The Harwell Heritage Trail

Welcome to the Harwell Heritage Trail, commemorating Harwell's 75th anniversary in 2021.





Useful information

There are 13 waypoints dotted along a 4km circular route which will take approx. 60-90 minutes on foot and each stop has a What3Words identifier to help you locate it.

Route distance: 4kms Difficulty: Easy Time: 70 mins Route type: Loop

Car parking

Postcode: OX11 OSQ There is a limited amount of on-road car parking near the War Memorial on Perimeter Rd, Harwell Campus.

Public transport information

The Harwell Connector bus runs regularly between Didcot and Harwell. The nearest bus stop is located on the Newbury Rd, just beyond Waypoint #2 at Thomson Gate entrance.

There is a toilet facility at Dish, close to Waypoint #4 and refreshments are at Waypoint #3 and #4, subject to normal opening hours.

Map key

Waypoint #1 Harwell War Memorial ///icon.giants.diner

RAF Harwell

Welcome to the first stop on the Harwell Heritage Trail, where you will start to uncover details about this fascinating place, some of the extraordinary discoveries made here and the people who have used science, technology, and engineering to improve the lives of millions of people around the globe. Today it is managed as a public/private sector joint venture, with an exciting ecosystem of facilities and organisations that work together, to further science and technology.

In 1935 Harwell was an RAF airbase, playing a key part in the D-Day landings of 1944, capturing strategically important bridges in Normandy and lighting Drop Zones for the troops and equipment to land safely on D-Day, the 6th June 1944, as part of the main 'Operation Overlord' offensive. The Harwell War Memorial commemorates those who helped liberate Europe and an annual service of remembrance is held here to remember them.

Wayppoint # 2 Main Gate, Thomson Avenue ///geek.caged.happily

Creating Science Town

You are at the second trail stop, standing close to the former Main Gate to the Harwell Research Establishment. Because of the secret work that took place here, the entire site was once behind a fence, and this was the main access point to it.

In 1946 the RAF handed the site over to the UK Government and work began to convert Harwell into a science campus dedicated to understanding nuclear energy. The campus grew to be the size of a small town, with its own dedicated police force, (the Civil Nuclear Constabulary) which still operates today, a fire brigade unit and amenities and transport including distinctive blue buses which commuted the scientists and workers into Harwell from the towns and villages in the surrounding area where they lived.







Waypoint #3 Quad Café and Fitness Studio ///credit.whisker.courage

Harwell's Nobel Prize Winning Discoveries Power Tomorrow's World

At the third trail stop we will electrify your understanding of batteries. The Quad One building is home to the Faraday Institution and is funded by the UK Government to fast-track commercially relevant battery science and technology, speeding up the electric revolution towards a cleaner world. UK researchers are working on Faraday Institution projects to improve current generation and invent next generation batteries that are better performing, lower cost, lighter weight, more sustainable and fully recyclable.

Work on batteries was conducted at Harwell from the early 1980s when a scientific exploration team and the University of Oxford, managed by American physicist John B. Goodenough, led to the early concepts of the lithium-ion battery being developed here, now used in everything from mobile phones to electric vehicles. Goodenough couldn't find a company to assemble the battery, so he gave the patent to the AERE Harwell Laboratory and later Sony invested in the concept to take it to market. In 2019, John B. Goodenough won the Nobel Prize for Chemistry for his work developing lithium-on batteries, sharing the prize with M. Stanley Whittingham and Yoshino Akira. The lithium-ion battery is now in common use everywhere in the world.

Waypoint #4

Second Street ///trailing.unheated.dragons

The 'Atomic Village' at Work and Play

The fourth trail stop is right at the heart of Harwell Campus past and present. In 1944, the Government created a blueprint for an atomic energy research establishment and the Air Ministry handed over the site on 1st January 1946 with the remit to create the entire nuclear fuel cycle, encompassing new areas of scientific discovery.

Nicknamed 'Atomic Village' in the 1940s, the AERE Harwell (Atomic Energy Research Establishment) site belonged to Berkshire before county boundaries changed it to Oxfordshire in 1974. The adjacent cricket ground was formerly the Berkshire Cricket Ground and is still used by the Harwell International Cricket club for practice and matches today.

Secrets, Lies and Espionage

Almost at the halfway trail point, we will reveal Harwell's top-secret past. The most infamous character in Harwell's history, Klaus Fuchs was appointed as Head of the Theoretical Physics Division in 1946, living near here at No. 17 Hillside, in one of the prefabricated homes that were built at Harwell after the war.

