**The Wright Brothers**

Hi. Good afternoon everybody. Today I want to talk to you about the Wright Brothers for a while. But, before that, don't forget, as always, if you go to my homepage: stevenaskew.com you can find the script for this talk and all my other talks. You can find questions. You can find answers. You can download the MP3. If you want to subscribe, please do. If you have any ideas or topics you'd like me to talk about, please put them in the comments below here.

OK. Thank you. Right, the Wright Brothers. You've probably heard of them. Who were the Wright Brothers? What were they famous for? Well, the Wright brothers of course, are commonly known as the first people to fly a powered aircraft. So, how did that come about? Well, the Wright Brothers, Wilbur and Orville Wright, were two of seven brothers and sisters. Wilbur was born in 1867, Orville in 1871. They were pretty close together in age. Throughout their lives, Orville was generally the brains, I suppose you would say, although they were both indispensable to each other. You couldn't have one without the other. And they both went to the same school. Orville actually quit first, and he went and set up a printing business. Wright printers. He printed commercially. He also printed a newspaper. His brother Wilbur joined him pretty quickly and together they went on to produce this newspaper called the West Side News. They didn't produce it for very long. About five or six years. They generally made a living printing commercially.

In December 1892, they gave all that up and they set up a bicycle business. The Wright cycle company. If you've seen my talk about the bicycle industry, of bicycles, you'll know that around about this time the safety bicycle was invented, and bicycles had rubber tires. And bicycle ownership was exploding … was taking off. A lot of people were starting to make bicycles. Well, the Wright Brothers got in on that. To begin with, they produced other people's bicycles. But, after a while, they designed and developed their own bicycle. The Wright Bicycle. So, 1892 they're making a living building, selling and repairing bicycles. However, this is their livelihood, but it's not their passion. Their passion of course is flying. As we talked about with cycling, a lot of people started off in the bicycle industry and learned how to make parts and how to make machinery and moved on from that into other industries, as the Wright Brothers themselves do of course.

Now, at that time, flying is becoming extremely popular. Gliding, I should say. Gliding, is becoming extremely popular. Gliding, of course, means sliding. Sliding through the air. A glider is any plane that doesn't have an engine. At this time, people were creating all sorts of inventions, all sorts of ways of trying to fly. Somebody the Wright Brothers were following was a German called Otto Lil … Lilienthal. He was quite a famous glider. He invented lots of different contraptions and he could glide quite far. However, he died in 1896 in a gliding accident, and this was very instrumental in the Wright Brothers development, because they realized at this point that control was the most important thing. You couldn't just strap an engine to a glider and hope to fly. You had to be able to control it. A lot of people were steering their gliders with their bodies. They would lean left or right to make the glider move left or right. And a lot of people of course, (I shouldn’t say “of course”. They didn't have our knowledge) … a lot of people thought that planes … gliders, would just be basically ships in the sky. You were replacing the sea with the sky, basically. So, a ship of course, goes forwards and backwards, and left and right. People assumed that gliders would do the same thing. But, of course, they don't. They have thee axis of control. Well talk about that in a minute. Anyway, so Orville and Wilbur Wright were developing gliders, and Orville Wright, he actually looked at a bird, and he got his inspiration from a bird. If you look at birds, big birds, or any kind of birds, how do they fly? Well, they flap their wings of course. How do they turn? What they do is, they angle one of their wings. When you angle the wing, you create drag … you create lift on one side, drag on the other side, and you can turn. So, Orville Wright looked at this, and he realized the way to make a plane turn, the way to control a glider, was to change the shape of the wings, to actually warp the wings. And he came up with this system using lots of wires. So, you turn the control stick … the yoke, and the … the wires pull the wings in different angles, and you can warp the wings. If you warp this wing this way, you create drag and you create lift, you turn that way. If you warp it the other way, you can turn that way. Of course, modern planes use the same idea, but not the same system, because if you're going to warp the wings you have to basically warp the frame of the plane and if you're bending the frame of the plane you're going to create weakness and at some point, it will probably break. So, modern planes use a system called ailerons. Those are just flaps. You can lower the flaps to create drag and lift and to turn yourself. Those ailerons were actually invented in England in 1868, quite a while before the Wright Brothers came up with their idea.

