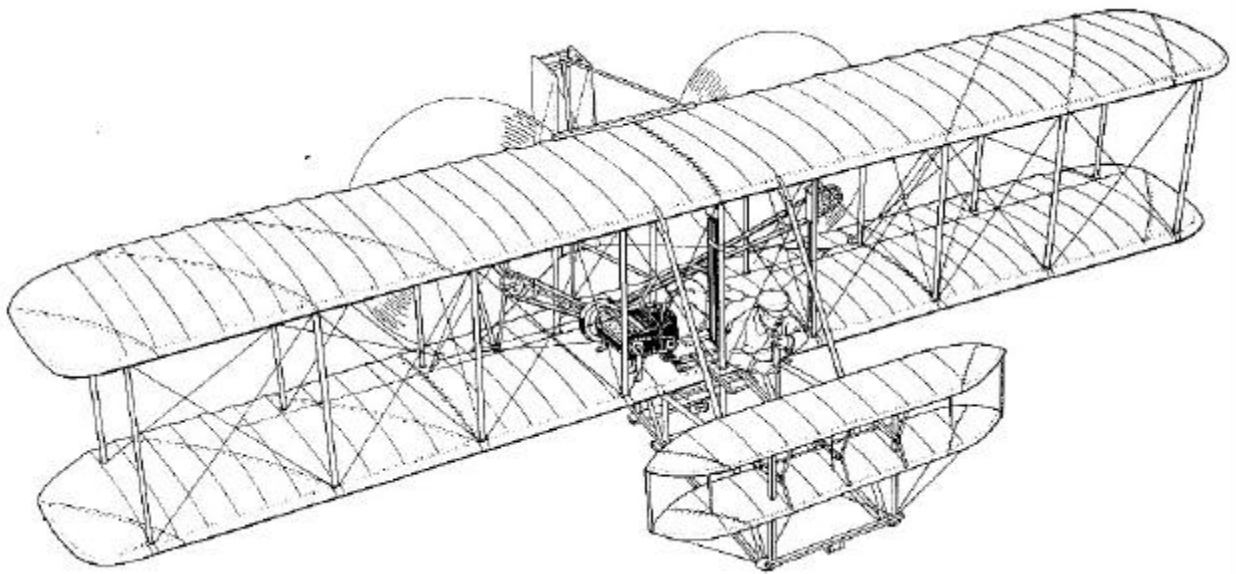


The Wright Stuff **Study Guide**



The Wright Stuff

A Musical for Young Audiences about The Wright Brothers

Book & Lyrics by Mark Amenta

Music & Additional Lyrics by Bill Vaananen

Presented by

Face to Face Productions

The Story of the Play

Having lost their way on a cross country flight, Wilbur and Orville Wright make an emergency landing at your school. As a matter of introducing themselves, the brothers decide to reenact the story of their great accomplishment. They demonstrate their childhood experiments making improvements on a sled, bicycle, and kite. The story then turns to their fascination with manned flight. The play comes to a climax as the brothers construct the first airplane onstage and recreate their historic twelve second flight.

Educational Goals

- ❖ Develop and/or refine problem-solving skills
- ❖ Foster an understanding of the process of inventing
- ❖ Establish work/study/research skills
- ❖ Cultivate personal perseverance
- ❖ Amplify creative and imagination skills

Curriculum Applications

- ❖ Biography (The Wright Brothers, Da Vinci, Octave Chanute, the Montgolfier Brothers, etc.)
- ❖ Methods of Transportation
- ❖ Inventions (in conjunction with school Science Fair/Invention Convention)
- ❖ History of flight from early mythology through the space shuttle
- ❖ Science of flight from birds to the Concord

Educator Comments

This is a well crafted play about flight, about the men who achieved the first powered flight, and the miracle at Kitty Hawk. - Anita Wesson, Children's Theatre Board, Winston-Salem, NC

The performance was not only entertaining, but lent itself to further academic growth for our students. - Ron Hale, Principal, Fairmount School, Downers Grove, IL

We were marvelously entertained and perhaps more importantly you helped to plant the seeds of the idea of perseverance. - Marjorie Dolbeer, Principal, South School, Westmont, IL

Events that Coincide with the Play's Themes

See if you can book *The Wright Stuff* around the time of these events:

- ❖ Your Science Fair
- ❖ Orville's birthday: 8/19
- ❖ Space shuttle launch
- ❖ Trip to airport
- ❖ Wilbur's birthday: 4/16
- ❖ First flight: 12/17/1903
- ❖ Kite-flying season
- ❖ Studying flight

Other Information

- ❖ Audience age: K-6
- ❖ Funding: Illinois Arts Council; Michigan Humanities Council
- ❖ Performance length: 40 minutes
- ❖ More info: 773-631-2013 or www.FaceToFaceProductions.com

Math Connections: Measuring Flight

Have students make paper airplanes and then conduct a time and distance measurement exercise:

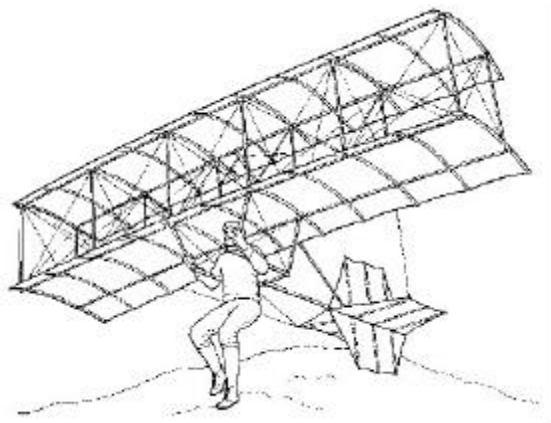
1. Fly the airplane from a very precise starting point, timing the duration of the flight—from release to landing.
2. Measure the distance from the starting point to the landing.
3. Calculate the “inches-per-second” of the flight.
4. Then, depending on where you are in your math curriculum, you can have the students work with these numbers. For example, they can convert the inches-per-second into feet-per-minute or even miles-per-hour.

You can work with the concept of flight and its related numbers in other ways, too. For example, you can have students “fly” air-powered planes by attaching the planes to air-filled balloons and releasing the air. Then, measure how long the balloon-plane traveled in terms of distance and time.

Language Arts Connections: Letter Writing

By writing the Smithsonian Institution, the Wright Brothers learned the weather and ground conditions on the outer banks of North Carolina were ideal for their glider experiments. Have your students write a letter requesting information about a classroom project in science, social studies, etc. Recommendations:

- ❖ NASA
- ❖ American Medical Association
- ❖ Commonwealth Edison
- ❖ Smithsonian Institution
- ❖ A local business



Chanute's Biplane Glider (1896) employed the same truss rigging that the Wrights were to use in their early glider structures. This craft had a 16-foot wingspan.

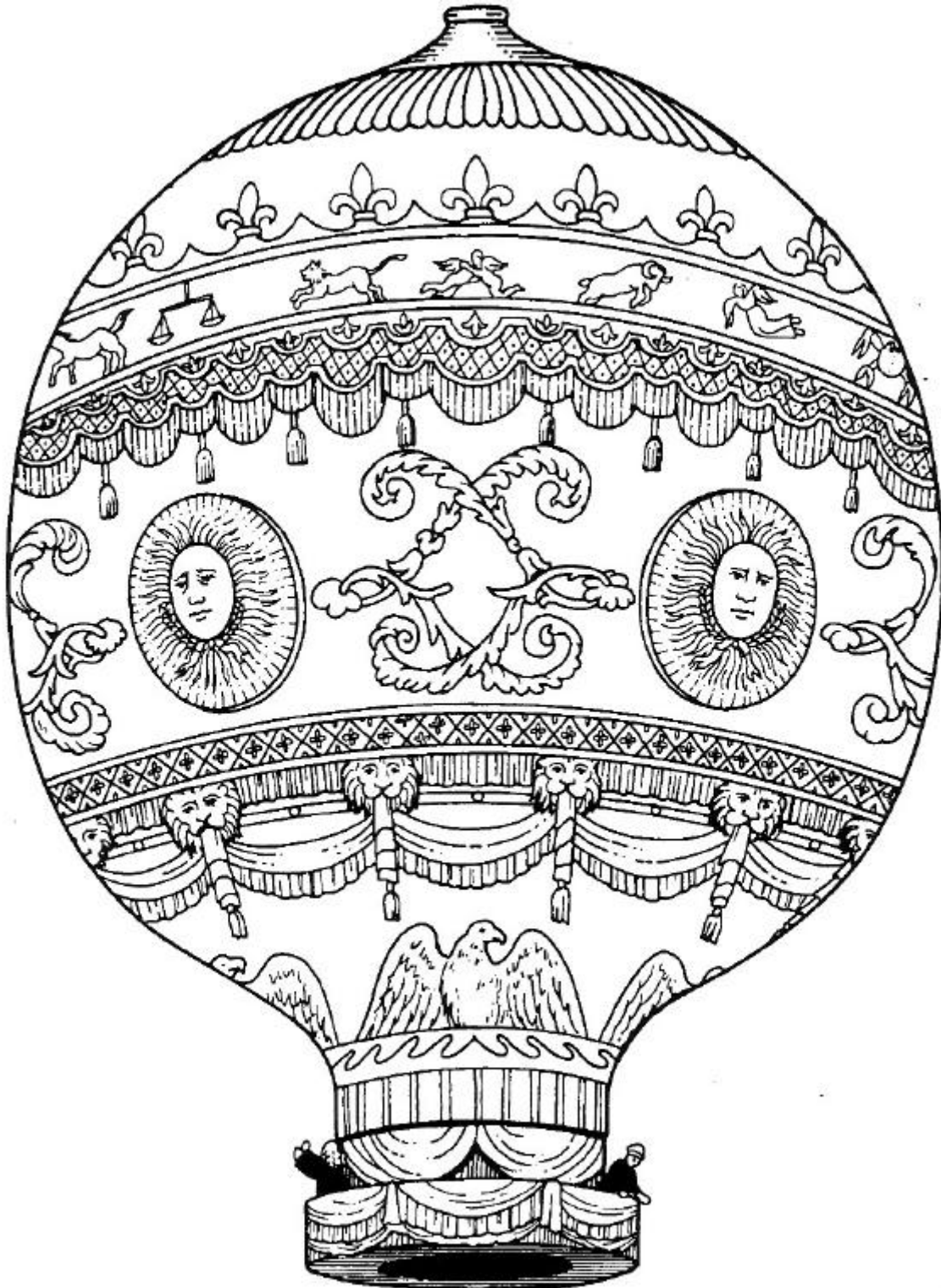
Language Arts Connections: Newspaper Reporting

