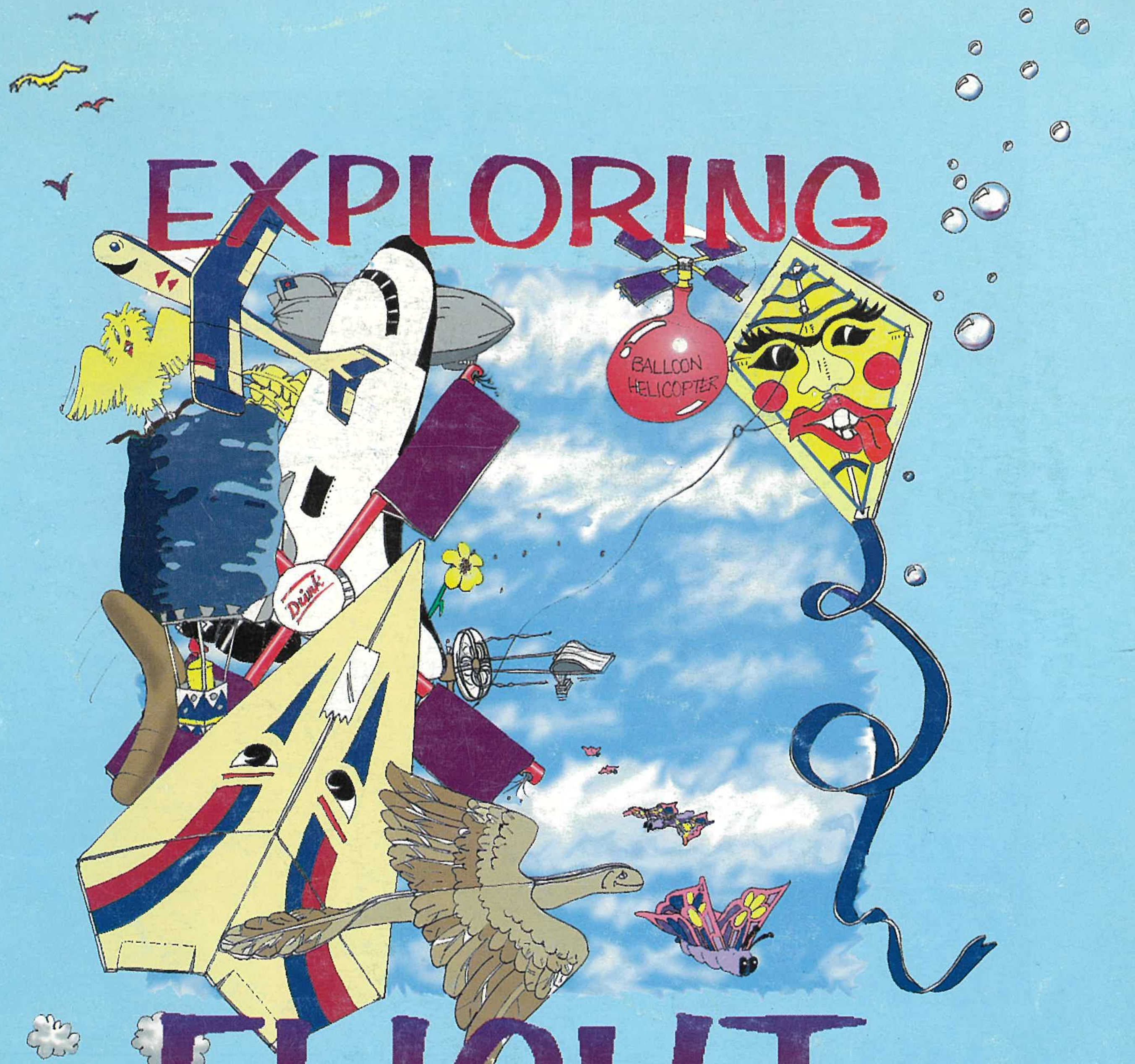
EXPLORING



FLIGHT

A Resource Book of Activities and Information For Science Week 1997

AUSTRALIAN
SCIENCE
TEACHERS
ASSOCIATION

asta


INGENUITY
ACHIEVEMENT
RECOGNITION

AUSTRALIAN SCIENCE TEACHERS ASSOCIATION

Proudly supported by the Science and Technology Awareness Program of the Department of Industry Science and Tourism

Flight

A resource book for Science Week 1997

Flight is a resource book of activities and information published by the Australian Science Teachers Association (ASTA). It is designed for teachers and students and provides many terrific activities for use at school and at home. The book can be used during Science Week and throughout the year.

Science Week is an initiative of ASTA, first held in 1984 and run every year since. It aims to focus community attention on science and its importance in the school curriculum, to promote the image of science, to involve students at all levels of schooling, parents, scientists and the rest of the community in a broad range of science-related activities and to promote science as being enjoyable.

During this, the fourteenth annual Science Week, ASTA hopes that teachers will be able to organise a celebration of science and that this book will provide useful ideas for the theme -*Flight.*

As well as providing this resource book, ASTA has a Science Week Coordinator in each State and Territory who organises activities and events during Science Week. If you would like more information or would like to help out with organising things in your State/Territory please contact your Science Week Coordinator who is listed on the back of the pull-out Resource List in the centre of this book.

Science Week is one of many programs which ASTA organises to enrich school science education opportunities for students and teachers in primary and secondary schools. If you would like to find out more about these and other programmes, please contact ASTA or your State/Territory Science Teachers' Association. A free copy of this resource book is one of the many benefits of membership.

On behalf of ASTA I would like to thank and congratulate the authors and designers of this book *Flight,* the Science Week Coordinators in each State and Territory of Australia and all the teachers who become involved with Science Week activities.

I do hope you find this resource book useful, interesting and enjoyable. Please write to me or ring me to let me know your views and opinions about the resource book or Science Week in general.

Deb Smith

Deb. Smith
PRESIDENT

Australian Science Teachers Association
PO Box 334
DEAKIN WEST ACT 2600

Phone: 06 282 9377
Fax: 06 282 9477
Email: asta@asap.unimelb.edu.au

BHP

ICI Australia

Exploring flight

Contents

Introduction 3

Birds and other animals that fly

Teachers' notes

Which animals fly? 4
How birds fly 4
Bats 4
Flying reptiles 5
Flying insects 5
Sugar gliders 5

Student activities

How do birds fly? 6
How do insects fly? 6
Growing moths or butterflies 7
Three things that fly 8
Archaeopteryx 9

Lighter than air

Teachers' notes

Physics of floating 10
Why hot air balloons fly 10
Hydrogen and helium balloons 10
The first balloons 11
Airships 11

Student activities

Harnessing hot air 12
Hot air bubbles 12
Lighter than air 13
Puzzle 15

Riding on air

Teachers' notes

Kites depend on wind for flight. 16
Gliders 16
Hang-gliders 16
Thermals 16
Seeds that ride on air. 17
Boomerangs 17

Student activities

Build a kite 18
Design your own kite 19
Banksia seeds like bushfires 20
Dandelions 20
A simple paper plane 21
A more complicated paper plane . . . 22
A model glider to make 23
Boomerangs 24
Hovercraft 25
Spinning paper cylinder 25

Early flying machines to Jumbo jets

Teachers' notes

Early planes and flights 26
How jet engines work 26
Helicopters 26
Controlling a plane in flight 27
Wing shapes and the physics of flight 27

Student activities

Why things fly 28
Wind tunnel 29
Make your own helicopter 32

Space flight

Teachers' notes

The beginning 33
The Canberra Deep Space Communication Complex. 33

Student activities

Balloon rocket 34
Bottle rocket 34
Astronauts in space 35
A space laboratory 35

Publisher: Australian Science Teachers Association,
PO Box 334, Deakin West, ACT 2600

ISBN: 0 9586618 12

Authors: Phillip Pain and Margaret Mitchell
Interactive Consultants (Canberra)

Graphic design: David Baskett
Illustration: Joanne Codling

Introduction

Flight is inspirational

Whether it is the majesty of the soaring condor, the vast migrations of the albatross, the bizarre sight of a hovering bumble bee or the tremendous technological achievements of humanity and aircraft, people have always been fascinated with flight and have sought to find answers to the questions it poses.

With this in mind we have produced an exciting book which links flight in all its forms to the underlying scientific principles behind it. The book is divided into five sections exploring five ways which people, animals and in some cases plants use to keep things airborne.

The first chapter *Birds and other animals that fly* explores the mechanisms used by birds, insects, reptiles and bats to fly.

The second chapter *Lighter than air* looks at things that float in air and how they do it. It covers hot air balloons, helium and hydrogen filled balloons and their past and present uses by people.

The third chapter *Riding on air* investigates the way kites, airborne seeds, paper planes, gliders and boomerangs can fly on moving currents of air.

The fourth chapter *Early flying machines to jumbo jets* looks at planes, how they fly, the importance of wing shape, different types of planes, how a jet engine works and developments in aviation throughout the twentieth century.

The final chapter *Space flight* looks briefly at the ultimate flying experience, flying beyond the Earth's atmosphere, into space and our solar system.

⚠ Safety warning

All student activities recommended in *Exploring Flight* have been designed to minimise hazards. However, there is no guarantee expressed or implied that an activity or procedure will cause no injury. Teachers selecting an activity should test it with their own materials before using it in class.

Any necessary safety precautions should be clearly outlined by the teacher and all safety equipment provided to the students before starting the activity.

Teachers' notes

Birds and other animals that fly

Which animals fly?

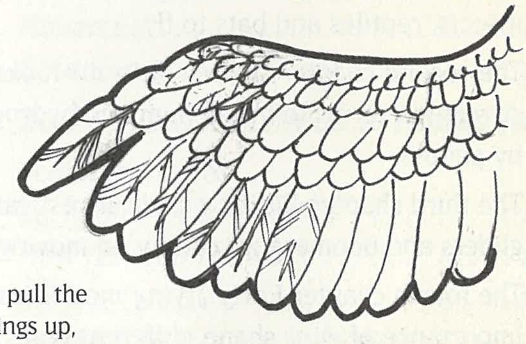
There are four main groups of animals capable of flight:

- insects,
- flying reptiles,
- birds, *and*
- bats.

Flying animals have wings, strong muscles for moving the wings, light bodies and sometimes, hollow bones.

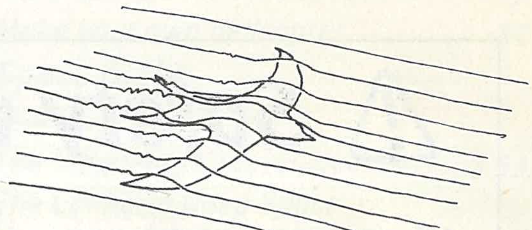
The earliest bird-like animal known was the *Archaeopteryx* which lived in the Jurassic period about 150 million years ago. While it had many reptile-like features such as teeth, solid bones and reptilian vertebrate, it also had feathers including tail and flight feathers. It is the earliest known species to have feathers and therefore is thought by many to be the first bird.

How birds fly



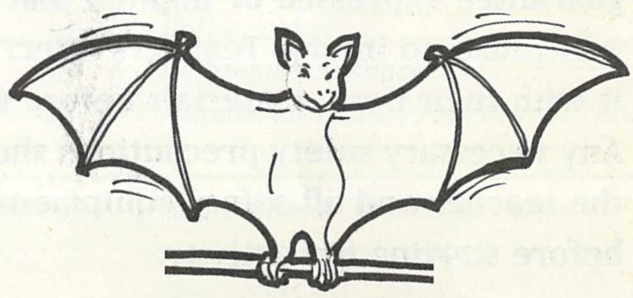
There is much variation between bird species when we consider the mechanisms of flight. The following features are widespread and common:

- Wing feathers overlap to give a wide, flat, airtight surface which when flapped causes lift;
- Wing flapping is controlled by strong chest muscles which pull the wings down and less strong back muscle which pull the wings up,
- As the wings flap downwards, air is pushed down and back, causing the bird to be pushed up and forward. This is an excellent demonstration of Newton's third law.
- Much of the ability of a bird to change direction and manoeuvre while flying is due to the bird (a) using its wing joints and muscles to change the wing shape and (b)twisting or spreading its tail feathers.
- Birds control their flight speed and their angle of attack (ie. the angle they fly through the air) by controlling their wing flapping rate and twisting and spreading their feathers.



Birds which need to move through the air at greater speed have a more streamlined shape so that air moves over their bodies more easily. This helps cut down air resistance which is also called drag. The common swallow has a very streamlined shape and as a result can fly at speeds up to 150km/h.

