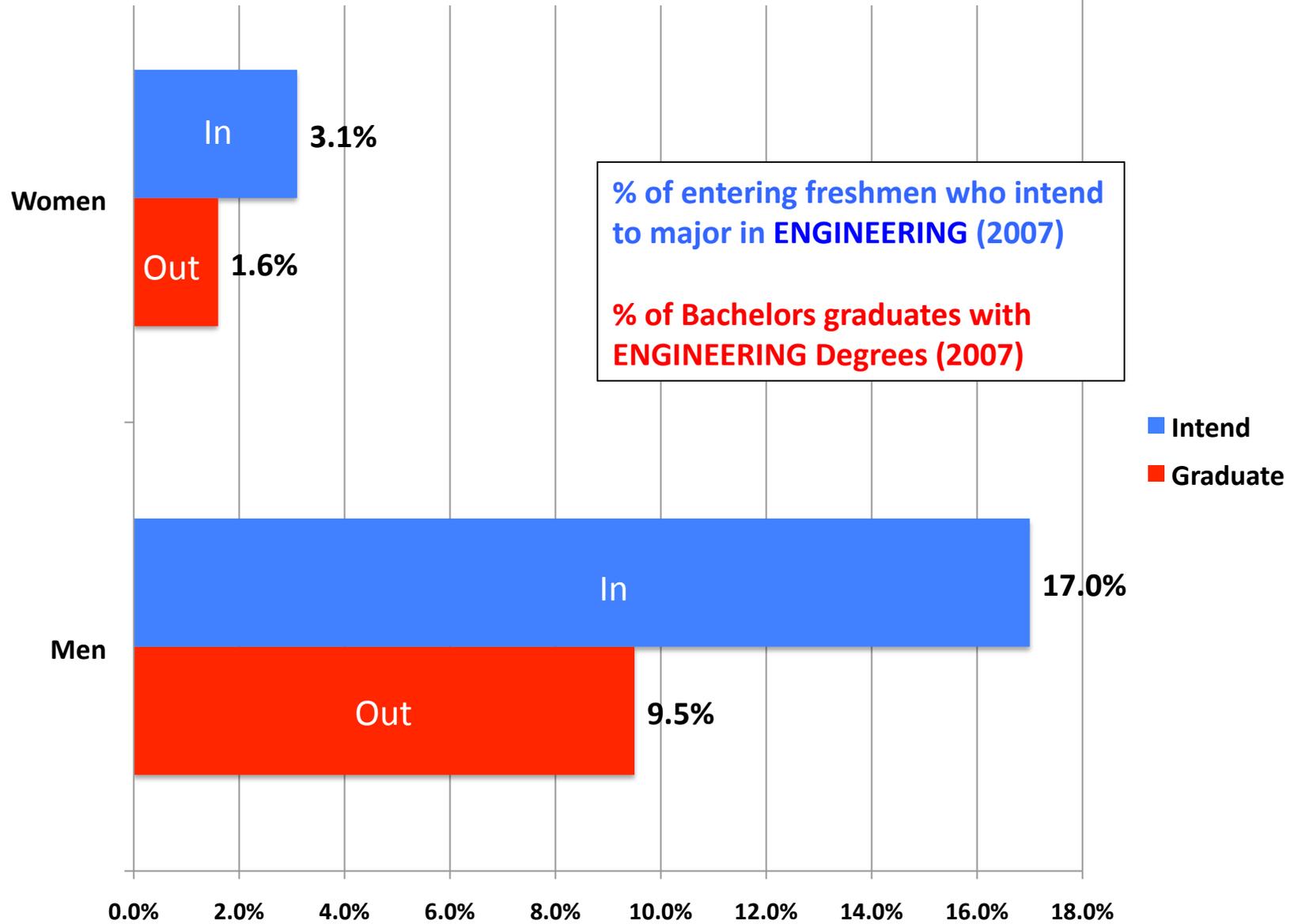
Source: NSF Science and Engineering Indicators, 2010; U.S. Census Bureau, 2011

