Bill Nye Commencement-Speech at Rutgers University

Distinguished faculty, parents, guests, alumni, ladies and gentlemen, boys and girls, Scarlett Knights of all ages, and especially graduates: Welcome and congratulations! You made it. Very nicely done. I plan to input some wisdom here, let me start with reminding everyone that now I can say, “Trust me — I’m a doctor…”

When I managed to get out, er… uh, I mean when I was graduated, after those few easy, carefree years in engineering school, the world was full of trouble. During my college years, we wound down a miserable war in Southeast Asia. We experienced in energy crisis in which people waited in their cars in a long line for fuel; gasoline prices along the New Jersey Turnpike skyrocketed to over 50 cents a liter, $2.00 a gallon. That would be $9.00 a gallon today. Still a bargain.

We were still in the throes of the Disco Era — the

Chevy Vega, and the Ford Pinto — something no designer, no engineer, and especially no lawyer could be proud of. We are now deep in the most serious environmental crisis in human history. I believe you all can avoid this looming disaster. And, much as I love my "Uptown Funk," I nevertheless hope you all can also avoid another Disco Era, and especially those polyester leisure suits.

The oncoming trouble is Climate Change: It is going to affect you all in the same way the Second World War consumed people of my parents' generation. They rose to the challenge, and so will you. They came to be called The Greatest Generation. I want you all to preserve our world in the face of Climate Change and carry on as The Next Great Generation.

Now, the fundamental reasons that the climate is changing are not that complicated.

I remember well being at the New York Worlds'

Fair in 1965. There was a large display, a tote board, depicting the estimated human population of the World. While we were at the fair, the world's population clicked over from 2,999,999,999 to 3 billion humans on Earth. Around Halloween of your freshman college year, we rolled over to 7 billion humans on Earth.

Then, if you had some sort of extraordinary ladder-climbing car that could operate on some sort of extraordinary ladder-runged road, you could drive straight up for an hour, and you'd be in outer space. I guess if it were a road like the turnpike, it would take you four or five hours. But, the stark, cold vacuum of space is barely 100 kilometers, 60 miles from here. Our atmosphere is surprisingly thin, barely visible from a distance in space.

That's it; that's our problem. We have almost 7.3 billion people breathing and burning an atmosphere,

which is, in the planetary scheme of things, quite shallow. We all share the same air. That's why our climate is changing. Denying it is in no one's best interest.

If you know any climate deniers, I'm sorry. But, try asking them this question: "Do you believe that it's a conspiracy of health professional that is duping the world into believing that cigarette smoking causes cancer?" The scientific consensus on climate change is at least as strong as the consensus on smoking.

Climate change is a real deal. So, hey deniers — cut it out, and let's get to work.

By the way, or BTW, article 1, section 8 of the U.S. constitution stipulates that Congress shall promote the progress of science and the useful arts — are they doing so?

With all this said, what can "we" do about climate change? By "we" of course, I mean "you."

As an engineer, I go looking for technical solutions to

almost any problem, transportation efficiency, catastrophic floods, ice storms that knock down power lines, or software to help you or me connect with a potential date or mate. Can we say, "connect," during a commencement? At any rate, for problems, I first turn to technology.

When it comes to climate change, wouldn't it be great, if technologies could save us automatically. But here in 2015, I don't think we can count on entrepreneurs to invent everything we need fast enough. Presuming that extraordinary global warming mitigation technology will emerge in the world marketplace by itself, so-called techno-optimism is just another way of living in denial.

When I was a kid, vacationing on the Delaware shore, it was a big day, when someone spotted a dolphin swimming by. People would stop in their sandy tracks to watch.

In those days, it was okay for ships to wash out their bilges, the filthy inside of their hulls, with seawater. Because old diesel engines leak thick bunker oil, the sand on the beach was often heavily streaked with tar. If you visit those same Jersey or Delaware beaches today, hundreds of dolphins swim by all the time, and there is virtually no tar on the beach. People decided that the environment was as or more important than letting any business damp, whatever it felt it needed to dump, into water and air. Environmental legislation changed the world for the better.

