

AIR RESEARCHER ACTIVITY BADGE

BADGE SUPPORT
RESOURCE
ROYAL AIR FORCE



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The Royal Air Force are proudly partnering with the Air Researcher Activity Badge.

The Royal Air Force (RAF) is delighted to be working in partnership with The Scout Association as part of a strategy to inspire and enthuse young people about science technology, engineering and maths. Operating at the leading edge of technology, the RAF relies on a constant inflow of talented and motivated young people to help us undertake our role as part of the UK's Defence and as an emblem for good around the world. We hope this activity pack in support of the Air Researcher Activity Badge, will give Scouts insight into the world of aviation and aerospace.

To find out more, visit www.scouts.org.uk/RAF

WHAT ARE THE REQUIREMENTS?

Here's what your Scouts need to do to earn this badge:

1. Research one historical aspect of flight, and share what you find out with the Troop. You might like to research about:
 - the development of aviation or flight over a period of history, previously agreed with your Leader.
 - balloons or airships, from their first appearance to the present day
 - a type of aero engine, such as a jet or piston engines in general, or a specific engine like the Rolls-Royce Merlin
 - the development of an aircraft type, like a Spitfire, Boeing 747, Harrier, Stealth Bomber, space shuttle or the Wessex helicopter. You could find out details about its history, role and achievements.
2. While you're doing your research, visit at least one place of interest that relates to your chosen subject. It could be a museum, an air display or an aeronautics factory.
3. Present your findings. Your presentation should include a model that you have made based on your subject. You should also include diagrams and pictures wherever you can.

Top tips

If you are visiting an airfield be sure to know the Scouting rules. You can find these rules in Chapter 9 of Scouting's Policy Organisation and Rules (POR) at scouts.org.uk/por.

Inclusiveness

Each young person who participates in the Scout Programme should face a similar degree of challenge, and requirements can be adapted according to each young person's abilities. For more information and practical tips see our guidance on inclusivity at scouts.org.uk/diversity.

Disclaimer: Please note that these are the requirements for the Scout Air Researcher Activity Badge at the time of going to print. For up to date information and badge requirements, please visit the Scout Badges and Awards section of scouts.org.uk/programme.

REQUIREMENT 1

Research one historical aspect of flight, and share what you find out with the Troop.

We've included some example topics, useful information, links and top tips below.

1. The development of aviation or flight over a period of time

For example:

The Wright Brothers - Wilbur and Orville Wright

Wilbur and Orville Wright were two American brothers who are credited with designing, building and flying the first successful fixed-wing heavier-than air flying machine. With only seven years of high school between them, the brothers set up their own printing shop, using a printing press that they had designed and built themselves. They then used this business to fund their growing interest in aeronautics. After a great many attempts, the brothers finally achieved success between 1904 and 1905, during which time they managed to fly distances of up to 200 feet at around 10 feet above the ground.

You may want to check out pictures of the Wright Brothers and have a go at one of the two bi-plane activities in Make Do Share (Winter 2016) available at www.scouts.org.uk/RAF

2. Balloons or airships, from their first appearance to the present day

For example:

Airships

With the development of the internal combustion engine the possibilities in linking the engine to flight were quickly recognised. The Brazilian Alberto Santos-Dumont had been experimenting with petrol engine driven airships since 1898. In 1900, Count von Zeppelin launched his first airship, the LZ1, powered by two Daimler engines. In light of the limitations of balloons, such experiments with dirigibles (being power steered or directional airships) interested those 'air-minded' individuals in the British Forces.

In January 1902 Col James Templer of the Balloon Section, Royal Engineers visited Santos-Dumont in Paris and compiled a report on his (non-rigid) airships. He recommended to the War Office that research should be undertaken. Consent was given to experiment with non-rigid airships, but progress was slow and the construction of Britain's first airship, the 55,000 cubic feet 'Nulli Secundus' did not begin until 1904. It did not fly until 1907, seven years after the first Zeppelin flight.

