Exploring Flight

Cross-curricular activities for KS2/3 students

Resources provided by the British Aviation Preservation Council

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Contents

Introduction

About this pack

This resource pack has been designed for students at KS2 and KS3 visiting museums and sites that are members of the British Aviation Preservation Council - the national body for the preservation of aviation-related items. Its members range from the some of the largest cultural collections (e.g. The Imperial War Museum) to small, local collections. An up-to-date list of all BAPC member sites is available on the BAPC website, http://www.bapc.org.uk/

These resources are designed to

- encourage cross-curricular learning focusing on the key skills of communication, literacy, visual literacy, critical thinking and research,
- help teachers guide children to develop knowledge and skills (around the topic of aviation) through creativity, inspiration and enjoyment.

The pack contains:

- Preparatory activities to do before a visit
- Ideas for activities during the visit
- Ideas for follow-up activities back at school
- Supporting fact sheets that can be used as simple primers, to inspire questioning or as research sources
- A list of further resources

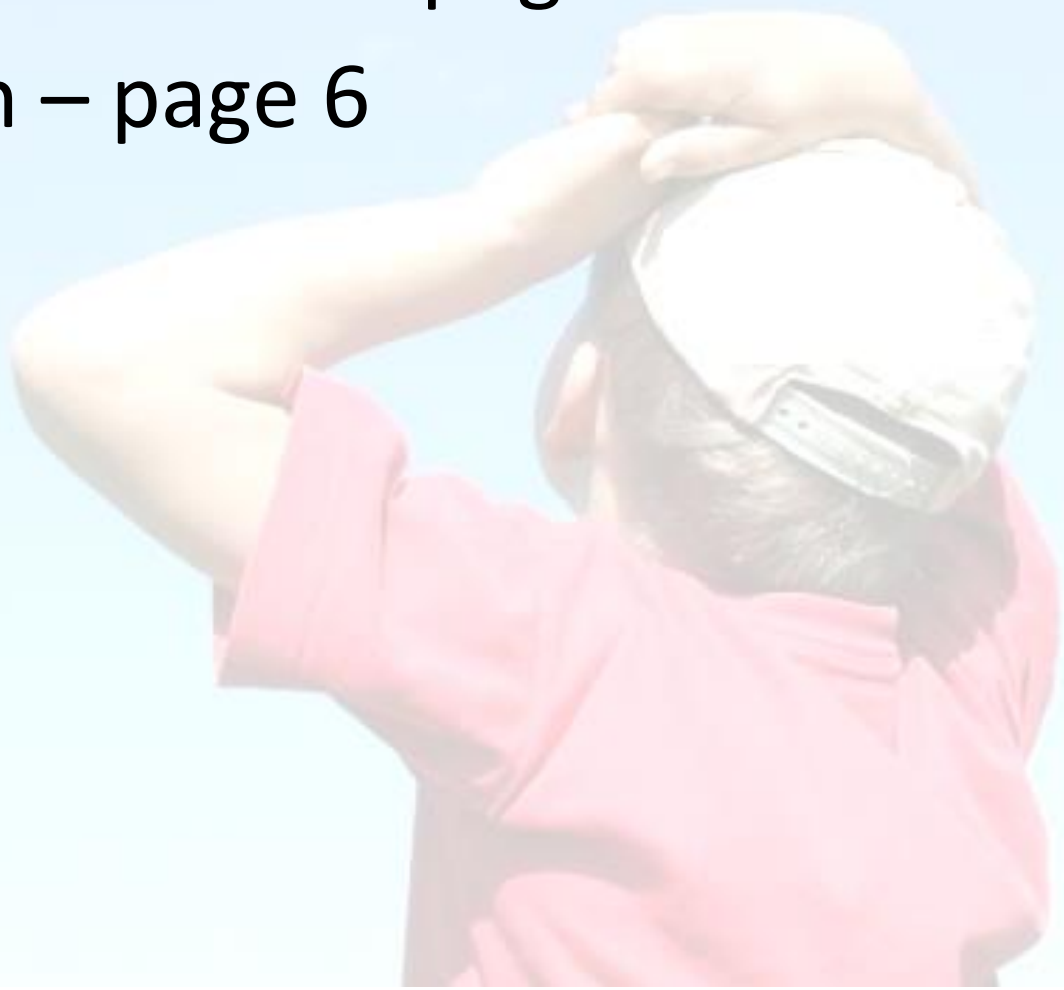
Curriculum links can be downloaded separately.

'Reconnaissance' learning

Because these resources are designed to support a visit to any BAPC-member site they do not rely on student's interaction with specific collections. Instead they stimulate creative enquiry by students, encouraging them to explore and ask questions of objects as a springboard for learning. Students could imagine that this is the attitude of mind when a pilot is on a reconnaissance flight – alert and curious, looking for an overview and then searching out for detail. The BAPC member's collections are perfect to inspire this kind of curious learning.

Pre-visit activities

- Create a question bank – page 5
- Form a mission – page 6



Create a question bank – teachers' notes

This activity asks students to create a list of questions about flight and related topics in preparation for your visit.

Steps

1. If you need to, introduce the topic of flying to the class. You might want to use the information sheets 'How do aeroplanes fly?', 'Fascinating Flight Facts' and 'Key moments in the history of flight' (pages 30-36).
2. What do students want to know about aviation? What questions do they want answered?
    - Be sure not to close down any avenues of questions. Encourage a wider view of aviation (e.g. students may ask 'is it a good thing we can fly?', 'What will flying be like in the future', 'have we always flown?' and so on). Allow them to explore social, historical and geographical questions as well as science and design.
    - If you are teaching KS3 students or your visit is intended to support particular learning outcomes (e.g. about forces and motion) then you may wish to direct some of the questioning.
3. Collate a list of questions, on a large sheet or whiteboard, or, for a more fun idea, by asking students to write questions on a piece of paper then fold it into a paper aeroplane to throw towards a target.
4. Once all the questions have been collected they can be grouped into three categories
    - 'Domestic' questions: Can we answer it now?
    - 'Short haul' questions: Do we need to do some research to answer this?
    - 'Long haul questions: Is this one we can't answer definitely?

