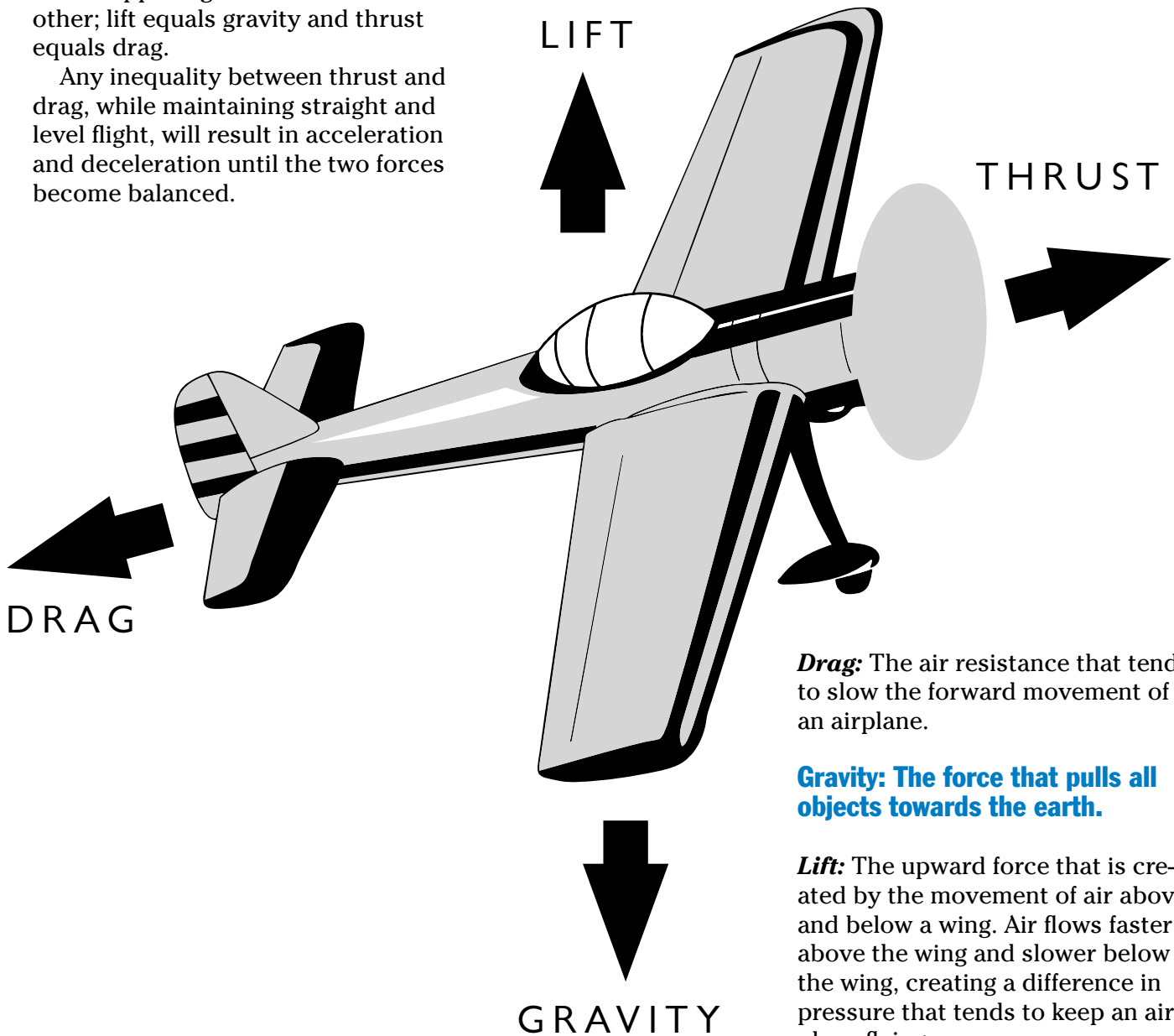


THE FOUR FORCES OF FLIGHT—GRAVITY

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 and deceleration until the two forces 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

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)*

GRAVITY

Gravity Busters



PROCEDURE:

1. Using Blackline 1, construct Gravity Buster.
2. Within their groups, students test their individual Gravity Busters by standing on a chair and releasing 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 the release and stop at the 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 they are dropped.
3. Add or remove weight.

CULMINATING ACTIVITIES:

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

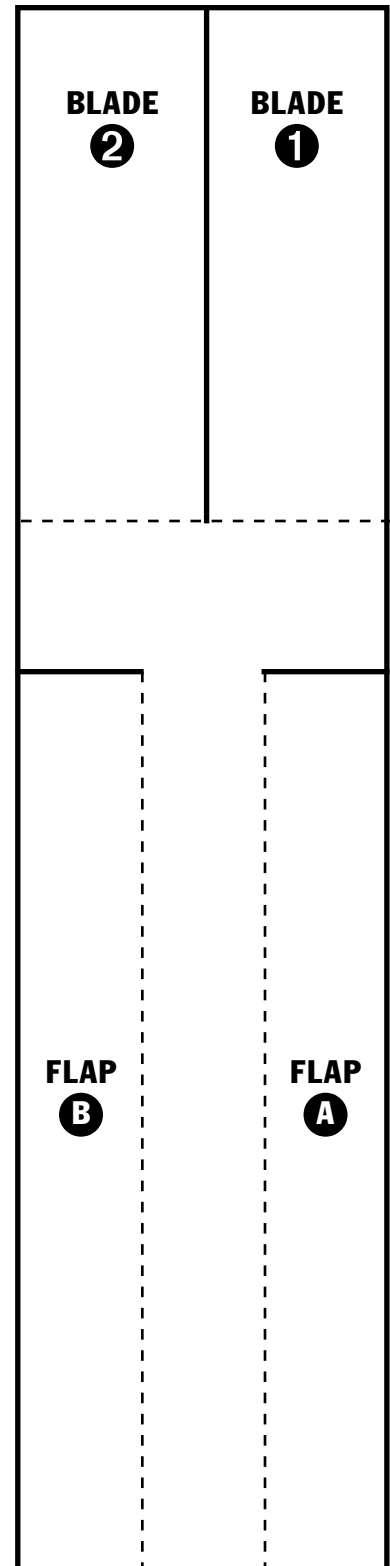
GRAVITY 



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  ↓

Gravity Busters



GROUP DATA SHEET

Pilots:

	DESCENT TIME SECONDS FROM RELEASE TO LANDING			
WEIGHT ADDED	TRIAL 1	TRIAL 2	TRIAL 3	AVERAGE TIME (IN SECONDS)
NO STAPLES				
ONE STAPLE				
THREE STAPLES				

