NATIONAL MUSEUM OF THE UNITED STATES AIR FORCE

TWELVE SECONDS THAT CHANGED THE WORLD

Students will learn about the Wright brothers, and how Orville and Wilbur invented the world's first airplane. Events leading up to, and after, the first powered, controlled, heavier-than-air flight (which only took twelve seconds) are also covered in this lesson plan, and they are also documented within the PowerPoint presentation.

LESSON PLAN

Learning Objectives

The students will

- Learn about the lives of Orville and Wilbur Wright, and about the importance of their closely-knit family.
- Discover what happened before, during and after the world's first powered, controlled, heavier-than-air flight.
- Identify and study historic figures who have made significant contributions, and analyze the importance of both the individual in history and the influence of ideas.
- Develop understanding of a scientific/technological breakthrough which has propelled change, and how these changes have altered human experience forever.
- Learn that advances in engineering, technology and science have influenced the quality of human life, as well as the way in which people behave and interact.
- Build a glider so that they may create a working model, test fly it and then ask/understand how it actually works.

Introduction/Background

Wilbur Wright was born in Indiana in 1867, just two years after the end of the Civil War. The Wright family moved to their home in Dayton in 1871, and Orville was born that same year. Katharine, their younger sister, was also born at the Dayton homestead, and she always supported her brothers in everything they did. The brothers grew up in an America filled with many new innovations and inventions, including the telegraph machine, the steamship, the transcontinental railroad, the automobile, the electric light and the telephone. Their father, Milton, was a bishop of the United Brethren Church, and he taught his children to read everything they could get their hands on about a particular subject, and to make up their own minds about the material's validity. Their mother Susan was very mechanically-inclined, and she taught the brothers how to build and fix things. Before the turn of the century, old-style bicycles had a huge wheel on the front and a tiny wheel on the back. New bicycles were called safety bikes because they had the same size wheels on the front and the back, and they were much easier and safer to ride. In the 1890's, the country experienced 'bicycle mania,' and there were 10 million bikes versus only 8,000 cars! People brought their bicycles to the Wright home for the brothers to fix.

Grade Level: 4—8

National Standards for Historical Thinking: Chronological Thinking, Historical Comprehension, Historical Analysis and Interpretation and Historical Research Capabilities.

National Standards—English Language Arts: Communication Skills, Evaluate Data and Applying Language Skills.

National Science Education Standards: Science as Inquiry, Science and Technology, Science in Personal/Social Perspectives and History and Nature of Science.

Materials Required:

- Magic board and markers
- PowerPoint presentation
- Laptop, monitor and digital projector
- Manila folders or cardstock
- Canard glider paper templates
- Small paper clips, scotch tape
- Student scissors, straws
- Pencils or pens

Resources:

- *The Bishop's Boys* by Tom Crouch; New York: W. W. Norton & Co.; 1989
- *First To Fly* by Peter Busby; New York: Crown Publishers; 2002
- *The Wright Brothers* by Russell Freedman; New York: Holiday House; 1991
- *Young Orville and Wilbur Wright* by Andrew Woods; Mahwah, NJ: Troll Associates; 1992
- http://www.centennialofflight.gov/wbh/index.htm
- http://wings.avkids.com/Book/Wright/
- http://www.fi.edu/wright/
- http://www.first-to-fly.com

There were so many people bringing their bikes to their home for repairs, Orville and Wilbur decided to open a bicycle shop in Dayton in the early 1890's. Their business was called the Wright Cycle Company, and they also built brand new models of safety bicycles from the frame up. Ultimately, they owned and operated six shops! Special Note: The sixth bike shop is where Wilbur and Orville created the parts for the first airplane. Henry Ford moved the sixth shop and the Wright's Dayton home (located at 7 Hawthorn Street) to Greenfield Village, Michigan to preserve both structures and to honor their great accomplishments!

Sidebar: When Wilbur was 11 years old and Orville was 7, their father came home from a church trip, walked into the room without saying a word and released a toy called 'the bat.' It was basically a propeller on a stick, but it fired both boys' imaginations and started them thinking about the prospect of human flight. Later, in 1895, they read magazine accounts of an inventor and scientist in Berlin named Otto Lilienthal, and this gentleman's gliding experiments further kindled the passion to fly in both Orville and Wilbur.

Since the Smithsonian was the 'research vehicle' of the day, Wilbur asked for, and received, everything the institution had relating to human flight. Most items dealt with reasons why man could not fly, stating that sustained, heavier-than-air human flight was an impossibility!

One day in 1899 in their bicycle shop, Wilbur was toying with an inner tube box while talking to a customer. He twisted the ends of the box, ran over to Orville and declared that he had discovered how to control the roll movement of an airplane! Later, they experimented with a five-foot-long 'bi-plane' kite with quad lines, and Wilbur's idea to 'warp the wings' really worked!