Note: Keep this question bank to help plan the visit. The 'long haul' questions could act as a springboard for post-visit activities (see pages 21 - 28).

5. As a class, address the questions that can be answered now. Then ask them to agree a set of 'short haul' questions to find answers to on your visit. **Note:** You may want to 'filter' these questions depending on the venue you are visiting (for instance, questions about airships might not be answered if there are none at the venue). Try to liaise with venue staff, ideally before the visit, to prime them about these questions as they may be able to help the students with them.

Form a mission – teachers' notes

This activity casts your venue visit as a 'fact finding mission' – seeking answers to your questions.

Steps

1. Explain the concept of reconnaissance to the class (perhaps using reconnaissance flights as an example of information gathering) and encourage pupils to think in the mode of researchers.
2. Ask the class to think about:
    - all the tools they can use to gather information – e.g. taking photos, drawing diagrams, creating a map of the venue, creating a question sheet to be filled in etc. Might they need measuring tape, note pads, magnifying glasses etc?
    - the sorts of things they can find out from a physical object that they can't from a picture of an object. How can they use their visit to make the most of what's on offer – and answer the questions they have?
3. Ask students to prepare their own methods of information capture ready for the visit.

Visit activities

1. Think of the following activities as a ‘menu’ from which to choose from. You can give different activities to different groups of students as appropriate, perhaps based on the nature of their questions.
2. You might want to group learners into pairs (a ‘pilot/ navigator’ team)
    - Mapping the site – pages 8 - 11
    - Drawing takes flight – pages 12 - 14
    - Make your own label – pages 15, 16
    - Write a specification – page 17, 18
    - Flights of fancy (literacy activity) – page 19

Mapping the site – teachers' notes

Every good mission needs a reliable map. In this activity the pupils are responsible for creating their own map of the location at the start of the visit. In drawing their own map and planning their own route for exploration pupils will direct their own investigations and gain confidence in entering, exploring and interpreting heritage and cultural visitor sites independently.

Steps

Student instructions for the activity are provided on the worksheet on page 9.

Extension ideas

This activity could be complemented with other map-making techniques, for example:

4. Mapping a journey from A to B in your locality for a pilot of a light aircraft. Get students to think about visible landmarks such as major roads, large buildings and any tall obstacles!
5. Mapping the road route to the venue you are visiting. Students use a road atlas to identify the most direct road route, draw out that route, and then check during the journey to see if it matches that taken by the driver.
6. Mapping through drawing. Give each student a small sketchbook to be a 'visual map' of the day. They begin drawing on the journey, continue to draw whilst walking around the site and draw on the way back home. These drawings could then be combined with maps in a large display. Students will begin to understand the correlation between a mapped landscape and the physical location.

Mapping the site - Student sheet

Your job is to map the site you are visiting.

1. Before you begin, think about the best way to record all the information. Not all maps of a place are the same. Very few show exactly what we would see if were above it looking down.

   For example:

   - a road atlas gives information about roads and service stations, but does not include details about nature
   - a tourist map includes interesting places to visit but not the ugly or boring places

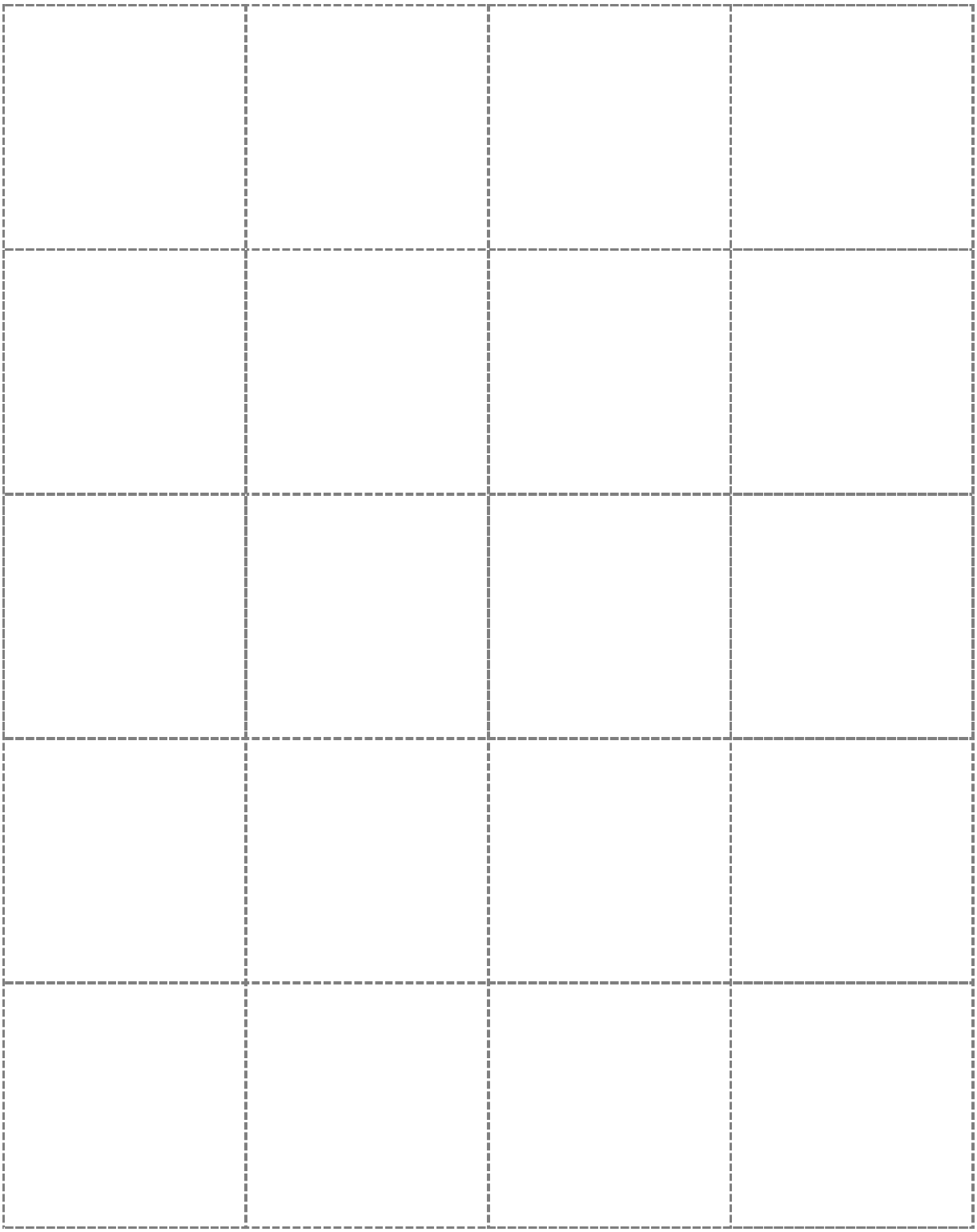
2. Have a look at the aeronautical navigation chart (a map used by aeroplane navigators) on the next page. What special information do the navigators get from this map?
3. Now, decide what information you should include in your map. Write these notes on the sheet 'Things to put on the map'.
4. Now you have that worked out you can begin to draw your map on the grid provided. Make sure you can get everything on the sheet.

