Grades: 5-8
Subjects: Social Studies, Science, English Language Arts
Time Required: 1 50-60 minute class period
Author: Perry F. Louden Jr. Rockvale Middle School, Technology Engineering Education

OVERVIEW
In this lesson, students explore the process and development of the Wright brothers’ earlier flying apparatuses leading up to and including their first sustained, controlled flight of 1903. They will analyze images from the Library of Congress Web site related to the Wright brothers’ aviation and investigate the flight process of the Wright brothers and the important steps they made during their design process.

GOAL
Students will study the history of the Wright brothers and understand the engineering design process.

OBJECTIVES
The learner will explore the early flight process of the Wrights, explore images from the Library of Congress Web site related to the subject matter that they are studying, and complete picture analysis worksheets. Each group will investigate one of the steps in the flight process and combine that step with other steps to produce a timeline of the important steps the Wright brothers made during their design process.

INVESTIGATIVE QUESTION
How did the Wright brothers’ methodical, systematic process in building the airplane demonstrating the steps in the engineering design process?

CURRICULUM STANDARDS

5th Grade Social Studies
5.05 Examine the contributions and impact of inventors on American society, including: Alexander Graham Bell, George Washington Carver, and Thomas Edison.

8th Grade Science
8.PS2: Motion and Stability: Forces and Interactions
2) Conduct an investigation to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.
3) Create a demonstration of an object in motion and describe the position, force, and direction of the object.
4) Plan and conduct an investigation to provide evidence that the change in an object’s motion depends on the sum of the forces on the object and the mass of the object.
5) Evaluate and interpret that for every force exerted on an object there is an equal force exerted in the opposite direction.

(Continued on p. 2)
RESOURCES:

Library of Congress Resources

“[…] Orville soaring in level flight […]” [1911] http://www.loc.gov/item/00652086/


[Left side view of the 1900 Wright glider before installation of forward horizontal control surface, flying as a kite, tipped forward; Kitty Hawk Lifesaving Station and Weather Bureau buildings in background to the left] http://www.loc.gov/item/2001696450/

[1901 glider being flown as a kite, Wilbur at left side, Orville at right; Kitty Hawk, North Carolina] http://www.loc.gov/item/2001696466/

[Side view of Dan Tate, left, and Wilbur, right, flying the 1902 glider as a kite] http://www.loc.gov/item/2001696561/

[First flight, 120 feet in 12 seconds, 10:35 a.m.; Kitty Hawk, North Carolina] http://www.loc.gov/item/00652085/

General Correspondence: Smithsonian Institute, 1899-1909 http://www.loc.gov/item/wright002544

Otto Lilienthal glider, 1895 http://www.loc.gov/item/2001696482/

Family papers: Correspondence – Wright, Katherine, 1910 http://www.loc.gov/item/wright002280

[Start of a glide; Wilbur in motion at left holding one end of glider (rebuilt with single vertical rudder), Orville lying prone in machine, and Dan Tate at right; Kitty Hawk, North Carolina] http://www.loc.gov/item/00652084/

[Wilbur in prone position in damaged machine, on ground after unsuccessful trial of December 14, 1903, Kitty Hawk, North Carolina] http://www.loc.gov/item/2001696254/

[Exterior view of the Wright Company factory; Dayton, Ohio] http://www.loc.gov/item/2001696640/

Other Resources

NASA: Models of the Wright Brothers' Aircraft (1900-1903) http://wright.nasa.gov/ROGER/models.htm

Wright Brothers’ Test Flight, 1909 Video http://www.history.com/topics/inventions/wright-brothers/videos/wright-brothers-test-flight-1909

Wilbur Wright’s sketches of the 1899 kite http://www.wright-brothers.org/History_Wing/Wright_Story/Inventing_the_Airplane/Warped_Experiment/Warped_Experiment_images/1899_Kite_Illustrations.jpg
**MATERIALS**
- PowerPoint presentation
- Engineering Design Process Worksheet (H1)
- Picture Analysis Worksheet (H2)
- Picture Bibliography Page Worksheet (H3)
- Poster Board (cut in half, long ways)

**PROCEDURE**

| Step 1: Introduction | Watch the video clip [Wright Brothers’ Test Flight, 1909](http://www.loc.gov/item/00652086/). Use the [PowerPoint presentation](#) as a guide for the lesson and to facilitate the discussion of the following questions:

1. Ask, “What do you observe in this video?”
2. Ask, “What do you know about the Wright brothers?”
3. Ask, “What questions do you have about the video?” |

| Step 2: Review the Engineering Design Process. | The learner will complete Part 1 on the [Engineering Design Process Handout (H1)](#) by filling in the name of each step. (Part 2 is completed during the Conclusion section)

Engineering Design Process

1. Identify the Problem
2. Brainstorm and Research
3. Design a Plan
4. Create a Model or Prototype
5. Improve the Model or Prototype
6. Manufacture the Product |

| Step 3: Guided Practice | Use the overhead projector or provide copies of the image “Side view from below of Orville soaring in level flight, spectators looking up at glider; Kitty Hawk, North Carolina” [http://www.loc.gov/item/00652086/](http://www.loc.gov/item/00652086/). Students work independently or with partners and complete the [Picture Analysis Worksheet (H2)](#) and [Picture Bibliography Page Worksheet (H3)](#) Upon completion of the worksheets, have each student tell the class what they discovered in the image. |


Provide one of the following images for each group to study. As a group, complete another [Picture Analysis Worksheet (H2)](#) and [Picture Bibliography Page Worksheet (H3)](#):

- 1900 Glider: [http://www.loc.gov/item/2001696450/](http://www.loc.gov/item/2001696450/)
- 1901 Glider: [http://www.loc.gov/item/2001696466/](http://www.loc.gov/item/2001696466/)
- 1902 Glider: [http://www.loc.gov/item/2001696561/](http://www.loc.gov/item/2001696561/)
- 1903 Flyer (Machine): [http://www.loc.gov/item/00652085/](http://www.loc.gov/item/00652085/)

Each group will copy the image to a MS Word document, resize pictures to 6”x6”, write at least a four sentence caption under each picture, and print.

