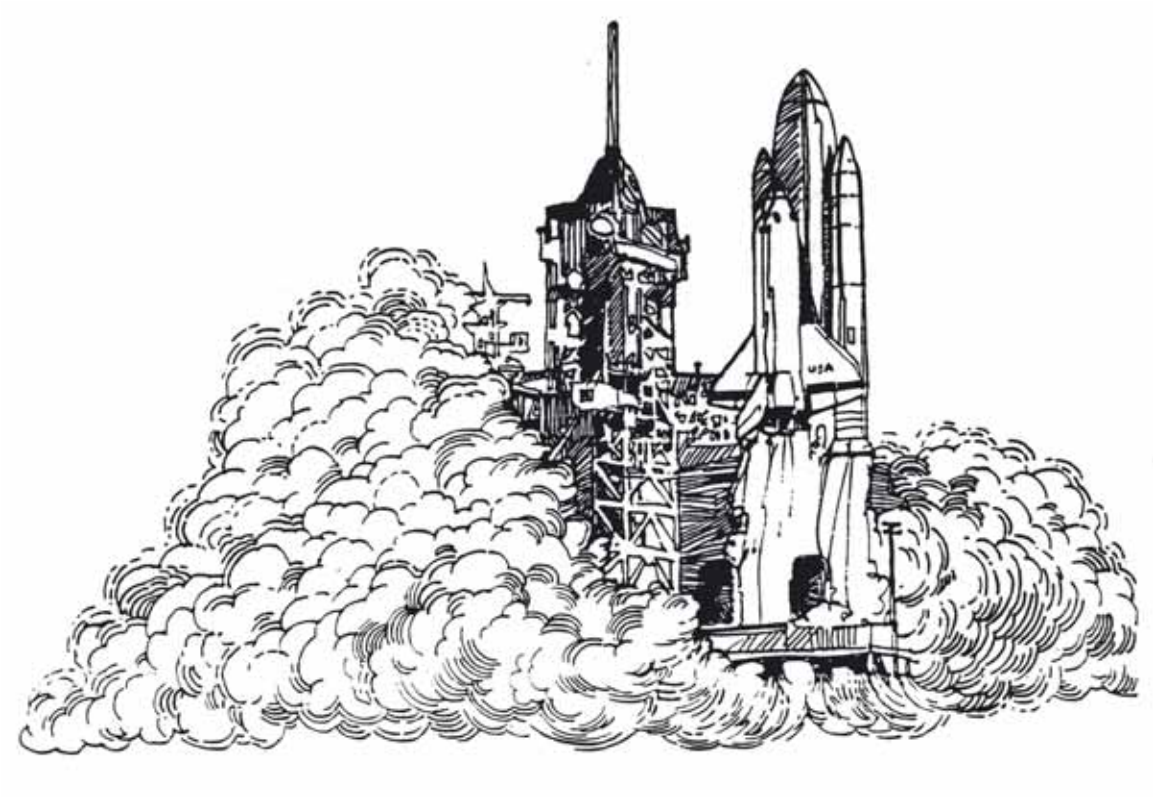
Exploration – Rockets Away



Can the stars tell us about life on earth? Engineers are exploring life on earth with satellites. To launch satellites into space engineers must, study the effects of thrust and design. In "Rockets Away" engineers help students explore the effects of design and thrust on flight by constructing a model rocket powered by compressed air to carry a load of six paper clips.

This is an independent learning activity from **A World in Motion**, free elementary school physical science supplement for grades 4-6, produced by the Society of Automotive Engineers. This activity was written for 6th grade students.

Most students will be able to work through this activity without help although the activity can be completed by a student working alone, it is designed to promote an understanding of how scientists and engineers work and is therefore intended to be completed by small groups.

Can the Stars Tell About Life on Earth?