   - You could give your map a **scale,** to make sure it reflects the size of everything accurately. (Hint: One way to measure the site is by counting your paces as you move around.)
   - If you want particular symbols to represent different features show what your symbols mean in the Key.
   - Don't forget, maps often have labels to help people find things.
   - Have you included everything on your list?

5. Do you think there is a good order in which to see each thing? Perhaps you can add a suggested route for people using your map.

Example of an Aeronautical Chart

Map Grid



Drawing takes flight – Teachers' notes

Using the drawing worksheets get students looking at the whole shape of objects, as well as at close details, and looking from different angles.

Steps

Instructions for students are on the worksheets on pages 13 and 14.

You might want to consider the following to improve their experience of the activity:

1. Photocopy the worksheets onto cartridge or drawing paper
2. Provide a range of different drawing materials such as pen, pencil and graphite. Demonstrate the differences between these materials and ask pupils to choose the most appropriate material for each object, for the textures they are representing or the surface they are drawing on.
3. Provide drawing boards or clipboards with bulldog clips or masking tape to fix the paper on. Clipboards with smooth hard surfaces are better for drawing on than the slightly padded type.

Drawing takes flight - Student sheet (1)

Choose an interesting object. Fill this box with an overview drawing of it. Draw the whole object, thinking about its shape and lines. Use shading to show light and dark areas.

In this box look closely at one part of your object, for example a line of screws, a control panel or an interesting pattern. Record this small part of your object in detail.

When you have finished, draw an arrow to show where the small detail is on the overview drawing?

Drawing takes flight - Student sheet (2)

Objects can look different depending on how you look at them. If you are trying to draw something it can be a good idea to move around it and draw it from different places. Choose an interesting object and make four different drawings of it below. Write the name of your object here: _____

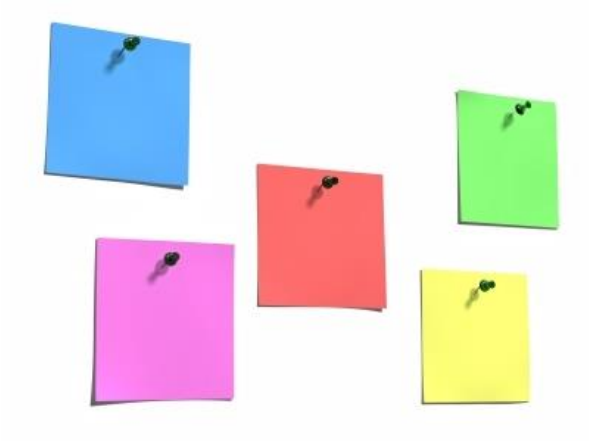
Draw it from the front.

Draw it from the back. (Try to do this without taking your pencil off the paper.)

Get low down to draw it from below.

Draw it from the side. (Try to do this without looking at the paper at all.)

Make your own label – teachers' notes



This activity aims to get students looking carefully and reading information about specific objects. In writing the label they sort, select and order information into a coherent description of an object.

Steps

Student instructions for the activity are provided on the worksheet on page 16.

Extended activity ideas

- Your visit venue may have the facility to display student labels temporarily alongside the objects. Whether or not this is possible, the final versions could be edited as an ICT activity back in school, thinking about the layout, font size and how to draw attention to key information.
- Use the skills developed above to present a mini-museum of flight in the classroom.
  - Dedicate a table and wall space to the mini-museum.
  - Ask pupils to bring in artefacts - these could be model aircraft, adverts for flights, photographs taken out of plane windows, old family souvenirs etc.
  - Through the presentation of these materials and writing labels students can make connections between the history of flight, the objects seen on their visits and their own experiences of or ideas about flying.

Make your own label – student sheet

You might have spotted labels for the objects. These might include the name of the object, the date it was made and how it was used. Writing labels is a tricky job, because you have to imagine all the questions visitors might ask and try to answer them. Can you help to write new labels for the objects?

1. Choose an object. Look at it very carefully. Think about
   - what you know about it,
   - what you find most interesting about it,
   - what makes you curious about it.

   Include unusual things that others may not notice.
2. Use the box below to write a new label for the object, including all the things you noticed. It may help to think about the following questions:
   - What is the object called?
   - When was it made?
   - Who made it?
   - Why might someone find it interesting?
   - What might people not notice that your label can point out?
   - Is there a story behind it, for example about people, that could be used to 'bring it alive'?

Write a specification – teachers' notes

This activity extends 'Make your own label' activity (see pages 15,16), this time asking pupils to apply their own knowledge to interpret the objects that they are seeing using technical and scientific language.

Steps

1. Instructions for students are on the worksheet on page 18.
2. Ask different groups to write specifications of their choices of objects. This will enable the whole class to make comparisons between different objects, perhaps tracing developments and changing trends in aviation design.

