Glider, Flying Saucer, It's A Plane!

Grade Level: 6

Time Required: 2 class periods

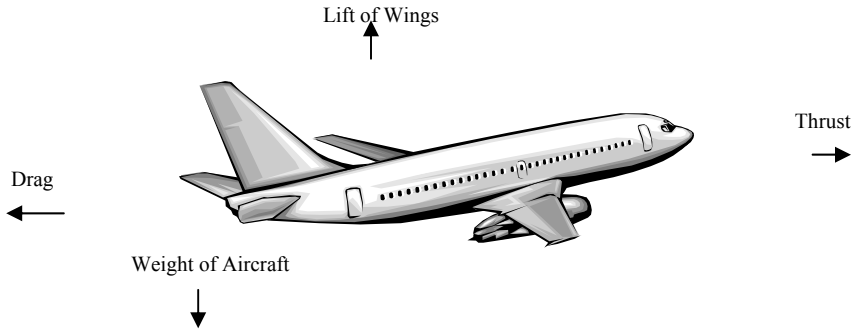
Suggested TEKS:	
Science -	6.6
Math -	6.9
Suggested SCANS:	
Technology. Applies technology to task.	
National Science and Math Standards	
Science and Technology, Physical Science, Observing, Communicating	

Countdown:

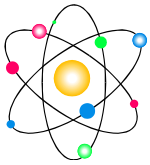
White Paper
Tape
String (3 1/4" piece per student)
Pencils
Paper Clips (7 per student)
Cardboard of Poster Board
Paper Fastener (1 per student)
Scissors
Glue

Ignition:

The four forces acting on an aircraft in flight are: weight, lift, thrust, and drag. The design of an aircraft accounts for these forces.



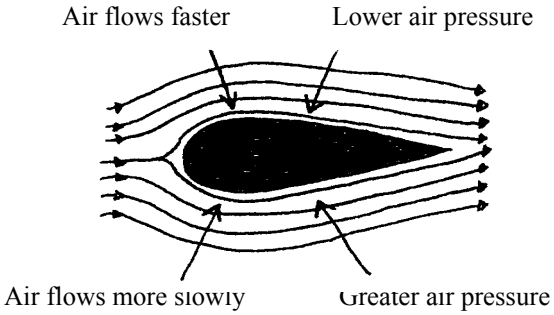
Weight, or gravity, is the force which pulls objects towards the earth. The pull of the earth's gravity accelerates everything downward at the same rate – no matter how much they weigh.



Lift is the opposite force of weight. It occurs when the air pressure below an object is greater than the air pressure above the object. Known as the Bernoulli effect, lift can be demonstrated as follows:

1) Hold a sheet of thin paper at eye level, parallel to the floor.
2) Blow hard over the top.
3) Instead of hanging limply, the far end begins to lift into the air.

The harder you blow, the higher the lift. See diagram below. Wings are able to lift gliders as well as jumbo jets into the air. Lift is created in flying saucers by the raised circles.

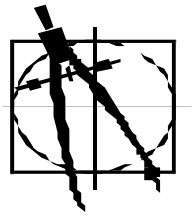


Wing of a plane

Thrust is the force that makes an object airborne and then causes it to continue to move. Isaac Newton's Third Law of Motion states that for every action, there is an equal and opposite reaction. For example, each time you walk, your feet push down on the ground (action) and the ground pushes up with equal force (reaction).

For a gasoline-powered plane, the propellers provide thrust. In rockets, the blast of hot gases from the tails pushing on the air provide the thrust for take-off. Once in the air, the reaction is between the rocket and the gases rushing from the engine, which thrust the rocket forward and the gases back. Students will provide thrust when they launch their paper airplanes (gliders) and flying saucers.