# U.S. Universities: Undergraduate Education, NATURAL SCIENCES



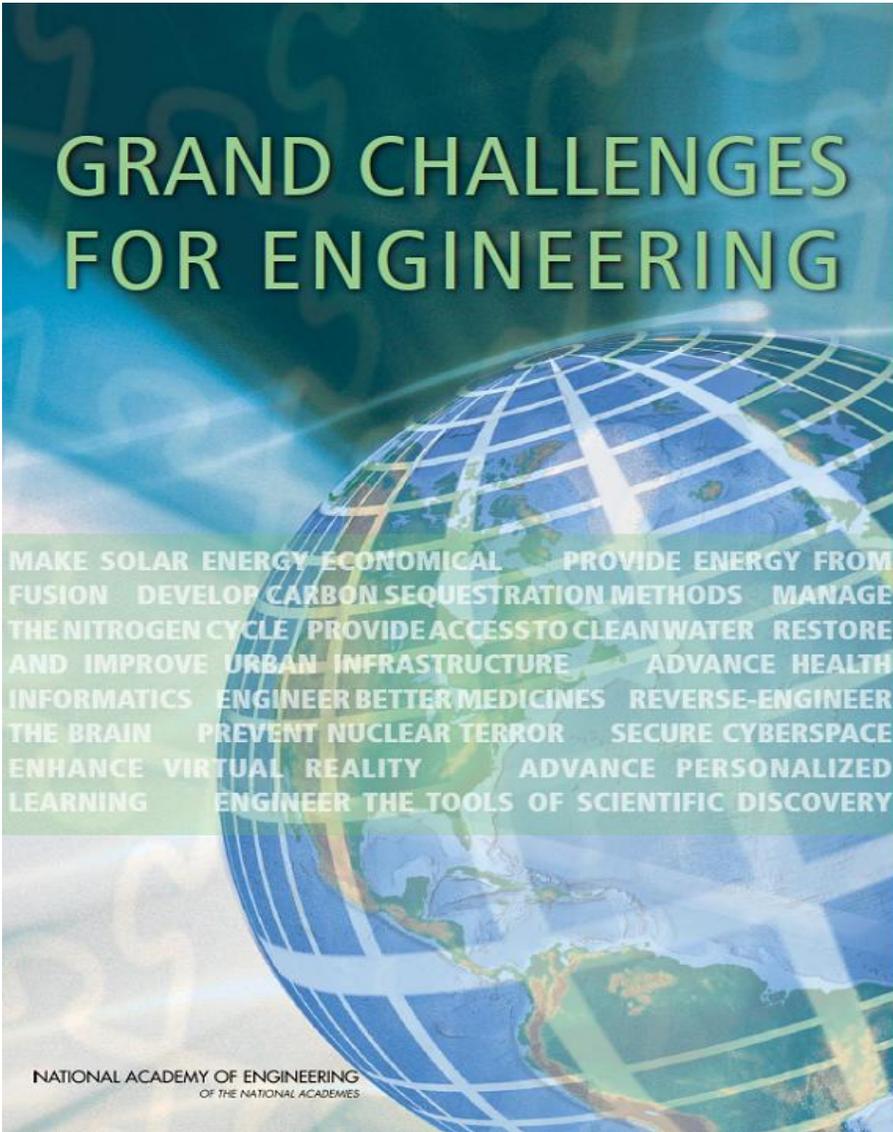
source: NSF S&E Indicators 2010 and US Dept. of Education Digest of Educational Statistics 2008

# U.S. Universities: Undergraduate Education, ENGINEERING



source: NSF S&E Indicators 2010 and US Dept. of Education Digest of Educational Statistics 2008

**We need  
Inspiration  
and  
Challenge!**

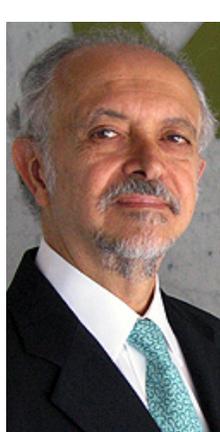
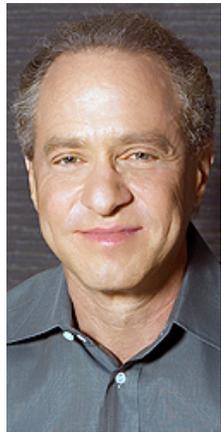
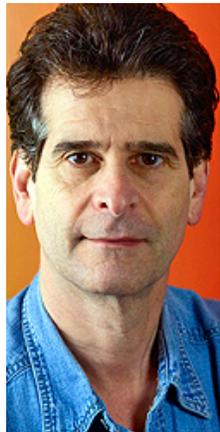
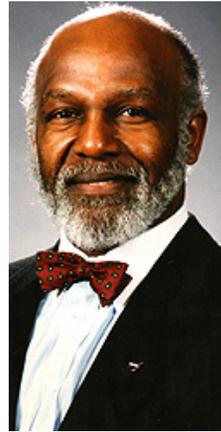


