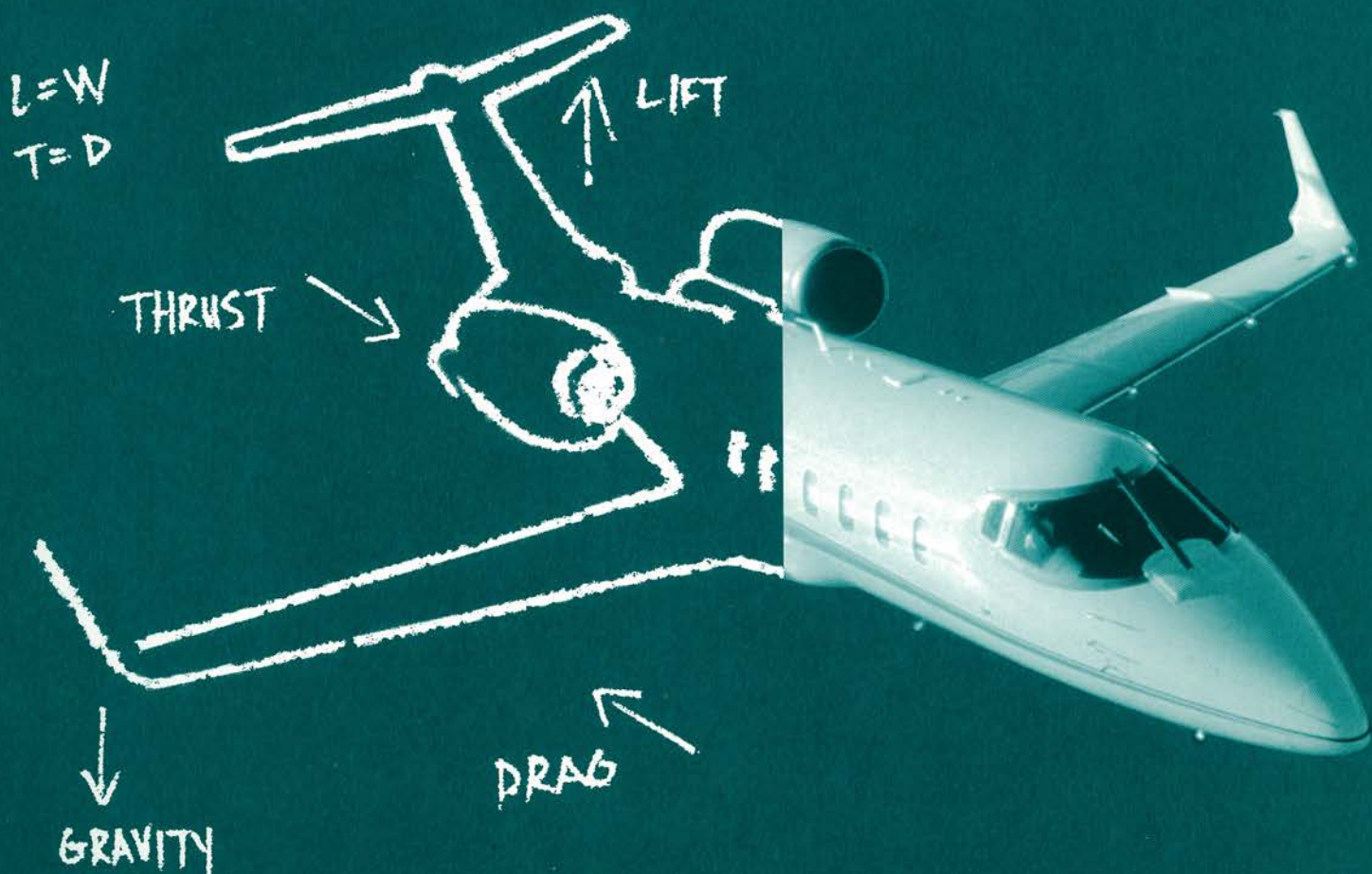


# NBAA's Aviation for Kids Program

## ACTIVITY GUIDE

(and Teacher's Resource)



*Celebrating the 100th Anniversary of  
the Wright Brothers' Flight  
December 17, 2003*



[www.avkids.com](http://www.avkids.com)



**NATIONAL  
BUSINESS AVIATION  
ASSOCIATION, INC.**

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WASHINGTON, DC 20036-2527  
TEL: (202) 783-9000 • FAX: (202) 331-8364  
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Dear Educator,

Airplanes have always excited children. With that in mind, the National Business Aviation Association (NBAA) has created the AvKids (Aviation for Kids) Program. Avkids incorporates science, math, geography, and language arts skills in an "AIMS like" format, to help students understand aviation. Developed in coordination with second through fifth grade teachers at Osceola Magnet School in Vero Beach, Florida, this Aviation Activities Guide includes the basic elements of flight, the parts of the airplane and a section on business aviation (the use of general aviation aircraft for business purposes), as well as an aviation glossary with an extensive recommended reading list.

The Activities Guide also can help you meet Standards of Learning requirements. Please see the attached details of how the Activities Guide relates to the National Standards of Learning.

December 2003 marks the 100th anniversary of powered flight by the Wright Brothers. AvKids can help you bring this celebration to your classroom.

We are interested in your feedback on these activities. Please let us know how these exercises work in your classroom, any changes you suggest or any additional exercises you have created that may be of interest to other teachers. In addition, if you would like to conduct an aviation art contest in your school, please contact NBAA for additional information. Your students' pictures may be added to the [avkids.com](http://avkids.com) Web site.

Our Web site — [www.avkids.com](http://www.avkids.com) — contains the *Activities Guide* as well as many other creative activities and ideas for your students. Again, we welcome your comments and suggestions.

For more information, please visit [www.avkids.com](http://www.avkids.com), contact NBAA at 202-783-9000, or write to us at 1200 Eighteenth Street NW, Washington, DC 20036.

We hope you and your students enjoy learning about the exciting field of aviation!

Sincerely,

John W. Olcott  
President

## Science Standards:

Standard A: Science as Inquiry

Standard B: Physical Science

- Motions and forces (Position and motion of objects)

Standard E: Science and Technology

- Abilities of technological design
- Understandings about science and technology

Standard F: Science in Personal and Social Perspectives

- Science and technology in local challenges

Standard G: History and Nature of Science

- Science as a human endeavor

Unifying Concepts and Processes:

- Evidence, models, and explanation
- Form and function

## Technology Standards:

3. Understanding of the relationships among technologies and the connections between technology and other fields of study.
4. Understanding of the cultural, social, economic, and political effects of technology.
6. Understanding of the role of society in the development and use of technology.
8. Understanding of the attributes of design.
10. Understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.
11. Ability to apply the design process.

## Mathematics Standard:

10. Representation Standard:

- Use representations to model and interpret physical, social, and mathematical phenomena.

## English Language Arts Standards:

3. Evaluation Strategies
4. Communication Skills
5. Communication Strategies
6. Applying Knowledge
12. Applying Language Skills

## Social Studies Standard:

3. People, Places, and Environments

# National Standards for NBAA's Aviation for Kids Program

<b>Activity Section</b>	<b>Science Standards</b>	<b>Technology Standards</b>	<b>Mathematics Standards</b>	<b>English Language Arts Standards</b>	<b>Social Studies Standards</b>
<b>Thrust</b>	A, B, E, Unifying Concepts and Processes	8, 10, 11			
<b>Gravity</b>	A, B, E, Unifying Concepts and Processes	8, 10, 11			
<b>Drag</b>	A, B, E, Unifying Concepts and Processes	8, 10, 11			
<b>Lift</b>	A, B, E, Unifying Concepts and Processes	8, 10, 11			
<b>Small Parts</b>	E, Unifying Concepts and Processes	8, 11			
<b>Bizzy</b>				3, 4, 5, 6, 12	3
<b>Business Aviation in Action</b>	F, G, Unifying Concepts and Processes	3, 4, 6	10		

# Lesson Summaries

## Lessons dealing with thrust

### Pages 2-6: Foamie Flyer

- OBJECTIVE: Investigating the principle of thrust.
- PROBLEM: Does the amount of thrust affect the Foamie Flyer's flight?
- MATERIALS: Foam paper plates (full size), scissors, masking tape, large paper clips, rubber bands, non-bendable straws, rulers and copies of Blackline 1 for each student.
- ESTIMATED TIME: 45-60 minutes

### Pages 7-10: Jammin' Jets

- OBJECTIVE: To use thrust as the main force while manipulating the design of an aircraft to increase the distance.
- PROBLEM: When using thrust to fly a Jammin' Jet, how do changes to the design affect the distance it can travel?
- MATERIALS: 2 straws with different diameters, masking tape, scissors, index cards, rulers, tape measures, and a copy of Black line 1 for each student.
- ESTIMATED TIME: 45-60 minutes

### Pages 11-15: Balloon Jet

- OBJECTIVE: Investigate the principle of thrust.
- PROBLEM: What force causes the Balloon Jet to move forward?
- MATERIALS: balloon (sausage-shaped works best), straws, spool of fishing line, scotch tape, a copy of Blackline 1 for each group, a copy of Blackline 1 for each student.
- ESTIMATED TIME: 45-60 minutes

## Lessons dealing with gravity

### Pages 17-21: Gravity Busters

- OBJECTIVE: Investigate the principle of gravity combined with lift.
- PROBLEM: How does lift work against gravity?
- MATERIALS: One blackline per student, scissors, staplers, stopwatches per group.
- ESTIMATED TIME: 45-60 minutes

## Lessons dealing with drag

### Pages 23-25: Paratrooper's Away!

- OBJECTIVE: Investigate the principle of drag.
- PROBLEM: How does a parachute create drag for a falling object?
- MATERIALS: Each pair of students needs one plastic grocery bag (with handles), one clothespin (or a large paperclip), and a copy of Blackline 1.
- ESTIMATED TIME: 30 minutes

### Pages 26-29: Drag Racers

- OBJECTIVE: Investigate the force of drag on a moving object.
- PROBLEM: How does a drag-chute affect the speed of student runners?
- MATERIALS: garbage bags (large, heavy-duty bags work best), tape, stopwatch, and copy of Blackline 1 for each group.
- ESTIMATED TIME: 45-60 minutes

### Pages 30-33: What A Drag!

- OBJECTIVE: Investigate the principle of drag.
- PROBLEM: Does drag affect the flight of an airplane?
- MATERIALS: Balloons (sausage-shaped works best), straws, scotch tape, paper plates (8 1/2" diameter)
- ESTIMATED TIME: 45-60 minutes

## Lessons dealing with lift

### Pages 35-41: An UpLIFTing Adventure

- OBJECTIVE: Investigate the principle of lift.
- PROBLEM: How does the design of the airplane affect the lift?
- MATERIALS: several 8 1/2 x 11 sheets of paper for each student, a stopwatch, and copy of Blackline 1a and 1b for each pair.
- ESTIMATED TIME: 45-60 minutes

### Pages 42-45: Fearless Flyers

- OBJECTIVE: Investigate the principle of lift.
- PROBLEM: How does the design of an airplane affect its ability to perform stunts?
- MATERIALS: several sheets of 8 1/2 x 11 paper, scissors, scotch tape, design pattern Blackline 1 for each student
- ESTIMATED TIME: 60 minutes

### Pages 46-50: Loop-to-Loop AdVENNtures

- OBJECTIVE: Compare two designs of loop airplanes, observing the four forces of flight.
- PROBLEM: How are loop-planes and tube-planes similar and different? (design, flight patterns, etc.)
- MATERIALS: one straw, design patterns, Blacklines 1 and 2, scotch tape. 8 1/2 x 8 1/2" paper for each student
- ESTIMATED TIME: 45-60 minutes

## Miscellaneous lessons

### Pages 51-54: Aircraft Parts

- OBJECTIVE: Familiarize students with the parts of general aviation aircraft.
- MATERIALS: Clay (see recipe), toothpicks, file folder labels, assorted MATERIALS for each student

### Pages 55-62: Bizzy the Business Jet

- OBJECTIVES: Develop map and writing skills.
- MATERIALS: Laminated class Friendly Flyer, Blackline 3 student Friendly Flyer, Class Logbook, individual Flight Journal —Black line 1, map, push pins, address list of business aviation manufacturers.

### Pages 63-87: Business Aviation in Action

- OBJECTIVE: Generate an interest in Business Aviation.
- GOAL: Create and run a successful Business Aviation company.
- MATERIALS: blacklines, paper, art MATERIALS. U.S. maps

# Sources for National Standards and Web Sites

1. National Science Standards — National Research Council  
<http://www.nap.edu/readingroom/books/nses/html>
2. National Mathematics Standards — National Council of Teachers of Mathematics  
<http://standards.nctm.org/document/index.htm>
3. National English Language Arts Standards — National Council of Teachers of English  
<http://www.ncte.org/standards/standards.shtml>
4. National Social Studies Standards — National Council for the Social Studies  
<http://www.ncss.org/standards/toc.html>
5. National Technology Standards — International Technology Education Association  
<http://www.iteawww.org/TAA/Listing.htm>

**Thrust**

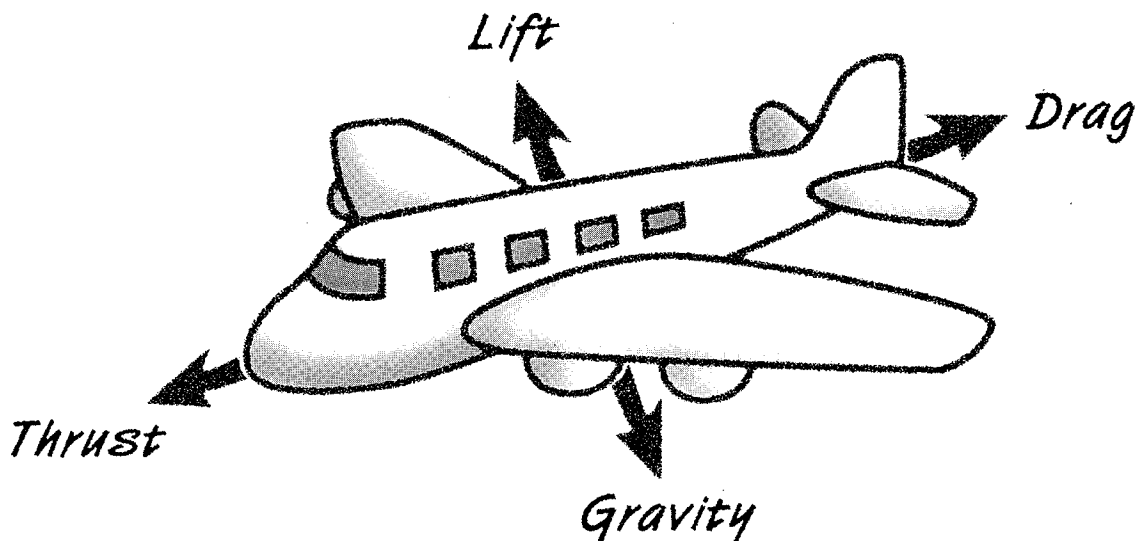


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# The Four Forces of Flight

An aircraft in straight and level flight is acted upon by four forces: *lift*, *gravity*, *thrust*, and *drag*. The opposing forces balance each other; lift equals gravity and thrust equals drag.

Any inequality between thrust and drag, while maintaining straight and level flight, will result in acceleration or deceleration until the two forces again become balanced.

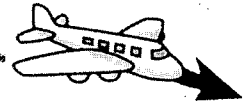


*Drag:* The air resistance that tends to slow the forward movement of an airplane.

*Gravity:* The force that pulls all objects towards the earth.

*Lift:* The upward force that is created by the movement of air above and below a wing. Air flows faster above the wing and slower below the wing, creating a difference in pressure that tends to keep an airplane flying.

***Thrust:* The force that moves a plane forward through the air. Thrust is created by a propeller or a jet engine.**



# Foamie Flyer

**OBJECTIVE:** Investigating the principle of thrust.

**PROBLEM:** Does the amount of thrust affect the Foamie Flyer's flight?

**MATERIALS:** Foam paper plates (full size), scissors, masking tape, large paper clips, rubber bands, non-bendable straws, rulers and copies of Blackline 1 for each student.

**BACKGROUND:** Thrust is the force that moves a plane through the air. Because airplanes fly in a three-dimensional environment, the following terms refer to the various directions an airplane can move:

*Pitch*—to move the nose of the airplane up or down

*Roll*—to tilt one wing up and the other wing down

*Yaw*—to point the nose of the airplane left or right while remaining level with the ground

*Bank*—to tilt the airplane inward while making a turn

Airplanes, including even the Foamie Flyer, use a variety of “control surfaces” to change the speed and direction in which they fly. These control surfaces include:

*Ailerons*—movable sections, hinged on the rear edge of the wing near the wingtip, that cause the airplane to roll

*Flaps*—movable sections, hinged on the rear of the wing, that can be lowered to increase lift and drag during takeoff or landing

*Stabilizer*—the vertical stabilizer is the upright portion of the airplane tail, while the horizontal stabilizer is the small wing usually located on the back of the airplane.

**MANAGEMENT:**

1. 45–60 minutes
2. Students will build their own flyer.
3. When launching the flyers, form groups of 3 or 4 so that all students are not launching at the same time.
4. This is an outdoor activity.
5. Foamie Flyers must be launched away from other children.
6. Save the unused parts of the plate for the extension activities.

**WORD BANK:** *thrust, lift, gravity, drag, wings, nose, fuselage, ailerons, flaps, pitch, roll, yaw, bank*

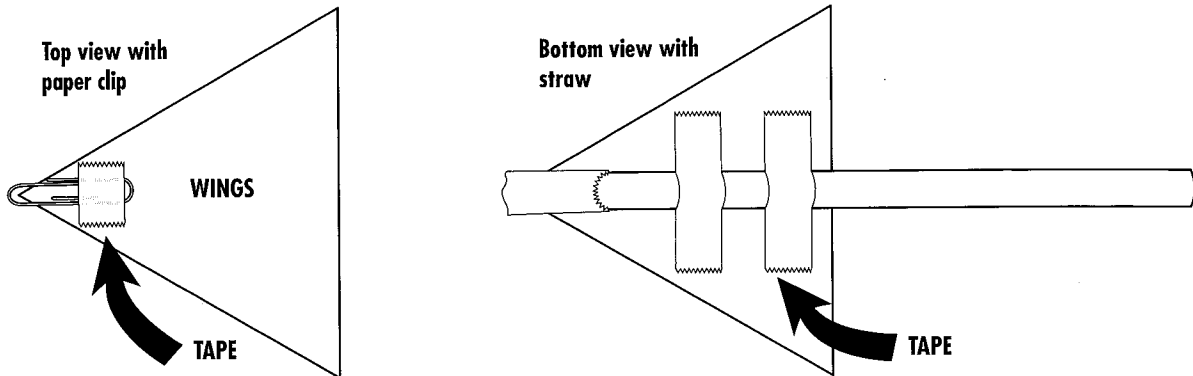
**PROCEDURE:**

1. Give each child the materials.
2. Instruct students to fold back the top three centimeters of the straw and insert the rubber band into the fold.
3. Fold the straw over the rubber band and secure the end with masking tape. This creates the launcher for the flyer.
4. Instruct students to cut a triangle out of the foam plate from the flat inverted side of the plate. A good size to start with is 13 cm x 13 cm x 13 cm (equilateral triangle).

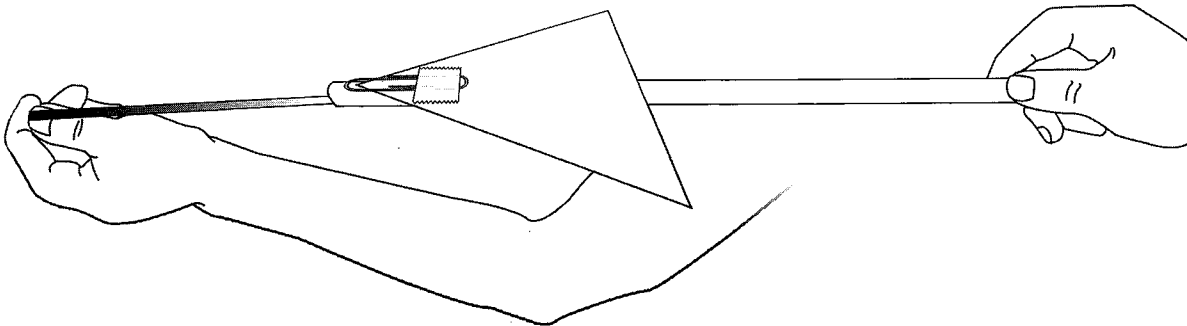
## *Foamie Flyer*

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5. Tape the paper clip to the top of the foam wings. Then, tape the wings to the top of the launcher so that it extends slightly over the tip.