The first long distance flight by 'Nulli Secundus' was made on 5 October 1907, with Col John Capper and Mr Samuel Cody flying from Farnborough to London. She flew over the city and circled the dome of St Pauls. The airship then turned south to return to Farnborough but increasing wind in excess of 16mph meant that she was unable to do so and she was moored at Crystal Palace. A few days later her skin was slashed to prevent her from coming loose from the ropes anchoring her to the ground in high winds. In stark contrast in Germany the Zeppelin LZ4, at over 400 feet in length and with a cubic capacity ten times that of 'Nulli Secundus', had just completed a voyage of 10 hours covering 240 miles.

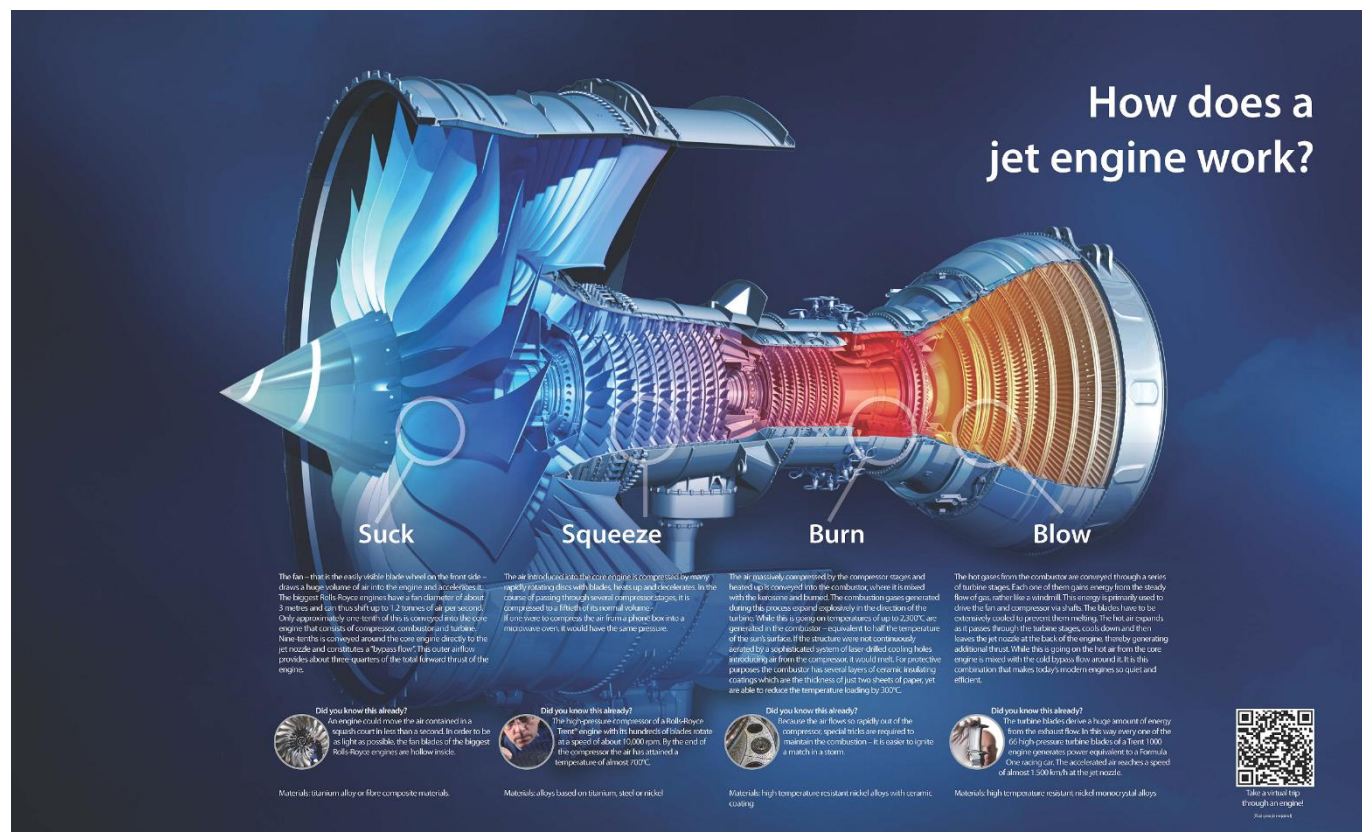
For more information about the RAF's involvement with airships, check out rafmuseum.org.uk

3. A type of aero engine, such as a jet or piston engines in general, or a specific engine like the Rolls-Royce Merlin

For example:

How does a jet engine work?