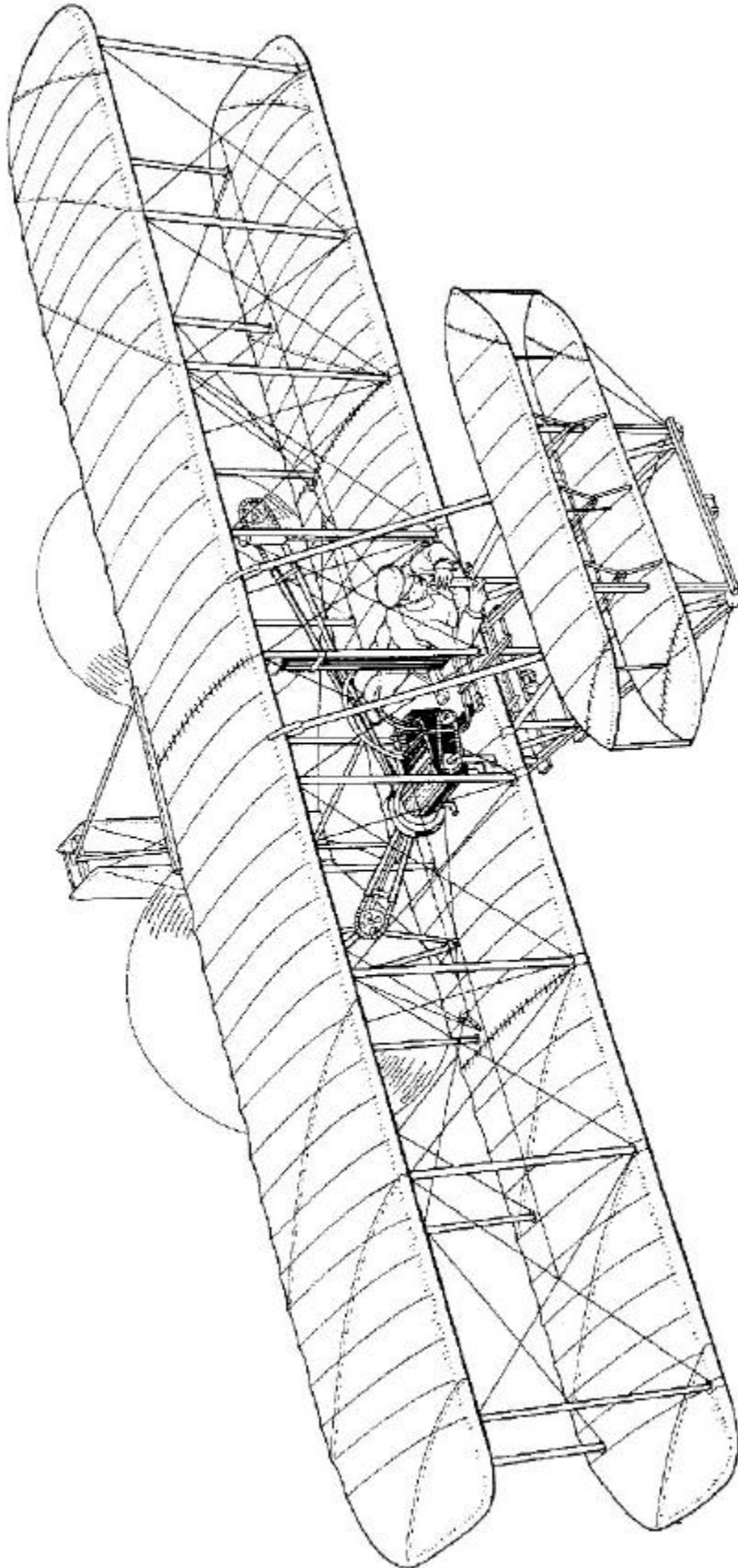
The Wright brothers' glider experiments and early heavier-than-air manned flights went all but unnoticed by the world at large. It was only after several successful flights at the world's fair, four years later, that people began to take notice of their achievement.

Have your students play a reporter from the “Kitty Hawk Sentinel” and let them write an eyewitness account of the historic flight.

Art Connection: Color the Balloon

Below is a picture of a hot air balloon similar to the type in use when the Wright brothers were alive. On the next page is a picture of the Wright Flyer. Have your students color either or both. Cut out the colored drawings, pasting them back to back, and hang them around the classroom from the ceiling.





