Teacher Information

Activity 1: Early Aviation

Objective
The student will
1. Learn about the experiments of aviation pioneers
2. Recognize the requirements for gliding

National Science Standards
Understanding About Scientific Inquiry
Motions and Forces
Science as a Human Endeavor
History of Science

Description
The students pretend to be employed by the fictional “Cincinnati Scientific Society.” They will look up information on aviation prior to 1900, write short paragraphs on early aviators, and answer some questions on their research.

Time requirements
40 minutes for research
20 minutes for writing

Materials
Library, reference books, and/or Internet access
Pencil and paper

Procedures
Students can research each topic or the work can be divided among groups and the results shared.

Background information
The Wright Brothers based their experiments on a body of knowledge collected by early aviators like Lilienthal and Chanute. The brothers were especially indebted to them for information on how to construct lightweight gliders. Curved wing surfaces, biplanes with wire bracing, and soft sand landing sites had all been used before 1900.

The German Otto Lilienthal was a respected aviator who built several successful gliders before being killed in flight. He had said, famously, “Sacrifices must be made.” Lilienthal was the first to carry out glider experiments carefully and methodically, taking note of important data. He was a great inspiration to the Wrights.

Octave Chanute was a civil engineer and scientist who began to study the problems of flight later in life. He was a close friend and mentor to the Wright Brothers, guiding and encouraging them.

Samuel Langley was a physicist and astronomer who served for a time as secretary of the Smithsonian Institute. Langley succeeded in flying a steam-driven airplane model three-fourths of a mile in 1896 and received a Congressional grant of $50,000. His further attempts to fly were failures. It is said that the jeers of the newspapers and cynics crushed his spirit.

For further information, see http://wright.nasa.gov/researched.htm

Assessment activity
Check student answers against the Activity Answers section. Students may give their reports orally to the class.

Activity 2: Your First Interview

Objective
The student will
1. Determine what questions to ask in a fictional interview with the Wright Brothers

National Science Standards
Abilities of Technological Design
Science as a Human Endeavor
Nature of Science
Description
Students are to assume the role of a newspaper reporter and determine relevant questions to ask the Wright Brothers about their intended experiments. They will try to determine how the Wrights would answer their questions. Questions should center on the Wrights' motivation to learn how to fly.

Time requirements
20 minutes

Materials
Library, reference books, and/or Internet access
Pencil and paper

Procedures
The students write questions to ask the Wright Brothers. Students can research a single topic or the work can be divided among groups and the results shared.

Background information
(See pages 4, 5, and 8.)

Assessment activity
Students may compare their questions with a partner. The class may stage a mock interview using the questions and possible responses that they have prepared.

Activity 3: Your First Report

Objective
The student will
1. Learn why the Wright Brothers wanted to gain control of a craft in the air
2. Learn about the Wright Brothers and how they planned to do their work

National Science Standards
Form and Function
Motion and Forces
Abilities of Technological Design
Science as a Human Endeavor
Nature of Science

Description
Students meet the Wrights and gain a little insight into what they are intending to do through a “personal encounter” in the Wrights' bicycle shop.

Time requirements
20 to 25 minutes

Materials
Pencil and paper

Procedures
Students read “Meet the Wrights” on page 11.

Background information
The Wrights' early intentions were to add to the body of knowledge needed to eventually fly. They recognized that Lilienthal and others had been killed because they failed to control their machines. Their first goal was to learn to control a craft in the air and not be at the mercy of the wind. The brothers had tested their ideas on a large kite and then decided to construct a large, man-carrying glider in their bike shop to test at Kitty Hawk in North Carolina. (See pages 1 to 3.)

For further information, see http://wright.nasa.gov/airplane/kite00.html

Assessment activity
Students are to write a report on their “visit.”
Activity 4: Build a Model of the 1900 Glider

Objective
The student will
1. Construct a scale model of the 1900 Wright Glider

National Science Standards
Form and Function
Abilities of Technological Design
History of Science

Description
Students read “1900: Kitty Hawk” on page 13 and then build a model of the Wrights’ 1900 Glider to understand its size, scale, and function.

Time requirements
60 to 90 minutes

Materials
(See page 41.)

Procedures
(See page 41.)

Background information
You may decide to have students read the additional background information about the 1900 Glider on page 40 in connection with making the model. Try a local supermarket as a source for the Styrofoam trays.

