Gender in STEM

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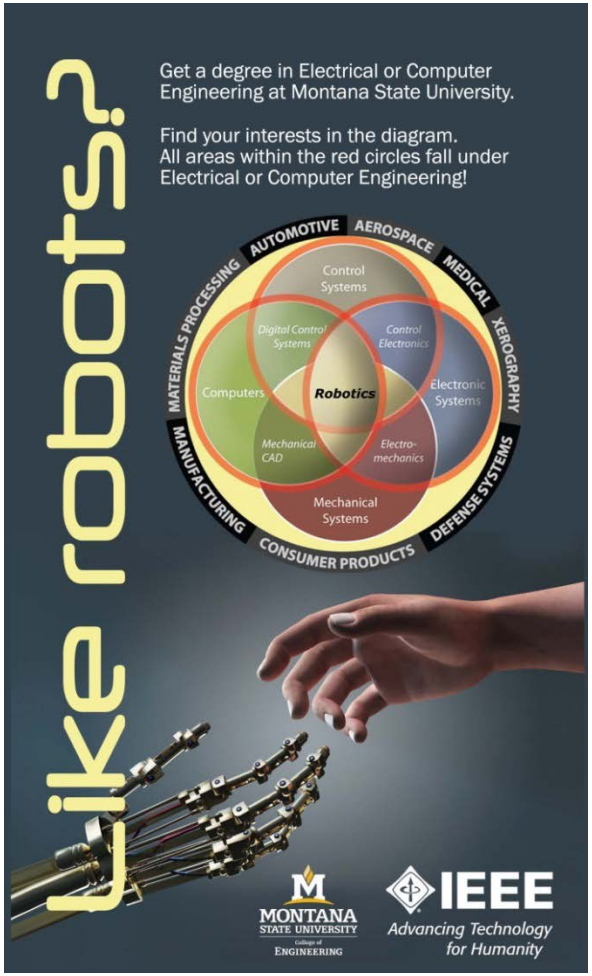
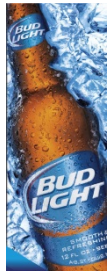


STEM Education – Who Cares?

- **Does technology make our lives better?**
  - In the US, we have electricity, smart phones, and more food that we can eat.
  - In the US, we don't spend the majority of our time looking for food, shelter, or fending off invaders.
  - This allows us to spend our time developing specialized expertise and exploring higher levels of abstract thought (or watching football and drinking lots of beer).



STEM Education – Who Cares?

- **Whether or not you think this is "Better", technology does do 3 things:**

1) Increase the population density

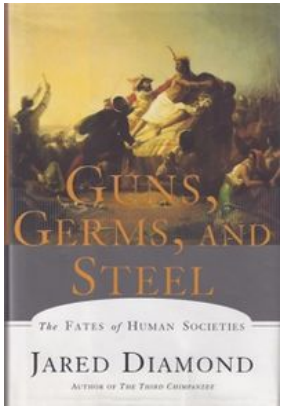
- Higher efficiency agriculture/ranching/housing
- More effective medicine

More people per square mile

2) Helps protect us

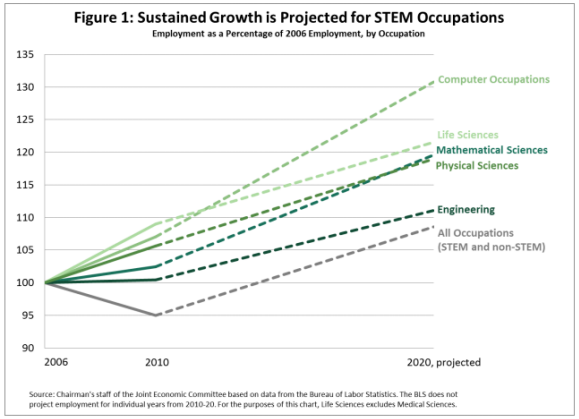
- Advanced weapons & surveillance

A smaller fraction of our population is needed to protect us.



3) Fuels our economy

- Scientific innovations account for 50% of the growth in U.S. economy.
- Predicted 10 year growth in STEM jobs (17%)
- Predicted 10 year growth in non-STEM jobs (14%)
- The non-STEM job rate includes recession recovery while the STEM jobs rate has increased throughout.