Social Studies Connection: Transportation

The Wright Brothers invented the first airplane in 1903. At the time, this new form of transportation went largely unnoticed. It was not until several years later that the world, in particular the United States War Department, realized the potential for this new invention.

1. Have your students talk about the different ways in which the airplane can be used.
2. Have your students discuss and/or draw different forms of transportation that people have used throughout history. Have them talk about what tasks are best suited for each mode of transportation.

Social Studies Connection: Geography

On a map of the United States, locate the following cities and have your students discuss the role each one played in the lives of Wilbur and Orville Wright, as well as the development of the first airplane.

- ❖ **Dayton, Ohio** – The city where the Wright family lived most of their lives. It was in Dayton that the Wright brothers opened their bicycle shop and built their gliders and the first airplane.
- ❖ **Kansas City, Missouri** - The Wright brothers' father often made business trips to Kansas City. It was on one of these trips that he bought his sons a whirlygig. This winged toy is said to have first inspired the boys towards their lifelong fascination with flight.
- ❖ **Washington, DC** - Home of the Smithsonian Institution. Samuel Pierpont Langley, head of the national museum, was the person Wilbur wrote to for advice on the best place in the country to fly their gliders. Langley suggested Kitty Hawk, North Carolina because there would be no trees, very few hills and wind speeds that would be most conducive for their experiments in flight.
- ❖ **Kitty Hawk, North Carolina** – This was the closest town on the outer banks of North Carolina to where Wilbur and Orville first made their historic flight. The exact location of this historic event was actually Kill Devil Hills. When the two brothers first traveled to the outer banks by boat from the mainland, it took them a full day, in good weather, to reach this remote outpost. The townspeople were at first skeptical, though curious about these two men. After three annual visits to the area, the townspeople became very supportive of their work.

Social Studies Connection: Who Are These People?

Wilbur and Orville were not the first people to think about flying. Since the beginning of time, people have dreamed about flying machines that would take them into the air. The trials and tribulations of these people contributed to the success of the Wright brothers. Below is a list of people, real and mythical, that are a part of this grand history of flight. Have your students research their contributions to flight.

Icarus and Daedalus

Francis Bacon

Octave Chanute

Sinbad the Sailor

Montgolfier Brothers

Otto Lilienthal

Leonardo da Vinci

Isaac Newton

Samuel Pierpont Langley

Social Studies Connection: Time Line

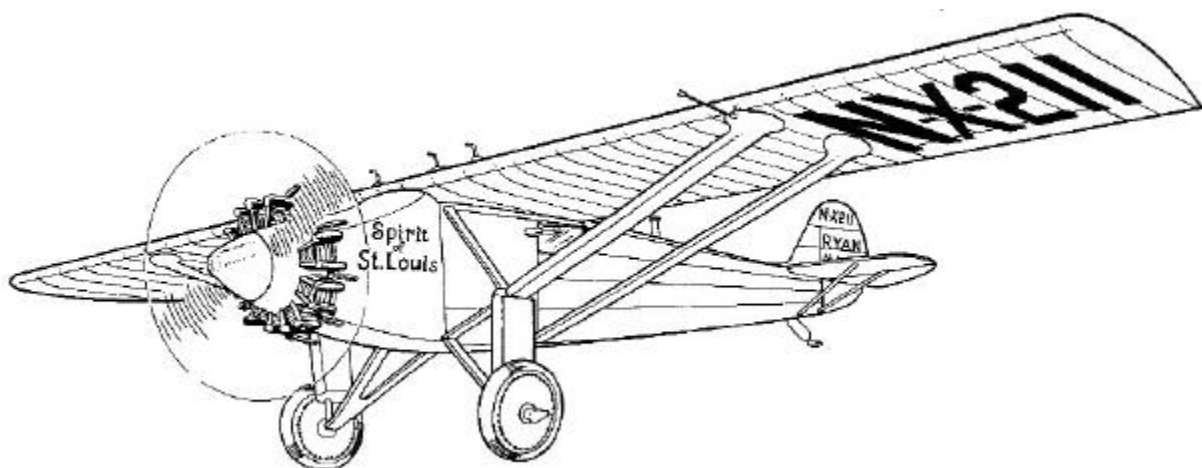
Have your students construct a time line based on the information below. Include above or below the time line other historical events which occurred during the same years.