Check out this useful poster resource from Rolls-Royce, available to download from <http://bit.ly/how-jet-engine>



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More information and other useful resources from Rolls-Royce, such as 'Take a journey through the RR EJ200 Engine' and 'Take an interactive journey through a jet engine' can be found at <http://bit.ly/interactive-resources>

4. The development of an aircraft type, like a Spitfire, Boeing 747, Harrier, Stealth Bomber, space shuttle or the Wessex helicopter. You could find out details about its history, role and achievements.

For example:

Spitfire

The ancestry of the Spitfire can be traced back to the failed Supermarine Type 224, designed to meet the Air Ministry specification F.7/30 by Reginald J. Mitchell; creator of the magnificent Supermarine seaplanes which won three successive Schneider Trophy contests.

The prototype first flew on 5th March 1936. The first order for 310 machines was placed three months later, followed by a further 200. Further orders of Spitfires in 1939 brought the number ordered to a total of 2,143 by the outbreak of war. In total, 20,341 Spitfires were built and the aircraft remained in production for 12 years.

The Spitfire played a major part in achieving ultimate victory in World War II and truly deserves its place as probably the most successful fighter design ever, and certainly as the most famous of all time.

Specifications:

Manufacturers: Vickers-Armstrong Ltd, and produced in subsidiary factories.

Engine: Rolls Royce Merlin

Speed: Maximum, 387mph at 18,500ft

Range: Very difficult to assess, as duration varies from three to six hours, according to the nature of duties undertaken.

Max altitude: 36,000ft

Dimensions: Wing span: 26ft 10in, length: 28ft 11in, height: 11ft 5in, wing area: 242 sq ft.

Distinguishing features: Low-wing monoplane with simple tail unit and retractable undercarriage. Sharp-pointed nose. Elliptical or petal-shaped wings. Radiator under starboard wing. Flat top to fuselage. Small egg-shaped fin and rudder. Graceful and well-curved bottom.



Monoplane – aeroplane with one pair of wings.

Starboard - the right-hand side of the aircraft, facing forward.

Fuselage – main body of an aircraft.

Fin – vertical tail at the rear of an aircraft.

Rudder - the hinged section of the fin.

Tornado GR4

The Tornado GR4 is a two-seater, all-weather, day/night attack and reconnaissance aircraft. It has been in service with the RAF for more than 30 years, but a combination of major upgrade programmes and numerous continual enhancements has kept the aircraft amongst the forefront of all attack aircraft.

Still one of the very few aircraft in the world that is able to operate at low level, day or night and in poor weather, the Tornado is now equipped with a modern precision-guided weapons suite and world-class reconnaissance sensors such as the Reconnaissance Airborne Pod for Tornado (RAPTOR). The aircraft also carries the Litening III Advanced Targeting Pod, which is used in both attack and reconnaissance roles.

The RAF has had Tornados deployed to the Middle East region for more than 20 years; further proof of the versatility and capability of this exceptional aircraft.

Specifications:

Engines: Two Rolls-Royce RB199 Mk103 turbofans

Max speed: 1.3 Mach

Length: 16.72m

Max altitude: 50,000ft

Wing span: 8.6m

Aircrew: 2



Reconnaissance - military observation of a region to locate an enemy or gain information.

Mach - is used as a unit of measurement in stating the speed of a moving object in relation to the speed of sound. Mach number equals object speed divided by speed of sound.

Chinook

The Chinook is an able and versatile support helicopter that can be armed with crew served weapons to provide self-defence, and can be operated from land or ship in such diverse environments as the Arctic, jungle and desert.

