

“Ready; Set; Change the World”

Presented by Dr. Robert D. Braun ('87 AERSP)

Penn State College of Engineering Commencement

May 4, 2012

Good evening. Dean Wormley, Dr. Pangborn, faculty, staff, and, most importantly, the students and families here today, thank you for the opportunity to share in this moment, to be with you here on this very special day.

It's hard to believe that I sat where you are sitting now 25 years ago. But, I did. I can tell you that I still remember pieces of that day, etched into my mind like photographs: Penn State alum and NASA astronaut Guy Buford was the commencement speaker that day at Rec Hall; it was an afternoon event, one of those beautiful days in May, here in Happy Valley; Professor Melton was there, as was my family: my parents, my brothers and my grandparents; Bryce Jordan was our president, and I was surrounded by friends from all walks of life, friends who I still consider family today. And while my time in Happy Valley was ending, my life was just beginning.

I came to Penn State as an excited teenager from Rockville, Maryland. I had never spent more than a few nights away from home. I remember thinking of this place as camp, as Disneyland. My parents dropped me off in August and I didn't go home until Thanksgiving. I was a sponge, soaking up every experience and every ounce of knowledge I could find. I made friends, lots of them. Friends from little towns across this great state where I had previously never been: Scranton, Wilkes Barre, Homer City, Mt. Lebanon, Lucerne, and Dallas. As a senior in high school, I watched Penn State win its first football national championship. My senior year on campus, we won the second.

I was always drawn towards engineering, but never sure exactly what type of engineer I wanted to be. My father was an EE, so that wasn't going to be it. I went into aerospace engineering because it was a field I found particularly inspiring. As a child, I dreamed of landing a spacecraft on Mars, of constructing hotels and industries in space, and of building a plane that could travel half way around the world in hours. These things were not possible then, but the future was bright. The Jetsons couldn't be too far away. Hopefully, you all know who the Jetsons are. Well, at least your parents do.

I learned. In fact, it was here, in Happy Valley, where I learned how to learn. I learned the fundamentals of physics, dynamics, chemistry, and materials science. I learned that math had a purpose. I learned the value of hard work, passion and dedication, the importance of honesty and trust. I learned how to create new ideas from scratch, and I learned how to work effectively with others in teams that were more capable than the individual sum of their parts. I learned these things from the faculty of this fine institution, from my classmates in aerospace engineering, and from students across the College of Engineering and across the Penn State campus.

And then, rather abruptly, it was over. I graduated from Penn State in 1987. My four years in the sun had ended. While at the time I thought of graduation as the beginning of the end, in hindsight, it was really the end of the beginning. I left Penn State and went to graduate school before eventually landing a job at the NASA Langley Research Center in Hampton, Virginia.

My time at Penn State had enabled me to fulfill a childhood dream and become a rocket scientist. At NASA, I began to work towards my passion – exploration of our solar system. My first job out of school was to help figure out how to one day send people to Mars. And while we have yet to accomplish that feat, in 1997, ten years after graduating from Penn State, I helped land our country's first planetary rover on Mars. It was the first Mars landing in a generation, coming 20 years after the Viking missions I had watched as a boy.

My part of the mission, the flight through the Mars atmosphere, was about five minutes in duration. I spent years getting ready for those five minutes. Since then, I have been involved in landing multiple spacecraft on Mars, other solar system exploration missions, and planning for human exploration into deep space. In August, I will be at the Jet Propulsion Laboratory in California where the NASA team will land a vehicle right out of my dreams on the red planet – a rover the size of a car or small jeep, nuclear-powered, complete with a laser.

In my career, I have developed several new technologies, designed space missions from scratch, and been involved in building and operating a range of space missions. What's more, it has been fun. I worked at NASA for about 15 years, earned my PhD, and eventually joined the faculty on the campus of the Georgia Institute of Technology. Most recently, as NASA Chief Technologist, I worked to recharge NASA's technology activities, focusing these efforts on the new capabilities required for an exciting future in space.

I spend most of my time now dreaming of ways to improve society, and creating solutions to some of society's grand challenges.

When I think about it, that's really what engineers do. Engineers create solutions to society's grand challenges. Whether agricultural, aerospace, architectural, bio, chemical, civil, computer, electrical, industrial, mechanical, or nuclear engineering, there can be no more fulfilling way to dedicate your life.

Theodore von Karman once said, "Scientists study the world as it is, engineers create the world that never has been."

Think of how our lives have been affected by engineering – the knowledge provided by weather and navigational spacecraft circling the Earth, the communications ease and information accessibility of today's constant-contact society, efficiency gains in ground and air transportation, computers, robotics, solar- and wind-generated energy, pacemakers, artificial hearts, and the protective gear that keep our military, firefighters and police safe. There is no doubt that engineers create a better society.

