



HOW AIRCRAFT FLY

BACKGROUND

PARTS OF AN AIRCRAFT

Aircraft are complex pieces of equipment and consist of many components or parts to help make them fly. Typically, they will have the following:

Vertical Stabiliser

This is also known as 'tail fin'.

Fuselage

The main 'body' of the aircraft. The front is the 'fore' the back is 'aft' the left-hand side is 'port' and the right side is 'starboard'.

Wing

The part which creates lift, holds fuel and houses jet engines. The front is the 'leading edge' and the back is the 'trailing edge'.

Flight Deck

Sometimes referred to as the cockpit. The place where the pilots sit. It is usually at the nose of the aircraft.

Hold

The hold is a big space underneath where the cargo goes.

Engines

Could be jets, propeller or turboprop.

Horizontal Stabiliser

Sits near the vertical stabilisers and houses the 'elevators' which control the pitch movement of the aircraft.

Landing Gear

The wheel and shock absorber assembly. The main section is called the 'main gear' and the front section the 'nose gear'.

Nose

The very front of the aircraft usually curved to make the aircraft aerodynamic. The nose contains some equipment such as radar.

TECHNICAL ENGINEERS AND MAINTENANCE

The Royal Air Force rely on engineers to make sure the aircraft and all the equipment that they use are in good working order.

Engineers working for the Royal Air Force examine, test and repair equipment on everything from fast jets to air transport, helicopters and air-to-air refuelling aircraft.

They carry out maintenance and repair work on the airframe and propulsion systems. They check rotor blades of helicopters, rotor heads and transmission systems and adjust, repair or replace any defective parts.

They also examine all the mechanical components, the structure of the aircraft, the engines and the associated electrical components that support these functions

An important part of what an engineer does includes keeping a detailed log of all work carried out.



Activity link

"RAF engineer log"



Activity link

"Parts of an aircraft"

PLACES TO VISIT

A great way to learn more about aviation is to visit a place of aviation interest. There are lots of options including museums, gliding sites, airfields and airports. We've identified three of the most popular ones below - and there are lots of links to others in the activity sheets.



Activity link

"Visiting a place of aviation interest"



Royal Airforce Museum

Lysander Ave, Cosford, Shifnal TF11 8UP

Open daily 10:00-4:00

<https://www.rafmuseum.org.uk/cosford/>

What you will find here:

- ✈ Exhibitions & displays
- ✈ Hangars
- ✈ Aviation lucky charms and mascots
- ✈ Guild of Aviation Artists
- ✈ Virtual tours
- ✈ Flight simulator
- ✈ 4D Experience
- ✈ Fun 'n' Flight
- ✈ Conservation Centre
- ✈ Dornier 17 conservation

Alongside the Aircraft Collection displays are a number of fascinating exhibitions and displays. These include Radar Echoing Models, aircraft, aero engines, missiles and tanks used in intelligence gathering, Air Gunners, a description of who, what, where, when and how air gunners operated, Prisoners of War, exploring Cosford's role as a POW reception centre and History of Cosford, a description of Cosford's role during and since the Second World War.

DID YOU KNOW?

THE WORD 'KNOTS' IS ALSO USED AS A MEASURE OF SPEED IN AIRCRAFT. 1 KNOT = 1 NAUTICAL MILE PER HOUR. JET AIRCRAFT OFTEN MEASURE THEIR SPEED IN 'MACH' WHICH IS SPEED RELATIVE TO THE SPEED OF SOUND. SOUND TRAVELS AT A SPEED OF MACH 1 WHICH IS 662 KNOTS!

Museum of Science and Industry

Liverpool Road, Manchester, M3 4FP

Open daily 10.00–17.00

<https://www.scienceandindustrymuseum.org.uk/>

What you will find here:

- ✈ See a replica of the Roe Triplane 1, which became the first all-British aeroplane to take to the skies on 23 July 1909.
- ✈ It was the work of Manchester-born inventor Alliot Verdon Roe, who founded A V Roe and Company (known as Avro) in 1910. A V Roe became a leader in British aircraft design, building aeroplanes that saw action in both World Wars.
- ✈ Get up close to the Avro Avian IIIA (G-EBZM), and the WR960 MR2/AEW2 Avro Shackleton, which was designed to locate and attack submarines and conduct search and rescue operations, thanks to its ability to fly for up to 24 hours.
- ✈ Flight simulators. You can take the controls on Fly 360, the hands-on flight simulator.
- ✈ You can learn to steer an aeroplane safely through the skies on a foggy night. Manchester-made radar scanners use radio-wave reflections to help pilots find their way in the dark and detect enemy aircraft.
- ✈ There are several seating areas with desks and tables for youngsters to use.