**INSPIRE**

**CHALLENGE**

**EDUCATE**

[source: www.engineeringchallenges.org](http://www.engineeringchallenges.org)



# 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

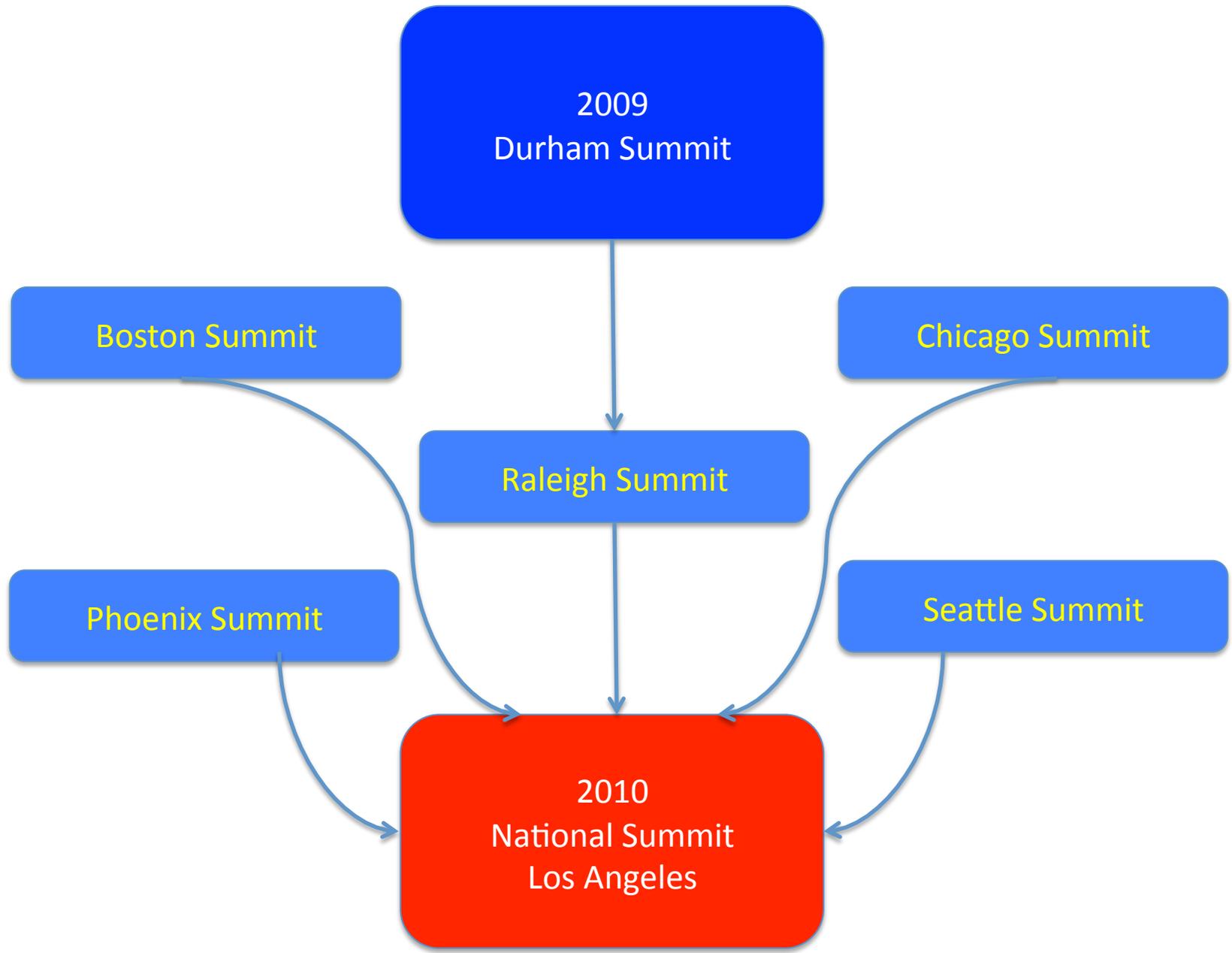


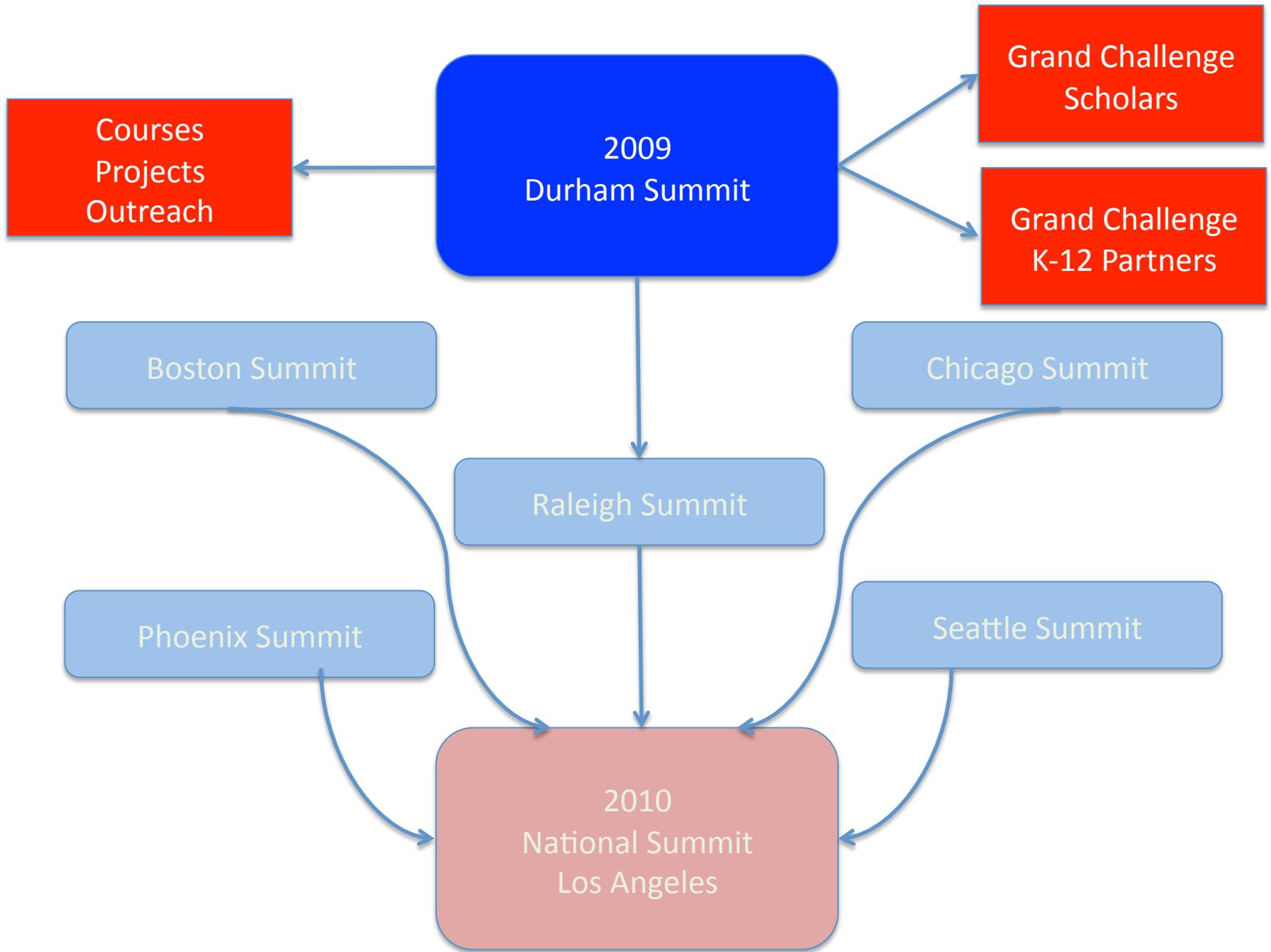
SUSTAINABILITY

SECURITY

HEALTH

JOY





## CLOSING COMMENT

We are in a very serious strategic crisis.

This is the most exciting era in human history for Science and Engineering.

We have democracy, free enterprise, diversity, and a stunning history.

It is time to be great again.

We know what the problems are.

We know how to solve them.

We know what the problems are.

We know how to solve them.