Students have trouble setting the templates so the leading (front) edges of the wings curve downward. They will get the best results if they go step by step with the directions and pictures in the book.

Assessment activity
Compare models to pictures in activity book.

Activity 5: Questions on the 1900 Glider

Objective
The student will
1. Understand how the Wrights control their craft in the air
2. Recognize that testing models is a way to prove theories
3. Understand the advantages of testing at Kitty Hawk

National Science Standards
Evidence, Models, and Explanation
Change, Constancy, and Measurement
Form and Function
Motion and Forces
Abilities of Technological Design

Description
Students answer questions based on reading about an imaginary visit to the Wrights’ 1900 camp at Kitty Hawk. The questions center on the factors that affect the flight of the glider.

Time requirements
10 minutes to read
15 minutes to answer the questions

Materials
Pencil and paper

Procedures
Students read “1900: Kitty Hawk” on page 13.
**Background information**

The students are "visitors" to the Wrights' 1900 experiments. Additional information on the 1900 Glider is available on page 40.

*For further information, see http://wright.nasa.gov/airplane/air1900.html*

**Assessment activity**

Students answers can be evaluated either in writing or in oral discussion.

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### Activity 6: What Would You Design?

**Objective**

The student will

1. Make design suggestions to increase lift

**National Science Standards**

- Change, Constancy, and Measurement
- Form and Function
- Motion and Forces
- Abilities of Technological Design

**National Math Standards**

- Geometry
- Measurement

**Description**

Having seen that the 1900 Glider has barely enough lift to carry a pilot, the students are asked to suggest how to redesign the glider. This also involves doing a dimensional drawing of their redesign.

**Time requirements**

60 minutes

**Materials**

- Library, reference books, and/or Internet access
- Pencil, ruler, and paper

**Procedures**

Students read “1900: Kitty Hawk” on page 13.

**Background information**

After their experiments in 1900, the Wrights realized that they needed to get more lift to be able to pilot a craft, so they redesigned their glider. You may wish to have the students do some research on factors affecting lift.

*For further information, see http://wright.nasa.gov/airplane/liftold.html*

**Assessment activity**

Students answers can be evaluated either in writing and drawing or in oral discussion. They can also present their designs to the class for discussion.

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### Activity 7: Build a Model of the 1901 Glider

**Objective**

The student will

1. Construct a scale model of the 1901 Wright Glider

**National Science Standards**

- Form and Function
- Abilities of Technological Design
- History of Science
Description
Students read “1901: The First Improvement” on page 17 and then build a model of the Wrights’ 1901 Glider to understand its size, scale, and function.

Time requirements
90 to 120 minutes

Materials
(See page 48.)

Procedures
(See page 48.)

Background information
You may decide to have students read the additional background information about the 1901 Glider on pages 46 and 47 in connection with making the model. Try a local supermarket as a source for the Styrofoam trays.

Students may have trouble setting the templates so the leading (front) edges of the wings curve downward. They will get the best results if they go step by step with the directions and pictures in the book.

Assessment activity
Compare models to pictures in activity book.

Activity 8: Forces on the 1901 Glider

Objective
The student will
1. Be able to recognize the four forces that act on an aircraft
2. Recognize that a change in a force will affect the position of the aircraft

National Science Standards
Evidence, Models, and Explanation
Motions and Forces

National Math Standards
Communicating
Geometry

Description
Using a picture of the 1900 Glider being flown as a kite, the students are asked to describe the forces that are acting upon it and to make a prediction about the results of changing one of the forces.

Time requirements
25 minutes

Materials
Library, reference books, and/or Internet access
Pencil, ruler, and paper

Procedures
The class may work on these questions individually or they can work in pairs or discussion groups.

Background information
The interactions of lift versus gravity forces and thrust versus drag forces are the core of this activity. These are vector forces, but are not presented as such. Since this exercise concerns a kite, which is affected by the static pull on its ropes to achieve balance in the wind, the forces are different than those on a glider or airplane. The main idea is that balance is maintained through opposing forces.

