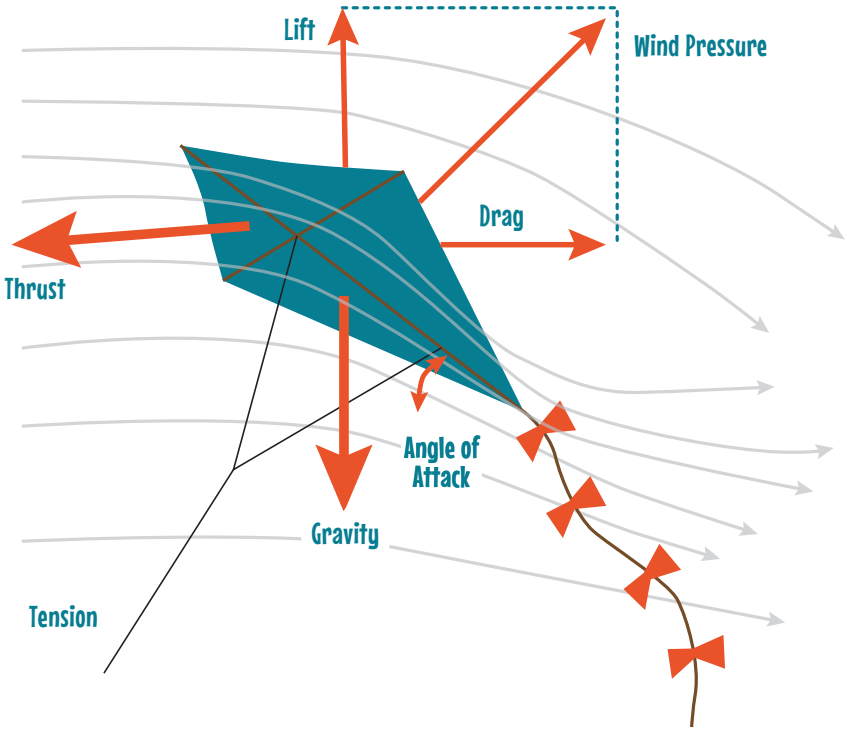
Investigate: Paper Airplane Kites



LIFT, DRAG, AND GRAVITY

Kites and airplanes are heavier-than-air objects that are flown by the **lift** created by air in **motion** over their wings. An airplane relies on **thrust** from a **propeller** or engines. A kite is tied in place and needs moving air (wind) to fly. There are many possible kite shapes. Each of these shapes, and how they use their **aerodynamic** features will determine if or how it flies.

Wind moving across the sail of a kite creates **pressure**. **Lift** results from this wind **pressure** being ***deflected*** along the face of the kite. In other words, the wind ***pushes up*** on the kite. Think of wind **pressure** like a hand, **pushing** the kite up into the sky and holding it there. If the hand is removed, the kite will fall. At the same time, wind passing **over** the top of the kite creates an area of **low pressure**, like a vacuum, along the back of the kite. This creates a **pull** from behind.

Three basic **forces** act on kites (gliders): **lift, gravity and drag** (airplanes have a fourth force: **thrust**)

Drag is created by wind resistance on the kite's surface (and tail). **Drag** can also result from turbulence (bumpy wind) behind the kite. **Gravity** is the downward **force** created by the **weight** of the kite. **Thrust** is the **force** of the wind which creates **lift**. To fly, a kite needs to have enough **lift** to overcome **gravity** and **drag**.

Angle of attack...

All four **forces** - **lift, drag, gravity,** and the **thrust** of the wind come together in the kite at a place called the **center of pressure**. And not surprisingly, that's where you tie your kite string. We call this special place the **tow point**. By moving the place where your string is attached to the kite on the **bridle line**, you can change the amount of **lift** that is created. You do this by changing what we call the **angle of attack**. This is the angle that the kite leans into the wind.