(This portion given to the engineer/teacher)

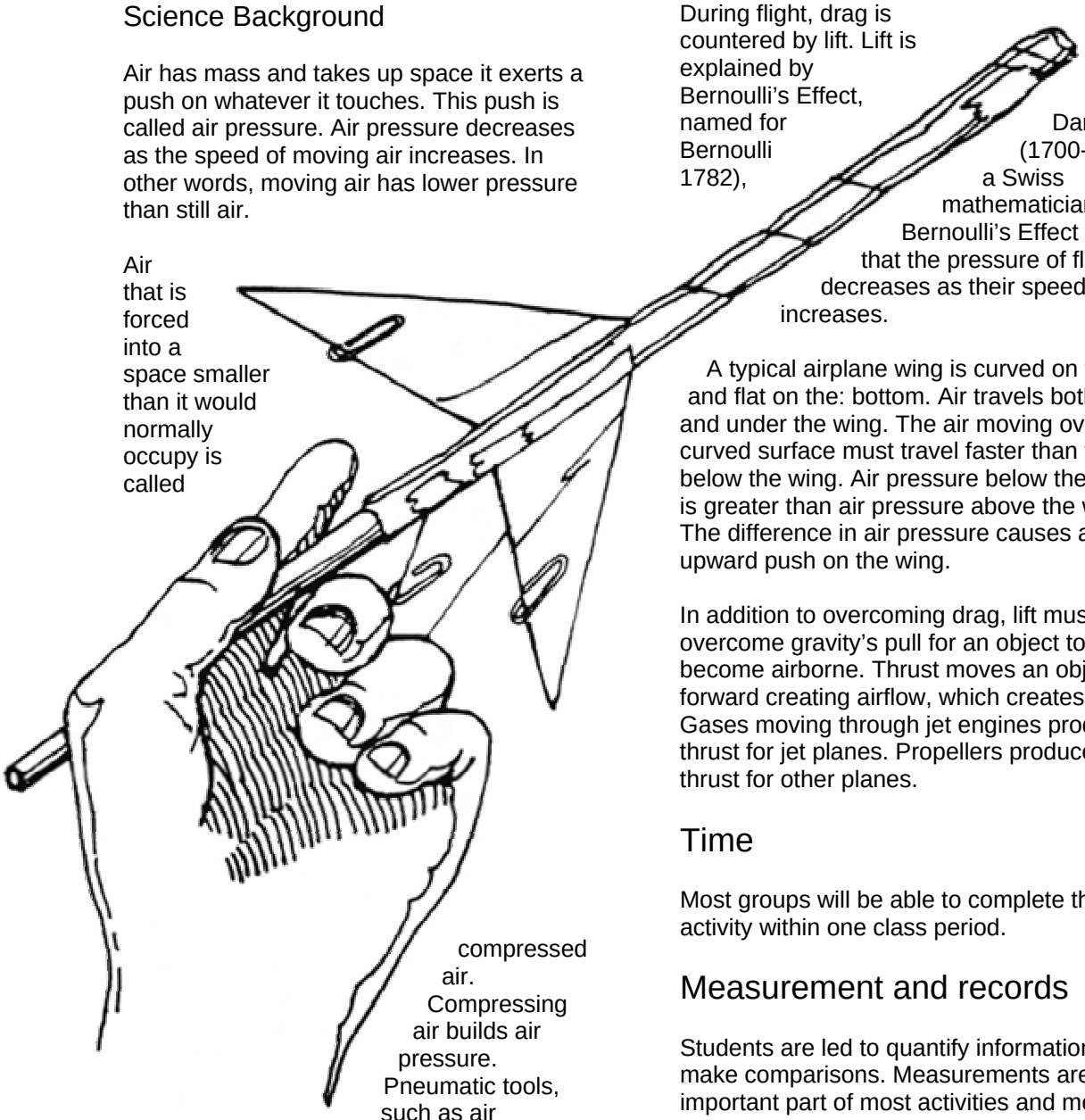
Key Concept

Thrust- Thrust gives the forward movement needed to overcome gravity.

Science Background

Air has mass and takes up space it exerts a push on whatever it touches. This push is called air pressure. Air pressure decreases as the speed of moving air increases. In other words, moving air has lower pressure than still air.