Extensions

The 'Design and build a fleet of aircraft' post-visit activity (see pages 22) leads on from this activity.

Write a specification – student sheet

The objects here had to be designed and made very carefully. The designers had to decide exactly how big all the parts should be, what they should be made of, how they should be fixed together and so on. These design details are called a 'specification'. When we look at these objects we can see many of these details. How many can you spot?

In your groups, choose an object and look carefully at it. Imagine you are the designer telling someone exactly how to make another one. By answering these questions build up a specification for it.

How big is it?

You could measure the length, height, depth and sizes of particular parts of the object. Draw a diagram and label it with the sizes if you want.

What materials is it made from?

Say which parts are made of which materials

How heavy do you think it is?

Can you make a good guess?

How is it made?

If there are many parts can you work out how they are fixed together? How many parts are there?

Flights of fancy – student sheet

Write an *acrostic poem* about the things you can see today. An acrostic poem means that the first letter of every line spells out the title of the poem. Here's an example called Take-Off:

Tarmac runway turns to a blur
As we go faster and faster
Keep holding my breath
Excited but nervous

Our metal carriage becomes
Free as a bird
Fields and roads now far below

Using ideas and words from your visit, try this acrostic poem called Flying:

F

L

Y

I

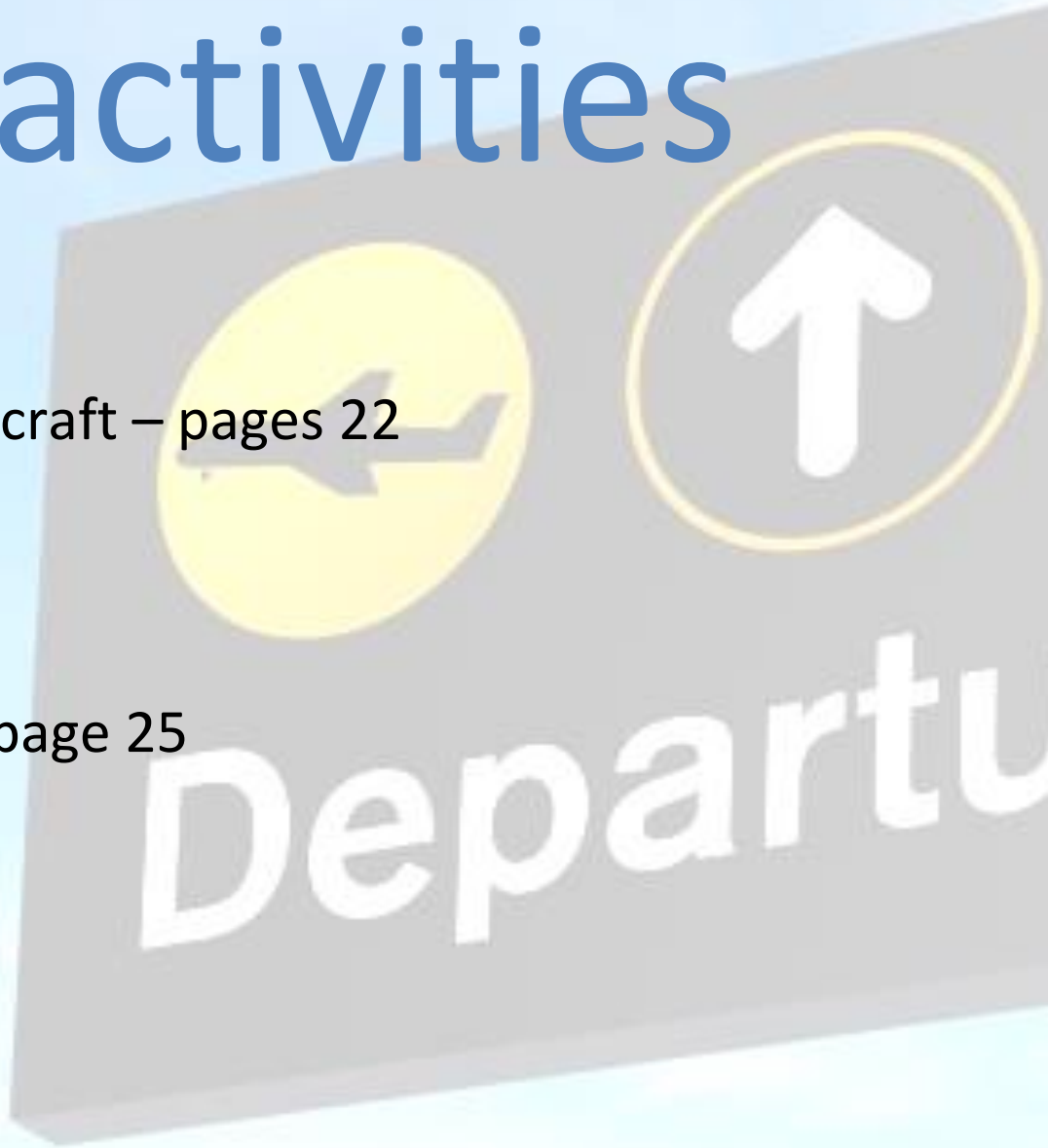
N

G

Now, write your own poem starting with your own title words? Or, why not challenge a friend to write a poem with those words and vice versa?

Post-visit activities

- Plenary – page 21
- Design and build a fleet of aircraft – pages 22
- Literary activities
    - Word picture – page 24
    - A line before take-off – page 25
- Debates – pages 26 - 28



Plenary – Teachers' sheet

This activity is a chance to discuss what the group has seen and learnt, and consider any questions arising.

***Note:** More questions about ethics and citizenship can be found in the 'Debate' activity on page 26.*

Steps

1. Share and discuss what students have recorded. What most surprised them? Was the visit useful? What did you enjoy the most? What would you have liked to have seen?
2. Look at the questions you created for your Question Bank (see page 5). Can they now answer some of the questions they couldn't before?
3. These further questions can be used to prompt discussion:
   - Why might someone want to fly?
   - Is flying safe?
   - Aircraft technology has improved a lot since humans first took to the skies. What stimulates these improvements? (Encourage students to think beyond advances in technology to what might act as a catalyst for these advances, e.g. economic drivers, wartime etc.)