Who are these STEM People?

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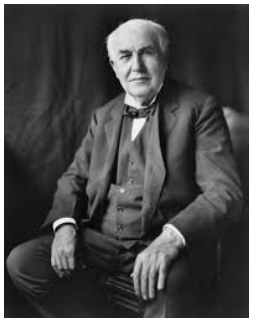
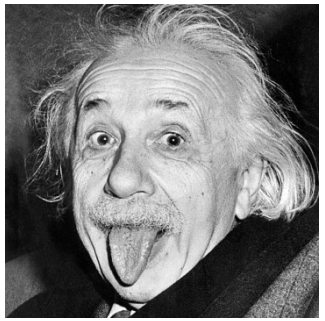
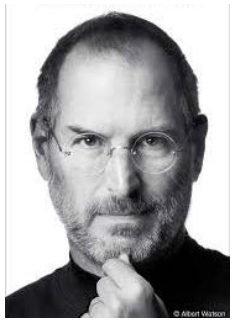
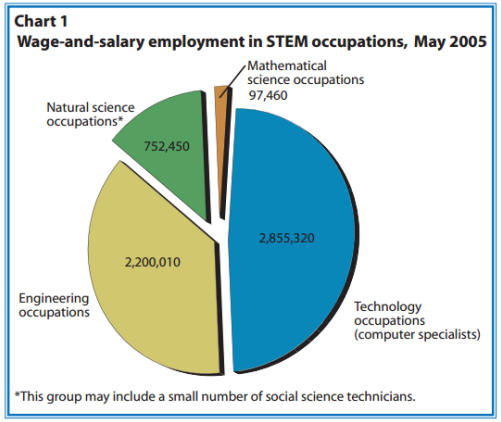
- **Scientists, Technologies, Engineers, Mathematicians = STEM**
  - ~132M people work in the U.S.
  - In 2012, **7.2M were in STEM** (1 of 18 jobs)
  - 1.1M science related jobs
  - 2.4M engineering/tech related jobs
  - 3.7M computer/math/tech related jobs
    (healthcare practitioners are not included in STEM)

- **Is the STEM field growing? Think about this…**
  - In 2005, STEM fields accounted for 6.2M jobs in the U.S.
  - In 2014, there were 4.4M **STEM JOB OPENINGS** requiring a bachelors degree.
  - Of these openings, 2.3M were considered entry level.
  - Where did these come from?
    - Computers skills are driving growth
    - The recover is replacing traditional jobs with high tech jobs
    - Today it's hard to find a sector that doesn't NOT use STEM



Are there enough STEM grads?

- **Let's look at engineering (easier to compare the number because we keep better track)**
  - First, what is an engineer?

    ~~"A super nerdy dork that …"~~

    "A person who designs technology that applies scientific knowledge to solve societal problems."

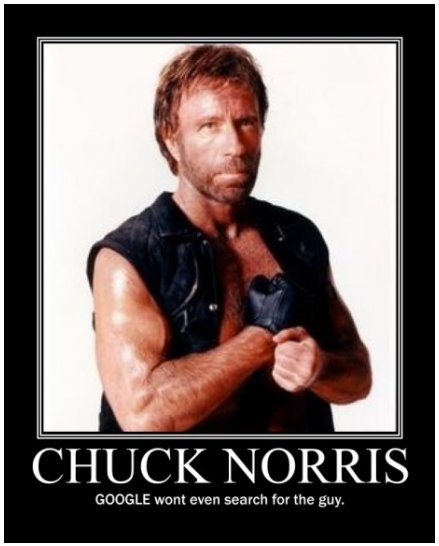
  - ~1 out of every 125 people in the U.S. is an engineer

- **Are there enough engineering grads to fill the need?**
  - If there are 2.3M entry level STEM jobs, and engineering represents ~30% of STEM, then we need ~700k engineering grads to meet the demand.
  - And we produced….. **80k in 2013…**

Do STEM grads really matter?