Air that is forced into a space smaller than it would normally occupy is called compressed air. Compressing air builds air pressure. Pneumatic tools, such as air hammers and drills, use compressed air to operate. Compressed air is also used in scuba tanks and tires.



Air rubs against whatever moves through it. Air friction, or drag, slows moving objects by Breaking up air into whirlpools, called eddies, as the air passes an object. Drag increases as the surface area blocking incoming air increases or as an object's speed increases. Streamlined shapes reduce drag by letting air flow smoothly over them.

During flight, drag is countered by lift. Lift is explained by Bernoulli's Effect, named for Bernoulli (1700-1782), a Swiss mathematician. Bernoulli's Effect states that the pressure of fluids decreases as their speed increases.

A typical airplane wing is curved on top and flat on the: bottom. Air travels both over and under the wing. The air moving over the curved surface must travel faster than the air below the wing. Air pressure below the wing is greater than air pressure above the wing. The difference in air pressure causes an upward push on the wing.

In addition to overcoming drag, lift must overcome gravity's pull for an object to become airborne. Thrust moves an object forward creating airflow, which creates lift. Gases moving through jet engines produce thrust for jet planes. Propellers produce thrust for other planes.

Time

Most groups will be able to complete the activity within one class period.

Measurement and records

Students are led to quantify information and make comparisons. Measurements are an important part of most activities and metric measurements are used throughout. Students are typically asked to run three trials and find and record the average result.

Records should be part of the activity. A sample record can be found at the back of this activity.

The Right Answer

Although expected results are indicated teachers should encourage students not to be intimidated by unexpected data. A surprise result should be viewed as an opportunity for science detective work and further discovery while investigating what influenced the result. Major goals of **A World in Motion** are to provide practice in problem solving and application of the scientific approach, as well as opportunities for hands-on learning. As long as a student is participating, he or she cannot fail to achieve these goals.

Safety

This activity poses no serious high-risk danger to students. As an extra precaution, students are sometimes advised to wear safety glasses and are cautioned to use care. Caution statements are in bold type. A general review of safety in the science lab is recommended for all students. Teachers must take responsibility for taking additional precautions as appropriate for their individual classes.

Explore Further

Help students continue to discover the science and engineering in the world around them. Tell them: when you throw a ball your arm supplies thrust. When you kick a ball into the air, your leg supplies thrust. Then ask them to list examples of other objects that overcome the force of gravity when you supply thrust. Next to each example, write where the thrust comes from.

If you would like a complete A World in Motion kit, would like to volunteer to bring the kit into a classroom, or need additional information, contact the SAE Education Program Coordinator at (412) 776-4841 or call 1-800-457-AWIM, 4-7 p.m. EST.

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Can the Stars Tell About Life on Earth?

(This portion is given to students.)

Looking back an Earth can tell us many things. From space we can see the weather, changes in our environment, and even shifts in the flow of a river.

Engineers are exploring life on Earth with satellites. Satellites can watch for storms and help us see into volcanoes. With communications satellites we can talk to friends in faraway places and watch television from other countries.