Bats

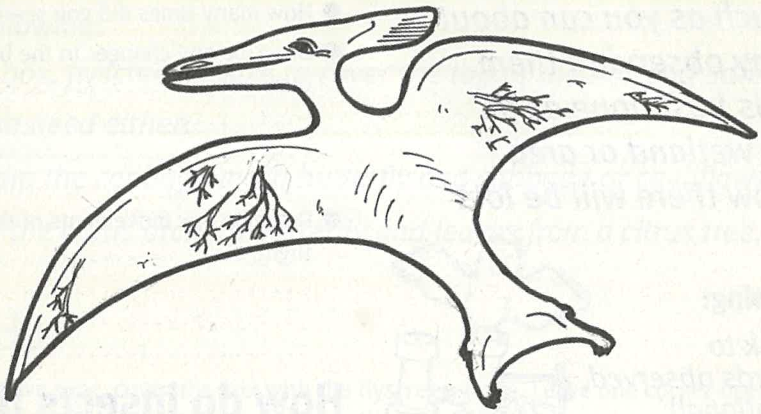


Bats fly using their well developed wings and associated muscles. As they do much of their flying at night, sometimes in caves, they need a navigation system other than sight, and so they navigate by echolocation. This involves the bat emitting high pitched noises which reflect back from solid surfaces and are picked up by the bat's large ears. This allows the bat to sense the distance and react accordingly.

Teachers' notes

Flying reptiles

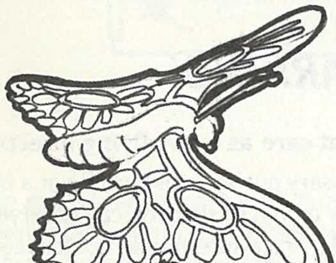
One of the best known and most fascinating of the extinct flying reptiles that lived millions of years ago was the *Pteradactyl.* Unlike birds which evolved later, it did not have feathers but wings covered in a leathery skin. These wings allowed its relatively heavy body to be launched from high places to fly or glide.

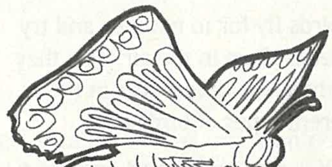


Flying insects

Insects were the first organisms to fly with wings. Unlike birds, their wings do not contain bone or muscle, and are controlled totally by muscles on the thorax. Flying insects are extremely manoeuvrable due to the fact that their flexible membrane wings can be rotated at the top and bottom of each flapping action.

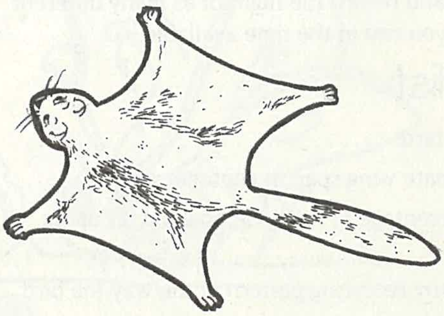
Some flying insects such as butterflies have two sets of wings. In the case of butterflies and moths, the wings are covered with tiny scales producing an airtight flapping surface to give lift. Butterflies and moths have the ability to hover (stay in one place while flapping their wings) and to manoeuvre in a very complex manner.

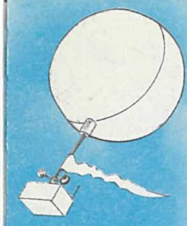




Sugar gliders

Some animals such as sugar gliders have skin flaps which allow them to glide considerable distances. However, their lack of wings to flap prevents them from achieving lift or an increase in height.





Birds and other animals that fly

How do birds fly?

Find out as much as you can about how birds fly by observing them. (This activity is best done as an excursion to a wetland or area where you know there will be lots of birds.)

Collect the following:

- *Reference book to identify the birds observed, binoculars (optional), sunglasses if you have them, to protect your eyes and a check list on which to record your data.*

Two excellent books for bird identification are:

- The Claremont Field Guide to the Birds of Australia, Simpson and Day, Penguin Books Australia Ltd, *and*
- Reader's Digest Complete Book of Australian Birds, Reader's Digest Services Pty Ltd, Sydney.

What to do

- Sit and watch the birds fly for 10 minutes and try to work out what keeps them in the air, how they manoeuvre, and if there are differences in the ways in which different types of birds fly.
- Choose a bird which is easy to observe and identify it by name. Use the reference books if necessary.
- Fill in your check list below as you observe the bird's flight.
- Observe and record the flight of as many different birds as you can in the time available.

Check list

- Name of bird. ....
- Approximate wing span in centimetres. ....
- What percentage of its flying time did it flap its wings? ....
- Is there any recurring pattern in the way the bird flaps its wings? ....
- How many times did you see the bird hover? ...
- How many times did you see the bird glide? ....
- How many times did you see the bird swoop? ..
- Describe any changes in the bird's wing shape during flight. ....
  ....
  ....
  ....
- Describe any movements of the bird's tail during flight. ....
  ....
  ....
  ....

How do insects fly?

Collect the following:

- *Small tubes, vials or jars in which to keep your insects, magnifying glass, and a check list.*

What to do

- Look in an area of high plant density for flying insects such as grasshoppers, butterflies, moths, flies, bees, bugs and beetles.

⚠ WARNING!

Take great care as many flying insects bite.

- If necessary put your insects one at a time into your jar or vial so that you can observe the wings carefully. Make sure you do not damage any part of the insect as you do so. The magnifying glass will help you observe.
- Answer the questions on your check list for as many insects as you can.
- Release the insects into their preferred environment.

Check list

- Name of the insect. ....
- Length of the insect. (approx) ....
- How many wings did it have? ....
- What did the wings look like? ....
- How would you describe the way in which the insect flew? ....

Growing moths or butterflies

Find out as much as you can about how a moth or butterfly develops into an adult insect which flies.

Collect the following:

- *Cardboard box, flyscreen gauze to cover the top of the box and adhesive tape.*

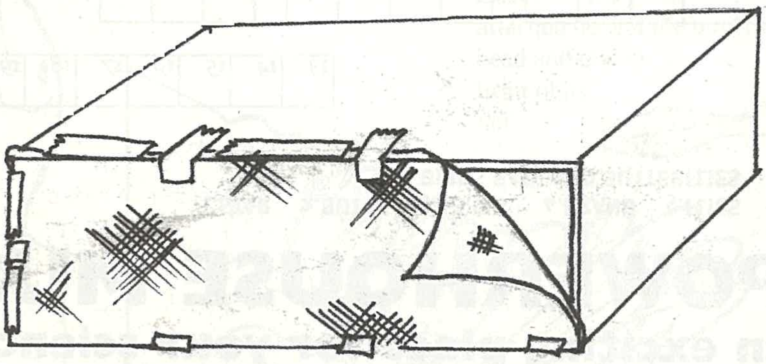
  You will also need either:

  (a) eggs from the cabbage moth butterfly and cabbage or cauliflower leaves, or

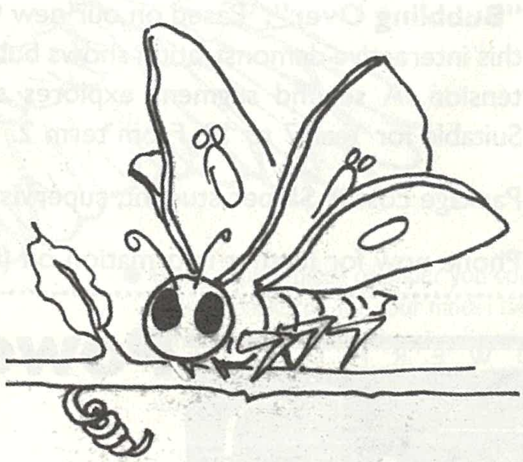
  (b) eggs of the citrus orchard butterfly and leaves from a citrus tree.

What to do

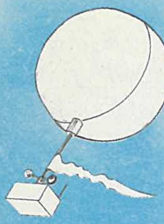
- Using the adhesive tape, cover the box with the flyscreen gauze. Leave one corner open.
- Turn the box on its side.



- Collect eggs of the cabbage moth butterfly from cabbage or cauliflower plants. Don't detach them from the leaf which they are on. Place them, and the leaf on which they are, in the box. Close the remaining corner. Alternatively, collect eggs of the citrus orchard butterfly from an orange or lemon tree and place them in the box.
- Watch the eggs daily. When they hatch to produce caterpillars, add fresh leaves daily (cabbage or cauliflower leaves for the moth and citrus leaves for the citrus orchard butterfly.)
- Keep watching what happens to the caterpillars and wait patiently until the adult moths or butterflies appear. Look carefully at the wings. Can you see the tiny scales?
- Release your butterflies or moths and watch how they fly.



Student activities



Three things that fly

Answer the clues below. Each letter in the answer has a corresponding letter. Write that letter next to the number in the puzzle solution.

Clues

- *A celestial body*

5	8	10	18

- *A desert landform which is a small mesa*

13	14	15	16	17

- *Abbreviation for 'International Body of Dental Scientists'*

2	1	12	9

- *The same product can be sold under different names. Each one has a different............*

6	3	7	11	4

- *These insects can be a pest in summer.*

19	20	21	22	23

Puzzle Solution

1	2	3	4	5

6	7	8	9

10	11	12

13	14	15	16	17	18	19	20	21	22	23

Solution: 1.STAR 2.BUTTE 3.I.B.D.S. 4.BRAND 5.FLIES
BIRDS BATS AND BUTTERFLIES

Student activities

Archaeopteryx

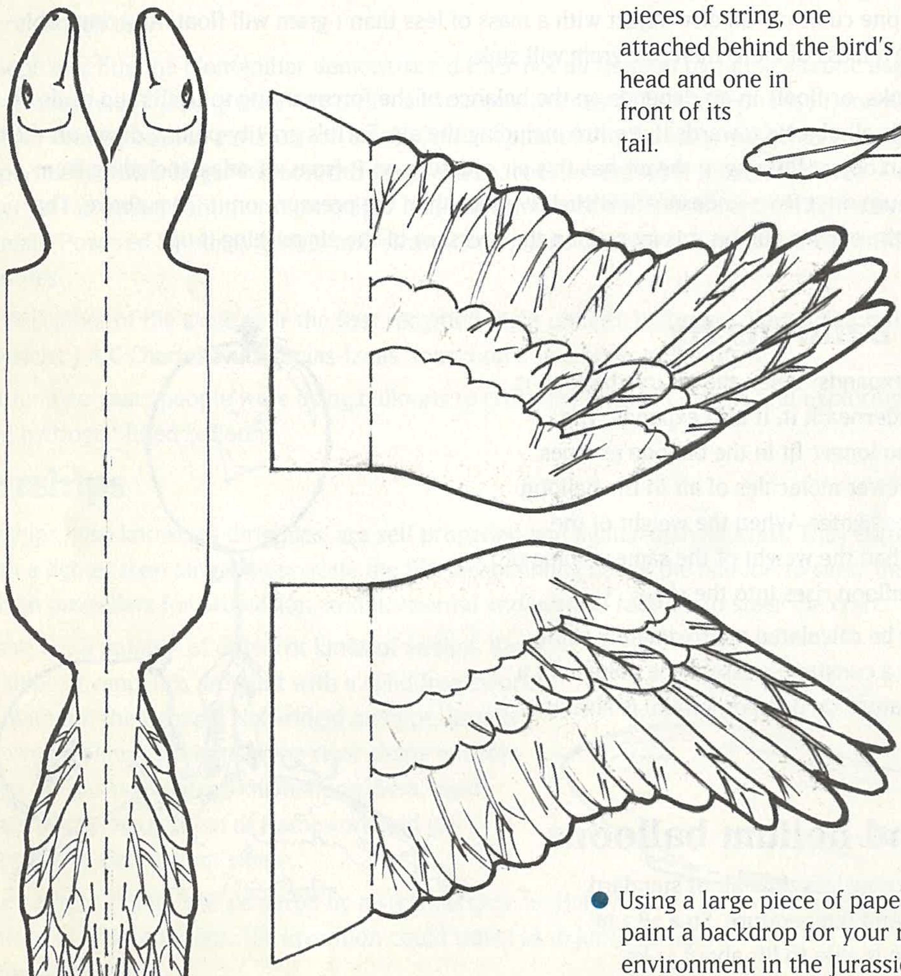
Make a model Archaeopteryx and find out how it lived.

Collect the following:

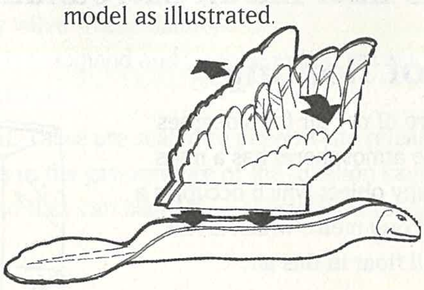
- *Paper, scissors, string, paints or coloured pencils.*

What to do

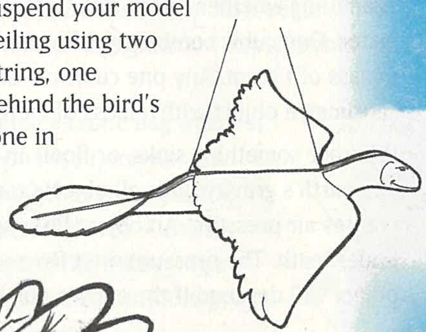
- Using the pattern below, draw the outline for your *Archaeopteryx* model in any size of your choice.