OK. So, from about 1890 onwards, the Wright Brothers create and design different kinds of gliders and they have a lot of fun. Then, from 1900, they start to become more serious. They start doing experiments at a beach called Kitty Hawk. They chose that place because a long flat beach, because of the weather, and because of the wind, I suppose. And they start to do hundreds and hundreds of glider tests. They experiment with different shape wings, different length wings, different materials, different bodies. Basically, everything you can think of, they test and they experiment. But, of course, they realize that to keep testing things on a beach takes a long time. You have to launch the glider, watch the glider, reset the glider, and fix the glider. So, they come up with the idea of building a wind tunnel in their bicycle shop. These days, anything you want to make that travels: a car, a sports car, a bicycle, a train, anything that's going to travel through the air, and is going to meet wind resistance, you basically test its wind profile … you test its profile in a wind tunnel. Well, the Wright brothers began doing that. They designed this wind tunnel and they built models and they tested hundreds and hundreds of different types of wings until they could find the wings that gave the plane the best lift and the best control. If you look at this picture, you can see over here, this is before, this was before they did all the tests, and this was after. The plane is flying much straighter, it's flying much higher and it's much more controlled. So, thanks to their experi … thanks to their experimentation, thanks to their tests, thanks to their constant note taking, perseverance, we basically have the planes we have today. A lot of other people were trying to create planes at the same time of course, but they were not doing it in such fine detail as the Wright Brothers were. They were basically going outside, throwing themselves off a hill, thinking, “Hmm. That didn't work. I should change something.” But the Wright Brothers took a very scientific approach to this and basically tested every single variable they could possibly think of.

OK. So, that's 1900. By 1902, they've realized that the wing warping system alone doesn't control the plane enough, so they introduce a movable rudder. Because, of course, a plane is controlled on three axis. You have well, ailerons … wing warping. That is the roll that basically makes the plane move that way. You have the forward elevator for pitch. That makes the plane go up and down, basically. But, you also need a rear rudder because when you use the ailerons, when you create drag and lift and you turn like this, the plane also rolls this way. So, to stop that, you need a rudder to bring the plane back into line, so it turns without spinning, basically. So, you have the three axis. You have roll, you have pitch and you have yaw.

OK. So, now they've got this controllable plane, they go back to Kitty Hawk and they keep trying. They keep experimenting with it as a glider. Now, towards the end of 1903, they've tested everything they can think of and they think they are ready for a powered flight, so they construct an engine. All the engines at that time were too heavy. They were made of irons and steels. So, what the Wright Brothers did is they commissioned an engine that was made of aluminium. That's actually the first aluminium engine ever, I believe. Because this engine was so light, they could fit it to their plane. So, they now have a plane that's controllable, with an engine. December 17th, 1903, Orville takes control of the plane. 10:35 am its launched from its catapult. It flies in the air for 37m, exactly 12 seconds, and lands. The first ever powered flight. The first ever powered flight, that is.

The Wrights go back to their cycle shop and they start improving on the plane. Within a year, by 1904, they can now fly the plane for 1,244m, and they can make turns. They can do a circle. Within another year, by 1905, they can now fly their plane for 40km. So, in two years they've gone from 37m to 40,000m. And they can fly the plane in figures of eights, they can turn, and they can land the plane. They have a fully controllable plane that they can fly for long distances. Incidentally, only the Wright Brothers could fly that plane. In 2003, for the centenary, they recreated the Wright Flyer One, and nobody could actually fly it. It was too difficult to fly. Because the Wright Brothers had spent so long learning how to fly this plane, they were the only ones that could actually fly it.