Eden Camp

Malton, North Yorkshire, YO17 6RT

Open daily 10am - 5pm

<https://www.edencamp.co.uk/visit/>

What you will find here:

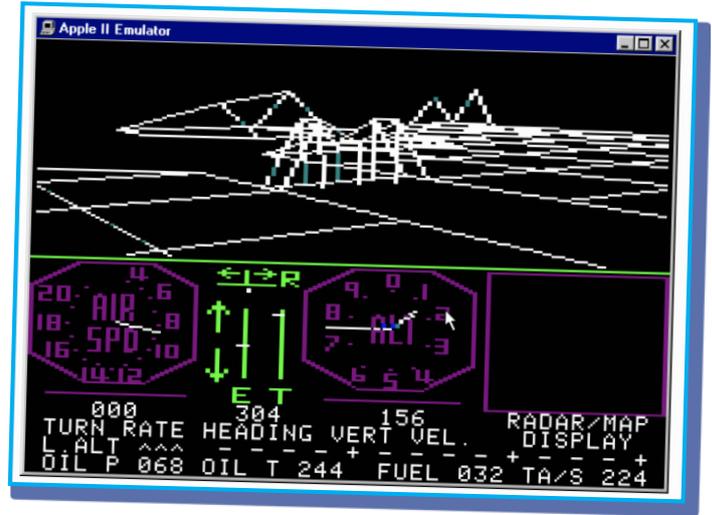
- ✈ A collection of WWII vehicles including a Spitfire and a Hawker Hurricane.
- ✈ Hut 9 at Eden Camp contains The Royal Observer Corps, Bomber Command, Resistance & RAFBD and Escape Lines
- ✈ Air Training - No air force in the world set itself a higher standard of training in peacetime than did the RAF. Not only was skill demanded from the pilot in the manipulation of joystick and rudder bar, but also a deep and exact knowledge of navigation, the theory of flight, the structure of an aeroplane, the working of an aero motor; of air gunnery, radio, air photography and instruments; and of fighter tactics, bombing methods and a hundred and one other things which the modern pilot should know if he was to get the best from his machine and himself.
- ✈ RAF Fighter Command - Dogfighting was the name given to the aerobatics involved in the fighter contest. RAF Spitfires or Hurricanes fought continuously against Luftwaffe Me 109s, leaving vapour trails thousands of feet up in the skies, a sign to onlookers that the battle was continuing. No one doubted that the pilots on either side were practising the deadliest performing act.



FLIGHT SIMULATORS

A flight simulator is a system (software and hardware) that allows the user to experience what it feels like to pilot a specific type of aircraft. It is regarded as one of the first successful applications of virtual reality software.

They have really developed since their introduction in the late 1970s. Take a look at one of the first simulators ever produced here, it was quite basic!



They are now very accurate and are used across the world to train aircrew and would-be pilots!

Activity link

"Online flight simulator"



JET SET! HOW JET ENGINES WORK

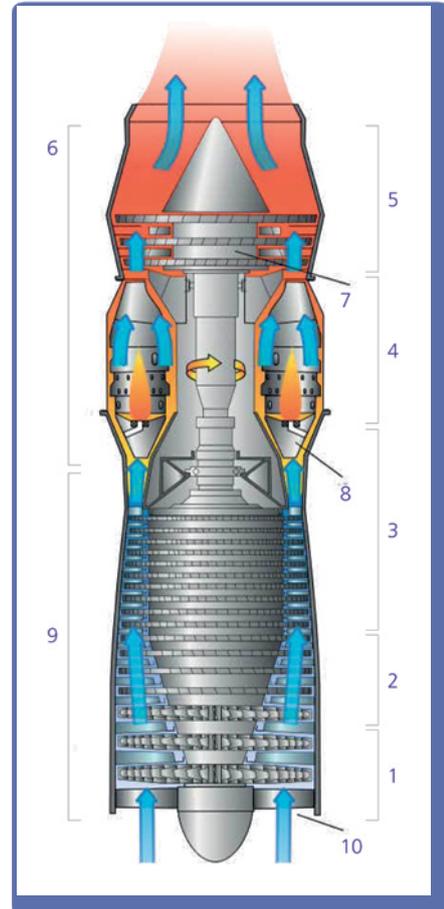
Jet engines are different to piston engines - but they do share a lot of similarities. In both there is a combustion chamber where fuel is mixed with oxygen and then ignited. Once it is ignited gas is created which expands rapidly. The major difference between the two is that in a jet engine these gases are allowed to escape and produce thrust directly by exiting the rear of the engine, forcing the engine forward. In a piston engine these gases are constrained which causes a piston to move, this moves a mechanism which indirectly turns a propeller or a wheel.