Design a fleet of aircraft – Teachers' sheet

If you visited a venue with several aircraft and students tried to write specifications of them, you could use this information to launch a larger project – challenging students to design their own aircraft. This activity can be extended to model making.

Steps

1. As a class compare specifications. Draw up a list of the design features (such as shape of wings, tail, use of propellers and materials) that are common to most of the aircraft. Note the design features and materials that have been used rarely in aircraft design, or that have been used in the past but less in recent designs. Use this information to draw up a new specification that lists the five (or more) most important features for an ideal aircraft.
2. Challenge groups to follow the specification to design their own aircrafts. Aside from the five specified features they can be as imaginative as they like with their design. You could challenge them further by adding other constraints to their design process, such as making a seaplane, or an eco-friendly aircraft. Pupils should demonstrate the features of their designs using annotated drawings and written descriptions.
3. Using their design, they should write a list of instructions, explaining the stages in constructing the aircraft.

Extension

If facilities allow:

- Pupils make a model of their designed aircraft, following their designs and instructions as carefully as possible. To enable flight, lightweight material such as balsa wood, tinfoil, paper and card could be used.
- The project culminates in a whole class air-show, where each plane is tested, evaluated and celebrated. If you really want to have fun you could build a model airstrip with blue-sky background and invite an audience.

Literary activities – Teachers' sheet

These two activity sheets are designed to generate source material for an extended piece of creative writing.

There are two activities:

1. 'A word picture' will generate a 'word bank' for use in creative writing about flight. Pupils could also be asked to use different colours for different types of words in their word picture, i.e. red for nouns, green for adjectives, blue for verbs.

   A student worksheet can be found on page 24

2. 'A line just before take-off' is designed to stimulate pupils to generate a single line of text that will form the basis of a piece of extended creative writing. Connect this activity to history projects by encouraging pupils to research the historical context of the aircraft that they selected - looking at wars, politics and technological progress. This research could inform their story.

   Consider working towards a small anthology or a website to publish their creative work and share this with staff at the venue.

   A student worksheet can be found on page 25

A Word Picture – student sheet

1. Think of something you saw on your visit and found interesting.
2. Make a quick drawing of it, showing the shape of its outline in the box below. This doesn't have to be a work of art – in a minute you're going to write all over it!
3. Once you have a simple drawing, fill it up with words to describe it. These words could be:
    - the names of its different parts (find out if there are any special words that are new to you),
    - the colours in the object, the material it is made from,
    - the feelings it gives you (does it make you excited, or scared and can you imagine how it would feel to be inside it?)
    - words to describe its texture and shape, such as smooth, wavy, graceful, lumpy, mechanical.
4. Don't stop until your picture is full of words.

A line just before take-off – student sheet

Think of an aircraft you saw on your visit. Imagine you are the pilot and keep that in your mind while you answer these questions.

What is your name?

Where are you?

To be the pilot of this aircraft did you need to go back in time? If yes, can you decide which year it is?

How long have you been flying this aircraft? Are you an expert pilot?

How do you feel about flying? Do you love it, or does it make you a little nervous?

Why are you flying the aircraft? Is it a passenger aircraft, or perhaps you are in a war, or are you flying it purely for fun?

How do you feel when you climb inside the aircraft?

Now, using your imaginative answers to the questions above, try and write the first line of a story about you flying this aircraft. What are you thinking about? How do you feel? Write the sentence carefully in the box below.

Later or now, could you write a story with this first line?

Debates – Teachers' sheet

This activity asks students to look at the wider aspects of flight and its social and ethical context. Using the quotes on the next two pages as stimulation and the motions for each subject, choose a debate topic and split the class into two groups, one to argue for and one to argue against the motion.

Debate 1: The relationship between aviation and war

Motion:

The invention of aircraft has reduced the number of wars.

Debate 2 : Aviation and climate change

Motion:

We should seek ways to reduce the amount of flights people take to help combat climate change.

Stimulating quotes for debate 1: The relationship between aviation and war

"The Wright Brothers created the single greatest cultural force since the invention of writing. The airplane became the first World Wide Web, bringing people, languages, ideas, and values together." — *Bill Gates, CEO, Microsoft Corporation*

"When my brother and I built the first man-carrying flying machine we thought that we were introducing into the world an invention which would make further wars practically impossible." — *Orville Wright, 1917.*

"Air power may either end war or end civilization." — *Winston Churchill, House of Commons, 14 March 1933.*

"Aviation is fine as a sport. But as an instrument of war, it is worthless." — *General Ferdinand Foch, Professor of Strategy, Ecole Superiure de Guere, 1911.*

"The greatest contributor to the feeling of tension and fear of war arose from the power of the bombing aeroplane. If all nations would consent to abolish air bombardment . . . that would mean the greatest possible release from fear." — *Ernest Rutherford*

"Hitler built a fortress around Europe, but he forgot to put a roof on it." — *Franklin D. Roosevelt*

"We want the air to unite the peoples, and not to divide them." — *Lord Swinton*

"As a peace machine, the value [of the airplane] to the world will be beyond computation. Would a declaration of war between Russia and Japan be made, if within an hour thereafter, a swiftly gliding aeroplane might takes its flight from St. Petersburg and drop half a ton of dynamite above the war offices? Could any nation afford to war upon any other with such hazards in view?" — *John Brisben Walker, owner of Cosmopolitan, 'Cosmopolitan,' March 1904.*

"If our airforces are never used, they have achieved their finest goal." — *General Nathan F. Twining*

Stimulating quotes for debate 2: Aviation and climate change

"Aviation's carbon footprint is growing and that is politically unacceptable for any industry. The challenge for aviation is to keep its many benefits, such as unprecedented global mobility supporting 32 million jobs and US$3.5 trillion worth of economic activity, while eliminating its negative impacts." — *www.climateactionprogramme.org*

"The whole [global warming] thing is created to destroy America's free enterprise system and our economic stability." — *Jerry Falwell, US preacher*