OK. So, 1905, their plane can fly quite a long way. Now, the Wright Brothers got into flying because they love it, because they … they really enjoyed it, and they wanted to fly. But, now they have built a plane, they start to think business. They want to sell this plane. They want to sell it to the American army. Because they now need to sell the plane, they start to withdraw into secrecy and they start to withdraw their plane from the public eye. And so, because of that, a lot of people don't actually believe the Wright Brothers have been able to fly, and don't believe the Wright Brothers’ plane is as controllable as they say it is. A lot of people, especially in France and Europe, where they're trying to build planes themselves, call the Wright Brothers liars. Now, the Wright Brothers don't fight this because they are improving their planes all the time and they want to sell these planes so they are keeping it secret. However, by 1909, the American Army agrees to buy the Wright Brothers’ new plane, the Model A, from them, if they can prove that it actually works … that it's as good as they say. So, Orville Wright takes the plane across to France and at an airshow there they demonstrate the plane. And people are so impressed that this plane can take off, fly figures of eights, land and fly for so long. People are so impressed that they actually apologize. People apologize in public for calling the Wright Brothers liars, and they finally admit that the Wright Brothers are as amazing as they actually are. And the American Army agrees to buy this plane. They agree to buy it for $35,000, which is about $900,000 of today's money. So, the Wright Brothers set up their plane company, the Wright Company, to start making and selling these planes.

OK. To this point the Wright Brothers have been wonderful people. They are heroes, basically. They've gone further and longer, and tried harder, and persevered more than any other person, and they have constructed planes far in advance of anybody else. They have done more for aviation than anybody thus far in the history of the world, I suppose. But, from here on out, they start to get more concerned with business. Wilbur Wright especially. He's the president of the company. Orville Wright is the vice president. They realize that the only way they can make money off this invention is to sell as many as they can before other people make them. And so they patent their ideas. They patent the wing warping system. They patent all the systems they can. And then they actively sue anybody that tries to create planes. They sue so many people that a rumor goes around, some people say that if you jump in the air and flap your arms, Wilbur Wright will sue you. And, because of this litigation, because they're actively suing so many people, their public image suffers incredibly. Up to this point they were seen as heroes and suddenly they're seen as greedy, they're seen as money orientated, they're seen as closed, they’re seen as trying to hurt the aviation industry. Their public image nosedives, basically. Because of this stress … because of this stress of suing, of trying to protect their invention, Wilbur Wright actually dies in 1912. He dies of typhoid fever, but I'm sure a huge part of it was the stress. His brother Orville Wright takes over the company, but he's not a manager like Wilber is. He's the inventor, I suppose. So, within a few years he gets sick of it and 1915, he sells the Wright Company. The Wright Company, it was actually bought by another company called Wright Martin, and then it was bought by another company and became the Wright Aeronautical, and then it was bought by another company called Curtis Wright, which actually still exists. And Curtis Wright, they make parts for airplanes, I believe. So, the Wright Company in effect does still exist, but not the same way as it was.

Orville Wright flies for the very last time in 1918, and after that he doesn't fly at the controls of a plane again. He becomes a statesman for the aviation industry. He tries to help wherever he can, I suppose. And the Wright Flyer One, the plane that was the first powered plane in the world ever, is on display in the Smithsonian.

So, the Wright Brothers did more for aviation in that period than anybody else in history. Then they became understandably concerned with their invention and they tried to profit off it. You can't really blame them for that. Although, because of their litigation, because of this activity, when World War One started, the American Army was actually far behind the German army in terms of aviation, and it took them a while to catch up. They did catch up and of course they exceeded any other country in the end, but in the beginning, because of the Wright Brothers, aviation was actually put back.

Something that I find absolutely amazing about all this, probably the most amazing thing about all this, is that 1783 the Montgolfier Brothers in France built the first hot air balloon, really the first controllable hot air balloon. 1903, 130 years later, the Wright Brothers built the first powered plane. 1969, 63 years after that, Neil Armstrong of course walks on the moon. So, in 200 years we've gone from not being able to fly, to walking on the moon. And these inventions are speeding up, as technology always does. Things get faster and faster and faster. So, in the next 30 years, in the next 50 years, what are we going to have? What is the next advancement in the aeronautical industry? It's very very exciting … very very exciting. Maybe I won't see it, but my children certainly will. The world they will live in is going to be amazing. I can only imagine.

Anyway, thanks for listening. I hope you understood that. It was a little bit complicated. If you liked this, like it, share it. If you want to subscribe, that button’s over here somewhere. If you have any idea for talks, please put them in the comments below. Thank you. Have a nice day. Bye.