Chinook aircraft are used for trooping, resupply, and battlefield Casualty Evacuation (CASEVAC), and for carrying internal and/or underslung loads. They can carry up to 55 troops (more, usually 24 to 40) and/or up to 10 tonnes of freight. A secondary role includes Search and Rescue (SAR).

In Afghanistan, the aircraft has become known for its emergency response role, in which the rear of the aircraft can essentially be used as an emergency operating theatre. The crew usually consists of two pilots and two crewmen, supplemented by other specialists depending on the specific task.

Specifications:

Engines: Two Textron Lycoming T55-L712F turboshafts

Max speed: 160 kts

Length: 30.14m

Max altitude: 15,000ft

Wing span: 18.23m

Aircrew: 4



kts - In aviation speed is often expressed in knots (kt). One knot is one nautical mile per hour. One nautical mile is equivalent to 1.852km.

Lightning II

This 5th Generation STOVL (Short Take Off Vertical Landing) Multi-Role supersonic stealth aircraft will provide the UK with a hugely capable and flexible weapons and sensor platform for decades to come.

Designed to operate from established land bases, austere landing strips and the new Queen Elizabeth Class aircraft carriers, the Lightning II will join the Typhoon FGR4 in providing the Combat Air component of UK defence from 2018.

The ability to carry a variety of weapons both internally or externally, combined with an advanced sensor suite including the AN/APG-81 AESA Radar, Electro Optical Distributed Aperture System and Electro Optical Targeting System put the UK and Lightning II at the forefront of aircraft and weapon system technology.

Specifications:

Engines: Pratt & Whitney F-135-600

Max speed: 1.6Mach

Length: 15.6m

Max altitude: 50,000ft

Wing span: 10.7m

Aircrew: 1



Austere landing strips – a makeshift runway often set up on dirt strips, stretches of desert or other long, flat areas.

Lancaster

The Avro Lancaster is a British four-engine, Second World War heavy bomber, designed and built by Avro for the Royal Air Force.

It first saw active service with RAF Bomber Command in 1942. As the strategic bombing offensive over Europe gathered momentum, the Lancaster played a crucial part in the night-time bombing campaigns that followed. It became the main heavy bomber used by the RAF, the Royal Canadian Air Force (RCAF), and squadrons from other Commonwealth and European countries serving within the RAF. The Lancaster, an evolution of the Avro Manchester, was designed by Roy Chadwick and was powered by four Rolls-Royce Merlins, or, in one version, Bristol Hercules engines.

Specifications:

Engines: 4 x 1,620hp Rolls-Royce Merlin 224

Max speed: 272 mph (438 km/h)

Wing span: 102ft (31.09 m)

Length: 69ft 6ins (21.18 m)

Height: 20ft (6.10 m)

Aircrew: 1 pilot and up to 6 crew



hp – horsepower (hp) is unit of measurement of power.

Harrier

The Harrier was used by the RAF in the close air support role and is the latest in a long line of 'jump-jets' dating back to the introduction of the first Harriers in the 1960s.

Brought into service in 1969 and based at RAF Wittering, this British aircraft was designed to take off and land both vertically and on a short runway.

Well known for its role in the Falklands War, the Harrier went on to serve in many other conflicts including in Bosnia and Iraq in the 1990s.

The RAF and Royal Navy Harrier squadrons joined forces in 2000 to form Joint Force Harrier, based at RAF Cottesmore. These combined Harrier squadrons served in Sierra Leone, the second Gulf War and most recently Afghanistan.

Specifications:

Engines: Rolls-Royce Pegasus 105 or 107 turbofan

Max speed: 1,013 km/h

Length: 14.36m

Max altitude: 43,000ft

Wing span: 9.25m

Aircrew: 1



Close air support - In military tactics, close air support (CAS) is defined as air action by fixed or rotary-winged aircraft against unfriendly targets, that are located close to friendly forces, and which requires detailed integration of each air mission with fire and movement of these forces.