"Global warming — at least the modern nightmare vision — is a myth. I am sure of it and so are a growing number of scientists. But what is really worrying is that the world's politicians and policy makers are not." — *David Bellamy, Botanist*

"Aviation is a rogue sector and its environmental impact is out of control. Climate change is the most urgent challenge facing humanity and yet aviation policy is doing the opposite of what is needed." — *Tony Juniper, Friends of the Earth*

"Environmental organizations are fermenting false fears in order to promote agendas and raise money." — *Michael Crichton, Author*

"The best thing we can do with environmentalists is shoot them. These headbangers want to make air travel the preserve of the rich. They are Luddites marching us back to the 18th century." — *Michael O'Leary, Chief Executive of Ryanair*

"The IPCC has determined that, worldwide, directly fueled transportation (i.e., that which achieves its motive power directly from fossil fuels, a category including cars, trucks and buses; diesel/electric railroad locomotives powered by gasoline engines; ships; and aircraft) currently accounts for 14 percent of CO2 emissions into the atmosphere. Now, of that, all of aviation represents 2.0 percent of CO2." — *Aviation Week*

"If aviation's CO2 emissions, by any careful measurement based on known statistical factors, are so small, both overall and among individual categories like business and general aviation, why is there concern within the industry of a backlash? Because of the disconnect between reality and perception. Because of its high profile, or because of ignorance mixed with fear on the part of the general public, or both, aviation is being singled out by some of the more radical fringes of environmental, social and religious movements as a major contributor to global warming. These factions arrive at their conclusion by distortion of aviation's scientifically derived emissions statistics and concern about its phenomenal growth over the past two decades in response to demand by the traveling public." — *Aviation Week*

Supporting Materials

- How do aeroplanes fly? – page 30
- Fascinating flight facts – page 34
- Key moments in the history of flight – page 35

How do aeroplanes fly?

***Note:** this sheet is a **very short** introduction to the principles of flight. You can find out a lot more by using some of the 'Further resources' recommended by the British Aviation Preservation Council at the end of this information sheet.*

Aeroplanes are heavier and more solid than the air. So how do they get off the ground (like the Spitfire in the picture above), stay in the air and land again safely?

A lot of the answer comes from how aeroplanes use the air itself.

The air

Air surrounds the Earth and presses down upon it due to gravity. Air near the surface is more dense because the rest of the air above it is pressing down on it. The higher up you go, the less dense the air and the less pressure. Knowing that there can be differences in air pressure and air density is the first step in understanding how aircraft are designed.

Getting off the ground - all about lift

You need to get moving

A car sitting on the road pushes down on that road with a force equal to its weight. The road 'pushes back' the same amount (as stated by Isaac Newton's famous 3rd law: "To every action there is an equal and opposite reaction").

But air is not nearly as solid as a road. How can a heavy aeroplane be supported by it? The answer is that when it is stationary it cannot. A stationary aeroplane, if somehow magically plonked in the sky, would soon fall to earth. Aeroplanes create the support they need by *moving through* the air.

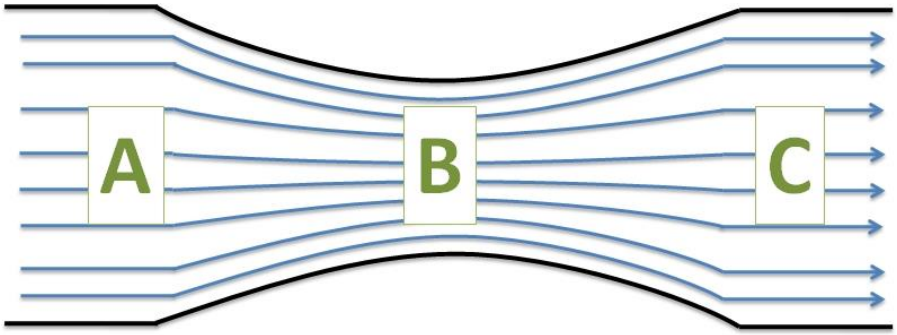
The faster the air the lower the pressure

Daniel Bernoulli

How does moving through the air create this lift, the 'equal and opposite reaction' to the aeroplane's weight needed to keep it in the sky? The answer is found in the work of a man called Daniel Bernoulli, a mathematician who lived in the 1700's. He discovered that when fluids (including air) move in a streamlined way around an object the *speed* at which they move affects the *pressure* they place on that object.

Wind tunnels

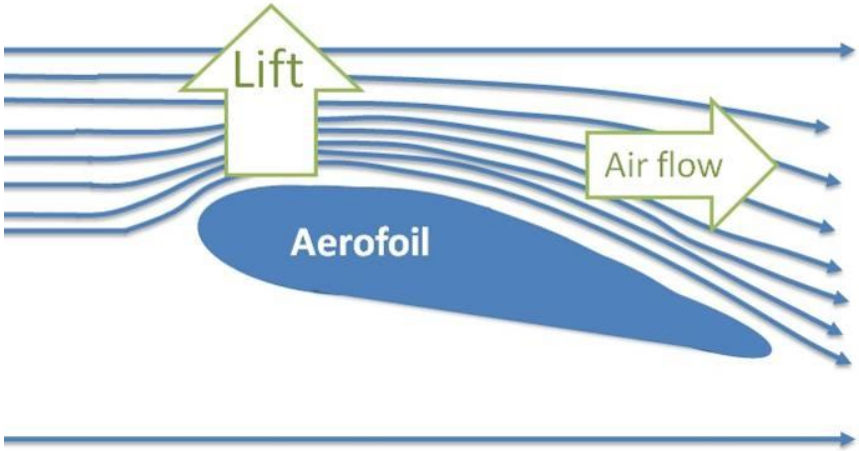
The 'Bernoulli Effect' can be seen in a simple experiment where air is blown into a wind tunnel which has been narrowed in the middle (as shown in the diagram).



Airspeed and air pressure are measured at A, B and C. As the tunnel narrows at B, the air must speed up to get through, and as the tunnel widens it slows down again. When we measure the pressure and speed at the three points A, B and C we find that at point B, where the air is moving fastest, the pressure *drops*. Aeroplane wings are designed to make use of this change.