In an age where iPhones are commonplace and it's difficult to remember a time without the Internet, it's easy to take the benefits of our technological prowess for granted. However, America is the nation we are today because of the engineers of past generations who dedicated their lives to making our country a global technological leader. This leadership was hard won, and it left a lasting imprint on the economic, national security and geopolitical landscape of the time.

New York Times journalist Brooks Atkinson once aptly said, "This nation was built by people who took risks – pioneers who were not afraid of the wilderness, business men who were not afraid of failure, scientists who were not afraid of the truth, thinkers who were not afraid of progress, dreamers who were not afraid of action." These characteristics aptly describe a successful engineer today.

Today, engineering is more important than ever. Engineering remains the key to economic, national security, and geopolitical leadership. Engineers develop technological solutions to real problems. Doing so, they change the world. Good engineers are not born; they are created over time. Your Penn State education has prepared you to innovate solutions to societal challenges, to create new industries, to improve our country and the world. What's more, your timing couldn't be better. Engineering is a field brimming with potential. It's a great time to be an engineer.

The 21st century will be won by those who innovate, seek breakthroughs and develop new technologies. Thorough knowledge of engineering fundamentals is a pre-requisite for success. Reaching for grand technological challenges, today's engineers stand on the cusp of dramatic advances in materials, information technology, energy, and biomedical science. Breakthroughs achieved will provide lasting societal benefit, and will also serve as a catalyst to America's innovation economy.

Congressman Chaka Fattah recently stated, "Engineering is critical to the success of our nation, allowing us to seize opportunities to win the future in the global economy. Investments in science, technology, engineering and mathematics are the gateway to American competitiveness."

I teach aerospace engineering at Georgia Tech. In this capacity, I am surrounded by young engineers, like you, with large aspirations, engineers planning to change the world. Each year, in the first lecture of my freshman Introduction to Aerospace Engineering class, I share a list of accomplishments that I believe our nation's civil space program is capable of achieving in my lifetime. Here are just two examples:

- Accurately Forecast the Emergence of Major Storms and Natural Disasters: Imagine the lives that would be saved if just thirty minutes advance notice could be given before the onset of a major storm or natural disaster. Think of the people impacted by the recent earthquakes in Haiti, the tsunami in Japan, the tornados at the University of Alabama. Fifty years ago, the world was awakened to the fragility of our planet by viewing it, for

the first time, against the vast emptiness of space. Today, Earth satellites are a critical component of our telecommunications, reconnaissance and navigation infrastructure. As the pace of remote sensing technology continues to accelerate, I believe we will soon have the predictive capability to warn and move a population out of harm's way. Won't that be a great day?

- Identifying Earth-like Worlds Around Other Stars: If I were giving this talk five years ago, I would have said that when I look up at the night sky and see all those stars, I know in my gut that there has to be another Earth out there, somewhere. Well today, I no longer have to simply believe. As a result of the Kepler mission and other NASA missions like it, I now know that there are billions of planets in the Milky Way galaxy and that a few percent of the stars in our galaxy have Earth-like planets in their habitable zone, where the temperature is not too hot and not too cold. This is an area of science that is poised for dramatic returns in the coming decades. In fact, as our technology improves, so will our definition of "Earth-like." "Are we alone?" is a question that has likely pervaded our consciousness for as long as people have looked up at the night sky. Think of how an answer to this question could draw the people of our world together like never before.

In the next few decades, similar breakthroughs are likely in engineering applications as diverse as energy, biomedical, national security and information technology. Across nanotechnology, big data, robotics, advanced manufacturing, genomics and cancer treatment, technological breakthroughs will dramatically change our society. Engineering solutions to grand challenges like these are within our grasp, and it is young engineers, like you, who by thinking through these problems differently will create novel solutions.

In February of last year, the President came to Penn State. He spoke of the importance of cutting-edge research and technology to our nation's future. Among his remarks, the President stated, "Innovation is what this country is all about. Sparking the imagination and creativity of our people, unleashing new discoveries – that's what America does better than any other country on Earth. That's what we do."

That's what I would encourage you to do.

We are a nation of dreamers; a nation never satisfied with the status quo; a nation continually striving to out-innovate ourselves in the creation of new knowledge and new capabilities; a nation that remains full of opportunity. There is no better place or better time to be an engineer.

Accomplishing large goals is precisely what our nation has come to expect of its engineering workforce. Congratulations on joining the ranks of this profession, a community of individuals who have the knowledge and talent to change the world. Penn State's College of Engineering has prepared you well for the future. Now, go make it happen.

Henry David Thoreau once said, "Go confidently in the direction of your dreams. Live the life you've imagined."

You are this country's future, and your future is bright. I am counting on you. Be innovative. Take risk. Apply your energy, your skills, and your education to problems that stir your passions. I look forward to seeing the technological solutions you develop over the course of your engineering career. I look forward to the living in the future that you will create.