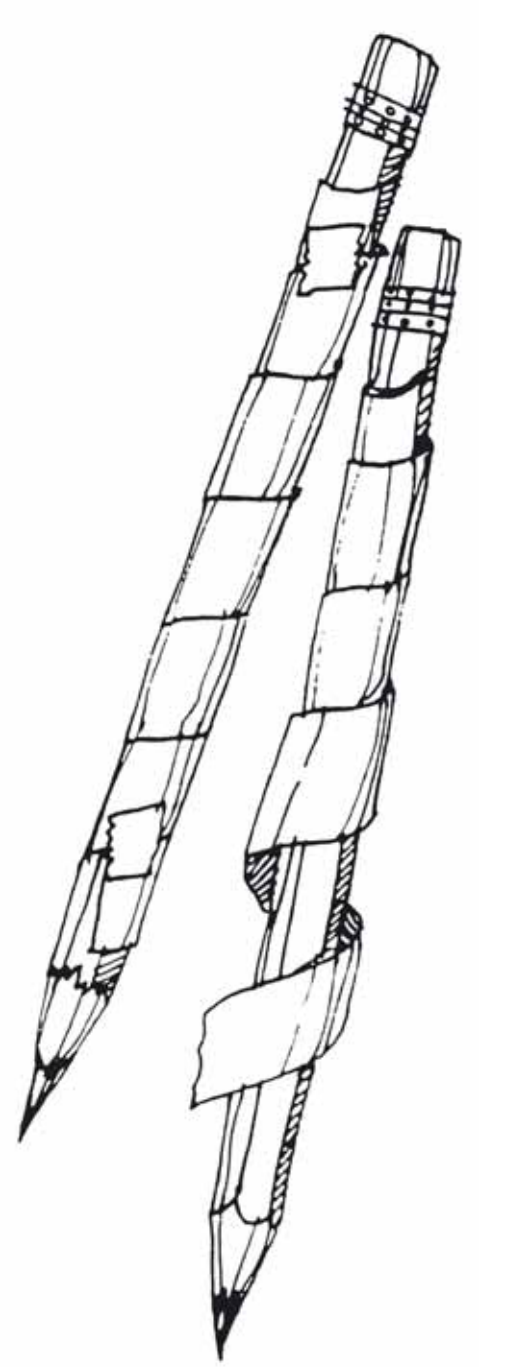
But to launch satellites into space engineers must study how much thrust is needed to help machines such as rockets and airplanes fly. They design these machines to carry heavy, loads, such as satellites, long distances. Engineers explore many things to find the design and the amount: of thrust needed to gin these machines a long flight.

You can explore the effects of design and thrust on flight too with this activity

Explore

To fly as long as possible, how should a model rocket powered by compressed air carry, a load of six paper clips?

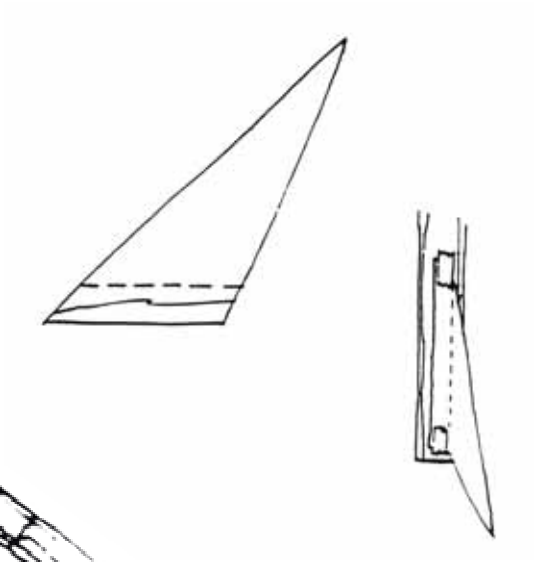
To answer this question, you need to make and fly, a model rocket powered by compressed air. You must fly the rocket several times. Each time you must load the paper clips in a different way. You must measure each flight so you can compare them all at the end**. Never aim your rocket at anyone.**