Using the air

Aeroplane wings are designed to create a similar 'narrow space' (like point B in the diagram) but they create it in the air itself using the bulk of the atmosphere like the sides of a big wind tunnel. Think of all the air below the wing as the 'floor' of the wind tunnel, and the all the air pressing down above the wing as the 'ceiling' of the wind tunnel.

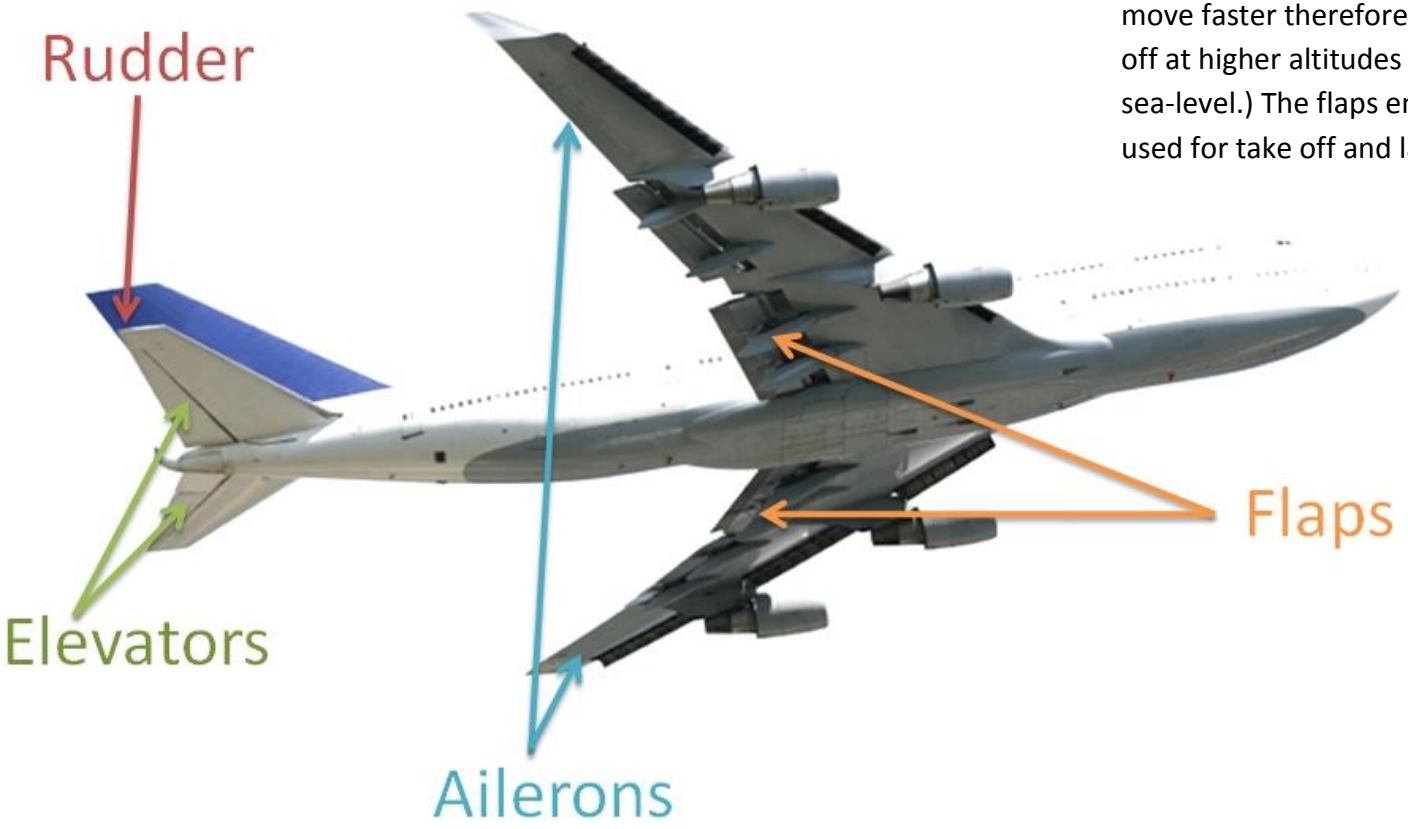


As you can see in the diagram air passing just over the top of the wing is diverted by the wing being 'in the way' and this causes it to pass through a narrow gap in the same as it did in the wind tunnel example.

This air speeds up – which causes pressure to drop above the wing. This means that *as long as the plane is moving* the air pressure above

the wing is *lower* than below the wing, causing *lift*. The faster the plane moves, the greater this difference – and when an aeroplane is going fast enough this difference in pressure is enough to lift it into the air.

The shape of aeroplane wings is referred to as an *aerofoil*. This shape is found in various forms on all aircraft and has been designed to make sure that air passes over it smoothly enough to create lift. (The 'Bernoulli effect' relies on *streamlined* air passing over the wing, which is why pilots try to avoid 'turbulence', where is air that is not flowing in a streamlined way.)



Staying in the air and landing safely

Adjustable *flaps* built into the wings allow the pilot change the shape of the wings to change the flow of air over them, creating more or less lift. For instance, at take-off the plane needs to create lift greater than the weight of the plane so it can become airborne. When landing the plane must lose height, so lift must slowly decrease until the plane lands safely. In the time in between the pilot must balance lift and weight to keep the plane in the air. Also as the aeroplane climbs, the density of the air becomes less, which reduces the difference in pressure between the top and bottom of the wing. The plane needs to move faster therefore to maintain lift. (This is why aeroplanes taking off at higher altitudes need faster take-off speeds than they would at sea-level.) The flaps enable more lift to be produced at the low speeds used for take off and landing.

A further system of elevators, ailerons and a rudder allow the plane to change its direction.

Just as weight and lift must be balanced, so must *thrust* and *drag*. Thrust is the forward force provided by a plane's engines. Drag is the backwards force created by the air the plane is travelling through pushing back at it. Aircraft designers must consider how best to balance these forces in their work – which is why planes tend to have a streamlined shape.