- **Who cares? We're the USA. Things are great in the U.S.**

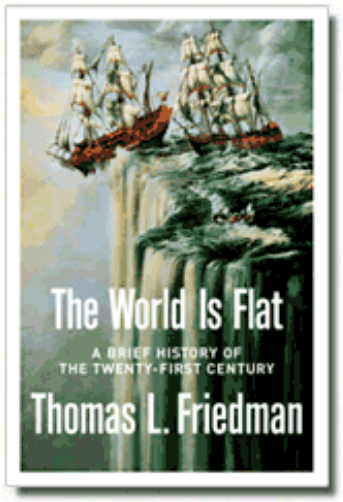
- **We're on top and always will be!**



Right???

The Gathering Storm

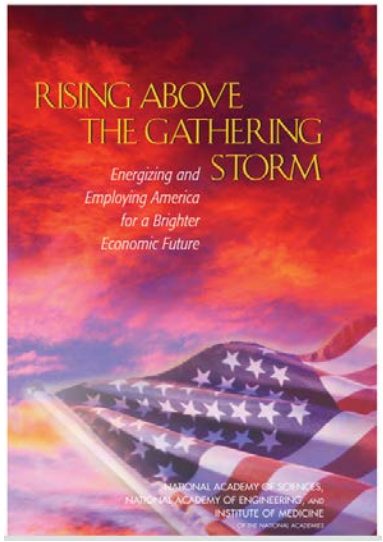
- **Around 1990, things started changing…**
  - The Berlin Wall came down ending a isolation between the east and west.
  - The internet proliferation hit critical mass, information was now available to all individuals, not just the privileged.
  - Our competition was now global.



- **What do you think emerging countries did to complete?**
  - They went all in on STEM

The Gathering Storm

- **In 2005 the National Academies released "Rising Above the Gathering Storm"**
  - The report was requested by congress to give recommendations on how to keep the U.S. competitive in the rapidly changing global economy.
  - The report was updated in 2010.
  - The report highlighted that the U.S. *may* be slipping..



The Gathering Storm

- **Is it really that bad?**

A Few Factoids

Thirty years ago, ten percent of California's general fund went to higher education and three percent to prisons. Today, nearly eleven percent goes to prisons and eight percent to higher education.[1]

In 2009, 51 percent of *United States* patents were awarded to non-United States companies.[4]

Only four of the top ten companies receiving United States patents last year were United States companies.[12]

Forty-nine percent of United States adults do not know how long it takes for the Earth to revolve around the Sun.[30]

The United States graduates more visual arts and performing arts majors than engineers.[31]

In 2000 the number of foreign students studying the physical sciences and engineering in United States graduate schools for the first time surpassed the number of United States students.[15]

The United States ranks 20th in high school completion rate among industrialized nations and 16th in college completion rate.[34]

In less than 15 years, China has moved from 14th place to second place in published research articles (behind the United States).[35]

The Gathering Storm (Higher Ed)

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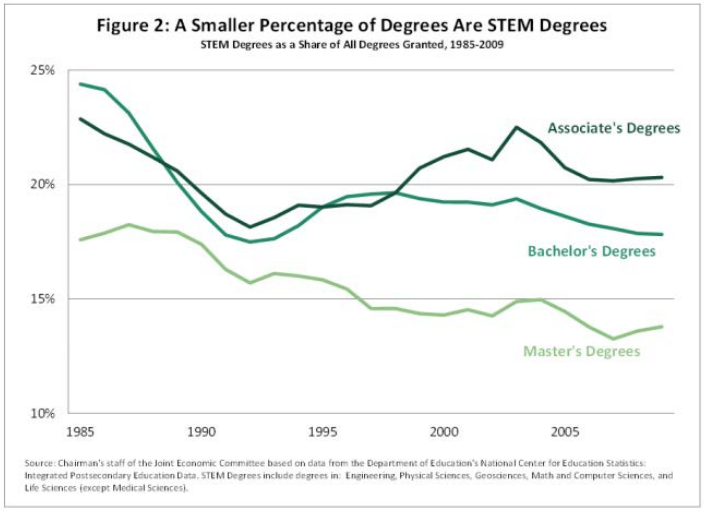
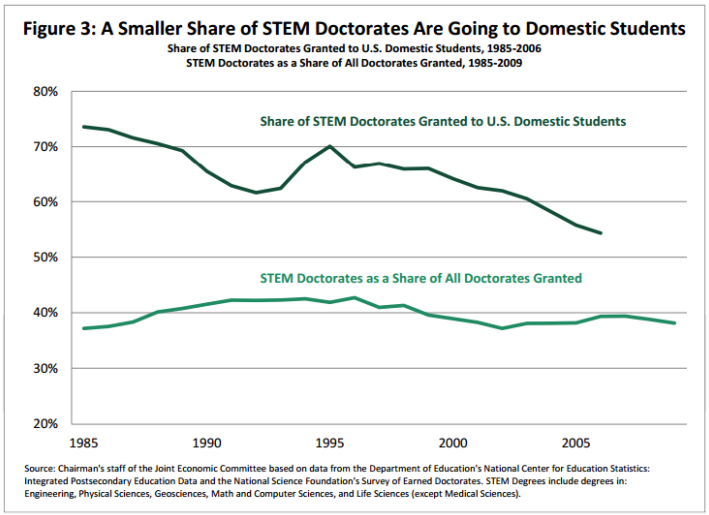
- **But we did graduate 80k engineering bachelor's degrees last year!**
  - There were 2M engineering B.S. graduates globally
  - India produced 340k
  - China produced 700k

