Engineering the Wright Way Lesson Plan

Grades 6-8

INTRODUCTION

This lesson is designed to teach students engineering skills using methods similar to those that made the Wright brothers pioneers of aviation. The lesson is intended to be taught in a classroom with access to computers with an Internet connection that students can use individually. It is divided into three segments. The first two segments are brief introductions to the forces of flight dynamics as they relate to the lift generated from an airplane wing. If desired, these introductory segments can be skipped and the primary lesson, **Activity Three: *Engineering the Wright Way***, can serve as the entire lesson. This lesson plan can be scaled to fit any timeframe. Students can write down a save code generated in the interactive to store their progress and return to finish the activity later.

Next Generation Science Standards

Middle School Engineering Design

http://www.nextgenscience.org/msets-ed-engineering-design

Students who demonstrate understanding can:	
MS-ETS1-1.	Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
MS-ETS1-2.	Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
MS-ETS1-3.	Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
MS-ETS1-4.	Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

ACTIVITY ONE: *Four Forces of Flight*

Objectives

Students will gain an introduction to the forces of flight.

Materials

- Computer for each student with an Internet connection

Ask: *How does an airplane fly?*

Explain: Understanding how airplanes fly begins by learning about the four forces of flight.

- Explore http://howthingsfly.si.edu/forces-flight
- Explore http://howthingsfly.si.edu/aerodynamics

End: When an airplane flies, the engine is designed to provide enough **Thrust** to overcome **Drag** and move the airplane forward, while the wing is designed to provide enough **Lift** to overcome the airplane's **Weight** and send it into the air.

ACTIVITY TWO: *Bernoulli Experiment*

Objectives

Students will be able to explain how wings create lift.

Materials

- Paper strip for each student, approx. 2x6in

Ask: *What is an airfoil?*
Explain: That's right, an airfoil is the cross section of an airplane wing.
Ask: *How does an airfoil work?*
Explain: Airfoils create lift!

- Air is all around you.
- Air exerts pressure in every direction: up, down, sideways.
- As air moves more quickly over a surface it exerts less pressure on the surface.
- As air moves more slowly over a surface it exerts more pressure on the surface.
- Faster air, less pressure; slower air, more pressure.
- Air moving over the top of a wing moves more quickly than the air moving beneath the wing.
- Lift acts perpendicular to the motion of the wing through the air.

Ask: *Would you like to do an experiment to test that out?* ***(hand out papers)***
Explain: We have an ordinary piece of paper. Hold the paper with your finger and thumb. If we put it here on top of your upper lip and blow, which way do you think the paper will move? ***(blow)*** It went up. Now hold it just under your bottom lip. Which way do you think the paper will move now? Let's see. ***(blow)*** It went up again.

Ask: *Why did the paper go up both times?*
Explain: Remember faster moving air, less pressure; slower moving air, more pressure. The paper rises because the air on the top is moving more quickly and has less pressure than the air on the bottom. The air on the bottom pushes the paper up, just like the air under an airfoil pushes a wing up.

End: The Wright brothers, who invented the first successful airplane, discovered that the shape of a wing determines how much lift it will produce and therefore how well an airplane flies.

ACTIVITY THREE: *Engineering the Wright Way*

Objectives

Students will use engineering skills to design and test airplane wings based on the methods of the Wright brothers. Success is determined by how far they are able to pilot a Wright-inspired glider of their design.

Materials

- Computer for each student with an Internet connection

Ask: *Who were the Wright brothers?*

Explain: That's right, Orville and Wilbur Wright invented the world's first airplane. In the process, they pioneered aeronautical engineering concepts and techniques that are still used today to design and build airplanes. The Wrights recognized that the airplane is a complete system of complex interconnected parts. Today we are going to focus on the wings. Design a set of wings that will fly your glider the farthest.

- Go to http://airandspace.si.edu/wrightbrothers/workshop
- Follow the instructions to design and test wing sizes and shapes.
- Fly your glider at Kitty Hawk to see how far you can go.
- Once you reach the success screen, record the data from your most successful glider – write down the wing lift-drag ratio and farthest flight.
- *Students can also write down their save code if they wish to return to the interactive later and retrieve their results.

Ask: *Who here flew their glider the farthest? What was your data? What does it mean?*
End: The gliders that flew the farthest had the best lift-drag ratio because they had an aspect ratio with a wide wingspan and a short chord depth. This produced the most lift and therefore carried the glider the farthest.