Fuchs passed important secret information to the Russians about the design of the Atom Bomb and the development of the Hydrogen bomb. His job at Harwell gave him access to important research about nuclear and applied science which he shared with his spy contacts. Key people gradually became suspicious of him, and his espionage was eventually discovered in 1950, leading to his arrest and a confession of his spying activities to the War Office. Fuchs served 9 of 14 years imprisonment for his espionage crimes.

Waypoint #6 Eighth Street ///enchanted.sunshine.cotton Photography is not permitted here

Harwell delivers Europe's First Nuclear Reactors, GLEEP and BEP0

Close to the original buildings, this area forms part of Harwell's early atomic research programme which was more powerful than any man-made source of energy that had existed before. Called GLEEP and BEPO, these first reactors were later added to, with curious sounding names such as 'DIMPLE', 'DIDO', 'ZEEP', 'ZEPHYR' and 'ZEUS'. Harwell built Europe's first atomic nuclear reactor 'pile', GLEEP (Graphite Low Energy Experimental Pile), made of graphite blocks and uranium rods, constructed in the Arctic winter of 1947 and the reactors were partially built using war surplus materials including spitfire fighter planes.

GLEEP helped scientists to discover that magnesium was virtually transparent to neutrons, enabling metallurgists to manufacture a special aluminium alloy containing magnesium and beryllium, the material known as 'Magnox'. This superior canning material for uranium fuel was used in the first phase of Britain's nuclear power stations dubbed 'Magnox' stations. GLEEP ran successfully for 43 years before being de-commissioned in 1990. This early atomic work paved the way for future facing energy sources, including wind, wave, and solar power for a more sustainable world. Some of the new buildings at Harwell including Zephyr, Zeus, BEPO and Zeta are named after the original reactors.



Waypoint #7 R100 RAL Space Building ///elections.silk.gems

A Shooting Star Lands at Harwell

On 22nd April 1957, a T-33 'Shooting Star' jet plane belonging to the US Airforce (USAF), took off from Kent, heading for Bournemouth. The crew suffered the loss of their compass and instrument failure, combined with a shortage of fuel and were lost in the darkness, looking for a safe spot to land. They could see a place with runways, large hangar buildings and a large red flashing light and thought they were above RAF Abingdon so after circling twice, they landed on Fermi Avenue, near the B412 building (now R12), bursting two tyres.

Efforts were made to re-launch the aircraft using a rocket on each wing but one caught fire, causing the wing to touch the ground. Luckily, two security fences slowed the aircraft down and it came to halt, dangerously close to the GLEEP reactor, tearing three wheels and a booster rocket off. A man called Peter Reeves, a foreman for Chivers Engineering, bravely rescued the pilot and luckily no one was hurt. Afterwards the plane was taken away on a large trailer and as a precaution, much stricter flying restrictions were placed over Harwell to avoid any similar incidents.

Waypoint #8 Atlas Building ///trophy.tricky.climate

Revolutionising Computing

Harwell has made a significant contribution to the advancement of mathematics and computers. The way scientists and staff arrived at mathematical calculations in 1948 was a combination of manual computation using brainpower, logarithm tables, slide-rules, and mechanical desk-top calculating machines. However, Harwell's research work required greater computing power and it opened its own electronics department to design and build bespoke computers.

In 1952 Edward (Ted) Cooke-Yarborough and the team, assembled the world's first all-transistorised computer called CADET, which was much smaller than others of its type. It was the first electronic computer in regular use in the UK and was overtaken in 1961 when Tom Kilburn at Manchester University and Ferranti Ltd designed and built the Atlas 1 supercomputer, (only three were built), with the "Chilton Atlas" located here. It was the biggest, fastest, most powerful programmable super-computer in the world, later upgraded to a CRAY-2 (Y-MP). In the 1990s, `when the CRAY-2 computer was not in use, it was programmed to search for prime numbers and in March 1992 it discovered a rare number, one that was not only the largest prime number then known, containing a quarter of a million digits, but also the largest Perfect number known, the 32nd Perfect number.

Waypoint #9 Fermi Avenue ///ironic.ticking.joggers

Great Minds Collaborate and Dr Who Roams Harwell

Just four stops now to reach your destination and we will share with you how Harwell helps keep us safe, from new generation antibiotics to protecting the nation's health. The recently expanded Research Complex at Harwell (RCaH), founded in 2006 is a centre for cutting-edge scientific research, with state-of-the-art equipment for academia and industry to use, so that researchers can achieve quality results very quickly. Their work covers electric cars and aircraft, environmental science such as smart windows that create electricity from sunlight and finding effective new treatments to fight infectious diseases.