For further information, see http://wright.nasa.gov/airplane/kitefor.html

Assessment activity
Students should compare their drawings to the actual answers.
Activity 9: Questions on the 1901 Glider

Objective
The student will
1. Be able to suggest reasons for the problems with the 1901 Glider design
2. Learn about a scientific method of conducting experiments
3. Recognize that it is important to for scientists to learn from failures and continue trying

National Science Standards
Evidence, Models, and Explanation
Understanding About Scientific Inquiry
Science as a Human Endeavor

Description
Having read about the 1901 experiments, the students are asked to propose reasons why the larger wings may have generated less lift. They are also asked what a scientist might do to solve the problem, and to suggest what course the Wrights should take at this point.

Time requirements
20 minutes

Materials
Pencil and paper
Reference books and/or Internet access

Procedures
The class may work on these questions individually or they can work in pairs or discussion groups.

Background information
The Wrights realized that there was a factor or factors that they were not considering in trying to generate lift. They were on the verge of giving up when they decided to reevaluate their data and build a wind tunnel. The Wrights, like scientists today, were careful to change just one variable at a time to note the effect of each change separately. This is an important point to make with students. It is also important that this experiment, like most experiments, did not work as expected the first time. The Wright Brothers worked through their failures until they eventually succeeded.

For further information, see http://wright.nasa.gov/airplane/test1901.html

Assessment activity
Students should be able to discuss their answers and give reasons and evidence for their choices.

Activity 10: Wrong Ideas

Objective
The student will
1. See that incorrect assumptions can lead to wrong ideas and conclusions
2. Recognize that incorrect ideas are sometimes widely accepted as correct

National Science Standards
Understanding About Scientific Inquiry
Nature of Science
History of Science

Description
In this activity the students research some wrong ideas that at one time were thought to be correct.

Time requirements
45 minutes
**Materials**
Library, reference books, and/or Internet access
Pencil and paper

**Procedures**
The students need to research the origins of some scientific theories that were once accepted as correct.

**Background information**
Throughout history people have had to change their ideas about the way the world worked when new evidence was presented. Many times in the past, ideas have been accepted as true on the basis of authority or reputation, religious beliefs, or just bad measurements.

The Wright Brothers also had to “question authority.” The accepted data of the time that they were using simply did not give the results they expected. Because the data came from Otto Lilienthal, the preeminent authority on aeronautics, the Wrights assumed that they were correct. Ultimately, the brothers conducted their own wind tunnel tests to determine what was wrong.

In fact, there were two sources of errors in the Wrights' initial design calculations. There was a pressure coefficient, called “Smeaton’s coefficient,” which was used as the reference for published aerodynamic data at the time. The Wrights used the accepted value for this coefficient, as did Lilienthal. But there was a large error in the value of the coefficient because it is a very difficult measurement to make accurately. The brothers discovered the error and derived a more accurate value. The second error was in the use of Lilienthal's lift coefficients. The brothers did not understand the important effects of wing planform shape on lift until they conducted their wind tunnel tests. The planform is the shape of the wing when viewed looking down onto the wing. Lilienthal had tested his models as small oval shapes, and the brother's wings were rectangles. The difference in shape makes a difference in the amount of lift generated. Wilbur writes, “Any table (of lift) is liable to great misconstruction if the surface to which it is applicable is not clearly specified.” The brothers actually tested Lilienthal's shape and found that his data was “...as near correct as it is possible to make it with the methods he used.”

— Wilbur Wright, from a 1901 letter to Octave Chanute.

For further information, see http://wright.nasa.gov/airplane/smeaton.html and http://wright.nasa.gov/airplane/models.html

**Assessment activity**
Students present their results to the class for discussion.

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**Activity 11: The Wrights’ Wind Tunnel**

**Objective**
The student will
1. Be able to describe the function of a wind tunnel and point out how its parts operate
2. Understand that a wind tunnel can be used to collect data under controlled conditions that can be applied on a larger scale

**National Science Standards**
Evidence, Models, and Explanation
Change, Constancy, and Measurement
Form and Function
Abilities of Technological Design

**Description**
This activity is designed to show students how a wind tunnel can be used to collect aeronautical data. Students learn that procedures used by the Wrights are still used in wind tunnels today.

**Time requirements**
45 minutes

**Materials**
Library, reference books, and/or Internet access
Pencil and paper

**Procedures**
The students read “New Data” on page 20 prior to answering the questions.
Background information
Orville and Wilbur’s tunnel was not the first wind tunnel ever constructed, but it was the first that gave accurate and useful data. It was also the first tunnel that could be used to verify earlier testing results and design future aircraft. For a wind tunnel to give accurate information, the flow of air needs to be as free of turbulence as possible, so the brothers used grids to straighten the airstream. Students should recognize that testing small-scale models saves time and expense.