**The Wright Brothers**

1. What was Wilbur Wright’s first job?

A: A printer

B: A bicycle maker

C: A glider maker

D: A plane maker

2. Why did the Wright Brothers start a bicycle company?

A: They wanted to know how to fit engines to bicycles.

B: They thought that they could use their bicycle making experience to make planes.

C: Bicycles were very cheap to make.

D: Bicycle ownership was expanding quickly.

3. What did Otto Lilienthal’s death teach the Wright Brothers?

A: That gliders were very dangerous.

B: That controlling the plane was very important.

C: That a lot of people in Germany would buy planes.

D: That gliders don’t fly very far.

4. How did people steer their gliders before the Wright Brothers’ inventions?

A: By leaning left or right.

B: By using a movable rudder.

C: By warping the wings.

D: They didn’t.

5. Which of these is NOT a reason why the Wright Brothers chose Kitty Hawk?

A: It is a long flat beach.

B: The sand is very soft.

C: The weather is good.

D: It has perfect wind.

6. Steven says, “the Wright Brothers took a very scientific approach.” What does “scientific approach” mean?

A: To make the lightest plane possible.

B: To take an invention and just use it.

C: To test all possible variables.

D: To use different chemicals in the construction process.

7. Why does a plane need a movable rudder?

A: So the plane can go up and down.

B: To make the plane fly forward.

C: So it can turn left and right.

D: To stop it rolling when it turns.

8. Steven says, “Incidentally, only the Wright Brothers could fly that plane.” Which of these words or phrases is closest in meaning to “incidentally”?

A: You could say

B: Purposely

C: By the way

D: Accidentally

9. What caused the Wright Brothers reputation to suffer?

A: The tried to steal other people’s plane ideas.

B: The began litigating people for patent infringement.

C: They kept their invention as hidden as possible.

D: They managed to sell their plane to the American Army.

10. When did Orville Wright sell the Wright Company?

A: 1912

B: 1915

C: 1918

D: 1921

11. What did the Montgolfier Brothers build in France?

A: The first rocket

B: The first plane

C: The first hot air balloon

D: The first glider

12. What do you think one of the next advances in aeronautics might be?

13. Orville Wright lived through World War 2. He expressed dismay at how airplanes were used to bomb civilian targets. Do you think he is responsible?

14. How did the invention of the powered airplane change society?

15. Should the Wright Brothers have given free access to their plane designs?

16. Once a technological jump is made, the following advances become faster and faster. Is this a good or bad thing?

**The Wright Brothers Answers**

1. A 2. D 3. B 4. A 5. B 6. C 7. D 8. C 9. B 10. B 11. C

12. What do you think one of the next advances in aeronautics might be?

There will be many advances in aeronautics over the next few years. I would like to look at one possible advance in aviation and one possible advance in space flight.

The main advance in aviation in the coming years will have to be related to fuel use. Current planes use internal combustion engines. They have to carry large quantities of fuel and they release huge amounts of CO2 into the atmosphere. As with cars, planes with electric engines will be arriving soon. In the beginning, there will be problems with the distance these planes can fly. Current batteries would only be able to hold a charge to carry planes for about 1000km. However, with investment, this can and will be improved upon. New, more powerful batteries will be produced, and electric planes will be able to fly equivalent, if not greater distances than current planes. These batteries would also weigh far less than the fuel planes currently have to carry. This would mean planes could carry more passengers, more freight, of travel further. This would also bring down the price of air travel.

The advance I can see in space travel is currently happening. Reusable space rockets. NASA’s rockets are basically one-time rockets. Once fired, they cannot be used again. A few private companies are working on reusable rockets. This will vastly reduce the cost of placing things in orbit. It will increase space travel and exploration.

There are many more advances coming. Some of the biggest advances are things that I cannot imagine. Just as a person fifteen years ago couldn’t have imagined an iPhone.

13. Orville Wright lived through World War 2. He expressed dismay at how airplanes were used to bomb civilian targets. Do you think he is responsible?

