The Ogden Trust

making physics matter

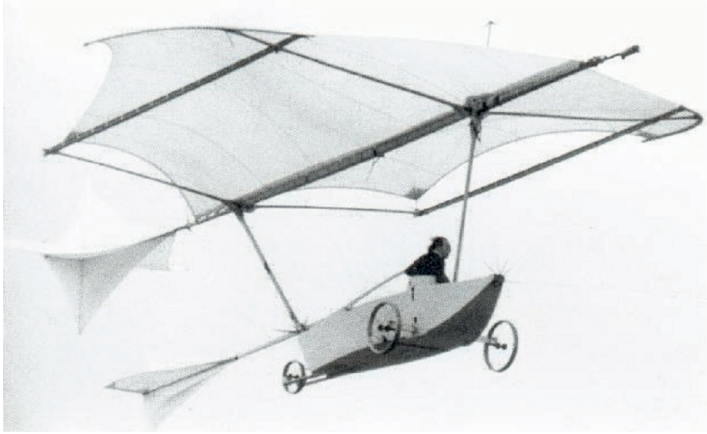
Age 5-11 years

Phizzi practical

Forces and flight

Introduction

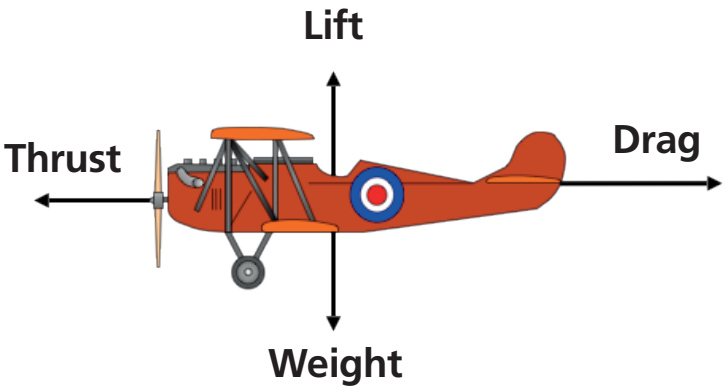
The Wright brothers invented and flew the first powered aeroplane in 1903 but they put their success down to the great work an English scientist and engineer, George Cayley, did on the physics of flight 50 years earlier. To investigate the forces involved in flight, Cayley would build flying models. In 1853, he constructed the first glider to carry a person. In this activity, children will work like George Cayley to make their own discoveries about the forces involved in flight.



Scientific explanation

Cayley's pioneering studies and experiments led him to identify the four forces which act on a flying vehicle that is heavier than air: weight; lift; drag; and thrust.

The weight is the force due to gravity and it always acts in a downwards direction towards the centre of the earth. Lift is the force that acts at a right angle to the direction that the plane is moving through the air so that is usually upwards. Lift is caused by difference in air pressure above and below the wing. Thrust is the forwards force acting on the aeroplane and it is produced by the engines. The fourth force is drag which is a type of friction force that always acts in the opposite direction to which the plane is travelling in.



Equipment needed

- A4 paper
- Large sheets of paper
- Stopwatch
- Tape measure, trundle wheel, meter ruler
- Paperclips
- Scissors

Method

To make a simple paper aeroplane:

1. Place a sheet of A4 paper on the table in front of you in the portrait orientation. Fold the paper in half vertically and then unfold it (image 1).
2. Fold each of the top corners into the centre fold line (image 2) and then fold each of the top edges into the centre line (image 3).
3. Fold the aeroplane in half and then fold the wings down (image 4). You can use a small piece of tape to hold the aeroplane in shape (image 5).

The forces involved in flight

To investigate how the force of weight affects how an aeroplane travels, children can attach different numbers of paper clips and explore how this affects the flight of their aeroplane.

- To investigate lift, children can make paper aeroplanes of different sizes to change the area of the wings.
- To investigate drag, children can cut strips where the wing meets the middle ridge and fold them upwards so there is a fin on the top (image 6).
- To investigate thrust, children can throw the glider with more or less force and observe any differences in how the plane travels.

Working scientifically

This practical activity is ideal for children to design and carry out their own simple tests. They can decide which variables they are going to change about their planes and which variables they will measure. They could measure the time of flight or the distance travelled; older children can repeat tests and collect multiple sets of data. There will be some great opportunities for discussions about control variables and how to keep them the same. Some data collected from these simple tests could be analysed in scatter graphs or line graphs; children could use these graphs to help them develop their own scientific explanations.

Children could develop their learning further by carrying out a research enquiry into the history of flight which could be enhanced with our scientific ideas over time – timeline card sort game: **www.ogdentrust.com/resources**

Teaching tip

- Children will need plenty of space for investigating their paper aeroplanes so this could be a good activity for the school hall or the playground on a dry day.
- Encourage children to select which measuring devices they think would be best for their enquiries and justify their choices.