6. Hook the rubber band around the tip of your thumb and pull back on the opposite end of the flyer. Release the straw and the flyer will fly forward.



7. There should be a designated launch starting line. Call groups forward, one at a time, to launch their flyers. Each child should launch the flyer using two different amounts of thrust. They should first pull the nose of the flyer halfway to their elbow and let it fly. Next, they should pull the nose of the flyer all the way to their elbow and let it fly. The group should observe the changes in their flyer's flight and distance. These observations can be recorded on the Student Data Sheet, Blackline 1.

**DISCUSSION:**

1. Does the amount of thrust affect the Foamie Flyer's flight?
2. What other factors affect how your flyer flew?
3. Why was your flyer successful or unsuccessful?
4. How does the thrust of the Foamie Flyer compare to the thrust of a real airplane?

**EXTENSIONS:**

1. Students can cut wing flaps and ailerons into the back of the foam wings and observe the changes in flight.
2. Students can alter the weight of the flyer and to observe the changes in flight by adding weight behind the wings with tape or paper clips.
3. Students can use the leftover foam plate parts to add stabilizers and rudders to their flyers and observe changes in flight.
4. Try different size foam wings to observe changes in flight.

*Student Data Sheet*

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# **Foamie Flyer**

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*Captain:* \_\_\_\_\_

1. Did the amount of thrust affect Foamie Flyer's flight?

\_\_\_\_\_

2. What did you observe when using different amounts of thrust to launch your Foamie Flyer?

\_\_\_\_\_

\_\_\_\_\_

3. How differently did the Foamie Flyer fly after modifications were made to the ailerons, flaps, stabilizers or rudder?

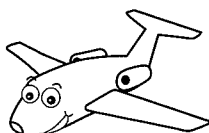
\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Draw and label a diagram showing how thrust affected the flight of your flyer.

### ***Did You Know?***



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*The Wright Brothers first successfully flew an airplane on Dec. 17, 1903. They discovered that airplanes needed to roll to turn. They invented a system of bending the wings with ropes in order to cause the plane to roll. This system was called wing warping.*



# Jammin' Jets

**OBJECTIVE:** To use thrust as the main force while manipulating the design of an aircraft to increase the distance.

**PROBLEM:** When using thrust to fly a Jammin' Jet, how do changes to the design affect the distance it can travel?

**MATERIALS:** 2 straws with different diameters, masking tape, scissors, index cards, rulers, tape measures, and a copy of Blackline 1 for each student.

**BACKGROUND INFORMATION:** Airplane designers try to increase airplane thrust by making more powerful jet engines and propellers.

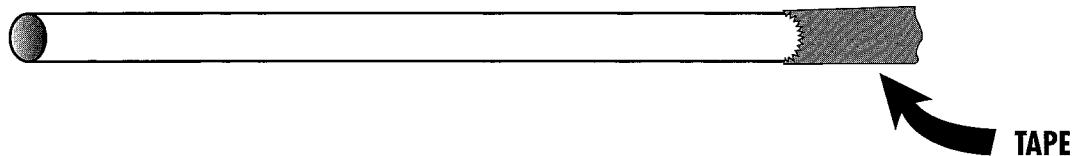
## **MANAGEMENT:**

1. 45–60 minutes
2. Construct the Jammin' Jets individually then work in groups of four to complete the activity.
3. A large open space is required for this activity.
4. Students should be instructed to blow only into their own straw and to launch their jets away from each other.
5. Set up a runway using tape measures for the students to launch their jets.

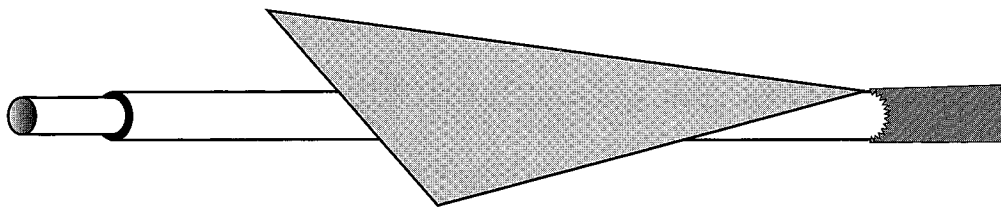
**WORD BANK:** *thrust, fuselage, wings, nose, stabilize*

**PROCEDURE:**

1. Hand out materials to each student.
2. Wrap a piece of tape around the front end of the straw with the larger diameter so that the opening is taped shut.



3. Allow the children to experiment by placing wings on different parts of the straw.
4. Insert the smaller straw into the larger straw, leaving an inch at the end of the smaller straw.



5. Demonstrate thrust by blowing into the smaller straw. This projects the jet forward.
6. If the front of the jet rises, wrap some tape near the front of it until it flies level. If the front of the jet falls, wrap some tape around the straw just behind the wings.
7. Students can practice flying the different jets within their group.
8. Choose the best jet and fly three trails recording the distance on the Student Data Sheet.



**DISCUSSION:**

1. What force was used to propel your Jammin' Jet?
2. Did your jet fly in a straight line?
3. What changes did you make to help your jet fly straighter?
4. What design feature increased the distance?

**EXTENSIONS:**

1. Students use their best design in a Jammin' Jets rally. The jets can compete against each other to see which one will fly the longest distance.
2. Different levels of thrust can be applied to see how this affects the stability of the plane.

**CULMINATING ACTIVITY:**

Set up a target (hula-hoop with paper plate inside) and see which jet can land closest to the center of the target by adjusting the amount of applied thrust. Award five points for jets that land in the hula-hoop and ten points for landing on the paper plate.

*Student Data Sheet****Jammin' Jets***

*Captain:* \_\_\_\_\_

**DISTANCE TRAVELED**

<b>Trial 1</b>	<b>Trial 2</b>	<b>Trial 3</b>	<b>Average</b>

Diagram and label your best design.

What changes to the jet's design were most successful?

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Why do you think these changes were successful?

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# Balloon Jet

**OBJECTIVE:** Investigate the principle of thrust.

**PROBLEM:** What force causes the Balloon Jet to move forward?

**MATERIALS:** balloon (sausage-shaped works best), straws, spool of fishing line, scotch tape, a copy of Blackline 1 for each group, a copy of Blackline 1 for each student

**BACKGROUND INFORMATION:** Thrust is the force created by a power source that moves the plane forward — either from a propeller or a jet engine. When the thrust is greater than the drag, a plane moves forward. This activity demonstrates Newton's Third Law of Motion: For every action, there is an equal and opposite reaction. Backward thrust of the air from the balloon produces the forward motion of the balloon.

**MANAGEMENT:**

1. 45–60 minutes
2. This activity works best with small cooperative groups of 3–4 students.
3. Pieces of fishing line should be cut to the length of the room available.
4. Create one Balloon Jet per group.
5. The class graph can be used for the main activity as well as the extensions.
6. Each group should have a designated “balloon blower” so that the same student always inflates the balloon.

**WORD BANK:** *thrust, average (mean), launch*

**PROCEDURE:**

1. Thread fishing line through a straw and attach the ends of the fishing line securely to a wall or other object. The line should be taut.
2. Instruct students to blow up their balloons to the desired size, measure its length and record it on the Group Data Sheet. Pinch off the end of the balloon so that no air is released.
3. Tape the balloon to the straw.
4. The students will release the balloon from the designated starting point.
5. Observe and measure the distance the balloon travels and record it on the Group Data Sheet, Blackline 1.
6. Repeat the procedure two more times with balloons that are inflated to the same size. (Balloons may be a different size for each group.)
7. After the groups have completed the activity and data sheet, compare the results.
8. Each student will then complete his or her own Class Graph, Blackline 2.

**DISCUSSION QUESTIONS:**

1. What makes the Balloon Jet travel forward?
2. Does the length of the Balloon Jet make a difference as to how far it travels? Why?
3. What else could affect the distance a Balloon Jet will travel?

**EXTENSIONS:**

1. Students could repeat the activity using different size or shape balloons.
2. The tautness of the line can be altered.
3. The angle of the line can be changed to show the effect of forward thrust.
4. The students can insert different size straws into the opening of the balloon to observe and measure changes in the distance the Balloon Jet travels.

*Balloon Jet*

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5. Students can find the speed of their Balloon Jet by dividing the distance traveled by the time it took.

**CULMINATING ACTIVITY:**

Using the variables from the main activity and the extensions, students can work to design a Balloon Jet that will travel the longest distance.

## Group Data Sheet

**Balloon Jet**

*Pilots:* \_\_\_\_\_  
 \_\_\_\_\_

Prediction: We think our balloon jet will travel \_\_\_\_ cm.

The name of our balloon jet is \_\_\_\_\_.

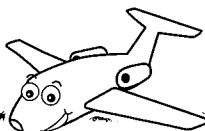
Diagram and label your balloon jet.

	Distance Traveled			
Balloon Length	Trial 1	Trial 2	Trial 3	Average Distance

Conclusion: What forces caused the balloon to move forward on the line?

\_\_\_\_\_  
 \_\_\_\_\_

**Did You Know?**



*Did you know: Almost all mail traveling farther than 200 miles, as well as airmail, is carried by airplanes.*

# Balloon Jet

Pilot: \_\_\_\_\_

Title: \_\_\_\_\_


Distance

Group

Group

Group

Group

Group

Group

Group

# Gravity

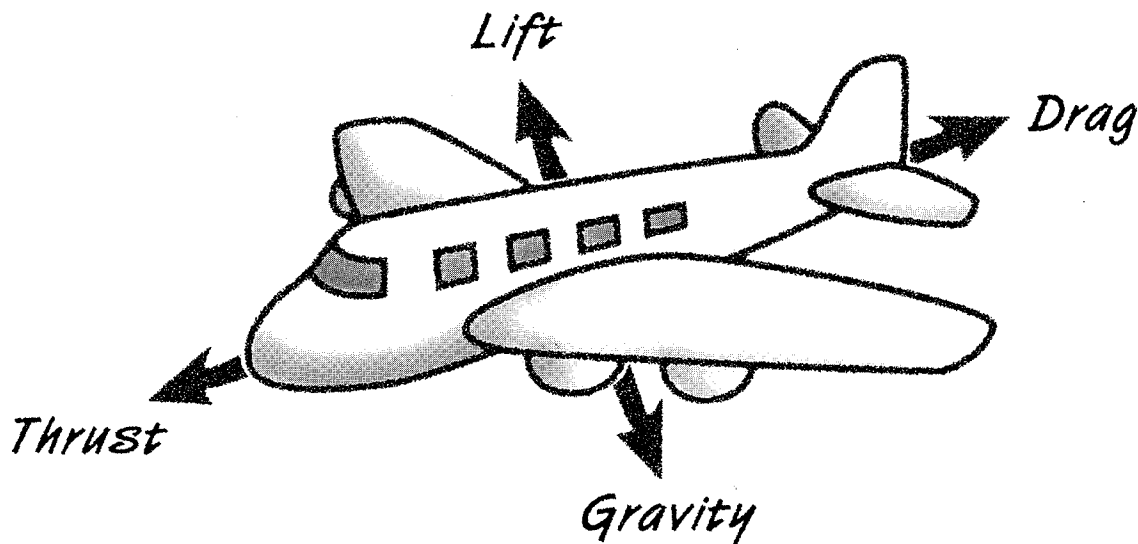


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# The Four Forces of Flight

An aircraft in straight and level flight is acted upon by four forces: *lift*, *gravity*, *thrust*, and *drag*. The opposing forces balance each other; lift equals gravity and thrust equals drag.

Any inequality between thrust and drag, while maintaining straight and level flight, will result in acceleration or deceleration until the two forces again become balanced.

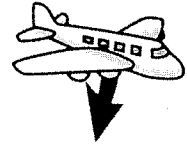


*Drag:* The air resistance that tends to slow the forward movement of an airplane.

***Gravity:* The force that pulls all objects towards the earth.**

*Lift:* The upward force that is created by the movement of air above and below a wing. Air flows faster above the wing and slower below the wing, creating a difference in pressure that tends to keep an airplane flying.

*Thrust:* The force that moves a plane forward through the air. Thrust is created by a propeller or a jet engine.



# Gravity Busters

**OBJECTIVE:** Investigate the principle of gravity combined with lift.

**PROBLEM:** How does lift work against gravity?

**MATERIALS:** One blackline per student, scissors, staplers, stopwatches per group

**BACKGROUND INFORMATION:** Gravity is the force pulling the plane down. When the gravity is stronger than the lift, the plane goes down. Helicopters are really airplanes with moving wings called rotors, which replace the fixed wings and propellers used on an airplane. A helicopter rises for the same reason an airplane flies: the movement of the air results in a pressure on the bottom of the rotor blades (wings) that is greater than the pressure on the top of the rotor blades (wings).

## MANAGEMENT:

1. 45 minutes to an hour
2. This activity works best with small groups of 3–4 students.  
Each student makes his or her own Gravity Buster.

**WORD BANK:** *gravity, rotation, rotary wing, weight, pull, aloft, descent, air-traffic controller (a person on the ground who uses radar to track aircraft and radios to direct the movement of aircraft)*

## PROCEDURE:

1. Using Blackline 1, construct the Gravity Buster.
2. Within their groups, students test their individual Gravity Busters by standing on a chair and releasing them. Ensure students release rather than throw them. They must be released from the same height each time.
3. After five minutes each group chooses the most effective Gravity Buster for the rest of the activity.

4. Each group is assigned a job:  
Timer, Recorder, Pilot, Air-traffic controller (boss)
5. The pilot drops the Gravity Buster three times. The timer will start at release and stop at landing. The recorder records each trial time on the Group Data Sheet, Blackline 2.
6. Add one staple to the bottom of the Gravity Buster and repeat step #5.
7. Add two additional staples to the bottom of the Gravity Buster and repeat step #5.
8. Complete the Group Data Sheet. Share and discuss results.
9. Have students create a graph, Blackline 3, using the class data.

**DISCUSSION QUESTIONS:**

1. How does lift work against gravity?
2. Why did your group choose the winning Gravity Buster?
3. How did the staples affect the Gravity Buster?
4. How does this activity show how a helicopter stays in the air?  
Answer: When lift is stronger than gravity, the craft stays up.

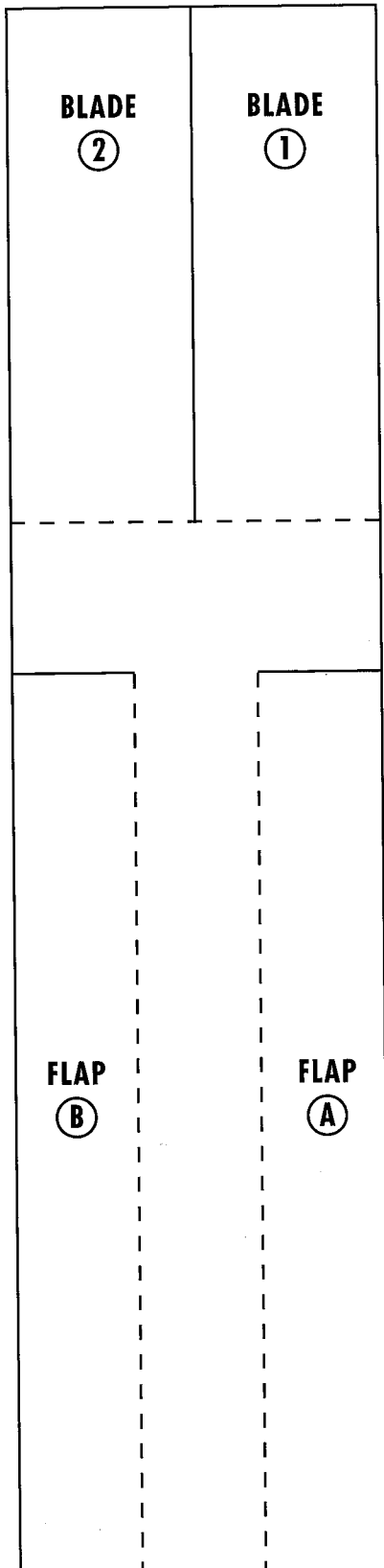
**EXTENSIONS:**

1. Construct Gravity Busters out of different materials and/or designs.
2. Change the heights at which it's dropped.
3. Add or remove weight.

**CULMINATING ACTIVITIES:**

Using the extension knowledge have the students improve their Gravity Busters and let them drop!

# Gravity Busters



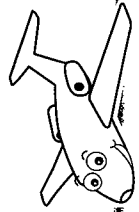
To construct:

1. Cut along the solid lines.
2. Fold along the dashed lines.
3. Fold Flap A in to the center.  
Then fold Flap B over Flap A.
4. Fold Blade 1 back and Blade 2 forward.

# Gravity Busters

Pilots: \_\_\_\_\_  
 \_\_\_\_\_

	Descent Time: Seconds from Release to Landing			Average Time (in seconds)
	Trial 1	Trial 2	Trial 3	
Weight Added				
No Staples				
1 Staple				
3 Staples				



### Did You Know?

Did you know: Gravity is the force that pulls everything to the center of the earth. This is why thrown objects and jumping people always end up back on the ground.



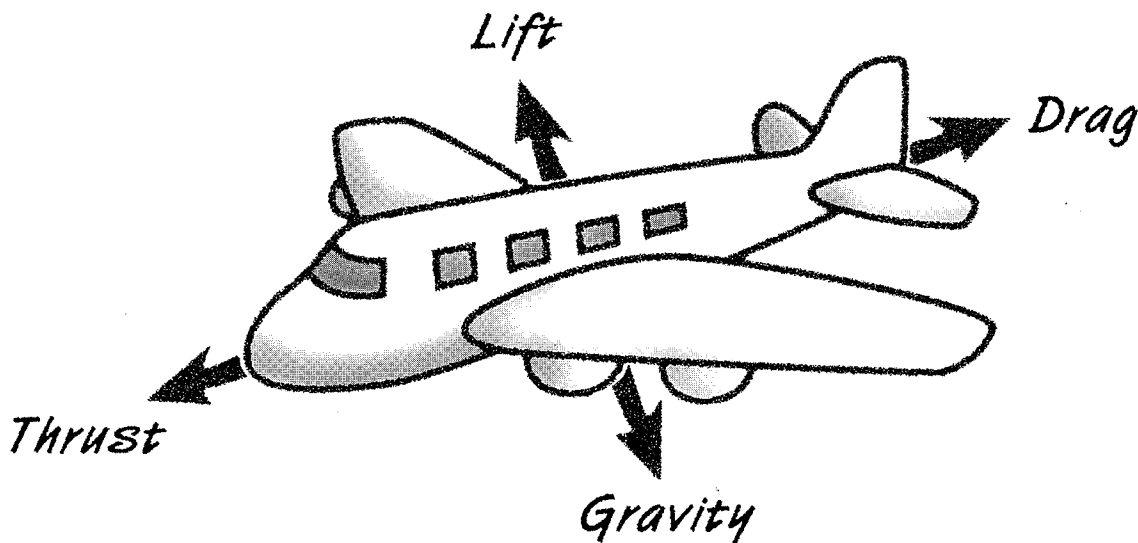
**Drag**

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# The Four Forces of Flight

An aircraft in straight and level flight is acted upon by four forces: *lift*, *gravity*, *thrust*, and *drag*. The opposing forces balance each other; lift equals gravity and thrust equals drag.

Any inequality between thrust and drag, while maintaining straight and level flight, will result in acceleration or deceleration until the two forces again become balanced.



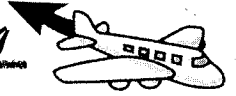
***Drag:*** The air resistance that tends to slow the forward movement of an airplane.

*Gravity:* The force that pulls all objects towards the earth.

*Lift:* The upward force that is created by the movement of air above and below a wing. Air flows faster above the wing and slower below the wing, creating a difference in pressure that tends to keep an airplane flying.

*Thrust:* The force that moves a plane forward through the air. Thrust is created by a propeller or a jet engine.