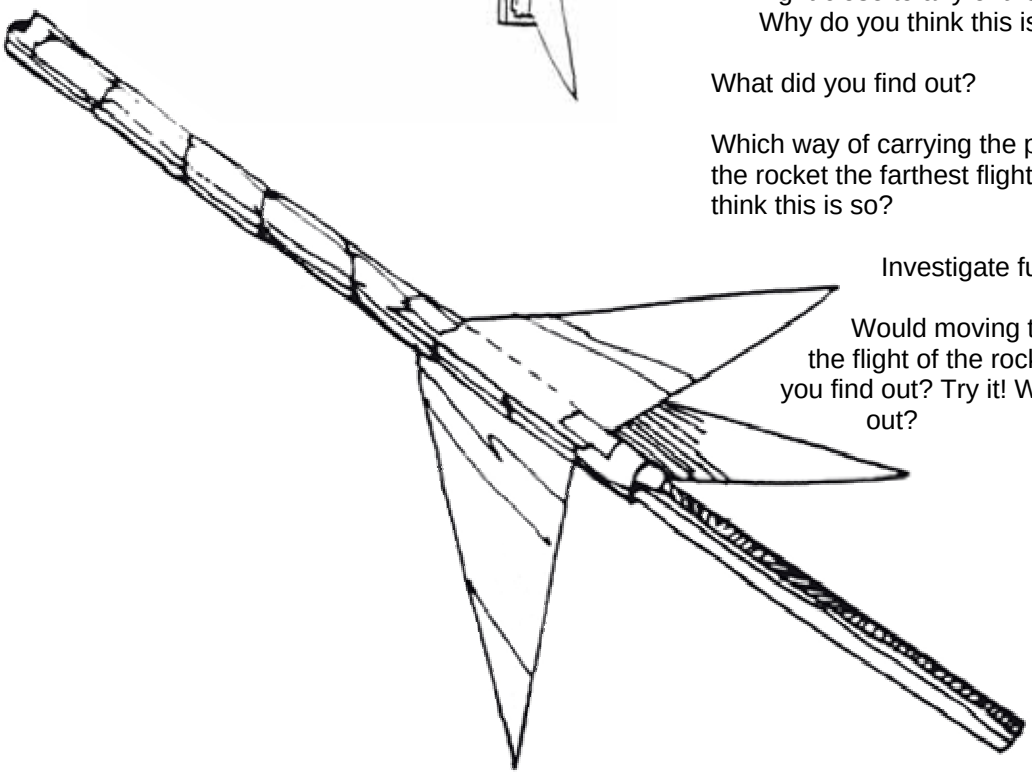


1. Cut a 3 X 28 centimeter (cm) paper strip. Make a paper tube by wrapping the strip tightly around a pencil as shown. Use transparent tape to tape the ends to keep them from unwinding. Remove the pencil. Tape one end of the tube shut.

2. Trace the rocker fin pattern and use it to make three paper fins. Label them 1, 2, and 3. Tape the fins to the tube as shown. Space them evenly. Put two paper clips on each fin. Put a straw halfway into the rocket.

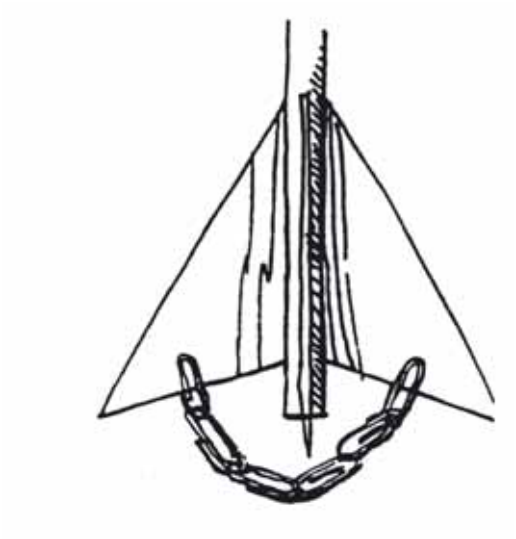
3. Find a long, clear area in which to work. Use masking tape to mark a launch pad on the floor. Stand at the mark, to launch your rocket. Caution: Do not aim the rocket at anyone. Hold the rocket straight and blow hard through the straw. Measure and record the distance the rocket traveled.





4. Put all six paper clips on fin 2. Repeat step 3. Try to blow with the same force. Did the rocket fly as far?

5. Remove the paper clips. Put three clips on fin 1 and three on fin 3. Repeat step 3.



6. Remove the paper clips. Make a chain and attach it to fins 1 and 3 as shown. Repeat step 3. Was the distance of this flight close to any of the other flights? Why do you think this is so?

What did you find out?

Which way of carrying the paper clips gave the rocket the farthest flight? Why do you think this is so?

Investigate further:

Would moving the fins change the flight of the rocket? How, could you find out? Try it! What did you find out?

Record Sheet

Name				
	Trials			Average
	1	2	3	

Use either the upper or lower section to write or to draw the chart you need. Use the lines as guides. **To find an average, add the results for each trial and divide by the number of trials.**