- Draw and colour in as much detail as you can on your model. You may need to use the library to find out details of the *Archaeopteryx's* appearance.
- Cut out your model.
- Fold it and tape the sides together to form the model as illustrated.



- You may suspend your model from the ceiling using two pieces of string, one attached behind the bird's head and one in front of its tail.



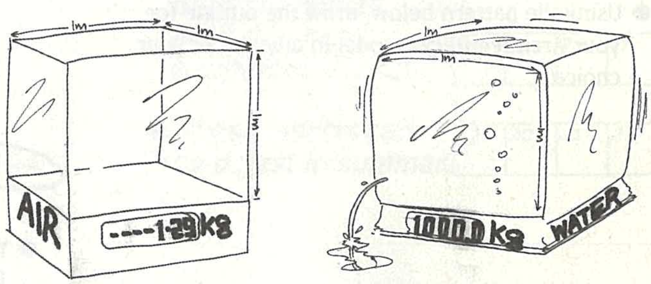
- Using a large piece of paper you could draw or paint a backdrop for your model depicting the environment in the Jurassic period. You may need to visit the library to find out what the environment was like during the Jurassic period.

Teachers' notes

Lighter than air

Hot air balloons, airships and a number of different gas filled balloons all fly in air. They all do this by being equally dense or less dense than the air surrounding them. They float on air.

Physics of floating



One cubic metre of dry air (at 0 degrees Celsius and one atmosphere) has a mass of 1.29 kg. So, any object which occupies a total volume of one metre which is less than 1.29 kg will float in this air.

This concept is easier to explain when examining whether things sink or float in water. One cubic centimetre of water has a mass of 1 gram. Any one cubic centimetre object with a mass of less than 1 gram will float. Any one cubic centimetre object with a mass of more than one gram will sink.

Whether something sinks, or floats in air depends on the balance of the forces trying to push it up or down. The earth's gravity pulls all objects towards its centre including the air. Earth's gravity pulling down on the air creates air pressure. An object floating in the air has this air pressure on it from all sides, including from underneath. The pressure on it from underneath is slightly more than the pressure on it from above. The object will descend if the earth's pull on it is more than the pressure of the air pushing it up.

Why hot air balloons fly

When air is heated it expands. When the air in a balloon is heated by a burner underneath it, it also expands. The excess air which can no longer fit in the balloon escapes. This means there are fewer molecules of air in the balloon so the balloon becomes lighter. When the weight of the whole balloon is less than the weight of the same volume of surrounding air, the balloon rises into the sky.

The amount of lift can be calculated approximately using the simple rule that at a constant pressure the volume of a gas divided by temperature (in degrees Kelvin) is always constant.

Hydrogen and helium balloons

Hydrogen weighs 1.14 kg/m^3 less than air at standard atmospheric pressure and temperature. So a 28.3 m^3 hydrogen filled balloon is able to lift about 32 kg.

The major problem with hydrogen balloons is that hydrogen is extremely flammable. As helium is not flammable, and has only slightly less lifting capability, helium filled balloons are more common. Ammonia and methane are also used as lifting gases.

Teachers' notes

Balloons are commonly used in meteorological research which carry scientific instruments to measure such things as wind speed and direction, humidity, temperature, radiation and the chemical composition of the atmosphere.

Three different kinds of balloons are commonly used in this research.

Rubber or neoprene balloons filled with lifting gas. With their stretchable skin they expand as they rise and the air pressure around them decreases. When the skin can't stretch any further they burst.

Non stretch balloons filled with lifting gas. As they rise in the air the gas in the balloon expands and is released from a special one way valve. These balloons are effected by the sun which warms the gas inside causing it to expand and be released. At sunset these balloons will fall because the lifting gas cools and exerts less pressure.

Superpressure balloons made of non stretch material. These are sealed to prevent the release of gas. The balloon rises until it reaches a constant level. Variations in the gas pressure of the balloon caused by the heat of the sun do not affect the volume of the balloon and so they can maintain a constant altitude despite these changes.

The first balloons

In the early 1700s it is thought that a Brazilian priest, Bartolomeu Lourenco deGusmao, may have begun experimentation on the first balloon craft. Later that century, in 1783, a number of significant experiments were carried out.

Joseph and Etienne Montgolfier demonstrated their hot air balloon by filling a fabric bag with hot air produced by burning wool and straw at Annonay in France. The balloon rose 1,000 metres before coming back to earth 2.4 km away. On 19 September in the same year they repeated the experiment with a larger balloon carrying a sheep, rooster and duck a short distance. A month later (21 November) another Montgolfier balloon completed the first recorded flight carrying a human. Powered by burning wool and straw it carried its occupants almost 9 km over Paris in 23 minutes.

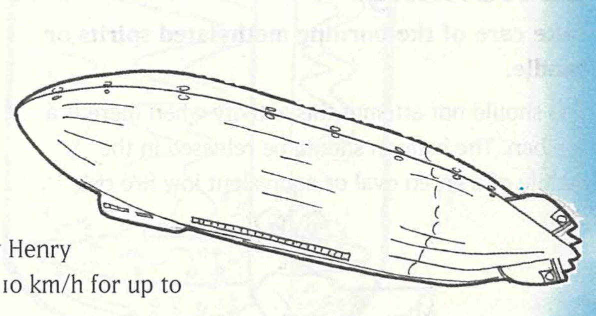
In December of the same year the first recorded flight under a hydrogen filled balloon took place carrying the physicist J A C Charles and Nicolas-Louis Robert on a two hour, 43 km flight.

Within two years people were using balloons to cross the English Channel and exploring other uses for hot air and hydrogen filled balloons.

Airships

Airships, also known as dirigibles, are self propelled and lighter than air craft. They consist of a balloon filled with a lighter than air gas to provide the lift, a cabin hung below the balloon to carry the passengers, engine driven propellers for propulsion, and horizontal and vertical rudders to steer the craft.

There are a number of different kinds of airship. Rigid airships or zeppelins are built with a solid framework to maintain their shape. Non-ridgid airships, usually known as blimps generate their cigar shape entirely from the gas pressure on the balloon. Semi-rigid ships use a combination of framework and gas pressure to define their shape.



The earliest airship was powered by a steam engine by Henry Giffard of France in 1852. His invention could travel at 10 km/h for up to three hours.

Probably the most famous of the airships is the Hindenburg, one of the longest airships ever built measuring 245 metres. It made its mark on history when its hydrogen filled balloons exploded in 1937 killing 36 of its 92 passengers.

Student activities

Lighter than air

Harnessing hot air

Can you make your own hot air balloon?

Collect the following:

- *Large light weight garbage bag, very thin lightweight wire eg tie wire, methylated spirits, lightweight metal container eg aluminium soft drink can, candle, matches and a hand or electric fan.*

What to do

- Make a frame with the wire for the mouth of the balloon (garbage bag). You might use bamboo (wrapped in aluminium foil) to hold the mouth open.
- Make a sling for the methylated spirits holder or candle and attach it to the frame of the balloon.
- Fill the balloon with cold air. You may need to use a fan.
- Light the candle or methylated spirits and watch your balloon rise.

You might like to make your balloon out of tissue paper, silk or other equivalent lightweight material. Aluminium wire could be used to make a lightweight frame to support the garbage bag.

Remember: when making your balloon it is most important to make it as big and as lightweight as possible.

⚠ *Warning!*

Take care of the burning methylated spirits or candle.

You should not attempt this activity when there is a fire ban. The balloon should be released in the middle of a green oval or equivalent low fire risk area.

Hot air bubbles

Explore the differences between hot and cold air bubbles.

Collect the following:

- *Bubble mix (or concentrated dish washing liquid), bubble loops (wire loops, or loops made from pipe cleaners), hair dryer, fan (optional) and thermometer.*

What to do

- Measure and record the temperature of the air:

  (a) 100 mm in front of a hair dryer on each of its settings,

  (b) in front of your mouth when blowing out

  and

  (c) in front of the fan.

- Use the air from the hair dryer on each of its setting, your breath and the fan to blow bubbles observing closely what happens to each of the bubbles.

Discussion

How does this experiment relate to hot air balloons? Can you determine any relationship between the temperature of the air inside the bubble and whether they rose or fell?

Further activity

Floating cold air bubbles

In a still room, place a quarter of a box of sodium bicarbonate and two cups of vinegar in a bucket or tall sided large container. The container will fill with carbon dioxide gas. Gently blow bubbles into the container. Observe closely what happens and try to explain your results.

If the air is very still and you are very careful it is possible to pour the gas from one container to another container. You can test if you have been successful by trying to float the light air bubbles on the heavy (dense) carbon dioxide gas. (Or simply put a burning match into the gas and see if it is extinguished.)

Student activities

Lighter than air

Investigate the comparative weight of air and other gases.

Collect the following:

- *Large solid air tight glass container with a non metal lid, a microwave oven, water and some accurate scales (accurate to at least 0.1 g).*

What to do

- Measure the volume of the jar by filling it with water and then measuring the volume of the water.
- Place a small amount of water in the bottom of the jar.
- Put the lid loosely on the jar and put the jar in the microwave.
- Heat the water in the microwave until boiling and boil the water for at least one minute.
- Then as quickly as possible screw the lid tightly on the jar.

  Let the jar cool watching what happens as it cools. Take care, as the jar may break while it is cooling.
- When the jar is cool, weigh it accurately on the scales.
- Carefully loosen the lid. Listen to what happens.

  Weigh the jar again. Has the weight of the jar increased? Why?
- Work out how much a litre of air weighs or how much a cubic metre weighs. (For a cubic metre, subtract the weight of the sealed jar from the unsealed jar plus lid, then divide this by the size of the jar in mls. Then multiply it by one million.)

Further activity

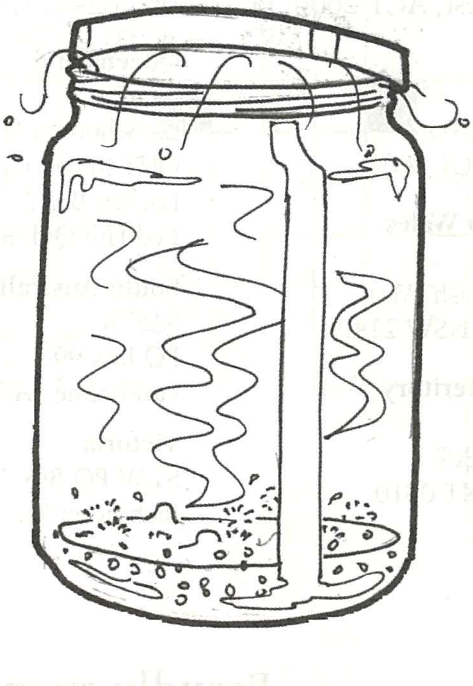
How heavy is carbon dioxide?

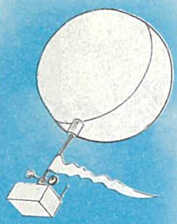
Accurately weight a large container eg a large peanut butter jar (full of air) to the nearest 0.1 g.

In a still room, make some carbon dioxide by mixing some bicarbonate of soda with some vinegar in a bucket. Carefully, so as not to disturb the carbon dioxide, pour the carbon dioxide produced into your preweighed container. Weigh the container again with the carbon dioxide in it.

How much heavier is the carbon dioxide than air? How much heavier is a cubic metre of carbon dioxide than a cubic metre of air? (For a cubic metre, subtract the weight of the air filled jar from the carbon dioxide filled jar then divide this by the size of the jar in mls and multiply it by one million.)

Why don't people make carbon dioxide balloons?





AUSTRALIAN
SCIENCE
TEACHERS
ASSOCIATION

Let your imagination take flight!

Enter the 1997 Australasian Poster Competition by designing an original, creative A3 poster on this year's Science Week theme: *Flight*

Your entry could be an Australasian finalist and be displayed at Questacon - The National Science and Technology Centre.
Enter in your age group (your age at the closing date: Friday 13 June 1997).

Categories

Primary	Secondary
1. Under 7 years	5. Under 14 years
2. 7-8 years	6. 14-15 years
3. 9-10 years	
4. Over 10 years	

For the selection criteria and further information, contact the Science Week Coordinator in your State/Territory as listed below, or the education officer at ASTA, PO Box 334 Deakin West, ACT 2600. Phone: 06 2829377. Fax: 06 282 9477.