# Paratrooper's Away!

**OBJECTIVE:** Investigate the principle of drag.

**PROBLEM:** How does a parachute create drag for a falling object?

**MATERIALS:** Each pair of students needs one plastic grocery bag (with handles), one clothespin (or a large paperclip), and a copy of Blackline 1.

**BACKGROUND INFORMATION:** Drag is the force that acts against the forward movement of an airplane and slows it down. All moving objects experience drag.

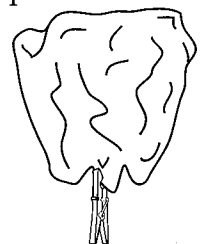
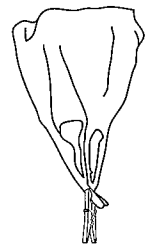
## MANAGEMENT:

1. 30 minutes
2. This activity should be done in pairs.
3. Allow the pairs to take turns dropping the parachutes.
4. Students will get more height if they stand on chairs.

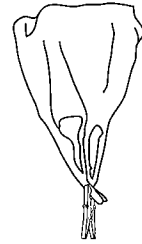
**WORD BANK:** *drag, parachute, weight, descent, streamline, observation, paratrooper (a soldier trained to jump from an airplane and be lowered slowly to the ground using a parachute), drag chute (a parachute used to slow down an airplane or other object that travels through the air)*

## PROCEDURE:

1. Bring the handles of the grocery bag together and secure with a clothespin.
2. First, the students drop the parachute from a chair-standing height. With the grocery bag first crumpled up, observe the descent of the clothespin.  
Note: make sure the clothespin drops first.



3. Next, students open up the parachute fully and drop it from the same height. Observe the descent of the clothespin.
4. The students should experiment with the two different ways of dropping the clothespin.
5. The students will record their observations on the Paratrooper Data Sheet, Blackline 1.



**DISCUSSION:**

1. How does a parachute create drag for a falling object?
2. What were the differences they observed between the two drops?
3. How does drag affect the flight of an airplane?
4. Would increased weight require a larger parachute? Why?

**EXTENSIONS:**

1. Have the students try different sized parachutes.
2. Have the students add different weights.
3. Drop the parachutes from different heights.

**CULMINATING ACTIVITY: Paratrooper Target Drop**

Students can compete by creating parachutes that land accurately on a bullseye target.

*Paratrooper Data Sheet*

**Paratrooper's Away!**

*Paratroopers:* \_\_\_\_\_

Diagram and label the two parachute drops.

Closed Chute

Open Chute

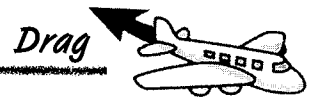
How does a parachute create drag for a falling object? Write your observations.

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# Drag Racers

**OBJECTIVE:** Investigate the force of drag on a moving object.

**PROBLEM:** How does a drag-chute affect the speed of student runners?

**MATERIALS:** garbage bags (large, heavyduty bags work best), tape, stopwatch, and copy of Blackline 1 for each group

**BACKGROUND INFORMATION:** This activity lets students to feel the force of drag. Airplanes are designed to be sleek so that drag is reduced, allowing easier movement through the air.

**MANAGEMENT:**

1. 45–60 minutes
2. Students should work in groups of four taking turns running and timing.
3. Construct the drag-chutes in the classroom. Running will take place outside on a marked 20–30 meter “runway.”
4. Garbage bag drag-chutes should be at least one square meter. (This might require taping bags together. If so, make sure seams are solid — no holes!)

**WORD BANK:** *drag, drag-chute, meter, runway, sleek, aerodynamic, speed, resistance, pull*

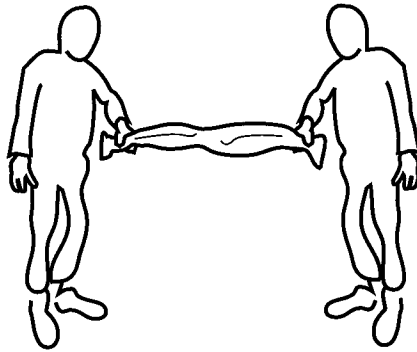
**PROCEDURE:**

1. Each group will make their garbage bag drag-chute. To do this, cut along one side and the bottom of the bag. This will make one flat sheet. Make sure it is at least one square meter. If it is not, tape another bag to it.

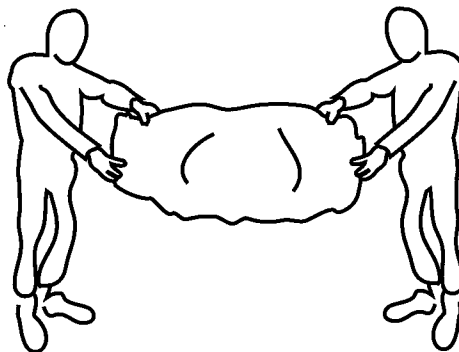
## *Drag Racers*

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- Two students run from the starting line, side by side, holding the drag-chute that is rolled up between them. The timers say “Go,” the students run to the finish, and the timers stop the watch. Record the time on the record log, Blackline 1.



- The same two students now repeat the run with the drag-chute unfurled. The timers instruct the students to “Go”, then stop the watches at the finish. Record time on the Record Log.



- The timers should now switch places with the runners. Repeat the procedure.
- The group then completes the Record Log, Blackline 1.

### **DISCUSSION:**

- Explain what it was like running with the drag-chute closed compared to when it was open.
- What force caused you to slow down?
- Do you think a larger drag-chute would cause you to run even slower? Why?
- How are airplanes designed to keep the force of drag in mind?

**EXTENSIONS:**

1. Complete more trials by running longer distances, using smaller or larger drag-chutes, or using different drag-chute materials.
2. Two students with a drag-chute can race two students without drag-chutes.

**CULMINATING ACTIVITY:**

Allow the students to design original drag-chutes, naming their teams.  
Then conduct a class drag race derby!

Record Log

# Drag Racer

Racers: \_\_\_\_\_  
 \_\_\_\_\_

	Time without Dragchute	Time with Dragchute
Racers 1 and 2		
Racers 3 and 4		

How did the drag-chute affect the speed of your race?

\_\_\_\_\_  
 \_\_\_\_\_

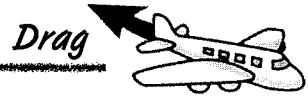
Why do you think the drag-chute affected your race?

\_\_\_\_\_  
 \_\_\_\_\_

Find the difference in speed between your race without the drag-chute and with the drag-chute:

Racers 1 and 2 \_\_\_\_\_

Racers 3 and 4 \_\_\_\_\_



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# What A Drag!

**OBJECTIVE:** Investigate the principle of drag.

**PROBLEM:** Does drag affect the flight of an airplane?

**MATERIALS:** Balloons (sausage-shaped works best), straws, scotch tape, paper plates (8-1/2" diameter)

**BACKGROUND INFORMATION:** This activity is similar to the Balloon Jet activity but emphasizes how drag slows down the jet.

**MANAGEMENT:**

1. 45–60 minutes
2. This activity works best with small cooperative groups of 3–4 students.
3. Cut pieces of fishing line to the length of the room available.
4. Create one Balloon Jet per group.
5. Each group should have a designated “balloon blower” so that the balloon is always blown up by the same student.

**WORD BANK:** *thrust, drag, average (mean), launch*

**PROCEDURE:**

1. Thread the fishing line through the straw and attach the ends of the fishing line securely to a wall or other object. The line should be taut.
2. Instruct the students to blow up their balloons to the desired size, measure the length, and record it on their Group Data Sheet. Pinch off the end of the balloon so that no air is released.



3. Tape the balloon to the straw.
4. The students will release the balloon from the designated starting point.
5. Observe and measure the distance the balloon travels and record it on the Group Data Sheet.
6. Repeat the procedure two more times keeping the balloon the same size. (Balloons may be a different size for each group.)
7. Repeat procedures 2–6, adding a paper plate to the front of the jet. (Be sure plate does not get caught on line)
8. After all groups have completed the activity and Group Data Sheet, compare the results.
9. Each student will then complete his or her own Class Graph.

**DISCUSSION QUESTIONS:**

1. Which jet went a shorter distance? Why?
2. Why is it important for an aircraft to have less drag?
3. How are aircrafts designed to overcome drag?
4. Would weight affect the flight of your jet in the same way?

**EXTENSIONS:**

1. Use different sized plates for drag.
2. Use different shapes for drag.
3. Use different amounts of weight for drag.

**CULMINATING ACTIVITY:**

Have students share information about their jets, explaining the drags used and their observations.

## Group Data Sheet

# What A Drag!

*Pilots:* \_\_\_\_\_  
 \_\_\_\_\_

**PREDICTION:**

We think our Balloon Jet without drag will travel \_\_\_\_\_ cm.

We think our Balloon Jet with drag will travel \_\_\_\_\_ cm.

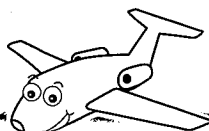
The name of our Balloon Jet is \_\_\_\_\_

Diagram and label your Balloon Jet.

	Distance Traveled							
	Trial 1		Trial 2		Trial 3		Average Distance	
Balloon Length	No Drag	Drag	No Drag	Drag	No Drag	Drag	No Drag	Drag

**CONCLUSION:** Explain how drag affects the flight of an airplane.

\_\_\_\_\_  
 \_\_\_\_\_

**Did You Know?**

*Did you know: Airplanes imitate birds in order to land. Both extend their wings and flaps to provide more lift at low speeds and to add drag to slow them down.*



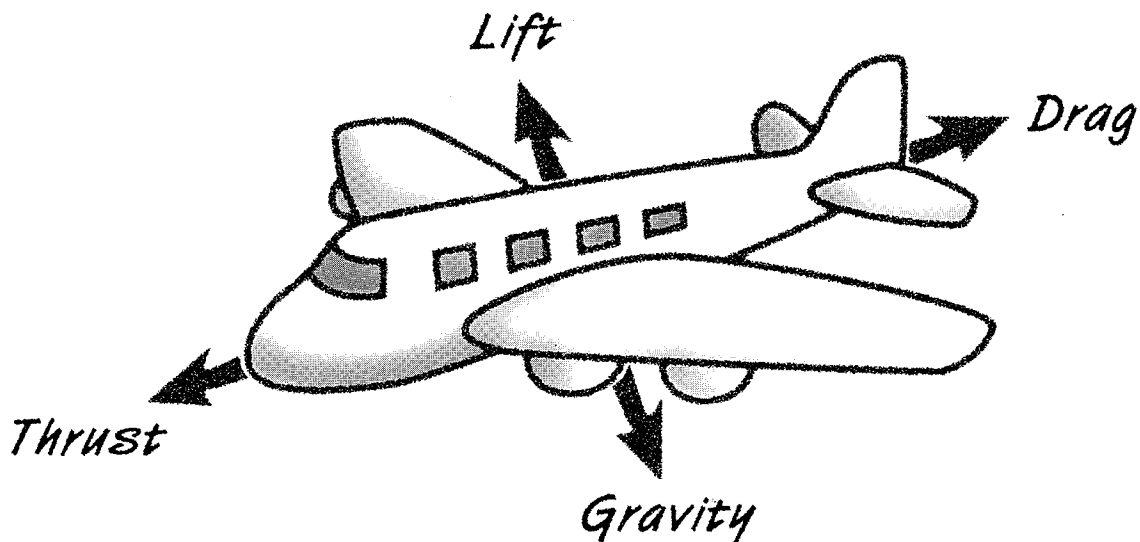
**Lift**

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# The Four Forces of Flight

An aircraft in straight and level flight is acted upon by four forces: *lift*, *gravity*, *thrust*, and *drag*. The opposing forces balance each other; lift equals gravity and thrust equals drag.

Any inequality between thrust and drag, while maintaining straight and level flight, will result in acceleration or deceleration until the two forces again become balanced.



**Drag:** The air resistance that tends to slow the forward movement of an airplane.

**Gravity:** The force that pulls all objects towards the earth.

***Lift:*** The upward force that is created by the movement of air above and below a wing. Air flows faster above the wing and slower below the wing, creating a difference in pressure that tends to keep an airplane flying.

**Thrust:** The force that moves a plane forward through the air. Thrust is created by a propeller or a jet engine.



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# An UpLIFTing Adventure

**OBJECTIVE:** Investigate the principle of lift.

**PROBLEM:** How does the design of the airplane affect the lift?

**MATERIALS:** several 8-1/2 x 11 sheets of paper for each student, a stopwatch, and copy of Blackline 1a and 1b for each pair

**BACKGROUND INFORMATION:** Lift is created by the shape of the wing, which makes the air pressure above the plane's wing less than the pressure below. This causes the plane to lift upward. When the lift is greater than gravity, the plane goes up.

**MANAGEMENT:**

1. 45–60 minutes
2. Students work in pairs. While one student pilots the plane, the other times the flight.
3. This activity works best outdoors or in a large indoor area.

**WORD BANK:** *lift, descent, ascent, landing, aloft, design, fuselage, wing, nose, elevators, rudder*

**PROCEDURE:**

1. Each pair constructs the two different designs of airplanes.  
(See Blacklines 3 and 4)
2. One pilot will fly his or her design at the timer's signal.
3. The timer starts at release and stops at landing.

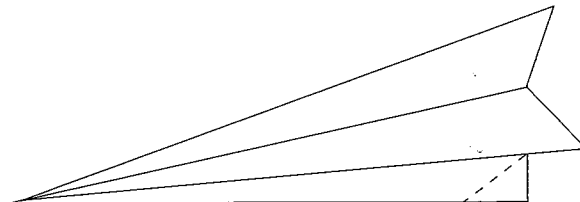
4. Each trial is recorded on the Pilot's Logs, Blacklines 1a and 1b.
5. This procedure is completed five times for each plane.
6. Complete the Flight Data Sheet, Blacklines 1a and 1b.
7. Share and discuss the results. Calculate the class average for each design.
8. Have students create a graph on Blackline 2 using this class data.

**DISCUSSION QUESTIONS:**

1. How does the design of the airplane affect the lift?
2. What features of the plane kept it aloft the longest?
3. What features of the plane kept the plane from staying aloft?
4. How does this activity show how a plane stays aloft?

**EXTENSIONS:**

1. Students can add elevators to their planes and observe changes in flight.
2. Students can add rudders by folding the base of the fuselage.



**Fold to the  
left or right**

**CULMINATING ACTIVITY:**

Challenge students to design an airplane that will remain aloft the longest.

## Pilot's Log Flight Data Sheet

**— An UpLIFTing Adventure —**

Captains: \_\_\_\_\_  
 \_\_\_\_\_

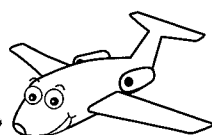
We think plane number \_\_\_\_\_ will stay aloft the longest.

Here are our reasons:

## Airplane #1

Flight #	Time Aloft
1	
2	
3	
4	
5	

Average Time Aloft: \_\_\_\_\_

***Did You Know?***

*Did you know: Airplane wings are curved on top because scientists observed that the curved shape of a bird's wing helped lift the bird into the air.*



*Pilot's Log Flight Data Sheet****— An UpLIFTing Adventure —*****Airplane #2**

Flight #	Time Aloft
1	
2	
3	
4	
5	

Average Time Aloft: \_\_\_\_\_

1. Which plane had the highest average time aloft?

\_\_\_\_\_

2. What features of the plane lead to longer time aloft?

\_\_\_\_\_

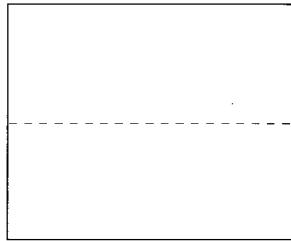
\_\_\_\_\_



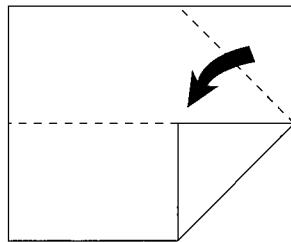
## Paper Plane Model #1

# — An UpLIFTing Adventure —

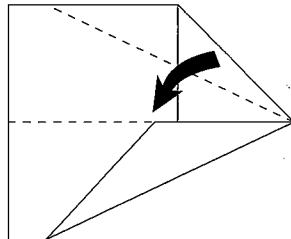
1. Take an 8-1/2 x 11" sheet of paper, fold it in half lengthwise and open it flat again.



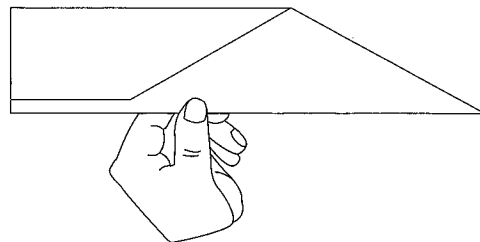
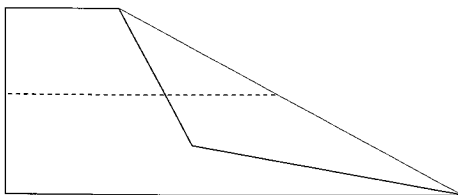
2. Fold the top two corners to the centerline.



3. In the same manner, fold the corners again to the centerline.



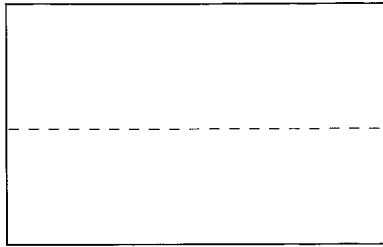
4. Fold back the sides along the original fold line, plain sides together. Fold down the sides half way down the wing.



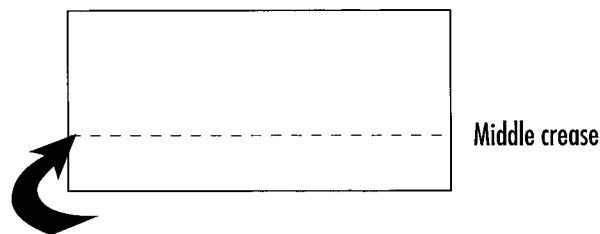
5. Hold the plane underneath and launch with a hard forward thrust.

*Paper Plane Model #2****— An UpLIFTing Adventure —***

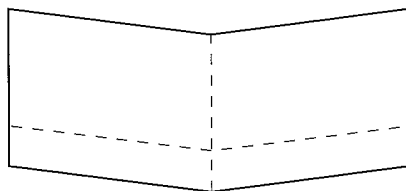
1. Fold an 8-1/2 x 11" piece of paper lengthwise and open it.



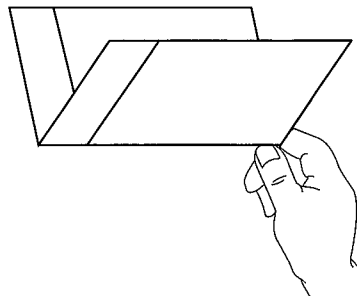
2. Fold the bottom edge to the middle crease. Fold it again making four thicknesses.



3. Crease the folded part at its mid point, causing a slight angle in the wing.



4. Hold at the back of the wing and launch with a gentle forward thrust.



# Fearless Flyers

**OBJECTIVE:** Investigate the principle of lift.

**PROBLEM:** How does the design of an airplane affect its ability to perform stunts?

**MATERIALS:** several sheets of 8-1/2 x 11" paper, scissors, scotch tape, design pattern Blackline 1 for each student

**BACKGROUND INFORMATION:** This activity uses Bernoulli's principle of lift. The shape of the wing (airfoil) causes air to move faster over the top of the wing. The faster the air moves, the less the air presses down on the wing. Because the wing is flat on the bottom, the air pressure is greater under the wing. This creates lift.

**MANAGEMENT:**

1. 60 minutes
2. Divide class into small groups (3–4 students).
3. This activity requires a large open space.

**WORD BANK:** *lift, thrust, gravity, drag, climb, bank, loop, boomerang, design, stunt, aerobatics, dive*

**PROCEDURE:**

1. Hand out the Fearless Flyers Data Sheet to each group.
2. Have the teams work together to design planes that will successfully perform the specified stunts on the Data Sheet, Blackline 1.
3. Individually, students draw diagrams of an airplane that completed a stunt and answer the questions on the design sheet (Blackline 2). Students do not have to write about their own plane.