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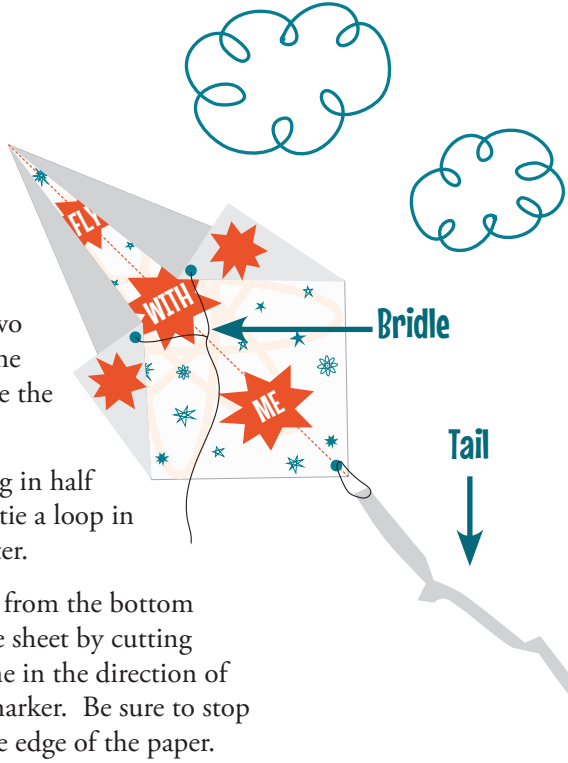
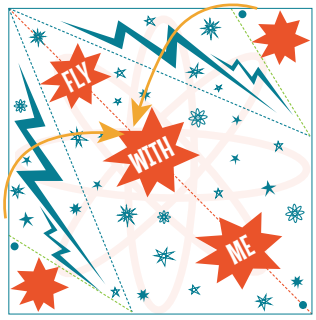


MATERIALS:

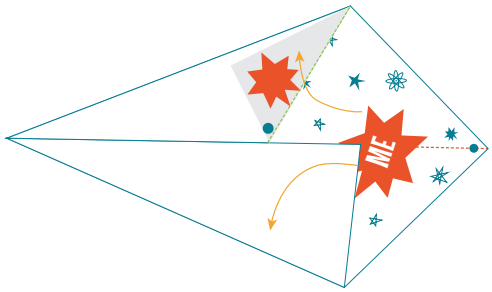
- 15 ft Clear Fishing Line
- a Sharp Pencil
- 1 Sheet of White Paper
- 3 Paper Reinforcers or Masking Tape
- Safety Glasses
- 1 Printer

PROCEDURE:

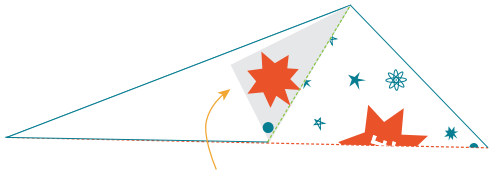
1. Print out the kite pattern (on next page).
2. Cut out the square kite (as shown).
3. With the design facing up, fold along the lines marked in **BLUE** and line up the edges of the paper at the **ORANGE** line in the middle.



4. Fold along the **GREEN** lines in the opposite direction.



5. Then, fold the square in half along the center **ORANGE DIAGONAL** line. Be sure to match up the corners.



6. Use a sharp pencil to punch our the holes marked in **BLUE** and place paper reinforcers or use masking tape to strengthen the hole.
7. Use fishing line to tie a knot in the two holes across the wings to make the bridle.
8. Fold the string in half and carefully tie a loop in the exact center.
9. Make the tail from the bottom portion of the sheet by cutting along each line in the direction of the triangle marker. Be sure to stop just before the edge of the paper.
10. Make a hole in one end of the tail and tie it to the single hole at the bottom of the kite.
11. Wrap about 15 feet of kite string around a scrap piece of cardboard.
12. Attach the free end of the string to the bridle loop.

TEST IT:

If it didn't work or you have even **BETTER** ideas…. Try again! **OBSERVE** and **RECORD DATA**

1. Set up and LAUNCH!

2. Did it work?

3. What should I change?

4. What should I keep the same?

5. What did I learn?

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