No, I do not think he is responsible. Someone who invents a weapon is responsible for how it is used. The gun, the crossbow, the nuclear bomb. These were created as weapons and they have no other practical use. The plane cannot be placed in this category. Wilbur and Orville Wright designed a machine for the good of humanity. Admittedly, they sold it to the American Army, but they envisioned its use for reconnaissance and not fighting. He cannot be held accountable for the way other people used his invention.

14. How did the invention of the powered airplane change society?

There are many ways that society was changed, but I would like to cover two. First, people began to believe that they could do the impossible. After the industrial revolution, inventions were appearing left, right and center. But, all of these inventions, as amazing as they were, didn’t appear to play with the gods. Making a man fly was to take him out of the realm of the human and place him firmly in the realm of the gods. And, once people realized they could reach such heights, they were inspired. Man walked on the moon as a direct result of the Wright Brothers and their ilk. Not only because they built the flying machine, but because they showed people they could reach further than they had ever thought possible.

Second, the world became smaller. Maybe not at first, but over the next decade and certainly by the middle of the century, intercontinental flight was available. And the more people that traveled, the cheaper it became, until regular people, regular factory workers and farmers, could now travel to distant countries, countries their parents had only ever read about in books. The Wright Brothers made that possible. And when you can travel to different countries so easily, you see the world as a whole and you become more as a person.

15. Should the Wright Brothers have given free access to their plane designs?

Yes, they should have done. It is clear why they wanted to hold a monopoly on the airplane and to make money from something that they had put years into developing. However, with hindsight, their course of action was not the correct one. There are three reasons for this.

Firstly, as is mentioned in the talk, the American aviation industry was far behind that of Europe when World War One broke out. In fact, the American planes were so far behind that, to begin with, they had to use planes bought from Europe. Very embarrassing for the country that invented powered flight.

Secondly, it was never going to be possible to stop people in so many countries from building airplanes. The Wrights should have looked at it as they did a bicycle. You cannot make the only bicycle, but you can make the best bicycle. Because they spent so much time and energy litigating against anyone they saw as a competitor, they stopped innovating. In 1908, their plane was without doubt the best in the world. By 1912, they hadn’t updated their design for years and their planes were no longer market leaders. They lost a huge advantage and they lost the chance to have the best bicycle.

Thirdly, the Wright Brothers simply did not have the copyright for the things that they attempted to sue for. They had patented their system of wing warping, but they tried to sue anybody who steered a plane by using lift and drag on the wings. Many people used ailerons both because it is a better system and because it wouldn’t intrude on a copyright, but the Wrights sued. They argued that turning using lift and drag was solely their idea. As is mentioned in the talk, ailerons were invented 40 years before the Wrights made their discovery. So, the Wrights sued. Some people fought them and won, but many less confident people just paid them a royalty. They made a lot of money from something they hadn’t invented.

If the Wrights had made their design open the American and the world’s aviation industry would have advanced, the Wrights planes would have been improved and they could have been market leaders, the Wrights’ image would have been better and, perhaps most importantly, Wilbur might not have died so young.

16. Once a technological jump is made, the following advances become faster and faster. Is this a good or bad thing?

It is neither good nor bad, it is inevitable. Once a jump is made, more people come on board. Once there is more money for research and development, and once there are more customers, the advances will come faster. They will peak at some point, and then the next jump will come along.

If you want to consider advantages and disadvantages, then here are two of each.

The first advantage is that these advances can pave the way for the next big jump. All technology is an upwards slide more than a jump. The leaps might appear big, but they are often supported by many advances that have come before them. The second advantage is that improvement and refinement is always necessary after an invention. We could not fly the world in the Wrights’ first plane and I could not type this on Charles Babbage’s first computer. Improvement is vital.

The first disadvantage would be advances without proper consideration. The customer always wants the next version, and this can come at the cost of quality, reliability or even safety. Research into genetic modification would be a good example of this. Just because we can do it doesn’t mean we should do it. The second disadvantage is that at some point human beings will not be able to keep up with the speed of these advances. AI and the singularity are often mentioned when talking about this topic. If you draw a graph back through human history, you can see that the time it takes for technological power to double gets shorter and shorter. At some point, humans will not be capable of making it and then we will have to turn to AI machines. And that will be opening a whole new kettle of fish.