**DISCUSSION QUESTIONS:**

1. How does the design of an airplane affect its ability to perform stunts?
2. Was there more than one design that could complete the same stunt?
3. Which design was affected most by gravity? Drag?
4. Did the amount of thrust affect the way your airplanes flew?
5. What happens when drag becomes greater than lift?

**EXTENSIONS:**

1. Add weight (paperclip) to different points on the fuselage.  
Observe and discuss the results.
2. Vary the size and weight of the paper.

**CULMINATING ACTIVITY: Air Jam**

Each group performs their stunts for the rest of the class.

## Data Sheet

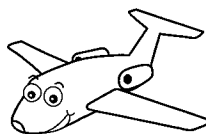
# Fearless Flyers

Stunt Pilots: \_\_\_\_\_  
 \_\_\_\_\_

Can your team design planes that will perform the following stunts?

	Affirmative	Negative
Fly Straight	_____	_____
Dive	_____	_____
Bank Left	_____	_____
Bank Right	_____	_____
Climb	_____	_____
Boomerang	_____	_____
Loop	_____	_____
Double Loop	_____	_____

## Did You Know?



Did you know: Aircraft engineers design planes with a sleek, trim shape so that they will cut through the air. Planes with low drag need less engine power to fly and have better flight performance.

*Design Sheet*

***Fearless Flyers***

*Stunt Design Engineer:* \_\_\_\_\_

*Stunt Performed:* \_\_\_\_\_

How did your team design the airplane to perform this stunt?

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Why do you think this design caused the airplane to perform the stunt?

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Draw and label a diagram of the stunt plane performing its stunt.

Plane name: \_\_\_\_\_





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# Loop-to-Loop AdVENNtures

**OBJECTIVE:** Compare two designs of loop airplanes, observing the four forces of flight.

**PROBLEM:** How are loop-planes and tube-planes similar and different? (design, flight patterns, etc.)

**MATERIALS:** one straw, design patterns, Blacklines 1 and 2, scotch tape, 8 -1/2 x 8-1/2" paper for each student

**BACKGROUND INFORMATION:** The loops cause enough lift to keep the plane in the air. As it descends, the top part of the loop catches the air and helps the plane stay aloft.

## **MANAGEMENT:**

1. 45–60 minutes
2. Work individually or in pairs.
3. A large open space is required for this activity.
4. Instruct students to launch the planes away from others.

**WORD BANK:** *lift, thrust, gravity, drag, loop, tube, Venn Diagram, compare, similar, different, flight*

## **PROCEDURE:**

1. Give each pair of students the materials and have them construct the loop and tube planes.
2. Experiment with the two planes. Have students observe the similarities and differences in both flight and design.

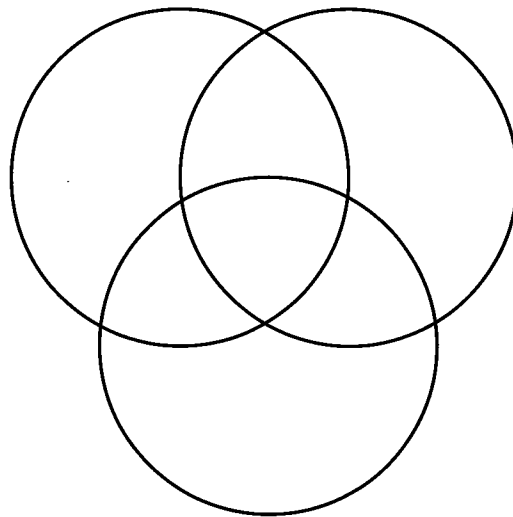
3. Working in pairs, students will complete the Venn Diagram and record their observations.

**DISCUSSION QUESTIONS:**

1. How are the two planes similar? How are they different?
2. How do lift, thrust, drag, and gravity affect these two planes?
3. Have you ever seen an airplane that is similar in design to the loop and tube planes?

**EXTENSIONS:**

1. Add a third design for an airplane and a third ring to the Venn Diagram to write comparisons.



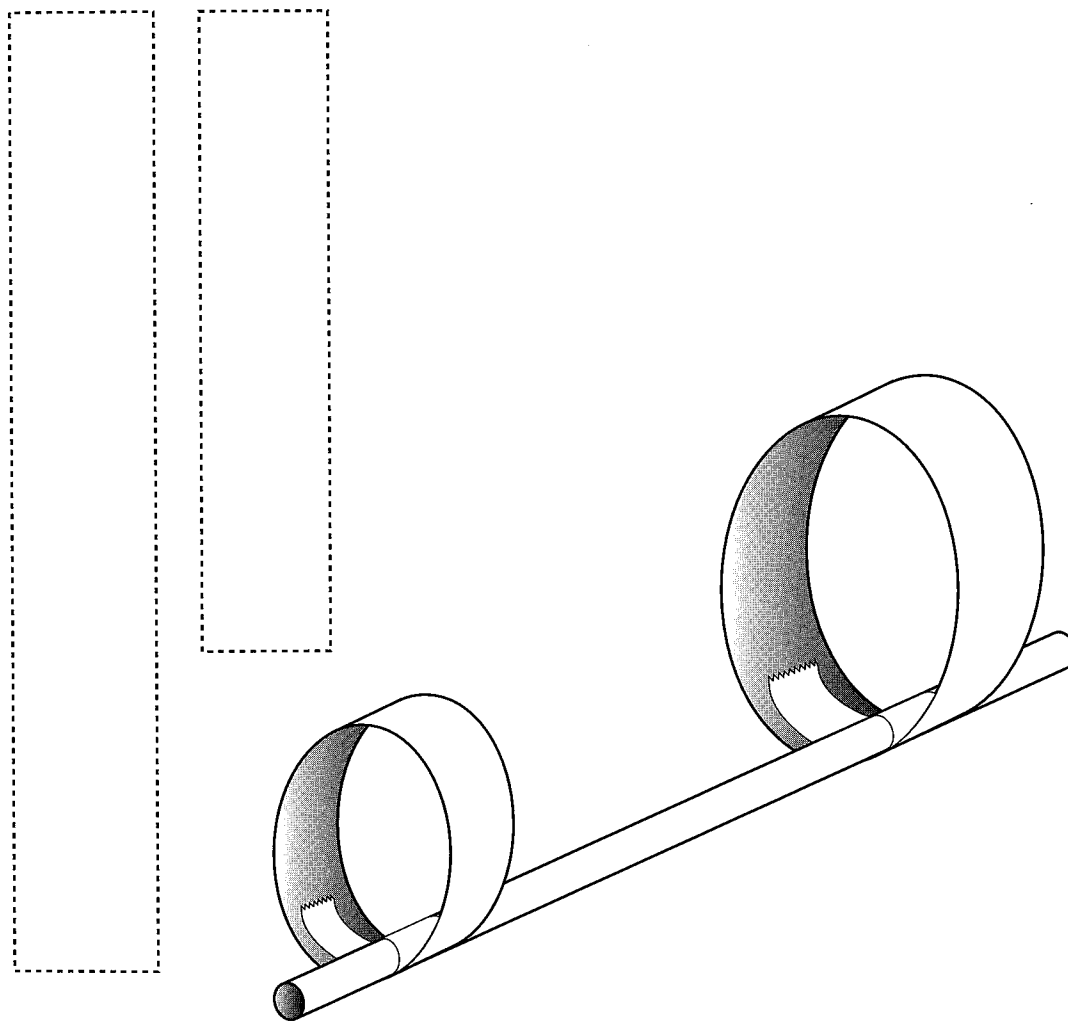
2. What happens if you use different sized tubes instead of a straw, as the loop plane's fuselage?
3. Use different sized sheets of paper to make the tube plane.

**CULMINATING ACTIVITY:**

Challenge the students to design a plane that uses multiple loops to create lift.

# Loop Plane

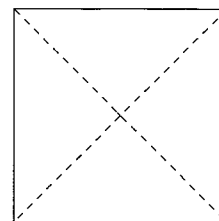
1. Cover both ends of the straw with pieces of tape.
2. Cut out the two loop patterns below.
3. Loop the strips of paper and secure with tape.
4. Tape the small loop to one end of the straw and the large loop to the other end.



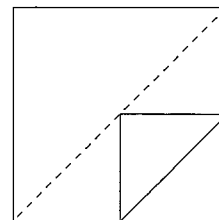
# Tube Plane

**MATERIALS:** 8-1/2 x 8-1/2" paper and scotch tape

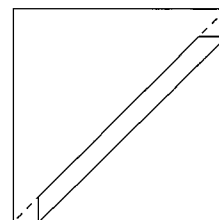
1. Fold the paper diagonally to find the center point.



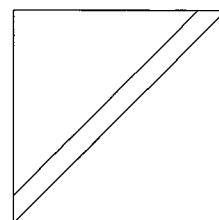
2. Open the paper and fold one corner to the center point.



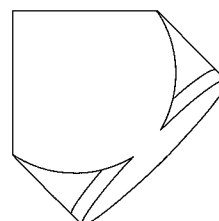
3. Continue folding to the center (1-centimeter folds).



4. Fold once more past the centerline.



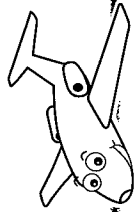
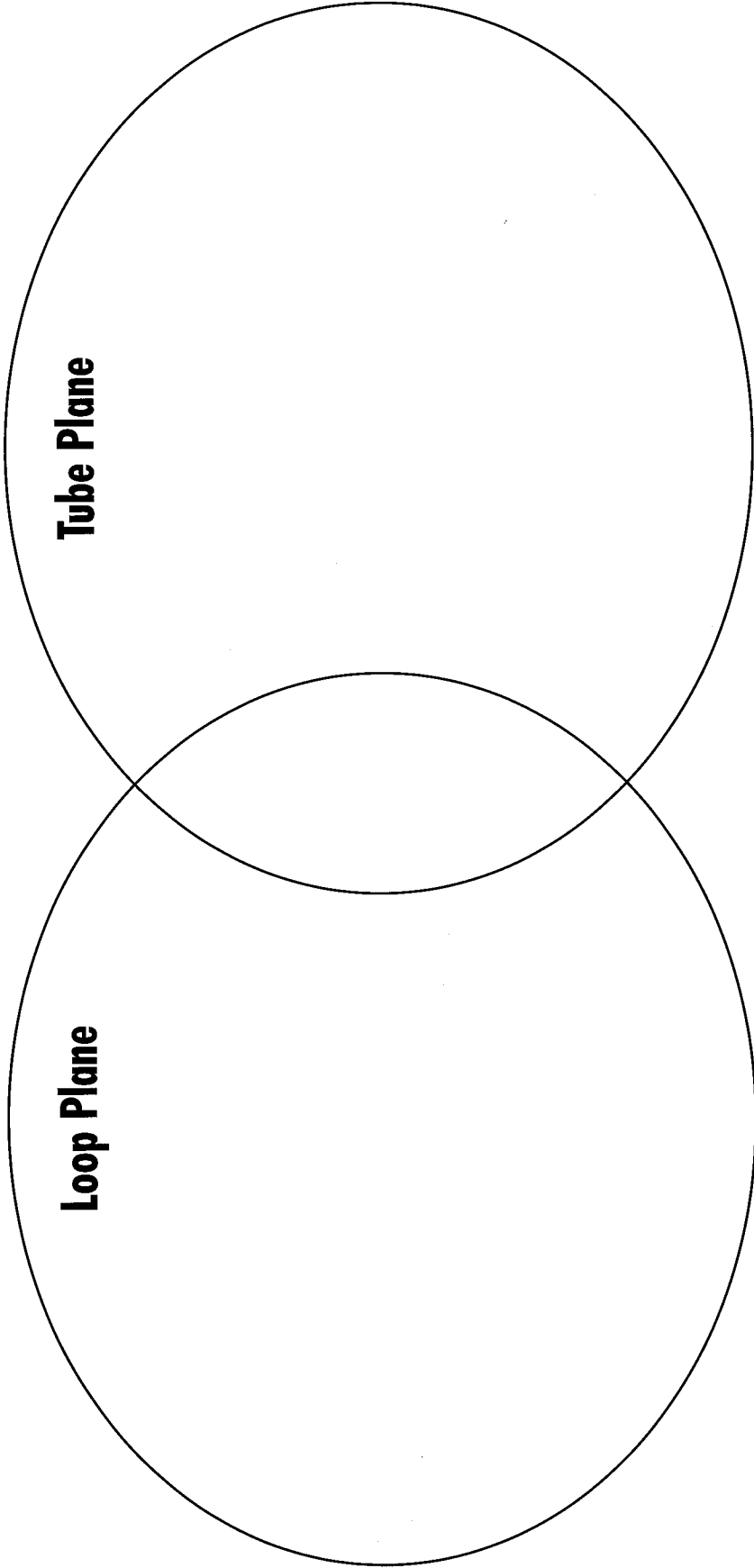
5. With the fold up, run the paper over the edge of the table several times to establish a curve. Then tape the overlapped ends.



6. Pinch at the folded end and gently toss.

# Loop-to-Loop Adventures

Pilots: \_\_\_\_\_



## Did You Know?

Did you know: The first flight across the United States was in 1911 by pilot Calbraith Rodgers. The actual flying time was three days and ten hours, although it took him 84 days, landing or crashing his plane 70 times.

# **Aircraft Parts**



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# Aircraft Parts

**OBJECTIVE:** Familiarize students with the parts of general aviation aircraft.

**MATERIALS:** Clay (see recipe), toothpicks, file folder labels, assorted materials for each student

**WORD BANK:** *ailerons, engineer, rudder, elevator, wing, cockpit, propeller, flaps, fuselage, stabilizer (horizontal and vertical), landing gear*

**MANAGEMENT:**

1. Have students bring in assorted materials for their plane designs (toothpicks, small sticks, Popsicle sticks, beads, spools, tin foil...).
2. Refer to the Parts of a Plane illustration, posters, and definition page to help design the models.

**PROCEDURE:**

1. Set up the materials and mix up the clay.
2. Allow the students to construct their own models. They must include the ten basic parts of an aircraft from the student definition page.
3. Have the students use the toothpicks and file folder labels to label the ten parts.
4. Have the students share and discuss their models.

**DISCUSSION:**

As a class, discuss the main parts of a plane and the function of each part.

**EXTENSIONS:**

1. Have the students draw a diagram of their model and label the parts.
2. Take a field trip to a local airport. Point out the ten main parts of the airplane on an actual aircraft.
3. Aside from the ten basic parts, encourage the students to include additional parts on their model.



# **Aircraft Parts**

**MATERIALS:**

4 cups flour

1 cup salt

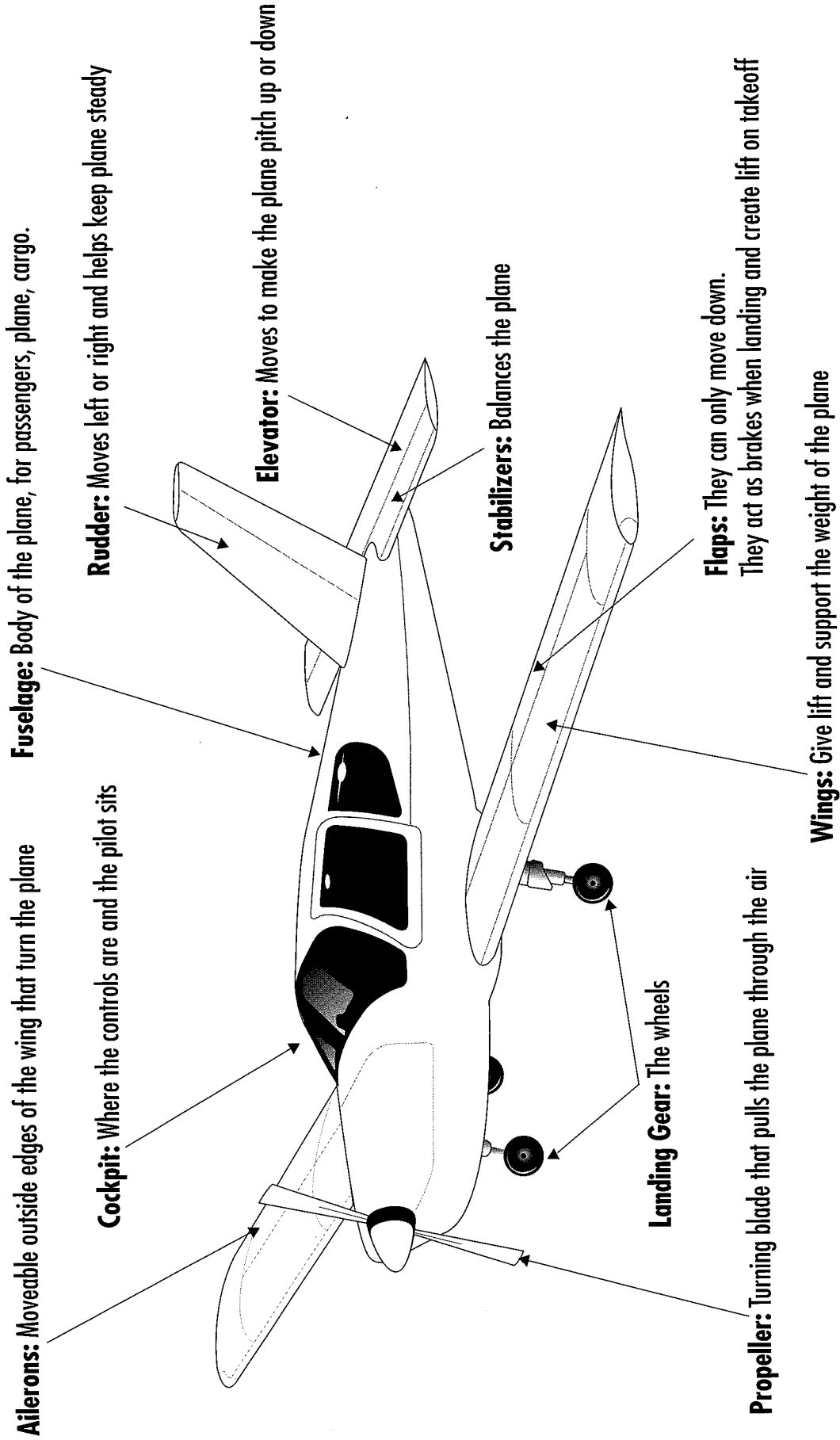
1-1/2 cups warm water

Bowl

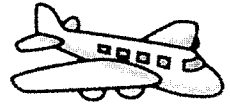
Spoon

1. Combine flour and salt in bowl.
2. Pour in the water.
3. Mix the dough with your hands.
4. If the mixture is too wet, add flour.
5. If the clay is too crumbly, add water.

# Ten Main Parts of a Plane



**Bizzy**



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# Bizzy the Business Jet

## **OBJECTIVES:**

1. Develop map skills.
2. Develop writing skills.

**MATERIALS:** Laminated class Friendly Flyer, Blackline 3 student Friendly Flyer, Class Logbook, individual Flight Journal – Blackline 1, map, push pins, address list of business aviation manufacturers.

**WORD BANK:** *business aviation, logbook, manufacture, destination, personnel*

## **MANAGEMENT:**

1. This activity will be used throughout the aviation unit.
2. Your class will determine how many flights Bizzy will go on and how long to extend the activity.
3. Rename your classroom “ \_\_\_\_\_ (teacher’s name) Hangar”
4. Have the students bring in pre-addressed stamped envelopes to school. These should be addressed to family and friends who would like to participate and respond to the students’ “air” mail.
5. Have copies of Blacklines 1 and 3 for the student flyers and student journals.

### **ADVENTURE 1**

Create the student logbook using Blackline 1 for the cover. Students can add notebook paper and copies of Blackline 2, then decorate the cover.

*Journal Entry:*

“What do you know about business aviation?”

“What would you like to know about business aviation?”

### **ADVENTURE 2**

Using Blackline 3, the students should cut out their own Bizzy Jet, decorate it, and name it.

*Journal Entry:*

“What is your Bizzy Jet’s name and why did you choose that name?”

“Where do you think your Bizzy Jet will travel?”

“What adventures do you think your Bizzy Jet will experience?”