Want to find out more about how aircraft work? - Further resources

General Aviation

Wikipedia

http://en.wikipedia.org/wiki/Aviation

http://en.wikipedia.org/wiki/List_of_aviation_topics

NASA (USA)

http://www.nasa.gov/worldbook/aviation_worldbook.html

http://virtualskies.arc.nasa.gov/main/mainresearch.html

History of flight

Open University

http://firstflight.open.ac.uk/index.html

National Air & Space Museum (USA)

http://www.nasm.si.edu/exhibitions/gal100/gal100.html

Imperial War Museum

http://www.iwmcollections.org.uk/dbtw-wpd/exec/dbtwpcgi.exe

Principles of flight

American Institute of Aeronautics and Astronautics

http://www.aiaa.org/content.cfm?pageid=473

How stuff works

http://home.howstuffworks.com/paper-airplanes.htm

http://travel.howstuffworks.com/airplane11.htm

RAF Museum

http://www.rafmuseum.org.uk/london/learning/resource_materials.cfm

Aeronautics Learning Laboratory (USA)

http://www.allstar.fiu.edu/

NASA (USA)

Bernoulli's Equation

http://www.grc.nasa.gov/WWW/K-12/airplane/bern.html

Fascinating flight facts

(facts compiled October 2008)

The first passengers on a hot air balloon were a hen, a duck and a sheep.

The Mitsubishi Regional Jet is the most fuel efficient and quietest aeroplane in the world.

The fastest speed an aeroplane has travelled is 7,000 mph.

The highest altitude a plane has reached is 37,650 m.

The fastest commercial aircraft is the Boeing 747-400. It can travel at 531 mph.

The Boeing 747 has 6 million parts.

The smallest jet plane in the world is only 3.7m long.

The world's heaviest plane is the Antonov An 225. It weighs over 640 tonnes.

Key moments in the history of flight

9 September 1783: A sheep, a duck and a cockerel are the first animals to fly, at Versailles in France in a Montgolfier balloon

15 October 1783: Pilatre de Rozier and Marquis d'Arlandes were the first human passengers on a Montgolfier balloon. Due to the risk involved it had been suggested that convicts should be used for the first flight.

June 1853: George Cayley's coachman becomes the first man known to fly, in a Cayley glider at Brompton Hall, near Scarborough

1901: American Samuel Franklin Cody, working in Britain, patents his 'man-lifting kite'.

17 December 1903: Orville Wright flies 120 feet (36.5 m) in 12 seconds and becomes the first man to fly a powered, controlled aeroplane in sustained flight

12 November 1906: Brazilian Santos Dumont flies 220 m in less than 22 seconds in his aeroplane 14-bis in France. This is the first flight of a powered aeroplane in Europe

21 June 1908: Suffragettes drop leaflets demanding votes for women on the House of Commons from a Spencer airship

16 October 1908: American Samuel Franklin Cody makes the first powered flight in Britain in British Army Aeroplane No 1 at Farnborough. Cody flies 424m (1,390 ft)

13 July 1909: AV Roe become the first Briton to make a flight in an all-British aeroplane when he flies 30m (100 ft) in his Triplane at Lea Marshes, Essex

25 July 1909: Louis Bleriot becomes the first man to fly across the English Channel, in his Bleriot XI monoplane. Lord Northcliffe, owner of the Daily Mail newspaper, declares that Britain is no longer an island, and so cannot now depend on the Royal Navy for defence against invasion

28 April 1910: Louis Paulhan wins the £10,000 London to Manchester flight prize, flying from within 5 miles of the Daily Mail's London office to within 5 miles of the Manchester office. Landing at Burnage, Paulhan is the first man to fly over Manchester.

9 May 1914: W Newall makes the first parachute descent from an aeroplane in Britain

14-15 June 1919: Jack Alcock and Arthur Whitten Brown win the £10,000 Daily Mail prize to make the first non-stop flight across the Atlantic, in a Weybridge-built Vickers Vimy converted bomber.

15 May 1930: American Ellen Church is appointed as the world's first air stewardess, flying with Boeing Air Transport

13 September 1931: Flight Lieutenant JN Boothman wins the Schneider Trophy seaplane race for Britain for the third time in a row, so Britain wins the trophy outright. Boothman is flying a Supermarine S6B seaplane powered by a Rolls-Royce R type engine

12 April 1937: Frank Whittle runs his jet engine for the first time, and the jet aeroplane age begins

27 August 1939: The German Heinkel He 178 makes the first flight of a jet powered aeroplane

15 May 1941: First flight of the Gloster E28/39, Britain's first jet powered aeroplane

7 November 1945: Group Captain HJ Wilson establishes a new world air speed record of 975.67 km/h (606.25 mph) in a Gloster Meteor F4 fighter

7 September 1953: Squadron Leader Neville Duke established a new world air speed record of 1,170.76 km/h (727.48 mph) in a Hawker Hunter F3 fighter

4 August 1954: First flight of Britain's first truly supersonic (Mach 1.53) aeroplane, the English Electric P1A, designed and built at Warton near Preston. It entered service as the RAF's truly supersonic aeroplane in December 1959.

10 March 1956: Lieutenant Peter Twiss establishes a new world air speed record of 1,821.39 km/h (1,131.76 mph) in the Fairey FD2. This is the first aeroplane to fly faster than 1,000 mph.

4 October 1958: BOAC starts the first transatlantic jet airliner service between London and New York with the De Havilland Comet 4

12 April 1961: Russian Yuri Gagarin becomes the first man in space

31 August 1966: First hovering flight of the Hawker Siddeley Harrier Jump Jet

2 March 1969: First flight of Concorde

6 February 1969: First flight of the Boeing 747 Jumbo Jet

20 July 1969: Neil Armstrong becomes the first man to walk on the Moon

5 December 1980: Janice Brown flies for 1 hour and 32 minutes in a solar powered aeroplane, Solar Challenger

27 April 2005: First flight of the Airbus A380

An Airbus A380

Key moments ir