ACT
STA*ACT
GPO Box 1205
Canberra ACT 2601

New South Wales
STANSW
PO Homebush West
Homebush NSW 2140

Northern Teritory
STANT
PO Box 41809
Casuarina NT 0810

Queensland
STAQ
c/- School of MSTE
QUT Kelvin Grove
Locked Bag 2
Red Hill Qld 4059

South Australia
SASTA
PO Box 99
Parkholme SA 5043

Victoria
STAV PO Box 190
Richmond Vic. 3121

Tasmania
STAT
PO Box 3053
Launceston Deliv.Centre
Launceston TAS 7250

Western Australia
STAWA
PO Box 1099
Osborne Park
WA 6916

Proudly sponsored by **ICI Australia**

Student activities

Puzzle

Fill in the puzzle below using the clues supplied. When you have completed the puzzle, the letters in the blue squares will spell out a famous phrase.

Clues

1. This is used to put humans and space craft into orbit.

2. The centre of our solar system.

3. The name of the spacecraft that landed on the moon.

4. Name of an American organisation concerned with space travel.

5. A small red planet.

6. Name given to some recent American space probes.

7. Name of a telescope currently travelling through space.

8. The Earth is one of these.

9. The name given to an early Russian space craft.

10. The sun is one of these.

11. The name of our planet.

12. This is outside the Earth's atmosphere.

13. This is needed to boost rockets into space.

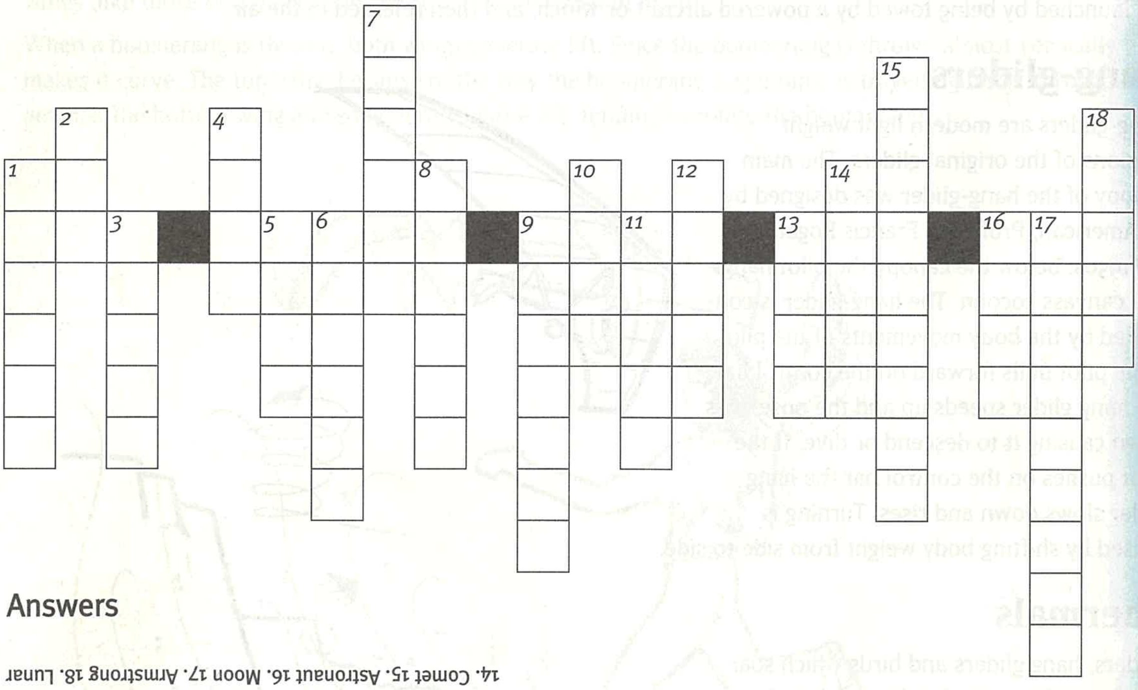
14. One of these was named after Halley.

15. Name given to a person who travels in space.

16. A natural body that orbits the Earth.

17. The surname of the man who first walked on the moon.

18. This word is often used when referring to things concerning the moon.



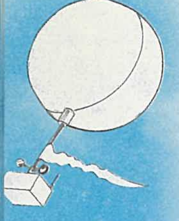
Answers

1. Rocket 2. Sun 3. Eagle 4. NASA 5. Mars 6. Apollo 7. Hubble
8. Planet 9. Sputnik 10. Star 11. Earth 12. Space 13. Fuel
14. Comet 15. Astronaut 16. Moon 17. Armstrong 18. Lunar

Puzzle Solution

One small step for man

Student activities



Riding on air

Build a kite

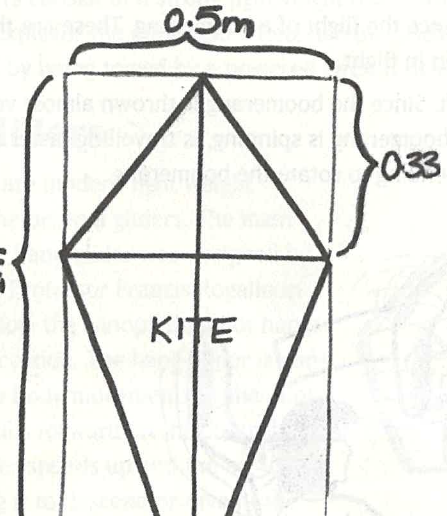
Build a basic diamond kite and then find ways to improve the design and decoration.

Collect the following:

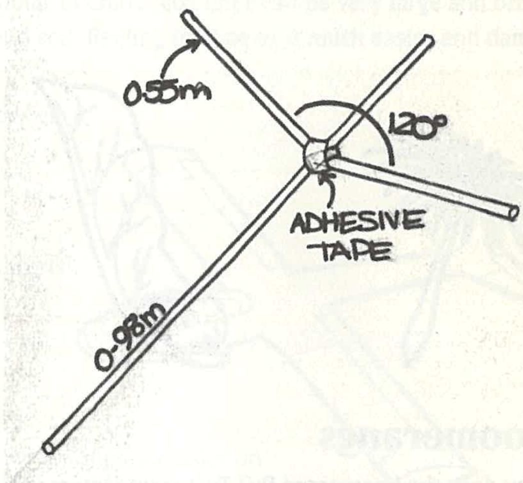
- *Piece of plastic or paper 0.5mx1m, adhesive tape, scissors, 2m of narrow rigid plastic tubing (such as used in watering systems), a ball of string or reel of fishing line, materials of your choice to make a kite tail (ribbon, plastic or paper), materials to decorate your kite, and plasticine.*

What to do

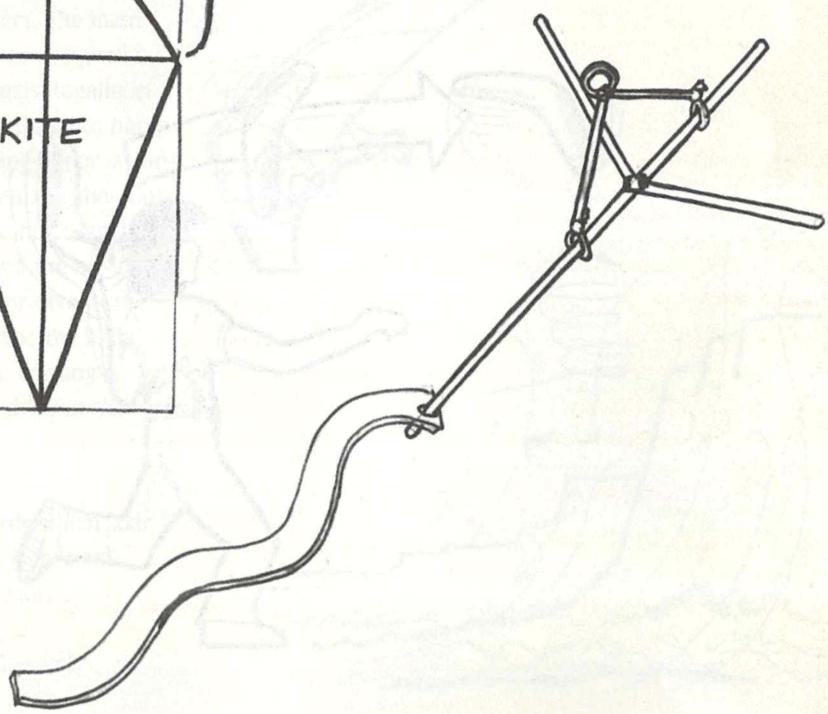
- Cut out your kite from the pattern below.



- Cut two lengths of narrow plastic tubing. One should be 0.98m and one should be 0.55m. Bend the 0.55m length of plastic tubing in the centre to make an angle of 120°. Join the two pieces as shown in the diagram below, using the adhesive tape.

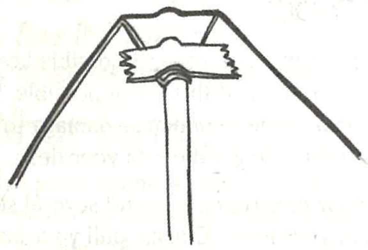


- Make three small loops of string, that are just big enough to slide easily along the plastic tubing. Place two of them as shown on the tubing.



Student activities

- Cut a 75cm length of string. Thread the third loop onto the string and then tie the ends to the loops on the kite frame. At the same time add one or more strips of coloured paper or plastic as shown to form a tail.
- Using the adhesive tape, attach each corner of the plastic to the kite frame.

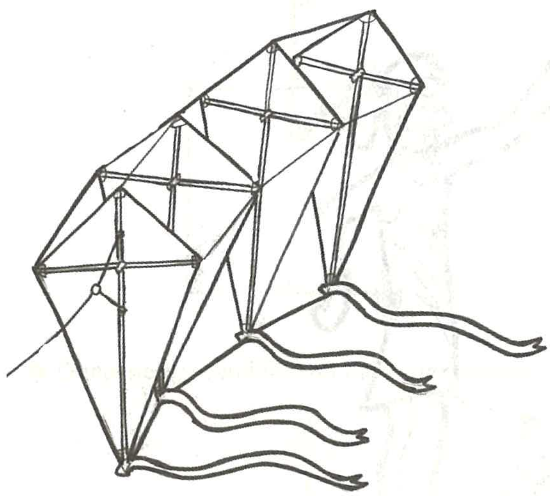


- Tie a long string to the centre loop.
- Wait for a suitable breeze and fly your kite.

Remember, never fly kites near power lines or trees.

Further activity

1. Make several kites and attach them as shown below. The kites should be spaced 1m apart using strings connecting each of the four corners of the diamond.



Design your own kite

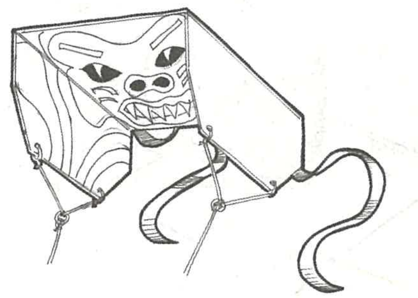
Can you design a kite that flies well and is very creative?

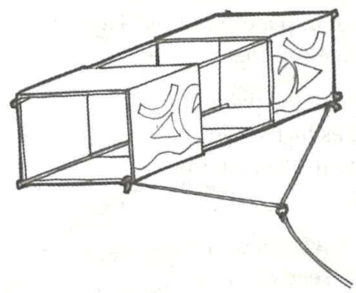
Collect the following:

- *Choose your own materials (you will need a lightweight material to make the frame, something to fix the pieces together with, material for the sail or sails of the kite, scissors and a long string with which to fly your kite).*

What to do

- Design your own kite. Be as creative and colourful as you like. The sky is the limit. If you are particularly adventurous, make a box kite. Below are some ideas to get you started.





- Fly your kite and evaluate how easily it lifted into the air, how well it flew and how well it landed. Remember, never fly kites near power lines or trees.
- Write a list of ways in which you could improve your design.
- Design and build your new kite.

Student activities

Banksia seeds like bushfires

Investigate how seed moves through the air.

Collect the following:

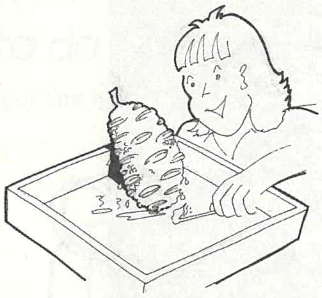
- *Banksia cone, metal tray, methylated spirits and heater.*

What to do

Warning!

This step must be carried out by the teacher or under very close supervision of the teacher.

