

# Helicopters

*Educational support materials for groups participating in this activity*

This pack contains information designed to support teachers whose classes are visiting the RAF Museum and participating in the Helicopters Activity. It is intended to provide information and suggestions for class lessons before and after the activity. All the photos and diagrams are available for reasonable reproduction to help with teaching.

## **Contents**

	<b>Page</b>
1. Educational Background	2
2. Activities for the Classroom	8

## **Pictures**

1. Images of helicopters in action	4
------------------------------------	---

Additional images from the RAF Museum's collections can be found online at <http://navigator.rafmuseum.org/>

# Helicopters

## *Educational Background to the Helicopters Activity*

### ***Links to the Curriculum***

Helicopters relates to a number of key areas of the National Curriculum. This section of the teacher resource pack discusses the scientific, historical and social factors which provide a background to the activity.

### ***Forces of Flight***

A force is a push or a pull. There are a number of forces which are relevant to helicopters.

**Gravity** – This is a force which attracts different masses together. The strength of gravity is determined by the mass of the objects. The greater the mass of an object the greater the gravitational attraction of the object.

**Lift** – This is a force which pushes an object upwards due to the motion of air flowing past the object. It is generated by the rotor blades on helicopters. When a helicopter is turning the lift direction changes so it is no longer vertical.

**Air Resistance** – This force is also referred to as drag. It is a frictional force which opposes the movement of an object through air. Air Resistance can be reduced by streamlining an object so that it has less surface area.

**Weight** – This is caused by gravity. It is the gravitational force between an object and the Earth.

**Torque** – As the engine in a helicopter turns the rotor blades in one direction, it tends to turn the body of the helicopter in the opposite direction. The tail rotor, or two sets of rotor blades turning in opposite directions, counteract the torque. The helicopter in *Aeronauts* has a tail rotor. The *Belvedere* has twin rotors. The *Chinook* is the most famous twin-rotor helicopter.

*Please note that forces will not be discussed in detail with your group unless it is appropriate.*

### ***The Principle of Autorotation***

Autorotation in helicopters occurs when the main rotor blades are not being turned by the engine but are turning as a result of the air moving upwards through the rotor. This process can usually only occur when the helicopter is descending. Autorotation is particularly useful as it allows helicopters to be landed safely, by a competent pilot even if the engine fails.

The model helicopters that are made during the Helicopters activity work on the principle of autorotation. When the helicopters are dropped from a height the air flowing around the 'blades' causes them to turn and slows the helicopters' descent.

The principle of autorotation can also be seen in nature as Sycamore trees use this method to disperse their seeds.

*Please note that autorotation will not be discussed in detail with your group unless it is appropriate.*

### ***History of Helicopters***

Helicopters, in some form have existed since 400BC. Initially they were simply a toy for children to play with, however many inventors and engineers, including Leonardo da Vinci and Sir George Cayley, have developed the idea behind helicopters into the flying machines we know today.

Jacques and Louis Breguet created the first helicopter capable of manned flight in 1907; however because of its instability it required someone to stand at each corner of the airframe to hold it steady. Fortunately it only rose to a height of approximately two feet above the ground. It was called Gyroplane No. 1. Later that year Paul Cornu designed and tested a more stable helicopter which was able to fly unaided, however his design was later abandoned as it too proved to be unstable.

It was not until the 1920's that the first practical rotary wing aircraft was designed, in the form of the autogyro. It was built in 1923 by Juan de la Cierva and used the principle of autorotation to power its flight. You can see an example of an autogyro from 1934, in the Historic Hangars at the RAF Museum.

Successful helicopters as well as autogyros had been developed by the beginning of the Second World War and were used by both the Allied and Axis forces.

### ***Applications of Helicopters***

Helicopters have a range of different uses, most of which are linked to their ability to hover or to take off and land vertically, making them suitable for use in areas where there is limited space to land.

The ability to hover is particularly important in search and rescue helicopters as they are often required to operate in extreme environments or situations such as mountain ranges, cliffs and floods. It is often impossible to land in these situations so people are lifted into the helicopter using a winch. Search and rescue helicopters are usually painted bright colours so that they can be easily spotted by anyone needing to be rescued. RAF search and rescue helicopters are generally yellow (see images below).

The RAF also use helicopters to transport supplies and personnel to a variety of locations, often to places where there are no runways, making them unsuitable for aeroplanes. Helicopters are also very useful for transporting awkward sized or shaped loads as these can be slung from cables below the helicopter and deposited safely on the ground without landing the helicopter (see images below).

Helicopters are not just used by the RAF but by a number of other organisations. They can be used as personal transport for the very rich or by travel companies for sightseeing tours and holidays; this is the most likely way that people are likely to travel on a helicopter.

Helicopters are also used by the Police to monitor and if necessary control crowds at large events such as the Notting Hill Carnival or to help when pursuing suspects. These helicopters, like those used for search and rescue, are often fitted with night vision cameras and heat detecting equipment.

Helicopters are also used as air ambulances in situations where a casualty is located beyond the reach of a conventional ambulance. Helicopters can also reach casualties faster than conventional ambulances as they do not have to negotiate as much traffic. This is particularly valuable when dealing with serious, life threatening injuries as the casualty needs to be reached as quickly as possible. London air ambulances can be recognised by their bright red colour.

Other uses for helicopters include fighting wildfires, aerial photography and filming and geographical and geological data gathering.



Search and Rescue training in the Scottish Highlands. A doctor is being lowered by the winch to attend to a casualty on the ground.



RAF helicopter lifting a naval officer from a ship.



Casualty being strapped to the side of a helicopter circa 1945. Modern helicopters have space for casualties inside.



Helicopter flying over the city of London.



Helicopter landing on the deck of an aircraft carrier.



Helicopter lifting and transporting an awkward shaped load, in this case a Citroen 2CV.

# Helicopters

## *Activities for the classroom*

### ***Links to the Curriculum***

Helicopters relates to a number of key areas of the National Curriculum. This teacher resource pack is intended to provide some suggestions for classroom activities for a variety of subjects.

### ***Science Activities***

**Activity:** Using paper and cotton thread, try to construct a helicopter with two main rotors like the Chinook and Belvedere helicopters you saw at the museum. Write up your results in the form of an experiment. What different techniques did you try? Did you succeed in building a helicopter with two main rotors? Do they fly better than those with one rotor? Why?

**Activity:** Try making helicopters to the same design as those you made in your activity but with different materials. Try to predict whether the different materials will fly better or worse than your paper helicopter. Why do you think this? Test your ideas and write up the results of your experiment.

**Research:** Your helicopters were made out of paper or card. Find out what materials real helicopters are made of. Why do you think these materials are used? Work out what properties these materials have that makes them suitable for helicopter construction.

### ***English Activities***

**Letter Writing:** Write a letter to the person who led your activity or to the Education Team at the RAF Museum, to tell them how you felt about your trip and what you learnt.

**Report Writing:** Write a report of your visit to the RAF Museum. What did you do? What was your favourite part? What did you learn? Did you enjoy the trip?

**Creative Writing:** Write a story about one of the helicopters you saw during your visit to the museum. You could write a story about the search and rescue helicopter, the Queen's helicopter or even the helicopter you made.

### ***Art Activities***

**Activity:** During your visit to the RAF Museum you will have noticed that a number of aircraft have been decorated by the people who flew them. Try drawing your own helicopter and decorating it to make it distinctive.