

Go Home! Change the World!

Gordon W. Day
IEEE President Elect
Closing Session, IEEE Sections Congress
San Francisco, August 22, 2011
(as prepared)

Good morning! It's almost over. Almost time to go home. For the past few days we've been informed, and trained, and inspired. We have briefcases full of papers and souvenirs. Those black books they gave us the other day are full of ideas. And now I hope we're going to put it all together and build a better IEEE.

So we have a lot to think about as we go home, but I want to add still one more thing to the list. I'd like us to spend some time looking outward, outside of IEEE. I'd like us to think about the importance of this profession that we share.

You saw a short video about that on Saturday morning, and you heard Vint Cerf talk about it.

Continuing those ideas, I'd like to introduce you to Theodore von Kármán. He was a Hungarian mathematician and a mechanical engineer in the first part of the 20th century. Educated in Hungary and Germany. Immigrated to the United States in the 1930s. Helped develop the field of aeronautics. Professor at the California Institute of Technology. Co-founder of Aerojet Corporation and the Jet Propulsion Laboratory. And famous enough that he appeared on a U.S. postage stamp. Not many engineers are so-honored.

If you read his autobiography, you'll see that he was also a keen observer of how technology develops, and the distinction between science and engineering. And he made a helpful observation about that. It was the quote that opened the video you saw Saturday morning.

“Scientists work to understand the world as it exists, engineers work to create a world that never before existed.”

Let me repeat that

Think about the first part of that sentence, the part about scientists. What do you see? A lot of famous people. Just in our areas, people like Faraday, Maxwell, Einstein, Bardeen, just to name a few. You see Nobel Prize winners. You see people who dramatically expanded our understanding of the world, and who became famous for their work.

Now think about the last part of the sentence, the part about engineers. What do you see there? More famous people, and now famous companies, too. In our field we see Marconi, Edison, Westinghouse, Bell and the companies that took their names. We see Steinmetz and GE, Grove and Intel, Gates and Microsoft, and many others, including a very large number of small companies. We see people and companies that dramatically changed our lives. We see enormous advances in quality-of-life. And we see millions of jobs and great prosperity created.

Like von Kármán, many of us here have worked in both science and engineering. And for me, that quotation is an accurate and respectful distinction.

Henry Petroski says it should be much more than that. He says it should be a roadmap for our future.

Petroski is a professor of civil engineering at Duke University. He also writes about the engineering profession. You may have read his column in last December's issue of Spectrum. Petroski builds on von Kármán's ideas, and points out that engineering achievements are sometimes accomplished without, or maybe even in spite of, advances in science.

For example, the steam engine preceded the science of thermodynamics by a century. The Wright brothers flew before the science of aerodynamics was developed. Marconi's radio transmission across the Atlantic defied the scientific understanding of the time. And so did Ted Maiman's ruby laser. The US space program and the internet were primarily triumphs of engineering, of designing and building things.

So Petroski says that von Kármán was right, and if we are to change the world, to create a new and better world, we need to focus at least as much on engineering as on basic science.

That's us he is talking about. That's our profession.

Now let's think about this from another direction. Sometime on your way home, take out pen and paper, and write down what you think are the most important engineering achievements of the past century. And when you get home, compare that list to the list produced by the National Academy of Engineering, about a decade ago, here in the United States. Your favorite search engine will help you find it.

But I'll give you a head start. The Academy's list has twenty items on it. It includes things like electrification, the automobile, the airplane, radio and television, computers, the telephone, highways, the internet, imaging technologies, health technologies, the laser and fiber optics. That's about half of them. I think you've got the picture.

And I think you'll have a good time comparing their list with yours. I'll bet they'll be similar, but resolve the differences to your satisfaction. And then, once you have a list that you like, a list of the most important things engineers did in the 20th century, try thinking about it from another perspective.

Think about your life, and your parents' lives, and your grandparents' lives. Make another list, a list of what has made your life and their lives better....the products, and services, the public works that have improved quality of life in the last century or so. And compare that list to the list of engineering achievements.

I think you'll discover very few things on your second list that are not somehow reflected on your first list. That is, you will not find many things on your list of quality-of-life enhancements that did not come from the work of engineers. I think you'll see that, for the past century or so, life has been shaped primarily by the creativity, the ingenuity, and the innovation of engineers. And I think you'll find that more of those

advances were created by electrical, electronics, and computer engineers than any other discipline.

