Bird Man

PERHAPS THE FIRST PERSON to make a real attempt to construct a flying machine and take it into the air was Muslim scientist Abbas ibn Firnas in the 9th century in the city of Cordoba, Spain. He gained knowledge of flight by studying birds.

Book References: Flight, page 308.

The activity is in two parts. First, pupils use ideas of drag and balancing forces to explain how birds control their landing speed. Second, they can investigate different designs for a glider using straws and tissue.

Curriculum links

11-14	**QCA 9K Speeding up** • When the upward force of air resistance balances the downward force of weight, the speed remains constant • Interpret distance-time graphs and relate them to the situation from which data was obtained

Learning Objectives

Students will:
- Be able to use the concepts of drag and lift to explain how flight occurs
- Recognise factors that affect the drag/lift on a glider

Running the activity

Starting the activity

Display **Activity 9a** (either projected or as an OHT). Ask pupils to read the deliberately anachronistic newspaper article of the year 875, announcing what may have been the first human flight.

Display **Activity 9b** and use the 'how does flight work?' box to reinforce the idea of balanced forces. Pupils are asked to create an explanation of a bird's flight in terms of forces. The activity is set in the context of helping Abbas ibn Firnas improve his glider design.

One 'correct' version of the card sort reads:

"When birds take off they need as much lift as possible. Birds create extra lift by turning the bottom of their wings into the air. In flight, birds use their streamlined shape to create as little drag as possible. Low drag means birds can fly fast to catch prey or escape predators. When birds are about land they need to reduce their speed. Birds are clever. Just as they land they create a 'stall' situation. Birds control the amount of drag from their wings by spreading out their tail. They drop their legs and tails down. Their wings open and this creates more drag. Just above their perch, their lift also drops to nothing – they fall the last few centimetres."

Running the activity continued...

Running the main part of the activity

Display **Activity 9c.** The main activity is an open-ended activity where pupils can investigate what factors affect the drag on a glider. They build their designs from straws according to the instructions on the sheet. This will involve some practical challenges, including how to add a simulated 'pilot' of the glider. There are three independent variables to test: length of the support bars, angle between support bars, and mass of pilot. The dependent variable is the time of the glider's flight.

Web Links

http://en.wikipedia.org/wiki/Abbas_Ibn_Firnas
An article about Abbas ibn Firnas, from an online encyclopaedia

http://www.uh.edu/engines/epi1910.htm
The story Abbas ibn Firnas's first flight

http://www.nurseminerva.co.uk/adapt/wing.htm
Details of hang glider wing geometry to support the investigation

Bird man

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Cordoba Daily News 875 CE

Local man first to fly

Abbas ibn Firnas has lived in our city all his life. Yesterday we saw the incredible flying machine he has invented.

It started twenty years ago when he saw a daredevil jump from a high tower – and survived – using a simple parachute.

Now Abbas ibn Firnas has taken the idea further. He has built a 'flying glider' that can carry a person.

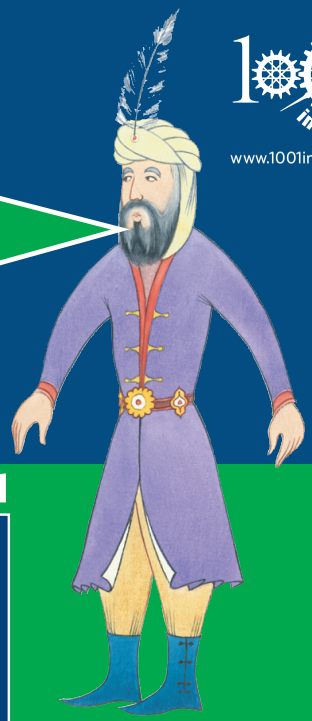
Amazingly, the flight was a success! Abbas stayed up for nearly a minute. But the landing was not so good. He badly injured his back and will not be repeating his feat.

Abbas explained "I studied the way birds fly, but obviously I did not take enough account of the way they slow down and land."

Learning from the birds

How does flight work? Flying requires a balance between forces. The glider's weight is pulling it downwards. When it moves, air flowing over the wings creates 'lift'. This upwards force balances the weight and keeps the glider up.

I know a lot about bird flight. Can I use this knowledge and design a glider that will land more safely?



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Sequence the cards to describe how birds control their landing speed

They drop their legs and tails down. Their wings open and this creates more drag.

When birds take off they need as much lift as possible.

In flight, birds use their streamlined shape to create as little drag as possible.

Just above their perch, their lift also drops to nothing they fall the last few centimetres.

Low drag means birds can fly fast to catch prey or escape predators.

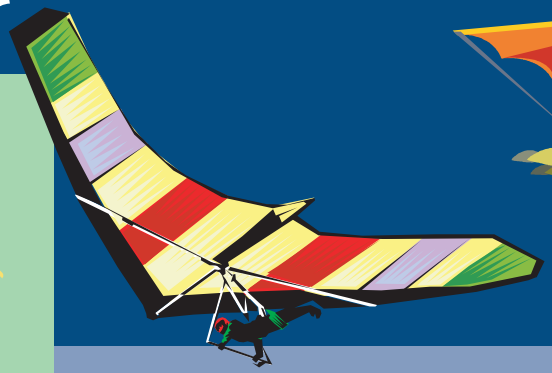
Birds are clever. Just as they land they create a 'stall' situation.

Birds control the amount of drag from their wings by spreading out their tail.

Birds create extra lift by turning the bottom of their wings into the air.

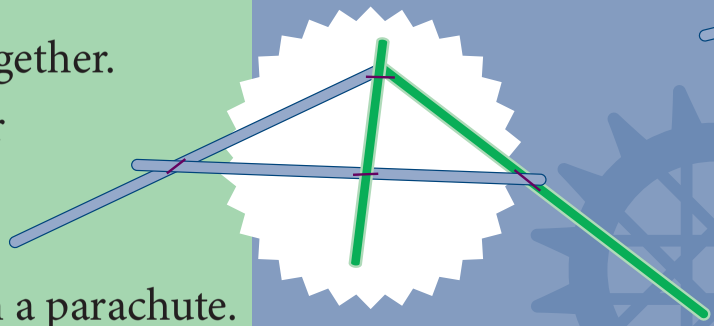
When birds are about to land they need to reduce their speed.

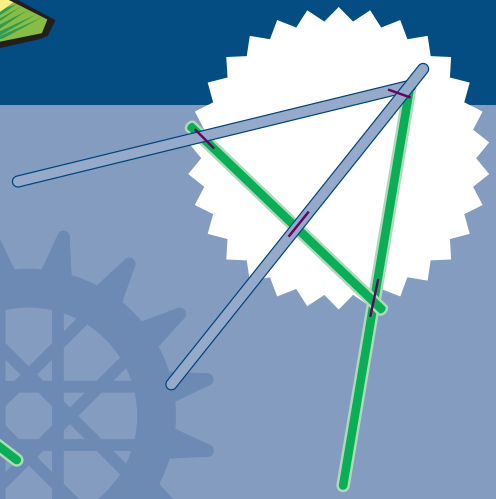
Design your own glider



Instructions

- Make several hang glider frames from drinking straws.
- Try different angles like in the diagram to vary the wing shape.
- Use a stapler to hold the frames together.
- Cover the frames with tissue paper to finish your model hang glider.
- Add a pilot to your hang glider. Hang the pilot from threads like in a parachute.





Now test the hang gliders. Record your results in a table. What patterns did you find?

Length of support bars /cm	Angle between support bars /degrees	Mass of pilot / g	Time of flight from ceiling to floor / seconds	Description of flight