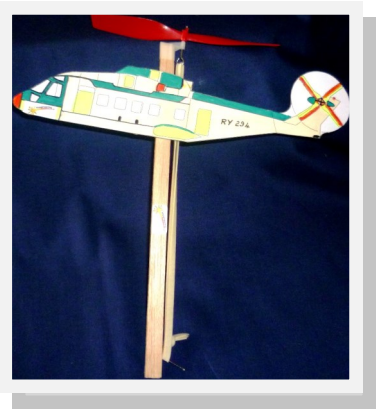
HELICOPTER

TEACHERS/TUTOR NOTES & WORKSHEETS



The project will take probably two sessions for assembly and test.

BACKGROUND

- The Chinese invented a bamboo “flying top” for children in about 400 BC and in the middle ages Leonardo da Vinci designed an “aerial screw” - it never flew. These were the first concepts of a hovering flying machine.
- Since then aeronautical engineers developed the helicopter and an American called Sikorsky designed a military helicopter, which went into production in 1942 and led to many well known designs made by many different companies including Westland in Yeovil.
- The forces on a helicopter are similar to a fixed wing aircraft — Lift; Drag; Gravity; Thrust — but in this case the lift is provided by the rotor and opposes the weight of the craft. The rotor blades are like rotating wings generating lift but require power to drive them.
- The engine or motor driving the rotor requires a torque or turning force to rotate it. This causes an equal and opposite torque on the helicopter fuselage which is generally prevented from rotating by the thrust of a propeller on its tail. By controlling the thrust the aircraft can remain stationary or rotate in either direction.
- In the case of the model, the reaction of the rotor is taken by the air resistance of the fuselage preventing it from rotating. However it does rotate but at a much slower speed than the rotor. As part of the construction of the helicopter, get one child to try and fly it without the fuselage in position. The result will show the importance of the reaction to the propeller torque.
- The angle that the blades of the rotor and propeller make to the air as they rotate is called the “angle of attack” or “angle of incidence”. The lift or thrust of the blades is increased or decreased when this angle is changed by feathering or tilting the blades.
- The rotor and propeller usually runs at constant speed and the lift of the rotor and thrust of the propeller are controlled by feathering.
- Forward flight is achieved by tilting the aircraft in the direction of flight so that there is a horizontal component of force from the rotor lift. The feathering controls of the individual blades can be used to achieve this. The feathering controls are usually very complicated to allow for the difference in speed of the blades through the air on either side of the aircraft.

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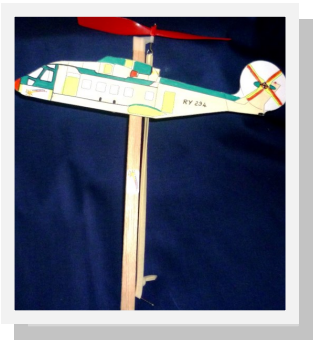
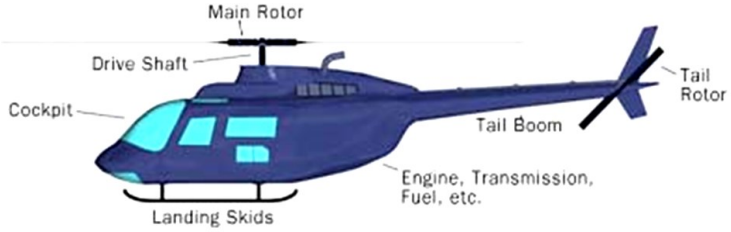


- Because engine power is required just to keep the aircraft in the air, it is very important to minimize the weight of every part.



The Fundamental Parts of any Helicopter

THE MODEL

The rubber band "motor" of the model should be adjusted so that it does not hit the "motor stick" when it rotates.

Practice is required when flying the model so that the rotor is released first.

Session 1

Blackboard

- Lift from a propeller rotating in air is same as lift from a wing of the glider we made earlier in the year.
- The same forces apply to the propeller -Lift, Weight, Drag and Thrust. We have to provide Thrust with a motor. In the case of our Helicopter the motor is an elastic band.
- The rotation of the propeller causes the body of the Helicopter to rotate, but at a much slower speed.
- In a real Helicopter the body is prevented from rotating by a small propeller at the end of the body.
- Get one child to try to fly the machine without a fuselage – note the result.

Practical

Cut out and glue according to the instructions.

The glue will not be hard enough to allow the plane to be flown during the first session.

Session 2

Flying - remember to release the propeller just before launch!

Worksheet

(1) Hovercraft Balloon Harrier Jump jet

(2) Petrol engines Gas turbines

Websites

www.helis.com

https://en.wikipedia.org/wiki/Helicopter

https://en.wikipedia.org/wiki/Airfoil

http://science.howstuffworks.com/transport/flight/modern/helicopter.htm

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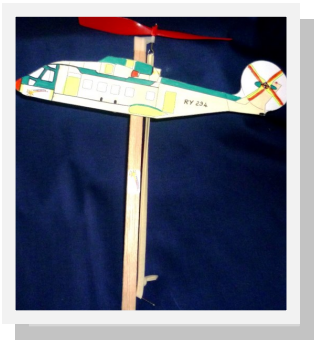

WORKSHEET

1 .Write down three sorts of Aircraft which can hover in the air.

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2 What sort of motors are used in a real helicopter?

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3 What happens if the motor breaks down in a helicopter?

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4 Write a short story about a young person who was rescued from a burning house by means of a helicopter.

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