The UK Health Security Agency (UKHSA) oversees health protection in the UK, encompassing chemical, radiation, and environmental hazards. In 2006 they assisted in diagnosing how Alexander Litvinenko was fatally poisoned with polonium-210 in a London hotel bar. Subsequently, chemical hazards were added to their remit, extending to wider environmental hazards such as the health impacts of flooding, extreme heat, cold and climate change, the effects of chemicals on health and air pollution monitoring. In 1975, the PHE building was used to film a series of Dr Who (The Android Invasion), when Tom Baker was the incumbent Dr Who and androids were let loose inside the building to do their worst.



Waypoint #10 Fermi Avenue ///spreading.tumble.promotion

What do Cancer Research, Chocolate and Spiders' Webs have in common?

You are now at the furthermost point of the Trail where we will find out more about how tiny particles can be used to learn more about the world around us. Harwell has a special science facility called the ISIS Neutron and Muon source based here at the Rutherford Appleton Laboratory (RAL), conducting research into the physical and life sciences, and is owned and operated by UKRI-STFC. One of only three in the world, the facility produces beams of neutrons and muons enabling scientists to study materials at the atomic level using a suite of instruments described as 'super-microscopes'.

As well as seeking answers to important questions such as how to cure cancer, reduce carbon emissions and make better batteries, ISIS has assisted manufacturers in improving their products, including new fabric conditioners, pesticides, fuel additives and Maltesers. Their work extends deep into the natural world, studying the tensile strength of spiders' webs, why frogs don't freeze and what we can learn from polar bear fur when developing new paints.

Waypoint #11 Fermi Avenue ///presides.quieter.increases

Women Scientists Blaze a Trail

At this stop we want to shine a special spotlight on Dr Mary Lyon and Rosalind Franklin, two female scientists who have made a huge contribution towards scientific advancement at Harwell. Mary Lyon was employed by the Medical Research Council to conduct research on radiation hazards but in 1961 she published her theory on 'X-chromosome inactivation', later known as Lyonization in her honour. She loved cats and wanted to understand the origins of their tortoiseshell colouration. We now know that the genes for black and orange fur, responsible for tortoiseshell colouration, are on the X-chromosome. Her work helped with later research into inherited conditions

In 2021 the Rosalind Franklin Institute, a national research institute opened on campus, and is dedicated to developing new technologies for tackling important health research challenges and unlocking new innovations. As you look across the road it is the building with blue panels, a yellow trim, and a copy of the



famous 'Image 51' on the front. Rosalind Franklin's own crystallography work provided a greater understanding of DNA, leading to discoveries about the structure and importance of DNA's double helical structure.

Waypoint #12 Fermi Avenue ///rabble.turns.chess

Shining a Light on the UK's National Synchrotron

It's the penultimate Trail stop and time to be dazzled by facts about Diamond Light Source, the UK's national synchrotron facility. The largest scientific instrument in the UK, the Diamond synchrotron produces light 10 billion times brighter than the Sun to study matter and material at the molecular and atomic level. The machine is 562m in circumference, is toroidal in shape, and covers an area the size of five football pitches. It acts like a giant microscope, focusing intense light beams at samples to study them in super fine detail.

Diamond scientists and visiting researchers use the light to study a vast range of subject matter, from foot and mouth disease viruses to priceless paintings, tiny fractures in commercial aircraft propellers, the Herculaneum Scrolls, and cannonballs from Henry VIII's favourite ship, The Mary Rose. Diamond's work has enabled the development of new drugs, the conservation of important artefacts and an array of other scientific breakthroughs. Diamond has been involved in many different COVID-19 research projects and continues to help contribute to the latest understanding of the virus, its mutations and vaccine development.



Waypoint #13 Fermi Avenue ///occurred.default.reason

Harwell Blasts Into Space

Congratulations, you have reached the final stop on the Harwell Heritage Trail, where the Space Cluster at Harwell is located. Look out for the European Space Agency (ESA), with international flags in front of the building, which opened in 2015. ESA formed part of the Rosetta space mission which involved tracking a comet and in November 2014, Rosetta's lander 'Philae', landed on its surface to gather data.

Harwell is home to more space organisations within walking distance than anywhere else in the world. These include the Satellite Applications Catapult, Thales Alenia Space, Open Cosmos, Oxford Space Systems and Astroscale and on the opposite side of the road is the space test and calibration facility R100. Looking back from where you are now, you will see RAL Space's National Satellite Test Facility, providing large-scale space test capabilities. Harwell space organisations are engaged in a range of activities, from collecting space debris (space junk), to earth observation (EO) to gathering climate change data, tracking weather patterns, measuring ocean temperatures, identifying penguin colonies and ice-melt statistics.