Do you know how many people of my parents' generation passed those laws? They participated in the political process. They paid attention. They voted! Class of 2015, you have to vote! For those of you, who don't want to participate — who don't want to vote, would you please just shut up, so the rest of us can get things done.

Right now, it's still too easy for any of us to dump our carbon waste in the world's atmosphere. We are going to need thoughtful, reasonable, fair, and tough regulations. We're going to find a means to enable poor people to advance in their societies in countries around the world. Otherwise, the imbalance of wealth will lead to conflict and inefficiency in energy production, which will lead to more carbon pollution and a no-way-out overheated globe.

When you all were born, the Earth's atmosphere comprised about 0.035% carbon dioxide. That number is often reckoned as 350 parts per million. Well today, as you're being graduated, the world has over 400 parts per million. By the end of the year, we may reach 40! It's not just the number… the rate of increase of people and pollution that's killing us.

In general, all this means we need to provide two things: Electricity and clean water to everyone on

Earth. Sooner or later, we are going to have to come up with some amazing new ideas to create or develop more resources to accommodate more people. I want you to solve our legal problems as well as our technical challenges and, dare I say it — Change the World.
The technical problems are easy enough to articulate, just very, very difficult to actually solve. First, we need a better battery, or a better system of batteries, or some means: chemical, mechanical, or hydrological, to store energy, especially electricity. There is enough wind and solar energy in North America to provide our energy needs many times over, if we just had some way to get it from where we can produce it to where we need it. That means a sophisticated or smart electrical grid, connected to much more efficient transmission lines, to create a system that moves electricity from where it is produced to where it is needed, on time, and at the right power levels.

Speaking of which, it has been recently shown that we may be able to use carbon in another way to produce fresh water from seawater with a fraction of the energy required, right now, using sheets of carbon a single atom thick-graphene. The seawater's fluid slip-length is longer than a carbon atom is wide. Water can slide on through and leave the salt behind. It's wild. If this idea proves workable, you all could use it to provide clean water to everyone on Earth.
Just think what else is out there, what other physical or biological phenomenon is just waiting to be discovered, or invented, or thought of. You all can do this. You all can be the Next Great Generation. You can, dare I say it, Change the World.
By the way, if you come up with one of these key technical ideas, changing the world would be just the start; you might also get rich — crazy rich.
It is sobering for me, and perhaps more than a few

of your parents, to consider that you all, Rutgers University graduates, know more physics than Isaac Newton or Albert Einstein did. You know more about the universe than Galileo or Copernicus knew. I can guarantee that significant discoveries will be made in your lifetime that will change everything in the same way the invention of powered flight or the Internet changed the way everyone connects with everyone around the globe. Your parents, loved ones, and I hope some of you sitting here today will be the ones who make these new discoveries.

By way of example, imagine this: when I was a kid, no one had a good theory as to what happened to the ancient dinosaurs.

In my lifetime, we discovered the tell tale worldwide layer of iridium metal and the world ending meteoric impact crater near Chixalub, Mexico. It was like science fiction, except it was real.

By the way, as a result of that discovery, the airburst over Chelyabinsk, Russia, and the recent near misses of several asteroids — people are at last appreciating the astonishing threat of a meteoric impact. You all are the first generation of engineers, scientists, educators, and foreign policy wonks, who can get humankind to do something about an incoming asteroid. What will it be? A kinetic impactor? A solar sail draped over the object like a painter's drop cloth? A swarm of sunlight-powered rock vaporizing lasers in space? Or something we have yet to conceive? The world is counting on you, The Next Great Generation.

Along with the evidence of common sense, researchers have proven scientifically that humans are all one people. We're a lot like dogs in that regard. If a Great Dane interacts (can we say interact?) with a Chihuahua, you get a dog. They're all of the same species. Same with us. The color of our ancestors' skin and

ultimately my skin and your skin is a consequence of ultraviolet light, of latitude and climate. Despite our recent sad conflicts here in the U.S., there really is no such thing as race. We are one species — each of us much, much more alike than different. We all come from Africa. We all are of the same stardust. We are all going to live and die on the same planet, a Pale Blue Dot in the vastness of space. We have to work together.