### **ADVENTURE 3: Bizzy’s First Flight**

1. Introduce the activity by referring back to the book and explaining that “Bizzy” has come to their classroom, and the class will be sending him out on many flights. Bizzy will visit several places and return to the classroom to share new information about business aviation companies.
2. Determine a destination and discuss a plan for Bizzy’s first flight. He can go on business trips with parents, vacations with friends, trips to grandparents’ houses, etc. Discuss the weather at the destination. Go over the route and discuss his journey.
3. Write a letter to include with Bizzy.
4. Refer to the enclosed Blackline 4 for ideas. Mail your letter and plane.

#### **ADVENTURE 4: Student Flyer's First Flight**

Explain to the students that their plane is now ready to embark on its first flight. The students will use their pre-addressed stamped envelopes to mail their own Bizzy Jet to a family member or friend. Students should compose a letter asking the person to show their Bizzy Jet around their hometown or vacation spot. Mail the letter with their Bizzy Jet.

#### *Journal Entry:*

What will Bizzy's flight be like?

What cities, states, and landforms will Bizzy travel over?

#### **ADVENTURE 5: Return Flights**

When Bizzy returns to your school, discuss his travels and record his flight in the Logbook, Blackline 2. Students can also discuss their own Bizzy's flight and travels. They can record their Bizzy's personal flights in their own Logbook, Blackline 2.

#### *Journal Entry:*

What interesting things did the Bizzy Jet do on its trip?

#### **ADVENTURE 6: Mapping It Out**

As Bizzy and the students' Flyers return, the class can mark where the flyers have traveled by placing pushpins or stickers on a map of the U.S.

#### **EXTENSIONS FOR BIZZY:**

1. Calculate the mileage of the flights.
2. Use the mileage information to create problem-solving questions.
3. Students can look at real flight charts, flight plans, and log books.
4. Research aviation careers and businesses.

5. Create a postcard showing the destination the plane visited. On the back, the students include information about that location.
6. Write a creative story about Bizzy's adventures.

**CULMINATING ACTIVITY:**

Take all of the flight information and combine it to create a class book. The book can be illustrated by the students and laminated.

\_\_\_\_\_ 's

***Bizzy the Business Jet***



***Log Book***

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My Hometown Hangar



*Flight Log*

# ***Bizzy the Business Jet***

*Engineer:* \_\_\_\_\_

**PRE-FLIGHT INFORMATION**

Date: \_\_\_\_\_

Origin: \_\_\_\_\_

Destination: \_\_\_\_\_

Weather Conditions: \_\_\_\_\_

**POST-FLIGHT INFORMATION**

Date: \_\_\_\_\_

Local Airport Visited: \_\_\_\_\_

Aviation Personnel Met: \_\_\_\_\_

**DEBRIEFING:**

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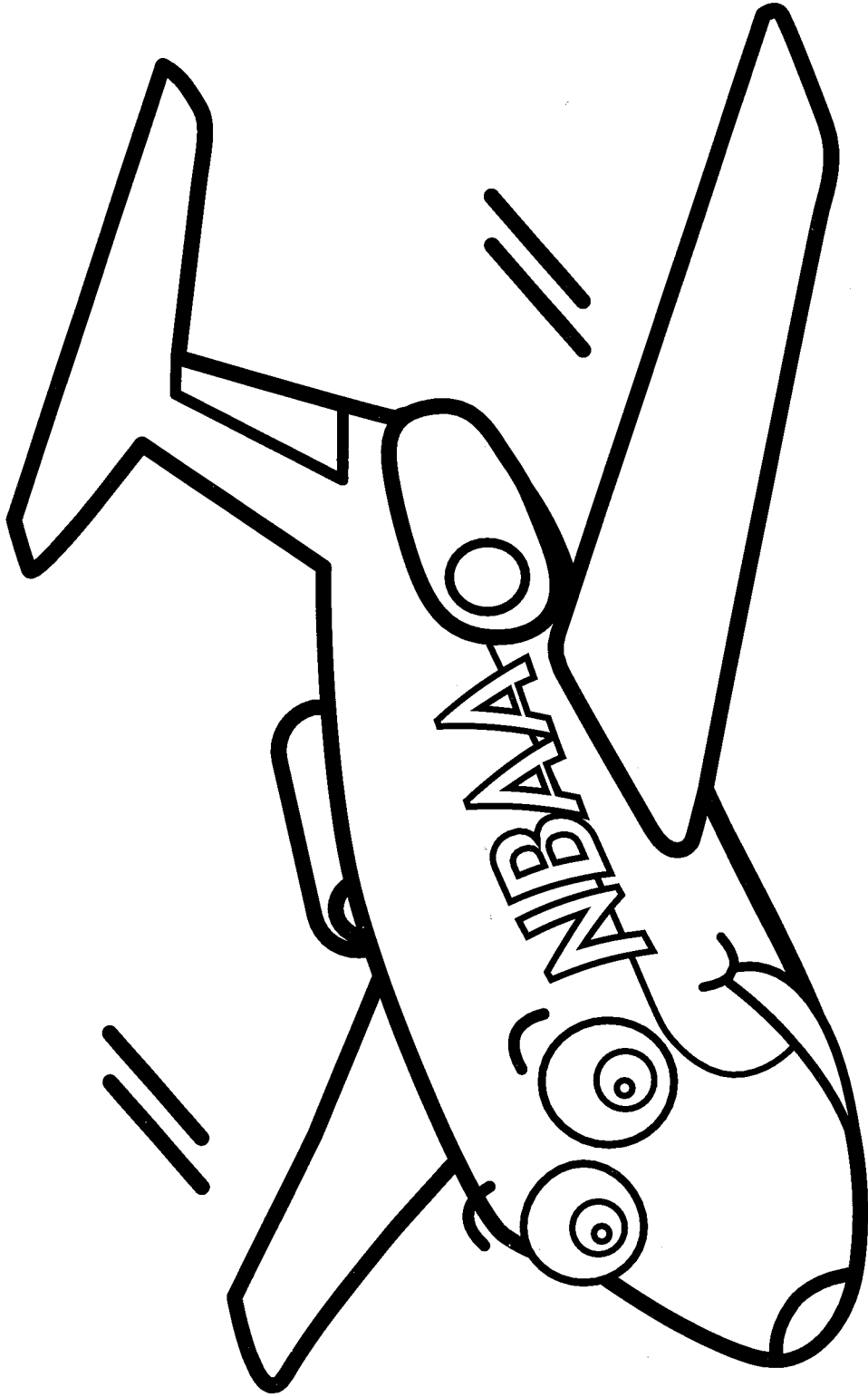
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*— Bizzy the Business Jet —*



*Student Data Sheet*

***Bizzy the Business Jet***

\_\_\_\_\_  
Date

Dear \_\_\_\_\_,

Hello! Enclosed you will find "Bizzy the Business Jet." He has traveled to you from our hangar at:

\_\_\_\_\_  
School

\_\_\_\_\_  
City

\_\_\_\_\_  
State

We are studying the principles of flight and Business Aviation. Please show Bizzy around your town.

Please return Bizzy along with any other enclosures such as postcards or photos, as soon as you can to:

\_\_\_\_\_  
Class Name

\_\_\_\_\_  
School

\_\_\_\_\_  
Address

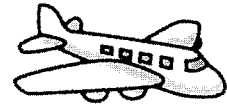
\_\_\_\_\_  
City, State, ZIP

We hope you enjoy Bizzy's visit. Thank you for a great flight!

Sincerely,

\_\_\_\_\_  
Class Name

# **Business Aviation**



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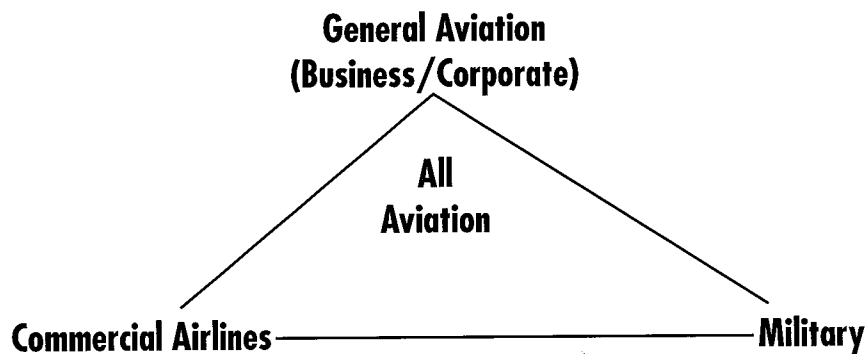
# Business Aviation in Action

**OBJECTIVE:** Generate an interest in Business Aviation.

**GOAL:** Create and run a successful Business Aviation company.

**MATERIALS:** blacklines, paper, art materials, U.S. maps

**BACKGROUND:** General Aviation includes all aviation except the airlines or the military. Business Aviation is one of the most important segments of general aviation. It consists of companies and individuals that use aircraft as tools to conduct their business.



**WORD BANK:** *General Aviation, Business Aviation, NBAA, logo, identification number*

**MANAGEMENT:**

1. 60–90 minutes per day
2. Gather several company logos as examples to share and discuss with class.
3. Break students into seven groups. (3–4 per group) Assign each group to a company.

**PROCEDURE:**

**DAY 1**

1. Distribute the appropriate instruction sheet (Blacklines 1a–1g) and the Aviation Alphabet (Blackline 2) to each group.
2. Give the students time to complete Blackline 1 and introduce their company to the class. Note: Decorate the room with student logos.

**DAY 2**

Distribute the appropriate worksheets to each group (Blacklines 3a–3g)

Decide how many questions the students must answer in the allotted time, in order for their company to be considered successful.

**EXTENSION:**

Students can role-play a mock flight of their company's trip. Each student should assume specific roles.

# Teacher Reference Sheet

**CITRUS COMPANY FLIGHT.** Your company will be transporting the corporate president and his staff to a Citrus Convention to make business contracts and market their products.

**LIFE FLIGHT.** Your aircraft will be transporting a heart to a waiting transplant patient.

**CHARTER FLIGHT.** Your aircraft will be flying a sports team to the National Championship.

**TOY COMPANY.** Your aircraft will be transporting what is hoped to be the hottest-selling toy of the year to distribution centers around the country.

**AIRPLANE MANUFACTURING COMPANY.** Your company will be transporting an aircraft that was designed at their plant to their buyers.

**MACHINERY PARTS COMPANY.** Your aircraft will be rushing a needed part to a candy factory so that production can continue.

**ELECTRONIC GAME COMPANY.** Your aircraft will be transporting the employees from one plant to another (across the country).

*Business Aviation in Action*

# — *Citrus Company Flight* —

Your company will be transporting the corporate president and his staff to a Citrus Convention to make business contracts and market the product.

1. Name your company.
2. Choose the aircraft your company will be using.
3. Create an identification number for your plane.
4. Design a logo for your company.

**CHALLENGE:**

Design an advertisement for your company to read over the local radio station.



*Business Aviation in Action*

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# *Life Flight*

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Your aircraft will be transporting a heart to a waiting transplant patient.

1. Name your company.
2. Choose the aircraft your company will be using.
3. Create an identification number for your plane.
4. Design a logo for your company.

**CHALLENGE:**

Design an advertisement for your company to read over the local radio station.

*Business Aviation in Action*

# **Charter Flight**

Your aircraft will be flying a sports team to the National Championship.

1. Name your company.
2. Choose the aircraft your company will be using.
3. Create an identification number for your plane.
4. Design a logo for your company.

**CHALLENGE:**

Design an advertisement for your company to read over the local radio station.

*Business Aviation in Action*

# ***Toy Company Flight***

Your aircraft will be transporting what is hoped to be the hottest-selling toy of the year to distribution centers around the country.

1. Name your company.
2. Choose the aircraft your company will be using.
3. Create an identification number for your plane.
4. Design a logo for your company.

**CHALLENGE:**

Design an advertisement for your company to read over the local radio station.

*Business Aviation in Action*

# *—Airplane Manufacturing— Company*

Your company will be transporting an aircraft that was designed at their plant to their buyers.

1. Name your company.
2. Choose the aircraft your company will be using.
3. Create an identification number for your plane.
4. Design a logo for your company.

**CHALLENGE:**

Design an advertisement for your company to read over the local radio station.

*Business Aviation in Action*

# ***Machinery Parts Company***

Your aircraft will be rushing a needed part to a candy factory so that production can continue.

1. Name your company.
2. Choose the aircraft your company will be using.
3. Create an identification number for your plane.
4. Design a logo for your company.

**CHALLENGE:**

Design an advertisement for your company to read over the local radio station.

*Business Aviation in Action*

# ***—Electronic Game Company—***

Your aircraft will be transporting the employees from one plant to another (across the country).

1. Name your company.
2. Choose the aircraft your company will be using.
3. Create an identification number for your plane.
4. Design a logo for your company.

**CHALLENGE:**

Design an advertisement for your company to read over the local radio station.

*Business Aviation in Action***Aviation Alphabet**

<b>A</b>	<b>ALPHA</b>	<b>N</b>	<b>NOVEMBER</b>
<b>B</b>	<b>BRAVO</b>	<b>O</b>	<b>OSCAR</b>
<b>C</b>	<b>CHARLIE</b>	<b>P</b>	<b>PAPA</b>
<b>D</b>	<b>DELTA</b>	<b>Q</b>	<b>QUEBEC</b>
<b>E</b>	<b>ECHO</b>	<b>R</b>	<b>ROMEO</b>
<b>F</b>	<b>FOXTROT</b>	<b>S</b>	<b>SIERRA</b>
<b>G</b>	<b>GOLF</b>	<b>T</b>	<b>TANGO</b>
<b>H</b>	<b>HOTEL</b>	<b>U</b>	<b>UNIFORM</b>
<b>I</b>	<b>INDIA</b>	<b>V</b>	<b>VICTOR</b>
<b>J</b>	<b>JULIET</b>	<b>W</b>	<b>WHISKEY</b>
<b>K</b>	<b>KILO</b>	<b>X</b>	<b>X-RAY</b>
<b>L</b>	<b>LIMA</b>	<b>Y</b>	<b>YANKEE</b>
<b>M</b>	<b>MIKE</b>	<b>Z</b>	<b>ZULU</b>

Give your plane an Identification Number. N is for the United States. Your Identification Number should start with N; followed by up to six numbers and letters.

**EXAMPLE: N3065Z (NOVEMBER 3065 ZULU)**

*Business Aviation in Action*

**CITRUS COMPANY**

Company Name: \_\_\_\_\_

**CREW MEMBERS:**

Captain: \_\_\_\_\_

First Officer: \_\_\_\_\_

Flight Attendant: \_\_\_\_\_

Passenger: \_\_\_\_\_

1. Your pilot needs to note the direction and flying path he or she will be flying to ensure the quickest route. You are flying from Orlando, Florida to Los Angeles, California. List each state, at least five cities, and two major landforms that you will fly over.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

2. Your pilot needs to know the mileage to be traveled to ensure the corporate president arrives on time. Using the map scale calculate the miles between Orlando and Los Angeles.

\_\_\_\_\_ miles



- 
3. You've traveled \_\_\_\_\_ miles. It took you 7 hours of flight time. What was your air speed? \_\_\_\_\_
4. The passengers need to keep the time zones in mind when traveling cross-country to ensure prompt arrival. If you depart Orlando at 9:00 a.m., what time will you arrive at the Citrus Convention in Los Angeles, California? \_\_\_\_\_

*Business Aviation in Action****Life Flight***

*Company Name:* \_\_\_\_\_

**CREW MEMBERS:**

*Captain:* \_\_\_\_\_

*First Officer:* \_\_\_\_\_

*Medical Team Member:* \_\_\_\_\_

*Medical Team Member:* \_\_\_\_\_

1. Your pilot needs to note the direction and path he or she will be taking to ensure quickest route. You are flying from a hospital in Columbus, Ohio to a hospital in Flagstaff, Arizona. List each state, at least five cities, and two major landforms you will fly over.

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2. Your pilot needs to know the mileage to be traveled to ensure the transplant arrives on time. Using the map scale calculate the miles between Columbus, Ohio and Flagstaff, Arizona.

\_\_\_\_\_ miles

- 
3. The medical team is awaiting the arrival of the Life Flight. A human heart can only exist outside the body for three hours. You've traveled \_\_\_\_\_ miles. You have only 3 hours. How fast would you need to travel? \_\_\_\_\_
4. The medical assistants need to keep time zones in mind when calculating arrival time so the doctors can schedule surgery. You depart Columbus at 9:00 a.m. What time will you arrive in Flagstaff? \_\_\_\_\_

*Business Aviation in Action*

# **Charter Flight**

Company Name: \_\_\_\_\_

**CREW MEMBERS:**

*Captain:* \_\_\_\_\_

*First Officer:* \_\_\_\_\_

*Flight Attendant:* \_\_\_\_\_

*Flight Attendant:* \_\_\_\_\_

1. Your pilot needs to note the direction and path he or she will be flying to ensure the quickest route. You are flying from Green Bay, Wisconsin to Salt Lake City, Utah for the National Championship event. List each state, at least five cities, and two major landforms you will fly over.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

2. Your pilot needs to know the mileage to be traveled to ensure the athletes arrive in time. Using the map scale calculate the miles between Green Bay, Wisconsin and Salt Lake City, Utah.  
\_\_\_\_\_ miles

- 
3. The fans, media, and competition are awaiting the arrival of your team. You've traveled \_\_\_\_\_ miles. It took you 5 hours of flight time. What was your air speed? \_\_\_\_\_
4. The passengers need to keep the time zones in mind when traveling cross-country to ensure prompt arrival at the event. You depart Green Bay, Wisconsin at 10:00 a.m. What time will you arrive in Salt Lake City, Utah? \_\_\_\_\_

*Business Aviation in Action***Toy Company**

Company Name: \_\_\_\_\_

**CREW MEMBERS:**

Captain: \_\_\_\_\_

First Officer: \_\_\_\_\_

(Other): \_\_\_\_\_

(Other): \_\_\_\_\_

1. Your pilot needs to note the direction and path he or she will be flying to ensure the quickest route. You are flying from El Paso, Texas to Baltimore, Maryland. List each state, at least five cities, and two major landforms you will fly over.

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2. Your pilot needs to know the mileage to be traveled to ensure that the toys arrive on time. Using the map scale, calculate the miles between El Paso, Texas and Baltimore, Maryland.

\_\_\_\_\_ miles

- 
3. Each airplane has an optimal air speed in order to use the fuel most efficiently. You've traveled \_\_\_\_\_ miles. It took you 5 hours of flight time. What was your airspeed? \_\_\_\_\_
  
  4. Your crew needs to keep the time zones in mind when traveling cross-country to ensure prompt arrival of the toys to the distributor. If you depart El Paso at 9:00 a.m., what time will the toys be delivered? \_\_\_\_\_

*Business Aviation in Action*

# ***Airplane Manufacturing Company***

*Company Name:* \_\_\_\_\_

**CREW MEMBERS:**

*Captain:* \_\_\_\_\_

*First Officer:* \_\_\_\_\_

*(Other):* \_\_\_\_\_

*(Other):* \_\_\_\_\_

1. Your pilot needs to note the direction and path that she/he will be flying to ensure the quickest route. You are flying from Wichita, Kansas to Buffalo, New York. List each state, at least five cities, and two major landforms that you will fly over.

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2. Your pilot must know the mileage to be traveled in order to deliver the airplane to the buyer on time. Using the map scale, calculate the miles between Wichita, Kansas and Buffalo, New York. \_\_\_\_\_ miles



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3. Each airplane has an optional air speed in order to use fuel most efficiently. You've traveled \_\_\_\_\_ miles. It took you 8 hours of flight time. What was your airspeed? \_\_\_\_\_
  
  4. Your pilot needs to keep the time zones in mind when traveling cross-country to ensure prompt delivery of the aircraft. If you depart Wichita at 10:00 a.m. what time will you arrive in Buffalo? \_\_\_\_\_

*Business Aviation in Action*

# *Machinery Company*

Company Name: \_\_\_\_\_

**CREW MEMBERS:**

*Captain:* \_\_\_\_\_

*First Officer:* \_\_\_\_\_

*(Other):* \_\_\_\_\_

*(Other):* \_\_\_\_\_

1. Your pilot needs to note the direction and path he or she will be flying to ensure the quickest route. You are flying from Seattle, Washington to Rockford, Illinois. List each state, at least five cities, and two major landforms that you will fly over.

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2. Your pilot needs to know the mileage to be traveled to ensure that the factory part arrives at the candy factory as quickly as possible. Using the map scale calculate the miles between Seattle, Washington and Rockford, Illinois.