- 1867 Wilbur Wright is born on April 16
- 1871 Orville Wright is born August 19
- 1878 The brothers experiment with a helicopter-like toy their father, Bishop, gives them
- 1886 Orville starts a printing business
- 1888 The brothers join forces to build a bigger printing press
- 1889 Susan, their mother, dies; the brothers publish *The West Side News*
- 1892 The brothers buy two safety bicycles (same size wheels and brakes); in December they start their own bicycle business
- 1896 The brothers begin manufacturing their own bicycles; Orville is stricken with Typhoid Fever; Otto Lilienthal dies in a glider crash
- 1899 The brothers sell printing business; Wilbur contacts the Smithsonian Institution for information on flight; they build a biplane kite and test their theory of wing-warping
- 1900 The brothers travel to Kitty Hawk, North Carolina to test their first glider
- 1901 Second set of glider tests are not as successful; the brothers build a wind-tunnel and conduct tests on wing design
- 1902 At Kill Devil Hills, south of Kitty Hawk, the brothers successfully fly their third glider almost 1000 times
- 1903 The brothers build the *Wright Flyer* in the back of their bicycle shop; on December 17, 1903 Orville pilots the *Wright Flyer* in the first successful controlled, heavier-than-air, powered flight.
- 1904 The brothers build and fly the *Wright Flyer II*
- 1905 The brothers build and fly the *Wright Flyer III*
- 1908 Wilbur demonstrates their airplane in France to the delight and amazement of all; at flight tests for the US Army, Orville crashes and is slightly injured; Lt. Thomas Selfridge, his passenger, becomes the first fatality from air travel
- 1909 The brothers demonstrate their plane throughout Europe; they sell their first planes and establish the Wright Company to build them; Dayton honors the hometown heroes; Wilbur pilots their *Flyer* at the Hudson-Fulton Celebration in New York
- 1912 At 45, Wilbur dies of Typhoid Fever on May 30
- 1914-18 World War I accelerates the need for the design and manufacturing of planes
- 1915 Orville sells the Wright Company and retires
- 1917 Bishop Wright dies
- 1932 A memorial to the accomplishment of the two brothers is dedicated at Kitty Hawk
- 1939-45 World War II further accelerates the development of new and improved planes
- 1948 At the age of 76, Orville dies on January 30

Social Studies Connection: Chronology of Flight

Below are the years and corresponding milestone related to the history of flight. Have one student, or a group of students, take each milestone and research it. They can either write or orally present a report on that milestone.

- 1903 *Wright Flyer* – First powered airplane
- 1926 Goddard Rockets – First liquid propellant rocket
- 1927 *Spirit of St. Louis* – First solo transatlantic flight
- 1942 *Bell XP-59A Airacomet* – First American turbojet
- 1947 *Bell X-1* – First aircraft to travel at the speed of sound
- 1957 *Sputnik I* – First artificial satellite (Soviet Union)
- 1958 *Explorer 1* – First successful US satellite
- 1961 *Vostok* (Yuri Gagarin - Soviet) – First man in space
- 1962 *Mariner 2* – First interplanetary probe; *Mercury* – First American, John Glenn, in earth orbit
- 1965 *Voskhod II* (Soviet) – First space walk; *Gemini IV* – First American space walk
- 1967 *North American X15* – First hypersonic, high altitude aircraft
- 1969 *Apollo 11 Command Module* – First manned lunar landing
- 1976 *Viking Lander* – First spacecraft to operate on Mars
- 1981 *Columbia* – First U.S. space shuttle to fly into orbit
- 1983 *Pioneer 10* – First spacecraft to leave the solar system
- 1999 *Breitling Orbiter 3 Gondola* – First nonstop balloon flight around the world



Science Connection: Making a Kite

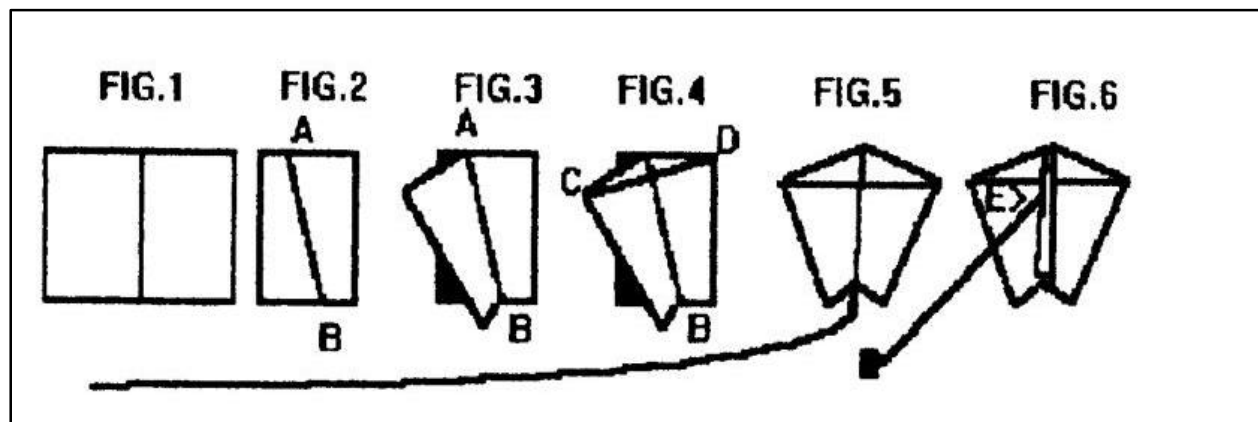
Working in pairs, have students build and fly a simple kite to explore air resistance and aerodynamic design. Older students could design and fly more complicated kites. Have them research the history of kites for both different designs as well as uses.