Included with all this stuff about making new great discoveries and changing the world, I'd like to give you some advice, just plain old advice like: If you smell fresh paint, don't walk under the ladder. Wear good shoes in a thumbtack factory. And, don't try to smoke in the rain. In fact, don't smoke at all, ever.

Here's an unusual one: If you're going to get a bucket of water dumped over your head for any reason, untuck your shirt. You might not think it would make

much difference. A cotton shirt like this one is hydrophilic. Water is going to stick to it. True enough, but a shirttail, even a water-loving one, directs a great deal of the torrent around your waistband. So, you get a lot less cold water in your trousers and skirt.

I'm telling you this not just because it's so obviously useful — but because there is a big idea. Everyone you will ever meet knows something you don't. This is troubling for many of us know-it-alls. Auto mechanics today write code and debug software. Cooks understand the use of copper to control egg proteins. Bricklayers have intimate knowledge of the strength of materials. Respect their knowledge. Learn from them. It will bring out the best in both of you.

So far, I've talked about problems and opportunities that are down on Earth. But I remind you all that we must continue to explore space. 100 years from now, humankind will almost certainly know whether or not

there was or even is life on Mars. But why not do that exploration now? Just think what it would mean to biology or even medicine, if we were to discover evidence of life, some sort of fossil Martian microbe — a "Marscrobe" perhaps — on that other world. It would change the way each of us thinks of his or her place in the cosmos, our place in space. The Planetary Society engaged experts, who evaluated the technology and the budget required to send a worthy few of you on a journey, during which you'd orbit Mars in 2033 and land a few years later. You could look for life and… Change the World.

While we're at it, I cannot help but remind everyone here and everyone listening that this coming Wednesday, 39 years after my old Professor Carl Sagan promoted the idea, The Planetary Society is going to launch our own citizen-funded Lightsail™ solar sail spacecraft. We hope it will change the world a little by

democratizing space exploration. Who knows what's next.

By the way, while you're on Mars, stroll by The Spirit, Opportunity, or Curiosity Mars rovers. Each is fitted with a photometric calibration target, a small sundial that serves as a test pattern for their cameras. Look closely. Engraved on each are these words: "To those, who visit here, we wish a safe journey and the Joy of Discovery." The joy of knowing: that's science; that's what drives us. It brings out the best in us — and makes our species worthy of the future.

I often reflect on the words of my third grade teacher, Mrs. Cochran: she told us that there are more stars in the sky than grains of sand on the beach. There are more than you can count, of course. But not only that, there are perhaps more than you can imagine.

I stood on the beach that summer, and I got to thinking about her assertion. Does she mean all the grains

of sand that I can see? Does she mean the ones I can't see, the ones that must cover the beach a few meters deep and a few thousand nautical miles north and south? That's a lot of grains… of sand. By reasonable reckoning, it turns out Mrs. Cochran was right. There are about 100 stars for every grain of sand on Earth.
In that long-ago moment I was paralyzed by self-doubt. I am just a little kid standing on a beach. And, that beach is a one of many beaches on a planet that turns out to be, in the cosmic scheme of things, pretty small — a speck really. Furthermore, my home speck, the Earth, is just a speck orbiting a star that really, considering all the other sand-grain-numerous stars, is just another speck in the galaxy of stars. The galaxy, in turn, being another speck, among galactic specks. I am a speck on a speck orbiting a speck in the middle of deep spacey specklelessness. I don't matter at all.
But then I think, wait. I have a brain, albeit only this

big. (My old boss's — somewhat smaller.) And, I can imagine all of this. That is wonderful. That is remarkable. That is venerable — worthy of respect!
So Class of 2015, here's wishing you the joy of discovery. Keep reaching. Keep seeking. Keep using your abilities to bring out the best in those around you, and let them bring out the best in you. Become the Next Great Generation! You can and you will — dare I say it, Change the World!
This has been an honor; *thank you!*

This booklet was designed by Shelby Charette in Type 1 at St. Edward's University. It is set in Times, designed by Stanley Morrison, and designed using a grid devised from the geometric proportions of the booklet's trim size.