Groups will paste their images onto the poster board to create a timeline illustrating the evolution of the Wright brothers’ flying machines.
### PROCEDURE

#### Step 5:
Sharing: Display the timeline in the front of the classroom. Have each group discuss their image and what they learned from analyzing the image.

Ask: “How has this human technology changed our lives today?” Allow for discussion.

#### Step 6:
On the overhead display images of various points in the Wright brothers’ methodical, systematic process in building the airplane. Have each student match the image according to the step in the engineering design process (H1).

**Engineering Design Process**

1. **Identify the Problem** [https://www.loc.gov/resource/mwright.03207](https://www.loc.gov/resource/mwright.03207)
   The Wright brothers wanted to solve the problem of human flight.

2. **Brainstorm and Research** [http://www.loc.gov/item/2001696482/](http://www.loc.gov/item/2001696482/)
   The Wright brothers studied prior attempt at flight and bicycle mechanics.

3. **Design a Plan** [http://www.wright-brothers.org/History_Wing/Wright_Story/Inventing_the_Airplane/Warped_Experiment/Warped_Experiment_images/1899_Kite_Illustrations.jpg](http://www.wright-brothers.org/History_Wing/Wright_Story/Inventing_the_Airplane/Warped_Experiment/Warped_Experiment_images/1899_Kite_Illustrations.jpg)
   The Wright brothers designed a flying machine.

4. **Create a Model or Prototype** [http://www.loc.gov/item/00652084/](http://www.loc.gov/item/00652084/)
   The Wright brothers’ first prototype was the 1900 glider.

5. **Improve the Model or Prototype** [http://www.loc.gov/item/2001696254/](http://www.loc.gov/item/2001696254/)
   The Wright brothers improved their design with the 1901 glider, 1902 glider and the 1903 flyer.

6. **Manufacture the Product** [http://www.loc.gov/item/2001696640/](http://www.loc.gov/item/2001696640/)
   The Wright brothers began the Wright Company.
**EVALUATION**

Use the following rubric to evaluate student participation in group work and discussion.

- Class participation (50 pts)
- Completing the Image Worksheet (25 pts)
- Group Image (25 pts)

**EXTENSIONS**

- Investigate the Library of Congress for more images related to the history of flight.
- Watch and discuss the video “Who Really Invented the Airplane?” [http://www.history.com/topics/inventions/wright-brothers](http://www.history.com/topics/inventions/wright-brothers)
- Have students create their own Wright gliders using cardboard and toothpicks. [http://wright.nasa.gov/ROGER/models.htm](http://wright.nasa.gov/ROGER/models.htm)
- Additional Wright Flight Video [http://www.youtube.com/watch?v=A-CvkEUSAO4](http://www.youtube.com/watch?v=A-CvkEUSAO4)
- Additional Library of Congress Flight Resources on earlier flight for study:
  - Deaths from Flying [https://www.loc.gov/resource/mwright.0500511](https://www.loc.gov/resource/mwright.0500511)
  - Women in flight [https://www.loc.gov/resource/mwright.0500566](https://www.loc.gov/resource/mwright.0500566)
  - Clouds obstructing view [https://www.loc.gov/resource/mwright.05003418](https://www.loc.gov/resource/mwright.05003418)
  - Wrights May Stop All Plane Flyers [https://www.loc.gov/resource/mwright.05002594](https://www.loc.gov/resource/mwright.05002594)
  - Roosevelt first former president to fly [https://www.loc.gov/resource/mwright.05003393](https://www.loc.gov/resource/mwright.05003393)
ENGINEERING DESIGN PROCESS WORKSHEET (H1)

1. Fill in the name of each step of the Engineering Design Process.

2. Give an example of the Wright Brothers carrying out each step.

Step 1 – ________________
_______________________________________________________________________
_______________________________________________________________________
_______________________________________________________________________

Step 2 – ________________
_______________________________________________________________________
_______________________________________________________________________
_______________________________________________________________________

Step 3 – ________________
_______________________________________________________________________
_______________________________________________________________________
_______________________________________________________________________

Step 4 – ________________
_______________________________________________________________________
_______________________________________________________________________
_______________________________________________________________________

Step 5 – ________________
_______________________________________________________________________
_______________________________________________________________________
_______________________________________________________________________

Step 6 – ________________
_______________________________________________________________________
_______________________________________________________________________
_______________________________________________________________________
<table>
<thead>
<tr>
<th>What do you observe?</th>
<th>What prior knowledge helps you understand what you see?</th>
<th>What questions does the picture raise?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Name ________________________

Period ________

Grade __________

WRGHT PICTURE ANALYSIS WORKSHEET (H2)
Picture Bibliography Page Worksheet (H3)

Name ___________________ Period ________ Grade ________

Name of Picture ________________________________

Creator ________________________________

Date ____________

Is there additional information relevant to what we have been studying?  Yes  No

If so, what? __________________________________________

_______________________________________________________________________

_______________________________________________________________________

Did the Biographical Page answer any of your questions?  Yes  No

If so, what? __________________________________________

_______________________________________________________________________

_______________________________________________________________________