NYU-Poly Convocation Remarks
John Seabrook, Journalist and Author
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Thank you, Dianne, and thanks very much to NYU-Poly for asking me to speak today. And greetings freshmen, and graduate students, faculty, and fellow Brooklynites — my home dawgs, as my eleven-year-old son would put it. Congratulations to everyone who has decided to become an engineer, or is thinking of a career in math and the sciences. The coming years are going to be a fantastic time for these professions, with lots of highly skilled, high paying jobs in these fields. Never before have inventors and innovators had so many tools available to them. Let me begin by mentioning just a few of the developments that I've come across in recent years in my work as a journalist that I think are particularly exciting.

I'm sure you are all familiar with computer-aided design, which allows you to draw on a computer screen virtually anything you can imagine. Recent years have seen the proliferation of rapid prototyping machines, which can print out, in three dimensions, many of those CAD drawings. These machines have radically reduced the time between conception, prototype, and an actual product, by eliminating the costly and time-consuming process of creating machine tools to make prototypes. To take just one example of what's possible these days — the Copenhagen Wheel is a new invention for turning an ordinary bicycle into an electric one, which will go on sale next year, for 600 dollars. It began only two years ago as a project pursued by a group of graduate students at MIT. So from student project to a real life product that could have a dramatic impact on transportation, in just two years — that's pretty amazing.

And that's just the beginning. Rapid prototyping machines are still expensive, but what happens when they become as common as Ink Jet printers – something that millions of people have on their desks. (Remember, Ink Jet printers cost 10,000 dollars in 1980, and they're under 100 dollars now.) That will mean masses of people will be able download and print out inventions directly from the engineers who create them – bypassing manufacturing and distribution and retail stores entirely. Such a technology could bring about a new age of Inventor -entrepreneurs such as existed in the mid to late

19th century. And it might not be that far off. A group of engineers in the US and the UK are working on a rapid prototyping machine that can make a copy of itself, which would mean virtually everyone could have a desktop factory for almost nothing.

If you are thinking of pursuing a career in structural engineering, you will have the enormous advantage of breakthroughs in material science, such in self compacting concrete, and structural glass (did you know that one of the safest rooms in New York City is made out of glass, the blast proof lobby of 7 World Trade Center designed by James Carpenter?) and the continually expanding uses of plastic. These are stunning developments to the history of construction, most of which were brought about by engineers, the implications of which are only beginning to be realized by architects like Zaha Hadid and Norman Foster. In Foster's buildings in particular, the structural engineering is the architecture. Which begs the question of who is the ultimate creator here, the architect or the engineer?

But in spite of all these new tools and opportunities, engineering as a profession is declining in the US, and it has been for years, relative to other skilled professions. China produces five times more engineers than the U.S. does. Of those Americans who do graduate with engineering degrees, almost half are no longer practicing by the time they're thirty. DARPA, the Defense Department's Research Agency, has called the decline in U.S. college graduates with degrees in the so-called STEM subjects (science, technology, engineering, and mathematics) an issue of "national importance" and one that "affects our capacity to maintain a technological lead in critical skills and disciplines" in the world.

By the year 2020, there will be a hundred and twenty-three million high-skill, high-paying jobs in the US but only fifty million Americans will be qualified for them. Now let's stop and think about this for a second. Assuming most young people make rational decisions about their future, why are so many going into Media Studies or fashion design or journalism or film making, or choosing careers in finance and marketing, although there may not be jobs in those fields when they get out of school, when there are plenty of interesting and well paying jobs in engineering? Is it because jobs in the so-called creative industries — television, publishing, movies — are easier, more fun, or more

fulfilling than careers in engineering? I don't think so. Is it because the prospect of a big score on Wall Street is too great? Is it because we aren't teaching engineering and science properly at the elementary school level? Does it have something to do with status?

Britain was the birthplace of the Industrial Revolution, and in 1850 it completely dominated the world of engineering and industry much as the US did a century later. Today Britain is an industrial nation in steep decline, which lags behind Germany and France in many categories, to say nothing of the US and China and Japan. It's known for beer and whiskey, soccer, and its creative industries. Only a few years ago, one might have said, well yes, but London is the future financial capital of the world, So Britain doesn't need industry and exports anymore. Wrong! Now, thanks to the crash, Britain is facing an enormous budget deficit and its most draconian budget cuts in fifty years.