Material list for 20 simple kites:

- ❖ 20 sheets of brightly colored 8-1/2" x 11" paper
- ❖ 20 8-inch bamboo barbecue/shish-kabob sticks or equivalent
- ❖ 1 roll of florescent surveyor's flagging plastic tape for the tail – available at any hardware store (a plastic bag cut in a 1" wide spiral all around will also make a great tail)
- ❖ 1 roll 1/2"-wide masking tape or any type of plastic tape
- ❖ 1 roll of string (at least 200', 6 to 10 feet for each child)
- ❖ 20 pieces of 1"x 3" cardboard on which to wind the string
- ❖ Scissors
- ❖ Hole punch

Directions:

1. Fold a sheet of 8-1/2" x 11" paper in half to 8-1/2" x 5-1/2"
2. Fold again along the diagonal line A in Fig. 2
3. Fold back one side forming kite shape in Fig.3 and place tape firmly along fold line AB (no stick is needed here because the fold stiffens the paper and acts like a spine)
4. Place barbecue stick from point C to D and tape it down firmly
5. Cut 6 –10 feet of plastic ribbon & tape to the bottom of the kite at B
6. Flip kite over onto its back and fold the front flap back and forth until it stands straight up (otherwise it acts like a rudder and the kite spins around in circles)
7. Punch a hole in the flap at E, about 1/3 down from the top point A; tie one end of the string to the hole and wind the other end onto the cardboard string winder



Science Connection: Go Fly Your Kite!

On a windy day, go fly your kites. Feel the resistance as the air is caught and deflected by the kite.

- ❖ What is the purpose of the tail?
- ❖ What causes the kite to rise into the air?
- ❖ What keeps the kite aloft?

Science Connections: Making a Whirlygig

Wilbur and Orville's father brought back a toy similar to the whirlygig below. It is believed that this toy was the boys' first inspiration for their lifetime fascination with flight.

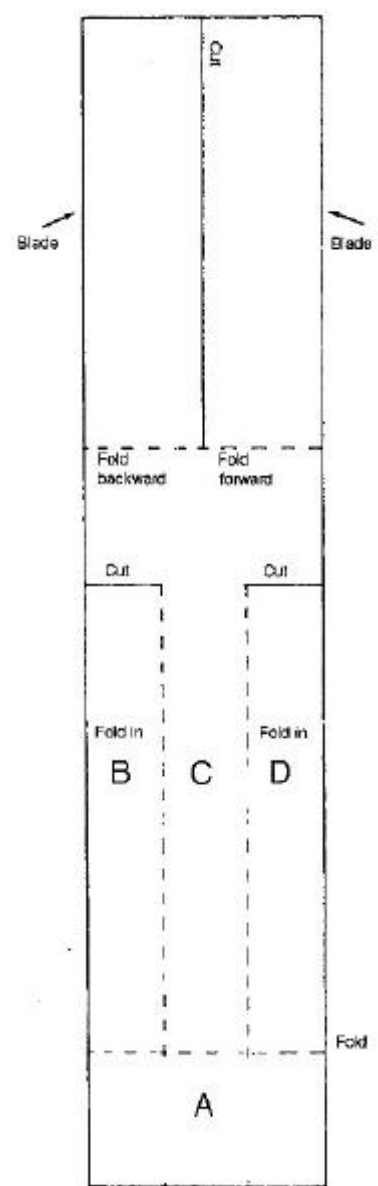
A whirlygig works like a helicopter. The paper blades spin around when it is dropped from high up. The blades keep spinning faster and faster as the whirlygig falls to the ground. The brighter the designs the prettier it looks when whirling around.

Have your students make a whirlygig for themselves.

Materials:

- ❖ 6-1/2" x 1" strip of paper (medium to heavy weight)
- ❖ crayons or markers
- ❖ scissors