- Place the *Banksia* cone on the metal tray and douse it with methylated spirits. Light it. Watch the follicles as the *Banksia* cone burns.



- When the cone has cooled, shake it over a sheet of paper until the seed falls from the follicles.
- Hold a seed in the palm of your hand as high as you can and release it. Observe the way it falls.
- Repeat this a second time, holding the seed above a heater which has been on for some time. Does the hot air rising above the heater make any difference to the fall of the seed?

Dandelions

Find out how air movement affects the movement of dandelion seed through the air.

Collect the following:

- *Dandelion seed, and an electric fan.*

What to do

- Collect some dandelion seed. If possible keep the seed heads together. If this is not possible, lie the seed flat on a tissue to minimise damage to the fine hairs, until you get them to your desk.
- While in your classroom, suspend several seeds in the palm of your hand. Quickly pull your hand away and observe what happens to the seed.
- Repeat the above outside and again observe what happens to the seed. How does the path of the seed compare with the path it took inside? Observe if the air is still, moving, a little windy or very windy. Is the air movement of the day affecting the movement of the airborne seed?
- Repeat Step 2 again, this time inside your classroom and in front of a fan. Again observe what happens to the seed and compare its path with your previous observations.

Further activity

Collect as many seeds as you can from different plants. Drop them, one type at a time, in front of a fan, to see which seeds travel the furthest.

A simple paper plane

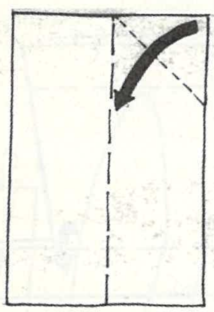
Make and examine the performance of a simple paper plane.

Collect the following:

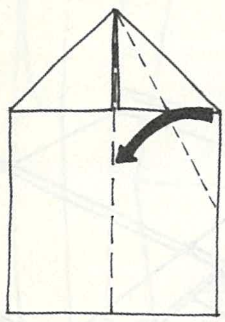
- *sheet of A4 paper(recycled paper is fine if it isn't bent or crumpled), scissors, and adhesive tape.*

What to do

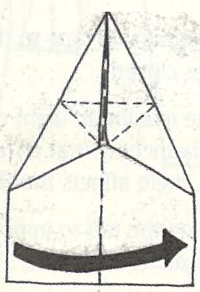
- A paper plane is really a glider as it is not powered. However, they are usually referred to as paper planes.
- Fold the paper in half lengthways.



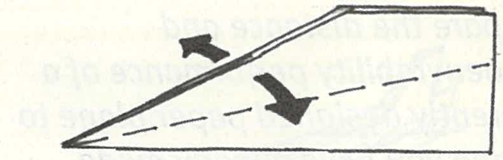
- Open out the sheet and fold in two ends as shown.



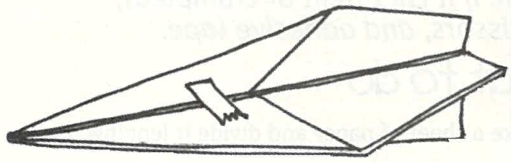
- Complete a second fold on these two corners as shown.



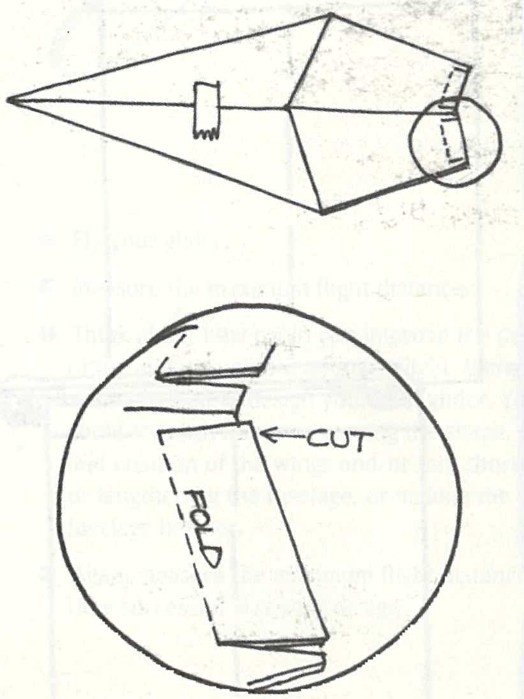
- Fold in half and bend down the wings as shown.



- Attach the two wings across the centre with adhesive tape to keep them in place.



- Fly your plane and measure your maximum flight distance.
- Give your plane wing flaps by cutting along the lines shown and bending the wing flaps up or down along the dotted line. Investigate how bending them up and down affects your flight path and flight distance.



Student activities

A more complicated paper plane

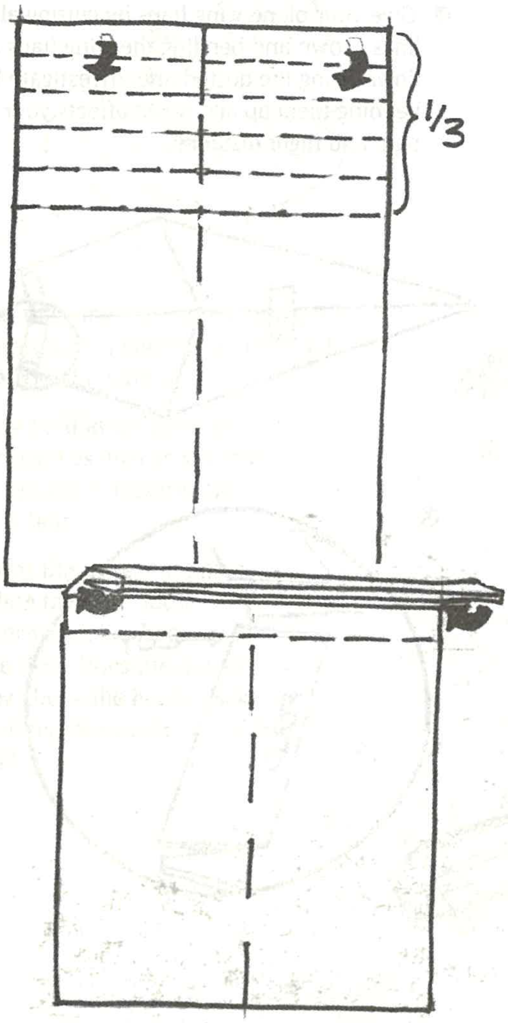
Compare the distance and manoeuvrability performance of a differently designed paper plane to the one you have already made.

Collect the following:

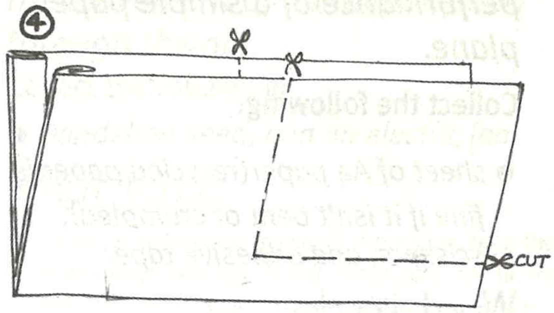
- *Sheet of A4 paper (recycled paper is fine if it isn't bent or crumpled), scissors, and adhesive tape.*

What to do

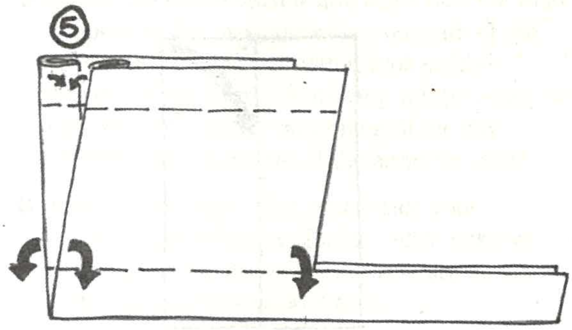
- Take a sheet of paper and divide it lengthways.
- Flatten it out, and measure down one third of the sheet.
- Fold the end of the sheet over and over five times, taking up only one third of the sheet.

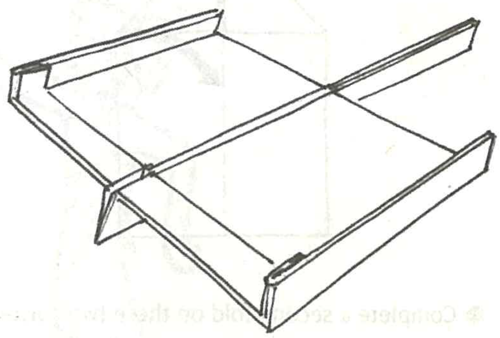


- Divide the sheet in half again and cut along the dotted line.



- Fold along the dotted line as shown in the diagram.





- Add a little adhesive tape to the centre to keep the fuselage closed.
- Measure the maximum flight distance of your plane. Try launching it at different angles to see if the launch angle affects the flight distance.
- Try modifying the tail to improve either flight distance or manoeuvrability.

A model glider

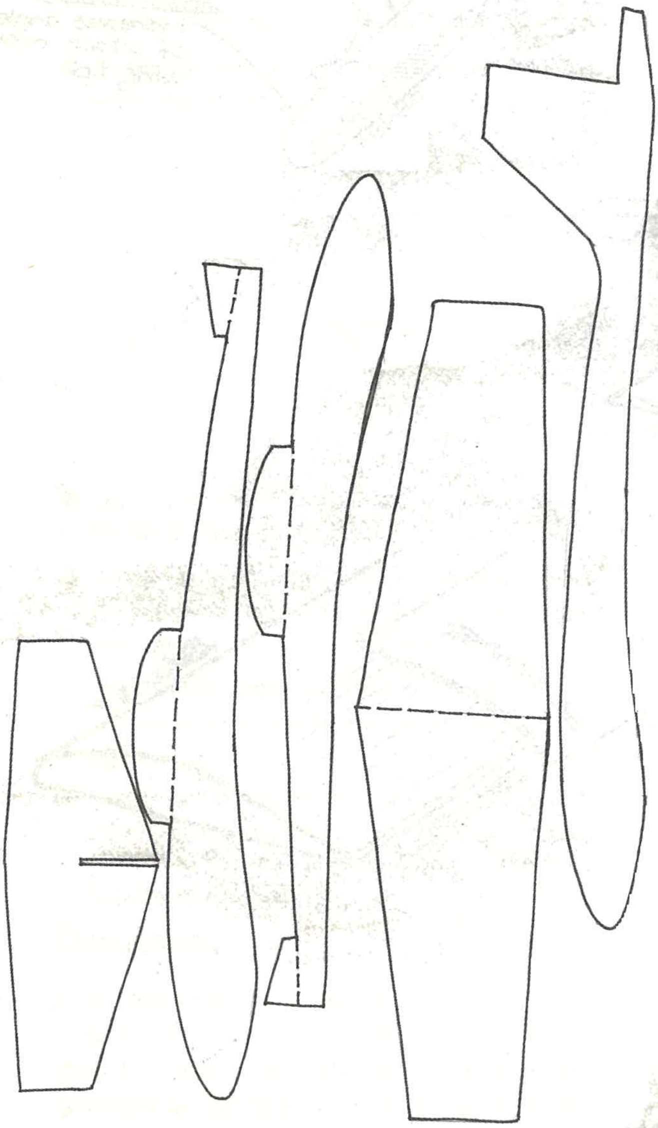
Make a simple glider and improve on the design.

Collect the following:

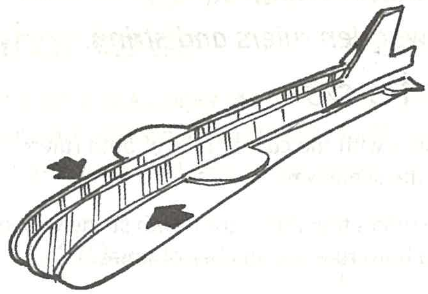
- *Sheet of light cardboard (A4 size will do), adhesive tape, scissors and a photocopy of the pattern below.*

What to do

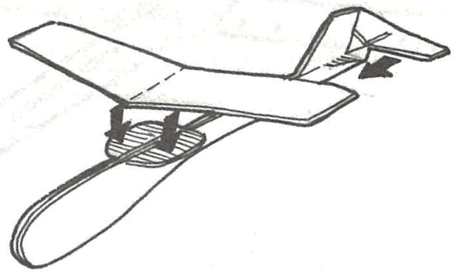
- Cut out the pieces in the glider pattern.
- Place these pattern pieces on the cardboard, draw around them and then cut them out.



- Cut out the pieces and stick the three fuselage pieces together.



- Add the tail and wings as shown using adhesive tape on the underside to keep it in place.