Why did Britain decline as an industrial power? The best explanation I have read, which is in a book called "English Culture and the Decline of the Industrial Spirit, 1850-1980," by Martin Wiener, is that the industrial revolution failed to produce a fundamental social revolution, and so the values and prejudices of the old landed aristocracy were left in place. These included a snobbery toward anything related to manual labor or trade. Therefore, the children of the newly wealthy industrialists valued the arts, leisure and investing over work and manufacturing, and the decline of the industrial spirit was inevitable.

Is the same thing happening in the US? Of course, in the US, we don't have a class system -- do we? Hmmm. I wonder if there isn't some hidden hierarchy in the way we divvy up the humanities and the sciences in academia. Why do the humanities get beauty and meaning and history, and the sciences get the technical stuff. Why is Leonardo da Vinci remembered as an artist, when he was just as great an engineer? The very word "humanities" seems to imply that science and the applied sciences are not as centrally involved with what it means to be "human," as are art and history. But that can't be true, for what is more human than tool making?

As engineers and scientists it behooves you to bridge this divide — to make beauty and meaning as much a part of your work as soldering and circuit boards. I try to do the same thing in my work, starting from the other side — to bring technical subjects like windshield wiper technology into the province of literature and film. It's difficult. People have fixed ideas about what is art and what is engineering, and how you go about creating the one and the other, and it's hard to reconcile them. But many of these divisions break down when you examine them closely.

The point at which they do break down is design. Design is both an art and science, which calls on beauty, logic, and technical competence all at the same time. In everything you do, I urge you think of yourselves as designers as well as engineers and scientists. Too often in the industrial world, engineers cede the responsibility for design to people who are called "industrial designers," who take the engineers work and apply a coating of style, which is often more geared toward selling a product than toward making it work better.

I've been working on a New Yorker article recently about a British engineer and inventor named James Dyson, whom some of you may have heard on TV, selling his bagless vacuum cleaners; perhaps you own one. Now he's back with a new bladeless fan, which is called the Air Multiplier. Dyson's story is the opposite of Robert Kearns story, the windshield wiper inventor who I wrote about in Flash of Genius. Dyson had an idea for a better vacuum cleaner, one that used centrifugal force to separate the dirt from the clean air, rather than a bag. He was rejected by every American and European vacuum company he approached, but he was able to sell a license in Japan, and with that money he was able to manufacture his machine himself. And now he's a billionaire, or close to it, and has an R &D staff of some five hundred engineers and scientists working on new ideas. If you are looking for a role model as an inventor, I recommend James Dyson, not Bob Kearns. We need more people like him, and with all the opportunities I mentioned earlier, there's no reason some of you can't do what he's done.

The Dyson vacuum cleaner is an example of great engineering that is also great design. It is an aesthetically pleasing object, beautiful in its way, that is entirely made out of industrial plastic. Instead of hiding the way the machine works under a gloss of product

design, the Dyson shows you the engineering in the design. You even get to see the dirt as it accumulates, which every other vacuum company thought was a terrible idea, but customers love it. At Dyson, there is no division between the engineers and the designers, such as exists in the automobile industry, for example. All the engineers are designers and all the designers are engineers. The company has closed up the divide between the aesthetic and the scientific, and that's why they are successful.

I will close with one of the most famously misguided pieces of advice ever delivered by a member of the older generation to a young person. This occurs in the 1967 film, "The Graduate," when Benjamin Braddock, the disaffected hero played by Dustin Hoffman, is at a cocktail party his parents have thrown for his graduation from college. A friend of Ben's parents, a man named Mr. McGuire, takes Ben aside at the party and says he has one word of advice for him, just one word — and the word is "Plastics." In the film, "Plastics" is understood to mean a cheap, sterile, ugly, and meaningless way of life, boring almost by definition — the embodiment of everything about the values of the older generation that seems repugnant to young Benjamin. Plastics! What a joke! How uncool!

In fact, Mr. McGuire was right. Plastics would have been a fantastic profession for young Benjamin to go into. Plastics was at the beginning of what is now, forty some years later, an extraordinary evolution as a material, and it's still going. If you imagine a world of 3-D printers, in which we download and print products, then a lot of things are going to be made out of plastic. Plastic construction materials, plastic car parts, expensive plastic jewelry. In plastic the world of form and beauty meets the world of science and materials. Plastics — how cool.

And so students, I have one final word for you.

Plastics.

Thank you very much.