Activity link

“Jet set! How jet engines work”

Answers:

1. Intake
2. Low pressure compression
3. High pressure compression
4. Combustion
5. Exhaust
6. Hot section
7. Turbines Low and High pressure
8. Combustion chambers
9. Cold section
10. Air inlet



“File:Jet engine.svg” by Jeff Dahl is licensed under CC BY 2.0.

PISTON ENGINES

Pistons are at the very heart of the reciprocating internal combustion engine, which is why they are often called a “piston engine”. At its most basic, the piston is simply a solid cylinder of metal, which moves up and down in the hollow cylinder of the engine block. The piston itself is slightly smaller than the hole it moves in, but it has piston rings under tension to achieve a (nearly) air-tight seal once it is installed within the engine cylinder. The piston is attached via a wrist pin to a connecting rod, which in turn is connected to the crankshaft, and together they turn the up and down (reciprocating) motion into round and round (rotational) motion to drive the wheels.

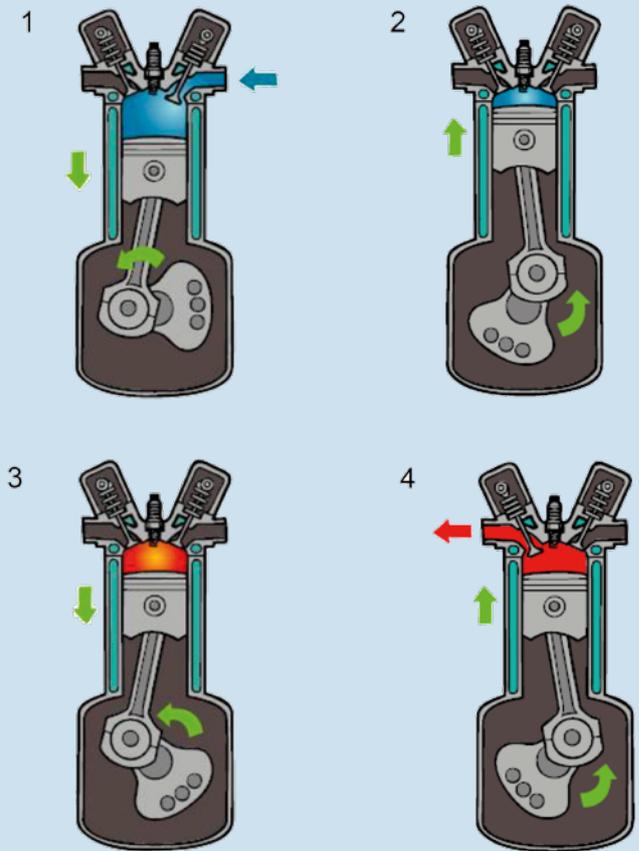
Internal combustion engines can operate with just a single cylinder and therefore one piston (as in motorcycles and lawnmowers) but piston powered aircraft have many more than these.

Activity link

“Powerful pistons”

Answers:

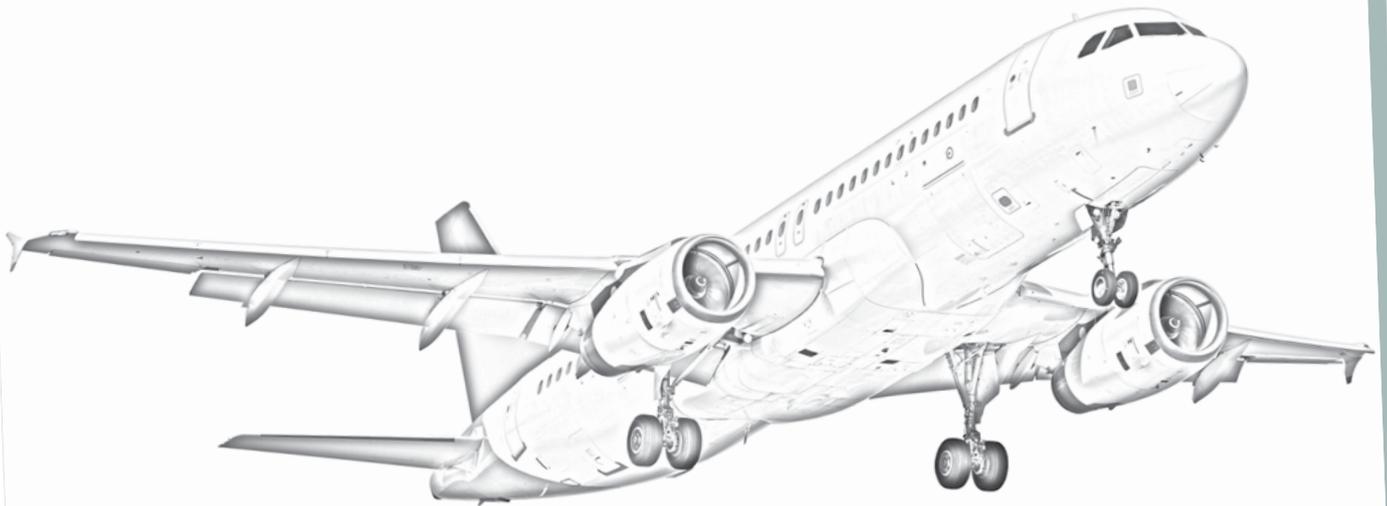
The correct order, following the principle of suck, squeeze, bang, blow is as follows:





HOW AIRCRAFT FLY

ACTIVITIES



PARTS OF AN AIRCRAFT

Label the relevant parts of the aircraft above:

- A** Vertical Stabiliser.
- B** Fuselage.
- C** Wing.
- D** Flight Deck.
- E** Hold.
- F** Horizontal Stabiliser.
- G** Landing Gear.
- H** Nose.

When you've labelled all the parts, why not colour the aircraft in too!

**FLIGHT
INSTRUMENTS**

Identify the following flight instruments by labelling the instruments with the correct letter:

- A** Airspeed.
- B** Artificial horizon.
- C** Altimeter.
- D** Turn and bank indicator.
- E** Heading indicator.
- F** Vertical speed.





RAF ENGINEER LOG

This is an example of a log sheet that an engineer with the RAF might use.

Think of the answers to these questions:

Why is it important that this work is carried out?

What tools do you think might be needed?

Why is it important to keep a log of maintenance work?

RAFForm7286
(Established May 89)
PPQ = 10

EFDC History Card

Engine Serial No _____ Installation Details _____ Card Serial No _____

A/C No _____ Date _____ A/F Hrs _____ Eng Hrs _____	A/C No _____ Date _____ A/F Hrs _____ Eng Hrs _____	A/C No _____ Date _____ A/F Hrs _____ Eng Hrs _____
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Date _____ Hrs _____ M.Oe _____ 1. Internal Gearbox _____ 2. Turbine Bearings _____ 3. External Gearbox _____ Sub Total _____ B/F Total _____ Total _____	1	2	3	Date _____ Hrs _____ M.Oe _____ 1. Internal Gearbox _____ 2. Turbine Bearings _____ 3. External Gearbox _____ Sub Total _____ B/F Total _____ Total _____	1	2	3
1	2	3	3	1	2	3	3

Date _____ Hrs _____ M.Oe _____ 1. Internal Gearbox _____ 2. Turbine Bearings _____ 3. External Gearbox _____ Sub Total _____ B/F Total _____ Total _____	1	2	3	Date _____ Hrs _____ M.Oe _____ 1. Internal Gearbox _____ 2. Turbine Bearings _____ 3. External Gearbox _____ Sub Total _____ B/F Total _____ Total _____	1	2	3
1	2	3	3	1	2	3	3

Date _____ Hrs _____ M.Oe _____ 1. Internal Gearbox _____ 2. Turbine Bearings _____ 3. External Gearbox _____ Sub Total _____ B/F Total _____ Total _____	1	2	3	Date _____ Hrs _____ M.Oe _____ 1. Internal Gearbox _____ 2. Turbine Bearings _____ 3. External Gearbox _____ Sub Total _____ B/F Total _____ Total _____	1	2	3
1	2	3	3	1	2	3	3