I often share these ideas with engineering students. And at this point I say, “So your predecessors essentially defined quality-of-life in the 20th century. The 21st century is your responsibility. What are you going to do with it?”

I find that very few have thought about their careers in that way. After a bit, they start talking about applying technology to health care....to diagnostics, therapeutics, and prosthetics.....and to sustainable energy....and to environmental concerns. I commend them for that. These are very important challenges, and engineers who make significant advances in those areas will be greatly honored. But I also encourage them to search for even bigger ideas....bigger opportunities. And I hope that you will also promote this idea of tackling big ideas, especially those of you who work with students and early career engineers.

Our profession has proven that it can take on the big challenges. Let’s not think small or let the next generation think small.

And now let me divert your thinking one more time. Most of you know the work of Thomas Friedman, the foreign affairs correspondent for the New York Times. He’s most famous for four words that formed the title of one of his books: “The World is Flat.”

What he meant by that is that many jobs, including many engineering jobs, can be done anywhere in the world there’s access to a broadband data connection. Friedman sees that as a threat to developed countries. Jobs shift to cheaper labor markets.

I don’t want to minimize the pain of the many engineers who have seen their jobs move to another country, but Friedman exaggerated. The world is flatter than it used to be, but not nearly flat. Import-export data, communications data, and travel data support that. The world is semi-globalized.

I like the way Richard Florida visualized it. Florida is a sociologist, now at the University of Toronto. He says the world is not flat, it's spiky. He started with night-time pictures of the earth from space, and made a three-dimensional plot of the light intensity. Light intensity is a measure of economic activity. I think you can picture that as spiky, not flat. And then he made a couple of plots related to where innovation occurs.....where inventors live, and where the mostly highly cited research papers are produced. It won't surprise you that those are spiky, too.

So may I suggest to you, as engineers of the 21st century, that one of your biggest opportunities is to make the world flatter. To improve quality-of-life in the dark parts of those images from space. To bring electricity, and communications, and clean water, and health care to those who lack these basics. We are the profession that is able, more than most others, to solve those problems. And I believe that we have a responsibility to do so.

Let's flatten the world!

And may I remind you that flattening the world includes developed countries? There are dark areas in most countries, and innovation is the basis for prosperity everywhere.

But countries don't innovate. Companies don't innovate. Universities don't innovate. People innovate!

So succeeding in technological innovation means building a talented, and well educated, and energetic, and entrepreneurial workforce. Countries need to attract their young people into technical professions, and make sure they have the educational opportunities to be successful....and they need to provide the infrastructure and financial resources technologists need.

We in IEEE are in the business of helping people innovate. Let's not forget that that's our mission. I love our motto: "Advancing technology for humanity."

We advance technology by providing what technologists need to do their jobs. We provide the technical resources – the journals, the conferences, the standards. We provide networking opportunities....the importance of which, I think, can hardly be overstated.

And I'm convinced that we need to do much more to help technologists advance in their careers....continuing technical education, building leadership skills and communications skills. We need to do that because, more than ever, engineers must take the responsibility for the development of their careers. Engineering labor is becoming more and more like a commodity, and I don't see that trend changing.

So here is your assignment. Think about the importance of the profession we share. Build on some of the ideas I've given you. Take them to a new level, and share them with your colleagues and friends. Share them with the young people in your lives. Share them with the people who make important decisions in your country.

Be assertive! Promote our profession!

I'd like to close by reminding you of the story of three medieval stone masons working in a quarry in England. A stranger came by and saw them chipping away at blocks of stone. He asked one of them what he was doing. The reply was "I'm shaping these stones for my master." The stranger wasn't satisfied with that answer, so he asked the second mason what he was doing. The reply was, "I'm building a wall." That was a better answer, but the stranger wanted to know more, so he asked the third mason. This time, the answer was "I'm building a cathedral."

So I ask you: "What cathedral are you building?" And when you've figured that out, I hope you'll focus on it. Accept our professional responsibility to change the world, to create a world that has never before existed. And let's make it a good one.

I thank you for coming to Sections' Congress. And I hope you have a good, thoughtful, trip home.