Vulcan

The Avro Vulcan (later Hawker Siddeley Vulcan) is a jet-powered, tailless delta wing, high-altitude strategic bomber, which was operated by the Royal Air Force from 1956 until 1984.

The Vulcan B.1 was first delivered to the RAF in 1956; deliveries of the improved Vulcan B.2 started in 1960. The B.2 featured more powerful engines, a larger wing, an improved electrical system and electronic countermeasures (ECM); many were modified to accept the Blue Steel missile. As a part of the V-force, the Vulcan was the backbone of the United Kingdom's airborne nuclear deterrent during much of the Cold War. Although the Vulcan was typically armed with nuclear weapons, it was capable of conventional bombing missions, a capability which was used in Operation Black Buck during the Falklands War between the United Kingdom and Argentina in 1982.

Specifications:

Engines: Turbojet, Rolls-Royce Olympus

Max speed: 1,038 km/h

Wing Span: 30m

For more information about current aircraft that the Royal Air Force operate, please visit

raf.mod.uk/equipment.

For more information on aircraft that the Royal Air Force has operated in the past 100 years, please visit

raf.mod.uk/history/AircraftoftheRoyalAirForce.cfm



Tailless – an aircraft that has no tail and no other horizontal surface besides its main wing.

Delta wing - a wing shaped in the form of a triangle.

Electronic Countermeasures (ECM) - an electrical or electronic device designed to trick or deceive radar, sonar or other detection systems, like infrared (IR) or lasers. It may be used both offensively and defensively to deny targeting information to an enemy.

Top tip:

If your Scouts can't decide what they want to research, why not give them some prompts to get them started? For example:

- When and where was their favourite aircraft first built?
- What date was the Royal Air Force formed?
- Who was the first British female to fly solo from Britain to Australia?
- What was the first commercial flight?
- What is the record for the fastest flight across the Atlantic in a commercial plane?
- What is the most expensive plane in the world?
- What is the furthest distance an aircraft has flown without stopping?
- Who are the current RAF Red Arrows Pilots?

REQUIREMENT 2

While you're doing your research, visit at least one place of interest that relates to your chosen subject. It could be a museum, an air display or an aeronautics factory.

For example:

RAF events

Over the summer months, the RAF hosts:

The Royal International Tattoo - RAF Fairford, Swindon

Scampton Air Show - RAF Scampton, Lincoln

More information about these events can be found at www.scouts.org.uk/RAF

RAF Museums

The Royal Air Force Museum occupies two public sites at Colindale in North London, and Cosford in Shropshire, West Midlands. Each site offers a unique experience to visitors and the exhibits complement each other. Both museums are free to enter. For more information visit:

London - rafmuseum.org.uk/london

Cosford - rafmuseum.org.uk/cosford

Imperial War Museums

Admission to **IWM London** and to **IWM Manchester** are free.

IWM Duxford offers a special group rate for any group of 10 or more.

For all group bookings, for all IWMs within the UK, visit iwm.org.uk/visits/iwm-london/groups-schools

UK aeronautical based museums

A great website to search for UK aeronautical based museums is aviationmuseumguide.co.uk.

REQUIREMENT 3

Present your findings. Your presentation should include a model that you have made based on your subject. You should also include diagrams and pictures wherever you can.

Encourage your Scouts to get creative with their presentations. Not every Scout will be comfortable delivering a presentation in front of their Troop, so instead you could suggest that they create a video or blog of their visit to an air show or museum. Other Scouts may like to act out their chosen research topic or make their presentation interactive in some way.

Making models

Your Scouts could get imaginative with their models and the materials they use. They could make their model out of recycled junk, natural materials or even make it from Lego or Meccano.

Here are a couple of example models that you might like to inspire them with:

Build a bi-plane - Make Do Share (Winter 2016) available at www.scouts.org.uk/RAF

Build a helicopter - curiositymachine.org/challenges/88

Top tip:

While working towards requirement 3 of the Air Researcher Activity Badge, requirements of other badges including Craft, Entertainer and Model Maker Activity Badges, might also be completed at the same time.