

Basic introduction to the world of flight

Introduction:

- People have always understood that flight was possible from observing birds, but it took thousands of years to actually achieve and there were many hurdles along the way.
- What are some examples of things that fly? Birds, planes, hot air balloons etc
- Can you group them into different types of flight? How about grouping them into natural and man made things?
- Flying is defined as controlled movement through the air and includes sustained, controlled and powered flight.
- Flight is the actual process of flying, many things can become airborne but are they actually flying and under control? What role does gravity play in our efforts to fly?

Wings, aerofoils and the forces of flying:

- Let's look at some of the common characteristics of things that fly. Looking at bird wings and plane shapes the main characteristic is the aerofoil shape.
- The wings of birds and planes have what is called an aerofoil shape. This aerofoil shape helps us overcome weight which is the effect of gravity pulling down on the mass of the aircraft.
- The aerofoil shape gives us something called lift. This is the upward force required to overcome gravity, being produced by a wing as it moves through the air. This action allows the object to lift up and push forward.
- Something that slows us down is drag, which is the resistance to airflow and consequently slows the progress of an aircraft through the air, arising from disturbing the air as it moves through it, and from the skin friction due to the viscosity or 'stickiness' of the air. The drag force is opposite to the flight path.
- Thrust is the forward force required to move an aircraft through the air, overcoming drag (and providing sufficient speed for a wing to develop enough lift to fly). This must be provided by an engine, by gravity (glider, sailplane) or by muscles (birds).

How do we control flight?

Control of an aircraft is on three axes: Yaw, pitch and roll. Moving parts of the wing, tailplane and fin surfaces change the camber of these parts and affect their lift (and their drag) and provide forces to change the aircraft's path.

- Rudder controls Yawing (left/right)
- Elevators control pitching (nose up/down)
- Ailerons control rolling

Bernoulli's principle:

Bernoulli's principle helps explain that an aircraft can achieve lift because of the shape of its wings. They are shaped so that air flows faster over the top of the wing and slower underneath. Fast moving air equals low air pressure while slow moving air equals high air pressure. The high air pressure underneath the wings will therefore push the aircraft up through the lower air pressure.

Demonstrations:

There are a number of useful demonstrations you can do to help explain flight, they include:

- Using a hairdryer to float ping-pong or polystyrene balls.
- Releasing a blown up balloon so that it flies up a string connected from one side of a room to the other.
- Helium balloons.
- Giant air blowers to help show the Bernoulli principle in action.
- Throwing paper airplanes of different designs, which work better and why?

Activities:

- Your challenge is to hold a rectangular piece of paper close to your mouth, blow across the top of it and get the paper to move down. Sounds simple enough but give it a go and see if you change your mind.
- Next, try and make a piece of paper into a simple bridge and get the bridge to rise up by blowing under it.
- Your final challenge is to hold 2 paper strips near your mouth, blow between them and get them to fly apart.

What's happening?

You might find the results of these challenges surprising. You blew across the paper and it went up rather than down! You blew under the bridge and the bridge went down, rather than up. You blew between the streamers and they moved in, not out.

- Your fast moving breath has less push (less air pressure) than the still air below the paper.
- The still air with the greater pressure pushes up into the low pressure area. It lifts the paper up with it.
- These interesting results are due to the Bernoulli effect, remember it because it plays an important role in our ability to fly.