\_\_\_\_\_ miles

- 
3. The candy factory can not continue production until the factory part arrives. You've traveled \_\_\_\_\_ miles. It took you five hours of flight time. What was your airspeed? \_\_\_\_\_
  
  4. Your pilot needs to keep the time zones in mind when traveling cross-country to ensure prompt delivery of the factory part. If you depart Seattle at 1:00 p.m. what time will the part arrive in Rockford? \_\_\_\_\_

*Business Aviation in Action****— Electronic Game Company —***

*Company Name:* \_\_\_\_\_

**CREW MEMBERS:**

*Captain:* \_\_\_\_\_

*First Officer:* \_\_\_\_\_

*(Other):* \_\_\_\_\_

*(Other):* \_\_\_\_\_

1. Your pilot needs to note the direction and path he or she will be flying to ensure the quickest route. You are flying from St. Paul, Minnesota to Baton Rouge, Louisiana. List each state, at least 5 cities, and two major landforms you will fly over.

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2. Your pilot needs to know the mileage to be traveled to ensure that your employees will make the brainstorming meeting for the newest video game. Using the map scale calculate the miles between St. Paul, Minnesota and Baton Rouge, Louisiana.

\_\_\_\_\_ miles

3. Each airplane has an optional airspeed in order to use fuel

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most efficiently. You've traveled \_\_\_\_\_ miles. It took you 3 hours of flight time. What was your air speed? \_\_\_\_\_

4. The passengers need to keep the time zones in mind when traveling cross-country to ensure prompt arrival to the meeting. You depart St. Paul at 10:00 a.m. what time will you arrive in Baton Rouge? \_\_\_\_\_

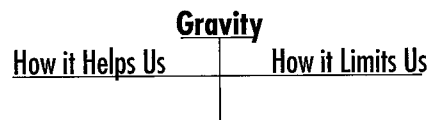
# **Curriculum Connections**



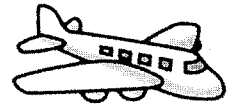
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# Curriculum Connections

1. Create an Aviation dictionary using new terms.
2. Research famous pilots, inventors, and important contributors to aviation.
3. Have students share current events relating to Business Aviation and aircraft manufacturers.
4. Have students choose and follow a business aviation company in the stock market. Allot a certain amount of money to invest.
5. Create a mobile, collage, or mural of aviation.
6. Design a three-dimensional airport (flight-based operations).
7. Create an aviation timeline with your class.
8. Compare an airplane with a fish and a bird. (Venn Diagram)
9. Make a comparison chart that shows how gravity helps us and how it limits us.



10. Draw pictures to show what the Earth would be like without gravity.



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# Writing Prompts

In 1927 Charles Lindbergh was the first pilot to fly from New York to Paris across the Atlantic Ocean without stopping. You have been chosen to co-pilot Charles Lindbergh's first flight. Describe this 33-1/2 hour adventure.

Think of a career you would like to have when you grow up. Explain how you will use aviation in that career.

In 1937 Amelia Earhart, with her navigator Fred Noonan, disappeared trying to fly around the world. No one has ever found a trace of Earhart, Noonan, or their plane. Tell the story of what you think happened on this flight.

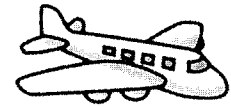
In 1947 General Chuck Yeager was the first to fly faster than the speed of sound. He piloted a Bell XS-1 aircraft at 670 miles per hour to break the sound barrier. The country admired his bravery. Describe a time when you were brave.

A hurricane has hit a few states away, and your company has been asked to use its business jet to fly emergency response personnel to the site. As the pilot, describe your adventure.

You are riding your bike to school. All of a sudden, all gravity is gone! Describe what happens next!



# **Aviation Terms**



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# AvKids Aviation Terms

**AEROBATICS**—spectacular stunts, such as rolls and loops, performed in general aviation aircraft specially designed to withstand the stresses of such maneuvers.

**AERODYNAMICS**—forces—such as resistance, pressure and velocity—that affect the movement of air around moving objects, such as aircraft.

**AERONAUTICAL CHARTS**—maps of the airspace designed to help pilots navigate.

**AILERONS**—moveable aircraft control surfaces located near the end of the wing which are used to make an aircraft bank or roll.

**AIRCRAFT**—any man-made object that flies, including airplanes, blimps and helicopters.

**AIRFOIL**—any surface designed to provide lift from the air through which it moves, including wings, control surfaces and propeller blades.

**AIRFRAME**—the structure of the aircraft, not including the powerplant or engine.

**AIRLINE**—a company that is in the business of providing scheduled transportation.

**AIRPORT**—a field from which aircraft land and takeoff.

**AIRSPACE**—the part of the atmosphere above a particular land area.

**AIRSPEED**—the speed of an aircraft relative to the air.

**AIR TAXI**—a company that provides on-demand (instead of scheduled) commercial air transportation.

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**AIR TRAFFIC CONTROL (ATC)**—the system of ground-based facilities that coordinates the movement of aircraft by tracking their progress using radar and communicating with pilots via radio.

**AIR TRAFFIC CONTROLLER**—a person who communicates with a pilot, usually by radio, directing the movement of aircraft, especially close to an airport.

**AIRWAYS**—highways in the sky.

**ALTIMETER**—a device that measures changes in air pressure to calculate how high an aircraft is flying.

**ALTITUDE**—the height that an aircraft is flying above the ground, usually expressed in the number of feet above sea level.

**ANTI-ICING**—a substance applied to the exterior of an aircraft before flight to prevent the formation of ice, which can impair the ability of an aircraft to fly. Also, a system that is used on board an aircraft to prevent the formation of ice on the wings, propellers, engine inlets and control surfaces.

**APPROACH**—the phase of flight in which an aircraft has started its descent toward its destination airport.

**ATTITUDE**—the position of an aircraft in relation to the earth's horizon.

**AUTOPILOT**—short for “automatic pilot,” this is a control system that keeps an aircraft on a set course or speed so that the pilot does not have to steer or add power to the aircraft. Autopilots are most often used during the level, cruising portion of a flight.

**AVIATOR**—a person trained and qualified to fly an aircraft; a pilot.

**AVIONICS**—short for “aviation electronics,” any electronic system used on an aircraft, primarily for navigation and communication.

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**BANK**—to tilt an aircraft laterally and inwardly during forward flight.

**BUSINESS AIRCRAFT**—a general aviation aircraft used to support a business.

**BUSINESS AVIATION**—the use of general aviation aircraft to support a business. These activities can range from individuals who fly rented, single-engine, piston-powered airplanes to companies that have flight departments that operate fleets of jet airplanes and helicopters.

**BUSINESS JET**—a jet-powered general aviation aircraft that is used to support a company's business.

**CAPTAIN**—the pilot in command or aviator in charge of the flight, who usually sits in the left seat of the cockpit.

**CEILING**—The highest altitude from which the ground is still visible in a particular weather condition.

**CHECKLIST**—a written list of procedures used by pilots to ensure that all the items that need to be accomplished during a flight are actually performed.

**CLEARANCE**—permission granted by an air traffic controller that allows a pilot to taxi, land or takeoff an aircraft.

**CERTIFICATION**—official approval granted by a government agency qualifying a pilot or aircraft to fly.

**COCKPIT**—the forward compartment of an aircraft where the pilots sit.

**COCKPIT VOICE RECORDER**—an audio system that records all the sounds made in the cockpit. Enclosed in a crash-proof container, this “black box” is used by accident investigators to help determine why an aircraft crashed.

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**COLLISION AVOIDANCE SYSTEM**—a device that can detect when one aircraft might be flying too close to another and tells a pilot which direction to turn in order to avoid a collision.

**COMPASS**—a magnetic device that helps determine the direction an aircraft is flying.

**CONTROL SURFACES**—moveable parts of the aircraft's wing and tail (or empennage) that are used to make an aircraft climb, descend or turn.

**CONTROL TOWER**—The building from which air traffic controllers direct the movement of aircraft on and around an airport.

**COPILOT**—a second pilot, who usually sits in the right seat of the cockpit assisting the captain (or pilot in command), who usually sits in the left seat of the cockpit.

**CORPORATE AIRCRAFT**—a general aviation aircraft used to support a corporation's business activities.

**CORPORATE AVIATION**—often used interchangeably with the term “business aviation,” this refers to the use of general aviation aircraft to support corporate business. Most corporations have flight departments that operate just one airplane, but some large corporations fly and maintain fleets of airplanes and helicopters.

**COWLING**—a removable cover or housing placed around a section of the aircraft, usually an engine.

**CROSSWIND**—any wind that blows across the intended course of an aircraft, causing it to drift off course.

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**CRUISING SPEED**—a steady, moderate speed considered optimum for long-range flight.

**DEICING**—a system or substance that removes ice that has formed on an airborne aircraft.

**DOWNWIND**—moving in the same direction as the wind is blowing.

**DRAG**—the air resistance encountered as an aircraft tries to move forward.

**ELEVATOR**—the control surface located on the horizontal tail of an aircraft that, when moved by the pilot, makes the airplane climb or descend.

**EMPENNAGE**—the rear portion or tail of the aircraft.

**EMPTY WEIGHT**—the weight of the aircraft alone, not including fuel, passengers or baggage.

**ENROUTE**—on or along the way.

**FEDERAL AVIATION ADMINISTRATION (FAA)**—The U.S. government agency that establishes and enforces rules for aviation.

**FIXED BASE OPERATOR (FBO)**—an airport-based fueling and service center for aircraft, similar to a gas station for cars.

**FLAPS**—devices located on the trailing or rearward portion of the wing that can be extended to increase lift and drag, especially during takeoff or landing.

**FLIGHT ATTENDANT**—a person whose job is to help ensure the safety and comfort of aircraft passengers by providing meals, beverages and instructions on what to do in case of an emergency.

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**FLIGHT DATA RECORDER**—a system that records the airspeed, altitude, heading and other operating characteristics of an aircraft in flight. Enclosed in a crash-proof container, this “black box” is used by accident investigators to help determine why an aircraft crashed.

**FLIGHT DEPARTMENT**—the organization within a company that is responsible for flying and maintaining aircraft. People who work in a flight department can include pilots, maintenance technicians, schedulers/dispatchers and flight attendants.

**FLIGHT MANUAL**—a guide issued by an aircraft manufacturer that contains official information regarding the speed, operating limits and other essential guidelines for safely operating an aircraft.

**FLIGHT PLAN**—a formal document that describes the intended course of a planned flight.

**FLIGHT SERVICE STATION (FSS)**—an official aviation information center that pilots use to obtain up-to-date information on weather and airport conditions before beginning a flight.

**FUSELAGE**—the body of an airplane to which the wing, tail and landing gear are attached.

**GENERAL AVIATION**—all flying activities other than commercial (airline) and military aviation. General aviation aircraft, which includes everything from two-seat training airplanes to intercontinental business jets, can fly to about 10 times the number of airports that airliners can.

**GENERAL AVIATION MANUFACTURERS ASSOCIATION (GAMA)**—a Washington, D.C.-based national trade association that represents U.S. manufacturers of general aviation aircraft and parts.

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**GLIDE SLOPE**—the part of an instrument landing system that provides a radio beam so that the pilot can follow a standard descent path to land at an airport.

**GROSS WEIGHT**—the maximum weight than an aircraft is designed to carry when taking off.

**HANGAR**—an airport building specially designed to house an aircraft.

**HEADING**—the course or direction in which an aircraft is moving, generally expressed in degrees of a circle (from zero to 360).

**HEADWIND**—a wind blowing directly against the course of an aircraft.

**HELICOPTER**—a type of aircraft that uses a rotor or propeller mounted on top of the fuselage to take off and land vertically, which allows it to operate without using a runway or airport.

**HELIPAD OR HELIPORT**—a small structure or paved area that is used by helicopters to take off and land vertically.

**HOLDING PATTERN**—to fly in a circle until an air traffic controller clears a pilot to proceed toward his destination.

**INSTRUMENT FLIGHT RULES (IFR)**—the regulations for flying an aircraft when clouds, fog or other weather conditions make it difficult or impossible to fly by sight alone.

**INSTRUMENT LANDING SYSTEM (ILS)**—electronic navigation equipment that uses a radio beam to guide pilots of descending aircraft along a standard path so they can land on a runway.

**INSTRUMENT PANEL**—the section of the cockpit located in front of the pilot that houses all the instruments, gauges and indicators that tell the pilot important information, such as airspeed, altitude and heading. The instrument panel is similar to an automobile dashboard.



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**JET**—a type of aircraft powerplant that uses a turbine, which increases the flow of air through an engine, for power.

**KNOT**—a unit of aviation speed that equals one nautical mile per hour, which is equivalent to 1.151 miles per hour.

**LANDING GEAR**—a system of wheels, floats or skis that are used to support an aircraft when it is on the ground or in the water. Landing gears either are “fixed” (permanently extended) or “retractable” (which means that they are pulled back inside the fuselage or wings of the aircraft once it becomes airborne).

**LIFT**—the aerodynamic force that tends to keep an aircraft in the air.

**LOGBOOK**—a book that contains a record of flights made by a pilot or maintenance procedures performed on an aircraft during its lifetime.

**MAINTENANCE TECHNICIAN**—a person who is trained and certified to maintain or repair an aircraft.

**MULTIENGINE**—an aircraft that has more than one engine.

**NACELLE**—the streamlined housing that encloses the engine.

**N NUMBER OR TAIL NUMBER**—the license plate of an aircraft that contains a series of numbers and/or letters that are painted on the fuselage near the tail of an aircraft. All aircraft registered in the United States have registration numbers that begin with the letter “N.”

**NATIONAL BUSINESS AVIATION ASSOCIATION (NBAA)**—a Washington, D.C.-based national trade association that is dedicated to enhancing the safety, efficiency and acceptance of business aviation. NBAA’s membership includes more than 6,100 companies that are involved in flying general aviation aircraft for business purposes.

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**NATIONAL TRANSPORTATION SAFETY BOARD (NTSB)**—The agency of the U.S. government that is responsible for investigating aircraft accidents.

**NAUTICAL MILE**—the standard unit of distance used in aviation. It equals 6,080 feet or 1.151 miles.

**NAVAIDS**—a shortened form of the words “navigational aids.” It refers to any system or device used to help guide a pilot while flying an aircraft.

**NAVCOM**—a shortened form of the words “navigation-communication.” It refers to any piece of aircraft equipment used by the pilot for navigation or communication purposes.

**NOSE**—the front portion of the aircraft.

**NOTICE TO AIRMEN (NOTAM)**—special announcements used to alert pilots of unusual conditions around an airport.

**OXYGEN MASK**—a small face mask that is connected to a canister of oxygen. This system is used by each person on board an aircraft in case there is a malfunction in the aircraft’s pressurization system, which normally supplies air to breath at high altitudes.

**PAYLOAD**—the total weight of passengers and cargo that an aircraft carries or can carry.

**PILOT**—a person trained and certified to fly an aircraft; an aviator.

**PILOT IN COMMAND**—the captain or aviator in charge of the flight, who usually sits in the left seat of the cockpit.

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**PITCH, ROLL AND YAW**—terms used to describe the three-dimensional movement of an aircraft. Pitch is the rotation of an airplane around its lateral axis. Roll is the motion of an aircraft around its longitudinal axis. Yaw is the movement of an airplane around its vertical axis.

**POWERPLANT**—an engine used to power an aircraft. There are four basic types of powerplants: a piston engine, which is similar to the engine used in a car, turns a propeller, which propels an aircraft by pulling the air over the wings. A jet engine uses a turbine to accelerate the flow of air without using a propeller. A turboprop uses a jet engine combined with a propeller. A turboshaft engine uses a jet engine and a rotor (or horizontally mounted propeller) to lift a helicopter and allow it to take off and land vertically.

**PREFLIGHT**—the testing procedure a pilot uses before flying to ensure that an aircraft's equipment and systems are working properly.

**PROPELLER**—a rotating airfoil with two, three or four blades that is used to move an airplane forward.

**PRESSURIZATION**—a system designed to maintain normal air pressure in an aircraft at higher altitudes, where the air is too thin to allow proper breathing.

**RADAR**—a shortened form of the words “radio detection and ranging.” Radar is a system that uses electronic pulses to measure how far away an object is. The distance is measured by timing how long it takes for the pulses to be transmitted from an airplane or ground facility and reflect or bounce off an object and return to their source. Airborne radar is used by pilots to detect thunderstorms and other severe weather, while ground-based radar is used by air traffic controllers to track the direction and speed of aircraft.

**RAMP**—the paved area, usually located next to a hangar, where aircraft can be loaded, unloaded or parked.

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**RANGE**—the maximum distance an aircraft can fly without being refueled.

**RIVET**—a small metal pin that is used to attach the various sheet metal parts of an aircraft.

**ROTORCRAFT**—an aircraft that uses rotors; a helicopter.

**RUDDER**—the movable vertical portion of the tail (or empennage) that is used to control the yawing movement of an aircraft.

**RUN-UP**—the process of increasing the power of an aircraft engine before takeoff to check and see that the powerplant and propeller are operating properly.

**RUNWAY**—a strip of level, usually paved ground on which aircraft take off and land.

**SCHEDULER/DISPATCHER**—a member of the flight department who is responsible for making all the non-mechanical arrangements—such as obtaining permits—to prepare an aircraft for a flight. They also make and maintain lists of the times that an aircraft is supposed to depart, arrive and be serviced.

**SIMULATOR**—a mechanical device that resembles a cockpit and is used by pilots to learn and practice flight maneuvers while on the ground.

**SKIN**—the outer covering of an aircraft, usually made of sheet metal, but also can be fabric or wood, especially on older airplanes.

**SPIN**—a maneuver in which the aircraft, after experiencing an aerodynamic stall, descends with its nose pointing toward the ground while turning rapidly around its vertical axis.

**STABILIZER**—a fixed (non-movable) horizontal or vertical part of the tail that keeps the aircraft stable as it flies.

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**STALL**—an aerodynamic condition in which the smooth flow of air over a wing or other airfoil is disrupted, thus decreasing the amount of lift produced and causing the aircraft to cease flying.

**STICK**—the control and steering wheel of an airplane, sometimes called the “yoke.”

**TAIL**—the rear most part of an aircraft fuselage.

**TAILWIND**—a wind that is blowing from behind an aircraft, helping it fly faster.

**TAKEOFF**—the point in a flight when the aircraft leaves the ground or runway and becomes airborne.

**TAXI**—to move an aircraft slowly on the ground or on the surface of the water before takeoff or after landing.

**TAXIWAY**—a paved strip on the airport that leads from the ramp to the runway.

**THROTTLE**—the cockpit lever that increases engine power, allowing an aircraft to takeoff or accelerate if it is already airborne.

**THRUST**—the forward force developed in a jet engine as a reaction to the high-velocity rearward ejection of exhaust gases.

**TOUCHDOWN**—the moment when the wheels of a landing aircraft touch the surface of a runway.

**TRAFFIC PATTERN**—a low-altitude course, usually an oval, around an airport that airplanes must follow in order to ensure the safe flow of aircraft to the runway.

**TRANSPONDER**—a transmitter-receiver that sends a unique, coded signal to ground radars, thus allowing air traffic controllers to identify and track individual aircraft.

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**TRIM**—a device that allows the pilot to adjust the attitude of the aircraft without having to constantly move the elevators.

**TURBULENCE**—a disturbance or uneven flow of air that causes an aircraft to bounce in flight.

**UPWIND**—flying an aircraft in the opposite direction the wind is blowing.

**VECTOR**—a heading given to a pilot by an air traffic controller via a radio communication.

**VISIBILITY**—the distance that one can see clearly in the air.

**VISUAL FLIGHT RULES**—the regulations for flying an aircraft in clear weather by sight alone.

**WAYPOINT**—a reference point in the airspace used for navigational purposes.

**WEATHER BRIEFING**—the official forecast information that a pilot gets from a flight service station before departing on a flight.

**WEIGHT AND BALANCE**—the mathematical calculations done to determine if the cargo and/or passengers aboard an aircraft are loaded properly.

**WING**—the large airfoils that extend out from either side of the middle of an airplane's fuselage to provide the lift needed to fly.