Half of all engineering B.S. degrees

- **U.S. students seem to becoming LESS interested in STEM**





The Gathering Storm (Higher Ed)

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- **How many engineering grades do we need?**
  - To keep the U.S. economy strong and growing, we need a STEM workforce of **~8.65M by 2018**.
  - That's ~1.5M new jobs in the next 4 years!

- **How do we get there?**
  - Obama calls for 10k new engineering grads NOW through retention efforts.
  - But there's only so much that higher ed can do because only so many students go into engineering.

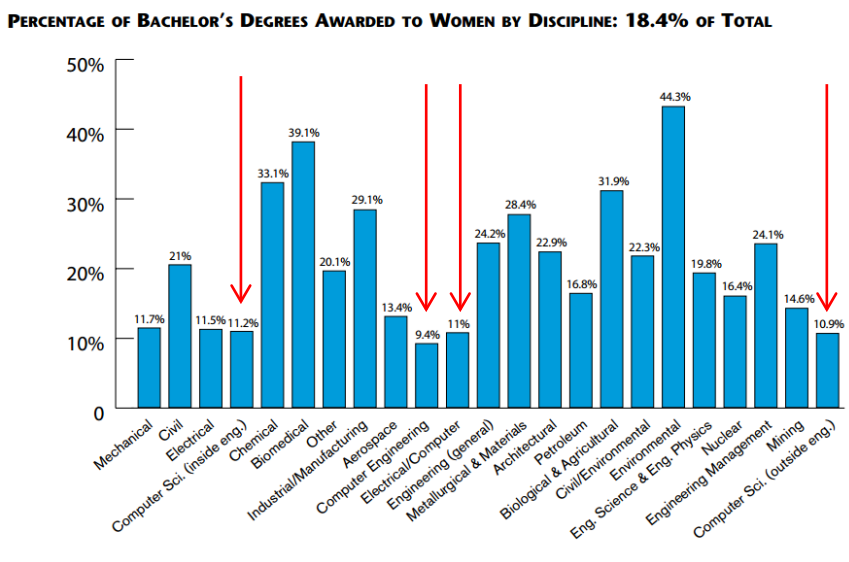
- **We need to fill the pipeline**
  - The #1 recommendation by the National Academies is:

    Move the United States K-12 education system in science and mathematics to a leading position *by global standards*.

    "10,000 Teachers Educating 10 Million Minds"