Keeping the Red Arrows safe in the sky

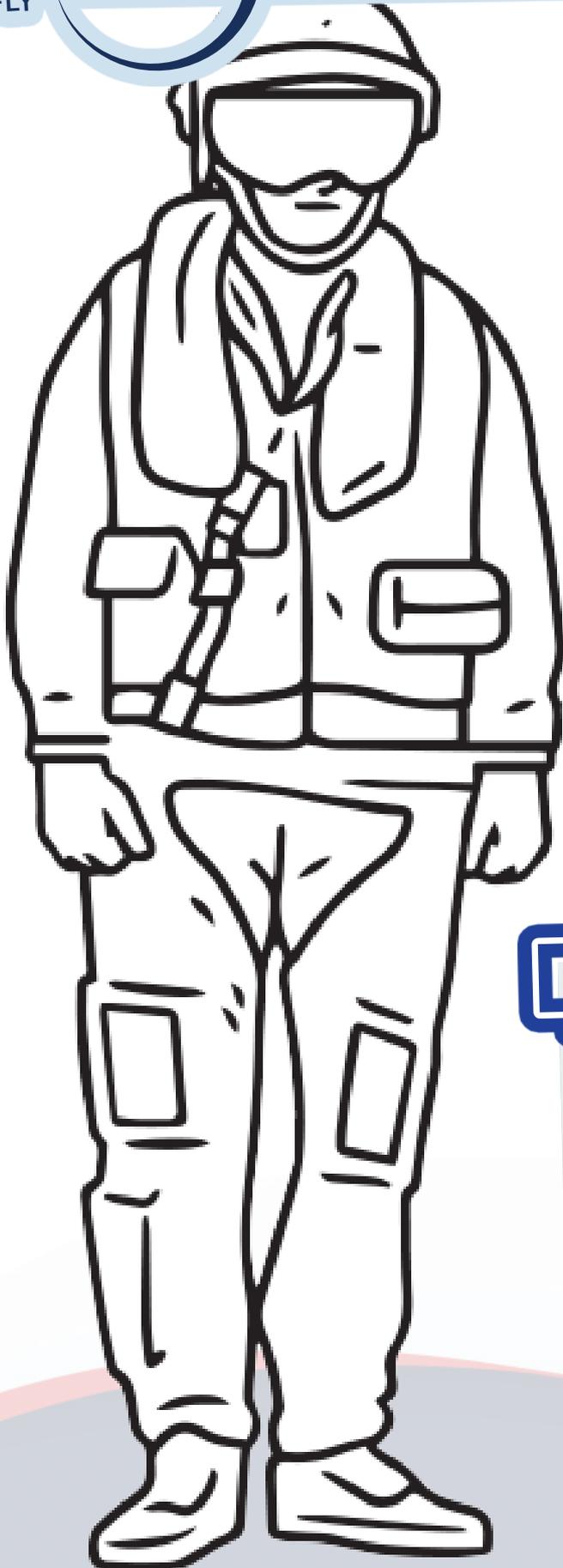
Take a look at the Red Arrows pilot here and try to identify all the safety equipment being worn.



Scan the QR code here to find out if you identified everything.



If you can't scan the QR code, use this URL instead:
<https://www.raf.mod.uk/display-teams/red-arrows/the-team/>



**COLOUR ME IN!
AIRCRAFT PILOT**

Using your knowledge and understanding of the kit worn by aircraft pilots, colour this pilot in.



AIRCRAFT PILOT - RAF

Want to know more about what it is like to be a pilot for the RAF? Take a look at our short video especially produced for this activity.

[LINK TO VIDEO HERE](#)

(you can download this Mp4 file so that you can use it anywhere)



VISITING A PLACE OF AVIATION INTEREST

Use this template to make some notes about the things you did and saw whilst on a visit to an air museum or other place of aviation interest.

WHERE DID YOU VISIT?

NAME AN AIRCRAFT TYPE YOU SAW?

REGISTRATION NUMBER OF THE AIRCRAFT?

HOW MANY SEATS DID IT HAVE?

WHAT WAS YOUR FAVOURITE PART OF THE VISIT?

WANT TO
KNOW MORE?



Scan the QR code here for a full list of aviation museums in the UK that you can visit.

If you can't scan the QR code, use this URL instead:
<http://www.aviationmuseum.eu>



Scan the QR code here for a list of gliding clubs that you can join.

If you can't scan the QR code, use this URL instead:
<http://www.gliding.co.uk>



Scan the QR code here for information about an aviation magazine you can read.

If you can't scan the QR code, use this URL instead:
<http://www.flyer.co.uk/directory>





Scan the QR code here to access a free online flight simulator.