**We need Political Will.**

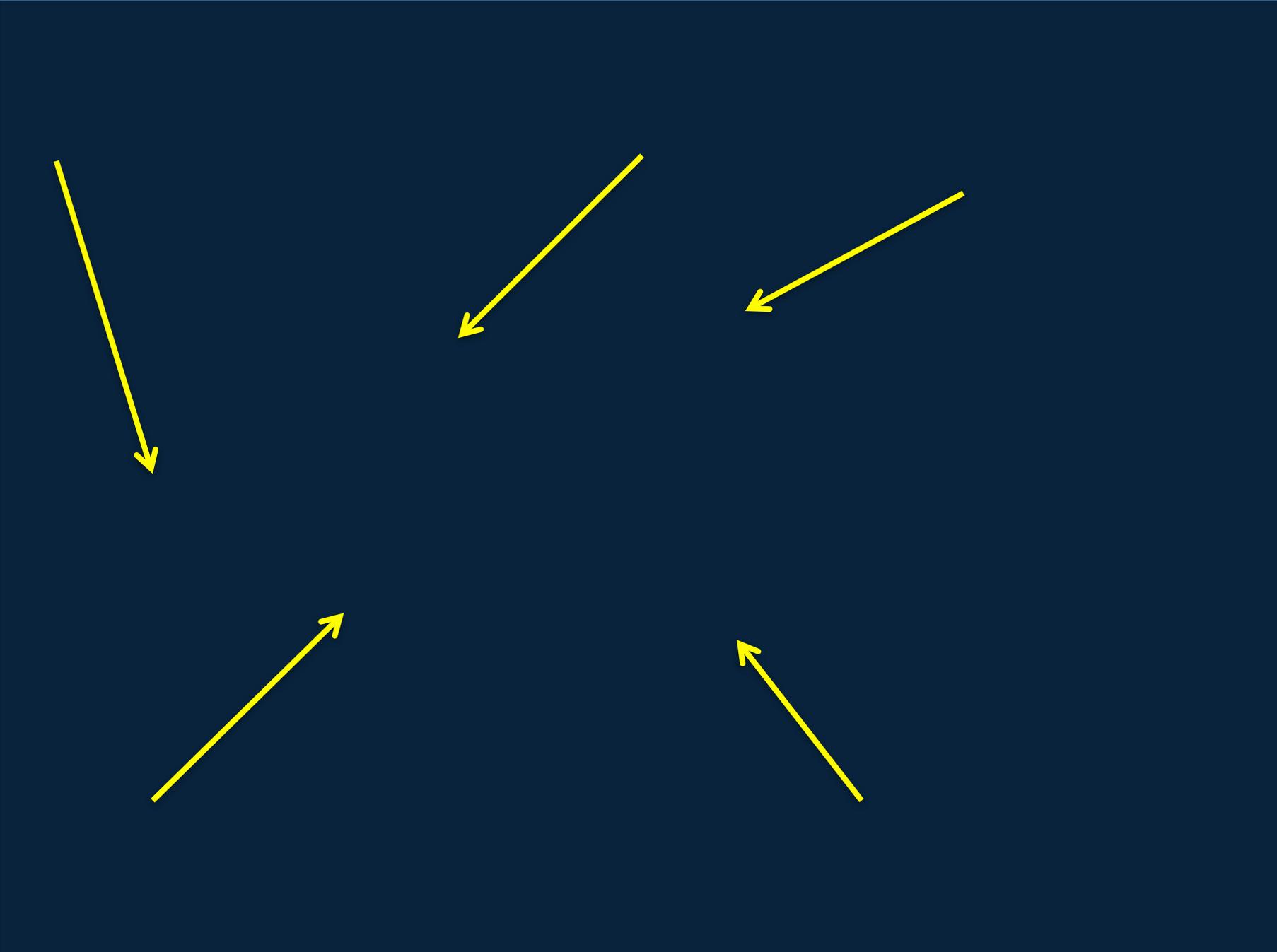
SCIENCE

RESEARCH

TECHNOLOGY

INNOVATION

EDUCATION



# State of the Union Speech, 2011

## Word Map



We know what the problems are.

We know how to solve them.

We need Political Will.

We know what the problems are.

We know how to solve them.

We need Political Will.

**and Inspiration**

This meeting is  
filled with  
Inspired  
Leaders.

We can prove  
that Winnie was right.



*You can always count  
On the Americans to do  
The right thing.*



*You can always count  
On the Americans to do  
The right thing.*

*After they've exhausted  
All the other possibilities.*

Thank you.