For further information, see http://wright.nasa.gov/airplane/tunnel.html

Assessment activity
Check student answers against the Activity Answers section.

Activity 12: Operate the Wrights’ Tunnel

Objective
The student will
1. Become more familiar with how a wind tunnel operates
2. Recognize that some wing forms give better lift
3. Understand how the Wrights gathered data from wind tunnel experiments

National Science Standards
Evidence, Models, and Explanation
Change, Constancy, and Measurement
Form and Function
Understanding Scientific Inquiry
Abilities of Technological Design
Nature of Science

National Math Standards
Communication
Numbers and Number Relationships
Patterns
Statistics
Geometry
Measurement

Description
Students operate a virtual Wright wind tunnel on a computer and collect data on a variety of wing forms actually used by the Wrights.

Time requirements
45 minutes

Materials
Internet access
Pencil

Procedures
Students print out a data form and then follow a set of activities in which they compare different aspects of wing design. They graph their results to draw conclusions.

Background information
The simulation in this activity operates in the same way as the Wrights’ original tunnel. The student can choose from any of the wing shapes tested by the Wrights (taken from the actual models now housed in the Franklin Institute in Philadelphia) and collect data in the same way they did. The student places a wing model in the tunnel, starts the fan, and then adjusts for the drag caused by the balance itself. The angle is read and the data graphed. The students should discover that long, thin wings give the best results.

For further information, see http://wright.nasa.gov/airplane/tunnlint.html

Assessment activity
The students could be given several of the wing forms at random and asked to comment on which might give the best results based on the data they have just collected. They can also compare graphs and discuss the best results.
Activity 13: Build a Model of the 1902 Glider

Objective
The student will
1. Construct a scale model of the 1902 Wright Glider

National Science Standards
Form and Function
Abilities of Technological Design
History of Science

Description
Students read “1902: Success at Last” on page 25 and then build a model of the Wrights’ 1902 Glider to understand its size, scale, and function.

Time requirements
120 minutes

Materials
(See page 55.)

Procedures
(See page 55.)

Background information
You may decide to have students read the additional background information about the 1902 Glider on page 54 in connection with making the model. Try a local supermarket as a source for the Styrofoam trays.

Students have trouble setting the templates so the leading (front) edges of the wings curve downward. They will get the best results if they go step by step with the directions and pictures in the book.

Assessment activity
Compare models to pictures in activity book.

Activity 14: Compare the 1900, 1901, and 1902 Gliders

Objective
The student will
1. Be able to list similarities and differences in the first three Wright gliders
2. Recognize the relationship between wing shape and performance

National Science Standards
Evidence, Models, and Explanation
Form and Function
Motions and Forces
Abilities of Technological Design

National Math Standards
Geometry

Description
Drawings of the 1900, 1901, and 1902 gliders are shown on page 26 at the same scale for the purpose of comparison. Students are asked to list similarities and differences and then speculate about reasons for the 1902 success.

Time requirements
25 minutes

Materials
Pencil

Procedures
The students compare glider features.
Background information
With each gliding season, the Wrights arrived at Kitty Hawk with a redesigned glider. When the 1900 Glider proved barely able to lift itself with a pilot, the brothers designed a glider with much greater wing surface in 1901, trying to create more lift. It turned out that this glider, although able to carry a pilot more easily, only produced about one-third of the expected lift. On the verge of giving up, the Wrights conducted wind tunnel tests during the winter of 1901 and determined that they had made the wrong choice with the 1901 Glider. Instead of short, wide wings, they should have made long, thin wings. The 1902 Glider had long, thin wings of nearly the same wing area as the 1901 Glider, but it set world records for gliding.

For further information, see http://wright.nasa.gov/airplane/air1902.html

Assessment activity
Students should be able to point out how the 1902 design differed from the previous gliders.

Activity 15: Prices Then and Now

Objective
The student will
1. Gain perspective on the relative costs of goods over a 100-year period
2. Be able to calculate percentages based on real data

National Science Standards
Change, Constancy, and Measurement
Understanding About Scientific Inquiry

National Math Standards
Problem Solving
Math Connections
Computation and Estimation

Description
Since Orville Wright recorded the brothers' experiments with a box camera, 1900 prices are given for cameras as well as for several common items. The activity has students calculate the percentage of a salary to buy a camera then and now. It also has the students compare how the prices on a number of common items have risen since 1900.

