



## Learning The “Wright” Way to Fly!

### LESSON THEME

This lesson uses the online NASA CONNECT: *The “Wright” Math Educator guide* and the *NASA Aeronautics Activity Guide*; *Sled Kite* activity to help students learn how the Wright brothers developed controllable aircraft by understanding, constructing, and testing different designs.

### OBJECTIVES

Students will:

- Construct 3 different kite models and predict the most effective design
- Design and test an aircraft given several parameters
- Explain how early flight was influenced by kites

### NASA SUMMER OF INNOVATION UNIT

*Engineering - Aeronautics*

### GRADE LEVELS

*7<sup>th</sup> – 9<sup>th</sup>*

### CONNECTION TO CURRICULUM

*Forces and Motion; Transfer of energy; Science and Technology in Society*

### TEACHER PREPARATION TIME

*60 minutes (includes 30 minute video viewing)*

### LESSON TIME NEEDED

*Construction lesson: 60 minutes (sled kite and 3 Wright templates)  
Testing activity: 90 minutes                      Complexity: Moderate*

### NATIONAL STANDARDS

#### National Science Education Standards (NSTA)

*Physical Science*

- Motions and forces
- Transfer of energy

*Science and Technology*

- Abilities of technological design
- Science and technology in society

*History and Nature of Science*

- History of Science

#### ISTE NETS and Performance Indicators for Students (ISTE)

*Creativity and Innovation*

- Use models and simulations to explore complex systems and issues
- Develop an understanding of the core concepts of technology

*Communication and Collaboration*

- Contribute to project teams to produce original works or solve problems
- Develop an understanding of engineering design

*Research and Information Fluency*

- Evaluate and select information sources and digital tools based on the appropriateness to specific tasks
- Process data and report results

*Technology Operations and Concepts*

- Understand and use technology systems
- Troubleshoot systems and applications

## MANAGEMENT

The lesson is most effective if the student build the sled kit prior to the activity. Use the template found in the *NASA Aeronautics* Guide “Sled Kite” activity on pages 43-51. After construction and flight of this basic kite then the actual “Wright” Math activity could be conducted. Prior to starting the construction activity, download and view the activity video. The teacher should have all three kite examples available for viewing prior to the student construction.

## CONTENT RESEARCH

The Wright Brothers initially began their work on flight by studying flight in nature. Their study of birds led them to experiment with kits. They wanted to learn how to control a box kite first before they attempted to build a flying machine. They scaled up their kites to man carrying gliders and eventually into a powered machine that incorporated these early elements of control.

### KEY CONCEPTS:

- Studying objects in nature (birds) and small models (kites) can provide valuable information in understanding flight.
- The Wright Brothers use the a variety of small models to understand how to control their aircraft.
- Engineering design principles are similar to the scientific method and help engineers answer and solve problems.
- Every design eventually needs to be “flight tested” to determine its performance.

### KEY TERMS:

- **Aerodynamic:** having a shape that allows for smooth air flow and lift
- **Aspect ratio:** the ratio of the square of the span (the widest distance from side to side) to the area of the kite
- **Bernoulli’s Principle:** as the flow of air over the long upper surface of an airfoil results in reduction of pressure creating lift
- **Reflection:** a one-to-one mapping over a line of symmetry, a mirror image; when a point A is reflected over a line of symmetry, the corresponding point is labeled A' ( A prime)

## LESSON ACTIVITIES

The listed sequence leads students to better understand how the Wright Brothers used the engineering design to understand how to control flight.

### Engineering the Sled Kite

Students construct and fly the basic sled kite design to understand the forces of flight and how kites were used to better understand aircraft control.

- Download the sled kite activity from the *NASA Aeronautics* activity guide
- Have students build a simple sled kit and demonstrate how a kite illustrates the 4 forces of flight by testing [http://www.nasa.gov/audience/foreducators/topnav/materials/listbytype/Sled\\_Kite.html](http://www.nasa.gov/audience/foreducators/topnav/materials/listbytype/Sled_Kite.html)

### NASA CONNECT: The “Wright” Math

Students construct and predict which design will be the most effective flyer. They then test 3 different designs and gather time data to verify their prediction. They learn how the Wright brothers used kites to understand aircraft control.

- Download the “Wright” Math activity guide and video:
  - URL: [www.knowitall.org/nasa/pdf/connect/flight-equation.pdf](http://www.knowitall.org/nasa/pdf/connect/flight-equation.pdf).
  - Video download: <http://www.knowitall.org/sites/nasa/connect/index3.html>

## MATERIALS

### Teacher Preparation Materials

- Each of 3 Kite templates (for identification and clarification of directions)
- Stopwatch or some timing device (3 for entire class)
- Hole puncher (single)
- Downloadable video: The “Wright” Math

### Student Materials (per 3 = student group) / used for both activities

- 3 Sheets of 8.5 x 11” multipurpose paper
- 3 Metric rulers
- Masking tape
- 3 Wooden skewer sticks /team (Wright Math activity)
- 3 Kite string holders and kite string (often found as kit as discount stores)
- 2 cm x 200 cm Kite tails (roll of survey tape works well)
- Scissors
- Two drinking straws/kite (sled kite activity)

- Show the introduction to *NASA CONNECT: The “Wright” Math*
- Review each of the 3 “Wright” Math kite templates and have students predict the best performer.
- Have students select and construct the one that they believe will be the best flyer
- Conduct timed flight tests outside and gather flight data

### **DISCUSSION QUESTIONS**

If the entire *The “Wright Math* is viewed there are numerous “Cue Card” questions that can be answered. These are best reviewed by stopping the video at the appropriate point during the showing. (See page 14-15 of activity guide.)

**Example:** What is the relationship between pressure and force? *There is a direct relationship between pressure and force. If the force increases, the pressure increases for a given area.*

### **ASSESSMENT ACTIVITIES**

Student progress for each activity will be assessed by collecting the student data sheets and observing the constructed “flyer” aircraft as each is tested. Students should be evaluated by observing how careful their distance measurements are determined and how well they complete are their flight logs.

### **ENRICHMENT**

If computers are available participants can visit the Web-based activity “*The interactive Kite Modeler*” and experiment with different shapes and sizes of kite design to determine the effect it has on performance. <http://www.grc.nasa.gov/WWW/K-12/airplane/kiteprog.html>.