**YOKE**—the control and steering wheel of an airplane, sometimes called the “stick.”

# **AvKids Recommended Reading**

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# AvKids Recommended Reading

The following is the AvKids LitBase, a reading list of books related to aviation. These books were reviewed by third grade teacher Scott Spindler of Benjamin Foulois Traditional Academy in the Washington, DC, Metro area.

**Rating System** — Scale 1-5 ( 🍏 – 🍏🍏🍏🍏🍏 )

Each book also has been given a rating of 1 through 5. The rating of excellent, five apples, is rarely given and only to books that demonstrate the concepts of aviation on grade level, with some focus on business aviation. Four- and three-apple ratings are awarded more frequently, and are given to books that range from very good to acceptable. Books scoring below three apples have failed to meet one or more of our criteria for demonstrating the concepts of flight, and the different types of aviation, probably student and grade-level appropriateness. Many of the books in the AvKids LitBase are appropriate for more than one grade level. This is specified in the review. This LitBase is available online at [www.avkids.com](http://www.avkids.com)

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**Title:** *How Do Airplanes Fly?*

**Author:** Melvin and Gilda Berger

**Number of Pages:** 48

**Grade Level:** 2–3

**Review:** This is a good short story for children not quite ready for chapter books, but past the picture book stage. It offers a lot of general information about how airplanes fly and presents that information in an easy-to-read form. It covers the early ideas of Leonardo da Vinci to modern jet planes.

**Rating:** 🍏🍏🍏🍏

**Color Illustrations:** Yes

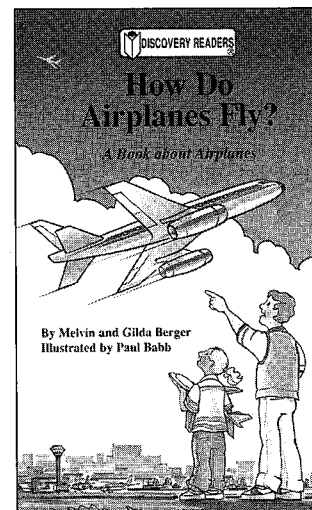
**Color Photos:** No

**B&W Illustrations:** No

**B&W Photos:** No

**Publisher:** Ideals Children's Books

**ISBN:** 0791050645





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**Title:** *The Berenstain Bears Fly-It! Up, Up, and Away*

**Author:** Stan & Jan Berenstain

**Number of Pages:**

**Grade Level:** 2–3

**Review:** *Fly-It!* is a really cool book. It is one in a series of books that gives experiments to try out through most of the book. The story starts with the kids on a trip to the Bearsonian Institution, where they meet up with Professor Actual Factual who explains the principles of flight. From there, the kids create several airplanes that they fly using the information they learned at the museum.

**Rating:** 🍎 🍎 🍎 🍎 🍎

**Color Illustrations:** Yes

**Color Photos:** No

**B&W Illustrations:** No

**B&W Photos:** No

**Publisher:** Random House

**ISBN:** 0679973176



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**Title:** *The Aircraft Encyclopedia*

**Author:** Roy Braybrook

**Number of Pages:** 188

**Grade Level:** 5 to advanced

**Review:** This book is similar to *A Field Guide to Airplanes*, except it has several color illustrations and photos. It is full of facts and statistics covering a wide variety of planes, including military, commercial, and private. This book would also be useful for identifying various aircraft.

**Rating:** 🍎 🍎 🍎

**Color Illustrations:** Yes

**Color Photos:** Yes

**B&W Illustrations:** Yes

**B&W Photos:** Yes

**Publisher:** Aladin Paperbacks

**ISBN:** 0671553372



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Title: *Ruth Law Thrills a Nation*

Author: Don Brown

Number of Pages: 15

Grade Level: 2–3

Review: This is a good short story picture book that describes Ruth Law's record-breaking flight from Chicago to New York City. The illustrations are colorful and the story would be entertaining for second or third graders.

Rating: 🍎 🍎 🍎 🍎

Color Illustrations: Yes

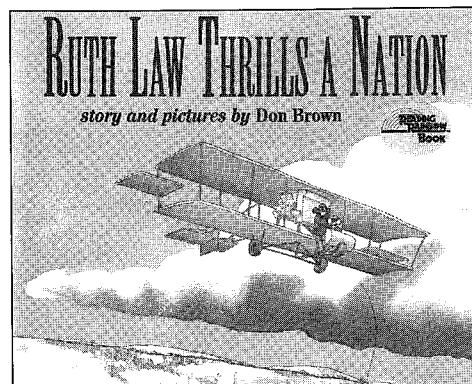
Color Photos: No

B&W Illustrations: No

B&W Photos: No

Publisher: Houghton Mifflin

ISBN: 0395664047



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Title: *Great Explorers: Pioneers of the Air*

Author: Molly Burkett

Number of Pages: 31

Grade Level: 4–6

Review: *Pioneers of the Air* would be a great book for anyone looking for information about the people responsible for humankind's leap into the skies. It begins with our early dreams of flight up to the present. The reading level would be challenging for younger kids, but there are lots of colorful pictures that would be enjoyed by kids of all ages.

Rating: 🍎 🍎 🍎 🍎

Color Illustrations: Yes

Color Photos: Yes

B&W Illustrations: Yes

B&W Photos: Yes

Publisher: Barron's

ISBN: 0764106333



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**Title:** *Flight: The Journey of Charles Lindbergh*

**Author:** Robert Burleigh

**Number of Pages:** 15

**Grade Level:** 2–3

**Review:** *Flight* is a very well written and illustrated story of how Charles Lindbergh completed his flight from New York City to Paris, France. It would make an excellent read-aloud or a story to share in a small group.

**Rating:** 🍌 🍌 🍌 🍌 🍌

**Color Illustrations:** Yes

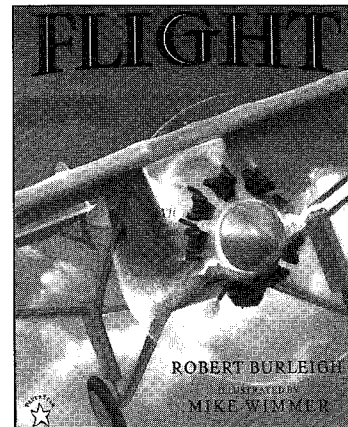
**Color Photos:** No

**B&W Illustrations:** No

**B&W Photos:** No

**Publisher:** Paper Star

**ISBN:** 0399222723



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**Title:** *The Magic School Bus Taking Flight*  
(Based on *The Magic School Bus*)

**Author:** Joanna Cole

**Number of Pages:** 15

**Grade Level:** 2–4

**Review:** If your students enjoy *The Magic School Bus* TV shows, then they'll really enjoy this story. As in the show, Ms. Fizzle takes the kids on a field trip, this time to a model airplane show. Their wild adventure begins after they are shrunk inside one of the model airplanes. From this, they learn about the principles of flight while trying to win the air show contest. A great adventure!

**Rating:** 🍌 🍌 🍌 🍌 🍌

**Color Illustrations:** Yes

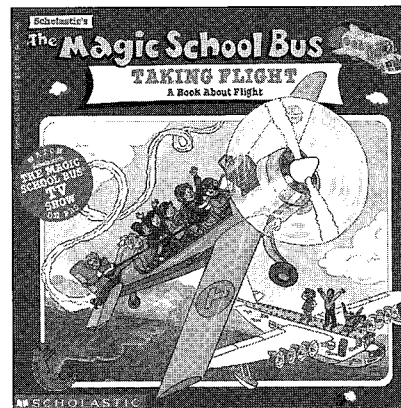
**Color Photos:** No

**B&W Illustrations:** No

**B&W Photos:** No

**Publisher:** Scholastic

**ISBN:** 0590738712



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**Title:** *Up and Away! Taking a Flight*

**Author:** Meredith Davis

**Number of Pages:** 23

**Grade Level:** 3–4

**Review:** If you ever wanted to know what was involved when taking a flight from an airport, this is the book for you. It starts by describing the main parts of an airport, then takes you through the terminal and baggage, to the food being loaded on the plane, preflight check, and more. The illustrations are attractive and the writing is easy to understand. This would be a good book to share in a small group so that you can read it together.

**Rating:** 🍌 🍌 🍌 🍌

**Color Illustrations:** Yes

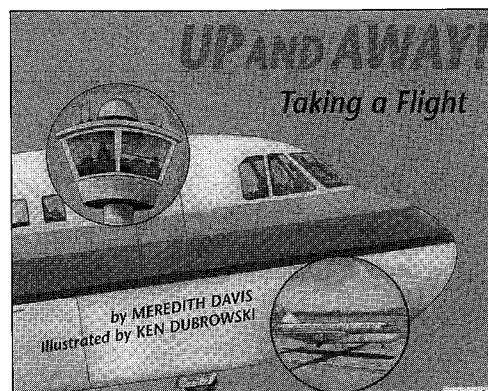
**Color Photos:** No

**B&W Illustrations:** No

**B&W Photos:** No

**Publisher:** Mondo

**ISBN:** 157255214X



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**Title:** *The Wright Brothers:  
How They Invented the Airplane*

**Author:** Russell Freedman

**Number of Pages:** 127

**Grade Level:** 4–6

**Review:** This Newbery Honor book gives a tremendous amount of information about the pioneers of sustained flight. This book includes original photographs taken by Wilbur and Orville and documents their research and development for creating the airplane. The book gives very detailed accounts of the Wright brothers' experiments and goes beyond the average book about the Wright brothers.

**Rating:** 🍌 🍌 🍌 🍌 🍌

**Color Illustrations:** No

**Color Photos:** No

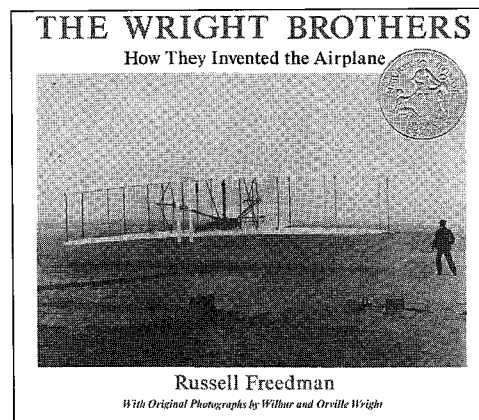
**B&W Illustrations:** No

**B&W Photos:** Yes

**Publisher:** Holiday

House/NY

**ISBN:** 0823408752



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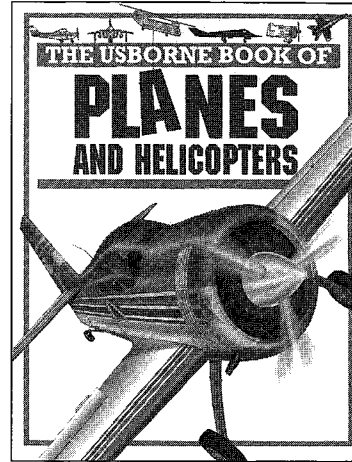
**Title:** *The Usborne Book of Planes and Helicopter*

**Author:** Clive Gifford, Mark Franklin, Sean Wilkinson.

**Number of Pages:** 32

**Grade Level:** 3–5

**Review:** This book covers a wide variety of airplanes and helicopters of all different shapes and sizes. The book has very good color illustrations that also offer cutaway diagrams with labels of some of the more interesting parts of the plane or helicopter. The information provided is specific and brief, very much like the captions in a science book. It also goes into detail of how different parts of an airplane work, like the ejection seat, thrusters, and swing wing.



**Rating:** 🍎 🍎 🍎 🍎

**Color Illustrations:** Yes

**Color Photos:** No

**B&W Illustrations:** No

**B&W Photos:** No

**Publisher:** Usborne

**ISBN:** 0746016581

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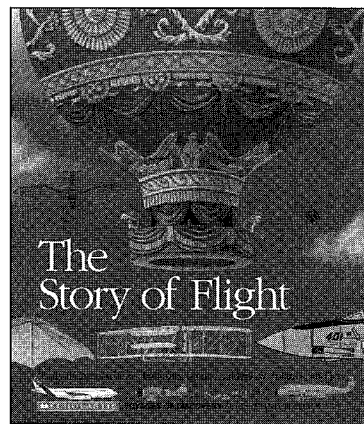
**Title:** *The Story of Flight: Early Flying Machines, Balloons, Blimps, Gliders...*

**Author:** Dan Hagedorn (Editor), Sheila Keenan (Editor)

**Number of Pages:**

**Grade Level:** 3–6

**Review:** This is an incredibly good book. It's stocked full of color illustrations and photos, and uses a variety of materials to create pages. For example, one page has the feel and look of metal and shows what an airliner looks and feels like on the inside and the outside of the fuselage. As a reader, you must pay close attention to the many captions so as not to miss any information.



**Rating:** 🍎 🍎 🍎 🍎 🍎

**Color Illustrations:** Yes

**Color Photos:** Yes

**B&W Illustrations:** No

**B&W Photos:** Yes

**Publisher:** Scholastic

**ISBN:** 0590476432

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**Title:** *Planes, Gliders, Helicopters, and Other Flying Machines*

**Author:** Terry Jennings

**Number of Pages:** 40

**Grade Level:** 3 to advanced (with adult supervision)

**Review:** *Planes, Gliders, Helicopters, and Other Flying Machines* is one book in a series called *How Things Work*. It has easy-to-read text and detailed color illustrations, many of them cut away to show what machines are like inside. "Special Focus On" boxes highlight and explain important scientific principles, and simple "Test It Out!" experiments and activities let you discover for yourself how things really work.

**Rating:** 🍎 🍎 🍎 🍎 🍎

**Color Illustrations:** Yes

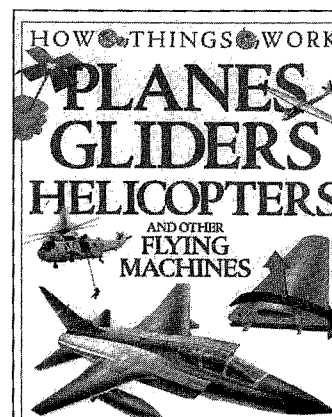
**Color Photos:** No

**B&W Illustrations:** No

**B&W Photos:** No

**Publisher:** Kingfisher Books

**ISBN:** 060605362X



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**Title:** *Airplanes and Flying Machines*

**Author:** Gallimard Jeunesse, Pascale De Bourgoing, Donald Grant

**Number of Pages:** 18

**Grade Level:** 2-3

**Review:** This book is unique in that it has transparent sheets that cover different illustrations, but when lifted reveal the inside of that part of the picture. The book is geared toward younger children, but could be enjoyed by anyone. I would see it as the kind of book you would sit with someone and read.

**Rating:** 🍎 🍎 🍎 🍎

**Color Illustrations:** Yes

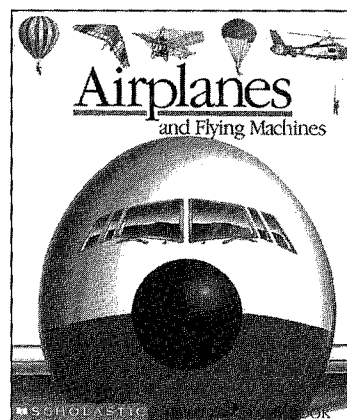
**Color Photos:** No

**B&W Illustrations:** No

**B&W Photos:** No

**Publisher:** Scholastic

**ISBN:** 0590452673



**Title:** *Look Inside: Cross-Sections: Planes*

**Author:** Michael Johnstone, Hans Jenssen (Illustrator)

**Number of Pages:** 32

**Grade Level:** 3–6

**Review:** This book offers detailed cross-section drawings of ten famous airplanes. If you are in need of discovering very fine details, then this is the book to use. It also gives concise information about some of the more interesting parts, such as the machine guns on a Fokker Triplane, the plane that the “Red Baron” made famous.

**Rating:** 🍎 🍎 🍎 🍎 🍎

**Color Illustrations:** Yes

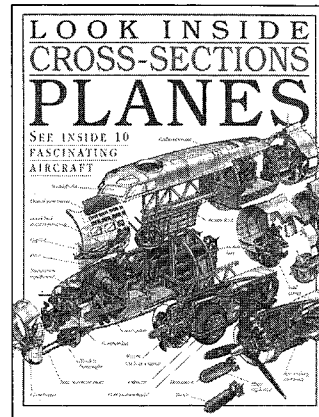
**Color Photos:** No

**B&W Illustrations:** No

**B&W Photos:** No

**Publisher:** DK Publishing Book

**ISBN:** 1564585204



**Title:** *Flight*

**Author:** Donald S. Lopez (Editor)

**Number of Pages:** 64

**Grade Level:** 3–6

**Review:** This is a fantastic book from the Time Life series and The Nature Company. It covers the principles of flight from birds, to squirrels, to high-powered military aircraft. Filled with tons of full-colored illustrations and diagrams, this book would be very appropriate for anyone needing a good resource for explaining flight.

**Rating:** 🍎 🍎 🍎 🍎 🍎

**Color Illustrations:** Yes

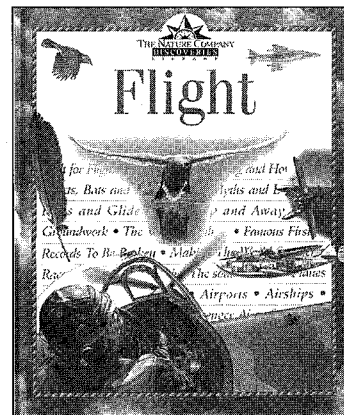
**Color Photos:** Yes

**B&W Illustrations:** Yes

**B&W Photos:** No

**Publisher:** Time Life Books

**ISBN:** 0783547617



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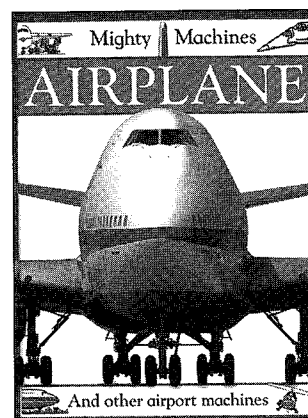
**Title:** *Mighty Machines: Airplane and Other Airport Machines*

**Author:** Christopher Maynard, Deni Bown

**Number of Pages:** 21

**Grade Level:** 2–4

**Review:** *Airplane* takes a close-up look at working airplanes and the support machines needed to get them in the air. Photographs of real machines combine informative text and entertaining artwork to reveal just how they work and what they do. From mechanical details to relative sizes, it also includes really neat facts, such as “The paint alone on a 747 can weigh as much as a large horse.”



**Rating:** 🍎 🍎 🍎 🍎

**Color Illustrations:** Yes

**Color Photos:** Yes

**B&W Illustrations:** No

**B&W Photos:** No

**Publisher:** DK Publishing Book

**ISBN:** 0789402114

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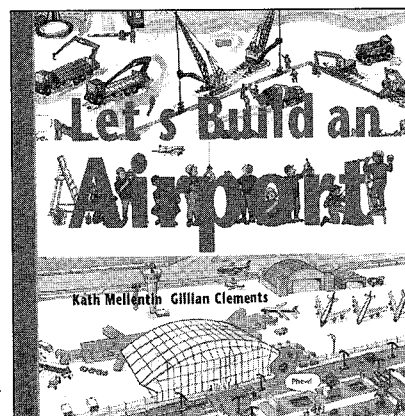
**Title:** *Let's Build an Airport*

**Author:** Kath Mellentin, Gillian Clements (Illustrator)

**Number of Pages:** 15

**Grade Level:** 2–4

**Review:** *Let's Build an Airport* is a great book that goes into excellent detail of how an airport is constructed, yet keeps it simple enough for children to understand. It covers all the people, machinery, and equipment used. The illustrations are cute and fun to look at. The book would be good to share in small groups or to allow students to explore by themselves.



**Rating:** 🍎 🍎 🍎 🍎 🍎

**Color Illustrations:** Yes

**Color Photos:** No

**B&W Illustrations:** No

**B&W Photos:** No

**Publisher:** Zero to Ten

**ISBN:** 1840890266



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**Title:** *Learn About Flight: A Fascinating Fact File and Learn-It-Yourself Project Book*

**Author:** Peter Mellett

**Number of Pages:**

**Grade Level:** 3–6

**Review:** I would compare this book's format to a school science book. It starts by giving a lot of information about a subject such as air resistance and then offers directions on a project to explore the principles that were just discussed. The directions for the projects are clear and would be great for hands-on learning or even science fair ideas.