Time requirements
30 minutes

Materials
Pencil, paper, and calculator

Procedures
The students collect data on some food costs today, compare them to food costs in 1900, and calculate the percentage change. They also calculate the percentage of a monthly salary needed to buy a camera in 1900 and today.

Background information
Orville took and developed a large number of pictures of the brothers' experiments to document their results. The glass negatives were developed back in Dayton, where large numbers of them remain today. All of the Wrights' experiments through 1903, including travel, cost them about $1,200.

Assessment activity
Students should be able to calculate percentage increases. Teachers might want to have students put their problems on the chalkboard.

Activity 16: Build a Model of the 1903 Flyer

Objective
The student will
1. Construct a scale model of the 1903 Wright Flyer
National Science Standards
Form and Function
Abilities of Technological Design
History of Science

Description
Students read “1903: Powered Flight” on pages 28 and 29 and then make a model of the Wrights’ 1903 Flyer to understand its size, scale, and function.

Time requirements
120 minutes

Materials
(See page 63.)

Procedures
(See page 63.)

Background information
You may decide to have students read the additional background information about the 1903 Flyer on page 62 in connection with making the model. Try a local supermarket as a source for the Styrofoam trays.

Students have trouble setting the templates so the leading (front) edges of the wings curve downward. They will get the best results if they go step by step with the directions and pictures in the book.

Assessment activity
Compare models to pictures in activity book.

Activity 17: Balancing Forces

Objective
The student will
1. Understand some of the challenges of making a powered flying machine

National Science Standards
Evidence, Models, and Explanation
Form and Function
Understanding About Scientific Inquiry
Motions and Forces
Abilities of Technological Design

Description
The students need to propose solutions to engine and pilot placement problems and also choose how to cancel the torque (twist) produced by two rotating propellers.

Time requirements
20 minutes

Materials
Pencil

Procedures
The students plot the location of the pilot and engine on the wing of the 1903 Flyer. They need to justify their placement, especially in terms of safety and balance.

Background information
Having crashed a number of times over the years, the Wrights were concerned about crashing into a hot engine or having the engine crash onto them. With this in mind, they put the engine on the wing beside the pilot. This created a balance problem because the engine was heavier than either Wilbur or Orville. To compensate for the extra weight, the brothers made the wing on the engine side 4 inches longer to add extra lift on that side and balance the plane.
They also made the propellers turn in opposite directions to have them cancel out each other's torque. To make this happen, they twisted one of the chains used to turn the propellers into a figure eight. This made the corresponding propeller rotate in the opposite direction.

For further information, see http://wright.nasa.gov/airplane/propeller.html

Assessment activity
Students should put the pilot next to the engine and have the propellers rotating in opposite directions.

**Activity 18: Center of Gravity**

**Objective**
The student will
1. Understand how balance is a function of both mass and distance from the center of rotation

**National Science Standards**
Evidence, Models, and Explanation
Change, Constancy, and Measurement
Understanding About Scientific Measurement
Motions and Forces

**National Math Standards**
Reasoning
Math Connections
Patterns
Measurement

**Description**
This is a followup to Activity 17 and deals with balancing the aircraft. The students balance paper clips on a ruler and investigate the relationship between mass and distance from the center.

**Time requirements**
30 minutes

**Materials**
String, 12-inch ruler, and paper clips

**Procedures**
The students attempt to keep a ruler hanging from a string level by sliding paper clips out from the center.

**Background information**
This activity takes patience and small adjustments. Students often have difficulty with this and may need assistance to get good results.

For further information, see http://wright.nasa.gov/airplane/cg.html

Assessment activity
Students should be able to tell how far from the center one must hang one paper clip (6 inches) to balance three paper clips hanging on the other side located 2 inches from the center.

**Activity 19: How Far Did They Fly?**

**Objective**
The student will
1. Estimate a distance of 120 feet
2. Realize how slow the Wrights flew at first
3. Collect and graph data
4. Calculate speed by dividing distance by time
National Science Standards
Change, Constancy, and Measurement
Understanding About Scientific Inquiry

National Math Standards
Problem Solving
Math Connections
Computation and Estimation

Description
Students try to estimate the distance that Orville Wright first flew. Then they find out how long it takes them to run this distance. They graph both results for discussion.