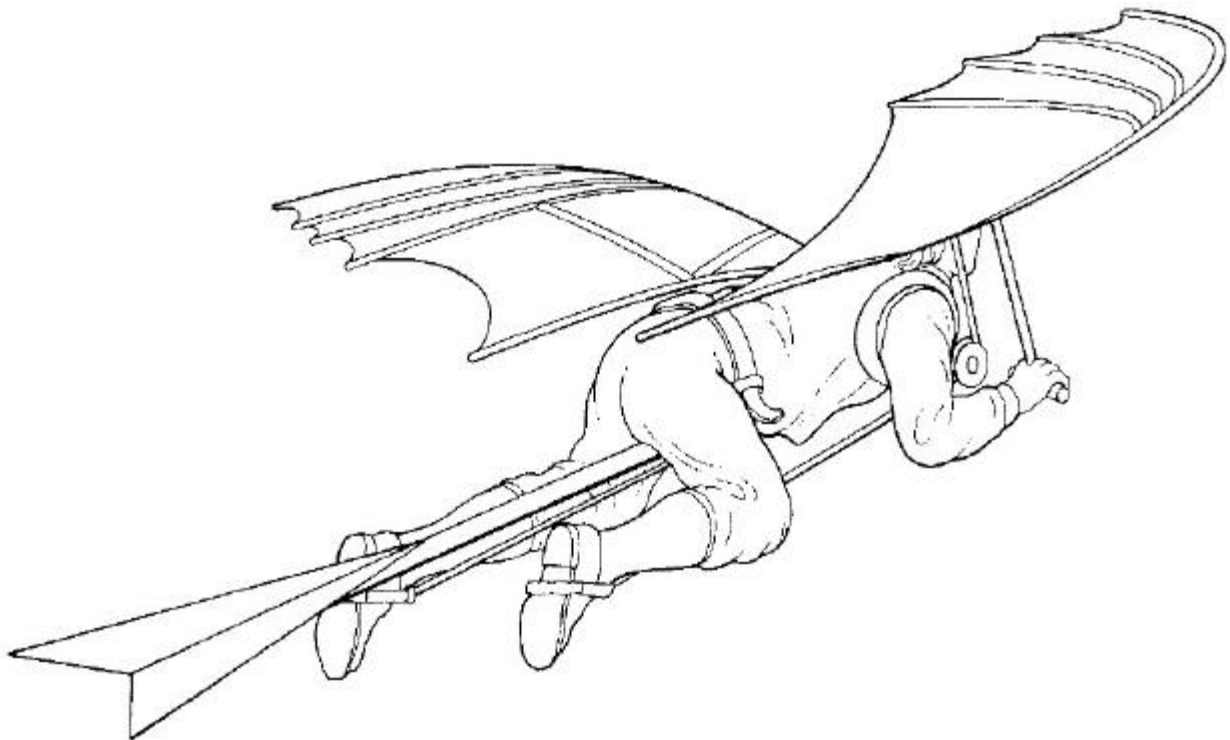
1. Photocopy the illustration on the right for each student.
2. Have students color the strip of paper as brightly and varied as they like—the more color, the more interesting the whirlygig will look when whirling. They will be cutting out the whirlygig, so students don't have to "stay in the lines" as they color.
3. Have students cut along all solid lines (the outer lines to remove the whirlygig from the rest of the paper, and the inner solid lines to form the different parts)
4. Have students fold on the dotted lines as follows:
 - a. Fold the top two rectangular flaps in opposite directions to form the "propeller" of the whirlygig.
 - b. Fold flap A up over flaps B, C & D
 - c. Fold flap B in, over flap C
 - d. Fold flap D in, over flap C
5. To fly, drop from a high place.



Science Connection: Design Your Own Flying Machine

The Wright Brothers spent many years reading and learning all there was to know about flight. They studied the ideas and designs of other people who had attempted to fly. Along with all of their research, they also used their imaginations.

Have your students design their own imaginative flying machines. For example, below is a drawing of Leonardo da Vinci's *Ornithopter*. He designed this man-powered, wing-flapping aircraft around 1485. Da Vinci also invented the parachute and designed a vertical takeoff device powered by a spring mechanism. These designs were far in advance of their time, but were not sufficiently developed for practical application.



Language Arts Connections: Word Search

Find the words listed below in the box at the bottom of this page. The words will be either left to right, right to left, upward, downward, or diagonal.

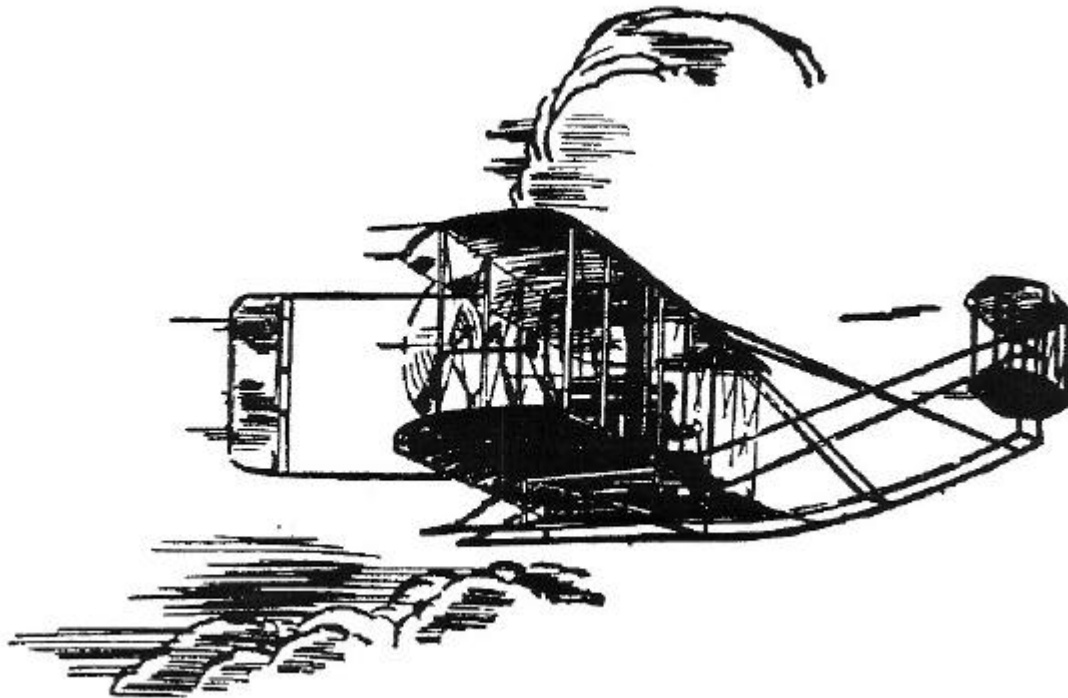
AIR	INVENT	SPIN
BICYCLE	KITE	TREE
BIRD	METAL	WAX
DAVINCI	MOTOR	WHEEL
FAST	PLANE	WILBUR
FLIGHT	SKY	WIND
FRICTION	SLOW	WING
GLIDER	SMITHSONIAN	WOOD
ICARUS	SOAR	WRIGHT