**Rating:** 🍎 🍎 🍎 🍎 🍎

**Color Illustrations:** Yes

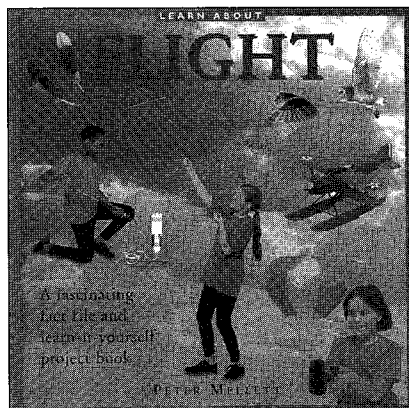
**Color Photos:** Yes

**B&W Illustrations:** Yes

**B&W Photos:** Yes

**Publisher:** Lorenz Books

**ISBN:** 1859673112



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**Title:** *A Field Guide to Airplanes: Completely Revised and Updated*

**Author:** M.R. Montgomery, Gerald Foster

**Number of Pages:** 230

**Grade Level:** 5 to advanced

**Review:** This book is similar to a bird-watcher's guide, except for planes. The reading level is quite high, but the black-and-white diagrams could be used to identify any number of planes you might see on a runway or in the air.

**Rating:** 🍎 🍎 🍎

**Color Illustrations:** No

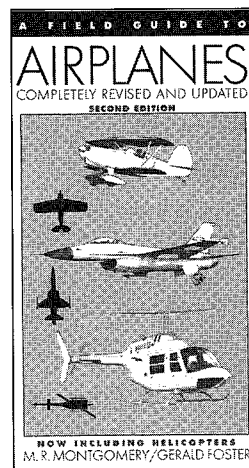
**Color Photos:** No

**B&W Illustrations:** Yes

**B&W Photos:** No

**Publisher:** Houghton Mifflin

**ISBN:** 0395628881



Title: *Flying Machine*

Author: Andrew Nahum

Number of Pages: 62

Grade Level: 4 to advanced

Review: This book contains wonderful color photos, illustrations, and diagrams of about every flying machine known. It offers labeled photographs of every important part of a flying machine. The reading level is a bit more challenging, and some information could be missed if all of the captions are not read. *Flying Machine* is a book that a child is going to want to explore again and again because you never know what you might have missed!



Rating: 🍎 🍎 🍎 🍎

Color Illustrations: Yes

Color Photos: Yes

B&W Illustrations: Yes

B&W Photos: Yes

Publisher: Alfred A. Knopf

ISBN: 0679807446

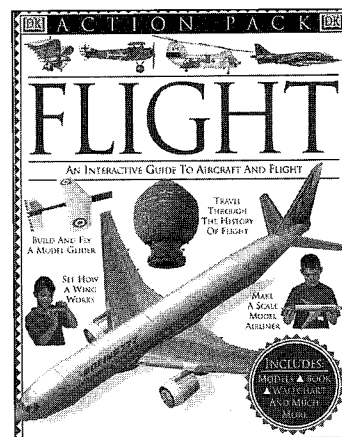
Title: *Action Pack: Flight*

Author: Chris Oxlade

Number of Pages: 15

Grade Level: 4-6

Review: *Action Pack: Flight* is an interactive guide to aircraft and flight. It includes a book full of experiments, a Boeing 777 model, wall chart, flight guidebook, time line, airfoil, glider, helicopter, and a facsimile of a pilot's navigation map. This kit would be a lot of fun to share with a class, especially if you're looking for hands-on activities to demonstrate the principles of flight.



Rating: 🍎 🍎 🍎 🍎 🍎

Color Illustrations: Yes

Color Photos: Yes

B&W Illustrations: No

B&W Photos: No

Publisher: DK Publishing Book

ISBN: 0789410060

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**Title:** *Plane (Take it Apart Series)*

**Author:** Chris Oxlade

**Number of Pages:**

**Grade Level:** 2–3

**Review:** This book takes the major components of a plane and breaks them down into great detail for younger readers. Each page has colorful illustrations and easy-to-understand descriptions of the part being discussed. Each section also includes a “Fact Box” with extra information that might be of interest. The book also includes an index and glossary.

**Rating:** 🍎 🍎 🍎 🍎

**Color Illustrations:** Yes

**Color Photos:** No

**B&W Illustrations:** No

**B&W Photos:** No

**Publisher:** Silver Burdett Press

**ISBN:** 0382396685



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**Title:** *High in the Sky*

**Author:** Steve Parker

**Number of Pages:** 24

**Grade Level:** 3–4

**Review:** *High in the Sky* is an informative book that covers several topics related to flight such as hot-air balloons, pedal power and gliders, radar, and airliners. The information is organized in a step-by-step, easy-to-understand fashion. The illustrations are colorful and interesting. There are even “true/false” questions throughout the book to pick your brain.

**Rating:** 🍎 🍎 🍎 🍎 🍎

**Color Illustrations:** Yes

**Color Photos:** No

**B&W Illustrations:** No

**B&W Photos:** No

**Publisher:** Candlewick Press

**ISBN:** 0763601284



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**Title:** *Inventor's Workshop: Flight*

**Author:** Belinda Recio

**Number of Pages:**

**Grade Level:** 3–6

**Review:** This inventor's kit comes with all the materials necessary to construct a diamond kite, snake kite, two types of gliders, and a parachute. *Inventor's Workshop: Flight* is a fully illustrated guide to inventive thinking, problem solving, and flying creations. The kit even comes with information on how you can patent your own flying machine and obtain a legal document that proves it's your invention.



**Rating:** 🍎 🍎 🍎 🍎

**Color Illustrations:** No

**Color Photos:** No

**B&W Illustrations:** Yes

**B&W Photos:** No

**Publisher:** Running Press

**ISBN:** 0762403462

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**Title:** *Cutaway Jetliners*

**Author:** Jon Richards, Simon Tegg (Illustrator),  
Mike Saunders (Illustrator)

**Number of Pages:** 32

**Grade Level:** 2–3

**Review:** Even though the book is titled *Cutaway Jetliners*, it also offers several color photos of jetliners. The cutaways aren't as detailed as others I've seen. The reading level is fairly easy, yet informative. The book also talks about the different tasks that jetliners perform and specifically mentions business jets.



**Rating:** 🍎

**Color Illustrations:** Yes

**Color Photos:** Yes

**B&W Illustrations:** No

**B&W Photos:** No

**Publisher:** Copper Beech Books

**ISBN:** 0761307443

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**Title:** *Planes*

**Author:** Anne Rockwell

**Number of Pages:** 11

**Grade Level:** 1–2

**Review:** This is a very simple book that would be appropriate for first or second graders. It's a cute story, but does not offer a lot of information.

**Rating:** 🍎 🍎

**Color Illustrations:** Yes

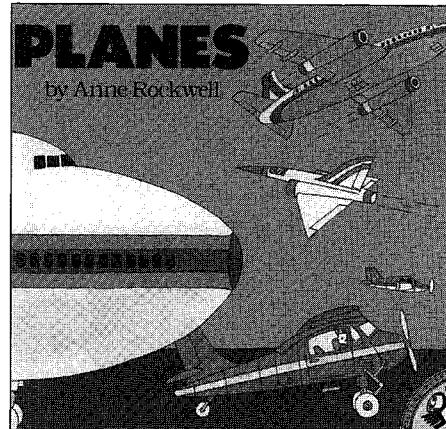
**Color Photos:** No

**B&W Illustrations:** No

**B&W Photos:** No

**Publisher:** Dutton Children's Books

**ISBN:** 0140547827



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**Title:** *Eye Openers: Planes*

**Author:** Angela Royston

**Number of Pages:** 21

**Grade Level:** 2–3

**Review:** This book is unique because it uses photos of models to represent various types of planes. Being a model builder myself, I can appreciate the work involved. Children may find this book appealing because the models offer a nice alternative to drawings or photos of real planes. The information covered is rather basic and the reading level would be comfortable for a second or third grader.

**Rating:** 🍎 🍎 🍎 🍎

**Color Illustrations:** No

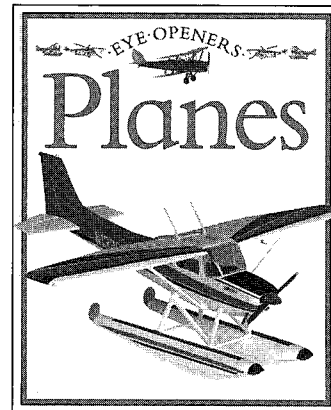
**Color Photos:** Yes

**B&W Illustrations:** No

**B&W Photos:** No

**Publisher:** Little Simon

**ISBN:** 0689715641



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**Title:** *Amelia Earhart: Challenging the Skies*

**Author:** Susan Sloate

**Number of Pages:**

**Grade Level:** 4–6

**Review:** This is a good biographical resource for Amelia Earhart. The book describes her many achievements that helped to spur the growth of commercial aviation and furthered the cause of women's rights. The book captures the excitement of Amelia Earhart's life and the mystery of her disappearance.

**Rating:** 🍎 🍎 🍎 🍎

**Color Illustrations:** No

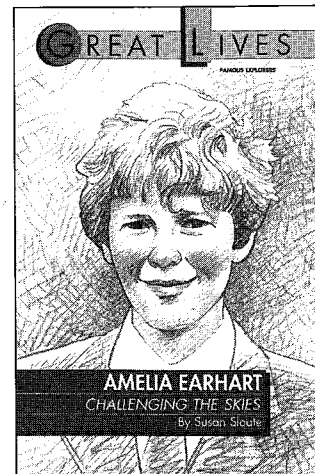
**Color Photos:** No

**B&W Illustrations:** No

**B&W Photos:** Yes

**Publisher:** Fawcett Books

**ISBN:** 0449903966



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**Title:** *Just Plane Smart: Activities for Kids*

**Author:** Ed Sobey

**Number of Pages:** 92

**Grade Level:** 3 and over (with adult supervision)

**Review:** *Just Plane Smart* is a book full of airplane puzzles, aviation trivia, factoids, and scientific tidbits. This would be a great book to supplement any lessons that you may be teaching on aviation. The activities are fun and the information is interesting.

**Rating:** 🍎 🍎 🍎 🍎

**Color Illustrations:** No

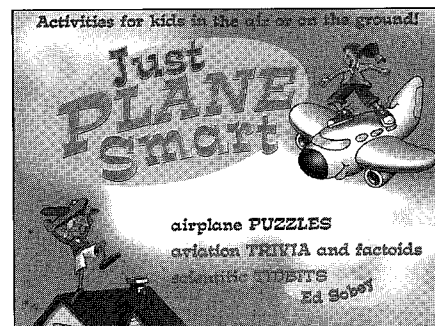
**Color Photos:** No

**B&W Illustrations:** Yes

**B&W Photos:** No

**Publisher:** Learning Triangle Press

**ISBN:** 0070595984



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Title: *How Do Airplanes Fly?*

Author: C.E. Thompson

Number of Pages: 32

Grade Level: 2-4

Review: This straightforward book explains many of the major principles of flying, and answers many questions that are often posed by young people interested in flying, such as “How does the pilot turn left or right?” or “How does the pilot land the plane?” or “What happens when a plane takes off?”

Rating: 🍎 🍎 🍎 🍎 🍎

Color Illustrations: Yes

Color Photos: Yes

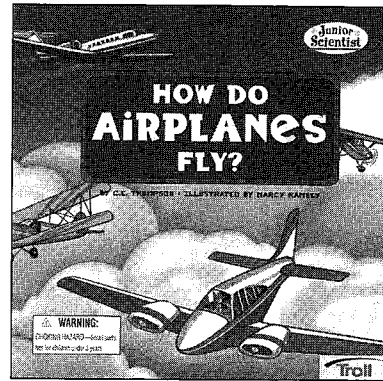
B&W Illustrations: Yes

B&W Photos: No

Publisher: Troll

ISBN: 0590897403 OOP see Troll version

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Title: *Molly Takes Flight*

Author: Valerie Tripp

Number of Pages: 47

Grade Level: 3-4

Review: *Molly Takes Flight* is an excellent story that is written to especially appeal to young girls interested in aviation, but would be appropriate for anyone. The story would be most appropriate as a read-aloud. It also includes directions at the end of the story for constructing a “stargazer” that is similar to what the main character used in the story.

Rating: 🍎 🍎 🍎 🍎

Color Illustrations: Yes

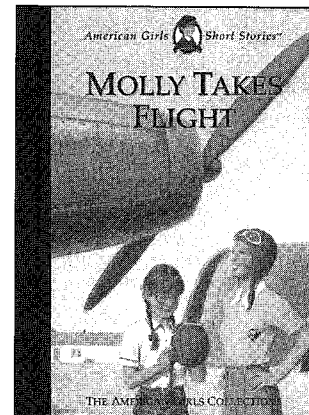
Color Photos: Yes

B&W Illustrations: Yes

B&W Photos: Yes

Publisher: Pleasant Company Publications

ISBN: 1562477676



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**Title:** *The Airplane Book*

**Author:** Cheryl Walsh Bellville

**Number of Pages:** 48

**Grade Level:** 3–6

**Review:** *The Airplane Book* follows a popular theme in aviation books. It begins by talking about early gliders, to the Wright Brothers, up to today's modern aircraft. The book is written in more of a story format, as opposed to an information book. There is a wide variety of color photos of many different kinds of planes in action. The book also includes a glossary of terms.

**Rating:** 🍌 🍌 🍌 🍌 🍌

**Color Illustrations:** Yes

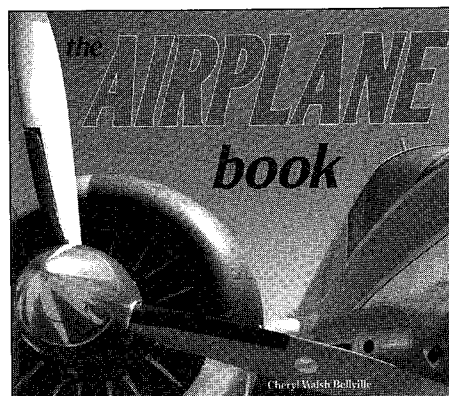
**Color Photos:** Yes

**B&W Illustrations:** No

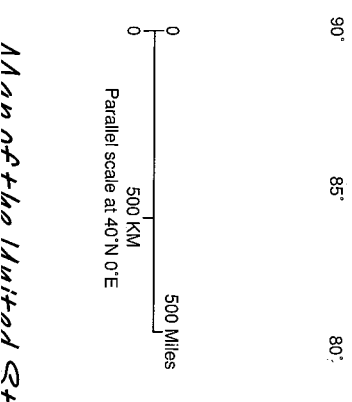
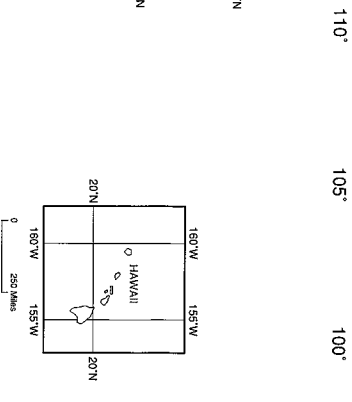
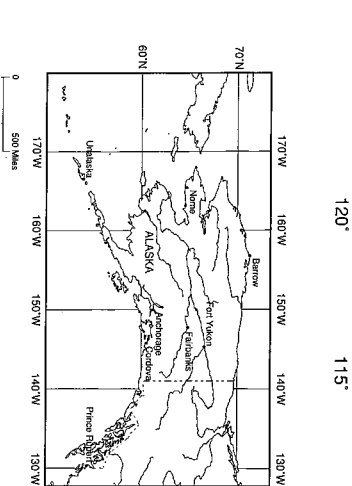
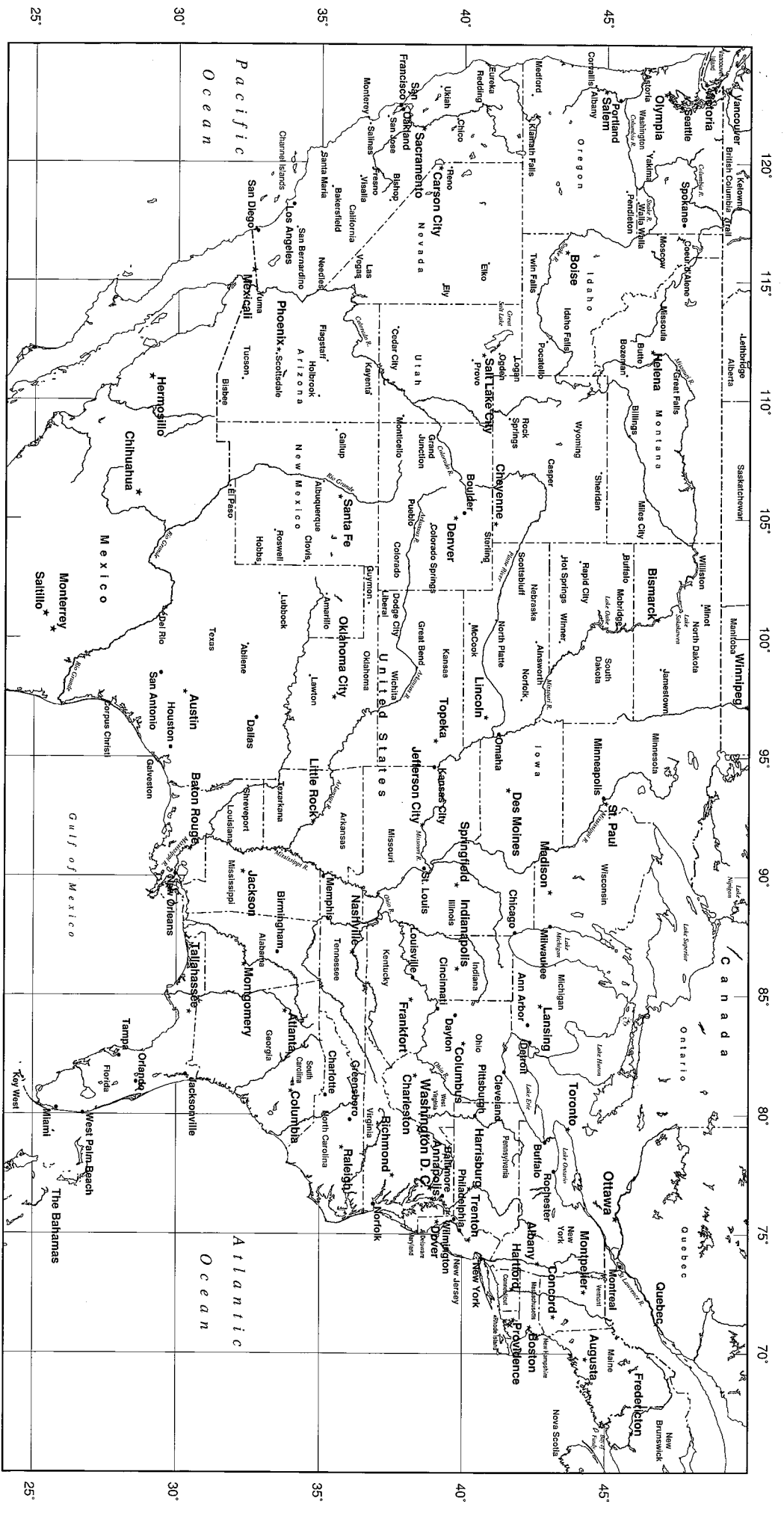
**B&W Photos:** No

**Publisher:** Carolrhoda Books, Inc.

**ISBN:** 0876146183







*Map of the United States*

*Your feedback is important to us!*

**Please take a moment to fill out the attached card with your comments and suggestions.**



Did you use this Activities Guide in your classroom?

**Yes**     **No**

Did the students enjoy the activities?

**Yes**     **No**

Which activities were the students' favorites?

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Did you find the activities easy to use?

**Yes**     **No**

Did your students find the concept of business aviation interesting?

**Yes**     **No**

Was this Activities Guide used in more than one classroom?

**Yes**     **No**

Would you recommend the Activities Guide to other teachers?

**Yes**     **No**

Did you visit [www.avkids.com](http://www.avkids.com)?

**Yes**     **No**

Any comments?

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What can we do to improve the Activities Guide?

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Name \_\_\_\_\_

Address \_\_\_\_\_

School \_\_\_\_\_

Grade level \_\_\_\_\_

Email \_\_\_\_\_



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