Time requirements
45 minutes to collect data
45 minutes to graph and answer questions

Materials
Library, reference books, and/or Internet access
Pencil, paper, ruler, and calculator
Craft sticks or other devices to mark distances
Measuring tape (the longer the better)
Timer to measure seconds
150-foot string (optional)

Procedures
Students estimate the distance of 120 feet down a line or string and place their marker at their estimate. Then the actual 120-foot distance is measured and the distance from each marker to the true 120-foot distance is measured and recorded. After the students pick up their markers, each student is timed as he or she runs 120 feet and this time is recorded. Students will need to measure several familiar distances to get a relative sense of scale (such as the length from home to first base on a baseball diamond, the length of a familiar hall at school, etc.).

Background information
Orville flew an estimated 12 seconds (he forgot to start the watch!) and landed 120 feet from the starting point. This was not far for an airplane flight, especially by today’s standards. The students should realize that this is the case and they should see that they can run faster than the flyer flew.

Assessment activity
Check student answers against the Activity Answers section.

Activity 20: How to Launch the Flyer

Objective
The student will
1. Be able to show how to change the direction of a force
2. Recognize the advantage of launching into the wind

National Science Standards
Evidence, Models, and Explanation
Transfer of Energy
Motions and Forces

Description
Students are asked to complete a diagram of how the Wrights launched their flyer using a falling weight.

Time requirements
20 minutes

Materials
Pencil
Procedures
The students draw the ropes and pulleys that will correctly transfer the force of the falling weight.

Background information
Once the Wrights had a powered flyer, they decided they did not need to journey to North Carolina to get sufficient wind for testing. However, although the Wright Flyer could sustain itself in the air, it still lacked the power for an unassisted takeoff. They solved this problem by using the energy from a falling weight. Launching into the wind added extra lift.

For further information, see http://wright.nasa.gov/airplane/air1905.html

Assessment activity
Check student answers against the Activity Answers section.

Activity 21: Write a Press Release

Objective
The student will
1. Be able to use what he or she has learned about the Wright’s efforts to write a factual press release

National Science Standards
Abilities of Technological Design
Science as a Human Endeavor

Description
Students take on the role of an eyewitness to the Wright Brothers’ experiments and are asked to turn their “observations” into a press release.

Time requirements
30 minutes

Materials
Pencil and paper

Procedures
Students review their observations of the Wright Brothers’ experiments in the booklet and write a press release.

Background information
In 1903, to be prepared, the Wrights wrote their own press release in advance of their first successful flight. When they telegraphed their success to their sister Katharine, she took it to the local papers. Very little was printed at the time because, as one editor put it, “Had they flown for 12 minutes instead of 12 seconds, that would have been news.”

Assessment activity
Have students pose as newspaper editors to select the best press releases to print.

Activity 22: Design a Mission Patch

Objective
The student will
1. Be able to relate a design to the Wrights’ achievement

National Science Standards
Science as a Human Endeavor

Description
Since all NASA missions are commemorated with a patch, the students are asked to design a Wright Brothers patch.

Time requirements
30 to 45 minutes

Materials
Colored pencils, crayons, markers, and paper
**Procedures**
Students can review NASA patches for ideas. They should then draw their own patch for the Wright Brothers. The shape and content is up to the student.

**Background information**
The Web site shows all the patches for the NASA missions. Patches can also be obtained from NASA visitor centers.

**Assessment activity**
Displays should be made of student work.

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**Activity 23: Be an Inventor**

**Objective**
The student will
1. Understand that invention requires imagination
2. Realize that inventors always face difficulties

**National Science Standards**
Understanding About Scientific Inquiry
Abilities of Technological Design
Science as a Human Endeavor

**Description**
Having followed the Wrights' invention process, students are asked to use their imaginations to propose an invention to improve transportation.

**Time requirements**
45 minutes

**Materials**
Pencil and paper

**Procedures**
Students can review the Wright Brothers' “observations” of their experiments in the booklet, and then write about something they would like to invent to improve transportation. They should consider problems they may encounter and decide how to publicize their efforts.

**Background information**
The invention process can be difficult for children. Emphasize to them that anything is possible and tell them not to limit their thinking. However, they should consider such things as cost and safety when they evaluate their ideas.

**Assessment activity**
Have students share their ideas and sketches with the class and let the class choose those that they think would be the most successful.