- Fly your glider.
- Measure the maximum flight distance.
- Think about how could you improve the design of the glider to obtain a longer flight. Using the same cardboard, design your own glider. You could try such things as varying the shape, size and position of the wings and/or tail, shortening or lengthening the fuselage, or making the fuselage heavier.
- Again measure the maximum flight distance. How successful was your design?

Student activities

Boomerangs

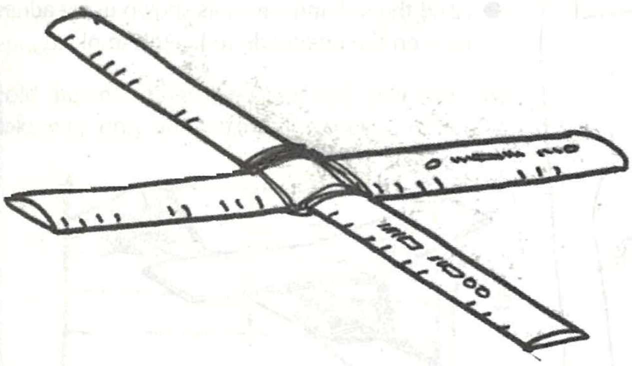
Make and fly a boomerang

Collect the following:

- *Two wooden rulers and string.*

What to do

- Form an x with the curved face of both rulers facing the same way.
- Tie the rulers together tightly with string wrapped around both rulers a number of times.



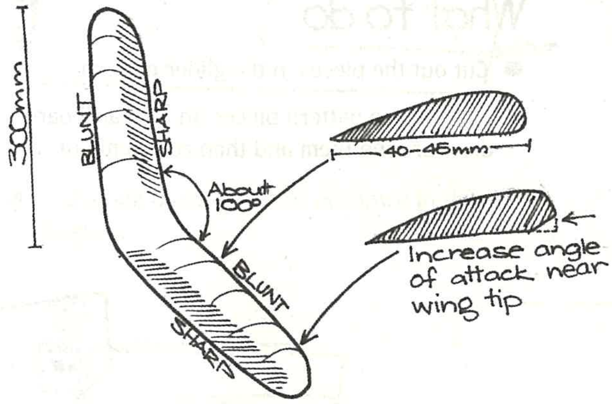
- Hold the boomerang almost vertically with the curved surface facing you. Throw it parallel to the ground.
- Experiment with your boomerang by taping small weights (small coins) to the tips of the wings and by shaping the wings with sandpaper.

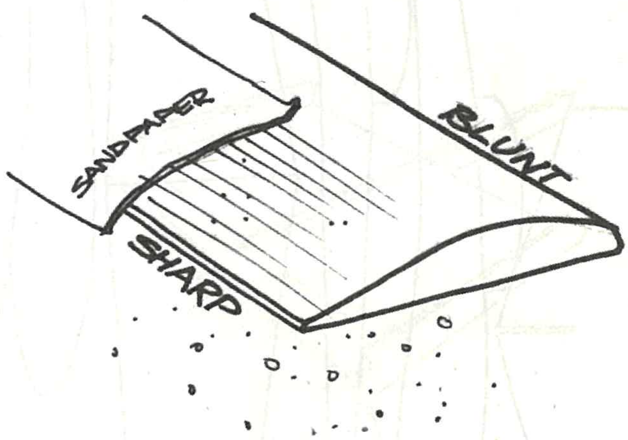
Further activity

Trace boomerang shapes out of books or experiment with your own shapes.

You could experiment with different weights and sizes of boomerangs. If your boomerang is too heavy for the amount of lift then it won't come back to you. If your boomerang is too light it won't have the weight to keep spinning.

- You might like to make a more traditional boomerang by cutting a boomerang shape out of wood. Plywood is best as it is stronger than most other kinds of wood. Shape the wings using a file, rasp or sandpaper so that they look like a teardrop flattened on one side.





Make sure that on the inside of your boomerang you have a sharp side facing a blunt side and that both wings have the flat side on the same side.

Student activities

Hovercraft

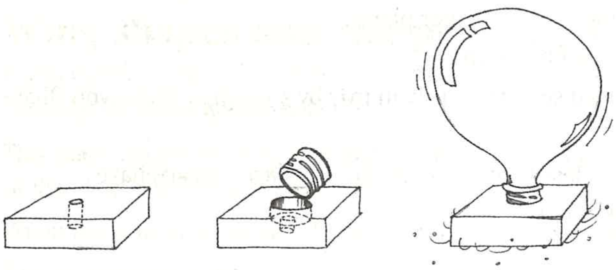
Make your own hovercraft.

Collect the following:

- *Balloons, smooth flat surface, small smooth wooden disk or square, the cut off top of a plastic soft drink bottle, sticky tape, drill and drill bits*

What to do

- Drill a small hole (about 3mm) all the way through the centre of the small block or disk of wood. Drill a groove around the hole penetrating just over half way through the wood. The groove should have a diameter just big enough so that the top of the drink bottle top can screw into and seal itself in it.
- Fit the balloon around the bottle end of the bottle top and inflate the balloon.



- Squeeze off the end of the balloon and screw the bottle top into the block
- Sit the block on a flat smooth surface and give the balloon a slight push, while at the same time releasing the neck of the balloon.

Observe what happens. Explain why it happens. Experiment with your design finding out ways of improving it.

- See if you can design and construct your own self propelled hovercraft. You could use another balloon to provide the propulsion or a rubber band powered propeller.

Discussion

A hovercraft rides on a cushion of air. The air reduces the friction between the craft and the ground. A commercial hovercraft uses air pressure generated by fans to provide the lift and other fans to provide propulsion.

If something as heavy as a car was floated on a cushion of air would you be able to push it?

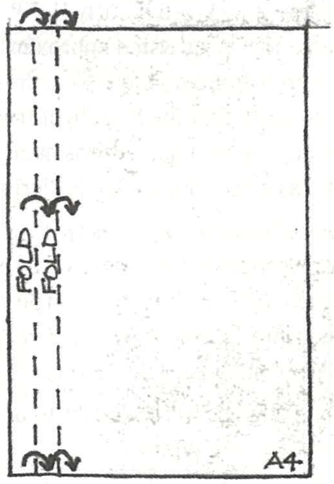
Spinning paper cylinder

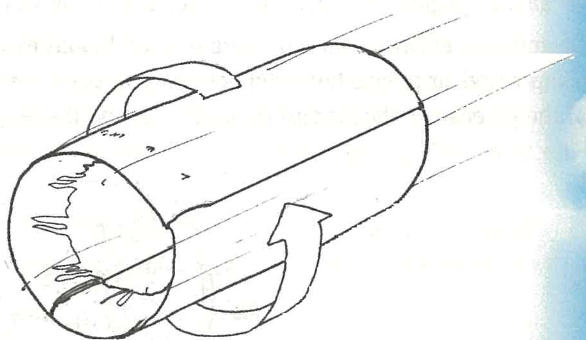
Collect the following:

- *Sheet of A4 paper and scissors*

What to do

Cut a piece of A4 paper in half. Fold the long edge over twice. Roll up into a cylinder tucking the folds into each other and tape up the length.

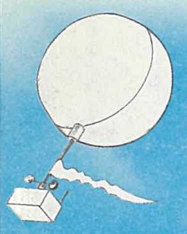




Throw your cylinder with a clockwise flick of your wrist. Make sure that the end with the double fold is in front so that the cylinder will rotate it as it comes out of your hand.

Describe the flight path of your unusual flying object. Experiment with different weights of paper, different sizes and different numbers and sizes of folds. Experiment with the fold on the outside of the cylinder. What difference does this make?

Teachers' notes

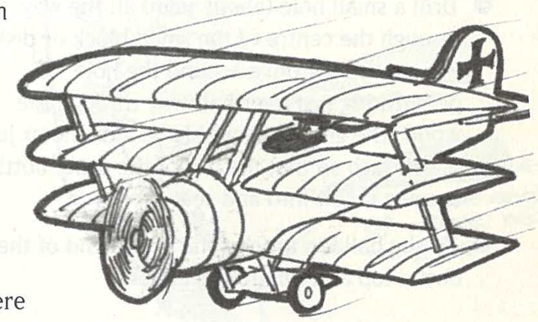


Early flying machines to Jumbo jets

Early planes and flights

A plane is a powered machine which can fly, despite the fact that it is heavier than air.

The first powered flight was made in 1903 by two American brothers, Wilbur and Orville Wright. It occurred in Kitty Hawk, North Carolina on an isolated beach. The flight lasted approximately 12 seconds and covered approximately 40 metres. It was only six years later, in 1909, that the first flight from France to England across the English Channel was made. The hero of this 41km flight was a Frenchman, Louis Bleriot.



In the early days of aviation biplanes were developed which had two shorter stronger wings. These contrasted with the monoplanes which had longer weaker single wings. Biplanes were very popular as fighter planes in World War 1. The most famous fighter plane was the 'Red Baron' piloted by the German Manfred von Richtoven.

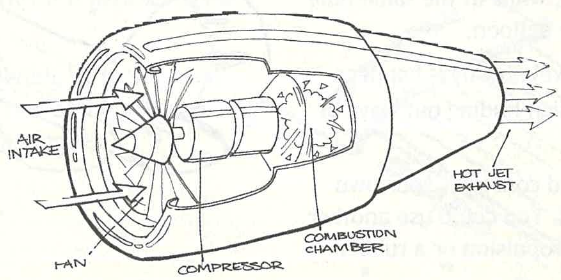
The first jet plane engines were thought to be developed simultaneously in 1937 by a German, Pabst von Ohain and an Englishman, Frank Whittle.

From a humble beginning on a beach in North Carolina less than one hundred years ago humans have developed Concorde, Jumbos and sophisticated fighter planes.

How jet engines work

Jet aircraft engines demonstrate Newton's third law of motion. For every action there is a related reaction.

Once the jet engine is started, there is a continuous explosion inside as the fuel burns in huge quantities of compressed air to give hot air under great pressure. The hot air under pressure escapes through the rear end of the jet engine. The air pushes backwards and the jet pushes forward. *(Action and reaction).*



Helicopters

The first rotating winged aircraft was the autogyro, invented by Juan de la Cierva in the 1930s.

Rotating wings, cutting through air, create lift without forward motion. A helicopter has rotor blades which are modified rotating wings. All the lift comes from the rotating blades which are powered by the engine causing the helicopter to be a very heavy fuel user. The rotating blade gives versatility and manoeuvrability.
For example, a helicopter can lift without moving forward, can hover when required and can fly close to the side of mountains etc. It is therefore an excellent choice for rescue work, troop movement, getting quickly from one place to another in a congested city and doing operational or field work.

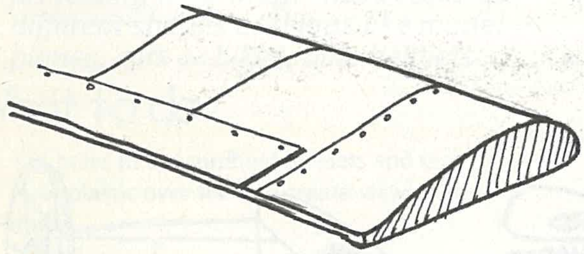
Controlling a plane in flight

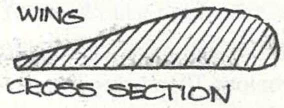
Simple planes are controlled in flight using:

(a) a rudder on the tail which can cause the plane to rotate on its vertical axis,

(b) elevators on the tail which cause the plane to rise or fall, *and*

(c) ailerons or wing flaps on the back of each wing which can be raised or lowered independently to cause the plane to decrease speed, bank or turn.





Wing shapes and the physics of flight

If you cut the wings off an airplane you would discover the shape which helps it fly. The shape is a bit like a teardrop flattened on one side.

This shape allows the wing to move easily through the air while at the same time lifting the wing and the body of the plane which is attached to it.

When the wing is stationary the air pressure is the same on the top and underneath the wing.

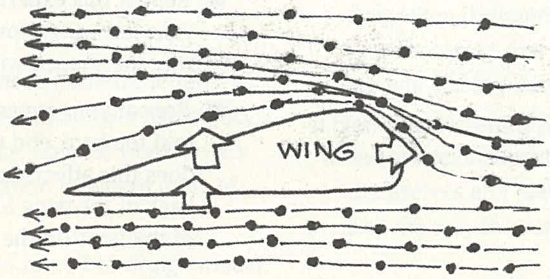
This air pressure is the result of the air in the atmosphere being pulled down by gravity to the centre of the earth.

It is sometimes hard to imagine why air pressure acts underneath things and can push things - like an airplane wing up. Imagine a hose filled with water in the shape of a J with your finger over the end. If your finger is applying more pressure than the water pressure (created by the weight of water in the hose) it will not leak. If you take your finger off the bottom of the hose, the water pressure will force your finger up. The water will spray into the air.