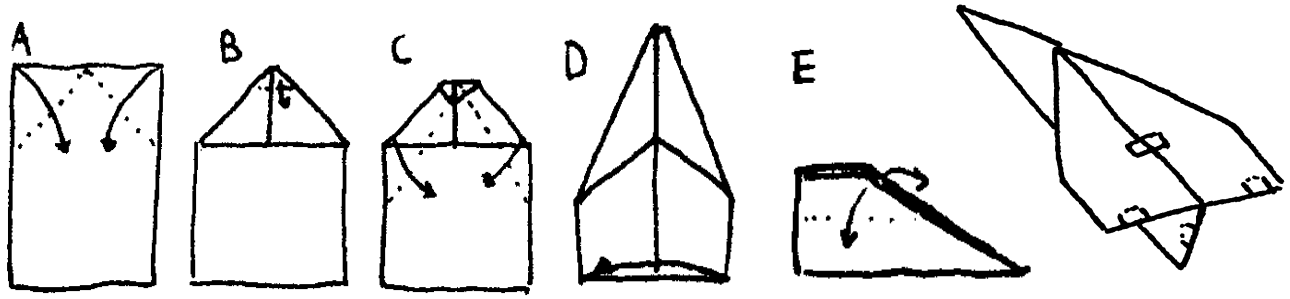
Drag is the force that opposes thrust. It is friction (or resistance) of the air to an object moving through it. Students will feel drag on the airplane and the saucer when their hands whip through the air for launching. To keep drag to a minimum, aircraft are especially shaped or "streamlined". The purpose is to get air to flow around them as smoothly as possible. One of the best-streamlined shapes is a slim teardrop.



Liftoff:

A. Make an airplane (glider)

1. Have each student fold a sheet of white typing paper according to the 5 steps shown in the figure that follows. Emphasize the importance of folding and creasing the paper carefully; each side of the plane is symmetrical.

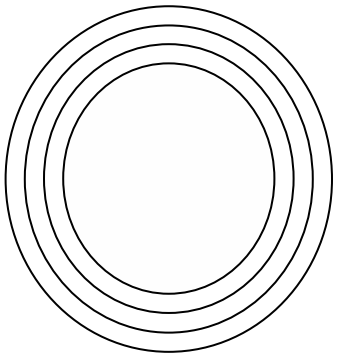


2. Launch planes in a large field or other clear area (like the gym). Compare and contrast flight times, distances, and ability of aircraft to soar.
3. After all planes have flown, ask students to experiment with another piece of paper to make the aircraft more streamlined. They may also choose to add weight by attaching a paper clip to the nose of their planes.

B. Make a flying saucer

Tell your students they will make a flying saucer with four cardboard circles.

1. Discuss how to make a circle by using a piece of string and a pencil. Tell the students to hold the nearest edge of the string steady, in one place. Loop the farthest edge of the string once around the pencil; secure it. Hold the pencil tautly and draw a full circle around the enter point. This is the pattern that will be traced on the cardboard to make the largest circle (6 inches in diameter).
2. Students will then cut the string one-half inch to make a small circle. They will follow the same procedure as above to make a 5-inch diameter circle from the cardboard.
3. For the third circle, cut the string one-half inch once again and make a 4-inch cardboard circle.
4. Repeat the same procedure to make the 3-inch circle.
5. The largest circle will be the base. The second circle is glued to the base. The third and fourth circles are to be glued in the same manner, similar to the picture below.



6. Fit a paper fastener (brad) into the middle point of the smallest circle, and spread the blades on the bottom side. Tape them securely.
7. Ask students to launch their saucers with a flip of the wrist, similar to how they would throw a Frisbee. The saucer will fly until the combined forces of gravity and drag overcome the forces of lift and thrust. The currents of air will also react with the design of the saucer, affecting how it flies. Its circular design and rotation should allow it to slice through the air with less resistance than the plane. The length of airtime will vary. Make comparisons and contrasts with a Frisbee and with the paper airplane.
8. Finally, to experiment with the effect of "weights" and balance of the craft, students may wish to add 6 large paper clips – evenly placed around the circle. They should be taped down on both sides of the saucer.

More Ideas …

- Discuss the three main parts of a glider: wings, body, and tail assembly. Each part has a streamlined design that creates minimum drag. When a glider flies through the air, it has certain glide ratio. This ratio is forward motion to backward motion. Or it may be called ground distance covered to kilometers of altitude lost. For teaching strategies with ratio see the following link:
  (http://trc.dfrc.nasa.gov/shape/TCU/radio.htm)
- Research gliders in conjunction with lessons on transversal lines and slope. See the following links: (http://trc.dfrc.nasa.gov/shape/TCU/trans.htm)and
  (http://trc.dfrc.nasa.gov/shape/TCU/jdslopes.htm).