B	C	W	O	O	D	P	L	A	N	E	Q	F	E
I	C	A	R	U	S	O	E	M	O	P	U	L	B
R	S	X	Y	Z	M	T	E	R	I	A	C	I	L
D	L	W	G	N	I	W	H	I	T	Y	L	G	N
V	O	F	A	S	T	Q	W	I	C	N	B	H	A
T	W	R	I	G	H	T	L	I	I	K	I	T	E
N	I	D	U	Y	S	E	B	H	R	O	N	J	Y
E	L	R	O	T	O	M	K	B	F	A	P	U	K
V	B	I	J	Y	N	A	W	I	N	D	O	R	S
N	U	B	G	L	I	D	E	R	T	P	D	S	P
I	R	F	U	D	A	V	I	N	C	I	C	B	I
M	E	T	A	L	N	E	E	R	T	O	L	B	N

Language Arts Connection: Vocabulary

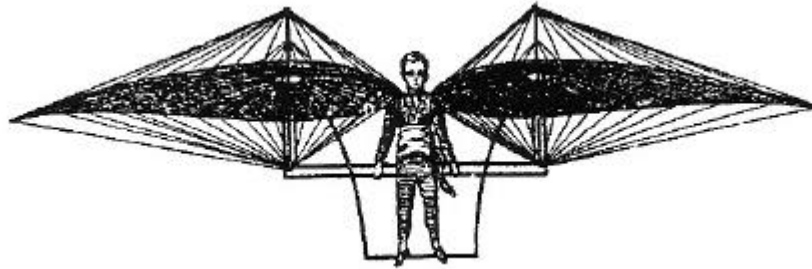
Below are words used in *The Wright Stuff*. Because of the wide age range of our audiences, we have chosen a variety of vocabulary levels. Choose the words that best suit your students and have them look up the definitions and present their findings to their classmates. You can also have students use the words in sentences about the Wright Brothers.

air	currents	flight	learn	sled
airplane	curve	fly	library	slow
aviation	delirious	frame	law	soar
balloon	diagram	friction	machine	south
bend	distance	front	measure	speed
bicycle	doctor	future	metal	spin
biplane	downhill	glider	moon	spoke
bird	dove	glue	motor	storm
book	dream	hawk	myth	transportation
breeze	eagle	high	nature	tree
brother	east	house	noise	vehicle
build	execution	idea	north	venture
calculate	experiment	imagination	plan	walk
component	fast	invent	propel	wax
construct	feather	invention	read	west
craft	fever	jet	roof	wheel
crash	fire	kite	sky	wing



Books on the Wright Brothers

Title	Author	Publisher	ISBN#	Ages
<i>Taking Flight: The Story of the Wright Brothers</i>	Stephen Krensky	Aladdin Library	0689812248	4-8
<i>The Wright Brothers</i>	Pamela Duncan Edwards	Hyperion Press	0786819510	4-8
<i>To Fly: The Story of the Wright Brothers</i>	Wendie C. Old	Clarion Books	061813347X	9-12
<i>Into the Air: The Story of the Wright Brothers' First Flight</i>	Robert Burleigh	Silver Whistle	0152168036	9-12
<i>History – Hands On: Wright Brothers</i>	Mary Tucker	Teaching & Learning Co.	1-57310-353-5	6-9



Wright Brothers Websites

Website	Address
Wright Brothers – educational website	www.wright-brothers.org
The Wright Brothers Aeroplane Co.	www.first-to-fly.com/
The Wright House	www.wam.umd.edu/~stwright/WrBr/Wrights.html
Henry Ford Museum:	www.hfmgv.org/exhibits/wright/
The First Flight	firstflight.open.ac.uk/
Time, Inc. – Scientists & Thinkers	www.time.com/time/time100/scientist/profile/wright.html
First Flight Society	www.firstflight.org/
The Wright Brothers in Photographs	www.libraries.wright.edu/special/wright_brothers/dmc.html
The Wright Experience	www.wrightexperience.com/
First Flight at Kitty Hawk	history1900s.about.com/cs/firstflight/