In late summer of 1900, the brothers traveled by train to Kitty Hawk, N.C. to conduct glider experiments with a much larger glider than the earlier kite version (one that a person could actually ride on in a prone position). The technology of the day featured cloth stretched over wooden spars. They chose Kitty Hawk because it had steady, consistent winds, and the sand dunes provided a soft landing surface. They also performed glider experiments with an even larger glider in the fall of 1901, but the glider that was truly successful was the one they used in the fall of 1902. This was also the first time that all three axes of motion had been controlled in the air by man (roll, pitch and yaw)! All they needed now was a small engine to power their aircraft, and the man who took care of their bike shops during the brothers' absences, Charlie Taylor, helped them to develop a four-cylinder, 1,200 RPM, 12 horsepower, 152 pound engine. Orville and Wilbur also had to develop large propellers for their first airplane, and these propellers were counter-rotating and they actually 'pushed' the airplane through the air! In September 1903, the brothers set up camp (again) at Kitty Hawk. When they started the engine, however, a crack formed on one of the propeller shafts, and Orville had to travel back to Dayton to repair it. Finally, on December 14th, 1903, Wilbur (who won the coin toss) took off, but the aircraft stalled, and the flight was only 3.5 seconds in duration. The 'Flyer' also had to be repaired before the brothers could try again. On December 17th, it was Orville's turn to try, and he flew 120 feet in 12 seconds—12 seconds that changed the world! Then Wilbur flew 175 feet, then Orville flew 200 feet and finally Wilbur flew 852 feet in 59 seconds, and the air age had begun!

Back in Dayton during the summer of 1904, the brothers invited reporters to Huffman Prairie to observe a 'Wright flight!' However, the airplane would NOT get off the ground—it seems that the cold, dense air at sea level at Kitty Hawk gave them much better lift than the warm, humid air 815 feet above sea level in Dayton! Therefore, Orville and Wilbur devised a catapult system to give them extra acceleration along a 60-foot long monorail track, and it worked wonderfully!

The 1903 'Flyer' was basically a prototype aircraft, but the Wright's crowning achievement was their 1905 version. It was the world's first practical airplane with better propellers, better controls and a more powerful engine, and its best flight was 39 minutes at an average speed of 38 miles per hour! The brothers' patent for a flying machine was granted in 1906. Wilbur and Orville had been trying to sell an airplane to the government for quite a while, but the government showed little interest in purchasing an airplane until 1909. The Wright 1909 Military Flyer was purchased by the U. S. Army Signal Corps at Ft. Myers, VA, and it had all the characteristics the government required: it carried two people, went 40 miles per hour, flew for one hour, was conveyable by horse and wagon and had a 125-mile range. The first military airplane sold for $25,000, plus $2,500 for each mile per hour over 40. Since it flew 42 miles per hour, the grand total paid for the first military aircraft was $30,000!

Wilbur passed away in May of 1912, having contracted typhoid fever, because they didn't have the antibiotics that we have today. Orville lived to see their incredible invention used in World War I, World War II and commercial aviation, and he also knew about Chuck Yeager breaking the sound barrier in 1947! There were many tributes to Orville and Wilbur's invention, but the best one might be when Neil Armstrong carried a piece of a wooden spar and some wing fabric from the 1903 Flyer on Apollo 11's journey to the moon!

Procedures:

- Write on board the things that will be covered/discussed/reviewed in class, including: the history of the Wright family, Wilbur and Orville's bike shops, what inspired them to fly, their kite and glider experiments, their camps at Kitty Hawk, their four flights on December 17th, 1903 and student glider building and flying.
- Hook: Prior to class, measure and mark 120 feet in the hallway adjacent to the classroom.
- As students walk into the classroom, show them the 120-foot section of the hallway and ask them what significance that distance has with respect to teaching and learning about the Wright brothers (discuss).
- Ask the students how many of them have flown in an airplane at least one time.
- Show the first PowerPoint slide of the first flight/ask which brother is on the aircraft: http://www.nationalmuseum.af.mil/shared/media/document/AFD-111201-033.ppt
- Tell the students that you are going to describe and discuss the events that happened before, during and after the first powered, controlled, heavier-than-air flight—a flight that has touched all of our lives!
- Present the PowerPoint slides to the class, utilizing the information in the 'Introduction/Background' section.
- Announce that it is now time for students to build their gliders. Special Note: one of the learning objectives is that students will build a glider so that they may create a working model, test fly it and then ask/understand how it works/flies (National Science Education Standards/Science As Inquiry/Evidence, Models And Explanation—Models correspond to real objects and have explanatory power. They help both scientists and students understand how things work).
- Use 'materials required' reference box on the first page of this lesson plan as a checklist, and pass out canard glider materials to all students. Note: this glider was originally created for the *Inventing Flight for Schools* curriculum, produced by ThinkTV, Greater Dayton Public Television, for *Inventing Flight: Dayton 2003*.
- Carefully show the class each step in the glider-building process at http://www.nationalmuseum.af.mil/shared/media/document/AFD-111201-035.pdf.
- Have the students put their initials, first name or appropriate nickname on their glider.
- Walk around the classroom, checking the students' gliders, making adjustments whenever necessary.
- Tell the class to put the gliders off to the side, until it is time to test fly them.
- Move the class to the gymnasium and allow students to safely fly their gliders in an orderly fashion, perhaps in several rows of ten students each, lined up behind one another.

Assessment/Evaluation

The students should be evaluated on their overall class participation, listening skills and their ability to follow verbal instructions (especially when they are constructing their gliders). You may also wish to lead a discussion about what was taught during the lesson, including historical references/questions about the Wright brothers' extraordinary invention. Students may also wish to compare and contrast Wilbur and Orville's world (filled with new inventions) with the students' present world, also filled with many new innovations!

References

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