Aircraft forces teacher notes

Key Stage 2

Science:

- Pushes, pulls and opposing forces
- Gravity and air resistance as forces
- Measuring forces

Overview

Children should be familiar with ideas about forces being pushes and pulls, and that forces can change the motion of objects.

Children think about the types of forces that apply to an aircraft during flight. The context for the activities is the RAF's Red Arrows display team.

1. RAF Red Arrows and the forces on an aircraft
2. Investigation into forces and motion

NOTE: a suitable risk assessment must be performed before carrying out any practical activity.

Activity 1: Forces on an aircraft

Use the presentation to introduce the idea of the pushes and pulls acting on an aircraft during flight. These are:

- forward thrust from the engine
- rearward drag caused by air resistance
- downward weight of the aircraft
- upward lift generated by the wings (or helicopter blades)

When flying level, and at a constant speed, the forces are balanced. Changes in direction require the forces to become unbalanced so that there is an overall force in the direction of the change.

Preparation

- Flying forces presentation
- Internet access to show Red Arrows video clip

Activity Notes

Use the presentation to introduce and summarise the forces acting on an aircraft during flight.

Use two video clips of the RAF Red Arrows to illustrate the extreme forces due to high-speed changes in direction. Each clip is just over two minutes in duration.

Ask the children to imagine what it must be like to be the pilot of one of the aircraft. What forces would they feel? Why do pilots need to be strapped in? What forces have they felt on things like playground swings or fairground rides?

Clips are at:

Introduction to the Red Arrows:
http://news.bbc.co.uk/1/hi/uk/8355531.stm

Plymouth air display:
http://news.bbc.co.uk/1/hi/england/8236895.stm

Extension

Have children practise using force meters to measure a variety of forces, to include:

- weight of a variety of suspended objects
- pulls by hand to experience the size of a particular force
- pulls by elastic bands attached to the force meters
- forces needed to drag objects across a range of surfaces and so give an indication of the force of friction

Activity 2: Forces and motion

Young people use plastic tubs as models for moving objects such as an aircraft.

A simple launcher (see student activity sheet) is used to look at forces and movement in a straight line. Tethering the tub to a central point allows young people to investigate forces on a turning object.

Throughout, the context is to model the forces on a pilot undertaking fast manoeuvres.

Preparation

- Tub launcher activity sheet
- Large rubber band
- Plastic tub (margarine tub or similar)
- Plasticine (to produce a sausage-shaped 'model pilot')
- String

Activity notes

Have young people set up the tub-launcher and investigate the effects of different forces on the motion of the tub. Young people should think about the forces acting on the tub and their resultant effects.

Use a simple rolled plasticine sausage shape to model a pilot inside their cockpit. What is their motion like? What forces act on the pilot? What happens when the pilot is not tethered in with seat belts? Have young people conclude that the pilots motion continues when the tub hits a barrier or slows down due to friction with the surface it is sliding upon. So pilots are therefore tethered with seat belts that exert a force on the pilot as the aircraft (tub) changes its motion.

Extension

Use data loggers and motion sensors to measure the motion of the tub.

Use a video camera to capture the motion of the tub and use a slowed-down video clip to analyse its motion in detail.

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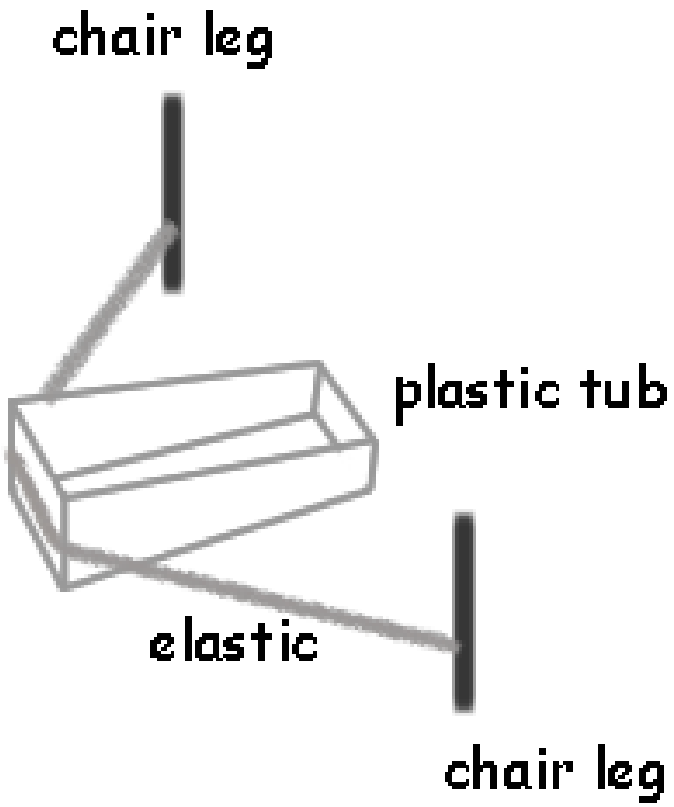
Forces and movement



Make a launcher like the one shown in the diagram on the left.

Use it to launch the plastic tub along the floor.

What force pushes the tub?

What force slows it down?

What happens if the tub crashes into a barrier?

Make a plasticine sausage shape as a 'model pilot' and put them in the tub.

What happens to the pilot when the tub is launched and moves across the floor?

Why does this happen?

How could you make it more safe for the pilot?