Fillings the STEM Pipeline

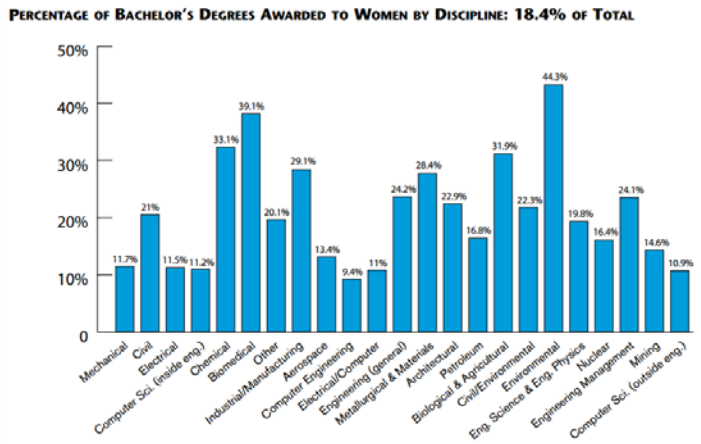
- **Step 1 – Increase Diversity**
  - Only 18% of engineering graduates were female.
  - This is the largest underrepresentation of all fields.
  - As early as 1st grade, students begin to form stereo types about careers (jocks, nerds, male vs. female)
  - Role Models are HUGE! (what do you want to be when you grow up?)



My team with President Cruzado

Fillings the STEM Pipeline

- **Step 1 – Increase Diversity**
  - What about at MSU?

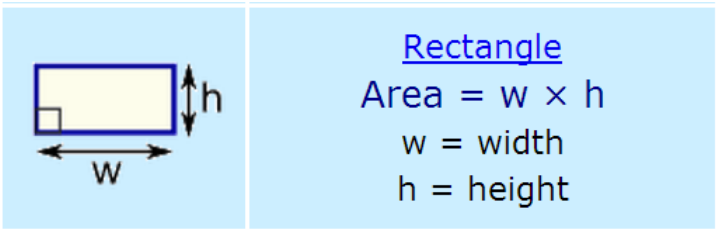


Major	Total	Gender Breakdown			
		Male		Female	
			%		%
Chemical & Biological Engineering	39	20	51%	19	49%
Chemical Engineering	80	57	71%	23	29%
Civil Engineering	133	103	77%	30	23%
Computer Engineering	41	37	90%	4	10%
Computer Science	94	77	82%	17	18%
Construction Engineering Tech	36	36	100%	0	0%
Electrical Engineering	107	99	93%	8	7%
Industrial Engineering	22	18	82%	4	18%
Mechanical Engineering	220	200	91%	20	9%
Mechanical Engineering Tech	47	47	100%	0	0%
General Engineering	59	54	92%	5	8%
Undeclared	73	58	79%	15	21%
Other	105	91	87%	14	13%
Male	897				
Female	159				
Total Engineering Majors	**878**	**748**	**85%**	**130**	**15%**
Total Undeclared Majors	**73**	**58**	**79%**	**15**	**21%**
Total Majors Outside Engineering	**105**	**91**	**87%**	**14**	**13%**
Total	**1056**	**897**	**85%**	**159**	**15%**

Note: Shaded boxes represent an ethnicity that also contains women.

- **Step 2 – Application of Theory**
  - Theory in a vacuum only appeals to a minority of students (e.g., the geeks)

This is OK



This is better

$50/acre

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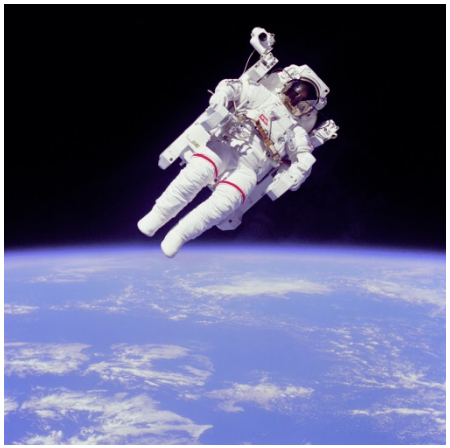
  - Applying theory to application brings new types of thinkers into STEM
  - Finding real world, and EXCITING applications of math and science makes STEM more appealing as a career choice.

Fillings the STEM Pipeline

- **At MSU the saying is:**

“There’s only three things that excite kids, robots, astronauts, and dinosaurs”



What do you think?

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- **Beareau of Labor and Statistics, 2013 data.**
- Number of US engineers in decline relative to China, India By Mike Shammas | September 19, 2011
- **STEM Education: Preparing for the Jobs of the Future ,, U.S. Congress Joint Economic Committee 2012**
- **Where are the STEM Students?, myCollegeOptions, STEM connector, 2012**

Robotics at MSU

- **Robotics is everywhere in the curriculum at MSU**
  - Freshman level courses
  - Senior design courses
  - Outreach