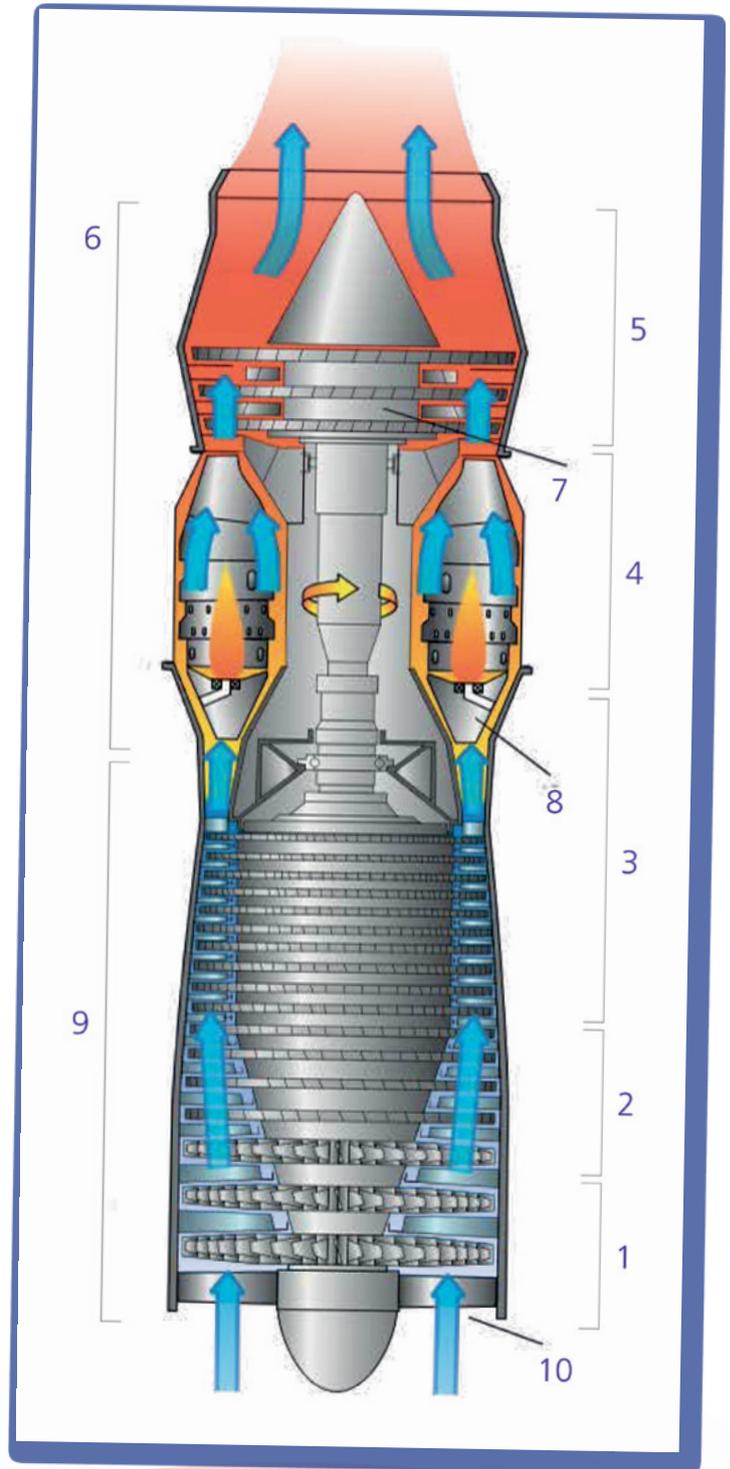
If you can't scan the QR code, use this URL instead:
<https://www.geo-fs.com/>

TOP TIPS TO GET GOING QUICKLY ON THE FLIGHT SIMULATOR

- ✈ Use + and - keys to set throttle.
- ✈ Keys 0 to 9 are also convenient to set throttle: 9 is full throttle.
- ✈ Use the mouse as a stick.
- ✈ As you gain some speed, pull gently (mouse down) on the stick to take off.
- ✈ You can change camera by using the menu or pressing "C".
- ✈ Press "G" to raise or lower landing gear.
- ✈ Press "Space" to brake.

JET SET! HOW JET ENGINES WORK

Using the diagram below label the components of the jet engine. You might need to do some research work to correctly label each part. Discuss what each part does with other students.



- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10

"File:Jet engine.svg" by Jeff Dahl is licensed under CC BY 2.0.

POWERFUL PISTONS

Many aircraft fly using piston engines - why not carry out some online research to identify some of these? Whilst conducting your research work, look at how a piston engine works. When you've done this you should be able to correctly label the following pictures in order (1,2,3,4 - showing how a piston engine works).