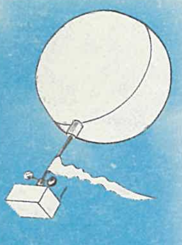
The water in the tube is similar to the weight of the air being pulled down to the earth. If we take some air pressure off the top of something and there is more air pressure under it than the weight of the object it will rise into the air.

The shaped wing uses these features.

The velocity of the air molecules travelling up and over the wing effectively creates a reduced pressure on the upper surface of the wing. The air moving under the wing is greater and causes the plane to rise in the air.



Student activities



Why things fly

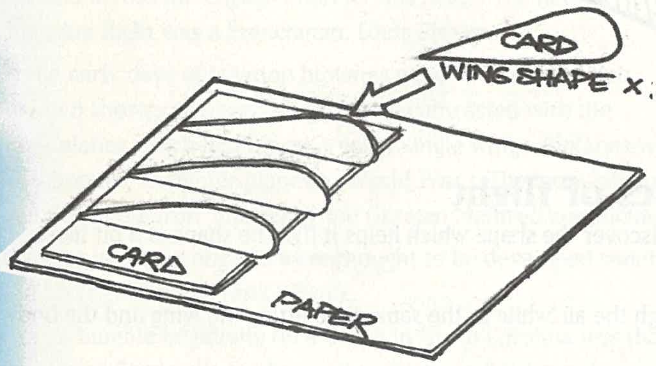
Find out why wings are shaped the way they are and why they lift planes off the ground.

Collect the following:

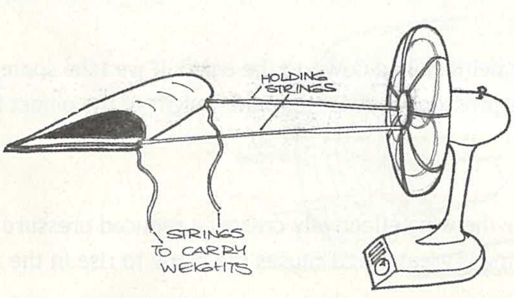
- *Paper, cardboard, glue, adhesive tape, string, fine cotton, fan, and small weights eg coins.*

What to do

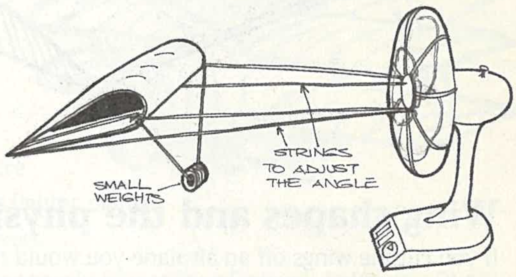
- Cut and your wing cross section from cardboard in the shape indicated below. Then using glue, attach the paper as shown.



- Fold paper over top of the wing templates and paste down the edge to form an airplane wing shape (see diag)



- Tie string to the front edges of the wing to hold it against the fan (holding strings) and string below the wing to hold the weights.
- Add two extra strings as shown, to allow you to change the angle of the wing (angle strings).
- Attach the angle strings and the holding strings to the centre of the fan.
- Turn on the fan. Watch the wing rise off the table.
- Add weights one at a time to determine the maximum weight the wing can carry.



- Change and measure the angle the wing makes with the table surface. Determine the maximum carrying weight at this new angle.
- Change the angle again and try again. Determine the angle which gives your wing the maximum amount of lift.
- Repeat the experiment with a flat piece of card in place of the wing.
- Explain the differences in the lifting capacity of the shaped wing and the flat wing. Determine the angle required to give maximum lift for each wing type.
- Attach (glue or tape) one centimetre lengths of very fine cotton at one centimetre intervals all over the surface of the wing. Turn on the fan and watch what happens to the lengths of cotton.
- Repeat this experiment with pieces of cotton on your flat wing. How does this help you explain why the shaped wing lifts better than a flat one?
- Repeat your experiment with the shaped wing but fold the back end of the wing up a little. How does this affect the wing. Now try again with the back of the wing folded down. Find out the name of the flaps on the back of the wings.

Student activities

Wind tunnel

Find out how you can stop things being such a drag.

Collect the following:

- *Fan, sheets of cardboard, sticky tape, clear plastic eg overhead projector sheets or plastic box lids, fine string, several weights eg coins and objects for testing wind drag. These could be different shapes or things like model planes, cars or bikes, bike helmets*

What to do

- Cut holes in the cardboard sheets and tape clear plastic over them to create viewing windows.
- On a long table or large piece of wood tape the cardboard in a series of arches to create the wind tunnel.
- Position the front sheets to form a funnel to collect the air from the fan.
- Attach string to the front of each object you are going to test and place the object at a marked place in the wind tunnel.

  Either tie the other end of the string onto a spring balance or hang it over the end of the table and hang weights from it.
- Turn on the fan and record the strain on the spring balance or the number of weights which must be added to the string to hold the test object in its starting position. This is your drag reading for that object. Compare other objects with your drag gauge and plot their different drag readings.
- You might like to test different bike helmets to see which are the most streamlined.
- You could test all the objects again at a different wind speed (turn down or move the fan) to see if the relative drag changes with wind speed.

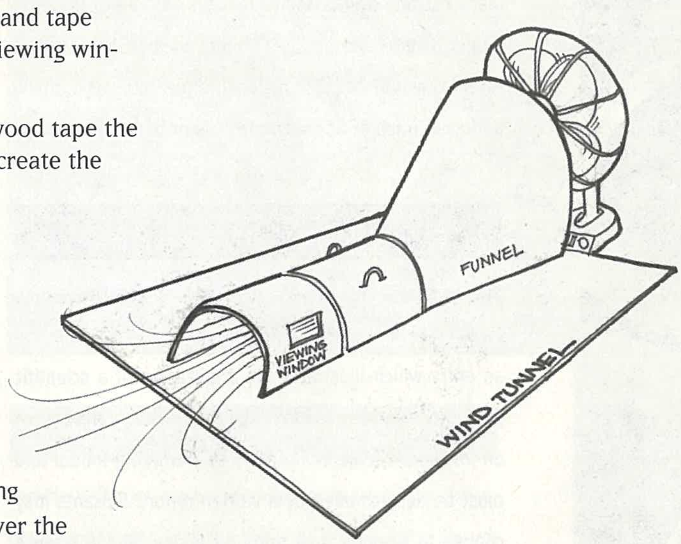
Further activity

You might like to attach one centimetre lengths of fine cotton or wool by one end all over the object you are testing. Observe the way the wool moves. This will give you an indication of where most of the drag is coming from.

You can also use your wind tunnel to design model planes seeing how different designs have reduced drag or increased lift. These planes could be made out of balsa wood or paper and cardboard.

To measure your plane's lift, drill a small hole in the base of your wind tunnel, under the plane. Tie fine string just under the centre of the wing of the plane, thread it through the hole and attach it either to a spring balance or add increasing weights to just hold the plane to the ground when the fan is on.

You might like to test the lift and drag of other objects such as a frisbee or boomerang



What kind of sports are influenced by drag and could use wind tunnels to improve performance?

You could design and carry out an experiment to try to work out the best angle a discus should be thrown at to maximise the length of its flight.

Discussion

Wind tunnels are used extensively to test the wind drag when designing new products. These wind tunnels can be extremely large to fit large scale models. Racing skiers can use these tunnels to reduce the drag of their equipment and by the way they stand. They actually stand inside the tunnel themselves and feel the effect of the wind on them and the way they stand.

The Shell Science Awards

Scientific inventions and ideas

Shell Australia, together with the Australian Science Teachers' Association are pleased to make available the Shell Science Awards. The awards support and encourage Australia's young men and women in their understanding and interest in science.

The program offers eight year nine and ten students and two science teachers the opportunity to participate in an interactive science and technology program in Canberra, during the first week of December. The visit includes many exciting events and culminates with a presentation dinner, where one national winner of the Shell Science Award is announced. The national winner receives a trophy and cash prize of $500 towards his or her education.

Shell Science Student Award

Students who are in year nine and ten are invited to participate in the Shell Science Awards by preparing an entry which illustrates the application of a scientific principle. An entry may take the form of such projects as an invention (scale or full size) or a working model and must be accompanied by a written report. Entrants may choose to develop their entry by taking part in science competitions, science fairs or science talent search programs conducted by State or Territory Science Teachers' Associations. However, individual students may enter the awards by making a direct entry as outlined on the entry form.

Each State or Territory Science Teachers' Association will select up to three students and forward their written documentation for national finalist selection. This selection will be based on the excellence of the student's project. Both the state/territory and national judging panels will take into account the excellence of the applicant's total project in terms of the:

- **clarity of the report** which outlines the reason for the investigation, the investigative processes including the difficulties encountered and any modifications necessary, and the design, testing and evaluation of the entry;
- **quality, workability, practicability and sophistication** of the entry;
- **understanding** demonstrated of the **scientific principles** involved in the design and working of the entry, and how that understanding is reflected in the entry;
- **level of complexity** of the science and technology underlying the operation of the entry; and
- **demonstration** of the practicability and sophistication of the entry.

Other selection criteria will include the student's academic and extra-curricular achievements within the area of science and technology, general schooling, and other interests. The student's suitability to represent Australian school students at a prestigious national science and technology event will also be considered.

Shell Science Teacher Award

One teacher from each state may be nominated to be selected as chaperone and educator for the trip. Interested teachers should submit an application form. Teacher selection will be based on:

- the range and amount of science teaching experience;
- involvement in extra-curricular student science experiences, particularly those related to student science projects;
- Association and ASTA activities, particularly those related to student activities;
- professional development activities as both recipient and presenter; and
- out-of-school hours student activities requiring supervisory skills.

1996 Shell Science Awards

The 1996 Shell Science Awards Program will take place between December 3–6.

The program aims to provide:

- information about leading edge Australian science and technology development;
- contemporary examples of Australian applied science and technological developments; and
- an indication of the diversity of career paths available in the science and technology fields.

The program will include:

- inspection of science presentations and display galleries at The National Science and Technology Centre;
- visit to the National Film and Sound Archive—the theme being 'science and technology at work';
- lecture and tour of the Australian National Botanical Gardens;
- visit to Telstra Tower; and
- observation of sports medicine facilities at the Australian Institute of Sport.

On the final evening, a national winner will be announced, by the Minister for Science and Technology, The Hon. Peter McGauran, at a presentation dinner.

1997 Shell Science Awards

Shell Australia are pleased to announce that the awards will continue in 1997. Application forms for students and teachers will be available from the State or Territory Science Teachers' Association.

For further information, contact the Education Officer, Australian Science Teachers' Association, PO Box 334 Deakin West ACT 2600, (06) 282 9377.

1996 Winner – Tenelle Wilks

Tenelle Wilks, a year nine student from Geraldton Senior High School, was awarded the 1995 Shell Science Award. Tenelle constructed a number of biodegradable plant pots using readily available household materials made into forms of papier mache. The pots were impregnated with additives to aid plant growth and health. 'Once the full idea of the biodegradable plant pot has been developed and produced, it will benefit our society and the environment, thus improving the state it is in today', says Tenelle.

Tenelle's project was a reflection of her own concern for the environment. She wanted a biologically based project that was environmentally friendly. Tenelle wants to continue her interest in this area, and intends to pursue a career in biology that focusses on the environment.

Student activities

Make your own helicopter

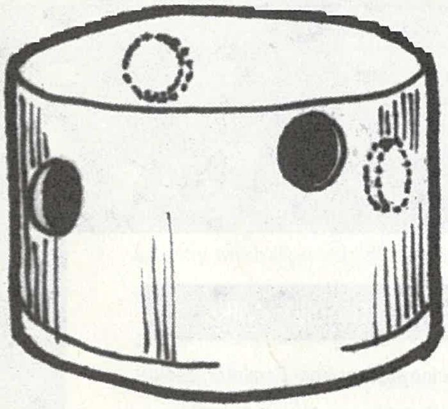
Can you make a model helicopter?

Collect the following:

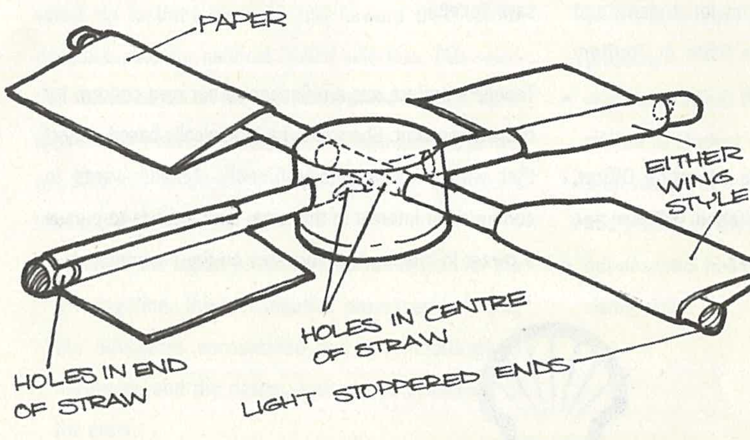
- *Lid of a plastic soft drink bottle, sausage shaped balloons, plastic straws, sticky tape, drill bit the same diameter as the straw (or pointed knife), paper and plasticine.*

What to do

- Drill four holes in the lid as in the diagram, with two holes directly opposite each other and one set of holes slightly bigger than the others. Make sure your holes are as close to the top of the lid as possible.



- Insert two straws in the holes. Cut a number of large holes in the centre of the straw (inside the lid).
- Seal the end of the straws with tape or a small amount of plasticine.



- Tape paper onto the straws to form wings. (You may wish to experiment with folded paper to make a wing shape.)
- Cut small holes in the ends of the straws on the same side as the wing. (You may wish to experiment with directing this air flow.)
- Inflate the balloon. Squeeze of the neck.
- Put the neck of the balloon over the lid. Then with the balloon pointing downwards release the balloon.
- Observe closely what happens.
- Make modifications to improve the performance of your balloon.

Many different things can be varied to make your helicopter perform better. You could change the type of balloon, the type or length of the straws, using three straws and three holes or making much longer wings. You could use bendy straws with the bent end at the wing tip. You could change the size and shape of the wing etc.

Discussion

Helicopters come in different shapes and sizes. One of the earliest designs by Leonardo Da Vinci has a number of characteristics similar to your balloon copter.

The faster a helicopter travels forward the more problems it has staying up. Why might this be? What things might be designed to stop this being a problem? One attempt is to have two rotors spinning in opposite directions.

What is the role of the propeller at the back of a helicopter?

Space flight

The beginning

The 1960s saw an achievement which humans had dreamt about for centuries. For the first time, in April 1961, a Russian astronaut became the first human to travel through space. His name was Yuri Gagarin and his space flight which lasted one hour and eighteen minutes in a space craft called Vostok 1, is now part of history. In May that year the first American astronaut, Alan Shepherd was to make a space hop as part of the Mercury program. The space race was on between the then USSR and the USA. Exploration of space and the development of technology that allowed it went ahead at an amazing rate. The Vostok program continued in the USSR and the Mercury program in America was replaced by the Gemini program which placed the first human on the moon in 1969. Neil Armstrong, in his space suit worth over $100,000 American dollars, took the first tentative human steps on the moon's surface, saying '*That's one small step for a man, one giant leap for mankind.*' It was July, 1969.

Since that time there have been many heroic stories, some deaths, much technological advance and much emotional outcry about the huge quantities of money being spent on space research. Despite all this, huge advances have been made and now space flights past other planets, the Hubble telescope, the space shuttle and space stations are all realities.

The Canberra Deep Space Communication Complex

The Canberra Deep Space Communication Complex is an integral part of NASA's Deep Space network. Pictures from as far away as the planet Neptune have been received by the complex to assist scientists with their investigations of the solar system.

The complex acts as a sophisticated mail exchange between scientists on Earth and interplanetary spacecraft. Messages are received and transmitted by the complex using very large antennas. The largest of these is 70 metres in diameter and weighs more than 3 million kilograms. Each antenna uses microwave signals to communicate with spacecraft. Microwaves travel easily through space, however the strength of the signal can be very weak by the time it reached Earth. The detect these signals we need to amplify them using a MASER amplifier which operates at 40K (-2700C). This temperature helps reduce amplification of background noise which can interfere with the signal.

Once the signal has been amplified it is recorded onto cassette and transported to the Jet Propulsion laboratories in California. The information is then available for examination and evaluation by scientists.

Commands can be sent to spacecraft from the Jet Propulsion Laboratories via antennas. These commands are sent as microwaves 500 times as powerful as a microwave oven.

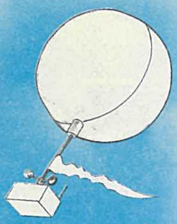
The Canberra Complex and two similar facilities in California and Spain, provide constant contact with all spacecraft. The Canberra Deep Space Communication Complex will continue its essential support role in the future. This will include support for missions to Mars, Jupiter, Saturn and hopefully Pluto in 2014.

This section was sponsored by **The Canberra Deep Space Communication Complex**.

Contact: Darren Osborne P.O. Box 4350 Kingston 2604

Phone: 201 7838 Fax 201 7975

Student activities



Balloon rocket

Can you make a multistage balloon rocket?

Collect the following:

- *Sausage shaped balloons, string, paper clips, sticky tape and disposable cups.*

What to do

- Stretch and tie a string tightly between two objects a reasonable distance apart.
- Cut the bottom off a cup. Inflate a balloon with its end inside a cup. Inflate a second balloon with its top inside the cup so that the air pressure of this balloon seals the first balloon.
- Use sticky tape and paper clips to attach both balloons to the string.
- You might like to add fins to the front balloon to make it travel straighter.
- Release the bottom balloon and observe the flight.
- Fine tune your rocket to increase the distance it can travel.

Bottle rocket

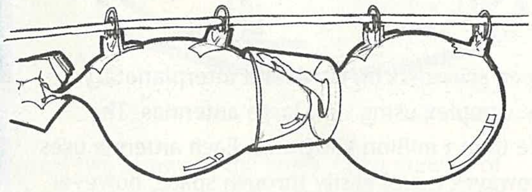
Can you make a plastic soft drink bottle take off like a rocket?

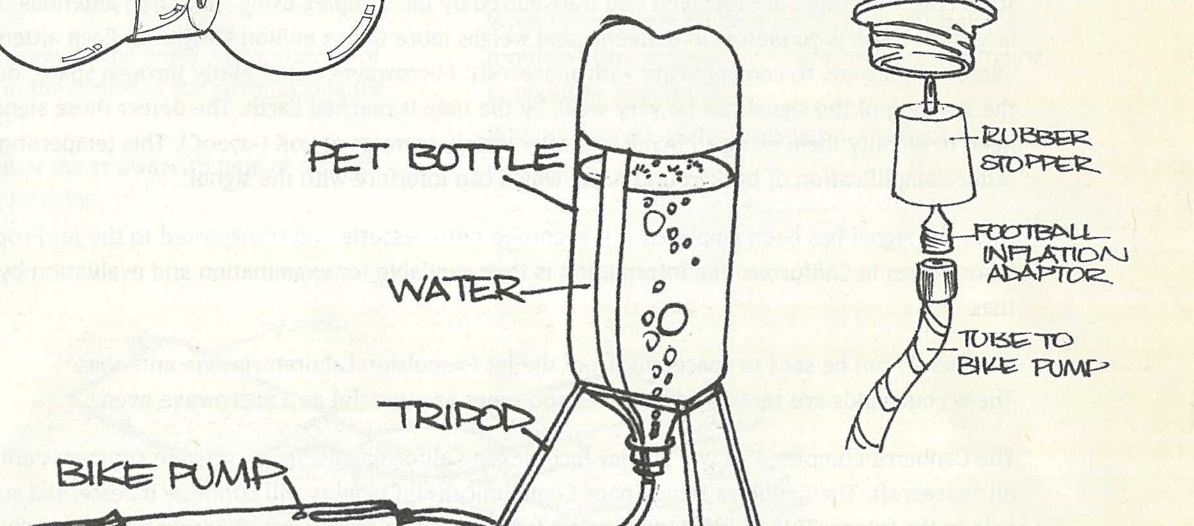
Collect the following:

- *2 litre plastic soft drink bottle, bicycle pump, tripod, rubber stopper to fit bottle with a football inflation adaptor inserted tightly through an appropriate sized hole and a connecting tube if necessary to connect the pump to the adaptor*

What to do

- Set up the apparatus as shown below, making sure the bottle is two thirds full of water.
- Pump as much air as you can into the bottle. Keep your head out of the way or you will be sprayed with water as your rocket blasts off.
- Release the bottom balloon and observe the flight.
- Fine tune your rocket to increase the distance it can travel.





This section was sponsored by **The Canberra Deep Space Communication Complex**.

Contact: Darren Osborne P.O. Box 4350 Kingston 2604

Phone: 201 7838 Fax 201 7975

Student activities

Astronauts in space

Collect the following:

- *writing materials, craft materials, every available source of information, creativity and imagination.*

What you do

- In this activity you will research, prepare and present information on one aspect of how astronauts live in space.
- Working with a partner find out as much as you can about one of the following topics. (Different class members could do different topics).

  The first astronaut in space

  Food in space

  Personal hygiene in space

  Landing on the moon

  The Apollo missions

  The Gemini missions

  Space suits

  The Sputnik missions

  Space laboratories

  Blasting off

  Space rockets

  The role of NASA

  Breathing in space

  Exercising in space
- Decide what you would like to say during your presentation.
- Write this up in note form.
- Think about things that you could make, or use, to make your talk more effective and interesting. We will call these presentation aids. (They could include posters, audio tapes, static models, working models, etc).
- Make your presentation aids.
- Practise your presentation.

A space laboratory

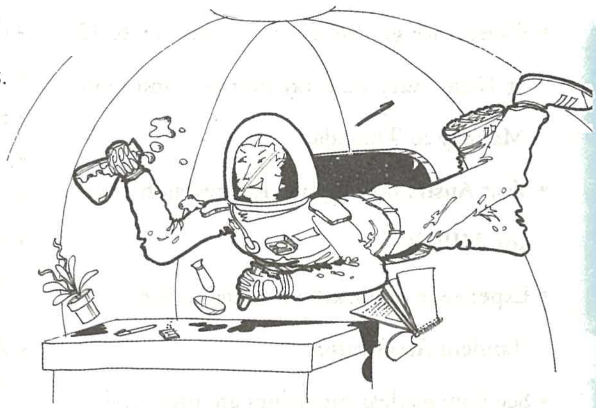
Can you make a walk in model of a space lab?

Collect the following:

- *Large cartons, paint, paste, sticky tape, coloured paper, scissors, information about the structure and function of space laboratories, and any craft materials you can find.*

What you do

- This is an opportunity to be very creative and learn science at the same time. Using the available large cartons, make a large cylinder big enough to hold four people.
- Imagine that you are an astronaught who will be living inside this model space laboratory for three weeks. Make a list of the things you will need. Remember space is very short and there is only sufficient room for things which you will need for survival and some comfort.
- Carry out an information search to find out as much as you can about space laboratories and living in space.
- Decide what you need to take with you in the space laboratory. Make a model of it and place it in the cylinder.
- Don't forget that you will need to re-enter the atmosphere and come back to the Earth's surface safely. What will you need to ensure this? Don't forget to add it to your model.



This section was sponsored by **The Canberra Deep Space Communication Complex**.

Contact: Darren Osborne P.O. Box 4350 Kingston 2604

Phone: 201 7838 Fax 201 7975

STROMLO
exploratory

What is Stromlo Exploratory?

An exciting hands-on astronomy education and tourist centre, opening July 1997. "Explore the Universe" and see what professional stargazers do! Visitors can 'fly a spaceship' over the planets or see what the sun really looks like, through a Heliostat telescope! Astronomy for everyone visiting Canberra.

Teachers

Group tours of telescopes by special arrangement. Teachers can book our resource room for their class to do fun, curriculum based astronomy projects with the Exploratory Education Officer. Maths, Science and other core subject 'trails' are built into the exhibits with trail finder activity sheets provided on request.

We need your help!

To build high tech & fun exhibits, costing $1 million, we need sponsors. Become a 'Friend of the Exploratory' - your membership will entitle you to free admission and other special benefits. Why not 'Adopt a Star' for your school - from $50 upwards. You will recieve an adoption certificate, a map to show your star, plus your school's name will be recorded on the Exploratory Star Display.

For more information contact:

Tony Oldfield or Katy Gilkes on (06) 249 0276

Mt Stromlo Observatory, Off Cotter Road, Weston Creek, Canberra, ACT

ANSTO SITE TOURS

Every Week is Education Week at

ansto

- Three hour guided tours for years 11 & 12 at 10am every weekday morning and 2pm Monday to Thursday.
- Visit Australia's only nuclear research reactor, HIFAR.
- Experience radiocarbon-dating at the Tandem Accelerator.
- See how nuclear medicines are produced and distributed.
- Learn about Synroc and nuclear waste management.

Also available:

- Nuclear Source Teachiong Kit.
- educational videos.
- information sheets & brochures.
- work experience.
- ANSTO is now on the Internet. Dial: http://www.ansto.gov.au

- **Australian Nuclear Science and Technology Organisation,**
  New Illawarra Rd,
  Lucas Heights
  Ph: 02 9717 3168,
  Fax: 02 9717 9274